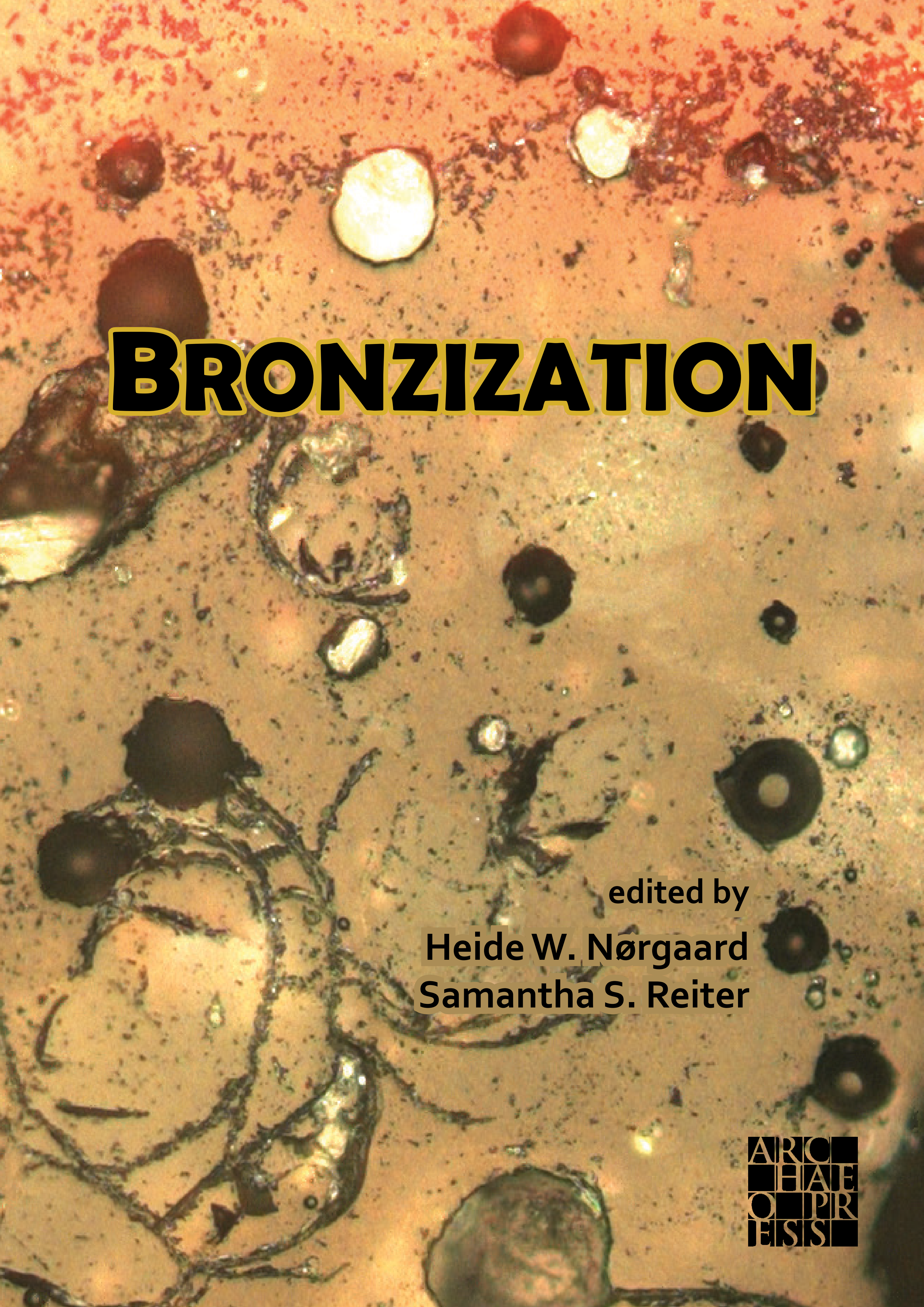


BRONZIZATION

edited by
Heide W. Nørgaard
Samantha S. Reiter

ARCHAEOPRESS

Bronzization

Essays in Bronze Age Archaeology

edited by
Heide W. Nørgaard and Samantha S. Reiter

Archaeopress Archaeology

ARCHAEOPRESS PUBLISHING LTD
13-14 Market Square
Bicester
Oxfordshire OX26 6AD
United Kingdom
www.archaeopress.com

ISBN 978-1-80327-921-3
ISBN 978-1-80327-922-0 (e-Pdf)

© the individual authors and Archaeopress 2025

Cover: Metallographic image of a crucible fragment from Vilsted, Ranum, Vesthimmerland.
Picture taken by Heide W. Nørgaard

Publishing was made possible through support by Moesgaard Museum and funding by Farumgaard-Fonden.

Farumgaard-Fonden

This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. To view a copy of this license, visit http://creativecommons.org/licenses/by-nc-nd/4.0/ or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.

This book is available direct from Archaeopress or from our website www.archaeopress.com

Essays in Bronze Age Archaeology in Honour of Dr. Phil h.c. Helle Vandkilde on her 70th birthday

With contributions by Samantha S. Reiter, Katrine Balsgaard Juul, Laura Ahlqvist, Catherine J. Frieman, Joseph Maran, Marie-Louise Stig Sørensen, Kristian Kristiansen, Anna Tornberg, Paulina Suchowska-Ducke, Flemming Kaul, Dalia Pokutta, Dmitry Zenyuk, Kerstin Lidén, Ole Thirup Kastholm, Morten Ravn, Philipp W. Stockhammer, Svend Hansen, Anne Birgitte Gebauer, Mads Lou Bendtsen, Lasse Vilien Sørensen, Lene Melheim, Constanze Rassmann, Valentina Matta, Søren Dietz, Johan Ling, Daniel Berger, Ernst Pernicka, Zofia Stos Gale, Mike Parker Pearson, Louise Felding, Neil Wilkin, Anna Sörman, Christian Horn, Harald Meller, Johannes Müller, Janusz Czebreszuk, Casper Sørensen, Jutta Kneisel, Christopher Prescott, Silja Arnfridardottir Christensen, Martin Egelund Poulsen, Tobias Torfing, Anna Thusgaard Kristensen, Jesper Olsen and Heide W. Nørgaard.

Contents

Part 3: Bronzification

Part 4: The Coded Bronze Age – Society, Value and Worldview

Part 5: The Lived Bronze Age – of Settlements and Burials

List of Figures

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Chapter 15

Chapter 16

Chapter 17a

Chapter 17b

Chapter 18

Chapter 19

Chapter 20

Chapter 21

Chapter 22

Chapter 23

Chapter 24

Chapter 25

Chapter 26

Chapter 27

Chapter 28

Chapter 29

Chapter 30

Tabula Gratulatoria

Andrea Dolfini
Andrew Jones
Anette Sand-Eriksen
Anna Sörman
Anna Thusgaard Kristensen
Anna Tornberg
Anne Birgitte Gebauer
Anne Lene Melheim
Anne-Louise Haack Olsen
Anne-Marie Søndergaard Christensen
Anthony Harding
Barbara Armbruster
Bart Cornelis
Benjamin Roberts
Casper Sørensen
Catherine J. Frieman
Christian Horn
Christopher Prescott
Constanze Rassmann
Daniel Berger
Dalia Pokutta
Deborah Olausson
Department of Archaeology and Heritage Studies at Aarhus University
Detlef Jantzen
Dmitry Zenyuk
Ernst Pernicka
Eszter Bánffy
Felix Riede
Flemming Højlund
Flemming Kaul
Harald Meller
Heide W. Nørgaard
Henry Skorna
Jan Apel
Jan Turek
Jan-Heinrich Bunnefeld
Janusz Czebreszuk
Jens-Henrik Bech
Jens-Peter Schmidt
Jens Winther Johannsen
Jesper Olsen
Joakim Goldhahn
Joanna Sofaer
Johan Ling
Johannes Müller
Joseph Maran
Jutta Kneisel
Karin Margarita Frei
Karl Hjalte Maack Raun
Katrine Balsgaard Juul
Kerstin Lidén
Knut Ivar Austvoll
Knut Rassmann
Kristian Kristiansen
Kristin Armstrong-Oma
Kristina Lund Udengaard
Lærke Recht
Lars Larsson
Lasse Vilien Sørensen
Laura Ahlqvist
Lilian Matthes
Liv Appel
Louise Felding
Mads Lou Bendtsen
Mads Ravn
Maikel Kuijpers
Malene Refshauge Beck
Malou Blank
Marianne Rasmussen Lindegaard
Marie-Louise Stig Sørensen
Mark Haughton
Marta Díaz-Guardamino
Martin Egelund Poulsen
Martin Furholt
Martin Mikkelsen
Matthew J. Walsh
Mats Roslund
Mette Løvschal
Mike Parker Pearson
Morten Ravn
Museum Silkeborg
National Museum of Denmark
Neil Wilkin
Nikolaus Boroffka
Nicola Ialongo
Nicole Taylor
Ole Thirup Kastholm
Orla Madsen
Paulina Suchowska-Ducke
Per Borup
Peter F. Biehl
Peter Tóth
Philipp W. Stockhammer
Richard Bradley
Samantha S. Reiter
Serena Sabatini
Silja Arnfridardottir Christensen
Sophie Bergerbrant
Stephen Shennan
Stuart Needham
Svend Hansen
Søren Dietz
Tim Flohr Sørensen
Timothy Earle
Tobias Mörtz
Tobias Torfing
Valentina Matta
Valerio Gentile
Viking Ship Museum in Roskilde, Denmark
Xenia Pauli Jensen
Zofia Stos-Gale

Introduction

Bronze, the Bronze Age and Bronzization

Samantha Scott Reiter[a] and Heide W. Nørgaard[b]

[a] Environmental Archaeology and Materials Science, National Museum of Denmark, Copenhagen, Denmark
[b] Department of Environmental Archaeology and Materials Science, National Museum of Denmark, Kgs. Lyngby (Brede), Denmark
samantha.scott.reiter@natmus.dk

The idea for this book was born in a restaurant. The chapter headings and contents were sketched out on napkins while the authors of this introduction outlined the evolutions we have witnessed in Bronze Age research since the start of our careers. One common element which kept cropping up was how much we (as have many authors in this book) were heavily influenced by Helle Vandkilde's research.

We (Heide and I) started as PhD students in 2009 as part of a small group of young researchers who came together from all over Europe to join Vandkilde's *Forging Identities* project. This specific Marie Curie training network was created to investigate the mobilities of culture. Main partners from five different countries were part of the project, including ten PhD students, four postdocs and five professors. Later, we learned that a secondary major aim of the project was to create lifelong cross-border bonds between researchers. 16 years later, we can unhesitatingly confirm that both the first and the secondary aims were attained. (It may also be of interest that 15 of the authors contributing to this volume were also associated with *Forging Identities* in various capacities.)

Since *Forging Identities* began, and in the intervening years since it came to a close, we have had a tremendous amount of new discoveries and new data, but this is – we would argue – not the most important aspect of how Bronze Age studies have altered. As prehistorians, a lot of what we do revolves around looking at an incomplete data matrix in order to retrofit the patterns they make into ancient realities. In short, we make stories out of what remains from the distant past. In actuality, our work often presents the datapoints which we perceive in the ground, gather from scientific analyses, or infer from the (pre)historical record as the *end-products of ancient events.*

This is where the *honourée* of the present volume steps out centre stage. Across the many research fields which have benefitted from her academic attention (see Balsgaard Juul,[1] this volume), Helle Vandkilde's approach to studying the past is one which looks at data not as static entities or 'end products', but rather as fixed points *within dynamic historical processes*. In other words, Vandkilde looks at prehistoric data not as individual points, but rather as knots within a wide and interconnected tapestry.

In this, she follows along in the footsteps of some of the greatest thinkers of the modern era; her preoccupation with the long-reaching after-effects of change could link up well with the Hegelian dialectic (Hegel 2010) and the Annales School's *longue durée* (Braudel 1992). That being said, Vandkilde's contribution to Bronze Age studies goes far beyond the replication of different approaches and methods to prehistory; she has fundamentally changed the greater discipline itself. She has altered how we go about building our knowledge of the distant past and how we approach building bridges between the fixed datapoints that our research establishes, because she looks at data as a network representing processes of change.

In pursuit of her study of these processes of change, Vandkilde has concentrated particularly on globalisation, mobility, transcultures, and – as was the inspiration for this monograph – 'bronzization'. Bronze Age studies have changed chiefly because Helle Vandkilde's approach (the study of processes and their interconnectedness) is becoming more and more evident. In the following, we will give a short overview of some of the major cornerstones, putting them in context in relation to the new and exciting explorations, viewpoints, possibilities, and angles of cutting-edge Bronze Age work that come together in this volume.

Vandkilde has argued that globalisation is not the purview of modern times – in fact, it can very aptly be applied to the Bronze Age as well. Globalisation in the ancient past refers to what Vandkilde has called 'a

[1] Katrine Balsgaard Juul, PhD, Museum Horsens, is genderarchaeologist, investigating the roles of women in Danish archaeology from the early 19th century till today. Her project „Arkæologiens Glemte Mødre“ and her work in Wikipedia shall create more gender equality in Danish archaeology by highlighting women's contributions to the field since the early days of archaeology (https://www.katrinebalsgaardjuul.com/).

world of things in transit' (2010: 903). In this she has been a continual inspiration to her colleagues and students (for globalisation, see also Vandkilde 2014a; 2016). Her research approach examines the varied and sometimes separate and/or differential flux of people, materials, and ideas as things. In so doing, she embraces the 'New Mobilities Paradigm' (Shellar and Urry 2006; Shellar 2021; Urry 2007). In point of fact, Vandkilde had already dived deeply into many of the precepts from the Mobilities Paradigm before it became known as such. In her landmark monograph *From Stone to Bronze* (Vandkilde 1996), she challenged and refined earlier ideas about a stiff and regimented changeover between era-defining materials (stone in the Neolithic and bronze in the Bronze Age; Thomsen 1836) which had formed almost a century's worth of archaeological thinking.

Vandkilde sees globalisation as a motor for change: novel materials and ideas became available brought about by contacts with new peoples and places. However, Vandkilde examines globalisation in prehistory as something which is greater than the sum of its parts. She sees it not as 'the fact that different cultures and economic systems around the world [were] becoming connected and similar to each other because of the influence of large multinational companies and of improved communication' (which is the *Oxford Learner's Dictionary* definition, Oxford Lexico 2024), but rather in relation to the expansion and intensification of relations across boundaries, writing: 'In [a] broad sense, globalization has always taken place ... [with the realisation] that each period of intensified wide-reaching interaction was uniquely constituted in a specific world historical context' (Vandkilde 2010: 905). She suggests, therefore, that we look at (pre) history as a place of flows (Vandkilde 2013a) and of travelling cultures (Vandkilde *et al*. 2015) rather than as a mono-directional march of increasing technological improvement (Vandkilde 2007). Through Vandkilde we have gained a glimpse of a Bronze Age world which was dynamic and which grew organically. As presented, this framework allows us to see the intense and long-distance connections evidenced by our various 'fixed points' (the mobility data from strontium isotopes, the isotopic and trace element analysis showing the exchange in metals, not to mention the tremendous amount of information from traditional archaeological approaches demonstrating the exchanges of objects and ideas), not as dry dots on maps, but as dynamic focal points around which an organic human network came into being.

As has also been argued by other scholars (Marshall 2015), there are certain areas in which those flows intensified. Here, too, Vandkilde has given us a means to come to grips with the transitional nature of change, referring to such places as 'intersecting spheres of interaction' (Vandkilde 2016: 115, see also Vandkilde 2017b: 518). In so doing, she advances previous thinking on so-called 'hot' societies (Lévi-Strauss 1962) by characterising them in relation to the mechanics of social, political, economic and technological change. According to Vandkilde, such 'hotspots' (Vandkilde 2014b: 54) are performative and promote social climates of creativity, mobility and entrepreneurship, in which new ideas, processes and techniques can take root (Vandkilde 2007: 11-23). These focal points acted as would radio towers – receiving and relaying culture at high frequencies, which, as Vandkilde has posited, result in the formation of a cultural koine (Vandkilde 2014b: 54).

Many scholars the world over have examined change in different forms. We know, therefore, that it is not rhythmic: it flows and gushes, pools and collects in time with other processes – war, disease, technological change (i.e. Crellin 2020; Diamond 1997). In terms of later prehistory (an important distinction to make as, in many parts of Europe it was a period which still predated the advent of the written word), Vandkilde has identified intercultural mobility as one of the key driving engines setting the pace of change (Vandkilde 2014b: 68). Fanning out from the above-mentioned 'hotspots', and borne on the backs of intercultural migrants, Vandkilde has hypothesised the presence of what she calls 'transcultures', defining them as 'fashion[s], or...meta-culture[s], which moved rapidly over wide geographical areas and which underwent various transformations while still maintaining a distinct transculturality' (Vandkilde 2014b: 54).

The interaction between people and materials is what we in archaeology know as a 'culture'. The dynamic interactions between people, materials, objects and ideas which we see in the Bronze Age came to define the era. As Vandkilde writes, the process(es) of interaction within those transcultures 'literally made the Bronze Age. This multifaceted process in place and space is here termed bronzization' (Vandkilde 2016: 108).

Vandkilde's keen eye for detail and the enormous breadth of her disciplinary knowledge and academic capacity has enabled her to combine typology, socio-political patterns, archaeometric analysis, and archaeological theory (to name but a few) in order to reveal the complexities of our distant past. As such, the term 'bronzization', which she coined, reflects not only the adoption of bronze (for Vandkilde's work here see Vandkilde 1988; 1989; 1992; 1993; 1996; 1998b; 1998a; 1998c; 2005; 2010; 2017a), but the preceding processes which brought people into contact with bronze, and also entrains all the processes which came after, and whose echoes we may still feel today (see Vandkilde

2016; 2017b; 2022; Vandkilde *et al.* 2021; Vandkilde *et al.* 2024). Some of these processes are particular areas on which Vandkilde has a particular focus, such as her fascination with social identity across Europe (see Vandkilde 1999; 2006b; 2006a; 2013b; 2015; 2018a; 2018b) and the trade and exchange networks (see Nørgaard *et al.* 2019; 2021; Nørgaard *et al.* 2022; Suchowska-Ducke *et al.* 2015; Vandkilde 2020; 2021; Vandkilde *et al.* 2015; Vandkilde *et al.* 2024).

This volume is, therefore, intended as an ode to Vandkilde in honour of her 70th birthday, but also as a representation of the inspiration she has seeded, and continues to instill, throughout her career. Furthermore, it is also intended to present the state-of-the-art (and beyond) of European Bronze Age research from a Scandinavian point of view. As such, the chapters in this volume address major aspects of Bronze Age research, and they do so from different perspectives. In this, they reflect the dynamism of the past decades' research into a dynamic period. They are, in short, facets of a complex and interrelated whole series of processes involving, touching upon, and touching off from 'bronzization'.

The five parts introduce different thoughts regarding the theoretical concepts of a globalised Bronze Age world and its challenges, the scientific evidence surrounding the increased mobility often associated therewith, the role of metal, with a focus on Scandinavian networks, the sacred world of the Bronze Age, and aspects and evidence of Bronze Age living. The aim is to present current debates in research, broaden the horizon of established Bronze Age scholars, and to provide the interested reader (be they academics, students, or others generally interested in the past) with an in-depth introduction to the Bronze Age. These last might be the excuse for the several very extensive bibliographies, which, we hope, will allow the curious reader to explore the breadth and depth of the fascinating topic of bronzization according to their own particular research needs.

The theoretical reflections on the concept of bronzization (Part 1) begin with the question of a united identity. *Samantha S. Reiter* discusses similarities in habitus, material culture and aDNA in the Bronze Age to clarify the potential origins of European Identity. *Laura Ahlqvist* also sheds light on this topic more provocatively, asking if Bronze Age people might have 'thought' in bronze? Within the Scandinavian Bronze Age, she identifies a translation of complex ideas into symbols that, when depicted on bronze artefacts, allowed for a generalised and united understanding of a complex world.

To allow the reader to identify the underlying global aspects in the local peculiarities of the Bronze Age world, *Catherine J. Frieman* and *Joseph Maran* present different case studies which address the fundamental parameters of bronzization: globalisation, hotspot zones, transculturality. More specifically, Frieman addresses the oppositional character of local archaeological inquiries in our understanding of global networks, focusing on the ore-rich Cornwall region, and Maran uses the term 'glocalisation' to show that the creative fusion of foreign influence within hot-spot zones is the key for understanding the societal and cultural changes in the Argolid of the Shaft Grave era.

In her call for a greater reflection on the potential of the knowledge that our interdisciplinary archaeology brings in terms of prehistoric people, *Marie-Louise Stig Sørensen* asks why we do not address the emotional aspects of prehistoric individuals and the resulting behavioral changes of mobile people, such as the 'Egtved Girl'. By stating that not knowing is not a reason for not asking, she lifts studies of Bronze Age identities to a new level. The last contribution in this section by *Kristian Kristiansen* centres around the long-term economic processes which took place in the Scandinavian Bronze Age. With a focus on change and how regional change impacts neighbouring regions, Kristiansen explores the role of ideology in the maintenance of a shared Nordic idiom.

Within Part 2, the contributions focus on the mobile Bronze Age, giving examples of the archaeological and scientific evidence for mobility. Deep within the third science revolution (Kristiansen 2014), archaeologists tend to forget the huge potential of traditional archaeological methodologies. Here, a hand-picked selection of traditional and transdisciplinary methodological studies concentrating on the identification or interpretation of mobility in Bronze Age inspires readers to remember the potential of traditional methods and the power of combining methodologies, as well as some thoughts on how to go beyond these in future research. The topic of mobility is addressed from different angles. *Anna Tornberg* introduces the potential of biomolecular archaeology and combines it with osteological analyses to show how bronzization affected health and lifeways in southern Scandinavia at the beginning of the Bronze Age. Within her contribution, Tornberg discusses the biocultural consequences of prehistoric globalisation for individuals and populations.

Evidence of mobility has different implications. *Paulina Suchowska-Ducke*'s focus is on so-called artefact mobility. She offers several examples of artefact categories that represent aspects of cultural transmission, translation, and adaptation between the Bronze Age cultures of temperate Europe and the Mediterranean. Her article not only emphasises the trade and exchange networks that emerged across and beyond Europe, but also lays a foundation for an investigation into the complex social processes that shaped objects through people, and, conversely, shaped people through objects. Taking as his starting point the sun-horse phenomenon, *Flemming Kaul* argues that specific symbols in Bronze Age Europe shares religious expression. In a transregional comparison Kaul investigates the potential for the loss of meaning when symbols are stylised under different social settings in time and space.

Dalia Pokutta, *Dmitry Zenyuk* and *Kerstin Lidén* take the reader to Bronze Age Russia to examine the crucial role played by nomadic tribes of the steppe as intermediaries of cultural exchange. With the example of the Litvinovka burial barrow in the Lower Don region, the authors scientifically investigate the lifeways of Bronze Age people during the transition from the Yamnaya to Catacomb cultures and the region's integration with wider cultural and economic systems across Eurasia.

While the last decades have shown an increasing amount of interest in various aspects of Bronze Age mobility, there has been significantly less discussion within the generic literature of the means by which this mobility was executed. *Ole Thirup Kastholm* and *Morten Ravn*'s contribution begins with a detailed description of Denmark's Late Bronze Age 'Varpelev Boat'. Importantly, this unique find is contextualised in relation to both Scandinavian (in particular) and European (in general) boat finds, and the technological differences between them. They highlight that the extensive maritime-based transportation of goods, people, and ideas which took place during the Bronze Age 'shaped' the boats themselves. This section of our book, focusing on the scientific and archaeological evidence for mobility, concludes in a non-traditional way. *Philipp W. Stockhammer*'s contribution presents the potential of the grand total of the detailed scientific and archaeological knowledge that scholars have gathered to date to tell stories about the past. Indirectly answering Marie-Louise Stig Sørensen's question (Chapter 5), Stockhammer explores and explains by means of examples how detailed personal stories can be told based on scientific facts and the posing of personal questions.

Part 3 of the book concerns bronzification, a term which has been lately much used in scholarly circles (see Melheim and Nørgaard, in this volume), specifically in relation to the importance of metal exchange networks over the process of Europe's bronzization. This section gathers contributions regarding technology, typology, and trade relative to the exchange networks of the European Bronze Age. We open with an attempt to explain the drivers for the diffusion of technological knowledge, with *Svend Hansen* taking the reader through thousands of years of the history of technological developments, thereby also providing a very detailed bibliography for further reading. Hansen examines in more detail three examples of the diffusion of products (daggers), formulas (recipes for copper-silver alloys), and technologies (lost-wax casting), thereby illuminating the chronological and spatial dimensions of the transfer of knowledge at the beginning of the European Bronze Age. The importance of bronze to the Bronze Age is clear. The chapter by *Anne Birgitte Gebauer*, *Mads Lou Bendtsen* and *Lasse Vilien Sørensen* addresses the key importance of the dawn of metallurgy in Scandinavia. The authors introduce the huge amounts of copper artefacts imported into the Baltic region in the 4th millennium BCE and present the latest interdisciplinary ideas on the origins of those imports. Evidence of casting equipment in Neolithic Denmark suggests that these established networks exchanged goods as well as knowledge. The transfer of knowledge is a topic that *Lene Melheim* and *Heide W. Nørgaard* also address when discussing evidence of communities of practice within the organsation of metalwork activities in the Middle Bronze Age. They present a picture of shared technological practices upheld and modified across the centuries by various kinds of workshop communities, and which, while geared towards local or regional consumption, nevertheless interacted in divergent manners with outside networks, depending on the individual focal points of those workshops.

Constanze Rassmann's chapter sheds light on the networks that supplied Scandinavia with another prestige material – gold. From the basis of the Danish Arildskov hoard and its three golden armrings, she discusses the interconnectedness of trade networks and technological advancements in metalworking. *Valentina Matta* and *Søren Dietz* take us to southern regions that likely played a crucial role in the network of European metal trade during the Middle and Late Bronze Age. Matta introduces the Nuragic civilisation (1800-720 BCE) and its significance for the Scandinavian Bronze Age, giving a well-rounded background both within the text and through her bibliography for further studies. The research by *Søren Dietz* is of a different nature, examining the origins of four so-called 'bronzetti', the figurative art of the Nuragic civilisation curated at the National Museum in Denmark.

The contribution by *Heide W. Nørgaard*, *Johan Ling*, *Daniel Berger*, *Ernst Pernicka*, *Zofia Stos Gale* and *Lene Melheim* unites the work and efforts of two of the largest Scandinavian archaeometallurgy research teams for the first time. It presents an educated guess on the metal networks which led to Scandinavia throughout the entire Bronze Age period. Isotopic evidence of metal artefacts in Scandinavia is used to define, model and compare trade connections between the mining regions in Europe and to denote the ways by which knowledge exchange might have happened from the Late Neolithic to the middle of the 1st millennium BCE.

Part 4 groups together research that we have placed under the umbrella term of the coded Bronze Age. These contributions touch upon Bronze Age society and the construction of value, and various united or different world views within the European Bronze Age. *Mike Parker Pearson* discusses the evidence of social hierarchy based on the excavation of a 500-year settlement sequence at Cladh Hallan in the Western Isles (Outer Hebrides) of Scotland. Arguing that defended ring-forts and enclosures were a key feature of social structure, he evaluates Britain's Late Bronze Age settlement record in relation to evidence for social inequality. By examining Nordic Bronze Age burials, *Louise Felding* illustrates shifting gendered expressions of identity from the Early to the Late Bronze Age. She highlights the gendered balance in Nordic Bronze Age society, by means of examples such as Late Bronze Age depositions dominated by female objects.

Neil Wilkin's contribution responds to the growing appreciation of the overlapping spectra of economic, social and spiritual values and mirrors recent developments in how prehistorians think about metalwork deposition in northwest Europe during the Bronze Age. He studies depositional behaviours during the British Bronze Age to define and develop the concepts of 'morality' and 'ethics'. *Anna Sörman* also works with the concept of fragmentation within northern and western Europe's Middle and Late Bronze Age metal deposits. She emphasises that the current interpretation of fragmented metal deposits as scrap-hoards should be challenged, and the concept of the 'secondary products revolution' can be useful for illustrating the diverse range of practices enabled by the increased fragmentation in the Late Bronze Age.

Nordic Bronze Age rock art is seen as evidence for the reconstruction of social, religious, and economic aspects of past societies, especially the human-like figures which seem to indicate high-status individuals. By studying a large corpus of anthropomorphic figures in rock art, *Christian Horn* seeks to understand which activities, body postures, and body characteristics were considered appropriate for elite individuals in terms of gaining status based on real-world activities. *Harald Meller* investigates the origins of snake depictions in the early Bronze Age, focusing on the Únětice culture and based on the Nebra hoard. He argues that the depiction of the snake in combination with the sun and ship appear together for the first time in the Nebra deposit and that, towards the end of its period of use, these became the central elements of the myth of the sun's journey through day and night.

The lived Bronze Age is the focus of Part 5, looking at settlements and burials of the European Bronze Age.

This section is introduced by two contributions focussing on the monumental burial mounds of the Tumulus culture. *Johannes Müller* and *Janusz Czebreszuk* explain how the practice of constructing large burial mounds first appeared with northeastern Únětice groups and was later adopted in central Germany. The authors conclude that different social practices of varying temporal performance existed between Greater Poland and central Germany, and that these played a role in internal social transformation processes. In his contribution, *Casper Sørensen* explores the newly proposed concept of 'mound durée' (a timeless aristocratic ethos) encompassing the burial traditions of the burial mounds of the Single Grave culture, the Late Neolithic, and the Early Bronze Age cultures in southern Scandinavia. Based on the idea that a shared vision of burials and identities existed then, including a prevailing symbolic warrior identity, he investigates the potential of grave goods as symbolic objects and their expressions of similar 'symbolic' identities. *Jutta Kneisel* illuminates the role of fire in burial customs of the European Bronze Age via an interdisciplinary strategy. Presenting a large number of early cremation burials, her focus is on the use of fire in burial rituals before cremation became the common form of burial custom, which includes the deliberate burning of mortuary chambers and grave constructions.

Christopher Prescott's contribution moves away from the exclusive discussion of funerary monuments and sheds light on the entirety of a specific region. Via a three-tiered scale in a study of the southwestern region of Lista, southern Norway, he suggests that a chronologically deep and extensive use of the landscape, including agriculture, mortuary practices, production (metallurgy) and ritual, characterises Lista as a maritime bottleneck in western Scandinavia. He further concludes that it seems highly likely that older monuments structured later construction (i.e. the construction and use of monumental mounds).

However, Bronze Age societies are characterised not only by their material culture, rituals and burial monuments. Among the most important and most frequent material legacies of Bronze Age societies are their settlements. *Silja Arnfridardottir Christensen* and *Martin Egelund Poulsen* present evidence from Jutland (Denmark) for the transition from two- to three-aisled longhouses. They argue that this transition is not a linear chronological evolution, but should instead be seen more as involving a longer period, with experimentation with different forms of construction. According to the authors, the main reason for the three-aisled revolution should be connected to the need for *monumental* architecture, as the culmination of building large longhouses coincides with the decline in erecting large round barrows. The new investigations at the Late Bronze Age settlement at Veldbæk, Jutland, are presented by *Tobias Torfing*, *Anna Thusgaard Kristensen* and *Jesper Olsen*. In their contribution, besides the archaeological evidence, the authors also present hitherto unpublished natural scientific evidence indicating that Veldbæk was one of the first large villages. The argument might run, therefore, that the formation of villages already existed in NBA VI and was accompanied by important changes in agricultural practice.

In all, the collected contributions within this volume study change and process, and are also themselves representations of the changes that scholarly inquiry into the Bronze Age has undergone. As Helle Vandkilde has shown in her research, these different windows into Bronze Age society, material, processes, trade, production, mobility, statecraft, technological change, and health (to name but a few) all combine to open different vistas onto a dynamic and interconnected world. It is in following this common pathway of plural approaches that we can best come to grips and understand how 'bronzization' came about.

Bibliography

Braudel, F. 1992. *The Mediterranean and the Mediterranean World in the Age of Phillip II*. London: Harper Collins.

Crellin, R.J. 2020. *Change and Archaeology*. London: Routledge.

Diamond, J. 1997. *Guns, Germs and Steel: The Fates of Human Societies*. New York: Norton Press.

Hegel, G.W.F. 2010. *Science of Logic*, 2nd ed. Cambridge: Cambridge University Press.

Kristiansen, K. 2014. Towards a new Paradigm? The Third Science Revolution and its Possible Consequences in Archaeology. *Current Swedish Archaeology* 22: 11-34.

Lévi-Strauss, C. 1962. *La Pensée Sauvage*. Paris: Plon.

Marshall, T. 2015. *Prisoners of Geography*. London: Elliott and Thompson Ltd.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2019. On the trail of Scandinavia's early metallurgy: provenance, transfer and mixing. *PLoS ONE* 14(7): 1-32, e0219574.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2021. Shifting Networks and Mixing Metals: Changing metal-trading routes to Scandinavia correlate with Neolithic and Bronze Age transformations. *PLoS ONE* 16: e0252376.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2022. 1600 BC: Fårdrup and Valsømagle-type axes and the first evidence of southern Alpine metal. *Acta Archaeologica* 92.2 (2021): 185-226.

Oxford Lexico 2024. Globalization noun, in: Oxford Advanced Learner's Dictionary. Oxford: Oxford University Press (available at: https://www.oxfordlearnersdictionaries.com/definition/english/globalization?q=globalization).

Shellar, M. 2021. *Advanced Introduction to Mobilities*. New York: Edward Elgar Publishing.

Shellar, M. and J. Urry 2006. The New Mobilities Paradigm. *Environment and Planning A: Economy and Space* 38(2): 207-226.

Suchowska-Ducke, P., S. Reiter and H. Vandkilde 2015. *Forging Identities. The Mobility of Culture in Bronze Age Europe. Report from a Marie Curie Project 2009-2012 with Concluding Conference at Aarhus University, Moesgaard 2012*. British Archaeological Reports International Series 2772. Oxford: Archaeopress.

Thomsen, C.J. 1836. *Ledetraad til nordisk oldkyndighed*. København: Møllers Bogtrykkeri.

Urry, J. 2007. *Mobilities*. Cambridge: Polity Press.

Vandkilde, H. 1988. A Late Neolithic Hoard with Objects of Bronze and Gold from Skeldal, Central Jutland. *Journal of Danish Archaeology* 7: 115-135.

Vandkilde, H. 1989. Det ældste metalmiljø i Denmark, in J. Poulsen (ed.) *Regionale forhold i Nordisk Bronzealder. 5. Nordiske symposium for Bronzealderforskning på Sandbjerg Slot 1987*. Aarhus: Jysk Arkæologisk Selskab.

Vandkilde, H. 1992. Metal Analyses of the Skeldal Hoard and Aspects of Early Danish Metal Use. *Journal of Danish Archaeology* 9: 114-132.

Vandkilde, H. 1993. Det første metalhåndværk, in S. Hvass and B. Storgaard (eds) *Da klinger i Muld: 25 års arkæologi i Danmark*. Aarhus: Det Kgl. Nordiske Oldskriftselskab, Jysk Arkæologisk Selskab.

Vandkilde, H. 1996. *From Stone to Bronze. The Metalwork of the late Neolithic and earliest Bronze Age in Denmark*. Aarhus: Jutland Archaeological Society.

Vandkilde, H. 1998a. Denmark and Europe: typochronology, metal composition and socio-economic change in the Early Bronze Age, in C. Mordant, M. Pernot and V. Rychner (eds) *L'atelièr du bronzier en Europe du XXe au VIIIe siècle avant notre ère. Actes du colloque international „Bronze '96", Neuchâtel et Dijon: Les analyses de composition de mètal: le rapport à l'archéologie del' Age du Bronze*. Paris: CTHS.

Vandkilde, H. 1998b. Metal Composition and Socio-Economic Change in the Early Bronze Age, in C. Mordant, M. Pernot and V. Rychner (eds) *L'atelièr du bronzier en Europe du XXe au VIIIe siècle avant notre ère. Actes du colloque international „Bronze '96", Neuchâtel et Dijon, 1996. Tome III. Production, circulation et consommation du bronze*. Paris: CTHS.

Vandkilde, H. 1998c. Metalwork, Depositional Structure and Social Practice in the Danish Late Neolithic and Earliest Bronze Age, in C. Mordant, M. Pernot and V. Rychner (eds) *L'atelièr du bronzier en Europe du XXe au VIIIe siècle avant notre ère. Actes du colloque international „Bronze '96", Neuchâtel et Dijon, 1996: L'atelier du bronzier, élaboration, transformation et consommation du bronze en Europe du XXe au VIIIe siècle avant notre ère*. Paris: CTHS.

Vandkilde, H. 1999. Social Distinction and Ethnic Reconstruction in the Earliest Danish Bronze Age, in C. Clausing and M. Egg (eds) *Eliten in der Bronzezeit Ergebnisse zweier Kolloquien in Mainz und Athen*. Mainz: Monographien des Römisch-Germanischen Zentralmuseums.

Vandkilde, H. 2005. A Biographical Perspective on Ösenringe from the Early Bronze Age, in T.L. Kienlin (ed.) *Kulturelles Wissen und Materielle Kultur*. Bonn: Verlag Dr. Rudolf Habelt.

Vandkilde, H. 2006a. Warfare and Gender according to Homer: An Archaeology of an Aristocratic Warrior Culture, in T. Otto, T. Henrik and H. Vandkilde (eds) *Warfare and Society. Archaeological and Social Anthropological Perspectives*. Aarhus: Aarhus University Press.

Vandkilde, H. 2006b. Warfare, Weaponry and Material Culture – an Introduction, in T. Otto, H. Thrane and H. Vandkilde (eds) *Warfare and Society. Archaeological and Social Anthropological Perspectives*. Aarhus: Aarhus University Press.

Vandkilde, H. 2007. *Culture and Change in Central European Prehistory 6th to 1st millenium BC*. Aarhus: Aarhus University Press.

Vandkilde, H. 2010. Metallurgy, Inequality, and Globalisation in the Bronze Age - discussant's commentary on the papers in the metallurgy session, in F. Bertemes and H. Meller (eds) *Der Griff nach den Sternen. Wie Europas Eliten zu Macht und Reichtum kamen. Internationales Symposium Halle/Saale 2005*. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Vandkilde, H. 2013a. Bronze Age Voyaging and Cosmologies in the Making: the Helmets from Viksø Revisited, in S. Bergerbrant and S. Sabatini (eds) *Counterpoint: Essays in Archaeology and Heritage Studies in Honour of Professor Kristian Kristiansen*. British Archaeological Reports International Series 2508. Oxford: Archaeopress.

Vandkilde, H. 2013b. Warfare in Northern European Bronze Age Societies, in S. Ralph (ed.) *The Archaeology of Violence. Interdisciplinary approaches*. Albany: State Univeristy of New York Press.

Vandkilde, H. 2014a. Breakthrough of the Nordic Bronze Age: Transcultural Warriorhood and a Carpathian Crossroad in the Sixteenth Century BC. *European Journal of Archaeology* 17(4): 602-633.

Vandkilde, H. 2014b. Cultural Perspectives on the Beginnings of the Nordic Bronze Age. *Offa* 67/68: 51-77.

Vandkilde, H. 2015. Conflict and War, Archaeology of: Weapons and Artifacts, in J.D. Wright (ed.) *International Encyclopedia of the Social & Behavioral Sciences* (2nd edn). Oxford: Elsevier.

Vandkilde, H. 2016. Bronzization: The Bronze Age as Pre-Modern Globalization. *Praehistorische Zeitschrift* 91(1): 103-123.

Vandkilde, H. 2017a. *The Metal Hoard from Pile in Scania, Sweden. Place, things, time, metals, and worlds around 2000 BCE*. Stockholm: Aarhus University Press/The Swedish History Museum.

Vandkilde, H. 2017b. Small, medium and large. Globalization perspectives on the Afro-Eurasian Bronze Age, in T. Hodos (ed.) *The Routledge Handbook of Archaeology and Globalization*. London: Routledge.

Vandkilde, H. 2018a. Body Aesthetics, Fraternity and Warfare in the long European Bronze Age – postscriptum, in C. Horn and K. Kristiansen (eds) *Warfare in Bronze Age Society*. Cambridge: Cambridge University Press.

Vandkilde, H. 2018b. Violent Beauty in the Bronze Age, in S. Hansen and R. Krause (eds) *Bronze Age Hillforts Between the Taunus and Carpathian Mountains. Proceedings of the First International LOEWE Conference, 7-9 December 2016 in Frankfurt/M*. Bonn: Verlag Dr. Rudolf Habelt.

Vandkilde, H. 2020. Amber, Weapons and Circulating Ideas about Leadership at the Threshold to the Middle Bronze Age in Europe, in J. Maran, R. Băjenaru, S.-C. Ailincăi, A.-D. Popescu and S. Hansen (eds) *Objects, Ideas and Travelers. Contacts between the Balkans, the Aegean and Western Anatolia during the Bronze and Early Iron Age. Volume to the memory of Alexandru Vulpe Proceedings of the Conference in Tulcea, 10-13 November, 2017*. Bonn: Verlag Dr. Rudolf Habelt.

Vandkilde, H. 2021. Trading and weighing metals in Bronze Age Western Eurasia. *Proceedings of the National Academy of Sciences* 118(30): e2110552118.

Vandkilde, H. 2022. Entrepreneurs, Metals and Change: Scandinavia meets its Neighbours in the Earliest Bronze Age, in R.J. Chacon, J. Ling and K. Kristiansen (eds) *Trade Before Civilization. Long-distance Exchange and the Rise of Social Complexity*. Cambridge: Cambridge University Press.

Vandkilde, H., S. Hansen, K. Kotsakis, K. Kristiansen, J. Müller, J. Sofaer Derevenski, and M. Sørensen 2015. Cultural mobility in Bronze Age Europe, in P. Suchowska-Ducke, S. Reiter and H. Vandkilde (eds) *Forging Identities. The Mobility of Culture in Bronze Age*

Europe. British Archaeological Reports International Series 2772. Oxford: Archaeopress.

Vandkilde, H., V. Matta, L. Ahlqvist and H.W. Nørgaard 2021. Anthropomorphised warlike beings with horned helmets: Bronze Age Scandinavia, Sardinia, and Iberia compared. *Praehistorische Zeitschrift*, advance online publication: 1-29.

Vandkilde, H., C.F. Stephansen, P. Suchowska-Ducke, C.S. Andersen, L. Ahlqvist, L. Felding, M. Bjørnevad-Ahlqvist, J. Czebreszuk and H.W. Nørgaard 2024. Metal-for-Amber in the European Bronze Age. *Praehistorische Zeitschrift* 99(1): 280-338.

Figure 1: Helle Vandkilde in autumn 2024 in front of the nuraghe Santu Antine, in the centre of the Cabu Abbas plain, on Sardinia (picture H. Nørgaard).

Helle Vandkilde – A groundbreaking pioneer in Danish archaeology

Katrine Balsgaard Juul

Department of Archaeology, Museum Horsens, Horsens, Denmark;
balsgaardjuulkatrine@gmail.com

In 2004, Helle Vandkilde was appointed Research Council Professor of Prehistoric Archaeology at the former Institute of Anthropology, Archaeology and Linguistics at Aarhus University, thereby becoming the first female professor of prehistoric archaeology in Denmark. That appointment made Vandkilde a groundbreaking pioneer in Aarhus archaeology and she is an invincible, archaeological force of nature (Juul 2024).

Vandkilde was born on 19th January 1955. She married Flemming Højlund in 1987 and became a mother to her son (Nicolai) in 1988 and her daughter (Christin) in 1990 (Læsøe Engberg 2005). She is keen on separating her personal life from her work life and has not given many interviews. Although she is protective of her privacy, she is warm and supportive as well as being one of the brightest academics in Danish archaeology.

She is a well-respected Danish archaeologist and professor of archaeology at the Department of Archaeology and Heritage Studies at Aarhus University (see Harding 2021). Vandkilde is particularly known for her many years of research on the Bronze Age and the Late Neolithic as well as on material culture, identities, prehistoric war and warrior culture, as well as globalisation in the past and present (e.g. Felding *et al.* 2020; Matta and Vandkilde 2023; Nørgaard *et al.* 2021; Otto *et al.* 2006; Tornberg and Vandkilde 2024; Vandkilde 2024a; 2024b; 2017a; 2017b; 2016; 2015; 2014; 2007a; 2007b; 1996; Vandkilde and Matta 2022; Vandkilde *et al.* 2024; 2023; 2015). She has conducted several large international research projects benefitting European archaeology and is the author of three monographs (Vandkilde 2017a; 2007a; 1996) as well as more than 100 research articles. Vandkilde has conducted field research in Denmark, Sweden, Greece, Romania, Papua New Guinea. and Sardinia.

From Stone to Bronze – early career

In 1979, Vandkilde became a bachelor of classical archaeology at the University of Southern Denmark in Odense. That same year she began studying prehistoric archaeology at the Department of Prehistoric Archaeology at Aarhus University. In 1985, she became MA in prehistoric archaeology. This led to her doctoral research; in 1996 she became Dr phil. (habilitation) with her thesis *From Stone to Bronze. The Metalwork of the Late Neolithic and Earliest Bronze Age in Denmark* (Vandkilde 1996).

From 1998-2004 Vandkilde was employed as a postdoc at the Department of Archaeology and Classical History at Lund University, Sweden. Here she directed the Pile project, which examined a Swedish axe hoard found in Pile in 1864 (Læsøe Engberg 2005). The deposit consists of 27 artefacts of copper, bronze, and silver dating to 2000 BC (Vandkilde 2017a). She has been a docent at the Department of Archaeology and Classical History at Lund University since 1999.

In 2003-2004, Vandkilde was a visiting professor at the Institut für Ur- und Frühgeschichte at Christian Albrechts Universität in Kiel, Germany (Læsøe Engberg 2005).

The first female professor of Prehistoric Archaeology at Aarhus University – later career

In 2004, Vandkilde became Research Council Professor at the Department of Prehistoric Archaeology, at the former Institute of Anthropology, Archaeology and Linguistics at Aarhus University (Læsøe Engberg 2005; Vandkilde 2004). She held the position as research council professor until 2009, when she was appointed as the professorial chair at the Department of Archaeology and Heritage Studies at Aarhus University. This title is still held by Vandkilde today. From 2013-2018, she was furthermore director of the Materials, Culture and Heritage research programme at Aarhus University.

In 2014-2015, Vandkilde was a visiting professor and had a fellowship at the DFG Exzellenzcluster Asien und Europa at Heidelberg Academy of Sciences in Germany.

Vandkilde is known for her great leadership and ability to create large international research projects (Læsøe Egeberg 2005). The latest project where Vandkilde oversees the major project leadership began in 2024 and will continue till 2027. Below is a list of selected research projects.

Metals and Giants, 2024-2027

In co-leadership with Mads Kähler Holst (director of Moesgaard Museum) and Gianfranca Salis (Soprintendenza of south Sardinia), Vandkilde is

Figure 2: Helle Vandkilde in summer 2024 east of Mykene beneath a Bronze Age bridge (picture F. Højlund).

primary investigator of the research project *Metals and Giants*. This archaeological research project investigates the Nordic connection with Bronze Age Sardinia starting with the iconic horned-helmet warriors from Viksø, Kallerup, Grevensvænge, and Tanum. The project is funded by the Augustinus Foundation. So far, the preliminary results have created headlines all over Europe. *Metals and Giants* is the first research project which compares human horned-helmet warrior figurines across such a large geographical area. Furthermore, the project includes metallurgical analysis of isotopes. This research project includes the participation of Heide Wrobel Nørgaard (Moesgaard Museum), and David Stott and Peter Jensen (Aarhus University). The project's partners include archaeologists and scientists from Curt-Engelhorn Zentrum Archäometrie Mannheim, The National Museum of Denmark, the University of Cagliari, the University of Sassari, and the University of Gothenburg.

***Violence and Warfare*, 2021-2023**

Jointly with bio-archaeologist Anna Tornberg, (University of Lund), Vandkilde was engaged in the *Violence and Warfare in the Nordic Corded Ware Complex* research project. The project received funding from Riksbankens Jubileumsfond: The Swedish Foundation for Humanities and Social Sciences. It investigated traces of violence and warfare in burials from the Corded Ware culture in Scania, Denmark, and Germany (Tornberg and Vandkilde 2024).

***The Mountain Sanctuary of Matzanni, Sardinia*, 2019-2021**

Vandkilde directed the research project *The Mountain Sanctuary of Matzanni in Sardinia* together with Mads Kähler Holst (Moesgaard Museum). The project illuminated gigantic heroes, metals, and a Nordic connection by means of high-tech archaeology. The research project received funding from the Danish Ministry of Culture and achieved fabulous results, not least due to the participation of the contemporary PhD project by Valentina Matta (then of Aarhus University), which Vandkilde was supervising at the same time (see Berger *et al.* 2023; Matta *et al.* 2020).

***Connecting Europe 1700-1500 BCE*, 2018-2020**

From 2018-2020, Vandkilde directed the research project *Connecting Europe 1700-1500 BCE* through time simulations of multiple high-resolution $^{C}14$ with Tibor-Tamás Daróczi (then at Aarhus University) as investigatory fellow. The research project was funded by Marie Skłodowska-Curie Actions as part of the European Union's Horizon 2020 scheme.[1]

***Forging Identities*, 2009-2012**

From 2009-2012, Vandkilde was director of the Marie Skłodowska-Curie Actions Initial Training Network *Forging Identities: The Mobility of Culture in Bronze Age Europe* project. Besides being primary investigator, Vandkilde was also the coordinator of the 18 European partner universities, the ten PhD scholars, and the four postdocs. The aim of the project was to investigate the intercultural mobility of people in the Bronze Age through various types of research, including archaeology, metallurgy, biochemistry, and bone studies (Suchowska-Ducke *et al.* 2015a; 2015b).

Archaeological and Social Anthropological Perspectives on War and Society 1999-2002

Vandkilde took the initiative to launch a research project dealing with civilisation and war, financed by the Research Council for the Humanities and headed by herself jointly with Professor Henrik Thrane (Aarhus University) and Professor Ton Otto (Aarhus University) (Otto *et al.* 2006).

[1] Ref: https://cordis.europa.eu/project/id/797494/it

Honours and awards

Throughout her career, Vandkilde has been the recipient of many certificates of honour and awards. Below is a selected list.

Member of Academia Europaea, 2019

In 2019, Vandkilde was elected a member of the Academia Europaea – part of the Academy of Europe for excellence in science and scholarship. Academia Europaea is an NGO promoting European research and education and is affiliated with the European Commission and distinguished national academies in Europe.

Doctor Philosophiae Honoris Causa, 2019

Vandkilde was appointed Doctor Philosophiae Honoris Causa or Fil. Dr. h.c. at Lund University in 2019.

The Prehistoric Society's Europa Prize for 'Outstanding contribution to European Prehistory', 2017

In 2017, Vandkilde was the recipient of The Prehistoric Society's Europa Prize in recognition of her contribution to European prehistory. This was celebrated with a conference at Southampton University in Vandkilde's honour.

Kraks Blå Bog, 2014

Helle Vandkilde was admitted to Kraks Blå Bog ('Krak's Blue Book') for her accomplishments in 2014.

Member of Shanghai Archaeology Forum, 2013

In 2013, Helle Vandkilde was elected a member of the Shanghai Archaeology Forum of the Chinese Academy of Social Sciences. Vandkilde is the only professor of archaeology in Denmark to receive this honour.

Member of Deutsches Archäologisches Institut, 2007

Vandkilde was elected a member of Deutsches Archäologisches Institut under the Academic Branch of the German Ministry of Foreign Affairs in 2007 as a recognition of her contribution to European archaeological research and collaboration. This is an honour that very few non-German nationals are granted.

Erik Westerby Prize, 2005

In 2005, Vandkilde received the Eric Westerby Prize in recognition of her outstanding archaeological research (Læsøe Engberg 2005).

Vandkilde has additionally been elected a member of several scientific panels and boards, including:

- 2022. Elected member, Professorial Panel Aarhus University for promotion of new professors.
- 2019-2023. Chairing the International board 'ROOTS', Christian Albrechts Universität in Kiel, funded by DFG, Deutsche Forschungsgemeinschaft Excellenz Cluster.
- 2019-2020. Executive Board. Independent Research Fund Denmark, Humanities.
- 2018-2023. Review Panel. Independent Research Fund Denmark, Humanities.
- 2018-2023. Scientific Advisory Board of The National Museum of Denmark.
- 2014-2022. Executive Board and Review Panel, Aarhus University Research Foundation.
- 2010-2017. ERC Expert Panel: SH6 'The Study of the Human Past'.
- 2008-2017. Review Panel. Riksbankens Jubileumsfond: The Swedish Foundation for Humanities and Social Sciences

The strong-minded trailblazer

During her 20 years of professorship at Aarhus University, Helle Vandkilde has been a true force of nature for European archaeology. For many women and men in Danish archaeology she has also been known as a strong-minded pioneer, trailblazing her way through the world of academia.

In 2025 we will celebrate the 150th anniversary of women in Denmark gaining access to study at university. Mary Beard has described how most people today still imagine a professor as male. The mere thought of a woman with power can be hard to deal with (Beard 2018: 54 ff). The many arguments against women have been researched thoroughly by Birgitte Possing, concluding that women need more than skills to be able break the so-called 'glass ceiling' (Possing 2018: 257 f). Vandkilde seems to have all that is needed: tremendous knowledge within her fields of expertise, the ability to explore new areas, the skill to think up new projects and raise funding for their execution, not to mention the enthusiasm and perseverance to pass on her knowledge to new generations of students. Truly, she has inspired many younger researchers to follow in her footsteps by being a true role model.[2]

In 2005, a colleague described Vandkilde as 'a reliable partner who takes her profession seriously and knows her stuff. At the same time, she has excellent leadership

[2] The author of this article about the jubilarian would like to highlight that a true role model is a person with the ability to show that women are not confined to being the 'second sex' as defined by Simone de Beauvoir (de Beauvoir 2021: 55 ff).

skills, is full of ideas and manages to bring a group together. She is a true project creator. However, her enthusiasm can sometimes get the better of her. She is not a born diplomat and can be very direct in her statements' (Læsøe Engberg 2005). These characteristics have led to vast amounts of new knowledge on the European Bronze Age.

Helle Vandkilde might not see herself as part of an important movement, trailblazing the path for more women in academia, but she is. She is a true role-model to all of us!

Bibliography

Beard, M. 2018. *Kvinder og magt – et manifest*. København: Gads Forlag.

Berger, D., V. Matta, H.W. Nørgaard, G. Salis and H. Vandkilde 2023. Origin and mixing of metals for Nuragic bronzetti studied with isotopes and trace elements, in F. Lo Schiavo, M. Perra and A. Giumlia-Mair (eds) *Proceedings of V Festival della civilità nuragica (Orroli, Cagliari)*: 243-261. Orroli: Cagliari.

De Beauvoir, S. 2021. *Det andet køn 1. Kendsgerninger og myter* (transl. Karen Stougaard Hansen and Mette Olesen). København: Gyldendal.

Felding, L., S.S. Reiter, K.M. Frei and H. Vandkilde 2020. Male Social Roles and Mobility in the Early Nordic Bronze Age. A Perspective from SE Jutland. *Danish Journal of Archaeology* 9: 1-167.

Harding, M. 2021. Helle Vandkilde. *Den Store Danske* (23 January 2015) (available at: https://denstoredanske.lex.dk/Helle_Vandkilde: lex.dk).

Juul, K.B. 2024. *Helle Vandkilde*. Wikipedia (https://da.wikipedia.org/wiki/Helle_Vandkilde; accessed 2 July 2024).

Læsøe Engberg, K. 2005. Drevet af nysgerrighed. *Kristeligt Dagblad* (5 November 2005; available at: https://www.kristeligt-dagblad.dk/mennesker/drevet-af-nysgerrighed).

Matta, V., H.W. Nørgaard, D. Stott, H. Vandkilde and M.K. Holst 2020. The Mountain Sanctuary of Matzanni in Sardinia: Project Motivations and Preliminary Research Results. *Open Archaeology* 6: 206-213.

Matta, V. and H. Vandkilde 2023. The State of the Debate: Nuragic Metal Trade in the Bronze Age and Early Iron Age. *Open Archaeology* 9(1): 20220280 (available at: https://doi.org/10.1515/opar-2022-0280).

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2021. Shifting Networks and Mixing Metals: Changing metal-trading routes to Scandinavia correlate with Neolithic and Bronze Age transformations. *PLoS ONE* 16: e0252376 (available at: https://doi.org/10.1371/journal.pone.0252376).

Otto, T., H. Thrane and H. Vandkilde (ed) 2006. *Warfare and Society. Archaeological and Social Anthropological Perspectives*. Aarhus: Aarhus Universitetsforlag.

Possing, B. 2018. *Argumenter imod kvinder – fra demokratiets barndom til i dag*. København: Strandberg Publishing.

Suchowska-Ducke, P., S.S. Reiter and H. Vandkilde (eds) 2015a. *Forging Identities. The Mobility of Culture in Bronze Age Europe*. Report from a Marie Curie Project 2009-2012 with Concluding Conference at Aarhus University, Moesgaard, 2012. British Archaeological Reports International Series 2771, Vol. 1. Oxford: Archaeopress.

Suchowska-Ducke, P., S. Reiter and H. Vandkilde (eds) 2015b. *Forging Identities. The Mobility of Culture in Bronze Age Europe*. Report from a Marie Curie Project 2009-2012 with Concluding Conference at Aarhus University, Moesgaard, 2012. Volume 2. British Archaeological Reports International Series 2771, Vol. 2. Oxford: Archaeopress.

Tornberg, A. and H. Vandkilde 2024. Violence and Warfare before the Nordic Bronze Age, in C. Prescott, L. Hedeager, K. Kristiansen and S. Solheim (eds) *Stone Age farmers, herders, hunters and gatherers: The Funnel Beaker Culture, the Single Grave/Battle Axe Culture and the Pitted Ware Culture (4000-2400 BC)*. Oxford: Oxford University Press.

Vandkilde, H. 1996. *From Stone to Bronze. The Metalwork of the late Neolithic and earliest Bronze Age in Denmark*. Aarhus: Jutland Archaeological Society.

Vandkilde, H. 2007a. *Culture and Change in Central European Prehistory 6th to 1st millennium BC*. Aarhus: Aarhus University Press.

Vandkilde, H. 2007b (ed). *Globalisation, Battlefields, and Economics. Three inaugural lectures in archaeology*. Aarhus: Aarhus University Press.

Vandkilde, H. 2014, Archaeology, theory, and war-related violence: theoretical perspectives on the archaeology of warfare and warriorhood, in A. Gardner, M. Lake and U. Sommer (eds) *The Oxford handbook of archaeological theory*. Oxford: Oxford University Press.

Vandkilde, H. 2015. Conflict and War, Archaeology of: Weapons and Artifacts, in J.D. Wright (ed.) *International Encyclopedia of the Social & Behavioral Sciences* (2nd edn): 607-613. Oxford: Elsevier.

Vandkilde, H. 2016. Bronzization: The Bronze Age as Pre-Modern Globalization. *Praehistorische Zeitschrift*, 91(1): 103-123.

Vandkilde, H. 2017a. *The Metal Hoard from Pile in Scania, Sweden. Place, things, time, metals, and worlds around 2000 BCE*. Stockholm: Aarhus University Press/The Swedish History Museum.

Vandkilde, H. 2017b. Small, medium and large. Globalization perspectives on the Afro-Eurasian Bronze Age, in T. Hodos (ed.) *The Routledge Handbook of Archaeology and Globalization*: 509-521. New York: Routledge.

Vandkilde, H. 2024a. From Stone to Bronze – Formation of the Nordic Bronze Age in Southern Scandinavia, in H. Vandkilde, C. Prescott, L. Hedeager and K.

Kristiansen (eds) *From Stone to Bronze – The End of the Neolithic and Beginning of the Metal Ages*. Oxford: Oxford University Press.

Vandkilde, H. 2024b. Towards an Archaeology-driven Sociology of Early Violence and Warfare. A Comment on 'Prolegomena to an archaeological Conflict Research' by Matthias Jung (Auf dem Weg zu einer archäologie-getriebenen Soziologie früher Gewalt und Kriegsführung. Ein Kommentar zu „Prolegomena zu einer archäologischen Konfliktforschung" von Matthias Jung). *Die Kunde, N.F*. 72, 2021.

Vandkilde, H. and V. Matta 2022. Nuragic Warrior Imagery: transcultural Perspectives on Bronze Age Weaponry. *Origini. Preistoria e protostoria delle civiltà antiche* XLV(2021): 65-90.

Vandkilde, H., S. Hansen, K. Kotsakis, K. Kristiansen, J. Müller, J. Sofaer Derevenski and M. Sørensen 2015. Cultural Mobility in Bronze Age Europe, in P. Suchowska-Ducke, S. Reiter and H. Vandkilde (eds) *Forging Identities. The Mobility of Culture in Bronze Age Europe*: 5-37. British Archaeological Reports International Series 2772. Oxford: Archaeopress.

Vandkilde, H., V. Matta, L. Ahlqvist and H.W. Nørgaard 2021. Anthropomorphised warlike beings with horned helmets: Bronze Age Scandinavia, Sardinia, and Iberia compared. *Praehistorische Zeitschrift*: 130-158.

Vandkilde, H., C.F. Stephansen, P. Suchowska-Ducke, C.S. Andersen, L. Ahlqvist, L. Felding, M. Bjørnevad-Ahlqvist, J. Czebreszuk and H.W. Nørgaard 2024. Metal-for-Amber in the European Bronze Age. *Praehistorische Zeitschrift* 99(1): 280-338.

Part 1

A Globalised Bronze Age – theoretical reflections on the concept of bronzization

"Globalization is basically about the expansion and intensification of relations across boundaries. In this broad sense globalization has always taken place, albeit realizing that each period of intensified wide-reaching interaction was uniquely constituted in a specific world historical context."
(Vandkilde 2010: 905)

Chapter 1

Written in blood? An exploration of the possibility of European Identity in the Bronze Age through examination of political *habitus*, origin myth, material culture, economics, mobility, aDNA, and linguistics

Samantha S. Reiter

Department of Environmental Archaeology and Materials Science, National Museum of Denmark, Kongens Lyngby (Brede), Denmark

Samantha.Scott.Reiter@natmus.dk

Abstract

Although there have been some more or less explicit links in the literature of the Bronze Age as the period in which we have the first origins of Europe, there is yet to be a specific study of the potential origins of European Identity at that time. It is namely this lacuna in our understanding which is the subject of this chapter.

Within the current context, 'European Identity' is understood to be personal identification with a sense of belonging to, and of having a place within the region that would come to be known as Europe. To approach this topic, this contribution brings together examples from recent research and extant theories regarding political *habitus*, European origin myth, material culture, economics, mobility data, aDNA, and linguistics in Bronze Age contexts. Case studies range from Scandinavia to the Mediterranean, including North Africa (here considered to be part of Bronze Age 'Europe'). This body of information is then examined in view of recent sociological and neurological research on the mechanisms of human bonding and the unique conditions of the Bronze Age for the promotion of Us/Them thinking.

Introduction

Did Bronze Age people have a concept of Europe? While the structural underpinnings of many academic writings on the European Bronze Age allude to European origins (Childe 1925; 1926; Hawkes 1940; Kristiansen and Larsson 2005), to my knowledge, a systematic assessment of the possible existence of a European Identity specifically has yet to be conducted. In addressing this topic, the following chapter takes a loose approach to what it considers 'Bronze Age Europe', i.e. a broad swathe of territory stretching from Scandinavia to the Mediterranean (including North Africa). To circumvent the temporal variations inherent to the Bronze Age across this expanse, this investigation is oriented thematically: it sequentially examines evidence for European Identity through Bronze Age data on political *habitus*, origin myth, material culture, economics, mobility data, aDNA, and linguistics. The whole of this evidence is then discussed in relation to sociological theory and recent neurological data on the mechanics of human bonding and the unique conditions present in the Bronze Age for the promotion of Us/Them thinking. It finishes with a few reflections regarding what considerations this may give us in the present day.

Problematisation and definition of terms

Be it past or present, identity is a complex and often contentious topic of study. This is partially because study of identity is often better stated as the study of identit*ies* (plural), as identities can be nested, plural, contested and changing depending on their context (Reiter 2014). This complexity is also the result of identity being one realm in which past and present are inextricably linked (Epstein 1978; Tilley 1996; Brubaker and Cooper 2000). Because of this sensitivity, it is important to discuss this chapter's ideological approach. To be clear, the intent here is not to attempt push the roots of the modern European Union (EU) into the distant past (see also discussion Hølleland 2012). Instead, this assessment is intended as cause for reflection about the mechanics – and inherent dangers – of collective identity formation and human bonding both in the past as well as in the present.

More specifically, in assessing the evidence for a potential 'European Identity' in the Bronze Age, this chapter seeks to determine whether prehistoric persons may have *self-identified* as part of a wider, large-scale interregional network in addition to their local ties and identities. In this, European Identity is similar to 'imagined communities' described as '... the members of even the smallest nation will never know most of their fellow-members, meet them, or even hear of them, yet in the minds of each lives the image of their communion' (Anderson 2006: 6). In short, within this chapter 'European Identity' refers to personal identification, with a sense of belonging to and of having a place within the broad region that would come to be known as Europe. Though it certainly influenced a great many types of identity, broadly speaking Bronze Age 'bronzization' (Vandkilde 2016) or globalisation (Reiter 2014) should not be conflated with European Identity as defined above. For the purposes of transparency, the suite of changes which changed the face of Europe (bronzization) are summarised and differentiated from European Identity.

What was 'bronzization' and how does it differ from European Identity?

One of the major social sea changes which defined the Bronze Age was the appearance of social hierarchies across Europe. Scholars have theorised that these were maintained through down-the-line distributions of wealth obtained via long-distance trade and kinship relations (Earle 1982; 1997; Earle *et al.* 1998; Kristiansen 1998; Earle 2002; Earle and Kristiansen 2010; Kristiansen 2017; Henriksen *et al.* 2018). To create and maintain that status, land use and exploitation intensified, resulting in widespread forest clearance and changing practices relating to the fertility of the soil (Andersen 1996; Brück 2002; French 2010).

Most of those changes are generally seen as part of a long-reaching trajectory with roots in preceding periods (Greenfield 2001: 39). Nevertheless, the Bronze Age transition has been heralded as sea change and paradigm shift (Reiter 2014) and as a transformation (Brück 2002; Kristiansen and Larsson 2005; Kristiansen and Suchowska-Ducke 2015). Importantly for the topic of this chapter, it has also been lauded as 'the golden age of Europe' (Demakopoulou *et al.* 1998; Tarschys 1998), characterised by what Renfrew (1972) poetically called an 'international spirit'. Even should this have been the case in the Bronze Age – and we must not forget the tremendous evidence for interpersonal violence with which this period is rife – an efflorescence of social mindedness or cultural highpoint is not equivalent to a shared group identity. Instead, I would argue that such an identity is created through alignments of people across different fields, including political *habitus*, origin myth, material culture, economics, mobility, genetics, and language. This examination of the potential presence of a European Identity is a thought experiment which looks at each aspect of shared group identity named above in turn relative to the Bronze Age data. In so doing, it examines 'bronzization' from the social sphere and attempts to imagine what social repercussions it may have had.

Political *habitus*

In terms of creating common identity, political groupings do more than set an ideological frame; they also define *habitus* (Threadgold and Nilan 2003; Mascheroni 2017). Politics in this sense is not only a system of government. Broadly seen, it also encompasses the suite of activities in which people improve or maintain social power. Those machinations shape social perception of the world, regardless of whether or not one is among the power-holding group (Bourdieu 1977). While there was no single unified political entity in the Bronze Age, what the Bronze Age world *did* have was a very clear definition of political *habitus.* That *habitus* was relative to the rules of hospitality. Known as 'xenia' or guest friendship, those rules dictated the behaviours needed to build and maintain long distance relations (Frank 2011; Kaul 2017). So important were they that breaking with xenia was a cautionary tale in contemporary epics. We see an example of this in the *Odyssey* when Polyphemus the cyclops scorns the rules of hospitality by killing and consuming the members of Odysseus' crew. His poor hospitality is repaid when Odysseus blinds him and orchestrates the famous escape by clinging to the bellies of the cyclops' own sheep (Homer 2000).

Scholars have suggested that the provision of guest friendship may have been normalised throughout mainland Europe by means of a specific item: the sword. Nominally a tool for violence, at least some swords (particularly those which were more ornate, would have been unsuitable for fighting and were – at least on some occasions – purposefully left unsharpened (see also below 'Material Culture' on recurved scimitars) (Neustupný 1991; Kristiansen 2002). By carrying such a sword, (elite) people could prove their eligibility to receive guest-friendship in foreign lands. Combined with its 'amber beaches', the high number of swords (over 2000) found in Denmark alone (Frei *et al.* 2019) are a good argument in favour of swords being used as xenia gifts to/from hosts (Kaul 2022), as exemplified by the *Iliad*'s unequal armour exchange between Glaucus and Diomedes (Homer 1990, Book VI).

Further systematic provisions for peaceful foreign travel were framed out by the Olympic Truce or Ἐκεχειρία (*ékécheiria*; lit. 'laying down of arms') organised in association with the ancient pan-Hellenic games. While the games' official start is 776 BC (Möller 2004), this date likely represents only the formalised beginning of practices which likely stretched back into the Bronze Age (German 2007). Particularly relevant to the present topic is that such ancient sporting festivals were more than cultural exchanges; they also acted as crucial moments in which diverse groups (with different, competing identities) came together 'under the same roof' for a common cause: political debate, negotiation, and (at least nominally) non-violent competition (Spivey 2012: xxv-xxvi).

Taken together, the systematic provision of guest-friendship (as suggested through the use of swords as 'passports' and the Ἐκεχειρία for the express purpose of travel, discussion and competition in, e.g., the pan-Hellenic games) is a strong argument in favour of the existence of European Identity in addition to local identities at this point and time. However, the subtext is that only certain kinds of people may have been allowed to engage in xenia. Sword 'passports' – like admission to the games – were things for which one must have been deemed eligible.

Mythical origins

Political myths are dramatic 'just-so' stories intended, often retrospectively, to tie together the formation of the group (Tudor 1972; Flood 2013; Hofmann *et al.* 2021: 2). As such, they are often quite politically loaded. Historically, it could be argued that Europeans have (perhaps purposefully) attempted to orient their own origins stories to ancient Greece (see esp. Ninck 1945) rather than give due credit to the heavy influences that Egypt and the Near East had upon the ancient inhabitants of Europe (Mastnak 2019).

One such example is the mythical founding of Europe through the abduction of Europa, princess of Tyre, by Zeus in the form of a bull. The origins of the story itself may not be entirely Greek. Though some scholars (de Reynold 1944) have argued that Europa was genuinely Greek, this has been challenged, suggesting that 'Europa' may have been the domesticated Aegean name for the goddess Anat (Dombarski 1984). Importantly with regards to the discussion here, though the political myth of Europa was popularised in the Renaissance (Marino 2007), it was based on much older tales (Kerenyi 1951). The first written evidence for the story occurs when Homer refers to the 'daughter of far-famed Phoenix' (1990, 380/ 14: 320-321) in the *Iliad*, though Europa's name first appears much later in Fragments 19 and 19A of Hesiod's *Catalogue of Women* (Evelyn-White 1914). In point of fact, in the case of the *Iliad*, we know that, though it was written in the Iron Age, it describes events which took place in the Bronze Age (Finley 1977: 16), thus setting a Bronze Age stamp on an origin myth (whatever its actual origins) as a key aspect of European Identity formation.

Material culture

Culture can take an abstract form – shared social values or practices/*habitus* (like xenia) or a common founding myth (as in the abduction of Europa). Archaeologically speaking, however, one of the primary means of grouping culture has been by means of shared or similar cultural material. In the following, I will examine a few case studies of shared cultural identity across Bronze Age Europe through the media of art. In so doing I will look at cases of shared culture through symbolism, technology, and cultural practice.

An important shared symbol has already been mentioned: the sword. If swords were symbols of elite status which also functioned as 'passports', it would be logical that they would also move around. This is exactly what the material culture shows. Swords typical of Hungary/Romania and the Mediterranean have been found in various parts of Denmark (Fig. 1). In this context, it is also worth mentioning curved scimitars. The most well-known examples were found at Rørby on Zealand, Denmark, though there is also an expertly knapped flint skeuomorph from Favrskov on Jutland, Denmark (Flohr Sørensen 2012; Larsson 2022) and a pictorial corollary from the rock art at Bohuslån, Sweden (Warming 2023; see Fig. 2). The bronze scimitars themselves are blunt and, due to its fragility, a flint scimitar would not have been much use in combat. Instead, such items may have been used as emblems of warriorhood, as has been argued by Anne Lene Melheim and Christian Horn (2014), or perhaps as representations of sheathed swords which became ritually important at a particular time (Horn, pers. comm.).

Next, we move from symbolism to more concrete uses of material culture: to the folding (or 'camp') stool. Bronze Age folding stools emerged in northern Europe (three are known from Denmark – at Guldhøj, Bredhøj and Kalvehavegaard – and 20 from northern Germany; Nørgaard 2022) that directly mirror examples from Egypt and the Mediterranean (Figs. 3 and 4). Literary and pictorial evidence from Greece and Egypt, as well as the high status of the individuals with whom the objects were buried, suggests that these stools likely served as reminders of the – literally – elevated status of the individuals who sat on them (Kuhlmann 2011); that they had such a wide spread further highlights elite connectivity in the Bronze Age.

A final example of elite connection comes via the Dohnsen cup, a bronze example found in Lower Saxony, Germany, which bears a striking resemblance to late Aegean Bronze Age metalworking. Recent metallographic analyses suggest that the cup may have been produced from ores mined in central Europe, possibly with the aid of a smith with expert knowledge of Aegean styles (Suchowska-Ducke *et al.* 2021). Drinking practices such as those in which the Dohnsen cup would have been used were a key element of xenia in the Greek world and would likely have been disseminated via long-distance guest-friendship exchanges between elites (Pilz and Seelentag 2014).

All in all, the distribution and particularities of Bronze Age swords, folding chairs, and the paraphernalia of

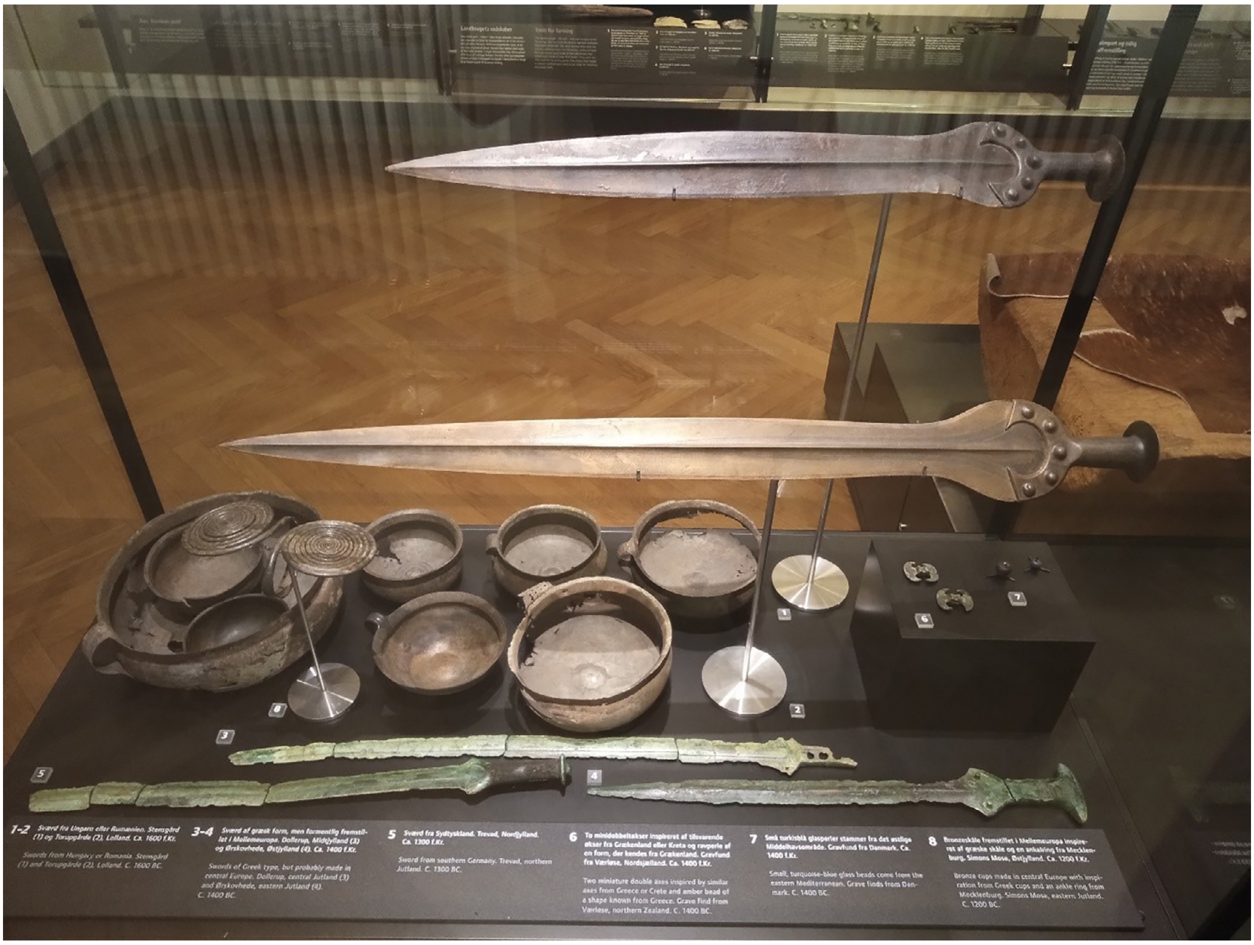


Figure 1: A display case showing swords from (1, top right) Stensgård; (2, top middle) Torupgårde; (3, lower left) Dollerup; and (4, lower right) Orskovhede, Denmark (from the National Museum of Denmark) (photo: S. Reiter).

drinking culture indicate the tremendous levels of shared material culture across Bronze Age Europe. Cultural identity essentially refers to the shared characteristics, values, and affective valence assigned to membership in a particular cultural group (Schwartz *et al.* 2008: 637). However, closer examination of the above suggests, once again, that the cultural aspect of Bronze Age European Identity was mostly shared between members of the social elite.

Economic ties

Discussion of Bronze Age economics often relies on world systems theory (Wallerstein 1974) to study exchange in terms of 'core' and 'periphery': commodity sources, processing locations and end destinations (Earle 1982; 2002; Kristiansen 1998; Kristiansen and Larsson 2005; Earle and Kristiansen 2010). The most recognisable of these commodities was amber, which travelled from the shores of northern Europe along the so-called 'amber roads' (de Navarro 1925; Shennan 1982; Bouzek 1993; du Gardin 1993; Earle *et al.* 2023, Vandkilde *et al.* 2024) as far as the Mycenaean shaft graves (Czebreszuk 2013) and the ancient Near East (Singer 2008). Glass (Bellintani 2014) and metals/ores (Ling *et al.* 2012; 2014; 2019; Melheim *et al.* 2018; Nørgaard *et al.* 2021; 2022) travelled northwards in exchange, possibly also for furs and slaves/thralls, in addition to amber (Ling Earle and Kristiansen 2018; Vandkilde *et al.* 2024).

Another material whose production intensified and which travelled extensively during this period is salt, a mineral both crucial to human biology as well as key to a number of crucial domestic processes, e.g. preserving foodstuffs long-term (Laszlo 2001). The literature refers to Bronze Age trade in alloyed bronze (Renfrew 1986; Primas 1997) or copper (Shennan 1994) in terms of commodification; Anthony Harding also raises Bronze Age salt exploitation to commodification status (Harding 2013: 119).

When examined purely from an economic standpoint, it seems that, here too, the Bronze Age had the hallmarks of European Identity: an interlinked economic system in which commodity exchange shaped the development of the socioeconomic entities

Figure 2: Left: at top right is a flint sword (9192) from Faurskov, Kerte søgn, above one of the curved swords from Rørby søgn (B14174) at bottom left (image by Lennert Larsen from the collections of the National Museum of Denmark, used here under a CC-BY-SA license). Right: figure with curved sword at left hip from Bohuslån, Sweden (digital sketch: S. Reiter).

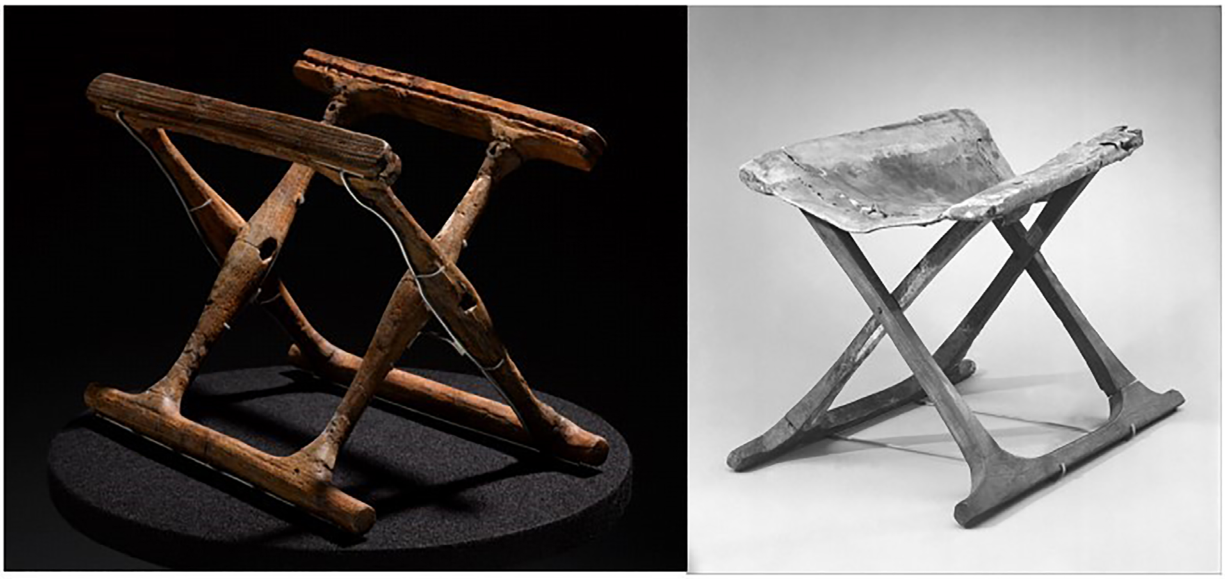


Figure 3: Left: the folding stool from Guldhøj, Jutland (Grave A, Æ Br. a). Vamdrup søgn, Ribe Amt (image by Roberto Fortuna and Kira Ursem, National Museum of Denmark collections, CC-BA-SA license). Right: the folding stool (*c.* 2030-1640 BCE) from the Khashaba excavations (1910-11) at Meir, Middle Egypt (12-182.58) (stool credited to the Rogers Fund, 1912, currently at the Metropolitan Museum of Art under CCO license (www.metmuseum.org)).

sending and receiving them (Pröschel 2012). Further support for the interdependence of Bronze Age trade comes from a recent study which suggests that western European weight systems are consistent with having a single origin point, which may be the Bronze Age shekel (Ialongo *et al.* 2021). As Kirman and Teschl (2004: 62) argue, '...we might want to consider homo economicus [sic] as an agent who wants to do things and who is able to influence the world [emphasis removed]'. From the Bronze Age economic flows, this very well may have been the case: elite networking created the social framework for commodities to flow freely. In turn, those commodities created and maintained elite positions within their local communities in a self-perpetuating system. Once again, in terms of economics, European Identity was focussed on the elites.

Mobility

We cannot forget that at this point in prehistory, the movement of people must have been the 'vehicle' for the movement of objects and materials (Bergerbrant 2007) as well as for the cultural practices and ideas reflected in the objects, artworks, and practices described

Figure 4: Line drawing of seated woman on stool from 'Camp stool fresco', west wing of the palace of Knossos. Drawing by author.

above. Original hypotheses about the socio-political kinship structures underpinning Bronze Age trade and political alliances were based on female exogamy and male patrilocality (for more discussion, see Reiter and Frei 2021; 2022; 2023; forthcoming; Fahlander *et al.* forthcoming), particularly in association with elites. However, the body of emergent data suggests shows that there was no single dominant mobility pattern characterising Bronze Age Europe (Table 1).

This is important in relation to European Identity as it indicates the nature and extent of contact between diverse groups; it intimates that, while previous models (of female exogamy and patrilocality) are not *wrong*, they must be expanded to include a diverse group of possible movement options. In turn, this suggests that there was a multiplicity of ways for both males and females to move and, furthermore, that it was unlikely that only elites moved between regions (Bergerbrant *et al.* 2017). While there may well have been a culture supporting elite movement, the emergent data shows that previous concepts in which 'encounters' between prehistoric Europeans were rare (Huntington 1996: 48) is less likely than one in which they were far more common (Grupe *et al.* 2017; Müller 2021).

aDNA

Connectedness in terms of intermobility is not the same as sharing genetic relations. Several genomics papers support the idea that the arrival of steppe ancestry between the 3rd and 1st millennium BCE set the major lines of European genetic makeup which we still see today (Lazaridis *et al.* 2014; Allentoft *et al.* 2015; 2024). Although there was a major population change in Europe with the arrival of farming, it seems that the last major turnover was in the Bronze Age: many of the racial characteristics (e.g. skin and eye pigmentation; Lazaridis *et al.* 2014; Allentoft *et al.* 2015) associated with 'Europeans' date from this period, which, soberingly, begs the question as to whether common identity may also be linked with plain old racism. Certainly, research has shown that race is one of the first things the brain perceives when meeting new people (Contreras *et al.* 2013). Put together, this changeover has led to claims that 'Europeans were "born" in the Bronze Age' (Jakobsen 2015). Interestingly, those conclusions are somewhat consistent with some models of the hypothesised spread of Proto Indo-European (PIE) languages as well.

Language

Historically, there are two philological models for the spread of PIE: the so-called Anatolian hypothesis proposed by Colin Renfrew (1987), which suggested the spread of PIE via Neolithic farming people, and the Kurgan hypothesis, first proposed by Gordon V. Childe (1925) and Otto Schrader (1980) and later popularised by Marija Gimbutas (1965), which puts the linguistic origin of PIE within the early Bronze Age. Philologists have given convincing arguments for a later, Bronze Age origin of PIE based on, e.g., word cognates that paint a picture of a PIE-speaking society which had use of the wheel, were settled farmers, and shared word concepts for history, culture, society, economy, and strife (Mallory 1989; 2019; Mallory and Adams 2006).

Given the above arguments relative to intermobility and genetic admixture, it seems that many hadronyms in Europe also seem to have PIE origins (Kitson 1996). Not only would rivers and other bodies of water have been key features of the new landscape into which PIE speakers may have expanded, but they would also have been a crucial means of maintaining contact between settlements (Wildgen 2012). Like genetics, studies of the origins of PIE are increasingly pointing towards the Bronze Age as a key moment of linguistic commonality which may have been impactful for European Identity in terms of facilitating intelligibility, trade, and ease of travel.

Discussion

The brief assessments of current and ongoing research trends and conclusions within the categories of political *habitus*, European origin myth, material culture, economics, mobility, aDNA, and linguistics overwhelmingly support the possibility of European Identity in the Bronze Age. However, closer analysis also suggests that the creation and maintenance of that European Identity was not something which was equally available to all. Bronze Age elites, in particular, seem to have been very tightly tied to European Identity, which suggests that other parts of the population may have been excluded.

Sociological theory suggests that the exclusion of certain people is a critical part of building social cohesion. Formalised by Tzvetan Todorov (1992) into the line between ‘Nous’ (Us) and ‘les Autres’ (Them), the concept essentially holds that identity cannot exist in a vacuum. This has been described as Us/Them thinking in neuroscience and primatology (Sapolsky 2018; Baron-Cohen 2022) and is perhaps best known to archaeologists by the work of the social anthropologist Fredrik Barth (1998) on the social organisation of

Table 1: Summary of recent studies of mobility trends relative to gender (after Reiter and Frei forthcoming).

Gender(s)	Mobility Trend	Area	Period	Reference
Female	Exogamy	Northern and western Europe	Neolithic	(Sánchez-Quinto *et al.* 2019)
		Europe	Neolithic	(Furholt 2021)
		Europe	Neolithic (Corded Ware)	(Kristiansen *et al.* 2017)
		Sweden	Late Neolithic	(Blank *et al.* 2021)
		Central Europe	Eneolithic (Bell Beaker)	(Sjögren *et al.* 2020)
		Northern Italy	Bronze Age	(Cavazzuttii *et al.* 2019)
		Bavaria	Bronze Age	(Knipper *et al.* 2017; Mittnik *et al.* 2019)
		Slovakia	Bronze Age	(Reiter and Frei 2015)
		Britain	Roman	(Leach *et al.* 2010)
Male	Mobility	Germany	Bronze Age	(Wahl 2009; Price *et al.* 2017)
	Repeated mobility	Alps	Chalcolithic	(Müller *et al.* 2003; Ruff *et al.* 2006)
Male and female	Alternating dominance of each gender being mobile	Hungary	Neolithic	(Depaermentier *et al.* 2020)
	Equal prevalence of male and female mobility	Britain	Chalcolithic	(Parker Pearson *et al.* 2016, 2019)
		Sweden	Bronze Age	(Bergerbrant *et al.* 2017)
	Male and female mobility	Denmark	Bronze Age	(Frei *et al.* 2019)

cultural difference. In this study he described the allocation of difference as an interplay between self-ascription and ascription through social interaction (Barth 1998). Regardless of how it is classified, the presence of social boundaries between groups (henceforth Us/Them thinking) finds rich support in Bronze Age material culture. One of the best examples of this is the explosion of social techniques for expressing an individual's locality/non-locality through regional dress and material culture (Laux 1973; Wels-Weyrauch 1989a; 1989b; Jockenhövel 1995; Sørensen 1997). Once again, some of the chief regional identity markers are *also* the purview of the upper social classes, as these were the few who could afford such items. This has the result of emphasising regional identity while also underscoring the overarching similarity in which those regional identities were expressed. Even in the Bronze Age regional identities could not exist in a vacuum and must have been expressed at an inter-regional level (at the level of European Identity) to be recognised.

Neurologically speaking, such Us/Them thinking is controlled by oxytocin, the hormone which is responsible for human bonding and pro-social behaviour (Carter 2022). Examining its role in Bronze Age group bonding is still circumstantial but may merit further investigation. Isotopic and aDNA analyses of Bronze Age individuals from several sites in central Europe have shown elite, non-local females buried together with local children with whom these women had no genetic relationship (Mittnik *et al.* 2019; Rebay-Salisbury *et al.* 2023). This relates to oxytocin in that recent research on modern individuals has shown that mothers interacting with their non-biological children showed *higher* levels of oxytocin than those interacting with their own biological children (Bick and Dozier 2010). This suggests that what may have been normalised Bronze Age behaviour relative to childcare may have created a situation which promoted high oxytocin levels and the Us/Them thinking that resulted therefrom.

Here's the rub. Represented more honestly, oxytocin is the hormone of love *and* violence. Its effect in the presence of people you consider 'others' is pre-emptive aggression and less social cooperation (Sapolsky 2018). Oxytocin, therefore, has a dual neurological purpose: it both builds cohesion ('Us') and makes one more aggressive towards 'Them' (Beery 2015). Such an importance on outward aggression and violence for the formation of the collective is strongly supported by anthropological studies (Whitehouse 2013; 2018; Walsh and Reiter 2024; Walsh *et al.* 2024).

Taken together, this body of information firstly intimates that identity formation is closely linked to Us/Them thinking. It also shows that Us/Them thinking is neither uncontentious nor unproblematic and, furthermore, that this thinking promotes aggressive behaviour just as much as it does a shared identity. This provides an important context for the tremendous evidence for Bronze Age violence, including, e.g., the headless skeletons outside the LBK settlement in Vráble, Slovakia (Furholt *et al.* 2023), the mass grave at Nord-Trøndelag, Norway (Fyllingen 2003), the war casualties at the Tollense battlefield, Germany (Jantzen *et al.* 2011), the warrior cemetery at Neckarsulm (Knöpke 2010), and the many other evidences for war and weaponry (Vandkilde 2011; 2013; Horn 2013; Horn and Kristiansen 2018). The creation of a shared European Identity in the Bronze Age should not be seen through rose-coloured glasses; it was likely a bloody undertaking, which, as the evidence above suggests, was likely heavily influenced by the social elite.

Conclusion

While a good deal of evidence supports the presence of an overarching 'imagined community' (*sensu* Anderson 2006) of European Identity in the Bronze Age, participation in that identity was far from universal. It was likely created for and by social elites and it also probably created and compounded a multi-layered Us/Them mindset. While new studies point to some instances in which Bronze Age childcare practices may have fostered higher oxytocin levels in certain individuals (and, thus, the potential for both increased pro-social behaviour *and* outside aggression), the body of archaeological, sociological, and anthropological data suggests that the Bronze Age was a period in which Us/Them thinking was rife. Such thinking both promotes group cohesion ('Us') alongside and concomitant to aggression towards outsiders ('Them'). This shows that the social after-effects of bronzization were neither unproblematic nor uncontested. While the Bronze Age may indeed have marked a turning point in Europe's history, we do Europeans, both prehistoric and modern, a disservice by calling it a 'golden age' (Demakopoulou *et al.* 1998; Tarschys 1998) of 'international spirit' (Renfrew 1972), as this presents the explosion of connectivity and flows as a *fait accompli* without the negotiation, exclusion, and violence required for the formation of any collective.

These self-same themes remain hugely relevant as we wrestle with increasing globalisation and negotiate between national powers, the EU, and a European presence on the world political stage. There is tremendous power to be held in mastering the art of identity formation. In fact, this is also one of the EU's specific recent research topics (Prutsch 2017), which has also been included in the European Plan for Archaeology specifically in relation to the Bronze Age (Hølleland 2012: 13). Archaeological reflection on the same topic is a cautionary tale; while it may be powerful, collective identity formation also has inherent dangers. Redefining 'Us' will necessarily redraft the 'Them'. As we see from the Bronze Age data, how, where, and when we draw these lines can cause them to be written in blood.

Bibliography

Allentoft, M.E., M. Sikora, K.-G. Sjögren and E. Willerslev 2015. Population genomics of Bronze Age Eurasia. *Nature* 522 (7555): 167-172.

Allentoft, M.E., M. Sikora, A. Refoyo-Martinez, E.K. Irving-Pease, A. Fischer, W. Barrie, A. Ingason, J. Stenderup, K.-G. Sjögren, A. Pearson, B. Sousa Da Mota, B.S. Paulsson, A. Halgren, R. Macleod, M.L. Jørkov, F. Demeter, L.V. Sørensen, P.O. Nielsen, R.A. Henriksen, T. Vimala, H. McColl, A. Margaryan, M. Ilardo, A. Vaughn and E. Willerslev 2024. Population genomics of post-glacial western Eurasia. *Nature* 625: 301-311 (available at: https://doi.org/10.1038/s41586-023-06865-0).

Andersen, S.Th. 1996. Pollen Analyses from Early Bronze Age Barrows in Thy. *Journal of Danish Archaeology* 13: 7-17.

Anderson, B. 2006. *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. London: Verso.

Baron-Cohen, S. 2022. *The Science of Evil: On Empathy and the Origins of Cruelty*. London: Basic Books.

Barth, F. 1998. Introduction. *Ethnic Groups and Boundaries: The Social Organization of Cultural Difference*: 9-38. New York: Waveland Press.

Beery, A.K. 2015. Antisocial oxytocin: complex effects on social behavior. *The integrative study of animal behavior* 6: 174-182 (available at: https://doi.org/10.1016/j.cobeha.2015.11.006).

Bellintani, P. 2014. Baltic amber, alpine copper and glass beads from the Po Plain. Amber trade at the time of Campestrin and Frattesina. *Padusa* 50: 111-139.

Bergerbrant, S. 2007. *Bronze Age Identities: Costume, Conflict and Contact in Northern Europe 1600-1300 BC*. Stockholm Studies in Archaeology 43. Lindome: Bricoleur Press.

Bergerbrant, S., K. Kristiansen, M.E. Allentoft, K.M. Frei, K.-G. Sjögren and A. Tornberg 2017. Identifying commoners in the Bronze Age: burials outside barrows, in S. Bergerbrant and A. Wessman (eds) *New Perspectives on the Bronze Age: Proceedings from the 13th Nordic Bronze Age Symposium, held in Gothenburg 9th June to 13th June 2015*: 37-64. Oxford: Archaeopress.

Bick, J. And M. Dozier 2010. Mothers' and Children's Concentrations of Oxytocin Following Close, Physical Interactions with Biological and Non-biological Children. *Developmental Psychobiology* 52(1): 100-107 (available at: https://doi.org/10.1002/dev.20411).

Blank, M., K.-G. Sjögren, C. Knipper, K.M. Frei, H. Malmström, M. Fraser, E.M. Svensson, T. Günther, H. Yngve, M. Jakobsen, A. Götherström and J. Storå 2021. Mobility patterns in inland southwestern Sweden during the Neolithic and Early Bronze Age. *Archaeological and Anthropological Sciences* 13(4): 64 (available at: https://doi.org/10.1007/s12520-021-01294-4).

Bourdieu, P. 1977. *Outline of a Theory of Practice*. Cambridge: Cambridge University Press.

Bouzek, J. 1993. The Shifts of the Amber Route, in C.W. Beck and L. Bouzek (eds) *Amber in Archaeology: Proceedings of the Second International Conference on Amber in Archaeology*: 141-146. Prague: Czech Academy of Sciences.

Brubaker, R. And F. Cooper 2000. Beyond Identity. *Theory and Society* 29: 1-47.

Brück, J. 2002. *Bronze Age Landscapes: Tradition and Transformation*. Oxford: Oxbow Books (available at: https://www.jstor.org/stable/j.ctt1kw29p2).

Carter, C.S. 2022. Oxytocin and love: Myths, metaphors and mysteries. *Comprehensive Psychoneuroendocrinology* 9: 100107 (available at: https://doi.org/10.1016/j.cpnec.2021.100107).

Cavazzutii, C., R. Skeates, A.R. Millard, G. Nowell, J. Peterkin, M.B. Brea, A. Cardarelli and L. Salzani 2019. Flows of people in villages and large centres in Bronze Age Italy through strontium and oxygen isotopes. *PLoS One* 14(1): 1-43 (available at: https://doi.org/10.1371/journal.pone.0209693).

Childe, V.G. 1925. *The Dawn of European Civilization* (4th edn.). London: Kegan Paul.

Childe, V.G. 1926. *The Aryans. A study of Indo-European Origins*. London: Kegan Paul.

Contreras, J.M., M.R. Banaji and J.P. Mitchell 2013. Multivoxel Patterns in Fusiform Face Area Differentiate Faces by Sex and Race. *PLoS One* 8(7): e69684 (available at: https://doi.org/10.1371/journal.pone.0069684).

Czebreszuk, J. 2013. Mysterious Raw Material from the Far North: Amber in Mycenaean Culture, in S. Bergerbrant and S. Sabatini (eds) *Counterpoint: Essays in Archaeology and Heritage Studies in Honour of Professor Kristian Kristiansen*: 557-563. British Archaeological Reports International Series 2508. Oxford: Archaeopress.

Demakopoulou, K., J. Jensen, K. Kemakopoulous, C. Eluere, A. Jockenhövel and J.-P. Mohen (eds) 1998. *Gods and Heroes of the European Bronze Age*. Copenhagen: National Museum of Denmark.

Depaermentier, M., M. Kempf, E. Bánffy and K.W. Alt 2020. Tracing mobility patterns through the 6th-5th millennia BC in the Carpathian Basin with strontium and oxygen stable isotope analyses. *PLoS One* 15(12): e0242745 (available at: https://doi.org/10.1371/journal.pone.0242745).

De Reynold, G. 1944. *The Formation of Europe. Idem: Qu'est ce que l'Europe?* Vol. 1. Fribourg (Switzerland): Librarie de l'Université Fribourg.

Dombarski, B.W.W. 1984. *Der Name Europa auf seinem Griechischen und Alt Syrischen Hintergrund: Ein Beitrag sur Ostmediterraranen Kultur- und Religionsgeschichte in Frühgriechischer Zeit*. Amsterdam: Verlag Adolf M. Hakkert.

Earle, T. 1982. Prehistoric Economics and the Archaeology of Exchange, in J.E. Ericson and T. Earle (eds) *Contexts for Prehistoric Exchange*: 1-12. New York: Academic Press (available at: https://doi.org/10.1016/B978-0-12-241580-7.50006-1).

Earle, T. 1997. *How Chiefs Come to Power: The Political Economy in Prehistory*. Stanford: Stanford University Press.

Earle, T. 2002. *Bronze Age Economics. The Beginnings of Political Economies*. Cambridge: Westview Press.

Earle, T., J.-H. Bech, K. Kristiansen, P. Aperlo, K. Kelertas and J. Steinberg 1998. The political economy of late Neolithic and early Bronze age society: The Thy archaeological project. *Norwegian Archaeological Review* 31(1): 1-28 (available at: https://doi.org/10.1080/00293652.1998.9965616).

Earle, T., J.H. Bech and C. Villa 2023. New Early Neolithic and Late Bronze Age amber finds from Thy. *Antiquity* 97(391): 70-85 (available at: https://doi.org/10.15184/aqy.2022.173).

Earle, T. and K. Kristiansen 2010. *Organizing Bronze Age Societies*. Cambridge: Cambridge Unviersity Press.

Epstein, A.L. 1978. *Ethos and identity: three studies in ethnicity*. London: Tavistock Publications.

Fahlander, F., T. Hjorungdal, J. Lund and M.-L. Sørensen (forthcoming). Gender archaeology in Scandinavian archaeology, in *The Oxford Handbook of Scandinavian Archaeology*. Oxford: Oxford University Press.

Finley, M.I. 1977. *The World of Odysseus*. London: Chatto and Windus.

Flohr Sørensen, T. 2012. Original copies: seriality, similarity and the simulacrum in the Early Bronze Age. *Danish Journal of Archaeology* 1(1): 45-61 (available at: https://doi.org/10.1080/21662282.2012.750446).

Flood, C. 2013. *Political Myth*. London: Routledge.

Frank, J.I. 2011. *Ξενία Πολύτροπος: The Social Ritual of Hospitality in the Odyssey*. Vassar: Vassar College.

Frei, K.M., S. Bergerbrant, K.-G. Sjögren, M.L. Jørkov, N. Lynnerup, L. Harvig, M.E. Allentoft, M. Sikora, T.D. Price, R. Frei and K. Kristiansen 2019. Mapping human mobility during the third and second millennia BC in present-day Denmark. *PLoS One* 14(8): e0219850 (available at: https://doi.org/10.1371/journal.pone.0219850).

French, C. 2010. The Palaeo-Enivronments of Bronze Age Europe, in T. Earle and K. Kristiansen (eds) *Organizing Bronze Age Societies*: 34-56. Cambridge: Cambridge University Press.

Furholt, M. 2021. Mobility and Social Change: Understanding the European Neolithic Period after the Archaeogenetic Revolution. *Journal of Archaeological Research* (preprint) (available at: https://doi.org/10.1007/s10814-020-09153-x).

Furholt, M., I. Cheben, M. Wunderlich, A. Bistáková, K. Fuchs, Z. Hukel'ová, K. Szilágyi and T. Kühl 2023. A New Peculiar Mass Deposition of Headless Human Bodies from the LBK Settlement in Vráble, SW Slovakia. *The European Archaeologist* 78 (Autumn) (available at: https://www.e-a-a.org/EAA/Navigation_Publications/TEA_78_content/Research_Overview.aspx#78_vrable).

Fyllingen, H. 2003. Society and Violence in the Early Bronze Age: An Analysis of Human Skeletons from Nord-Trøndelag, Norway. *Norwegian Archaeological Review* 36(1): 27-43 (available at: https://doi.org/10.1080/00293650307297).

Du Gardin, C. 1993. The Circulation of Amber in Prehistoric Europe, in C. Scarre and F. Healy (eds) *Trade and Exchange in Prehistoric Europe: Proceedings of a Conference Held at the University of Bristol, April 1992*: 131-134. Oxford: Oxbow Books.

German, S.C. 2007. Onward to the Olympics, in G.P. Schaus and S.R. Wenn (eds) *Onward to the Olympics: Historical Perspectives on the Olympic Games*: 15-25. Waterloo, Canada: WLU Press (available at: https://doi.org/10.51644/9781554581290-006).

Gimbutas, M. 1965. *Bronze Age Cultures in Central and Eastern Europe*. Paris/The Hague: Mouton and Co.

Greenfield, H.J. 2001. European Early Bronze Age, in P.N. Peregrine and M. Ember (eds) *Encyclopedia of Prehistory*: 139-156. New York: Springer (available at: https://doi.org/10.1007/978-1-4615-1187-8).

Grupe, G., A. Grigat and G.C. Mcglynn 2017. *Across the Alps in Prehistory: Isotopic Mapping of the Brenner Passage by Bioarchaeology*. New York: Springer Cham (available at: https://doi.org/10.1007/978-3-319-41550-5).

Harding, A. 2013. *Salt in Prehistoric Europe*. Leiden: Sidestone Press.

Hawkes, C.F.C. 1940. *The Prehistoric Foundations of Europe to the Mycenean Age*. London: Methuen.

Henriksen, P.S., D.E. Robinson and K. Kelertas 2018. Bronze Age agriculture, land use and vegetation at Bjerre Enge based on the results of archaeobotanical analyses, in J.-H. Bech, B.V. Eriksen and K. Kristiansen (eds) *Bronze Age Settlement and Land-Use in Thy, Northwest Denmark*: 387-412. Højbjerg: Jutland Archaeological Society.

Hesiod (trans. H.G. Evelyn-White) 1914. *Homeric Hymns, Epic Cycle, Homerica*. Loeb Classical Library Vol. 57. London: William Heinemann.

Hofmann, D., E. Hanscam, M. Furholt, M. Bača, S. Reiter, A. Vanzetti, K. Kotsakis, H. Petersson, E. Niklasson, H. Hølleland and C.J. Frieman 2021. Forum: Populism, Identity Politics, and the Archaeology of Europe. *European Journal of Archaeology* 24(4): 1-37 (available at: https://doi.org/10.1017/eaa.2021.29).

Hølleland, H. 2012. Personhoods for Europe, C. Prescott and H. Glorstad (eds) *Becoming European: The Transformation of the Third Millennium in Northern and Western Europe*: 12-18. Oxford: Oxbow Books.

Homer 1990. *The Iliad* (trans. R. Fagles). New York: Penguin.

Homer 2000. *The Odyssey* (trans. S. Butler), Internet Classics Archive. Cambridge, MA: MIT (available at: https://classics.mit.edu/Homer/odyssey.html).

Horn, C. 2013. Weapons, fighters and combat: spears and swords in Early Bronze Age Scandinavia. *Danish Journal of Archaeology* 2(1): 20-44 (available at: https://doi.org/10.1080/21662282.2013.838832).

Horn, C. and K. Kristiansen 2018. *Warfare in Bronze Age Society*. Cambridge: Cambridge University Press.

Huntington, S.P. 1996. *The Clash of Civilizations and the Remaking of the World Order*. New York: Touchstone Publishing.

Ialongo, N., R. Hermann and L. Rahmstorf 2021. Bronze Age weight systems as a measure of market integration in Western Eurasia. *Proceedings of the National Academy of Sciences of the United States of America* 118(27): e2105873118 (available at: https://doi.org/10.1073/pnas.2105873118).

Jakobsen, R.K. 2015. History rewritten: Europeans were 'born' in the Bronze Age. *ScienceNordic* (online: accessed 21 May 2024).

Jantzen, D., U. Brinker, J. Orschiedt, J. Heinemeier, J. Piek, K. Hauenstein, J. Krüger, G. Lidke, H. Lübke, R. Lampe, S. Lorenz, M. Schult and T. Terberger 2011. A Bronze Age battlefield? Weapons and trauma in the Tollense Valley, north-east Germany. *Antiquity* 85: 417-433 (available at: https://doi.org/10.1017/S0003598X00067843).

Jockenhövel, A. 1995. Zur Ausstattung von Frauen in Nordwestdeutschland und in der Deutschen Mittelgebirgszone Während der Spätbronzezeit und Älteren Eisenzeit, in A. Jockenhövel (ed.) *Festschrift für Hermann Müller-Karpe zum 70.Geburtstag*: 195-212. Bonn: Habelt.

Kaul, F. 2017. The xenia concept of guest-friendship. Providing an elucidatory model for Bronze Age communication, in P. Skoglund, J. Ling and U. Bertilsson (eds) *North Meets South. Theoretical Aspects on the Northern and Southern Rock art Traditions in Scandinavia*: 172-198. Oxford: Oxbow Books.

Kaul, F. 2022. Middle Bronze Age Long-Distance Exchange: Amber, Early Glass and Guest Friendship, Xenia, in R.J. Chacon, J. Ling and K. Kristiansen (eds) *Trade Before Civilization. Long-distance Exchange and the Rise of Social Complexity*: 109-141. Cambridge: Cambridge University Press (available at: https://doi.org/10.1017/9781009086547.008).

Kerenyi, K. 1951. *The Gods of the Greeks*. London, Thames & Hudson.

Kirman, A. and M. Teschl 2004. On the emergence of economic identity. *Revue de Philosophie Economique* 9: 44-77.

Kitson, P.R. 1996. British and European River Names. *Transactions of the Philological Society* 94(2): 73-118.

Knipper, C., A. Mittnik, K. Massay, C. Kociumaka, I. Kucukkalipci, M. Maus, F. Wittenborn, S. Metz, A. Staskiewicz, J. Krause and P.W. Stockhammer, 2017. Female exogamy and gene pool diversification at the transition from the Final Neolithic to the Early Bronze Age in central Europe. *Proceedings of the national Academy of Sciences* (preprint) (available at: https://doi.org/10.1073/pnas.1706355114).

Knöpke, S. 2010. *Der urnenfelderzeitliche Männerfriedhof von Neckarsulm*. Stuttgart: Theiss.

Kristiansen, K. 1998. *Europe Before History*. Cambridge: Cambridge University Press.

Kristiansen, K. 2002. The tale of the sword – swords and swordfighters in Bronze Age Europe. *Oxford Journal of Archaeology* 21(4): 319-332 (available at: https://doi.org/10.1111/1468-0092.00166).

Kristiansen, K. 2017. Interpreting Bronze Age Trade and Migration, in E. Kiratzi and C. Knappet (eds) *Human Mobility and Technological Transfer in the Prehistoric Mediterranean*: 154-181. Cambridge: Cambridge University Press.

Kristiansen, K., M.E. Allentoft, K.M. Frei, R. Iversen, N.N. Johannsen, G.J. Kroonen, L. Pospieszny, T.D. Price, S. Rasmussen, K.-G. Sjögren, M. Sikora and E. Willerslev 2017. Re-theorizing mobility and the formation of culture and language among the Corded Ware in Europe. *Antiquity* 91: 334-347.

Kristiansen, K. and T.B. Larsson 2005. *The Rise of Bronze Age Society: Travels, Transmissions and Transformations*. New York: Cambridge University Press.

Kristiansen, K. and P. Suchowska-Ducke 2015. Connected Histories: the Dynamics of Bronze Age Interaction and Trade 1500-1100 BC. *Proceedings of the Prehistoric Society* 81: 361-392 (available at: https://doi.org/10.1017/ppr.2015.17).

Kuhlmann, K.P. 2011. Throne. *UCLA Encyclopedia of Egyptology* 1(1) (available at: https://escholarship.org/uc/item/8xc7k559 (accessed: 30 May 2024)).

Larsson, A. 2022. *Skeuomorphs what art thou? A skeuomorphic perspective on material preference and categorisation in prehistory*. Unpublished Master's dissertation, University of Lund (available at: https://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=9102761&fileOId=9102764).

Laszlo, P. 2001. *Salt: Grain of Life*. Columbia: Columbia University Press (available at: https://www.degruyter.com/document/doi/10.7312/lasz12198/html (accessed: 30 May 2024)).

Laux, F. 1973. *Die Fibeln in Niedersachsen*. Prähistorische Bronzefunde XIV. Munich: C.H. Beck.

Lazaridis, I., N. Patterson, A. Mittnik, G. Renaud, S. Mallick, K. Kirsanow, P.H. Sudmant, J.G. Schraiber, S. Castellano, M. Lipson, B. Berger, C. Economou, R. Bollongino, Q. Fu, K.I. Bos, S. Nordenfelt, H. Li, C. De Filippo, K. Prüfer and J. Krause 2014. Ancient human genomes suggest three ancestral populations for present-day Europeans. *Nature* 513(7518): 409-413 (available at: https://doi.org/10.1038/nature13673).

Leach, S., H. Eckardt, C. Chenery, G. Müldner and M. Lewis 2010. A Lady of York: Migration, Ethnicity and Identity in Roman Britain. *Antiquity* 84: 131-145.

Ling, J., E. Hjärthner-Holdar, L. Grandin, K. Billström and P.-O. Persson 2012. Moving metals or indigenous mining? Provenancing Scandinavian Bronze Ageartefacts by lead isotopes and trace elements. *Journal of Archaeological Science* 40: 1-14.

Ling, J., Z. Stos-Gale, L. Grandin, K. Billström, E. Hjärthner-Holdar and P.-O. Persson 2014. Moving metals II: provenancing Scandinavian Bronze Age artefacts by lead isotope and elemental analyses. *Journal of Archaeological Science* 41: 106-132.

Ling, J., E. Hjärthner-Holdar, L. Grandin, Z. Stos-Gale, K. Kristiansen, A.L. Melheim, G. Artioli, I. Angelini, R. Krause and C. Canovaro 2019. Moving metals IV: Swords, metal sources and trade networks in Bronze Age Europe. *Journal of Archaeological Science: Reports* 26: 101837 (available at: https://doi.org/10.1016/j.jasrep.2019.05.002).

Ling, J., T.K. Earle and K. Kristiansen 2018. Maritime Mode of Production: Raiding and Trading in Seafaring Chiefdoms. *Current Anthropology* 59(5): 488-524 (available at: https://doi.org/10.1086/699613).

Mallory, J.P. 1989. *In Search of the Indo Europeans: Language, Archaeology and Myth*. London: Thames & Hudson.

Mallory, J.P. 2019. Proto-Indo-European, Proto-Uralic and Nostratic: A brief excursus into the comparative study of proto-languages, in B.A. Olsen, T. Olander and K. Kristiansen (eds) *Tracing the Indo-Europeans: New evidence from archaeology and historical linguistics*. Oxford and Philadelphia: Oxbow Books.

Mallory, J.P. and D.Q. Adams 2006. *The Oxford Introduction to Proto-Indo-European and the Proto-Indo-European World*. Oxford, Oxford University Press (available at: https://www.saxo.com/dk/the-oxford-introduction-to-proto-indo-european-and-the-proto-indo-european-world_jp-mallory_paperback_9780199296682 (accessed: 21 May 2024)).

Marino, J.A. 2007. The Invention of Europe, in J.J. Martin (ed.) *Renaissance Europe*. London: Routledge (available at: https://doi.org/10.4324/9780203401163).

Mascheroni, G. 2017. A Practice-Based Approach to Online Participation: Young Peoples Participatory Habitus as a Source of Diverse Online Engagement. *International Journal of Communication* 11(0): 22.

Mastnak, T. 2019. Europa: The Politics of Mythology. *Filozofski vestnik* 40(2): 7-58.

Melheim, A.L., L. Grandin, P.-O. Persson, K. Billström, Z. Stos-Gale, J. Ling, R.A. Williams, I. Angelini, C. Canovaro, E. Hjärthner-Holdar and K. Kristiansen 2018. Moving Metals III: Possible Origins for Copper in Bronze Age Denmark based on Lead Isotopes and Geochemistry. *Journal of Archaeological Science* 96: 85-105.

Melheim, L. and C. Horn 2014. Tales of Hoards and Swordfighters in Early Bronze Age Scandinavia: The Brand New and the Broken. *Norwegian Archaeological Review* 47(1): 18-41 (available at: https://doi.org/10.1080/00293652.2014.920907).

Mittnik, A., K. Massay, C. Knipper, F. Wittenborn, R. Friedrich, S. Pfrengle, M. Burri, N. Carlichi-Witjes, H. Deeg, A. Furtwängler, M. Harbeck, K.V. Heyking, C. Kociumaka, I. Kucukkalipci, S. Lindauer, S.E. Metz, A. Staskiewicz, A. Thiel, J. Wahl, W. Haak, E. Pernicka, S. Schiffels, P.W. Stockhammer and J. Krause 2019. Kinship-based social inequality in Bronze Age Europe. *Science* 366: 731-734 (available at: https://doi.org/10.1126/science.aax6219).

Möller, A. 2004. Greek Chronographic Traditions about the First Olympic Games, in R.M. Rosen (ed.) *Time and Temporality in the Ancient World*: 169-184. Philadelphia: University of Pennsylvania Museum of Archaeology and Anthropology.

Müller, J. 2021. Welcome by the Head of the Scientific Committee and Local Organizer. *The European Archaeologist* 70 (Autumn/Fall): 21-23.

Müller, W., H. Fricke, A.N. Halliday, M.T. Mcculloch and J.-A. Wartho 2003. Origin and Migration of the Alpine Iceman. *Science* 302(5646): 862-866 (available at: https://doi.org/10.1126/science.1089837).

De Navarro, J.M. 1925. Prehistoric Routes between Northern Europe and Italy Defined by the Amber Trade. *The Geographical Journal* 66(6): 481-503.

Neustupný, E. 1991. Community Areas of Prehistoric Farmers in Bohemia. *Antiquity* 65: 326-331.

Ninck, M. 1945. *Die Entdeckung von Europa durch die Griechen*. Basel: Benno Schwabe.

Nørgaard, K. 2022. *Bronzealder-høvdingen med kop med stjernemønster af tin og klapstol.* Unpublished BA dissertation, Copenhagen University (available at: chrome extension://efaidnbmnnnibpcajpcglclefindmkaj/https://arkaeologen.dk/Tincup.pdf).

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2021. Shifting Networks and Mixing Metals: Changing metal-trading routes to Scandinavia correlate with Neolithic and Bronze Age transformations. *PLoS One* 16: e0252376.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2022. 1600 BC: Fårdrup and Valsømagle-type axes and the first evidence of southern Alpine metal. *Acta Archaeologica* 92.2 (2021): 185-226.

Parker Pearson, M., A. Chamberlain, M. Jay, M. Richards, A. Sheridan, N. Curtis, J. Evans and N. Wilkin 2016. Beaker people in Britain: migration, mobility and diet. *Antiquity* 90(351): 620-637 (available at: https://doi.org/10.15184/aqy.2016.72).

Parker Pearson, M., A. Sheridan, M. Jay, A. Chamberlain, M.P. Richards and J. Evans 2019. *The Beaker People: Isotopes, Mobility and Diet in Prehistoric Britain*. Oxford: Oxbow Books.

Pilz, O. and G. Seelentag 2014. *Cultural Practices and Material Culture in Archaic and Classical Crete: Proceedings of the International Conference, Mainz, May 20-21, 2011*. Berlin: Walter de Gruyter.

Price, T.D., R. Frei, U. Brinker and D. Jantzen 2017. Multi-isotope proveniencing of human remains from a Bronze Age battlefield in the Tollense Valley in northeast Germany. *Archaeological and Anthropological Sciences* 11: 33-49 (available at: https://doi.org/10.1007/s12520-017-0529-y).

Primas, M. 1997. Bronze Age economy and ideology: Central Europe in focus. *Journal of European Archaeology* 5: 115-130.

Pröschel, N. 2012. *Commodification and Culture: How can culture be economically used without selling it out*. Unpublished BA dissertation. Modul University Vienna (available at: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.modul.ac.at/uploads/files/Theses/Bachelor/Thesis-2012-Proeschel-Natascha.pdf (accessed: 6 April 2024)).

Prutsch, M.J. 2017. *Research for CULT Committee - European Identity*. Report IP/B/CULT/NT/2017-004 PE 585.921 of the European Parliament Directorate General for Internal Policies, Policy Department B - Structural and Cohesion Policies, 10.2861/39683.

Rebay-Salisbury, K., D. Pany-Kucera, M. Spannagl-Steiner, F. Kanz, C. Amory and W. Parson 2023. Tracing mother-child relations in Austrian Early Bronze Age communities through mitochondrial DNA, in H. Meller, J. Krause, W. Haak and R. Risch (eds) *Kinship, Sex, and Biological Relatedness: The Contribution of Archaeogenetics to the Understanding of Social and Biological Relations. 15. Mitteldeutscher Archäologentag Vom 6. Bis 8. Oktober 2022 in Halle (Saale)*: 210-232. Tagungen des Landesmuseums für Vorgeschichte Halle. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Reiter, S.S. 2014a. A Choreography of Place: Globalisation and Identity in the Bronze Age, in S. Reiter, H.W. Nørgaard, Z. Kolzce and C. Rassmann (eds) *Rooted in Movement: Aspects of Mobility in Bronze Age Europe*: 15-22. Aarhus: Jutland Archaeological Society.

Reiter, S.S. 2014b. Identity lies in the eye of the beholder: a consideration of identity in archaeological contexts, in V. Ginn, R. Einlander and R. Crozier (eds) *Exploring Prehistoric Identity in Europe: Our Construct or Theirs?*: 14-21. Oxford: Oxbow Books.

Reiter, S.S. and K.M. Frei 2015. Migration and Identity at the Early Bronze Age Cemetery of Jelsovce, Southwest Slovakia. The Strontium Evidence, in P. Suchowska-Ducke, S. Reiter and H. Vandkilde (eds) *Forging Identities: Mobility of Culture in Bronze Age Europe*: 121-130. British Archaeological Reports International Series 2772. Oxford: Archaeopress.

Reiter, S.S. and K.M. Frei 2021. Examining alternative constructions of power and mobility in the Early Nordic Bronze Age: A case study of a local elite female from Denmark, in C. Trémaud (ed.) *Les Nouvelles de l'Archéology*: *Mobilité, genre et archéologie* 163: 24-32.

Reiter, S.S. and K.M. Frei 2022. Bronze Age Women. Innovative methods: Unexpected stories of Bronze Age female mobility, leadership and global networks. *The New Historia* (available at: https://historia.3.nftest.nl/pattern/innovative-methods/ (accessed: 18 May 2022)).

Reiter, S.S. and K.M. Frei 2023. The 'Ultimate Gift': A gift that kept on giving? A fresh look at recent strontium isotope data on elite mobility patterns from individuals from Nordic Bronze Age Denmark relative to extant anthropological models, in I. Sèguy and C. Contente (eds) *Autor des populations du passé: Les migrations humaines*: 111-140. Paris: INED and IN-HOPPE.

Reiter, S.S. and K.M. Frei (forthcoming). One Step Further: Reflections on Gendered Mobility Studies of Ancient Individuals through an Examination of Recent Data from European Prehistory, in B. Gaydarska and U. Matić *Themes in Contemporary Archaeology Gender in Prehistory*: 1-22. Cham: Springer.

Renfrew, C. 1972. *The Emergence of Civilization: The Cyclades and the Aegean in the Third Millennium BC*. London: Methuen.

Renfrew, C. 1986. Varna and the Emergence of Wealth in Prehistoric Europe, in A. Appadurai (ed.) *The Social Life of Things*: 141-168. Cambridge: Cambridge University Press.

Renfrew, C. 1987. *Archaeology and Language: The Puzzle of Indo-European Origins*. Cambridge: Cambridge University Press.

Ruff, C.B., B.M. Holt, V. Sládek, M. Berner, W.A. Murphy Jr, D. Zur Nedden, S. Schwartz, B. Zamboanga and R.S. Weisskirch 2008. Broadening the Study of the Self: Integrating the Study of Personal Identity and Cultural Identity. *Social and Personality Psychology Compass* 2(2): 635-651 (available at: https://doi.org/10.1111/j.1751-9004.2008.00077.x).

Sánchez-Quinto, F., H. Malmström, M. Fraser, L. Girdland-Flink, E.M. Svensson, L.G. Simões, R. George, N. Hollfelder, G. Burenhult, G. Noble, K. Britton, S. Talamo, N. Curtis, H. Brzobohata, R. Sumberova, A. Götherström, J. Storå and M. Jakobsson 2019. Megalithic tombs in western and northern Neolithic Europe were linked to a kindred society. *Proceedings of the National Academy of Sciences* 116(19): 9469-9474 (available at: https://doi.org/10.1073/pnas.1818037116).

Sapolsky, R.M. 2018. *Behave: The Biology of Humans at our Best and Worst*. London: Vintage Publishing.

Schrader, O. 1980. *Prehistoric Antiquities of the Aryan People: A manual of comparative philology and the earliest culture*. London: Charles Griffin and Company.

Shennan, S. 1982. Exchange and Ranking: The Role of Amber in the Earlier Bronze Age of Europe, in C. Renfrew and S. Shennan (eds) *Ranking Resource and Exchange*: 33-45. Cambridge: Cambridge University Press.

Shennan, S. 1994. Commodities, Transactions and Growth in the Central European Bronze Age. *Journal of European Archaeology* 1(2): 59-73.

Singer, G.G. 2008. Amber in the Ancient Near East. *i-Medjat* 2: 1-3.

Sjögren, K.-G., I. Olalde, S. Carver, M.E. Allentoft, T. Knowles, G. Kroonen and V. Heyd 2020. Kinship and social organization in Copper Age Europe. A cross-disciplinary analysis of archaeology, DNA, isotopes, and anthropology from two Bell Beaker cemeteries. *PLoS One* 15(11): e0241278 (available at: https://doi.org/10.1371/journal.pone.0241278).

Sørensen, M.L. 1997. Reading Dress: The Construction of Social Categories and Identities in Bronze Age Europe. *Journal of European Archaeology* 5(1): 93-114.

Spivey, N. 2012. *The Ancient Olympics*. Oxford: Oxford University Press.

Suchowska-Ducke, P., Z. Stos-Gale, H.W. Nørgaard, E. Pernicka and B. Ducke 2021. The bronze cup from Dohnsen in the light of old and new evidence. *Archaeometry*: 728-743 (available at: https://doi.org/10.1111/arcm.12743).

Tarschys, D. 1998. Foreward by the Secretary General of the Council of Europe, in K. Demakopoulou, J. Jensen, K. Kemakopoulous, C. Eluere, A. Jockenhövel and J.-P. Mohen (eds) *Gods and Heroes of the European Bronze Age*. London and New York: Thames and Hudson.

Threadgold, S. and P. Nilan 2003. Young people, habitus and opinions about politics. *Melbourne Journal of Politics* 29: 96-113.

Tilley, C. 1996. *Citizenship, Identity and Social History*. Cambridge: Cambridge University Press.

Todorov, T. 1992. *Nous et les Autres*. Paris: Éditions du Seuil.

Tudor, H. 1972. *Political Myth*. London: Red Globe Press.

Vandkilde, H. 2011. Bronze Age Warfare in Temperate Europe, in S. Hansen and J. Müller (eds) *Sozialarchäologische Perspektiven: Gesellschaftlicher Wandel 5000.1500 v. Chr. zwischen Atlantik und Kaukasus*: 365-380. Berlin and Darmstadt: Phillip von Zabern.

Vandkilde, H. 2013. Warfare in Northern European Bronze Age Societies, in S. Ralph (ed.) *The Archaeology of Violence: Interdisciplinary Studies*: 37-62. New York: New York State University Press.

Vandkilde, H. 2016. Bronzization: The Bronze Age as Pre-Modern Globalization. *Praehistorische Zeitschrift* 91(1): 103-123 (available at: https://doi.org/10.1515/pz-2016-0005).

Vandkilde, H., C.F. Stephansen, P. Suchowska-Ducke, C.S. Andersen, L. Ahlqvist, L. Felding, M. Bjørnevad-Ahlqvist, J. Czebreszuk and H.W. Nørgaard 2024. Metal-for-Amber in the European Bronze Age. *Praehistorische Zeitschrift* 99(1): 280-338 (available at: https://doi.org/10.1515/pz-2024-2003).

Wahl, J. 2009. *Die Menschliche Skelettereste aus dem Urnenfelderzeitlichen Männerfriedhof von Neckarsulm*. Stuttgart: Konrad Thiess.

Wallerstein, I. 1974. *The Modern World System: Capitalist Agriculture and the Origins of the European World-Economy in the Sixteenth Century*. New York: Academic Press.

Walsh, M. J., S. O'Neill and L. Sørensen 2024. *In the Darkest of Days*. Oxford: Oxbow Books.

Walsh, M.J. and S.S. Reiter 2024. Societies that Sacrifice? Examining the potential for attendant sacrifices in the Nordic Bronze Age, in M.J. Walsh, S. O'Neill and L. Sørensen (eds) *In the Darkest of Days*: 13-26. Oxford: Oxbow Books.

Warming, R. 2023. The Rørby Swords. *Society for Combat Archaeology*, 26 January 2015 (available at: https://combatarchaeology.org/the-rorby-swords/ (accessed: 21 May 2024).

Wels-Weyrauch, U. 1989a. Fremder Mann. *Germania* 67: 162-167.

Wels-Weyrauch, U. 1989b. Mittelbronzezeitliche Frauentrachten in Süddeutschland, in C. Mordant (ed.) *Dynamique du Bronze Moyen en Europe Occidentale, Actes du 113e Congrès National des Sociétés Savantes*: 117-134. Strasbourg: Ministère de L'éducation Nationale, de la Jeunesse et des Sports Comité des Travaux Historique et Scientifiques.

Whitehouse, H. 2013. Religion, Cohesion, and Hostility, in S. Clarke, R. Powell and J. Savulescu (eds) *Religion, Intolerance, and Conflict: A Scientific and Conceptual Investigation*. Oxford: Oxford Universitry Press (available at: https://doi.org/10.1093/acprof:oso/9780199640911.002.0003).

Whitehouse, H. 2018. Dying for the group: Towards a general theory of extreme self-sacrifice. *Behavioral and Brain Sciences* 41: e192 (available at: https://doi.org/10.1017/S0140525X18000249).

Wildgen, W. 2012. Cosmological Memory Space and the Origin of Human Language, in E.W.B. Hess-Lüttich (ed.) *Sign Culture Zeichen Kultur*: 149-163. Würzburg: Königshausen und Neumann.

Chapter 2

Bronze times, bronze minds: Thinking about 'Bronzization'

Laura Ahlqvist

Department of Archaeology and Heritage Studies, Aarhus University, Aarhus, Denmark
laura.ahlqvist@cas.au.dk

Abstract

Vandkilde's concept of 'bronzization' has prompted the consideration of the trajectory and after-effects which unfolded in the wake of the invention of bronze in terms of mobility, connectivity, and exchange of goods and ideals. In this contribution, I consider the implications of bronzization from a different, yet related perspective, as I discuss whether the concept could be taken even further. Bronze Age people handled bronze, traded with bronze, relied on bronze, and transformed bronze. Is it possible that they may also have 'thought' in bronze? Some famous archaeological objects from the Nordic Bronze Age illustrate this point, as they emerge as bronze materializations of such complex ideas as celestial cycles and the progression of time. The Trundholm Sun Chariot can be seen as a material conceptualisation of changing positions of the sun on the sky when observed by humans – an idea that seems even further developed in the later asymmetrical razors with incised motifs on the blades. In these motifs, the passing of time can be witnessed, as the exact constellation of motifs places each artefact on a specific time of the day. The measurement of time progressing is materialised in these artefacts. Bronze can then be seen as a scaffold for the human mind, aiding it in grasping complex matters that may otherwise have lain outside human understanding, thereby prompting the suggestion that this was yet another outcome of bronzization.

Introduction

Helle Vandkilde's concept of bronzization captures the unusual level of connectivity between different areas of Eurasia that can be witnessed in the archaeological record *c.* 2000-1200 BCE (Vandkilde 2016). Rooted in theoretical approaches to globalisation processes described in key literature (Appadurai 1996; Nicolaescu 2004), bronzization describes the interconnectivity of areas and cultures that relied on bronze during this time. The reliance on bronze is key in understanding the socio-cultural changes that unfolded during the period. The importance of this metal grew in cultural significance during the *c.* 800-year-long period, and because it is an alloy consisting of different elements that stem from diverse geographic areas this demanded a high degree of trading and exchange. As a result, the period is characterised by an unprecedented level of connectivity, meaning that it can be insightful to approach it almost as a prehistoric case of globalisation (Vandkilde 2016). Vandkilde's concept also describes how the mobility processes involved in the bronze trade resulted in the exchange of cultural traits that accompanied the exchange of bronze objects. It also considers potential pushback from recipient cultures, meaning that it both accounts for the shared and discrete cultural traits present across the entire geographical area that these processes can be seen to have encapsulated (Vandkilde *et al.* 2015; Vandkilde 2016). It is a strong analytical tool, well suited to nuanced discussions of this particular period.

In this chapter, I experiment with expanding the concept of bronzization beyond its original use. The key player during the cultural period – bronze – constitutes the foundation for these thoughts, as I ask just how deep the cultural importance of this metal was. Some bronze objects can be seen to mediate ideas and concepts that extend beyond the economic dimension of bronze, suggesting that it could be imbued with a host of varying cultural significances. Such other meanings of bronze are particularly evident and well explored in artefacts from the Nordic Bronze Age (NBA) cultural area, *c.* 1700-500 BCE (see, e.g., Vandkilde 2014; Vandkilde *et al.* 2022; Kaul 2004; Kristiansen and Larsson 2005; Goldhahn 2007), prompting my use of this rich material record as a framework for the questions pursued here.

Several NBA artefacts seem to mediate complex concepts such as cosmological narratives, even the progression of time (Kaul 2021; Ahlqvist 2023; 2024). Notably, this phenomenon – the progression of time conceptualised in a material – occurs almost from the onset of the NBA and has no obvious predecessors. Why did it occur at this time and why was bronze chosen as the medium for such notions? The possible answers to these questions are intertwined and can be guided by the concept of bronzization. If bronze mattered so much to these people, is it any wonder that it entangled itself in other aspects of human society? Here, bronze and the associated technologies can be seen as a resource for the human mind, impacting the way that NBA people thought about and navigated in the world. As such, here I experiment with operationalising bronzization as a cognitive process occurring as a result of the economic and transcultural developments taking place with the onset of the Bronze Age. I also consider the multifaceted relationships between people, innovation and thinking, and contextualise this with the socio-cultural context.

Material culture as a cognitive resource

The recognition that material culture actively shapes and mediates human cognition and behaviour is a good place to start, as this provides a framework for understanding how the access to and demand for bronze impacted NBA people. Material culture and associated technology require a cognitive effort and have been argued to provide a window into the way that past societies thought about the world (Knappett 2005). By engaging with past technology and material culture, archaeologists can approach a better understanding of past perceptions of the world. However, material culture is not just a passive reflection of past practices, it can be seen to play an active role in societies, as it entangles with behaviour and mind. Material culture can act upon humans in a reciprocal relationship, for example by functioning as a cognitive resource for individuals and communities when they grapple with complex or abstract notions (Knappett 2005).

These insights align with Lambros Malafouris' (2020) framework of 'thinking as "thinging"' – which emphasises the dynamic interplay between human cognition and material artefacts. Malafouris argues that human thought is inherently entangled with the material world, and cognitive processes are distributed across minds, bodies, and external objects (see also Hodder 2012). From this perspective, material culture is not passive but actively participates in cognitive processes, shaping and extending human thought beyond the confines of the individual mind.

Niels Johannsen (2010) terms such processes 'technological conceptualisations', wherein material culture serves as a vehicle for cognitive processes. He argues that people draw upon their knowledge of familiar objects and technologies to understand and engage with more abstract concepts. This process involves a metaphorical translation of known material forms into new areas of understanding, allowing people to gain insights into otherwise opaque phenomena. In a sense, material culture is 'good to think with' as it can provide a concrete dimension to something that is otherwise opaque or abstract.

The invention of the chariot serves as an example of how experiences with technological processes, such as metalworking, provided a framework for conceptualising astronomical phenomena in Mediterranean Bronze Age cultures (Johannsen 2014). The complex movements of celestial bodies were metaphorically understood through analogies with the mechanical operations of charioteering. The new technology and the opportunities it afforded changed the perception of natural phenomena, serving as a cognitive resource for interpreting and engaging with the world (Johannsen 2014). This suggestion aligns with the discussions laid out here.

The use of material culture often incorporates a bodily element through the technology associated with it (Knappett 2005), which means that the boundaries between human and material, mind and technology can be blurred (Haraway 1985); philosopher Andy Clark even goes so far as to state that 'the mind is a leaky organ, forever escaping its "natural" confines and mingling shamelessly with body and with world' (Clark 1998). This aligns with Donna Haraway's notion of the cyborg as a hybrid creature springing from the interplay between humans and technology. She argues that neither humans nor technology can exist without the other, making such distinctions unhelpful (Haraway 1985). These perspectives underline the continuous relationship between technology and the mind, such as are further explored below.

Along similar lines, Malafouris and Colin Renfrew (2010) have proposed the concept of the 'cognitive life of things', which reconceptualises the boundaries of the mind to include material artefacts. Objects serve as cognitive scaffolds, extending and enhancing human cognitive abilities beyond the capacities of the individual mind alone. Furthermore, the role of sensory-motor experiences and environmental context in shaping cognitive processes is highlighted. Through their physical properties, affordances, and cultural meanings, material artifacts become integral components of cognitive systems, facilitating problem-solving, memory, and communication.

The framework laid out above illustrates the active role of material culture and technology in shaping human thoughts about the world. These insights are valuable when exploring if and how bronze and bronzization impacted NBA people, allowing for the pursuit of the central research question, i.e. whether the concept of bronzization can be extended into an analysis of past cognition.

Night and day in bronze objects

Some NBA objects lend themselves particularly well to exploring the relationship between material, the mind. and perception of the world. The ornamented one-edged razors from the Late NBA (1100-500 BCE) are perhaps the most readily apparent example. The razors are decorated with elaborate art on the blade – displaying

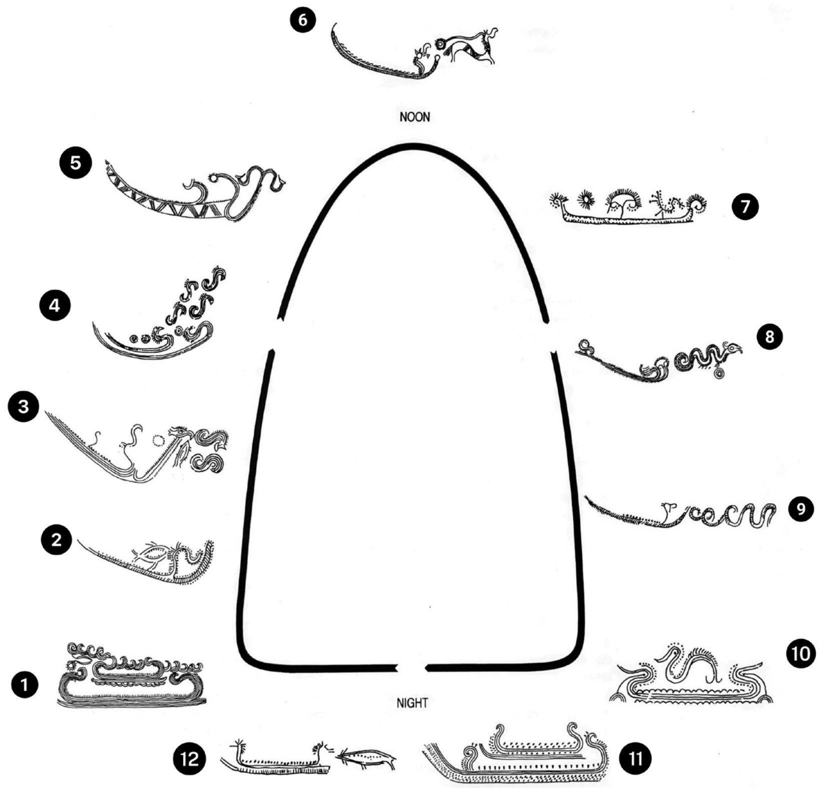


Figure 1: The sun-journey as envisioned by Flemming Kaul (1998) illustrated through parts of motifs from 12 razors. (1) Starting in the lower left corner (at sunrise), the sun gets picked up from a ship sailing left (indicating that it is a night ship) by a fish, who then delivers it on a day-ship (sailing to the right). (2) The fish pulls the sun unto the day ship before (3) it is eaten by a bird of prey, while (4 and 5) sun-horses collect the sun from the morning ship. (6) The sun-horse galops across the sky pulling the sun and (7) then delivers the sun to an afternoon-ship. (8) A snake collects the sun and hides or eats it, (9) leading it to become invisible. (10) The sun is pulled underwater and (11) night-ships sailing to the left travel with the invisible sun, whose light has been temporarily extinguished until sunrise (12). Finally, the fish approaches the ship, ready to begin a new journey and a new day (modified from Kaul 1998, fig. 170).

ships, waves, circular imagery and various zoomorphic and therioanthropic creatures. In total, more than 350 decorated razors from the entire Nordic area are known, mostly stemming from 1100-700 BCE. Their art is considered central to archaeological understanding of NBA cosmology; previous research suggests that they depict segments of a myth centred around the position of the sun (Fig. 1). The exact constellation of different animals in relation to ships and different versions of the sun demarcates a particular time of day. Together, these scenes relay a narrative that explains how the sun rises and sets every day (Kaul 1998; 2004). This also means that an *axis mundi* with a tripartite cosmos is implicit in the razor imagery (cf. Eliade 1991; Kaul 2005). The movement of the sun is conditioned by animals that move in different realms, e.g. the air (the upper world) and the water (the nether world). The times around sunrise and sunset are characterised by a transition from the upper to the nether world and vice versa (Kaul 2005; Vandkilde 2013). The positioning of the ships and the animals follow the trajectory of the sun when observed in the northern hemisphere, i.e. from left to right, meaning that the razor imagery can be divided into day and night motifs: right-facing motifs pertain to the day and left-facing ones pertain to the night (Kaul 2018a).

This perception of the world seems to be introduced early in the period, famously exemplified by the Trundholm Sun Chariot. The object originates from the 14th century BCE and consists of a large disk, likely portraying the sun, pulled by a horse (Müller 1903). The sun is ornamented with swirling spirals that loop together in an ongoing pattern and the right side is gilded. This means that when the object is viewed from the side facing right, only the golden side of the sun is visible. The left-facing side is darker, thus underlining the right-as-day, left-as-night logic. At night, the sun

Figure 2: The *Vogelsonnenbarke*-motif on an imported vessel found at Siem, Denmark (left), along with Nordic variations of the motif as seen on one of the Viksø helmets (right, top) and on an endplate of a neck-ring (right, bottom) from southern Sweden (photos of the Siem vessel and the neck-ring: Flemming Kaul; photo of the Viksø helmet: the author).

is dark as it travels in the underworld. The Trundholm Sun Chariot is wheeled (both sun and horse), meaning that it could be moved; this underlines the dynamic elements of the solar myth, which could be emphasised when the object was in use (Kaul 2004).

The mentioned objects are distinctly Nordic but seemingly incorporate themes that were common elsewhere in Europe during this period, notably the *Vogelsonnenbarke*-motif (Fig. 2). The motif occurs on a Europe-wide scale throughout an extended period ranging from early Urnfield through to early Hallstatt, and can be found on *situlae*, amphorae and buckets (e.g. the Hajdúböszörmény vessel), as well as on helmets and cuirasses (Hornstrup 2013; Bilić 2016). It is also well known from the Villanovan culture (see also fig. 4), where it can also be found on bronze belts (Iaia 2004). In its most diagnostic form, it consists of two opposing swan-like birds connected by a structure resembling a ship, often carrying a circular object, probably the sun (Sprockhoff 1957; Becker 2018). The same motif may also be found in other variations, some of which are only vaguely recognisable (see Ilon 2009).

The *Vogelsonnenbarke*-motif can be found on razors and other Nordic metal objects in various renditions; a version very faithful to the original can be seen on one of the Viksø helmets, embossed *en miniature* on the side. The placement of the motif in this context seems to associate the bearer and the therianthropic themes exemplified in the object with a larger European network (Vandkilde 2013; Vandkilde *et al.* 2022). The motif postdates the earliest occurrence of the sun ship imagery in the Nordic region (Kaul 1998), suggesting that complex processes of transmission, adoption, and cultural translation likely played a role in the development of what later became a distinct Nordic notion (Vandkilde 2016). As such, the themes playing out in NBA art relate to the larger European network that NBA humans navigated in, facilitated by trading and exchange.

The constellation of motifs on the razor blades mean that each razor seemingly signifies a specific time of day. The art on the contemporary belt bowls and neck rings operationalises the sun's trajectory differently. This ornamentation is less obviously figurative but can be seen to incorporate abstractly the elements known from the razors – horse, ship, snake, bird, sun – into sets of curved lines. This can be recognised by linking up different versions of the motif in a sequence of increasing stylisation. Here, the sun imagery is rendered in a more conceptual version (Ahlqvist 2024). The belt bowls tend to be covered with friezes and bands of these curved lines that loop together so that no beginning or end is visible; on the neck rings, the end plates are decorated with similar patterns that include a perfect mirror image (Fig. 3). These objects seem to emphasise themes of cyclicality and repetition rather than the specificity and narrative qualities present in the razors. Whereas the razors are placed within certain times of the day, the belt bowls and neck rings connote the entire solar narrative at once (Ahlqvist 2024; cf. Kaul 2021).

The art on the objects described here all relate to the sun and its position in different ways, yet they seem linked due to the similarities between them. The *Vogelsonnenbarke*-motif can be seen as a key influence in all the imagery described here, connecting the themes expressed in the Nordic art style with wider European

Figure 3: Examples of belt bowl and neck-ring ornamentation. The belt bowl ornamentation is organised in continuous bands, whereas the ships and waves on the neck-rings are arranged as mirror images of each other (photos: courtesy of John Lee and Lennart Larsen, the National Museum of Denmark under CC-BY-SA license, modified, and Tania Muñoz Marzá and Sara Kusmin, Historiska museet/SHM under CC BY 4.0 license, modified).

trends. There is a long tradition in Scandinavian archaeological research of ascribing the preoccupation with the sun and its movements various spiritual or religious reasons (e.g. Kaul 2004; Brøndsted 1938; Müller 1903; Ohlmarks 1945; Bradley 2006), but besides the obvious supernatural elements present in the art, another theme is recurring: time (Kaul 2021). Here, the close relationship between the NBA and other European Bronze Age cultures may have played a vital role.

Time measured in bronze

The art on NBA bronze objects mediates different perceptions or relationships with time. The razors and their snapshot-like motifs distinctly point to a certain point of day and can, therefore, be seen as a materialisation of something as ephemeral as time. Different times of day are then effectively recorded in these artefacts, meaning that the abstract notion of time becomes intertwined with a physical human-made component. In a sense, it attains matter through the human action of thinking about and inventing a way of keeping track of specific points in the day. A modern clock does something similar by adding a physical dimension to something entirely immaterial for human purposes.

The razors were personal objects, seemingly closely associated with the bearer (Treherne 1995). By extension, this means that each owner of a razor related to a certain time of day through the object they had acquired and were using regularly (Kaul 1998). Perhaps the motif on each razor is a record of the bearer's time of birth (cf. Kaul and Nielsen 2017)? This proposition can of course never be tested and proven, however, that personhood and identity may be defined by the sun's position during time of birth resonates with, for example, Maya views on similar matters (Hendon 2018). Here, personhood can be seen as composed of relationships, environment, and importantly, the passage of time. Time is visible and measurable in the daily movement of the sun, which ties to the body by setting a destiny for a person defined by the time of birth. This destiny can be mitigated or achieved throughout one's life via actions and relationships (Hendon 2018). Similar ideas can also be found and are thriving in mainstream astrology.

A preoccupation with recording the specific time of day in the razors emerges, regardless of the exact significance of this time. In this way, the bronze objects become physical representations of time and the passing of it, emphasised by the narrative character of the razor art that shows clear progression between different moments in time. In a sense, the objects let time become 'bronzized'.

The belt bowls and neck rings are also examples of bronzized time, but the art here seems to revolve around time as a concept rather than a specific point. The patterns of curved lines that incorporate horses, ships and other agents in the solar myth are organised in running patterns on the objects without any beginning or end point. This underlines the cyclical nature of the entire narrative of the sun in a more obvious manner than on the razors. Here, the entirety of time is present within one object and at the same time, the continuous nature of it emphasised. The pattern may be seen as an extension of the spiral ornamentation from the Early Bronze Age (particularly during 1500-1300 BCE), which then also possibly signifies the ongoing movement of the sun (Kaul 2021). That this could be the case is supported by the presence of spiral ornamentation on the Sun Chariot disk.

This way of relating to time could suggest that NBA ontology operated with a time system that was cyclical rather than linear. Whereas modern Euro-American ontology understands time as constantly progressing, some societies consider events and developments to reoccur in an everlasting loop which cycles back in rhythms (Kimmerer 2013). Maybe NBA worldviews operated with similar relationships to time? Instead of necessarily using these discussions to typecast NBA society, the material presented here rather suggests that their perception of time may have been fluid and incorporated aspects of different time systems. Time perhaps sometimes moved in cycles, whereas other events were fixed, or time was not necessarily universal to all individuals (Ahlqvist 2023)?

The belt bowls and neck rings record the passing of time yet in a different manner. Following the examples laid out in the previous sections, the art on these object types can be seen as a way of materialising and thinking about time (cf. Kaul 2021). In this sense, bronze comes to function as a medium for grappling with complex notions, such as the way in which NBA humans could have experienced and thought about time. The human mind can be seen to have relied on a material component – bronze – to make the unfathomable knowable (Malafouris and Renfrew 2010). By becoming entangled with the technology that society relied on, the human mind extended past the biological body, making an imprint on the artefacts it produced (Malafouris 2020; Haraway 1985). These bronze objects and the host of new possibilities that they afforded provided a metaphor the mind could use as a scaffold, allowing it to conceptualise abstract notions that posed epistemic challenges to people, such as, e.g., how time is organised (Johannsen 2010; 2014). The bronze objects became a cognitive resource that supported NBA people in their negotiations with time and, as such, are effectively ontological tools.

I argue that we can view the close integration between time, mind, and bronze as another outcome of bronzization. At this point in Scandinavian history, time took physical form and bronze was the material that allowed it to do so, facilitated by the close relationship between NBA people and the metal that came to be so important for society. Viewing matters this way suggests that the metal somehow transformed from something of pure economic importance into an ontological constituent of the Bronze Age world. Furthermore, I suggest that the process of bronzization can be seen as having extended into and shaped human thinking during the period.

Materiality and dynamics of bronzization

The importance of the sun and the passage of time is not limited to razors, belt bowls and neck rings. The spiral ornamentation of the Early Bronze Age and the corresponding waveband patterns of the Late Bronze Age can be found on a plethora of bronze objects, underlining the impression that time was an issue of concern for Bronze Age people. This likely relates to the socio-cultural context of bronzization as a time of large-scale mobility and widespread connectivity.

The extensive networks of trade and exchange necessitated by the request for bronze made travelling and mobility equally necessary. Much of this travel likely took place by ship (Kastholm 2015; Ling *et al.* 2018) and it is notable that the ship is one of the key motifs in Nordic imagery. On the razors, the ship is a mode of transport that carries the sun, meaning that it is one of the driving forces of the sun's movements across the sky. Seafaring allowed NBA people to go further in less time than they would have been able to on foot, which might have radically impacted the perception of time. Being able to travel further in less time can create the illusion that time is passing faster or changing speed, thus giving the impression that the ship or time spent at sea affects the speed of time. Seafaring technology enabled long-distance travelling in a way that was crucial for this society that was so reliant on it (Kveiborg *et al.* 2020; Vandkilde 2014; 2016). In this light, the ship appears as a particularly well-chosen motif for a metaphorical translation of the passing of time, as discussed above.

Horses and associated technologies, such as charioteering, were also introduced in the Scandinavian Bronze Age (Kveiborg 2017; 2019), enabling humans to travel at great speed, meaning that the perception of time could also be affected by the horse. The close relationship with this animal allowed for new modes of transportation, perhaps linked to warfare or various performances. The Järrestad rock carving suggests the existence of equestrian acrobatics, which could have had a symbolic or ritual meaning, or could suggest an unfamiliar relationship with horseback riding, which is not firmly attested until the final Bronze Age (Kveiborg 2017: 113; 2019: 147-149). Furthermore, the introduction of horses may have played another important role in the process of bronzization, as the addition of horse manure to clay moulds for *cire perdue* casting improves the mould significantly. Improving the mould this way

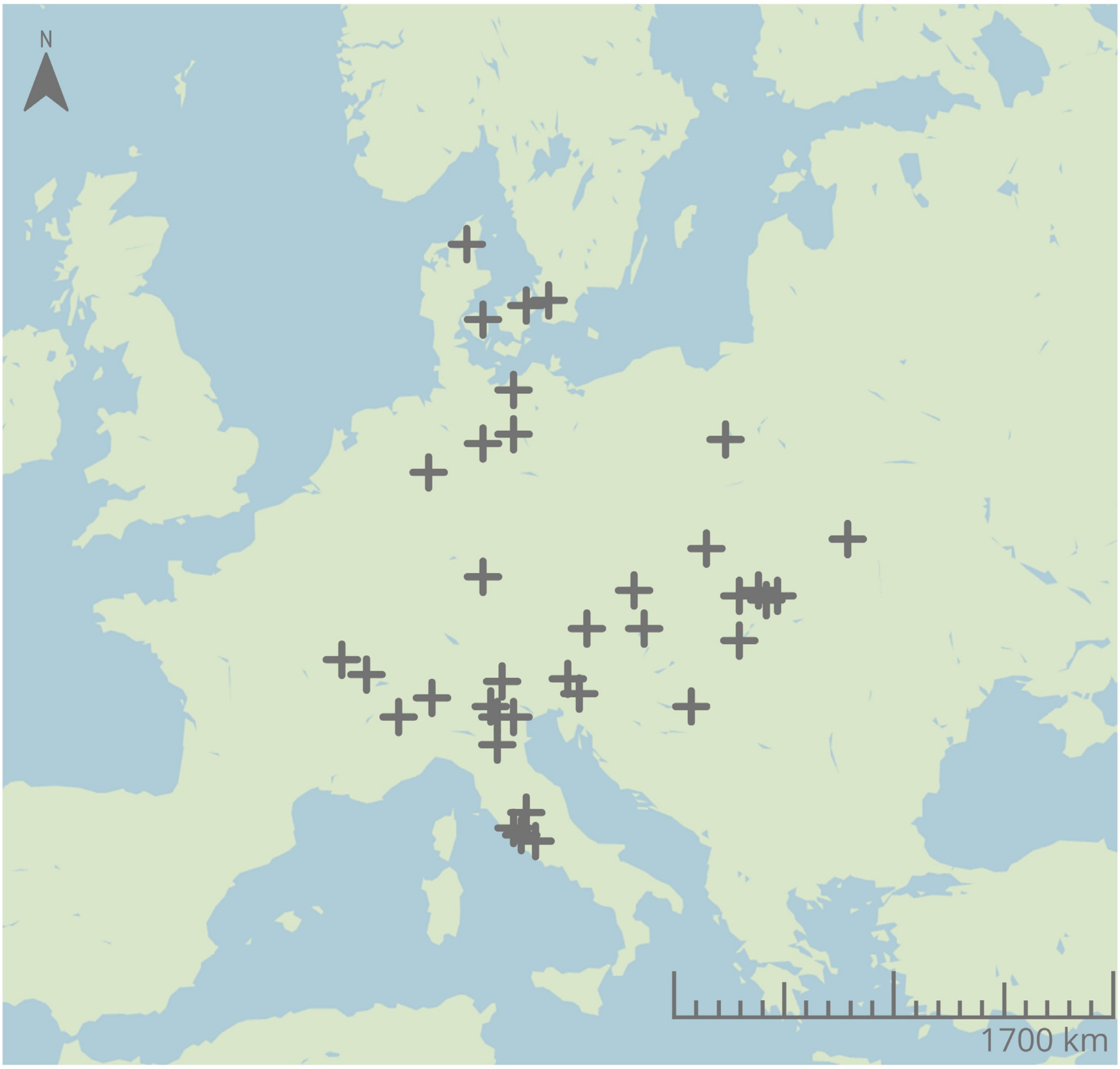


Figure 4. Europe-wide distribution of the *Vogelsonnenbarke*-motif. Many different versions of the motif exist on a European scale, but the map shows only objects with the most faithful copies of the motif, so as not to accidentally include objects with other art that just happens to bear resemblance to the *Vogelsonnenbarke* (figure: the author).

allows for better temperature regulation during the casting process and thus for less mistakes in the final product (Kaul 2018b). In this sense, the introduction of the horse and the use of horse manure may have been a prerequisite for the production of NBA high-quality bronze objects. Equestrianism and horse imagery were thus seemingly associated with the elite, its practices and its objects, which proposes another link between the choice of motif, significance, object, and material (Kveiborg 2017; Kveiborg *et al.* 2020). These associations may have been instrumental in the cognitive process of translating the passing of time into art: art that is only found on the objects of the elite.

Generally, the art on the bronze objects appears dynamic; bodies are moving, pulling, flying, swimming, eating and the conceptual versions of the imagery add movement through their structure of spirals and waves that continue forever. Motion is the very pinnacle of the solar myth, as that is what makes the world persist through continuation of the daily cycle. Both seafaring and horseback riding incorporate a bodily element and require certain human actions to be possible. At their very core, they are dynamic and embodied, requiring almost a merging between human and horse or human and ship by means of the technology associated with them (cf. Haraway 1985; Knappett 2005). This may have enhanced the feeling of time changing speed. Time passes differently when involved in physical activity. In this case, the close relationship between human body and thing may have strengthened the cognitive link between ships, horses, and the effect of time on the human body, making these concepts appear entangled in the minds of Bronze Age people (cf. Malafouris and Renfrew 2010). That NBA ontology and cosmological narratives centred around movement is perhaps no surprise given the importance of mobility to secure the large amounts of bronze consumed in the NBA.

Lastly, the very composition and structure of the art on the Nordic objects can also be seen as directly linked to the wider concept of bronzization. The portrayal of time and movement could have been undertaken in a variety of ways, but, notably, a motif with clear connections to other areas and cultures was chosen as one of the central elements. The ships, birds, horseheads, and even the waves, are all reminiscent of the *Vogelsonnenbarke* that enjoyed enormous popularity on a wider European scale at the same time (Becker 2015; 2018, see Fig. 4). The NBA also boasts its own (presumably imported) objects, exhibiting the motif. In Bjärsjöholm, Scania, SE; Siem, Jutland, DK; Mariesminde, Funen, DK and Kostræde, Zealand, DKHajdúböszörmény-type vessels, an amphora, and a sieve displaying the *Vogelsonnenbarke* have been found (Kaul 1998). These are thought to have been deposited in their Nordic contexts *c.* 1100-900 BCE, based on a combination of the contextual finds and the ornamentation, as well as cross-referencing European finds (Thrane 1975; Wirth 2010). It is likely that such objects and their ornamentation, along with perspectives earned from contact with other Bronze Age areas, impacted the development of NBA art style. The NBA renderings of ships may be seen as creative translations, drawing upon the imported *Vogelsonnenbarke*-motifs as a frame of reference, along with the antecedent examples of ship imagery known prior to these imports (Kaul 1998).

As such, the process of bronzization affected the development of NBA art and the related aspects in more than one way. In fact, other European notions became entangled in Nordic art and ontology. In this way, the effects of bronzization can be said to be manyfold and multidimensional, as they impacted the way people thought, expressed these thoughts, and also affected what was deemed important enough to think about and express.

Conclusion

By viewing bronze objects as cognitive scaffolds, it is possible to explore how NBA people may have navigated and made sense of their world, particularly in relation to concepts as abstract and fundamental as time. Insights from archaeological theory illustrate the dynamic interplay between humans, technology, and material artefacts. This challenges traditional notions of the mind and its boundaries, shedding light on the dynamic relationship between humans and their material environment.

As I have discussed in the previous pages, Vandkilde's concept of bronzization can function as a useful and inspiring tool with which to think, allowing us to explore the cognitive dimensions of the NBA. The ornamentation on bronze artefacts from this period can be seen as mediating complex relationships with, and understandings of, time. Here, bronze served as a cognitive resource. Through the integration of material culture with cognitive processes, NBA people used bronze objects as ontological tools, extending human thought beyond the mind, effectively entangling with material culture. The specific focus on time visible in these artefacts likely links up with the innovations in transportation technology which enabled people to travel further in shorter lengths of time – a necessity and outcome of the increased mobility and largescale trading and exchange springing from bronzization.

I would argue that operationalising bronzization in this way offers an additional layer to our understanding of NBA life. It also suggests exactly how significant this material may have been for human behaviour and perception. Bronze was not just a material that people traded, it was also a technology to *think* through. Utilised in this way, the already very impactful concept of bronzization can expand from a practical and sociological theory into an abstract, ontological one.

Bibliography

Ahlqvist, L. 2023. The Social Role of Nordic Bronze Age Visual Art: Perspectives from ornamented personal objects. Unpublished PhD Thesis, Aarhus University.

Ahlqvist, L. 2024. Reshaping Gendered Narratives: Reinterpreting Female Art, Identity and Social Change in the Late Nordic Bronze Age. *Norwegian Archaeological Review*: 1-18.

Appadurai, A. 1996. *Modernity at Large: Cultural Dimensions of Globalization*. Minneapolis: University of Minnesota Press.

Becker, S. 2015. Birds on Bronzes. A study of religious branding in later prehistoric Europe. Unpublished PhD Thesis, University of Cambridge.

Becker, S. 2018. Creativity as sensual cosmology: Bird iconography on metalwork in Late Bronze Age Europe, in L.B. Jørgensen, J. Sofaer Derevenski and M.L.S. *Sørensen* 2018 (eds) *Creativity in the Bronze Age. Understanding Innovation in Pottery, Textile, and Metalwork Production*: 207-220. Cambridge: Cambridge University Press.

Bilić, T. 2016. The swan chariot of a solar deity: Greek narratives and prehistoric iconography. *Documenta Praehistorica* 43: 445-465.

Bradley, R. J. 2006. Danish razors and Swedish rocks: Cosmology and the Bronze Age landscape. *Antiquity* 80: 372-389.

Brøndsted, J. 1938. *Bronzealderens Soldyrkelse*. Copenhagen: Gyldendalske Boghandel.

Clark, A. 1998. *Being there: Putting brain, body, and world together again*. Boston: MIT Press.

Eliade, M. 1991. *Images and symbols: Studies in religious symbolism*. Princeton: Princeton University Press.

Goldhahn, J. 2007. *Dödens Hand – en essä om brons- och hällsmed*. Göteborg: Göteborg Universitet, Institut för arkeologi och antikens kultur.

Haraway, D. 1985. A cyborg manifesto: Science, technology, and socialist-feminism in the late 20th century, in J. Weiss, J. Nolan, J. Hunsinger and P. Trifonas (eds) *The international handbook of virtual learning environments*: 117-158. Dordrecht: Springer.

Hendon, J. A. 2018. Can Tools Have Souls? Maya Views on the Relations between Human and Other-than-Human Persons, in J.A. Hendon and E. Harrison-Buck (eds) *Relational Identities and Other-than-Human Agency in Archaeology*: 147-166. Denver: University Press of Colorado.

Hodder, I. 2012. *Entangled. An archaeology of the Relationships between Humans and Things*. Chichester: Wiley-Blackwell.

Hornstrup, K.M. 2013. Var fuglen kun „vandbærer" i yngre bronzealder?, in S. Boddum, M. Mikkelsen and N. Terkildsen (eds) *Dødekulten i yngre bronzealders lokale kulturlandskab*: 127-134. Viborg/Holstebro: Viborg Museum and Holstebro Museum.

Iaia, C. 2004. Lo stile della 'barca solare ornitomorfa' nella toreutica italiana della prima età del ferro, in N. Negroni Catacchio (ed.) *Miti simboli decorazioni. Ricerche e scavi*: 307-318. Preistoria e Protostoria in Etruria VI. Milano: Centro Studi de Preistorica e Archeologica.

Ilon, G.A. 2009. Kerék, a nap, a vízimadár és a napbárka késő bronzkori kardjainkon… a kereskedelem avagy más kapcsolatok lehetséges lenyomatai?, in G. Ilon (ed.) *Proceedings of the 6th meeting for the researchers of prehistory. Raw materials and trade*: 151-188. Field Service for Cultural Heritage. Budapest: Szombathely.

Johannsen, N. 2010. Technological Conceptualization: Cognition on the Shoulders of History, in L. Malafouris and C. Renfrew *The Cognitive Life of Things*: 59-69. Cambridge: McDonald Institute for Archaeological Research.

Johannsen, N. 2014. Deus Ex Machina: Technological Experience as a Cognitive Resource in Bronze Age Conceptualizations of Astronomical Phenomena. *Journal of Cognition and Culture* 14: 435-448.

Kastholm, O. 2015. Plankboat Skeuomorphs in Bronze Age Logboats: a Scandinavian Perspective. *Antiquity* 89(348): 1353-1372.

Kaul, F. 1998. *Ships on Bronzes. A Study in Bronze Age Religion and Iconography. Text*. Copenhagen: Publications from the National Museum.

Kaul, F. 2004. *Bronzealderens Religion: Studier af den nordiske bronzealders ikonografi*. København, Det Kongelige Nordiske Oldskriftselskab.

Kaul, F. 2005. Bronze Age tripartite cosmologies. *Praehistorische Zeitschrift* 80: 135-148.

Kaul, F. 2018a. Left-Right Logic: An innovation of the Nordic Bronze Age, in L.B. Jørgensen, J. Sofaer and M.L. Stig Sørensen (eds) *Creativity in the Bronze Age. Understanding innovation in pottery, textile, and metalwork production*: 235-246. Cambridge: Cambridge University Press.

Kaul, F. 2018b. The Chariot of The Sun and other sun horses of The Nordic Bronze Age – including some interesting anatomical details, in J. Dodd and E. Meijer (eds) *Giving the Past a Future. Essays in Archaeology and Rock Art Studies in Honour of Dr. Phil. h.c. Gerhard Milstreu*: 58-69. Oxford: Archaeopress.

Kaul, F. 2021. The eternal voyage of the Sun, the perpetual cyclical advance of time, seen from a Nordic Bronze Age position. Movement is time – time is movement, in H. Meller, A. Reichenberger and R. Risch (eds) *Zeit ist Macht. Wer macht Zeit? Time is power. Who makes time?*: 165-179. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt. Landesmuseum für Vorgeschichte.

Kaul, F. and B.H. Nielsen 2017. Ragekniven fra Tranemosen – en genfunden rigt dekoreret ragekniv fra yngre bronzealder. Årbog 2017, Vesthimmerlands Museum: 21-40.

Kimmerer, R.W. 2013. *Braiding Sweetgrass. Indigenous wisdom, scientific knowledge and the teachings of plants*. Minneapolis: Milkweed Editions.

Knappett, C. 2005. *Thinking Through Material Culture*. Philadelphia: University of Pennsylvania Press.

Kristiansen, K. and T.B. Larsson 2005. *The Rise of Bronze Age Society: Travels, Transmissions and Transformations*. Cambridge: Cambridge University Press.

Kveiborg, J. 2017. The Nordic Bronze Age Horse: Studies of human-horse relationships in a long-term perspective. Unpublished PhD Thesis, Aarhus University.

Kveiborg, J. 2019. Traversing Sky and Earth. The Nordic Bronze Age horse in a long-term perspective. *Praehistorische Zeitschrift* 93(2): 225-264.

Kveiborg, J., L. Ahlqvist and H. Vandkilde 2020. Horses, Fish and Humans: Interspecies Relationships in the Nordic Bronze Age. *Current Swedish Archaeology* 28: 75-98.

Ling, J., T. Earle and K. Kristiansen 2018. Maritime Mode of Production: Raiding and Trading in Seafaring Chiefdoms. *Current anthropology* 59: 488-524.

Malafouris, L. 2020. Thinking as 'Thinging': Psychology With Things. *Current Directions in Psychological Science* 29: 3-8.

Malafouris, L. and C. Renfrew 2010. *The cognitive life of things: recasting the boundaries of the mind*. Cambridge: McDonald Institute for Archaeological Research.

Müller, S. 1903. *Solbilledet fra Trundholm*. København: Nordiske Fortidsminder.

Müller, S. 1921. *Bronzealderens Kunst i Danmark*. København: A. Reitzels Boghandel, H.H. Thieles Bogtrykkeri.

Nicolaescu, M. 2004. Circulating Images: The Translation of the Global into the Local, in I. Vainovski-Miha (ed.) *New Europe College GE-NEC, Program 2001-2002*: 73-114. Bucharest: New Europe College.

Ohlmarks, Å. 1945. 'Toalettredskapen' och solreligionen under yngre bronsåldern. *Fornvännen* 40: 337-358.

Sprockhoff, E. 1957. *Das Bronzene Zierband Von Kronshagen Bei Kiel: Eine Ornamentstudie Zur Vorgeschichte Der Vogelsonnenbarke*. Neumünster: Karl Wachholtz Verlag.

Sprockhoff, E. and O. Höckmann 1979. *Die gegossenen Bronzebecken der jüngeren nordischen Bronzezeit*. Mainz: Verlag des Römisch-Germanischen Zentralmuseums.

Thrane, H. 1975. *Europæiske Forbindelser. Bidrag til studiet af fremmede forbindelser i Danmarks yngre Broncealder (periode IV-V)*. København, Nationalmuseet.

Treherne, P. 1995. The Warrior's Beauty: The Masculine Body and Self-Identity in Bronze-Age Europe. *Journal of European Archaeology* 3: 105-144.

Vandkilde, H. 2013. Bronze Age Voyaging and Cosmologies in the Making: the Helmets from Viksø Revisited, in S. Bergerbrant and S. Sabatini (eds) *Counterpoint: Essays in Archaeology and Heritage Studies in Honour of Professor Kristian Kristiansen*: 165-178. British Archaeological Reports International Series 2508. Oxford: Archaeopress.

Vandkilde, H. 2014. Breakthrough of the Nordic Bronze Age: Transcultural Warriorhood and a Carpathian Crossroad in the Sixteenth Century BC. *European Journal of Archaeology* 17: 602-633.

Vandkilde, H. 2016. Bronzization: The bronze age as pre-modern globalization. *Praehistorische Zeitschrift* 91: 103-123.

Vandkilde, H., S. Hansen, K. Kotsakis, K. Kristiansen, J. Müller, J. Sofaer and M.L.S. Sørensen 2015. Cultural Mobility In Bronze Age Europe, in P. Suchowska-Ducke, S.S. Reiter and H. Vandkilde (eds) *Forging identities: the mobility of culture in Bronze Age Europe: report from a Marie Curie project 2009-2012 with concluding conference at Aarhus University, Moesgaard 2012*: 5-37. British Archaeological Reports International Series 2772. Oxford: BAR Publishing.

Vandkilde, H., V. Matta, L. Ahlqvist and H.W. Nørgaard 2022. Anthropomorphised warlike beings with horned helmets: Bronze Age Scandinavia, Sardinia, and Iberia compared. *Praehistorische Zeitschrift* 97: 130-158.

Wirth, S. 2010. Sonnenbarke und zyklisches Weltbild: Überlegungen zum Verständnis der spätbronzezeitlichen Ikonographie in Mitteleuropa, in H. Meller and F. Bertemes (eds) *Der Griff nach den Sternen. Wie Europas Eliten zu Macht und Reichtum kamen*: 501-515. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Chapter 3

Local practices and global processes: Cornwall in the Bronze Age world

Catherine J. Frieman

School of Archaeology and Anthropology, Australian National University, Canberra, Australia
catherine.frieman@anu.edu.au

Abstract

Helle Vandkilde has challenged us to reimagine the European Bronze Age as a supra-regional phenomenon that can best be understood through the context of globalisation. The flow of metal in particular links distant people and regions, shaping social ties and economic systems throughout the 2nd and into the 1st millennium BCE. But archaeological inquiry often takes place on a much smaller scale. Just as local and global are in tension in modern globalisation models, so they are in our attempts to reconstruct past worlds. This present contribution looks back and forth between Vandkilde's continental scale and the evidence for Bronze Age lives in Cornwall. Cornwall, today the somewhat sleepy and deeply peripheral southwest corner of Britain, is rich in ore and played an important role in the earliest western European metallurgical networks. Yet, the Cornish archaeological record remains deeply local, with longstanding traditions and unique practices well documented. This chapter seeks a preliminary answer to the question: is bronze really the best lens through which to study the people and practices of the 2nd millennium BCE?

Introduction

Reconstructing the deep past is a difficult and complex task. We work from a discontinuous and fragmented archaeological record to find plausible connections, explanations, and patterns of causality among the noise (Frieman, 2024). For recent periods, texts and other documents can help us pick our way through the data, whilst deeper time requires more material from geology, palaeoclimatology, and other environmental sciences to help tell the story. The European Bronze Age falls on the fuzzy line between deep prehistory and the historic past, being contemporary and tangentially in contact with partially literate societies and having also been semi-mythologised in various texts which have come down to the present, the Homeric epics most famous among them. As a consequence, the material and practices of this period have a tendency to seem more familiar to researchers familiar with these texts (and their various influences on contemporary culture), while a considerable body of parallel evidence is available from a host of archaeoscientific fields to help us access the texture of daily life. Perhaps because of this mix of cultural proximity and abundance of evidence, archaeologists who research the Bronze Age have constructed numerous overarching models to explain an interconnected and rapidly changing prehistoric world. These models have centred innovation, interconnection, and, of course, bronze, an alloy of copper and tin developed during the 3rd millennium BCE.

In this chapter, I explore these large-scale models with a special focus on Helle Vandkilde's (2016) influential model of Afro-Eurasian 'bronzization'. I focus on the special properties and affordances of metals – especially bronze – that have played a role in their elaboration. I contrast the continental-scale, top-down models with a consideration of Bronze Age Cornwall, a major source of metal during the early 2nd millennium BCE, but also a region which seems only lightly impacted by the long-distance networks in which it was entangled. If bronze is the material most influential in the period, why is a region so rich in both copper and tin so little engaged with the social trends hypothesised by bronzization?

Modelling Bronze Age Eurasia

What is the Bronze Age but a period defined and shaped by the desire for and circulation of metal? While the long-distance mobility of people, ideas, and practices is, if anything, an innate part of human society (Hofmann *et al.* 2024; Frieman 2021: 165), the Eurasian Bronze Age appears to demonstrate a notable increase in both scale and intensity of long-distance contact. More people were to-ing and fro-ing more often, and more ideas were travelling with them than in earlier periods. Metal, it seems, was a technology with legs.

Archaeologists have grappled with this step change in connectivity in various ways, but metal is always central to the narrative. Andrew Sherratt (1993), for example, built outwards from Wallterstein's (1974) World Systems Theory to model a Bronze Age World system as an elite-driven constellation of shifting cores, peripheries, and margins from which, and through or to which, various valued materials passed: metals of course, but also wool, chariots, and special sets of drinking vessels for fermented drinks. This approach foregrounded economic relations, positioning metal and other 2nd-millennium valuables as commodities passing through complex exchange systems that spoke to and reinforced imbalances between social strata and geographical regions. By contrast, Kristian Kristiansen and Thomas B. Larsson (2005), leaned more heavily on social anthropology to re-ground these economic practices in more complex social concerns. Their model of cosmologically driven exchange views exogenous materials and practices, including perhaps metallurgy in its earliest phases, and certainly including special metal objects like swords or elaborate ornamentation, as valuable because of their associations with foreign peoples, important rituals, and other places.

While these models propose contrasting purposes for exchange and mobility, they hold in common both a fixation on elites as drivers of connectivity and cultural norms as well as an idea of Bronze Age Eurasia in which value systems, practices, and cosmologies are shared, or at least easily translated, over long distances and across myriad cultural and natural boundaries. This reflects, to some extent, the shared suite of materials and practices which appears across a wide swathe of the Bronze Age world: specific technologies (chief among them, bronze working, of course), types of artefact (swords, shields, etc.), apparent shared social roles (warriors being a paramount example), and ritual practices (the erection of large mounds over the dead, and later the proliferation of enurned cremation cemeteries). There is no question that, from the mid 3rd millennium onwards, people in western Eurasia were taking pains to create a shared grammar of practice that would be at least somewhat familiar to both near and more distant neighbours.

Vandkilde (2016)[1] sees in these shared ways of doing, being, and living a Bronze Age world that was global in the modern sense and bound together by the flow of metal. Building on contemporary globalisation theory, she posits an Afro-Eurasian interconnectivity she terms 'bronzization': 'an overarching phenomenon knit by one crucial resource' (Vandkilde 2016: 104), i.e. bronze, an alloy of tin and copper. These metals, being unevenly distributed around Eurasia, were not equally available, so an extensive network emerged through which they flowed to satisfy the desires of elites, in particular, as well as commoners. In Vankilde's model, this network also facilitated the exchange and communication of knowledge and shared practices, beliefs, and values, not just economic but also social. So, we see common social personae like 'The Warrior' whose role, socio-political importance, attire, and (bronze) equipment were widely distributed across western Eurasia, forming what she terms (again, drawing on contemporary globalisation theory) a 'transculture' (Vandkilde 2014). Vandkilde highlights the uniqueness of this species of interaction sphere by contrasting a decentralised bronzization with dispersed nodes to the more centralised and imperial globalised world we currently occupy. This structure allows her to account for the obvious regional differences within the Bronze Age world, as well as the much more complex and smaller-scale flows of materials she classes as commodities in addition to ideas and ideologies. In subsequent years, her model has become an influential structure against which to set large-scale archaeological data that speaks to connectivity, flow, and knowledge exchange across Bronze Age Eurasia.

Bronze in the Bronze Age

While all these models acknowledge earlier periods of interconnection and mobility, they are premised on the idea that the Bronze Age represents a step change in interaction and social organisation, and that bronze metal and metallurgical knowledge are intrinsic to this transformation. Bronze, as Vandkilde and others note, is a material whose physical properties diverge in unique ways from most others in use in the 4th and 3rd millennia BCE (Vandkilde 1996). The vast majority of materials with which past people interacted are shaped through reductive processes, i.e. recycling or reworking them typically removes material. So, a pot, once complete, can fragment into reusable sherds or be ground up into temper but cannot become wet clay again and be reshaped. Similarly, a nodule of flint can be reduced to a stone tool, but that tool can only be resharpened or reshaped by further reduction. Certainly, materials can be combined into composite tools – the stone knife can be given a handle or set into a curved sickle hafting – but this is not quite the same thing as fluidly recyclable metal. Metal, by contrast, once set into an object is not morphologically fixed, but can be melted down and returned to its 'raw', workable state and then remade with imperceptible losses into a wholly different form of essentially the same weight and heft. This physical property, along with its malleability and various aesthetic aspects (colour, lustre, etc.) has been noted repeatedly by archaeologists as setting metal and metallurgy apart in a prehistoric context, giving it a special value and, perhaps, a paradigm-shifting role in ancient society (Kuijpers and Fontijn 2021).

These properties were not immediately recognised by past people. There is now abundant data to suggest

[1] Helle, your willingness to embrace big-scale modelling is such an inspiration to me. Taking the risky path of building outwards from the small fragments of archaeology to continent-spanning connectivity is brave and powerful! By doing this work you make space for me and others to also push outwards from the small and fragmented to the expansive and long-term. I hope I do your work justice here!

that at least one of the origins of metallurgy lies in the use of brightly coloured stones as colourant and body paint (Bar-Yosef Mayer and Porat 2008; Roberts *et al.* 2009). Colourful powders unintentionally exposed to heat might sometimes have yielded strange new materials. Even in later periods when metal-making was more common, Miljana Radivojević and colleagues (Radivojević 2010; Radivojević *et al.* 2013) document early alloys of copper and tin that they believe derived from the preferential exploitation of green and black stones as most likely to yield copper when ground and heated as ore. Peter Bray (2012) refers to uniquely metallic properties as the material's 'metalleity', which, based on the close study of Irish and British Bronze Age metalwork, he suggests took centuries of familiarisation to become fully understood. However, it is evident that, by the middle of the 2nd millennium BCE, the physical properties, affordances, and value of various metals, chief among them bronze and gold, were well understood and deeply appreciated throughout western Eurasia.

Our knowledge of these materials, however, and their function in society is limited by the contexts from which we recover them. So, special assemblages like burials and hoards loom large, while the day-to-day use and circulation of metals is more difficult to access. Certainly, the accumulation of large quantities of metal seems to have been a significant part in apparently ritual contexts throughout the *c.* two millennia of the European Bronze Age, although these must have varied in process and meaning over time and space. Indeed, similar practices – e.g. the deposition of metalwork hoards – may well have varied, depending on the specific objects, people, or events involved, or instigating a given deposition event. A long-standing debate in Bronze Age archaeology has pitted ritual against function in the deposition of hoarded metal (Bradley 1998; Levy 1982; Fontijn 2002; Kuijpers and Popa 2021; Radivojević *et al.* 2019; Wiseman 2018; Yates 2007). Depending on the researchers, these represented either spiritual practices or the accumulation of scraps for future trade, recycling, or commodity exchange. However, given the entanglement of ritualised practice and the world of the spiritual in quotidian Bronze Age life in many other domains (Cleary 2018; Bradley 2005), this distinction seems one without merit. Certainly, these contexts were carefully assembled from specially chosen and sometimes manipulated or broken material (Bedianashvili and Robinson 2024; Knight 2021), but that does not preclude their future use in subsequent social, economic, or technological practices (Needham 2001).

That these were innately structured depositional practices is evident by comparing them with the more ad hoc assemblages from apparent shipwrecks or other accidental depositions. Off Salcombe on the South Devon coast, dozens of Bronze Age metal objects have been recovered that are interpreted as representing multiple shipwreck events in a notoriously difficult stretch of water (Needham *et al.* 2013). This large body of material includes items never or rarely found elsewhere in northwest Europe, including a number of tin and copper ingots (Berger *et al.* 2022; Wang *et al.* 2018) and a rather odd-shaped bit of scrap bronze identified as a fragment of an agricultural tool of likely western Mediterranean origin (Needham and Giardino 2008). What these anomalous materials make evident is both the scale of networks through which metal circulated, in the form of ingots as well as scrap metal, and the frequency with which it was reworked into locally significant forms prior to deposition in most accessible archaeological contexts.

These long-distance ties were not birthed in the Bronze Age, however, but pre-existed it by millennia. The Atlantic seaways through which the boats carrying ingots navigated in the 2nd millennium saw the movement of people, domestic crops, new religious practices, and exotic materials, e.g. Alpine jadeite axes and Iberian variscite beads (Rodríguez-Rellán *et al.* 2020; Sheridan *et al.* 2020; Cassen *et al.* 2020; Anderson-Whymark and Garrow 2015; Vander Linden 2006). Similar terrestrial and fluvial networks extended throughout continental Europe, facilitating interconnection and the mobility of people, ideas, and things, i.e. the well-known flint daggers found from Anatolia to Iberia to the northern Nordic region, for millennia before the start of the European Bronze Age (Frieman 2012a; 2012b; Frieman and Eriksen 2015).[2] However, when looking at these phenomena on a continental scale, it is worth noting that people living in what Barry Cunliffe (2008) terms 'peninsular Europe' were rather late adopters of metal and metallurgy, to the point that copper use seems to have been a part of the 'Neolithic package' brought into southern Scandinavia *c.* 4000 BCE (Roberts and Frieman 2015; Klassen 2000; 2004). In other words, it is not actually possible to say definitively that metal had no impact on the extensive networks that crisscrossed Europe in the millennia before the Bronze Age, but we can look at the quantities of material of various sorts in circulation and

[2] Helle, I could not resist putting a few flint daggers into this contribution largely about metal! I started my own journey into the European Bronze Age after seeing flint daggers on display at the Moesgaard Museum during my undergraduate years. I then discovered your 1996 book *From Stone to Bronze* whilst trying to learn more about them. Your book inspired me to enrol in an archaeometallurgy class (for which I ended up writing a final research essay about metal and stone!) and, of course, to use the southern Scandinavian flint daggers as a case study in my doctoral research. Your supervision of my doctoral work was, consequently, both mildly terrifying and such a gift! I don't do much with flint daggers these days, but I still love them, and I am deeply grateful for your incredible support for my research into them and their wider technological context.

suggest it was not a major driver of these connections as it is hypothesised to have become in later periods.

The reason metal had to journey is that ore sources, especially the cassiterite used to produce tin bronze, are discontinuous. Unlike clay or flint or many of the plants used for basketry, there are simply not local options that can be adapted to exogenous techniques or designs. Isotopic data give us insight into the use and distribution of specific metal sources, allowing us to perceive changing routes through which metal flowed at different times during the Bronze Age (Radivojević *et al.* 2019). So, for example, Heide W. Nørgaard and colleagues (2021) trace the flow of metal into southern Scandinavia throughout the 2nd millennium BCE, documenting shifting networks of trade and affiliation and connecting them to larger sociopolitical events. They identify that much of the earliest copper alloy material deposited in southern Scandinavia originated in the Austrian Inn valley and Slovakia via central German connections until the disintegration of the Únětice network in 1600 BCE, after which metal in circulation was more widely recycled, while new materials arrived from various locations, including Britain, the Carpathian Basin, the eastern Alps, and, after 1500 BCE, northern Italy.

Regions with particularly important ore sources tend to loom large in our discussion of Bronze Age connectivity. The central and southeastern European copper sources drove the rise of the Early Bronze Age Únětice culture and later extensive north-south routes, as documented by Nørgaard and colleagues. Ireland's rich gold sources made possible the formation of an innovative local gold-working practice throughout the 2nd millennium BCE. Cypriot copper and tin made the island an important locale for Levantine and Aegean traders. Iberia, with its many types of metal ore sources became a significant crossroads between Mediterranean and Atlantic networks. Among these, Cornish copper, tin, and gold seem to have been exploited relatively early within the western European context and to have remained significant well into the 2nd millennium (Standish *et al.* 2015; Ehser *et al.* 2011; Penhallurick 1986; Haustein *et al.* 2010; Powell *et al.* 2019; Timberlake 2017) Yet, Cornwall never quite seems to have become a major centre, certainly it does not demonstrate the wealth of imported materials found in other polymetallic regions, e.g. Iberia, nor do we see increasing inequality as savvy individuals profit from this lucrative trade. Something else seems to be happening here.

Living in Bronze Age Cornwall

Cornwall is a contemporary county that occupies the far end of Britain's southwestern-most peninsula, with its sole land boundary (between it and neighbouring county Devon), being defined by the River Tamar, a fordable and partially navigable north-south oriented river. While there is no implication that the modern political boundaries extend deep into prehistory, nevertheless, there is some evidence that people living beyond the Tamar, and particularly those in the far west of the county, may have perceived themselves as separate from their inland neighbours. A distinct local language, Cornish, closely related to Breton and Welsh, was spoken in the area until the 18th century and persists in songs, toponyms, and scholarly libraries. Stephen Leslie and colleagues (2015) constructed a cladistic model of the contemporary British population in which there is a distinct genetic difference between populations living east and west of the Tamar, with the implication that those to the west were preferentially having children only with each other and not mixing with their English neighbours. Local ceramic traditions and settlement patterns characterise more recent archaeological periods and demonstrate endogenous practices not shared in other parts of southern England, and which do not reflect an innately backwards or non-innovative society but have been intentionally cultivated to resist exogenous influence or domination (Frieman *et al.* 2022; Frieman and Lewis 2021b).

Atlantic connections

Part of this distinction lies in Cornwall's Atlantic orientation. Trends in settlement and material culture that distinguish those west of the Tamar from those east of it find parallels in Brittany, Ireland, Wales, and Scotland in both Later Prehistory and more recent periods (Cunliffe 2000; Henderson 2007). One controversial hypothesis suggests the persistence of the Celtic languages in the Atlantic fringes lies in them having originated in this maritime interaction zone in later prehistory, perhaps as a sailors' lingua franca (Cunliffe 2009; Cunliffe and Koch 2010; for a thorough and convincing critique, see Sims-Williams 2020). Genetic data also speak to this deep history of connectivity, as Cornwall's genetic distance from southern England contrasts with its obvious clustering with Irish, Welsh, and Breton populations (Alves *et al.* 2024).

During the Bronze Age (*c.* 2250-800 BCE, following the British chronology), Cornwall was both a part of long-distance networks and distinct from them. At no point were the area or its people cut off or isolated from people elsewhere in Britain, and we find shared practices, beliefs, and ways of life throughout the period. In the late 3rd millennium, for example, we have evidence for Beaker ceramics (in both ritual and domestic contexts) dating to all phases of the Beaker sequence in Britain from *c.* 2450 BCE onwards. Ritual sites are more abundant, and the variety of stone and earth monuments found west of the Tamar are clearly part of wider suites of practice and belief. For example, barrows of various types and sizes, a typical type of British Early Bronze Age ritual and funerary monument, dot the landscape and may follow habitual routeways (Jones 2005; Frieman and Lewis 2021a). These sometimes include central burials, although only cremated remains have been well preserved due to Cornwall's acidic soils, as well as evidence for repeated depositions and reconstruction. Cornish barrows often date to after 2000 BCE, somewhat more recent than their southern English parallels (Frieman and Lewis 2016). Fine collared urns, a type of pottery found in funerary contexts throughout Britain in the early 2nd millennium BCE, have been recovered from some of these (Jones and Quinnell 2021: 9).

In keeping with the rest of Britain and Ireland, domestic structures are amorphous and ephemeral before 1600 BCE (Jones *et al.* 2012), at which point we see the initial construction of small roundhouse settlements, usually comprising one or two to five or six structures, more or less contemporaneously in use (Nowakowski 2016). During the Later Bronze Age, after 1000 BCE, we see a clear reconnection with other southern British communities, evident in shared forms of domestic architecture and tools, e.g. ceramic vessels and metalwork (Jones and Quinnell 2011: 222-224). Subsistence was likely based on a mixture of small-scale agriculture and pastoralism, with maintenance, access to and use of upland grazing forming an important social (and likely also political) aspect of the domestic economy.

A handful of exogenous artefacts, most from ritual or unknown contexts, testify to longer-distance connections. Four sheet gold *lunulae*, a late 3rd-millennium BCE ornament form thought to originate in Ireland, have been recovered from Cornish contexts along the Atlantic coast (Taylor 1970; 1980). Based on technological and stylistic aspects, these were initially thought to have been produced by a mobile Irish goldworker, but new isotopic data suggest that the gold used to make many of the *lunulae* found in Ireland came from Cornish sources (Standish *et al.* 2015). A sheet gold cup recovered from a barrow at Rillaton on Bodmin Moor in eastern Cornwall (Smirke 1867) and dated to *c.* 1750 BCE may well have been made locally, but is clearly part of a class of handled cups in special materials found around the English Channel zone in the earlier Bronze Age (Needham *et al.* 2006). Needham suggests these might have played a role in drinking rites surrounding the welcoming or integration of travellers throughout this particular 'maritory' (Needham 2009). Also from eastern Cornwall, though lacking a clear provenance, is a fragment of a bronze dagger or sword hilt that has been typologically linked to Aegean forms dating *c.* 1350-1100 BCE (Childe 1951; Jones and Quinnell 2013). The evidence for metal extraction mentioned above – isotopic analyses of gold and tin, as well as the tin ingots found in the water off Salcombe – also indicates that people living west of the Tamar were closely engaged with various neighbours and other non-locals throughout the Bronze Age.

Local identities

Yet, the extent to which these connections impacted daily life is unclear. Day-to-day life would likely have followed pastoral rhythms. In the earlier part of the Bronze Age, people were highly mobile, likely moving with animals between various seasonal home territories and carrying portable yurt-like homes with them (Jones 2012). Later periods seem to have been more settled, with the regular construction of small roundhouse settlements, evidence for increasingly dense occupation of both upland and lowland landscapes, and the maintenance of field systems and upland commons (Vervust *et al.* 2020; Nowakowski 2016; Nowakowski *et al.* 2007), perhaps by lineage groups or sodalities (Johnston 2020). The roundhouses themselves were mostly so-called 'sunken-floor' structures throughout the later 2nd millennium BCE, a locally distinct form that contrasts with the primarily post-built forms erected east of the Tamar (Jones and Quinnell 2011), although other construction styles are known. Ceramic traditions also testify to a distinct local identity west of the Tamar during the 2nd millennium BCE. The ceramic assemblages of the Earlier and Middle Bronze Age were dominated by a locally produced ceramic form known as Trevisker Ware, consisting of flat-bottomed, baggy vessels, sometimes decorated with geometric patterns, sometimes with applied lugs, and typically with outward turning rims (ApSimon *et al.* 1972; Parker Pearson 1990). These pots were made in a variety of sizes and to a variety of skill levels, with a broadly shared idea of form and suites of appropriate decoration, but no control of consistency in these beyond the level of the household (Quinnell 2019: 44; 2010: 96). Worth noting however, the people who made Trevisker Ware pots preferred to use a specific source of clay from the Lizard peninsula in Cornwall's southwest, often mixing it with locally sourced clays (Harrad 2004; Peacock 1988; Quinnell 1987).

There are, furthermore, clear indications in both the ritual and funerary sphere that people living west of the Tamar shared a series of beliefs, and probably ideas about their own identity, that distinguished them from their neighbours. While they made and used barrows in the earlier Bronze Age, the rites that took place at these look somewhat different to those archaeologists find elsewhere in Britain. Beaker burials, for example, are scarce; and where Beaker pottery is found in a funerary context it is primarily associated with cremated rather than inhumed remains, as well as being scattered and fragmented (Jones and Quinnell 2006). Unlike barrows constructed elsewhere in southern England, most of the Cornish barrows lack evidence for central deposits of any sort; they may have served as loci for public rites (Frieman and Lewis 2016) or been used for structured depositional practices best understood as cenotaph burials, a tradition which is retained into the Later Bronze Age (Jones and Quinnell 2021). Indeed, although the period after 1000 BCE sees the abandonment of Trevisker Ware in favour of Plain Ware forms shared across southern England, and the emergence of smaller, post-ring roundhouses, likely introduced by neighbours to the east of the Tamar, continuity in localised practices persists in the ritual sphere, visible in structured depositions in pits and at the closing or abandonment of houses, as well as the practice of cist burial, perhaps continuing into the Iron Age (Jones and Quinnell 2011: 224-225; 2021: 13; Jones and Gossip 2014).

At no point during the entire stretch of the Bronze Age in Cornwall is there obvious evidence for anything that looks like settlement hierarchy, coercive social control, or the emergence of an elite or other form of social stratification. Unlike on the continent, or even elsewhere in England, funerary mounds are rarely erected over single burials and almost never include exogenous or rare objects.[3] During the Middle and Later Bronze Age, no evidence has yet emerged that distinguishes any one roundhouse settlement as being distinctly wealthier than any other (Jones *et al.* 2015: 182).

Cornish metallurgy and metal extraction

The evidence to date suggests that Cornish alluvial gold and tin sources were among the earliest exploited in the Atlantic zone, with tin-bronze a locally invented alloy sometime before 2100 BCE (Carey *et al.* 2023). Simon Timberlake (2017) argues that very early gold panning activities, concurrent with the earliest copper mining at Ross Island in southern Ireland, may have led to experimentation with other alluvial deposits and, consequently, the local invention of tin metallurgy. This local technology seems to have been undertaken within a context of low economic and political control, and is probably best understood as a domestic industry, alongside pottery and textile production, although perhaps with some special cosmological aspects.

Traces of metal extraction are thin, due to the long history of mining on the peninsula, but also perhaps to a greater interest in tin and gold exploitation, rather than less accessible copper ores. Alluvial deposits of cassiterite ore and gold were widely available, and metal extraction was likely to have been carried out only on the small scale during the Bronze Age, perhaps as a seasonal activity integrated within the pastoral rhythms of mobility and labour. Anvils and mortar stones consistent with ore dressing have been recovered from the vicinity of historically exploited mines, but are not well dated (Budd and Gale 1994), and no hammerstones for mining activities have been discovered among them (Timberlake 2017). At least one presumed mining tool is known, an antler pick dated 1620-1497 BCE, one of a pair recovered by 19th-century miners at the Carnon tin streamworks (Timberlake and Hartgroves 2018). Bronze Age finds are relatively numerous at streamworks, indicating the repeated visitation of these sites in prehistory. Cassiterite pebbles have been found in a handful of Beaker and Early Bronze Age contexts west of the Tamar, including in association with stone tools bearing traces of ore grinding (Carey *et al.* 2023). Andy M. Jones and Henrietta Quinnell (2021: 9) note that, in two instances at the late 3rd-millennium BCE sites of Sennen and Lezant, these stone tools are associated with some of the earliest Beaker ceramics on the peninsula, and may represent traces of intentional metal prospecting by Beaker-using people.

In common with the rest of Britain, traces of actual smelting are equally sparse. A fragment of tin slag was recovered from Caerloggas I barrow, although in a secondary position (Miles 1975). Cassiterite pebbles and mould fragments have been recovered from Middle Bronze Age and Late Bronze Age settlements (e.g. ApSimon *et al.* 1972), suggesting smelting took place in and around domestic contexts. Indeed, throughout the period moulds were used with some frequency in the closing deposits that characterised roundhouse abandonment. Amongst the best evidence we have for metalworking practices derives from a Middle Bronze Age sunken-floor roundhouse at Tremough (Jones *et al.* 2015). Excavation of this structure revealed a hearth used for smelting, nine bivalve moulds, and stone tools consistent with ore processing tasks, suggesting that the choice to include moulds in the closing deposit was made intentionally to reinforce the structure's role in metalworking. At Trethellan Farm, another Middle Bronze Age settlement, copper alloy waste was found associated with a firepit adjacent to, but postdating, one of the roundhouses (Nowakowski 1991). During the Later Bronze Age, we see the emergence of palisaded sites ('ringworks') in coastal zones. At Tremough, a

[3] It is worth noting here that two cist burials have recently been excavated on Dartmoor, an important upland region east of the Tamar in Devon, that have yielded quite rare materials and organic remains, including ornaments of metallic tin in the Whitehorse Hill cist, the only one of the two that has been published (Jones 2022; Dartmoor National Park 2024). Nevertheless, Jones (2022: 238-242) cautions against a simplistic equation between the Whitehorse Hill cremated individual's own status in life and the number or rarity of objects found alongside them, especially given the accessibility of these cists to the living community, who may have had ongoing access to the grave and its contents.

recently excavated ringwork dated to after 1000 BCE contained several small rectilinear structures and a pit in which a sword mould had been deposited (Jones *et al.* 2015). Jones and Quinnell (2021: 14) suggest this site, like others of its kind, may have been linked to the expanding exogenous networks through which copper, tin, and bronze flowed.

Despite the paucity of archaeological evidence, metal extraction and metalworking were evidently significant practices for people living west of the Tamer. Some Cornish Later Bronze Age hoards show the distinctly local flair of including copper ingots (Knight 2022), and recent excavation at a small enclosure barrow near Penzance revealed a Late Bronze Age pit dug into the earlier monument, inside which was deposited a textile- or leather-wrapped copper-alloy ingot fragment, a ceramic sherd, and a red pebble (Jones and Allen 2023). Indeed, the very minimal evidence of metalworking available to us might reflect the efforts of Bronze Age metallurgists to limit access to the material traces of their work to people of the appropriate lineage or other initiates (Carey *et al.* 2019). While no clear economic or political control operated to shape metalworking in the southwest British Bronze Age, smaller-scale concerns about access to secret or sacred knowledge are certainly possible.

Local vs global in the European Bronze Age

Placing ourselves in Bronze Age Cornwall gives us a very different image of the Bronze Age than that offered by continental-scale models of the movement of warriors, bronze, and other exotic materials. Here, life was incontrovertibly rural, local, and small-scale, with no evidence for emerging elites, social distinctions, or political hierarchies, even as people were engaging directly with the very international metal trade presumed to instigate major social upheaval in other areas. The flow of metal seems to have been uncontrolled, and we can envisage each small settlement or group of settlements engaging in their own negotiations with crews of rowers who pulled up to shelter for a night or three in protected coves. No great wealth accumulates, and no great tumuli are built to cover singular great individuals and their booty. Swords are made locally, but there are no obvious warriors.

Perhaps being close to the source of the highly valued tin, which itself was eminently accessible in streams across the peninsula, obviated the need or ability to establish such controls, eliminating the bottlenecks hypothesised to lead to the rise of chiefs (Earle *et al.* 2015). Indeed, we might ask if the central and northern European power struggles explained by Vandkilde's model of bronzization might instead be understood as a crossroads phenomenon (for a British parallel, see Sherratt 1996). However, the point here is not to establish a new top-down model to explain the entirety of the European Bronze Age along Cornish lines, but to reassess to what data we give explanatory value. Top-down models based on centres of archaeological attention, e.g. Wessex, or the rich tumulus burials of central and northern Europe, not to mention the thousands of kilos of metalwork recovered from burials and hoards, tend to drown out the regional variations presented by places like Cornwall (Jones 2011a; 2011b).

Metal certainly had value to people living west of the Tamar in the Bronze Age, and the local production of tin and gold were significant factors for Cornwall's obvious integration with the wider European Bronze Age, especially within the Atlantic maritory. Yet, on the scale of daily life and interpersonal and inter-community interaction, metal was likely far less significant than more mundane materials and technologies: the right clay for the cooking pots, the knowledge of how to make and fire pottery; the care and keeping of domestic animals; the preparation and preservation of foodstuffs, textiles, and thatched wooden structures; and the maintenance and significance of field boundaries. In Cornwall, particularly during the 2nd millennium BCE, all of these combined in a sort of ultra-local socio-technic through which local people and communities distinguished themselves from neighbours near and far. They speak to a low-control society with a shared set of values and beliefs that engaged with wider European trends but were retained distinctly apart from them. The products of Cornish people's hands may well have driven the Bronze Age metal trade in western and central Europe, but that does not mean that bronze shaped the values, social structures, and identities of people living west of the Tamar in the Bronze Age.

So where does this leave us with regard to Vandkilde's model of bronzization? All generalising models suffer from inconsistent details, especially in fields like archaeology where data are complex, partial, and contested. Thus, the fact that there are regions for which bronzization does not seem explanatory does not in itself obviate the utility of the model. Indeed, we could suggest that the scale on which the model operates, and the scale of fine-grained local excavation, are not commensurate and should not be directly compared. However, meta-narratives, such as bronzization, are powerful interpretative tools that can affect both data collection and public reception of archaeological information (compare with the discussion of grand narratives by Graeber and Wengrow 2021). Indeed, grand narratives are excellent at concealing variation, complexity, resistance against domination, as well as other socially and economically peripheral ways of being, doing, and living (Politopoulos *et al.* 2024). The view from the periphery can be illuminating, both in what it tells us about the people who occupied these margins in the past, and its highlighting of the blind spots in our own contemporary research practices (Frieman and Lewis 2021b). I would argue that bronze, in all its mobile and malleable glory, has distorted our view of its eponymous period – the late 3rd to early 1st millennia BCE. Maybe it is time to de-centre it from our models of prehistory, if only to see more clearly what the glittering wealth of metal has up to now obscured, and to speak of multiple interconnected Bronze Ages, rather than a singular, shared period, even within the small area of peninsular Europe and its outlying islands.

Bibliography

Alves, I., J. Giemza, M.G.B. Blum, C. Bernhardsson, S. Chatel, M. Karakachoff, A. Saint Pierre, A.F. Herzig, R. Olaso, M. Monteil, V. Gallien, E. Cabot, E. Svensson, D. Bacq, E. Baron, C. Berthelier, C. Besse, H. Blanché, O. Bocher, A. Boland, S. Bonnaud, E. Charpentier, C. Dandine-Roulland, C. Férec, C. Fruchet, S. Lecointe, E. Le Floch, T.E. Ludwig, G. Marenne, V. Meyer, E. Quellery, F. Racimo, K. Rouault, F. Sandron, J.-J. Schott, L. Velo-Suarez, J. Violleau, E. Willerslev, Y. Coativy, M. Jézéquel, D. Le Bris, C. Nicolas, Y. Pailler, M. Goldberg, M. Zins, H. Le Marec, M. Jakobsson, P. Darlu, E. Génin, J.-F. Deleuze, R. Redon and C. Dina 2024. Human genetic structure in Northwest France provides new insights into West European historical demography. *Nature Communications* 15: 6710 (available at: doi:10.1038/s41467-024-51087-1).

Anderson-Whymark, H. and D. Garrow, D. 2015. Seaways and Shared Ways: Imagining and Imaging the Movement of People, Objects and Ideas over the Course of the Mesolithic-Neolithic Transition, c. 5,000-3,500 BC, in H. Anderson-Whymark, D. Garrow and F. Sturt, F. (eds) *Continental Connections*: 59-77. Oxford: Oxbow Books (available at: doi:10.2307/j.ctvh1dj3c.8).

ApSimon, A.M., E. Greenfield, L. Biek, G.C. Boon, B.R. Hartley, J.F. Levy and F.S. Wallis 2014. The Excavation of Bronze Age and Iron Age Settlements at Trevisker, St. Eval, Cornwall. *Proceedings of the Prehistoric Society* 38: 302-381 (available at: doi:10.1017/S0079497X00012160).

Bar-Yosef Mayer, D.E. and N. Porat 2008. Green stone beads at the dawn of agriculture. *PNAS* 105: 8548-8551 (available at: doi:10.1073/pnas.0709931105).

Bedianashvili, G. and A. Robinson 2024. Intentional damage to metal artefacts in burials and hoards in the south Caucasus, 2000-550 BC. *Antiquity* 98: 417-432 (available at: doi:10.15184/aqy.2023.202).

Berger, D., Q. Wang, G. Brügmann, N. Lockhoff, B.W. Roberts and E. Pernicka 2022. The Salcombe metal cargoes: New light on the provenance and circulation of tin and copper in Later Bronze Age Europe provided by trace elements and isotopes. *Journal of Archaeological Science* 138: 105543 (available at: doi:10.1016/j.jas.2022.105543).

Bradley, R. 1998. *The Passage of Arms. An Archaeological Analysis of Prehistoric Hoards and Votive Deposits* (2nd edn). Cambridge: Cambridge University Press.

Bradley, R. 2005. *Ritual and Domestic Life in Prehistoric Europe*. London: Routledge.

Bray, P.J. 2012. Before 29Cu Became Copper: Tracing the Recognition and Invention of Metalleity in Britain and Ireland during the Third Millennium B.C. *In*: M.J. Allen, J. Gardiner and A. Sheridan (eds) *Is There a British Chalcolithic: People, Place and Polity in the Later 3rd Millennium*: 56-70. London: Prehistoric Society Research Papers.

Budd, P. and D. Gale 1994. Archaeological Survey of an Early Mineworking at Wheal Coates near St Agnes, Cornwall. *Cornish Archaeology* 33: 14-22.

Carey, C., A.M. Jones, M.J. Allen and G. Juleff 2019. The social organisation of metalworking in southern England during the Beaker period and Bronze Age: absence of evidence or evidence of absence? *Internet Archaeology* 52 (available at: doi:10.11141/ia.52.4).

Carey, C., C. Tsoraki, A.M. Jones, O.J.T. Harris, R.J. Crellin and P. Lyons 2022. Beaker and Early Bronze Age Tin Exploitation in Cornwall: Cassiterite Processing Identified through Microwear and pXRF Analyses. *European Journal of Archaeology* 26: 147-167 (available at: doi:10.1017/eaa.2022.30).

Cassen, S., P. Pétrequin, G. Querré, V. Grimaud and C. Rodríguez-Rellán 2020. Spaces and Signs for the Transfer of Jade and Callaïs in the Neolithic of Western Europe, in C. Rodríguez-Rellán, B.A. Nelson and R. Fábregas Valcarce (eds) *A Taste for Green. A Global Perspective on Ancient Jade, Turquoise and Variscite Exchange*: 121-140. Oxford: Oxbow Books (available at: doi:10.2307/j.ctv138ws4v.11).

Childe, V.G. 1951. Bronze Dagger of Mycenaean Type from Pelynt, Cornwall. *Proceedings of the Prehistoric Society* 17(1): 95.

Cleary, K. 2017. Broken Bones and Broken Stones: Exploring Fragmentation in Middle and Late Bronze Age Settlement Contexts in Ireland. *European Journal of Archaeology* 21: 336-360 (available at: doi:10.1017/eaa.2017.61).

Cunliffe, B. 2000. Brittany and the Atlantic Rim in the Later First Millennium BC. *Oxford Journal of Archaeology* 19: 367-386 (available at: doi:10.1111/1468-0092.00116).

Cunliffe, B. 2014. A Race Apart: Insularity and Connectivity. *Proceedings of the Prehistoric Society* 75: 55-64 (available at: doi:10.1017/S0079497X00000293).

Cunliffe, B. 2008. *Europe between the Oceans: Themes and Variations: 9000 BC to AD 1000*. New Haven: Yale University Press.

Cunliffe, B. and J.T. Koch 2010. *Celtic from the West: Alternative Perspectives from Archaeology, Genetics,* *Language, and Literature*. Celtic Studies Publications 15. Oxford: Oxbow Books.

Dartmoor National Park 2024. Cut Hill Burial Cist, Dartmoor (available at: https://www.dartmoor.gov.uk/wildlife-and-heritage/heritage/bronze-age/cut-hill-burial-cist).

Earle, T.K., J. Ling, C. Uhner, Z. Stos-Gale and A.L. Melheim 2015. The Political Economy and Metal Trade in Bronze Age Europe: Understanding Regional Variability in Terms of Comparative Advantages and Articulations. *European Journal of Archaeology* 18(4): 633-657 (available at: doi:10.1179/1461957115Y.0000000008).

Ehser, A., G. Borg and E. Pernicka 2011. Provenance of the gold of the Early Bronze Age Nebra Sky Disk, central Germany: geochemical characterization of natural gold from Cornwall. *European Journal of Mineralogy* 23(6): 895-910 (available at: doi:10.1127/0935-1221/2011/0023-2140).

Fontijn, D. 2002. S*acrificial Landscapes. Cultural biographies of persons, objects and natural places in the Bronze Age of the Southern Netherlands, c. 2300-600 BC*. Leiden: Sidestone Press.

Frieman, C.J. 2012a. Flint Daggers, Copper Daggers and Technological Innovation in Late Neolithic Scandinavia. *European Journal of Archaeology* 15(3): 440-464.

Frieman, C.J. 2012b. *Innovation and Imitation: Stone Skeuomorphs of Metal from 4th-2nd Millennia BC Northwest Europe*. British Archaeological Reports International Series 2365. Oxford: Archaeopress.

Frieman, C.J. 2021. *An Archaeology of Innovation: Approaching Social and Technological Change in Human Society*. Manchester: Manchester University Press.

Frieman, C.J., 2024. Attending to Unproof: An archaeology of possibilities, *Antiquity* 98(402), 1679–88.

Frieman, C.J. and B.V. Eriksen (eds) 2015. *Flint Daggers in Prehistoric Europe and Beyond*. Oxford: Oxbow Books.

Frieman, C.J., A.M. Jones and J. Lewis 2022. Worlds within Worlds: Embanked Enclosures and Transforming Identities during the Romano-British Period in Cornwall, in T. Ibson, K. Ilves, B. Maixner, S. Messal and J. Schneeweiß (eds) *Fortifications in Their Natural and Cultural Landscape. From Controlling Space to the Creation of Power*: 267-284. Bonn: Rudolf Habelt.

Frieman, C.J. and J. Lewis 2016. Mountain Barrows: A South-Eastern Cornish Barrow Group in Its Local Context. *Cornish Archaeology* 55: 145-161.

Frieman, C.J. and J. Lewis 2021a. Bronze Age Wayfaring and the Monumentalised Landscape, in C. Gibson, K. Cleary and C.J. Frieman (eds) *Making Journeys: Archaeologies of Mobility*. Oxford: Oxbow Books.

Frieman, C.J. and J. Lewis 2021. Trickle down innovation? Creativity and innovation at the margins. *World Archaeology* 53: 723-740 (available at: doi:10.1080/00438243.2021.2014948).

Graeber, D. and D. Wengrow 2021. *The Dawn of Everything: A new history of humanity*. New York: Farrar, Straus, and Giroux.

Harrad, L. 2004. Gabbroic clay sources in Cornwall: a petrographic study of prehistoric pottery and clay samples. *Oxford Journal of Archaeology* 23(3): 271-286 (available at: doi:10.1111/j.1468-0092.2004.00212.x).

Haustein, M., C. Gillis and E. Pernicka 2010. Tin Isotopy – A new Method for Solving old Questions. *Archaeometry* 52: 816-832 (available at: doi:10.1111/j.1475-4754.2010.00515.x).

Henderson, J.C. 2007. *The Atlantic Iron Age: Settlement and Identity in the First Millennium BC*. London: Routledge (available at: http://www.loc.gov/catdir/toc/ecip0717/2007017434.html).

Hofmann, D., C.J. Frieman, M. Furholt, S. Burmeister and N.N. Johannsen 2024. *Negotiating Migrations: The Archaeology and Politics of Mobility*. London: Bloomsbury Academic (available at: https://library.oapen.org/handle/20.500.12657/92553).

Johnston, R. 2020. *Bronze Age Worlds: A Social Prehistory of Britain and Ireland*. London: Routledge (available at: doi:10.4324/9781315177632).

Jones, A.M. 2005. *Cornish Bronze Age Ceremonial Landscapes c. 2500-1500 BC*. British Archaeological Reports British Series 394. Oxford: Archaeopress.

Jones, A.M. 2011a. Regionality in Prehistory: Some Thoughts from the Periphery, in A.M. Jones and G. Kirkham (eds) *Beyond the Core: Reflections on Regionality in Prehistory*: 1-4. Oxford: Oxbow Books.

Jones, A.M. 2011b. Without Wessex: The Local Character of the Early Bronze Age in the South-West Peninsula, in S. Pearce (ed) *Recent Archaeological Work in South-Western Britain. Papers in Honour of Henrietta Quinnell*: 61-74. British Archaeological Reports British Series 548. Oxford: Archaeopress.

Jones, A.M. 2019. *Excavation of Later Prehistoric and Roman Sites along the Route of the Newquay Strategic Road Corridor, Cornwall*. Oxford: Archaeopress.

Jones, A.M. 2022. *Preserved in the Peat: An Extraordinary Bronze Age Burial on Whitehorse Hill, Dartmoor, and Its Wider Context*. Oxford: Oxbow.

Jones, A.M. and M. Allen 2023. *Drowning of a Cornish Prehistoric Landscape: Tradition, Deposition and Social Responses to Sea Level Rise*. Oxford: Archaeopress.

Jones, A.M. and J. Gossip 2014. The Bronze Age Roundhouse at Trevalga, in A.M. Jones and H. Quinnell (eds) *Lines of Archaeological Investigation along the North Cornish Coast*: 26-35. British Archaeological Reports British Series 594. Oxford: Archaeopress.

Jones, A.M., J. Gossip and H. Quinnell 2015. *Settlement and Metalworking in the Middle Bronze Age and beyond. New Evidence from Tremough, Cornwall*. Leiden: Sidestone.

Jones, A.M. and H. Quinnell 2006. Cornish Beakers: New Discoveries and Perspectives. *Cornish Archaeology* 45: 31-69.

Jones, A.M. and H. Quinnell 2011. The Neolithic and Bronze Age in Cornwall, c. 4000 Cal BC to c. 1000 Cal BC: An Overview of Recent Developments. *Cornish Archaeology* 50: 197-229.

Jones, A.M. and H. Quinnell 2013. Daggers in the West: Early Bronze Age Daggers and Knives in the Southwest Peninsula. *Proceedings of the Prehistoric Society* 79: 165-192.

Jones, A.M. and H. Quinnell 2021. Updating the Cornish Neolithic and Bronze Age: Significant Developments of the Last Decade. *Cornish Archaeology* 60: 1-22.

Jones, A.M. and S.R. Taylor 2010. *Scarcewater, Pennance, Cornwall: Archaeological Excavation of a Bronze Age and Roman Landscape*. British Archaeological Reports British Series 516. Oxford: Archaeopress.

Jones, A.M., S.R. Taylor and J. Sturgess 2012. A Beaker Structure and Other Discoveries along the Sennen to Porthcurno South-West Water Pipeline. *Cornish Archaeology* 51: 1-67.

Klassen, L. 2000. *Frühes Kupfer im Norden. Untersuchungen zu Chronologie, Herkunft und Bedeutung der Kupferfunde der Nordgruppe der Trichterbecherkultur*. Aarhus: Aarhus University Press.

Klassen, L. 2004. *Jade und Kupfer. Untersuchungen zum Neolithisierungsprozess im westlichen Ostseeraum unter besonderer Berücksichtigung der Kulturentwicklung Europas 5500-3500 BC*. Aarhus: Jutland Archaeological Society.

Knight, M.G. 2020. There's Method in the Fragments: A Damage Ranking System for Bronze Age Metalwork. *European Journal of Archaeology* 24: 48-67 (available at: doi:10.1017/eaa.2020.21).

Knight, M.G. 2022. *Fragments of the Bronze Age: The Destruction and Deposition of Metalwork in South-West Britain and its Wider Context*. Oxford: Oxbow Books.

Kristiansen, K. and T.B. Larsson 2005. *The Rise of Bronze Age Society*. Cambridge: Cambridge University Press (available at: http://www.loc.gov/catdir/toc/cam051/2004058556.html).

Kuijpers, M. and D. Fontijn 2021. What Does Bronze Do? Part I: Affordances. *West 86th: A Journal of Decorative Arts, Design History, and Material Culture* 28: 247-252 (available at: doi:10.1086/721205).

Kuijpers, M.H.G. and C.N. Popa 2021. The origins of money: Calculation of similarity indexes demonstrates the earliest development of commodity money in prehistoric Central Europe. *PLoS ONE* 16: e0240462 (available at: doi:10.1371/journal.pone.0240462).

Leslie, S., B. Winney, G. Hellenthal, D. Davison, A. Boumertit, T. Day, K. Hutnik, E.C. Royrvik, B. Cunliffe, D.J. Lawson, D. Falush, C. Freeman, M. Pirinen, S. Myers, M. Robinson, P. Donnelly and W. Bodmer 2015. The fine-scale genetic structure of the British population. *Nature* 519: 309-314.

Levy, J.E. 1982. *Social and Religious Organization in Bronze Age Denmark: An Analysis of Ritual Hoard Finds*. British Archaeological Reports International Series 124. Oxford: BAR Publishing.

Miles, H. 1975. Barrows on the St. Austell Granite, Cornwall. *Cornish Archaeology* 14: 5-82.

Needham, S. 2001. When Expediency Broaches Ritual Intention: The Flow of Metal Between Systemic and Buried Domains. *Journal of the Royal Anthropological Institute* 7(2): 275-298 (available at: doi:10.1111/1467-9655.00063).

Needham, S. 2009. Encompassing the Sea: 'Maritories' and Bronze Age Maritime Interactions, in P. Clark (ed.) *Bronze Age Connections; cultural contact in prehistoric Europe*: 12-37. Oxford: Oxbow Books.

Needham, S. and C. Giardino 2015. From Sicily to Salcombe: a Mediterranean Bronze Age object from British coastal waters. *Antiquity* 82: 60-72 (available at: doi:10.1017/S0003598X00096447).

Needham, S., K. Parfitt, G. Varndell, A. Birchenough, B. Corke and S. Crummy 2006. *The Ringlemere Cup: Precious Cups and the Beginning of the Channel Bronze Age*. London: The British Museum.

Needham, S., D. Parham and C.J. Frieman 2013. *Claimed by the Sea: Salcombe, Langdon Bay, and Other Marine Finds of the Bronze Age*. York: Council for British Archaeology.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2021. Shifting Networks and Mixing Metals: Changing metal-trading routes to Scandinavia correlate with Neolithic and Bronze Age transformations. *PLoS ONE* 16: e0252376 (available at: doi:10.1371/journal.pone.0252376).

Nowakowski, J.A. 1991. Trethellan Farm, Newquay: The Excavation of a Lowland Bronze Age Settlement and Iron Age Cemetery. *Cornish Archaeology* 30: 5-242.

Nowakowski, J.A. 2016. Prehistoric Settlement - Roundhouses and Fields 2nd to 1st Millennia BC. In: P. Herring, N. Johnson, A.M. Jones, J.A. Nowakowski, A. Sharpe and A. Young (eds) *Archaeology and Landscape at the Land's End, Cornwall: The West Penwith Surveys 1980-2010*: 138-159. Truro: Cornwall Archaeological Unit, Cornwall Council.

Nowakowski, J.A., H. Quinnell, J. Sturgess, C. Thomas and C. Thorpe 2007. Return to Gwithian: Shifting the Sands of Time. *Cornish Archaeology* 46: 13-76.

Parker Pearson, M. 1990. The Production and Distribution of Bronze Age Pottery in South-Western Britain. *Cornish Archaeology* 29: 5-32.

Peacock, D.P.S. 2015. The gabbroic pottery of Cornwall. *Antiquity* 62(235): 302-304 (available at: doi:10.1017/S0003598X00074093).

Penhallurick, R.D. 1986. *Tin in Antiquity: Its Mining and Trade throughout the Ancient World with Particular Reference to Cornwall*. London: Institute of Metals.

Politopoulos, A., C.J. Frieman, J.L. Flexner and L. Borck 2024. An Anarchist Archaeology of Equality: Pasts and Futures Against Hierarchy. *Cambridge*

Archaeological Journal (available at: doi:10.1017/S0959774323000483).

Powell, W., R. Mathur, J. John, M. Price, H.A. Bankoff, M. Tisucká and L. Godfrey 2019. Unearthing Europe's Bronze Age Mining Heritage with Tin Isotopes: A Case Study from Central Europe. *European Geologist Journal* 48: 58-62.

Quinnell, H. 1987. Cornish Gabbroic Pottery: The Development of a Hypothesis. *Cornish Archaeology* 26: 7-12.

Quinnell, H. 2010. Prehistoric and Roman pottery, in A.M. Jones and S. Taylor *Scarcewater, Pennance, Cornwall: archaeological excavation of a Bronze Age and Roman landscape*. Oxford: Archaeopress.

Quinnell, H. 2019. Section 3. The Analyses; Chapter 3. The ceramics, in A.M. Jones *Excavation of later prehistoric and Roman sites along the route of the Newquay Strategic Road Corridor, Cornwall*. Oxford: Archaeopress.

Radivojević, M., T. Rehren, J. Kuzmanović-Cvetković, M. Jovanović and J.P. Northover 2013. Tainted ores and the rise of tin bronzes in Eurasia, c. 6500 years ago. *Antiquity* 87(338): 1030-1045 (available at: doi:10.1017/S0003598X0004984X).

Radivojević, M., T. Rehren, E. Pernicka, D. Šljivar, M. Brauns and D. Borić 2010. On the origins of extractive metallurgy: new evidence from Europe. *Journal of Archaeological Science* 37(11): 2775-2787 (available at: doi:10.1016/j.jas.2010.06.012).

Radivojević, M., B.W. Roberts, E. Pernicka, Z. Stos-Gale, M. Martinón-Torres, T. Rehren, P.J. Bray, D. Brandherm, J. Ling, J. Mei, H. Vandkilde, K. Kristiansen, S. Shennan and C. Broodbank 2018. The Provenance, Use and Circulation of Metals in the European Bronze Age: The State of Debate. *Journal of Archaeological Research* 27(2): 131-185 (available at: doi:10.1007/s10814-018-9123-9).

Roberts, B.W. and C.J. Frieman 2015. Early Metallurgy in Western and Northern Europe, in C. Fowler, J. Harding and D. Hofmann (eds) *The Oxford Handbook of Neolithic Europe*: 711-728. Oxford: Oxford University Press.

Roberts, B.W., C.P. Thornton and V.C. Pigott 2009. Development of metallurgy in Eurasia. *Antiquity* 83: 1012-1022.

Rodríguez-Rellán, C., R.F. Valcarce and A.F. Carvalho 2020. From the Green Belt, in C. Rodríguez-Rellán, R.F. Valcarce and B.A. Nelson (eds) *A Taste for Green. A Global Perspective on Ancient Jade, Turquoise and Variscite Exchange*: 77-96. Oxford: Oxbow Books (available at: doi:10.2307/j.ctv138ws4v.9).

Sheridan, A., P. Pétrequin, A.-M. Pétrequin, S. Cassen, M. Errera, E. Gauthier and F. Prodéo 2020. Fifty Shades of Green, in C. Rodríguez-Rellán, R.F. Valcarce and B.A. Nelson (eds) *A Taste for Green. A Global Perspective on Ancient Jade, Turquoise and Variscite Exchange*: 97-120. Oxford: Oxbow Books (available at: doi:10.2307/j.ctv138ws4v.10).

Sherratt, A. 1993. What would a Bronze Age world system look like? Relations between temperate Europe and the Mediterranean in later prehistory. *Journal of European Archaeology* 1(2): 1-58.

Sherratt, A. 1996. Why Wessex? The Avon Route and River Transport in Later British Prehistory. *Oxford Journal of Archaeology* 15(2): 211-234.

Sims-Williams, P. 2020. An Alternative to 'Celtic from the East' and 'Celtic from the West. *Cambridge Archaeological Journal* 30: 511-529 (available at: doi:10.1017/S0959774320000098).

Smirke, E. 1867. Some Account of the Discovery of a Gold Cup in a Barrow in Cornwall, A.D. 1837. *Archaeological Journal* 24(1): 189-195 (available at: doi:10.1080/00665983.1867.10851381).

Standish, C.D., B. Dhuime, C.J. Hawkesworth and A.W.G. Pike 2015. A Non-local Source of Irish Chalcolithic and Early Bronze Age Gold. *Proceedings of the Prehistoric Society* 81: 149-177.

Taylor, J.J. 1970. Lunulae reconsidered. *Proceedings of the Prehistoric Society* 36: 38-81.

Taylor, J.J. 1980. *Bronze Age Goldwork of the British Isles*. Cambridge: Cambridge University Press.

Timberlake, S. 2017. New ideas on the exploitation of copper, tin, gold, and lead ores in Bronze Age Britain: The mining, smelting, and movement of metal. *Materials and Manufacturing Processes* 32(7-8): 709-727 (available at: doi:10.1080/10426914.2016.1221113).

Timberlake, S. and H. Hartgroves 2018. New Evidence for Bronze Age Tin/Gold Mining in Cornwall: The Date of the Antler Pick from the Carnon Valley Streamworks, Devoran Near Truro. *Cornish Archaeology* 57: 107-122.

Vander Linden, M. 2006. *Le Phénomène Campaniforme Dans l'Europe Du 3ème Millénaire Avant Notre Ère: Synthèse et Nouvelles Perspectives*. British Archaeological Reports International Series 1470. Oxford: Archaeopress.

Vandkilde, H. 1996. *From Stone to Bronze. The Metalwork of the late Neolithic and earliest Bronze Age in Denmark*. Aarhus: Jutland Archaeological Society.

Vandkilde, H. 2014. Breakthrough of the Nordic Bronze Age: Transcultural Warriorhood and a Carpathian Crossroad in the Sixteenth Century BC. *European Journal of Archaeology* 17(4): 602-633 (available at: doi:10.1179/1461957114Y.0000000064).

Vandkilde, H. 2016. Bronzization: The Bronze Age as Pre-Modern Globalization. *Praehistorische Zeitschrift* 91(1): 103-123 (available at: doi:10.1515/pz-2016-0005).

Vervust, S., T. Kinnaird, P. Herring and S. Turner 2020. Optically stimulated luminescence profiling and dating of earthworks: the creation and development of prehistoric field boundaries at Bosigran, Cornwall. *Antiquity* 94(374): 420-436 (available at: doi:10.15184/aqy.2019.138).

Wallerstein, I.M. 1974. *The Modern World-System*. New York: Academic Press.

Wang, Q., S. Strekopytov and B.W. Roberts 2018. Copper ingots from a probable Bronze Age shipwreck off the coast of Salcombe, Devon: Composition and microstructure. *Journal of Archaeological Science* 97: 102-117 (available at: doi:https://doi.org/10.1016/j.jas.2018.07.002).

Wiseman, R. 2018. Random accumulation and breaking: The formation of Bronze Age scrap hoards in England and Wales. *Journal of Archaeological Science* 90: 39-49 (available at: doi:10.1016/j.jas.2017.12.007).

Yates, D.T. 2007. *Land, Power and Prestige. Bronze Age Field Systems in Southern England*. Oxford: Oxbow Books.

Chapter 4

Shaft Grave period Greece in the interconnected world of Bronze Age Europe: The need for a ‘glocalized’ perspective

Joseph Maran

Institute for Prehistory, Protohistory and Near Eastern Archaeology, Heidelberg University, Heidelberg, Germany
joseph.maran@zaw.uni-heidelberg.de

Abstract

It will be demonstrated that the hitherto frequently voiced assumption that cultural traits of the societies of mainland Greece and Crete during the Shaft Grave period were emulated by societies in the Carpatho-Balkan zone and perhaps even in northern Europe due to some sort of ‘civilizational advantage’ enjoyed by Aegean societies finds no support in the available archaeological sources. Relations between these politically diverse regions of Europe *c.* 1600 BCE seem not to have been asymmetrical, but rather of mutual significance and they occurred thanks to various trade routes, of which the one through the central Mediterranean in LH I was probably even more important than the one through the Balkans and the Carpathian Basin. It is argued that Vandkilde’s concept of a ‘hotspot zone’ opens the door to new explanations. In the period *c.* 1600 BCE, certain segments of the populations of several geographical zones in Europe – parts of Scandinavia, the Carpathian Basin, the Peloponnese and Crete – seem to have invested a significant amount of time and energy in developing new forms of material culture. These ‘hotspot zones’ were characterised especially by the fact that in them ideas and objects from other areas were creatively developed and adapted to local conditions, processes that have been designated as ‘glocalization’ in the social sciences and cultural studies. The parameters of this fusion of the local with the global were determined by the respective receiving societies and were not dictated by any trading partners, even if these were organised as early states with palaces. In this respect, the societal and cultural changes described by Vandkilde in the Scandinavian ‘hotspot zone’ in the period *c.* 1600 BCE resembled those in the Argolid of the Shaft Grave era not because they were causally related, but because the creative processes of glocalization in both regions unfolded under similar conditions and brought about a profound transformation in their respective societies.

Introduction

Helle Vandkilde has shown that the emergence of the Nordic Bronze Age as ‘a cultural zone in and of its own right’ (Vandkilde 2014a: 51) was closely linked to an increase in contacts between what she calls the ‘hotspot zone’ at the southernmost end of Scandinavia and the Carpathian Basin during the phase Nordic Bronze Age (NBA) IB (*c.* 1600-1500 BCE) (Vandkilde 2014a: 54-73; 2014b: 605-625). She provides evidence that the beginning of this phase of the Nordic Bronze Age of *c.* 1600 BCE, which was contemporary with the transitional period between the later central European Early Bronze Age and the Middle Bronze Age (Reinecke BzA2/B1) led to a boom not only in copper imports – primarily from British and central European (Slovakian, Eastern Alpine) sources – and the adoption of imported bronze objects, especially weapons of Carpathian Basin derivation, but also in the active redesign of object forms by people in Scandinavia based on imports (Vandkilde 2022: 325-329; Nørgaard *et al.* 2021; Vandkilde 2020: 31-33; 2014b: 602-605, 611-618). ‘Glocalization’ (Bauman 1998; Robertson 1995)[1] has become the accepted term for such processes of creative transformation of foreign object forms at the local level, ones that led to items ‘that were neither imports nor truly indigenous’ (Vandkilde 2014a: 54). Vandkilde has also argued that within the context of these extensive contacts, not only things, but also religious ideas and gender ideals – according to which men of high status were idealised as great warriors – were adopted in the north (Vandkilde 2020: 33-39; 2014a: 54-69; 2014b: 611-616). The Carpathian Basin, in her view, served as a hub of exchange with strong links also to the Early Mycenaean Aegean, during which time Mediterranean impulses were transmitted north, and conversely, goods from northern Europe, such as amber, were transported to the Aegean (Vandkilde 2022: 323-329; 2020: 33-39; 2014b: 613-625). Heeding the scholarly opinion that the volcanic eruption of Thera, which occurred in LH I/LM IA, should be dated to *c.* 1620 BCE, she synchronised the beginning of NBA IB at *c.* 1600 BCE with the period post-dating Late Helladic (LH) I and Late Minoan (LM) IA in the Aegean (Vandkilde 2022: 328-330; 2020: 32-35).

Encompassing the period between the beginning of Middle Helladic (MH) III and early LH IIA, the shaft graves of Grave Circles A and B at Mycenae date to the

[1] The term ‘glocalization’ refers to cultural processes in which the global is merged with the local by reinterpreting material and immaterial traits coming from the outside and creating new syntheses through the fusion with local traits.

formative phase of the Mycenaean period, which came to be known accordingly as the Shaft Grave period (Maran and Wright 2020: 103-106; Dickinson 1977: 56-57). Researchers have long assumed that close contacts between societies in the Aegean and those in the Balkans and the Carpathian Basin must have existed during the Shaft Grave period. By contrast, already in 1957 Rolf Hachmann pointed out the paucity of objects substantiating such contacts (Hachmann 1957: 165-180). Since then, the number of known items that reached the Aegean from the Carpatho-Balkan zone during the Shaft Grave period (or vice versa) has grown, albeit not significantly. All the same, in the six decades since the publication of Hachmann's study, scholars have repeatedly argued that the Shaft Grave period must have been of central importance to Bronze Age societies elsewhere in Europe. For a long time, such claims were closely tied to the diffusionist approach, which claimed that the palatial societies of the 2nd-millennium BCE Aegean had a kind of civilising effect on the surrounding Balkan regions, with repercussions extending all the way to northern Europe (cf. Schauer 1985; 1984; Vladár 1973; Childe 1942: 170-172). Since the 1980s, this overly positive image of these societies has been challenged by proponents of World Systems Theory, which claims that Aegean palatial cultures economically exploited peripheral and marginal areas and thereby triggered transformations through patterns of economic dependency in an ever-expanding zone around their core (Frank 1993: 395-399). The diffusionist image of palatial societies as a kind of 'civilizing sun' whose warm rays gradually spread over ever more regions was thus replaced by World Systems Theory's image of palatial societies as 'spiders in a web' that thrived through the exploitation of their peripheries. As diametrically opposed as these views may be, both deny any agency to societies north of Greece, perceiving them as merely reacting to what had been initiated by and unidirectionally transmitted by societies in a distant civilised centre (Kienlin 2019; 2015: 170-184; Stein 2014; Harding 2013: 381-394; Stein 1998; Dietler 1998).

In what follows, I use the example of the Shaft Grave period in Greece to demonstrate that neither the diffusionist nor the World Systems approach is suitable for interpreting the nature of the contacts between the societies of the Aegean and those in other parts of Europe. In this respect, recent insights necessitate the correction of certain assumptions about the mechanisms and orientation of long-distance contacts in the Shaft Grave period. These pertain to four issues: the absolute dating of the volcanic eruption in Thera; the routes of northern contacts; the emergence and geographical extent of the Shaft Grave phenomenon, and the role of foreign objects in the societies residing in Greece in that period.

The volcanic eruption of Thera and the shaft graves of Mycenae

Until recently, the volcanic eruption of Thera was often dated to the final decades of the 17th century BCE, and a sharp difference was thought to exist between scientists who argued for an early date and those archaeologists who still supported the traditional date (*c.* 100 years later). An entire conference was held based on the assumption that the volcanic eruption dating to some point between 1627 and 1600 BCE (Friedrich *et al.* 2006) is an historical fact, and discussed the historical and cultural consequences of this revised chronology on the assessment of the cultural changes that took place in different parts of Europe *c.* 1600 BCE (Meller *et al.* 2013). Due to the 'high' dating of the volcanic eruption, most of the Shaft Grave period would have fallen well before that event, meaning that the transition between the central European Early and Middle Bronze Age at *c.* 1600 BCE would have post-dated LH I and been contemporaneous with the phase LH IIA. This, in turn, would indicate that any north-south contacts *c.* 1600 BCE would have had nothing to do with the zenith of the Shaft Grave period during LH I.

More recent times, however, have seen a surprising turnaround in the assessment of the available scientific dates for the volcanic eruption in Thera. For one, the 1628 BCE sulphate spike in Greenland's ice that some scholars have associated with the eruption have now been shown to have been caused by the Mt Aniakchak II volcano (Alaska) (Pearson *et al.* 2022). Secondly, evidence is emerging that the Thera eruption may have occurred well before the end of the phase LH I (Manning 2022: 39; see already Mühlenbruch 2017). Thirdly, a refinement of the calibration curve for the period 1700-1500 BCE has led to a recalibration of the available ^{14}C data, which has extended the calibration range for the volcanic eruption to the period from the late 17th to at least the first half of the 16th century BCE. Accordingly, Sturt Manning (2022) now proposes a time span of 1606-1589 BCE (68.3% probability) or ~1609-1560 BCE (95.4% probability) for the eruption, while Charlotte Pearson and colleagues (2023) have recently argued that the volcanic eruption should be dated to *c.* the mid 16th century BCE or even a little later, which would significantly reduce the difference from the traditionally proposed archaeological date towards the end of 16th century BCE. The seemingly wide gap between the scientific and archaeological date of the volcanic eruption in Thera is, thus, beginning to narrow and may even close in the future. It has also become apparent that the processes of cultural transformation unfolding *c.* 1600 BCE that were analysed by Vandkilde (cf. Nørgaard *et al.* 2022) must have taken place at the time of the LH I phase, which probably began at some point during the 17th century

BCE (Manning 2022). The earlier shaft graves of the MH III phase date to the remainder of the 17th century BCE and possibly extend into the 18th, which would make them contemporaneous with the late sub-phase of the later Early Bronze Age (Bz A2b) in central Europe.

The routes of the northern contacts during the Shaft Grave period

Although the new assessment of the absolute dating of the Shaft Grave period is still relatively imprecise, it definitely shows that the volcanic eruption in Thera occurred at some point within LH I, and, thus, vindicates the old view that the changes that occurred during the transition from the Early to the Middle Bronze Age in central Europe *c.* 1600 BCE ran parallel to LH I and no later. We also know that all examples from the Shaft Grave period of items of northern derivation – e.g. the amber objects and horse harness equipment; see below – date to LH I, and have not yet been found in MH III. Yet does all this evidence of an upswing in north-south long-distance connections support the claim of strong ties between Greece and the Carpatho-Balkan zone in LH I? Another insight of the last few decades underscores the need for a far more nuanced view of Shaft Grave period trade routes with other parts of Europe. The discovery of 'emporia', such as the one on the tiny island of Vivara in the Gulf of Naples, or the site of Castello on the island of Lipari, both of which have yielded a relatively high number of Aegean pottery imports from precisely the period of Schliemann's shaft graves, has demonstrated the extraordinary interest of Peloponnesian centres in exchange relations with distant areas along the Tyrrhenian coast of Italy in LH I and LH IIA (Maran 2004; Graziadio 1998; Marazzi and Tusa 1994; Vagnetti 1991). Thus, trade with northwestern Europe, which, along with tin from Atlantic Europe, also brought crescentic amber necklaces with spacer plates and possibly techniques for decorating weapons with gold studs to Greece (Papadimitriou *et al.* 2021), did not travel through Scandinavia, the Carpathian Basin and the Balkans, but rather through western and/or central Europe and the central Mediterranean. This also accounts for the lack of crescentic amber necklaces and weapons with gold stud decorations in Scandinavia and the Carpatho-Balkan zone.

But how intensive were the contacts across the Balkans in the Shaft Grave period? What is telling is that sites such as Torone, Molyvopyrgo, and Agios Mamas on the Chalkidike (Aslanis 2017; Morris 2009), which may have served as a trade 'emporia' along the shortest route from the Aegean to the Carpathian Basin through the valley of the Axios/Vardar and Morava rivers have not yielded comparable concentrations of LH I pottery to those found at Vivara or Castello on Lipari, even though these locations would have been far easier to reach from the Argolid than was Tyrrhenian Italy. The composition of the pottery assemblage from Agios Mamas certainly indicates that the site had contacts with parts of the Greek mainland to the south, but the significant amount of Gray Minyan pottery within this assemblage suggests connections in the direction of central Greece rather than direct contacts with the Peloponnese (Maran 2021; Pavúk 2007: 305). Even along the route through the Gulf of Euboea via the Magnesian peninsula and the northern Sporades, which was important for trade with the northern Aegean, there seem to be no sites that have yielded LH I/LM IA pottery imports to a degree remotely comparable to those of Vivara (Mountjoy 1999: 644, 694-695, 743, 811). In fact, examples of lustrous decorated LH I pottery are either absent from or extremely rare in central Greece. The north Aegean site that comes closest to Vivara as an 'emporion' with relatively numerous finds demonstrating southern Aegean affinities is Mikro Vouni on Samothrace, which began serving as a trade base with Crete in the Protopalatial period (Girella and Pavúk 2016: 17-23). It has yielded a great deal of Minoan-inspired material culture, of which there is none at sites on the Chalkidike, but, as far as I know, no Early Mycenaean material. The position of Mikro Vouni on the northeastern Aegean island of Samothrace suggests that Cretan elites were interested in contacts with the metal-rich eastern Balkans, but the site was not well situated to accommodate trade relations with the Carpathian Basin.

Beyond the Aegean, the fortified hilltop settlement of Monkodonja in Istria has been proposed as a northern Adriatic transshipment point for Baltic amber with contacts to the Aegean, one that would have provided Aegean societies with a direct link to the Carpathian Basin (Hänsel *et al.* 2015: 501-504). However, the material culture of the site is of clearly regional character without any Aegean imports (Hellmuth Kramberger 2017; Hänsel *et al.* 2015: 503). Comparisons of the impressive fortification of Monkodonja to Aegean defensive structures, such as the one on Middle Helladic Aegina (Hänsel *et al.* 2015: 175-176), are too general to rule out convergence. All in all, the material culture of Monkodonja lacks precisely those indisputably Aegean elements that we encounter at sites such as Vivara, Castello, and Mikro Vouni, which is why I see it as highly unlikely that the site served as an 'emporion' for Aegean societies.

None of this is to say that there were no contacts between the Shaft Grave period centres of the Argolid and the Carpatho-Balkan zone in LH I. However, the evidence presented here suggests that the direct involvement of people from the Peloponnese in trade extended as far as the central Mediterranean, but not as far as the northern Aegean or even the northern

Adriatic. This can only mean that the route through the central Mediterranean was more important to the elites in the Argolid than the one via the Balkans. The few object forms known to have reached central and southern Greece during LH I via the Balkans and the Carpathian Basin, such as the disc-shaped and rod-shaped cheekpieces of horse harnesses from Mycenae and Mitrou (East Lokris, central Greece) (Maran 2020 with further literature; Maran and Van de Moortel 2014), as well as the wheel-headed bronze pins from Antron near Glypha (Phthiotis, central Greece) and from shaft grave Ypsilon of Grave Circle B (Ruppenstein 2010 with further literature; Mylonas 1972-1973: plate 208:1) may have been transferred from the northern Aegean to the southern parts of Greece along a trade route with many intermediate stops without the involvement of people from Mycenae or other places in the Peloponnese.

If we now look for evidence of trade relations in the opposite direction, no Aegean imports that clearly date to the Shaft Grave period are known from the Carpathian Basin and the central Balkans (Gogâltan and Marinescu 2020; Kilian-Dirlmeier 1993: 31-33; Harding 1984: 213-227). This differs greatly from the significant evidence of Carpathian metal objects in southern Scandinavia in NB IB or Minoan objects in Mycenae and Pylos in MH III and LH I. As Imma Kilian-Dirlmeier has shown, rapiers of Karo type A, which can be regarded as the most typical weapon of the Shaft Grave period, are found north of Greece in Albania, while examples of rapiers found in Transylvania and Bulgaria cannot be regarded as imports; their dating, which is unclear, ranges between MM II and LH II (Harding 2022: 28; Kilian-Dirlmeier 1993: 30-33 with further literature). The long-standing belief that the earliest swords of the Apa-Hajdúsámson type (developed in the Carpathian Basin in the 17th century BCE) must have been based on the model of Mycenaean or Minoan rapiers thus rests on quite shaky foundations. Nevertheless, because the earliest swords in the Carpathian Basin, unlike those of Crete, appeared abruptly and seemingly discontinuous to earlier dagger forms, there may well have been a connection between them and Aegean swords. Individual rapiers of type A may have reached the Carpathian Basin via Samothrace or the Axios/Vardar-Morava route and served locally as models for further sword development (David 2002: 410). Yet, even if this were the case, it is also clear that something completely different was created in the Carpathian Basin in emulation of these Aegean models, since the relatively short Apa-Hajdúsámson-type swords with their full-metal hilts and curved blades could not be more different from the extremely long and narrow type A rapiers. Moreover, the regular combination of these earliest swords with metal axes found in the Carpathian Basin (cf. David 2020) cannot have had anything to do with the Aegean, since metal axes were not part of the equipment of warriors in the Middle and Late Bronze Age, either on Crete or the Greek mainland, whereas such axes had a tradition as weapons in the Carpathian Basin from long before the 2nd millennium BCE (Maran 2015: 250).

In short, objects of Aegean origin could have reached the Carpathian Basin sporadically via Balkan trade routes, just as object forms of Carpathian or Balkan provenance occasionally reached central and southern Greece. However, there is nothing to suggest that the societies of Crete or the Argolid had a particularly strong influence on those in the Carpatho-Balkan zone in LH I/LM IA. Kristian Kristiansen and Thomas B. Larsson's claim (2005: 160-186) that societies in the Carpathian Basin consciously imitated Minoan and Mycenaean weapons, practices, religious ideas, and palatial architecture is based on vague similarities, not actual evidence. Ultimately, such views fit seamlessly into the aforementioned traditional approach that sees Aegean societies playing a paramount role in distant areas of Bronze Age Europe (for a critique of the 'Mycenaean myth' see also Gogâltan and Marinescu 2020: 205-206; Fischl *et al.* 2013: 364). Kristiansen and Larsson combine aspects of (neo)-diffusionism and World Systems theory with the idea of Mary W. Helms (1988) that long-distance travellers, including political elites, served as central actors in trade relations. Like Tobias Kienlin, I am dubious that these views do justice to the complexity of the contacts between North and South in the Shaft Grave period (Kienlin 2015: 175-178; 2019: 21-28), and elaborate on this below.

The emergence of the shaft grave phenomenon and its geographical range

The extremely limited evidence of Aegean contact with the Carpatho-Balkan zone in LH I/LM IA stands in striking contrast to the conviction, often expressed in the literature, that Shaft Grave period Greece must have exerted a colossal influence on regions such as the Carpathian Basin or even northern Europe. Every hypothesis propounding this appears to rest on the assumption that the social and cultural changes expressed by the Shaft Grave phenomenon must have affected large areas of mainland Greece. However, the opposite was the case. In MH III and LH I, the processes that initiated the formative phase of the Mycenaean period seem to have originated at very few sites in the Argolid and Messenia, with certain social groups in Mycenae and Pylos serving as the driving forces behind the transformation. The way in which the emerging mainland Greek elites perceived the self-representation and habitus of the military elite of Neopalatial period Crete – members of whom they may have met during visits by Cretan delegations to the Peloponnese – led to the development of new gender ideals in Mycenae that were presented in a performative way in the grave furnishings of the shaft graves (Maran 2011; Voutsaki 2004; 1997). While men of high status were represented in the tombs as 'great warriors and hunters', women were richly adorned. These gender ideals marked a radical break with the earlier and far more modest burial customs of the phases MH I and II, which neither elevated the individual nor furnished the dead with sets of valuable weapons or jewellery. Indeed, this is why burials of that period cannot readily be attributed to a gender based on their furnishings.

The delay in the Mycenaeanisation of central Greece has long been known. It is reflected in the clearly belated introduction of Mycenaean lustrous decorated pottery no earlier than LH II (Pavúk 2012), as well as in the absence of MH III and LH I tombs with grave furnishings of the quality of those in the shaft graves of Mycenae. All the same, indications exist that social changes likewise took place in the regions north of the Gulf of Corinth during the Shaft Grave period. They are manifested above all in the discontinuity of settlements characterised by long-term occupation. The fact that neighbourhoods in many central Greek sites dating back to earlier phases of the Middle Helladic were abandoned or completely restructured in MH III or LH I indicates that certain social groups were no longer satisfied with the traditional, Middle Helladic ways of life, and adopted new forms of settlement (Worsham 2015: 256-275; Maran 1995). For all that, there is only weak evidence from central Greek centres, e.g. Thebes, that the new forms of self-expression and the rise of a warrior elite in certain areas of the Peloponnese were gradually adopted by social groups in other regions in MH III and LH I (Kilian-Dirlmeier 1997: 83-84). Finally, in northern Greek Macedonia even until the end of LH II, there is no indication that the innovations originating in the Peloponnese were adopted. Thus, it seems that the processes of social and political transformation that took place in the Argolid in the 17th and 16th centuries BCE, and that led to the emergence of what we call 'Mycenaean culture', were not initially aimed at spreading the new ideologemes to other regions. Rather, they were intended to have certain effects primarily within the Argolid, where the intra-regional supremacy of Mycenae had to be asserted and consolidated against the ancient centre of Argos and other rival sites. In addition, the belated Mycenaeanisation of central Greece may have also been fuelled by the rejection of the new gendered manner of expressing social status that was emanating from the Argolid.

Since the emergence of a warrior elite in some parts of the Peloponnese before the end of LH I had so little effect even on central Greece, and does not seem to have had any noticeable consequences in northern Greece, how could the situation of the Argolid during the Shaft Grave period have had any particular impact on the even more remote Carpatho-Balkan zone? It was archaeological research that not only established a causal link between transformative processes in the different areas of Europe *c.* 1600 BCE, but also, in the diffusionist tradition, could only imagine an impact of a specific 'high cultural' centre on a perceived periphery.

'Glocalization' – The role of foreign objects at the time of the shaft graves

Vandkilde designated southern Scandinavia of *c.* 1600 BCE as a 'hotspot zone' since it adopted and creatively engaged with foreign forms of material culture. She claims that a 'mentalité of experimentation, bricolage [and] copying' brought about the onset of the Nordic Bronze Age and led to a transformation in weaponry that went hand-in-hand with the adoption of new religious ideas (Vandkilde 2014a: 65). When providing an example of the creativity of this glocalized activity, she draws on a group of curved-tip swords dating to NBA IB. In a recent article, I reject the previously cited Anatolian comparisons of such objects and argue that we are dealing instead with a special ceremonial item indigenous to the Nordic Bronze Age that represents, above all, a reaction to the first hafted metal sickles imported into Scandinavia (Maran 2022). The 'sword-sickles' that emerged from this act of 'creative translation' (Vandkilde 2014a: 69) were, in fact, non-functional ceremonial objects that encompassed various levels of symbolic meaning regarding issues such as fertility, power and violence, long-distance contacts, the sea and religious beliefs.

Coincidentally, Schliemann's 1876 excavations at Mycenae uncovered tombs of the very social groups that played a crucial role in creating the norms and values that today we consider 'typically Mycenaean' (Maran 2011). Objects and knowledge received from the outside played a prominent role in the construction of the gender ideals discussed above (Voutsaki 1997). As some of the researchers who followed diffusionist reasoning were determined to designate the Shaft Grave period in Greece as the starting point of changes in other regions of Europe (cf. Schauer 1985; Vladár 1973), they did not recognise the structural similarities between the processes in southern Scandinavia and the Argolid. In a quite different political climate, Vandkilde's characterisation of southern Scandinavia as a 'hotspot zone' thus also applies to the Argolid. In both 'hotspots' the development of new material forms for expressing gender ideals took place through the appropriation of foreign objects and most likely also religious ideas. In the formative phase, this process remained endemic, so to speak, in that initially it had little impact on surrounding areas, served primarily to consolidate regional social orders, and was adopted only later in neighbouring regions.

To the same degree that eastern central Europe served as a source of foreign objects and ideas for Vandkilde's Scandinavian 'hotspot zone', so too did Crete for the Argolid during the Shaft Grave period. Aspiring mainland elites adopted weapon and jewellery forms from Crete, but also received religious paraphernalia that must have been gifts from Cretan palaces, especially the one of Knossos. This points to the emerging Mycenaean rulers' interest in appropriating religious ideas from Crete. In Mycenae, these foreign objects, symbols, and ideas must have been adapted to local conditions and desires and, thus, were inscribed with new meanings that linked the global with the local (Cobb 2022; Galaty 2018; Maran 2011). What is far more difficult to understand is why Cretan palaces from the Neopalatial period onwards were so keen on developing contacts with social groups in the Argolid that they were willing to send them valuable weapons and other items that could only have reached Mycenae during the course of inter-dynastic relations, probably of the kind documented in 14th- and 13th-century BCE texts from Egypt and the Near East (cf. Warburton 2023; Feldman 2006; Moran 1992). The answer may lie in Mycenae's location at the crossroads of a northwestern route through the Corinthian Gulf and a northern route through the Euboean Gulf (Maran and Van de Moortel 2014: 541-543; Rutter 2001: 142-146; Dickinson 1977: 54-57, 101-110), along which tin, amber objects, and the various components needed for light chariots, reached the Argolid and were transmitted from there to Crete.

Compared to the dominant Cretan traits of the Shaft Grave assemblages, objects such as the crescentic amber necklaces or disc-shaped cheekpieces of bone or antler, which must have arrived in Mycenae from the north, are extremely rare. Yet, despite their scarcity, they must have been of great importance for the construction of these new gender ideals, presumably because they possessed two qualities important to the elite: the magical protective power attributed to amber, and fascination with the new composite weapon – the light chariot. In Early Mycenaean Greece, male and female members of the elite did wear amber necklaces around their necks, but sometimes also disassembled the necklaces and used the individual amber components to decorate (among other things) sword belts, presumably to magically protect warriors (Maran 2013; 2004). As evidenced by their strong iconographic presence in the Shaft Graves beneath Grave Circle A, light chariots seem to have been of considerable importance to the self-image of warriors. As I recently demonstrated, the components that contributed to the innovation of the light chariot reached the northeastern Peloponnese at about the same time via different contact systems with the Near East on the one hand, and the Carpatho-Balkan zone on the other (Maran 2020). During the Shaft Grave Period in Greece, different types of horse harnesses of Carpathian or eastern European derivation were combined with certain originally Levantine traditions of using chariots as weapons for collective violence. Such new syntheses led to the development of the Mycenaean chariot and its typical elements, most probably in the course of LH II.

Conclusions

There are several ways in which Vandkilde's ideas help us understand the relationship between Shaft Grave period Greece and other parts of Europe. The hitherto frequently voiced assumption that the cultural traits of the societies of mainland Greece and Crete in the phases MH III/MM III and LH I/LM IA were emulated by societies in the Carpatho-Balkan zone and perhaps even in northern Europe due to some sort of 'civilizational advantage' enjoyed by Aegean palatial societies finds no support in the available archaeological sources. Relations between these politically diverse regions of Europe *c.* 1600 BCE seem not to have been asymmetrical, but rather of mutual significance and benefit (Kienlin 2017: 150; 2015: 174); they occurred thanks to various trade routes, of which the one through the central Mediterranean in LH I was probably even more important than the one through the Balkans and the Carpathian Basin. While the old diffusionist hypothesis of a 'cultural incline' is insufficient to adequately describe the contacts between societies in the Aegean and other parts of Europe, Vandkilde's concept of a 'hotspot zone' opens the door to new explanations. In the period *c.* 1600 BCE, certain segments of the populations of several geographical zones in Europe – parts of Scandinavia, the Carpathian Basin, the Peloponnese, and Crete – seem to have invested a significant amount of time and energy to developing new forms of material culture (Harding 2013). These 'hotspot zones' were characterised especially by the fact that in them ideas and objects from other areas were creatively developed and adapted to local conditions. Examples of such glocalization include the creation of new weapon and jewellery forms in the Carpathian Basin and southern Scandinavia, the appropriation of Cretan kinds of weapons and jewellery, the reinterpretation of amber items, and the fusion of components of the light chariot that reached the Peloponnese from multiple directions.

As has been shown here, the amount of clear evidence of contact between the Aegean and other parts of Europe during the Shaft Grave period is still extremely limited. If we did not know of the disk- and rod-shaped bone/antler cheekpieces from Mycenae and Mitrou, and the amber objects from Mycenae, we would probably not even consider the possibility of any contact between them and distant parts of Europe at that time. The number of Aegean objects in the Carpathian Basin and parts of Europe further to the north that can clearly be dated to the Shaft Grave period is even smaller. It is probably this situation's impediment of the reconstruction of regular trade routes between the Carpathian Basin and the Aegean that gave credence to Kristiansen and Larsson's idea that contacts must have been established through long-distance travel by elite individuals who had become acquainted with ideas and objects in distant areas and who applied and developed them once they returned to their homeland. This view is as much based on Helms's studies as it is on the assumption that the descriptions in the *Odyssey* reflect Late Bronze Age long-distance voyages. As for the application of Helms's ideas to the Bronze Age, Kienlin (2019: 21-23) has already offered an adequate critique. And as for the *Odyssey* as testimony of long-distance travel in the Late Bronze Age (Kristiansen and Larsson 2005: 32-61), the journey of Odysseus through the Mediterranean has been closely linked to Mediterranean mobility in the 8th century BCE (cf. Malkin 1998: 1-31), while other scholars doubt whether his voyages were meant to convey information on any specific historical situation at all (cf. Ulf 2011). This is but one example of Kristiansen and Larsson's strategy of using the Homeric poems as an historical source for understanding Late Bronze Age societies, an approach utterly discredited by archaeologists, philologists, and historians of Early Greece (cf. Grethlein 2006: 165-179, 312-317, with further literature).

The assumption that elite 'travellers' decisively shaped Bronze Age trade thus rests on very few sound arguments and runs the risk of succumbing to methodological circularity, as it proposes that the existence of long-distance 'travellers' is a given and uses this assumption to explain contact between distant areas, which it then regards as proof of the reality of these travellers. As long as we lack tangible archaeological evidence of the presence of travellers from distant areas, this explanation should not serve as a central element in the reconstruction of trade contacts. A far more likely mechanism would have been the spread of objects and ideas via trade networks consisting of segments of maritime and terrestrial routes and maintained by many groups of people in different regions from northern Europe all the way down to the Mediterranean. The impact of new ideas and foreign objects on such long-distance trade would have depended above all on the ideas that the receiving societies had formed about the world surrounding them and the local value systems into which the foreign forms had been integrated. The parameters of this fusion of the local with the global were thus determined by the respective receiving societies and were not dictated by any trading partners, even if these were organised as early states with palaces. In this respect, the societal and cultural changes described by Vandkilde in the Scandinavian 'hotspot zone' in the period *c.* 1600 BCE resembled those in the Argolid of the Shaft Grave era not because they were causally related, but because the creative processes of glocalization in both regions unfolded under similar conditions and brought about a profound transformation in their respective societies.

Acknowledgements: This article has benefitted from the many stimulating discussions with Helle Vandkilde during the time of her research stay in Heidelberg in the Cluster of Excellence 'Asia and Europe in a Global Context: The Dynamics of Transculturality' during the winter term 2014/2015, for which I am very grateful to her. I am indebted to Irina Oryshkevich (New York) for improving the English of the article.

Bibliography

Aslanis, I. 2017. *Das Prähistorische Olynth. Ausgrabungen in der Toumba Agios Mamas 1994-1996. Die mittelbronzezeitliche Keramik der Schichten 18 bis 12*. Rahden: Verlag Marie Leidorf.

Bauman, Z. 1995. On Glocalization: Or Globalization for Some, Localization for Others. *Thesis Eleven* 54: 37-49.

Childe, V.G. 1942. *What Happened in History*. Harmondsworth: Penguin Books.

Cobb, M.A. 2022. From Bronzization to 'World System': Globalization and Glocalization across the Globe (2000 BCE-1500 CE), in V.N. Roudometof and U. Dessì (eds) *Handbook of Culture and Glocalization*: 28-44. Cheltenham: Edward Elgar Publishing.

David, W. 2002. *Studien zu Ornamentik und Datierung der bronzezeitlichen Depotfundgruppe Hajdúsámson-Apa-Ighiel-Zajta*. Bibliotheca Musei Apulensis 18. Alba Iulia: Verlag ALTIP S.A.

David, W. 2020. Waffen als Grabbeigabe im Raum der oberen und mittleren Donau während der Früh- und Mittelbronzezeit, in A. Kozubová, E. Makarová and M. Neumann (eds) *Ultra Velum Temporis: Venované Jozefovi Bátorovi k 70. narodeninám*: 87-101. Slovenská Archeológia Supplementum 1. Nitra: Archeologický ústav SAV.

Dickinson, O.T.P.K. 1977. *The Origins of Mycenaean Civilisation*. Studies in Mediterranean Archaeology 49. Göteborg: Paul Åströms Förlag.

Dietler, M. 1998. Consumption, Agency and Cultural Entanglement: Theoretical Implications of a Mediterranean Colonial Encounter, J.G. Cusick (ed.) *Studies in Culture Contact: Interaction, Culture Change, and Archaeology*: 288-315. Center for Archaeological Investigations, Occasional Paper 25. Carbondale: Southern Illinois University.

Feldman, M.H. 2006. *Diplomacy by Design. Luxury Arts and an 'International Style' in the Ancient Near East, 1400-1200 BCE*. Chicago: University of Chicago Press.

Fischl, K.P., V. Kiss, G. Kulcsár and V. Szeverényi 2013. Transformations in the Carpathian Basin around

1600 B.C., in H. Meller, F. Bertemes, H.-R. Bork and R. Risch, (eds) *1600 – Kultureller Umbruch im Schatten des Thera-Ausbruchs? 4. Mitteldeutscher Archäologentag vom 14. bis 16. Oktober 2011 in Halle (Saale)*: 355-371. Tagungen Landesmuseum für Vorgeschichte Halle 9. Halle: Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Frank, A.G. 1993. Bronze Age World System Cycles. *Current Anthropology* 34: 383-405.

Friedrich, W.L., B. Kromer, M. Friedrich, J. Heinemeier, T. Pfeiffer and S. Talamo 2006. Santorini Eruption Radiocarbon Dated to 1627-1600 B.C. *Science* 312(5773): 548 (available at: https://doi.org/10.1126/science.1125087).

Galaty, M.L. 2018. Mycenaean Glocalism: Greek Political Economies and International Trade, in K. Kristiansen, T. Lindkvist and J. Myrdal (eds) *Trade and Civilisation: Economic Networks and Cultural Ties, from Prehistory to the Early Modern Era*: 143-171. Cambridge: Cambridge University Press.

Girella, L. and P. Pavúk 2016. The Nature of Minoan and Mycenaean Involvement in the Northeastern Aegean, in E. Gorogianni, P. Pavúk and L. Girella (eds) *Beyond Thalassocracries: Understanding Processes of Minoanisation and Mycenaeanisation in the Aegean*: 15-42. Oxford: Oxbow Books.

Gogâltan, F. and G.G. Marinescu 2020. Kurt Horedt's 'Siebenbürgen und Mykenä' after more than 50 Years, in J. Maran, R. Băjenaru, S.-C. Ailincăi, A.-D. Popescu and S. Hansen (eds) *Objects, Ideas and Travelers: Contacts between the Balkans, the Aegean and Western Anatolia during the Bronze and Early Iron Age*: 205-219. Universitätsforschungen zur Prähistorischen Archäologie 350. Bonn: Rudolf Habelt.

Graziadio, G. 1998. Trade Circuits and Trade-routes in the Shaft Grave Period. *Studi Micenei ed Egeo-Anatolici* 40: 29-76.

Grethlein, J. 2006. *Das Geschichtsbild der Ilias: Eine Untersuchung aus phänomenologischer und narratologischer Perspektive*. Hypomnemata 163. Göttingen: Vandenhoeck & Ruprecht.

Hachmann, R. 1957. *Die frühe Bronzezeit im westlichen Ostseegebiet und ihre mittel- und südosteuropäischen Beziehungen – Chronologische Untersuchungen*. Hamburg: Flemmings Verlag – Kartographisches Institut.

Hänsel, B., K. Mihovilić and B. Teržan 2015. *Monkodonja: Forschungen zu einer protourbanen Siedlung der Bronzezeit Istriens, Teil 1: Die Grabung und der Baubefund*. Archäologisches Museum Istriens, Monographien und Kataloge 25. Pula: Archäologisches Museum Istriens.

Harding, A. 1984. *The Mycenaeans and Europe*. London: Academic Press.

Harding, A. 2013. World Systems, Cores, and Peripheries in Prehistoric Europe. *European Journal of Archaeology* 16(3): 378-400.

Harding, A. 2022. Mycenaean Greece and Europe. Interconnections and exchanges in the light of recent research. *Studia Hercynia* 26(1): 21-43.

Hellmuth Kramberger, A. 2017. *Monkodonja: Forschungen zu einer protourbanen Siedlung der Bronzezeit Istriens, Teil 2: Die Keramik aus der bronzezeitlichen Gradina Monkodonja*. Archäologisches Museum Istriens, Monographien und Kataloge 28. Pula: Archäologisches Museum Istriens.

Helms, M.W. 1988. *Ulysses' Sail: An Ethnographic Odyssey of Power, Knowledge, and Geographical Distance*. Princeton: Princeton University Press.

Kienlin, T.L. 2015. All Heroes in Their Armour Bright and Shining? Comments on the Bronze Age 'Other', T.L. Kienlin (ed.) *Fremdheit – Perspektiven auf das Andere*: 153-193. Cologne Contributions to Archaeology and Cultural Studies 1, Universitätsforschungen zur Prähistorischen Archäologie 264. Bonn: Rudolf Habelt.

Kienlin, T.L. 2017. World Systems and the Structuring Potential of Foreign-Derived (Prestige) Goods. On Modelling Bronze Age Economy and Society, in A.K. Scholz, M. Bartelheim, R. Hardenberg and J. Staecker (eds) *ResourceCultures: Sociocultural Dynamics and the Use of Resources –Theories, Methods, Perspectives*: 143-157. RessourcenKulturen 5. Tübingen: Universität Tübingen.

Kienlin, T.L. 2019. On Europe, the Mediterranean and the Myth of Passive Peripheries, in X.-L. Armada, M. Murillo-Barroso and M. Charlton (eds) *Metals, Minds and Mobility: Integrating Scientific Data with Archaeological Theory*: 19-36. Oxford: Oxbow Books.

Kilian-Dirlmeier, I. 1993. *Die Schwerter in Griechenland (außerhalb der Peloponnes), Bulgarien und Albanien*. Prähistorische Bronzefunde IV, 12. Stuttgart: Franz Steiner Verlag.

Kilian-Dirlmeier, I. 1997. *Das mittelbronzezeitliche Schachtgrab von Ägina, Alt-Ägina IV, 3*. Mainz: Verlag Philipp von Zabern.

Kristiansen, K. and T.B. Larsson 2005. *The Rise of Bronze Age Society: Travels, Transmissions and Transformations*. Cambridge: Cambridge University Press.

Malkin, I. 1998. *The Returns of Odysseus: Colonization and Ethnicity*. Berkeley: University of California Press.

Manning, S.W. 2022. Second Intermediate Period Date for the Thera (Santorini) Eruption and Historical Implications. *PLoS ONE* 17(9): e0274835 (available at: https://doi.org/10.1371/journal.pone.0274835).

Maran, J. 1995. Structural Changes in the Pattern of Settlement during the Shaft Grave Period on the Greek Mainland, in R. Laffineur and W.D. Niemeier (eds) *Politeia: Society and State in the Aegean Bronze Age.*

Proceedings of the 5th International Aegean Conference, University of Heidelberg, Archäologisches Institut 10-13 April 1994: 67-72. Aegaeum 12. Liège: Université de Liège, Histoire de l'art et archeologie de la Grèce antique; Austin: University of Texas, Program in Aegean Scripts and Prehistory.

Maran, J. 2004. Wessex und Mykene. Zur Deutung des Bernsteins in der Schachtgräberzeit Südgriechenlands, in B. Hänsel and E. Studeníková (eds) *Zwischen Karpaten und Ägäis. Neolithikum und Ältere Bronzezeit. Gedenkschrift für Viera Němejcová-Pavúková*: 47-65. Internationale Archäologie Studia Honoraria 21. Rahden: Verlag Marie Leidorf.

Maran, J. 2011. Lost in Translation: The Emergence of Mycenaean Culture as a Phenomenon of Glocalization, in T.C. Wilkinson, S. Sherratt and J. Bennet (eds) *Interweaving Worlds: Systemic Interactions in Eurasia, 7th to 1st Millennia BC. Proceedings of the Conference Ancient World Systems, Sheffield, 1st-4th April 2008 in Memory of Andrew Sherratt*: 282-294. Oxford: Oxbow Books.

Maran, J. 2013. Bright as the Sun: The Appropriation of Amber Objects in Mycenaean Greece, in H.-P. Hahn and H. Weiss (eds) *Mobility, Meaning and the Transformation of Things*: 147-169. Oxford: Oxbow Books.

Maran, J. 2015. Near Eastern Semicircular Axes in the Late Bronze Age Aegean as Entangled Objects, in D. Panagiotopoulos, I. Kaiser and O. Kouka (eds) *Ein Minoer im Exil: Festschrift für Wolf-Dietrich Niemeier*: 243-270. Universitätsforschungen zur Prähistorischen Archäologie 270. Bonn: Rudolf Habelt.

Maran, J. 2020. The Introduction of the Horse-Drawn Light Chariot: Divergent Responses to a Technological Innovation in Societies between the Carpathian Basin and the East Mediterranean, in J. Maran, R. Băjenaru, S.-C. Ailincăi, A.-D. Popescu and S. Hansen (eds) *Objects, Ideas and Travelers: Contacts between the Balkans, the Aegean and Western Anatolia during the Bronze and Early Iron Age*: 505-528. Universitätsforschungen zur Prähistorischen Archäologie 350. Bonn: Rudolf Habelt.

Maran, J. 2021. Review of Aslanis 2017. *Gnomon* 93(5): 436-444.

Maran, J. 2022. The Nordic Bronze Age and Hittite Anatolia: Deconstructing an Archaeological Myth, in E. Kaiser, M. Meyer, S. Scharl and S. Suhrbier (eds) *Wissensschichten: Festschrift für Wolfram Schier zu seinem 65. Geburtstag*: 449-466. Internationale Archäologie, Studia Honoraria 41. Rahden: Verlag Marie Leidorf.

Maran, J. and A. Van De Moortel 2014. A Horse Bridle Piece with Carpatho-Danubian Connections from LH I Mitrou and the Emergence of a Warlike Elite in Greece. *American Journal of Archaeology,* 18(4): 529-548.

Maran, J. and J.C. Wright 2020. The Rise of the Mycenaean Culture, Palatial Administration and Its Collapse, in I. Lemos and A. Kotsonas (eds) *A Companion to the Archaeology of Early Greece and the Mediterranean*: 99-132. Hoboken: Wiley-Blackwell.

Marazzi, M. and S. Tusa (eds) 1994. *Vivara – Centro commerciale mediterraneo dell'età del bronzo. Volume II: Le tracce dei contatti con il mondo egeo (scavi 1976-1982).* Ricerche di storia, epigrafia e archeologia mediterranea 3. Rome: Bagatto Libri.

Meller, H., F. Bertemes, H.-R. Bork and R. Risch (eds) 2013. *1600 - Kultureller Umbruch im Schatten des Thera-Ausbruchs? 4. Mitteldeutscher Archäologentag vom 14. bis 16. Oktober 2011 in Halle (Saale).* Tagungen Landesmuseum für Vorgeschichte Halle 9. Halle: Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Moran, W.L. 1992. *The Amarna Letters*. Baltimore: Johns Hopkins University Press.

Morris, S.P. 2009. Prehistoric Torone: A Bronze Age Emporion in the Northern Aegean: Preliminary Report on the Lekythos Excavations 1986 and 1988-1990. *Mediterranean Archaeology* 22/23 (2009/10): 1-67.

Mountjoy, P.A. 1999. *Regional Mycenaean Decorated Pottery*. Rahden: Verlag Marie Leidorf.

Mühlenbruch, T. 2017. The Absolute Dating of the Volcanic Eruption of Santorini/Thera (Periferia South Aegean/GR) – An Alternative Perspective. *Praehistorische Zeitschrift* 92(1): 92-107.

Mylonas, G. 1972-1973. Ο ταφικός Κύκλος Β των Μυκηνών. Βιβλιοθήκη της εν Αθηναίς Αρχαιολογικής Εταιρείας 73. Athens: Archaeological Society.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2021. Shifting Networks and Mixing Metals: Changing Metal Trade Routes to Scandinavia Correlate with Neolithic and Bronze Age Transformations. *PLoS ONE* 16(6): e0252376 (available at: https://doi.org/10.1371/journal.pone.0252376).

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2022. 1600 BC: Fårdrup and Valsømagle-Type Axes and the First Evidence of Southern Alpine Metal. *Acta Archaeologica* 92.2 (2021): 185-226 (available at: https://doi.org/10.1163/16000390-20210036).

Papadimitriou, N., E. Konstantinidi-Syvridi and A. Goumas 2021. A Demanding Goldworking Technique Attested in Armorican/Wessex and Early Mycenaean Funerary Contexts. *Bulletin de l'Association pour la promotion des Recherches sur l'Age du bronze*: 19, 26-33.

Pavúk, P. 2007. What can Troia Tell Us about the Middle Helladic Period in the Southern Aegean?, in F. Felten, W. Gausz and R. Smetana (eds) *Middle Helladic Pottery and Synchronisms. Proceedings of the International Workshop Held at Salzburg, October 31st - November 2nd 2004*: 295-308. Ägina – Kolonna: Forschungen und

Ergebnisse 1. Vienna: Verlag der Österreichischen Akademie der Wissenschaften.

Pavúk, P. 2012. Mittelgriechenland und Korinthia in der ausgehenden MBZ und frühen SBZ, in B. Pavúk and B. Horejs (eds) *Mittel- und spätbronzezeitliche Keramik Griechenlands*: 40-88. Veröffentlichungen des mykenischen Kommission 31. Vienna: Verlag der Österreichischen Akademie der Wissenschaften.

Pearson, C., M. Sigl, A. Burke, S. Davies, A. Kurbatov, M. Severi, J. Cole-Dai, H. Innes, P.G. Albert and M. Helmick 2022. Geochemical Ice-Core Constraints on the Timing and Climatic Impact of Aniakchak II (1628 BCE) and Thera (Minoan) Volcanic Eruptions. *PNAS Nexus* 1(2) (available at: https://doi.org/10.1093/pnasnexus/pgac048).

Pearson, C., K. Sbonias, I. Tzachili and T.J. Heaton 2023. Olive Shrub Buried on Therasia Supports a Mid-16th century BCE Date for the Thera Eruption. *Scientific Reports* 13(6994) (available at: https://doi.org/10.1038/s41598-023-33696-w).

Robertson, R. 1995. Glocalization: Time-Space and Homogeneity-Heterogeneity, in M. Featherstone, S. Lash and R. Robertson (eds) *Global Modernities*: 25-44. London: SAGE Publications.

Ruppenstein, F. 2010. Einfache Radnadeln als Indikatoren europaweiter Fernbeziehungen zur Zeit der Deponierung der Himmelsscheibe von Nebra, in H. Meller and F. Bertemes (eds) *Der Griff nach den Sternen. Wie Europas Eliten zu Macht und Reichtum kamen, Internationales Symposium in Halle (Saale), 16.-21. Februar 2005*: 641-653. Tagungen Landesmuseum für Vorgeschichte Halle 5. Halle: Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, Landesmuseum für Vorgeschichte.

Rutter, J.B. 2001. Review of Aegean Prehistory II: The Prepalatial Bronze Age of the Southern and Central Greek Mainland, in T. Cullen (ed.) *Aegean Prehistory: A Review*: 95-155. American Journal of Archaeology Supplement 1. Boston: Archaeological Institute of America.

Schauer, P. 1984. Spuren minoisch-mykenischen und orientalischen Einflusses im atlantischen Westeuropa. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz* 31: 137-186.

Schauer, P. 1985. Spuren orientalischen und ägäischen Einflusses im bronzezeitlichen nordischen Kreis. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz* 32: 123-195.

Stein, G.J. 1998. World System Theory and Alternative Modes of Interaction in the Archaeology of Culture Contact, in J.G. Cusick (ed.) *Studies in Culture Contact: Interaction, Culture Change, and Archaeology*: 220-255. Center for Archaeological Investigations, Occasional Paper 25. Carbondale: Southern Illinois University.

Stein, G.J. 2014. Economic Dominance, Conquest, or Interaction among Equals? Theoretical Models for Understanding Culture Contact in Early Near Eastern Complex Societies, in M. Azizi Kharanaghi, M. Khanipour and R. Naseri (eds) *Proceedings of the International Congress of Young Archaeologists, Archaeological Scientific Association, Tehran, 27-29 October 2014*: 55-67. Tehran: University of Tehran Press.

Ulf, C. 2011. Die Diskussion über Ilias und Homer: alte Thesen – neue Zugänge, in C. Ulf and R. Rollinger (eds) *Lag Troia in Kilikien?: Der aktuelle Streit um Homers Ilias*: 11-29. Darmstadt: Wissenschaftliche Buchgesellschaft.

Vagnetti, L. 1991. Le ceramiche egeo-micenee, in L. Bernabò Brea and M. Cavalier (eds) *Meligunìs Lipàra VI: Filicudi. Insediamenti del età del bronzo*: 263-305. Palermo: Flaccovio.

Vandkilde, H. 2014a. Cultural Perspectives on the Beginnings of the Nordic Bronze Age. *Offa* 67-68 (2010/11): 51-77.

Vandkilde, H. 2014b. Breakthrough of the Nordic Bronze Age: Transcultural Warriorhood and a Carpathian Crossroad in the Sixteenth Century BC. *European Journal of Archaeology* 17(4): 602-633.

Vandkilde, H. 2020. Amber, Weapons and Circulating Ideas about Leadership at the Threshold to the Middle Bronze Age in Europe, in J. Maran, R. Băjenaru, S.-C. Ailincăi, A.-D. Popescu and S. Hansen (eds) *Objects, Ideas and Travelers: Contacts between the Balkans, the Aegean and Western Anatolia during the Bronze and Early Iron Age*: 31-41. Universitätsforschungen zur Prähistorischen Archäologie 350. Bonn: Rudolf Habelt.

Vandkilde, H. 2022. Entrepreneurs, Metals and Change: Scandinavia Meets Its Neighbours in the Earliest Bronze Age, in J. Ling, R.J. Chacon and K. Kristiansen (eds) *Trade before Civilization: Long Distance Exchange and the Rise of Social Complexity*: 309-333. Cambridge: Cambridge University Press.

Vladár, J. 1973. Osteuropäische und mediterrane Einflüsse im Gebiet der Slowakei während der Bronzezeit. *Slovenská Archeológia* 21: 253-357.

Voutsaki, S. 1997. The Creation of Value and Prestige in the Aegean Late Bronze Age. *Journal of European Archaeology* 5: 34-52.

Voutsaki, S. 2004. Age and Gender in the Southern Greek Mainland, 2000-1500 BC. *Ethnographisch-Archäologische Zeitschrift* 45: 339-363.

Warburton, D.A. 2023. *Bronze Age Egypt and Globalisation*. Newcastle upon Tyne: Cambridge Scholars Publishing.

Worsham, R. 2015. Discontinuous Settlement Structures and Social Organization in Late Early Helladic and Middle Helladic Greece. Unpublished PhD dissertation, University of North Carolina at Chapel Hill (available at: https://doi.org/10.17615/n7f2-kv37).

Chapter 5

Did the Egtved girl feel homesick? Reflections on the unanswerable questions to the Bronze Age

Marie-Louise Stig Sørensen

McDonald Institute of Archaeological Research, University of Cambridge, Cambridge, UK
e-mail mlss@cam.ac.uk

Abstract

As our insights into Bronze Age peoples' lives have exploded due to isotope analyses, aDNA, and the development of more refined osteological methods, the Bronze Age person has become more knowable. However, are we in danger of developing interpretative and descriptive languages which essentialise or typify these lives? We express surprisingly little concern about how the social institutions, conventions, and regulations that underlie the new interpretations, which we offer, would have affected peoples' lives. This is largely because we cannot answer such questions, but is that good enough? In this contribution, I want to pursue the thought that just because a question cannot be answered does not mean that it should not be asked. I shall argue that questioning and wonder play a profound epistemological role in knowledge production, especially when the latter concerns itself with insights rather than simply results. The genesis of questions matters. The musing and introspection about what we know and what we cannot know and why that is the case are not only constitutive parts of the path to insight but should be highlighted as significant in their own right. To foreground this shadowland, I will reflect on how we can respond to the question of whether the Egtved girl (and others like her) was homesick, and how the foster child who moved away from 'home' at age five may have been affected by this experience.

Introduction: On knowledge

The concern – or curiosity – that I want to share here is whether we are becoming a bit too comfortable about the Bronze Age person, who we are now able to present in novel ways due to the considerable new data arising from osteology, isotope analysis, and genetics. Do we risk slipping into a position of assuming that because we now know so much more than just a decade or so ago, we now know enough? Alternatively, might we risk reducing our aim to just know more of the same? In response to the accumulation of knowledge, do we need to reformulate new searching questions, and how do we progress to such a stage?

The pursuit of knowledge is an integral aspect of archaeology as a discipline and praxis. But how we shape that pursuit is an ever-challenging question – either explicitly acknowledged and struggled with, or resting somewhere in our disciplinary subconsciousness. Our intellectual backbone affects how we, as archaeologists, ask questions and formulate interpretations. We have a long-established tradition of close interaction with data and observation, and archaeology can probably be characterised as having a distinct form of sensitivity as well as high expectations about verification, often expressed as hypothesis testing (Sørensen 2022). We embrace curiosity but are more cautious about imagination, often relegating it to popular science outlets or the amateur. However, a core challenge is that our data and observations are proxies for the communities and processes we aim to study. We, therefore, always need to develop better ways of getting beyond existing data and being aware of the biases and limitations of our data. Joanna Brück and Catherine Frieman have pointed to the danger that the new kinds of data may overwhelm our understanding of persons, and they warn that we risk producing 'essentialist, biogenetic formulations of identity that do not fit people's lived experience' (Brück and Frieman 2021: 48). Moving on is particularly challenging when our insight into a specific phenomenon appears to be reaching a platform – is there nothing else to understand or is it a matter of us not knowing how to proceed beyond what is now familiar? Moving beyond is not easy and can be uncomfortable as it entails challenging assumptions and getting entangled with epistemology, including the notion of evidence. It is never easy to conduct research beyond the expected.

Research on the so-called 'dark side of the genome' or dark genome[1] is interesting in this regard. The human genome which was revealed in 2003 only included 2% of identifiable protein-coding genes, with the rest written off, first as 'junk' (the rubbish bin of human evolution) and later as the dark genome. The purpose of this part of the genome was not understood, and for some time there was little research on it. This neglect was probably partly because the methods developed for genomic studies were not sufficient and partly because it was not clear what functions were linked to this part of the genome and therefore what questions

[1] https://www.bbc.com/future/article/20230412-the-mystery-of-the-human-genomes-dark-matter (accessed 15 June 2024).

to ask (Morillon 2018). With more sophisticated DNA sequencing technology, studies of the dark genome are now producing considerable new knowledge about our genetic makeup. The point is that this area of important matters was given little attention because the geneticists did not know how to study it.

Margaret Conkey's reflections about the intellectual challenge of moving gender research forward are also helpful. She suggests moving forwards will need 'The act of undoing preexisting premises and challenging what is known' and she asks us to enact an 'active theory' which 'unsettles', 'un-does' and is 'destabilizing' (Conkey 2007: 296-297, 300). To advance insights in this manner, we might benefit from learning to use imagination and curiosity, not as a means of interpretation but rather as a tool of enquiry and shaping questions. We must do this with great caution and a high degree of self-critique and introspection, but we might learn from doing so. I, therefore, want to turn to the idea of the unanswerable question.[2]

On unanswerable questions

I want to stress the importance of the unanswerable question because questioning and wonder play a profound epistemological role in knowledge production. The genesis of questions matters and the musing and introspection about what we know and what we cannot know and why this is the case are not only taken-for-granted parts of the path to insight but should be highlighted as constitutive elements of that process. The outcome of a question is not the only thing at stake; the entirety of the process of questioning must be embraced as an integral part of our endeavour. Thus, I propose that just because a question cannot be answered does not mean that it should not be asked. Such questions introduce a degree of epistemological insecurity, they are disruptive of the sense of the familiar and the predictability underwriting normative scientific praxis. They can, therefore, be effective thinking tools, stimulating critical engagements with and scrutiny of the conditions of our knowledge claims, especially their foundations – ranging from assumptions embedded within language to the easy acceptance of interpretative tropes, such as the common reference to 'marriage' in our studies of the Bronze Age.

Others have also argued for the importance of raising such questions. In a recent volume on how we narrate migration, Daniela Hofmann, Catherine J. Frieman and Astrid J. Nyland, for instance, include the question of 'what they [migrations] meant to people – both those moving and those staying put' (Hofmann *et al.* 2024: 10) as a central part of migration research. They also, however, acknowledge that it is not straightforward how we would engage with such questions but suggest that 'They require us to think imaginatively and to take the human factor into account' (Hofmann *et al.* 2024: 10), while also warning about the creeping in of unreflected stereotypes. Similarly, in textile research, it has for a long time been common to point to sensuous aspects of past lives, such as the touch and movement of different textiles: 'People perceive and know textiles through their bodily senses, through the way they feel, appear, smell and move' (Harris 2019: 210).

I will attempt to foreground this shadowland of questions we cannot answer but which may be important for our research by reflecting on the unanswerable question of whether the Egtved girl (and others like her) was homesick. My aim is not to try to answer the question but rather to use the retrospection which it provokes to explore whether we can think differently about some of the aspects of the Bronze Age that we have recently learned about. In this endeavour, I take comfort in the philosopher Renford Banbrough's statement that truth does not depend on being known (1966: 153).

On the Egtved girl – and others

In parallel with our growing ability to discuss 'the mobility of single individuals in unprecedented detail' (Frei *et al.* 2017: 2) and unfold previously unimaginatively detailed 'biographies', or at least to claim these as new levels of insights, there have been extensive reflections on traditional interpretations of Bronze Age mobility. This has included a critique of the gender stereotypes underwriting what had become an almost normative interpretation of social relations in the Bronze Age (e.g. Frieman *et al.* 2019). This critique has particularly focussed on the role given to elite exchange between regions which argued that women were exchanged as 'supreme gifts', a model favoured by, amongst others, Kristian Kristiansen and Thomas B. Larsson (2005). Pointing to the routine assumption that women took no active part in deciding on their lives, critiques have highlighted our uncritical acceptance of their presumed objectification (e.g. Felding 2016; Reiter *et al.* 2019) and ask whether these women did not have agency. Frieman *et al.*'s (2019) extensive discussion of alternative interpretative pathways and critical engagement with data is particularly helpful as it points to novel and thoughtful ways of engaging analytically with mobility, its varied reasons and impacts.

[2] I have known Helle for a very long time, and, apart from in Århus, we have met and talked at different venues, conferences, and workshops, looked at exhibitions, and shared meals and excursions – and always with the Bronze Age as a kind of taken-for-granted background and point of reference. Apart from friendship, Helle has brought much to these exchanges, including her long-standing additional interest in the Mediterranean and formidable factual knowledge. I am very grateful to have this opportunity to write with her in mind – the Bronze Age expert as well as the person.

This critical engagement with traditional narratives is both important and constructive, but it also brings forth new challenges. One of these is how we tend to ignore age as a dimension of the person and therefore under-appreciated how agency is of a different order for a child of five and a 16-year-old woman. The other is the nature of agency itself. Agency, in the sense of being able to enact a degree of control and comprehension of the world around oneself, is to some extent held by all, but it may be too simplistic to assume that so is power, including the ability to partake in all decisions affecting the individual self. Nonetheless, the two are often intertwined in our arguments. The extent to which during the Bronze Age the individual child, teenage girl, or young woman was in 'charge' of or even able to substantially influence their own lives – possibilities, actions, and outcomes – is unknown. However, drawing on ethnographies, historical records, and our own time should caution us to recognise that gender ideology is commonly suppressive and strongly regulatory about rights and 'proper' behaviour (Sørensen 2024); the ability to act freely is commonly circumscribed. I suggest that judicating whether Bronze Age women were free active agents of their lives or what limitations they may have experienced in terms of their ability to act out their own wishes and desires, falls within the unanswerable questions. They, nonetheless, indicate serious matters of concern.

Through the last decade, new detailed studies have emerged that address Bronze Age lifeways through isotopic and other analyses of individual bodies/people. This very exciting development has been extensively published and various types of mobility patterns outlined, as done very effectively for the Danish examples in publications by Karin Frei and Samantha Reiter (e.g. Reiter and Frei 2021; Reiter *et al.* 2019). I shall base my reflections on these publications, with some additional challenges drawn from wider European Bronze Age case studies. Amongst the important results emerging, I want to highlight the observation from the Danish examples of the considerable variation between individuals co-habiting a location, the suggestion that some young children moved away from their birthplace around the age of five to seven years old and that the young women who came from outside the local area moved around the age of 16 (an interpretation supported by data from several regions), and the evidence for the importance of family relations over generations demonstrated in the Lech Valley, southern Germany (Knipper et al. 2017), as well as other places.

Turning to these kinds of insights we may begin to discern ways of responding (note the difference between answering and responding) to our unanswerable question. Firstly, the variability in *mobility experience* between individuals living in the same area is striking. Although 'local' cannot be interpreted to mean a lack of mobility (see Reiter *et al.* 2023 for a discussion of the concept of local), and there being degrees and variations on how qualities such as local, home, and mobility are experienced, I suggest that sameness is still an experiential quality that is recognised and matters. The differences between people in terms of local and non-local (and combinations thereof if we take stages in the life course into account) show that people living together in a place could have held very different experiences and life course trajectories. If we think about Bronze Age society in terms of burial communities, in other words, those we access as a 'community' because they were buried in the same location,[3] then this means that some of the people had very different life experiences, social networks, and memories than the rest. This is not necessarily about differences in wealth or social position, but about standing, and possibly feeling, apart from others due to how experiences make a person (see further below). In such communities, there may have been in-groups, constituted by those who shared both a general cultural habitus inherited through generations and specific experiences and memories. These were members who would be able to recall experiences and perform and reference the routines that underpinned the notion of 'we'. But how were the non-local persons positioned within these communities? Whether they were valued, treated equally, or discriminated against, we can assume they would have experienced 'outsiderness', and they may even have suffered degrees of alienation.

Moreover, the degree of similarity and differences between regions mattered. As isotopic data are based on differences in the geological environment, different isotopic readings would, by definition, mean different environments – different vegetation cover, landscape contours, and maybe even weather patterns. Within the local and non-local differentiation would be an experience of different kinds of places. This kind of difference was hardly acknowledged in traditional mobility discussions for the Bronze Age, as mobility was mainly thought about through socio-political or trade relations. The differences between people in terms of their sensuous experiences of places and the effects of the environment on people as sentient beings have been given little attention in our discussions. As more analyses of Bronze Age people are carried out, we will probably learn that in most regions most people either did not move or stayed within a similar geological area, but some moved and often over considerable distances, and such phenomological differences may have influenced their ways of interacting with others.

[3] Although not always made explicit, we tend to include those who conducted the funeral (as the mourners) in our reflections on such communities.

The age of movement is an important feature. For instance, the person from Grave A in the Ginderup barrow is thought to have been local until the age of around 7 to 8, whereafter she travelled outside present-day Denmark before returning at about the age of 16 (Reiter *et al.* 2023). In the study of the Lech Valley, southern Germany, three cases showed a similar move away from the birthplace during adolescence with a subsequent return as adults (Mittnik *et al.* 2019). This raises important issues. For the formation of the self (affective links, relationships and establishing habitus) age is critical, despite the influence of cultural context as well. In psychoanalysis, it is argued that around three years of age, the child starts to form its peer group and that it is as 'children that we have the original hard task of becoming social human beings' (Mitchell 2023: 3). For fosterage in medieval Ireland, it was decreed that a child is ready to be fostered 'when he recognises his own mug from other mugs' (O'Donnell 2020: 17). Age matters in terms of the formation of bonds, and historically it is known that fosterage can result in strong bonds being formed, leading to both positive and negative emotions. Various evidence shows the beginning as well as the formal end of fosterage as a potentially emotionally fraught time, with Scottish ballads mourning the end of fosterage as if it was a death (O'Donnell 2020: 18). So, fosterage may have deeply influenced the child moving.

The Skrydstrup woman moved just once. When she was around 13-14 years old, she moved from outside present-day Denmark to southern Jutland, a travel which is estimated to have taken some months; she died 17 to 18 years old (Frei *et al.* 2017). Hers was the central grave in the barrow in which she was buried and she was bestowed with grave goods, so it appears she was granted some kind of status. Nonetheless, she lived only for some 40 months in the area, probably not long enough to re-establish affective connections and develop an embodied sense of belonging, and to lose the sentiments attached to her previous connections.

The Egtved girl is a different case. She is unusual insofar as she seems to have moved extensively, at least during the last two years of her short life. She was between 16 and 18 years old when she died (Felding 2016; Frei *et al.* 2015). Recently some authors have tried to create close links between the evidence of travel and her personal abilities and active roles (e.g. Felding 2016; Frieman *et al.* 2019). But this emphasis risks losing sight of both age and distance. She was probably only 13 to 14 years old when the movement north was first being planned, and she was young when she first came to Jutland. This is an early age if she is expected to have had the capacity to carry out the entrepreneurial spirit and independence we now want to assign her. Similarly, although the length of her travels was extensive (estimated to be 2,400 km during her last two years (Frei *et al.* 2015)), since her place of origin is thought to be *c.* 800 km from Egtved, this represents just one and a half trips back and forth. It is, however, striking that she was 'on the move' most of the time during the last two years of her life.

The new data has also provided novel insights into *biological relationships*. Archaeology has always operated with ideas of 'family', in many ways assuming similar core social relations to those with which we are familiar. What is novel, therefore, is the ability to map actual biological relationships over time and space. This comes with a risk of overestimating biology and underestimating the importance of social relations (see also Brück and Frieman 2021), but nonetheless the new data provide us with important insights. The detailed data about the Late Neolithic-Early Bronze Age communities in the Lech Valley, southern Germany, is useful to think with. Various studies have argued that the burial evidence shows patrilocality and female exogamy (e.g. Mittnik *et al.* 2019), but it has also been possible to identify biological relatedness within cemetery populations including parent-offsprings, siblings, and second or third to fifth-degree relatives. As my concern here is social cohesion and how the 'outsider' may be challenged in terms of feelings of attachment, the main point to stress is that many of the members in the burial community were related to each other biologically, and some of these relationships spanned over several generations and were often strengthened by the shared use of a cemetery or nearby ones. Also of note, male individuals who did not belong to the predominant maternal linage had no close relatives buried in the same cemetery, and there was a correlation between the number of grave goods found with an individual and the rate of relatives, with many grave goods found with both male and females from multigenerational families (Mittnik *et al.* 2019). A notion of relatedness, and probably one focussed on maternal descent, seemed explicitly present. This meant that women moving into these communities would have encountered several obstacles, or at least challenges, in their attempts at building new social and affective relationships – they were not blood kin.

Finally, whereas traditional mobility discussions have emphasised portable objects, such as dress items, which were analysed as proxies for the movement of individuals, new questions are being raised about the link between objects and persons. These earlier studies provided important insights into movements. Albrecht Jockenhövel's arguments about '*Fremde Frauen*' (Jockenhövel 1995) did, for example, help to generate new perspectives on women in the Bronze Age (e.g. Bergerbrandt 2007). However, with hindsight, we can now see how some of the taken-for-granted assumptions were fallible. In particular, it was assumed that objects, or at least certain objects, were inalienable parts of the social person, and that foreigners or outsiders would be marked as such through their different dress (and presumable also other traits). We are, however, learning that the relationship between objects and people can be unstable and that it can be subject to change over the life of an individual. We were generally aware that age may affect the object-person relationship, either by accumulation or, the opposite, reduction, but these changes were understood to take place within the same cultural logic and as part of *rites de passage* stagings of the life course. So, for example, with age, a woman may accrue more pins or armbands (Sørensen 2004). The recent analysis of the Ølby woman is, therefore, important (Reiter *et al*. 2019). The rich grave goods with extensive links to areas outside Denmark made her a strong candidate for a non-local person, but the isotope study suggests she was local.

Such results challenge the simple assumption of dress and objects travelling with people, and of objects 'naturally' staying linked to the person. In turn, this suggests that non-local people at some point between leaving one community and becoming incorporated into another may have been stripped (voluntarily or not) of the emblems of their familiar appearance; potentially a very literate experience of changing or erasure of an established and familiar notion and expression of identity (or at least the outer skin of identity). The questioning of earlier assumptions about portable objects being static/inalienable aspects of the person is now leading to unsureness about people-object relations, and we need to rise to that challenge.

Renewed attention to the connection between mobility and portable objects also brings forth an awareness of the non-portable aspects of peoples' lifeways – or in other words that which they had to leave behind. This would typically be about the kind of houses and settlements they had lived in and through which they were socialised and developed their social habitus, but even more fundamentally, it may also be based on shared foodways and language dialects, which they had to leave behind. We must imagine that losing the tangible sense of being an insider in one's culture would have affected people. It may have caused degrees of experiential and emotional rupture – maybe excitement as well as loss.

On the formation of identity

Homesickness refers to experiences of distress caused by being away from home (e.g. van Tilburg *et al*. 1996). It is associated with a longing for and preoccupation with thoughts of home, feelings of depression and anxiety and (at times) withdrawal. It has been known historically and it seems to be a cross-cultural phenomenon. Individuals respond differently. It is presumed that this is due to different abilities regarding the regulation of emotions and adjusting to novelty. When I ask whether the Egtved girl felt homesick, I am essentially asking about her affective attachments (and those of others like her), and what happens when such attachments are ruptured. To reflect further, I think we need to consider how identity is shaped in order to consider how the notion of 'home' and attachments are formed.

Over the duration of Helle Vandkilde's career, notions of identity have become more widely used, scrutinised, and argued about. Within these debates, long-accepted identities, such as the warrior, have been reassessed (e.g. Vandkilde 2017), and previously naturalised identities, such as gender, have become part of our analytical toolkits and interpretative engagements (e.g. Bergerbrandt 2007; Felding *et al*. 2020; Sørensen 2024). Recently, the intersectionality perspective (e.g. Lund and Moen 2019) has added more engagement with arguments about identities as layered, composite, and contextual. Throughout, the challenge remains to understand identity as always present and yet always fragile and to be cautious about sliding towards primarily analysing identity as an emblematic possession. Treating identity as static underestimates its significance and dynamics. Moreover, identities must be recognised as being both about an interior sense of self and as part of social processes through which the self sees itself through and with others.

In line with this concern, I have recently argued (Sørensen 2024) that researching identity can lead to at least two different approaches, one concerned with identity as a possession or outcome, and the other focussed on the processes of acquiring identity. I will try to follow this second approach but not only focus on how we form identity but rather on what may challenge identity. Many factors can be considered when investigating the formation and maintenance of identities. To simplify, I will focus on the nexus of social, spatial, and temporal conditions that are involved and which may have come into play during the experience of Bronze Age mobility.

The social dimension of identity arises from how we live and how we live together. It refers to notions of traditions, customary practices, shared memories, but also regulations, conventions, and being able to recognise potentials for alternative actions and subversion. These are axes which the individual navigates, internalises, and to which they also contribute. The social provides a profound notion of 'knowing how to' – in other words, it is about being able to 'operate' one's social world competently, of having and sharing habitus (Bourdieu 1977). The social dimension provides an embodied experience and means of routine performances of belonging. It also affects notions of capability, which in turn is important for well-being (Sen 1993). When that social setting is taken away, the person is cast adrift, lacking the anchor of routines and probably experiencing an eroded sense of capability, at least until the person is profoundly connected to a new social context.

The spatial dimension is an extension of the social as it refers to the importance of locations for the experience of self. Discussions of space, whether focussed on the sense of place, place attachment, or using post-colonial critique have become widespread over recent decades (e.g. Acharya and Panda 2022; Tuan 1977). We have learned about the importance of notions of placeness and environs as the settings for not just social actions but also memory making and identity. Such notions are part of how social meanings get locked into place, as when a location becomes 'home'. The spatial dimension is fundamental to the orientation of the self and to the formation of notions of belonging. Cultural and political geographers have demonstrated how people are attached to and affected by places, including informing their self-perception. Places have traces of actions, are affected by memories, and elicit emotions. Mobility, whether this is ongoing movements, the joining up of discreet places, or moving from one settled existence to another, is about change, and it can involve losing a familiar place and needing to make a new place familiar, making it a place of attachment and producing new notions of 'home', with the latter entailing the need to develop new attachments and alter self-perceptions. The strong link between self-perception and place means that moving away can cause complex psychological responses, especially when such movements are done alone.

Temporality is about the importance of rootedness for a sense of identity. On one hand, temporality reflections are typically framed around narratives of origin and ancestors, accounts of past deeds and events that are used to create people as a common. On the other hand, they refer to specific events and memories that can be individually recalled and shared and which are used to strengthen a notion of 'having in common' the conditions of one's personal history. Moreover, while sharing memories provides cohesion and supports affective relations, not being able to share memories can be a negative feeling and can be divisive. It can also produce positive outcomes in terms of curiosity, learning, etc., but this will not overcome the separation. Moving away from home around the age of 14 to 16 years old entails losing the ability to share the memories accumulated until then, including the assumption that such memories are (largely) shared.

By way of conclusion: what is left of the unanswerable question?

These reflections do not answer the question of whether the Egtved girl (and others like her) felt homesick. Nevertheless, exploring the new evidence beyond its ability to characterise Bronze Age mobility in terms of the physical body and with a concern for how such mobility may have affected individuals, makes it clear that the conditions of the lives of non-local people probably affected their perception of self and would have introduced a sensation of rupture. This rupture, moreover, would probably have related to fundamental affective and cognitive dimensions of self and relations to others, such as sharing memories and feeling capable. It is, however, also possible to predict that different individuals would have navigated such ruptures and challenges differently. I am, however, left with an even more fundamental question – namely, how much can we use historical, ethnographic, and contemporary sources to discuss Bronze Age cognition and behaviour? In line with how we generally study prehistoric people, I have assumed a degree of uniformitarianism – for example, the importance of affective relations; but that could be questioned!

Bibliography

Acharya, I. and U.K. Panda 2022. *Geographical Imaginations: Literature and the 'Spatial Turn'*, Oxford: Oxford Academic.

Banbrough, J.R. 1966. Symposium: Unanswerable Questions. *Proceedings of the Aristotelian Society, Supplementary Volumes* 40: 151-186.

Bergerbrandt, S. 2007. *Bronze Age Identities: Costume, Conflict and Contact in Northern Europe 1600-1300 BC*. Lindome: Bricoleur Press.

Bourdieu, P. 1977. *Outline of a Theory of Practice*. Cambridge: Cambridge University Press.

Brück, J. and C.J. Frieman 2021. Making kin: The archaeology and genetics of human relationships. *TATuP* [Internet]. 26 July 2021 [cited 12 July 2024] 30(2): 47-52.

Conkey, M.W. 2007. Questioning Theory: Is There a Gender of Theory in Archaeology? *Journal of Archaeological Method and Theory* 14: 285-310.

Felding, L. 2016. The Egtved Girl. Trade Travel and Alliances in the Bronze Age. *Adoranten* 2015: 5-20.

Felding, L., S.S. Reiter, K.M. Frei and H. Vandkilde 2020. Male Social Roles and Mobility in the Early Nordic Bronze Age. A Perspective from SE Jutland. *Danish Journal of Archaeology* 9(1): 1-167.

Frei, K.M., U. Mannering, K. Kristiansen, M.E. Allentoft, A.S. Wilson, I. Skals, S. Tridico, M.-L. Nosch, E.

Willerslev, L. Clarke and R. Frei 2015. Tracing the dynamic life story of a Bronze Age Female. *Scientific Reports* 5: 10431 (available at: doi: 10.1038/srep10431).

Frei, K.M., C. Villa, M.L. Jørkov, M.E. Allentoft, F. Kaul, P. Ethelberg, S. Reiter, A.S. Wilson, M. Taube, J. Olsen, N. Lynnerup, E. Willerslev, K. Kristiansen and R. Frei 2017. A matter of months: High precision migration chronology of a Bronze Age female. *PLoS ONE* 12(6): e0178834 (available at: https://doi.org/10.1371/journal.pone.0178834).

Frieman, C.J., A. Teather and C. Morgan 2019. Bodies in Motion: Narratives and Counter Narratives of Gendered Mobility in European Later Prehistory. *Norwegian Archaeological Review* 52(2): 1-22 (available at: https://doi.org/10.1080/00293652.2019.169735).

Harris, S. 2019. The Sensory Archaeology of Textiles, in R. Skeates and J. Day (eds) *The Routledge Handbook of Sensory Archaeology*: 210-231. London: Routledge.

Hofmann, D., C.J. Frieman and A.J. Nyland 2024. *Migration Narratives in Archaeology*. Leiden: Sidestone Press.

Jockenhövel, A. 1995. Zur Ausstattung von Frauen in Nordwestdeutschland und in der Deutschen Mittelgebirgszone Während der Spätbronzezeit und Älteren Eisenzeit, in A. Jockenhövel (ed.) *Festschrift für Hermann Müller-Karpe zum 70. Geburtstag*: 195-212. Bonn: Rudolf Habelt.

Knipper, C., A. Mittnik, K. Massay, C. Kociumaka, I. Kucukkalipci, M. Maus, F. Wittenborn, S.E. Metz, A. Staskiewicz, J. Krause and P.W. Stockhammer 2017. Female exogamy and gene pool diversification at the transition from the Final Neolithic to the Early Bronze Age in central Europe. *PNAS* 114(38): 1-6 (available at: https://doi.org/10.1073/pnas.1706355114).

Kristiansen, K. and T. Larsson 2005. *The Rise of Bronze Age Society: Travels, Transmissions and Transformations*. Cambridge: Cambridge University Press.

Lund, J. and M. Moen, M. 2019. Hunting Identities. Intersectional Perspectives on Viking Age Mortuary Expressions. *Fennoscandia Archaeologica,* XXXVI,137-150.

Mitchell, J. 2023. *Fratriarchy. The Sibling Trauma and the Law of the Mother*. London: Routledge.

Mittnik, A., K. Massy, C. Knipper, F. Wittenborn, S. Pfrengle, N. Carlichi-Witjes, H. Deeg, A. Furtwängler, M. Harbeck, K. Von Heyking, C. Kociumaka, I. Kucukkalipci, S. Lindauer, S. Metz, A. Staskiewicz, A. Thiel, J. Wahl, W. Haak, E. Pernicka, S. Schiffels, P.W. Stockhammer and J. Krause 2019. Kinship-based social inequality in Bronze Age Europe. *Science* 366(6466): 731-734. (available at: https://doi.org/10.1126/science.aax6219).

Morillon, A. 2018. *Long Non-coding RNA: The Dark Side of the Genome*. London: Elsevier.

O'Donnell, T.C. 2020. *Fosterage in Medieval Ireland: An Emotional History. The Early Medieval North Atlantic*. Amsterdam: Amsterdam University Press.

Reiter, S.S. and K.M. Frei 2021. Examining Alternative Constructions of Power and Mobility in the Early Nordic Bronze Age: A Case Study of a Local Elite Female from Denmark, in C. Trémaud (ed.) *Mobilité, Genre et Archéologie. Dossier Du Les Nouvelles de l'archéologie* 163: 24-32.

Reiter, S., N. Algreen Møller, M.L. Jørkov, J.-H. Bech, R. Frei and K.M. Frei 2023.Tales from Ginderup Mound in Thisted County, Denmark: Further Investigations of Female Mobility in the Nordic Bronze Age. *Danish Journal of Archaeology* 12(1): 1-25.

Reiter, S.S., K.M. Frei, H.W. Nørgaard and F. Kaul 2019. Ølby Woman: a comprehensive provenance investigation of an elite Nordic Bronze Age oak-coff in burial. *Danish Journal of Archaeology* 8: 1-22.

Sen, A. 1993. Capability and Well-being, in M. Nussbaum and A. Sen (eds) *The Quality of Life*: 30-54. Oxford: Clarendon Press.

Sørensen, M.L.S. 2004. The Interconnection of Age and Gender: a Bronze Age Perspective. *Ethnographisch-Archäologische Zeitschrift* 45(2): 327-338.

Sørensen, M.L.S. 2022. Does the Archaeology/heritage divide need a rethink? *Archaeological Review from Cambridge* 37(1): 158-165.

Sørensen, M.L.S. 2024. The Construction, Performance, and Effects of Gender: Reflection on the Evidence from Prehistoric Burials, in M. Moen and U. Pedersen (eds) *Routledge Handbook of Gender Archaeology*: 211-222. Oxford: Routledge.

Tuan, Y.F. 1977. *Space and Place: The Perspective of Experience*. Minneapolis: University of Minnesota Press.

Van Tilburg, M.A.L., A.J.J.M. Vingerhoets and G.G.L. Van Heck 1996. Homesickness: A review of the literature. *Psychological Medicine* 26: 899-912.

Vandkilde, H. 2017. The Beautiful Warrior Twenty-one Years After – Bronze Age Warfare and Warriors. *European Journal of Archaeology* 20: 55-59.

Chapter 6

Coping with crisis: diverging economic and social trajectories in the Nordic Bronze Age

Kristian Kristiansen

Department of Historical Studies, University of Gothenburg, Sweden, and Globe Institute, University of Copenhagen, Denmark
k.kristiansen@archaeology.gu.se

Abstract

In this contribution I trace how long-term economic processes unfolded during the Bronze Age in Scandinavia creating both diversity and homogeneity. How did processes of change in one region of southern Scandinavia impact other regions? What kept together the different regions of Scandinavia within a shared Nordic idiom; how much was shared, and how much was different? These questions lead on to the integrating role of ideology: how did ritual display change direction during the Bronze Age, and what were the implication of these processes for social and political change? It is demonstrated that when contradictions arose during the Late Bronze Age, between an unsustainable economic practice and existing social and political practices, religious ontologies were mobilised in an expansive ritual display to suppress social and economic reform. Instead, elites increasingly separated themselves in larger kingdoms or super chiefdoms where social connections were with other elites, rather than with the commoners who were impoverished and suppressed.

Background

More than anyone, Helle Vandkilde has focused her research on one of the big historical questions in European prehistory: what brought about the technological change from Stone to Bronze Age, and what were the social, political, and economic implications of that change? In doing so, she has been able to integrate solid empirical research with theoretically informed, innovate interpretations. Thus, she demonstrated how the beginning of the Bronze Age proper unfolded into a global economy that she termed 'bronzization' (Vandkilde 2016).

In the following, I shall trace how long-term economic processes unfolded during the Bronze Age in Scandinavia, creating both diversity and homogeneity (Fig. 1). How did processes of change in one region of southern Scandinavia impact other regions? What kept

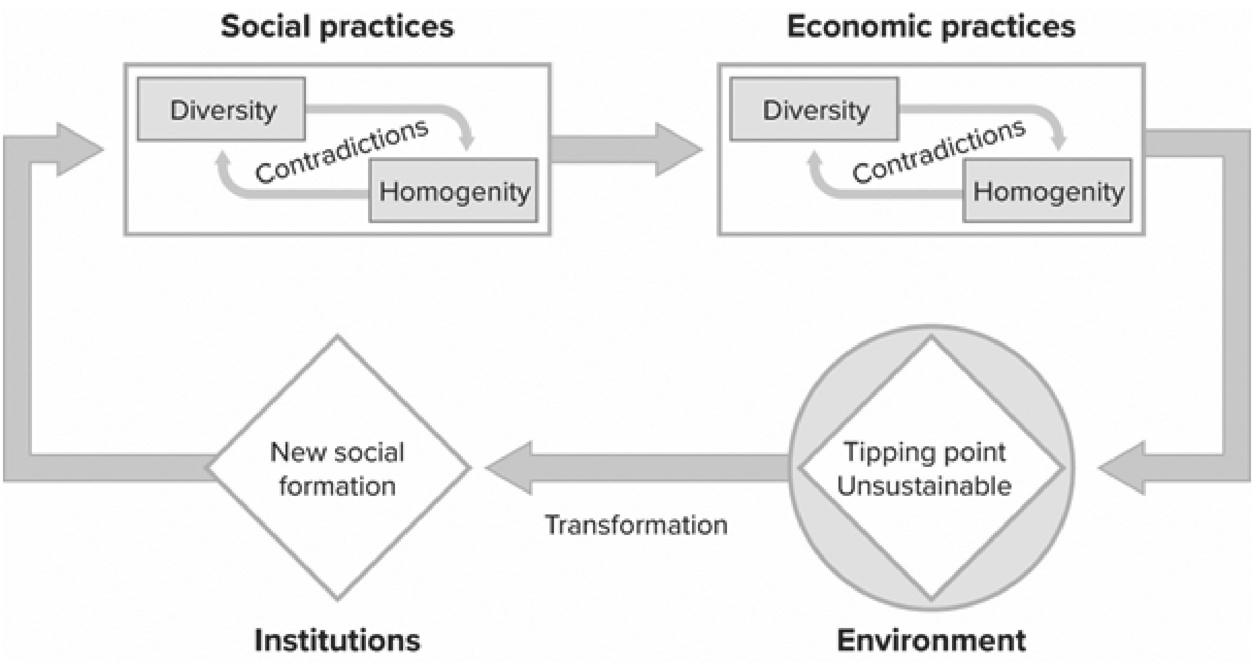


Figure 1: Theoretical framework for tracing long-term processes that may lead to social transformation (graph: K. Kristiansen; digital production: Rich Potter).

together the different regions of Scandinavia within a shared Nordic idiom; how much was shared, and how much was different? These questions lead on to the integrating role of ideology: how did ritual display change direction during the Bronze Age, and what were the implication of these processes for social and political change?

Theoretical framework

We need a theoretical framework to situate the basic social and economic parameters operating in a long-term perspective that might lead up to a major social transformation. Thus, I assume that a social transformation arises out of long-term gradual changes, that may reach a critical tipping point enabling change, or even making change inevitable in some instances.

I further assume that there is always a social and economic dynamic between diversity and homogeneity that could develop over time into unresolvable contradictions. There is an ongoing adjustment in every social system to changes. This can take many forms: from increasing hierarchies to flattening hierarchies. When resources are plentiful, consensus and homogeneity in social and economic organisation may prevail. When resources become scarce, harder decisions regarding the distribution of surplus production need to be taken. Thus, stronger households will often use their power to bring weaker households into debt relations. Over time, this may lead to them losing their social standing and freedom, becoming commoners or unfree (Gosden 1989; Kristiansen 2005: fig. 5.1).

The ultimate result of processes of internal contradictions will also have to take into account the role of environmental change, and the human impact on the environment. In short, sustainability defines limits to reproduction and can, thus, trigger major social transformations, including revolts, and conquest migrations. Finally, we need to consider the regulating role of ideology in sustaining and providing meaning to social life. I propose that there are two responses to an economic and social crisis: one of ideological reinforcement of power, which leads to increasing inequality, and one of ideological collapse or the weaking of power, which leads to decreasing inequality. There is also the possibility of an ideological reinvention of tradition, which can lead in both directions. We shall see all these processes at work during the Nordic Bronze Age.

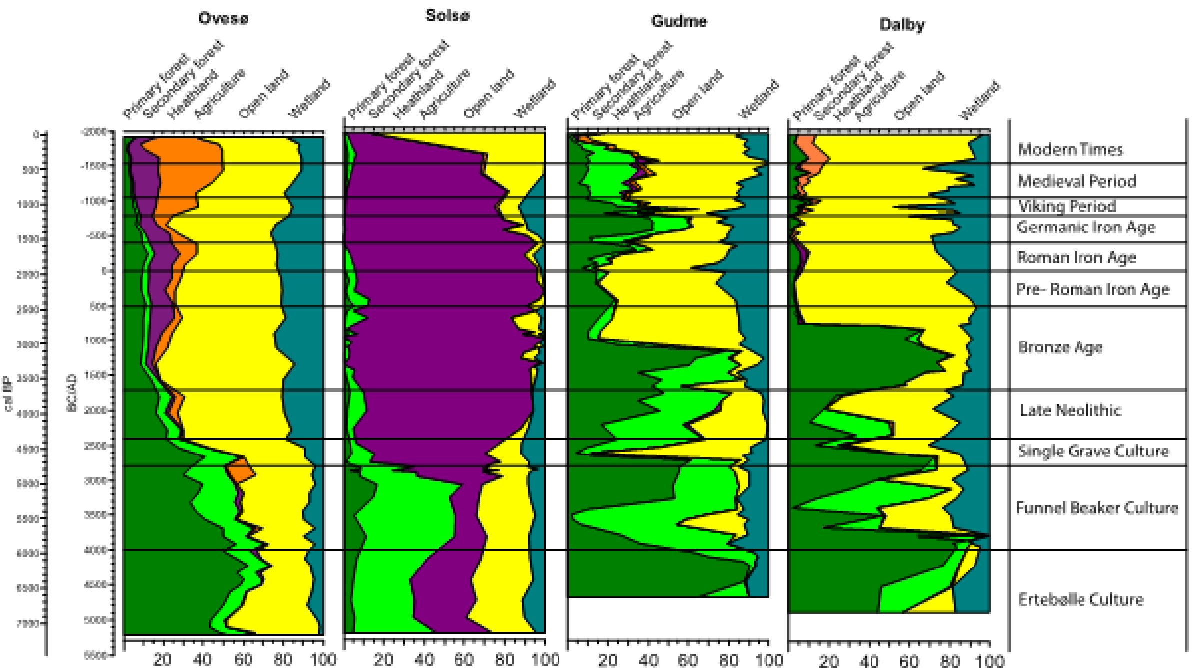


Figure 2: Absolute pollen diagrams from western and eastern Denmark. The x (horizontal) axis shows the percent of total pollen (20%, 40%, 60%, etc.) of the taxa (plant types – colour code) for each region. Ovesø and Solsø are located in Thy and western Jutland, Gudme on south Funen and Dalby on eastern Zealand. In Jutland, deforestation started in the early 3rd millennium and is re-enforced during the Early Bronze Age, while on Funen and Zealand a permanent opening of the landscape starts with the Late Bronze Age (Reveals and Love calibrations by Morten Fischer Mortensen and Anne Brigitte Nielsen, reproduced after Haak *et al.* 2024: fig. 5.7).

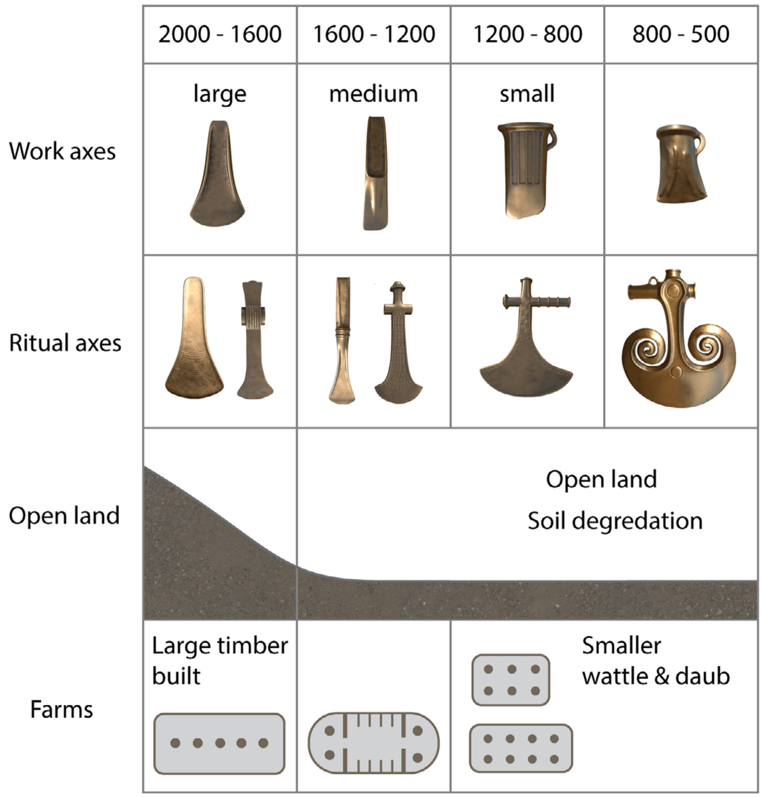


Figure 3: Summary model that shows major changes in land-use, farm types, and the changes of work axes and ritual axes in south Scandinavia (graph: K. Kristiansen; digital production: Rich Potter).

Coping with crisis: diverging trends during the Bronze Age

During the Bronze Age, we observe a west to east gradient of increasingly open landscapes. Starting in western Jutland and Thy during the period 1450-1100 BCE, the process continued during the Late Bronze Age on the Danish Isles and in Scania. For Denmark, this development is summarised in four pollen diagrams (Fig. 2).

This general process has previously been documented and discussed (Kristiansen 1981). It was concluded that 'the economic decline in western Scandinavia was counterbalanced by an economic expansion in eastern Scandinavia.' Further 'when viewed in this perspective we may regard the local economic declines and rises as part of the reproduction of the larger Scandinavian system' (Kristiansen 1981: 253).

Thus, in response to environmental and economic decline in western Scandinavia, there were local migrations towards better soils in Jutland, as well as new colonisation in Sweden of inland forest zones and coastal zones. In this way, the overall system was maintained. During the last 20 years, new pollen diagrams, as well as evidence from hundreds or even thousands of Bronze Age houses and farms, allowed a shift from burial evidence to settlement evidence. It has provided a new and fresh look at the integrating role of households during the Nordic Bronze Age (Kristiansen 2013). It also provided new evidence of regional economic specialisation, which I shall now discuss.

Recent case studies from Thy have detailed our knowledge of the mechanisms behind the rise and fall of this region during the Early Bronze Age (Kristiansen 2018). Among the processes were deforestation leading to lack of timber for house construction, as well as a gradual degradation of soils stimulated by excessive mound construction during this period (Holst *et al.* 2013). There is much to suggest that similar processes took place during the Late Bronze Age in east Denmark and Scania, when considering the pollen evidence (Fig. 2; Kristiansen 2013: 248-251).

This development is reflected (among other things) in a change in house construction from timber walls to wattle and daub, and from large houses to smaller houses (Kristiansen 2013: fig. 13.10). It is also reflected in a gradual decline of work axes from Early to Late Bronze Age (Fig. 3). During the Late Neolithic period (*c.* 2100/2000-1700 BCE), large axes testify to the need for forest clearance, as this was a period of expanded land-use and internal colonisation (for an overview see Vandkilde 1996). The large timber build farmhouse dominated. The period 1600-1200 BCE saw less demand for new clearances, but solid timber houses were still being built, even if they downsized towards the later part of the period. They were gradually replaced by small houses with wattle and daub walls, which did not demand the use of heavy axes. Consequently, they were reduced in size and became socketed. This downscaling in both house sizes and construction quality no doubt reflects a decline in living condition for most households in south Scandinavia.

However, there is an important deviation from this trend in central and eastern Sweden, where the rather heavy Mälar axes bear witness to the need for continued forest clearance and settlement expansion. This falls in line with the rise of the Baltic region as an important and interconnected maritime world (Ljunge and Wehlin 2022). It distinguishes itself from the south Scandinavian development with an emphasis on ship setting burials, as well as fortifications (Wehlin 2012).

A reverse development to the work axes can be observed in ritual axes in Denmark/Scania. As exploitation of the environment increased during the Late Bronze Age, ritual display was scaled up. Foreign imports and gold were now assembled in a few centres of wealth, i.e. Voldtofte on southwest Funen (Thrane 2019), Borgbjerg Banke in western Zealand, Håga in Uppland, and Seddin in north Germany. They reflect a new concentration of wealth and power, based on political control of larger regions (Kristiansen 1998: fig. 97), where local households became clients to support the new royal centres (Kristiansen 1998: fig. 96). International trade and confederacies between the new royal elites supported the system until the end of the Bronze Age, when it collapsed as iron took over as the dominant metal.

Thus, western and eastern Scandinavia display opposing trajectories, where in the west no aristocratic environments took hold. It rather seems that instead they shifted social organisation in order to pursue a more egalitarian ideology, in opposition to southern Scandinavia. How were these processes linked to developments in central Scandinavia? In southwest Norway, we observe similar developments as in northwest Jutland and Thy. Further along the Norwegian coastline, Bronze Age settlements are linked also to marine economies (Austvoll 2021), as well as an expansion of grazing into the mountain region, introducing a new economy of seasonal transhumance (Prøsch-Danielsen *et al.* 2020). Thus, sustainable local economies took hold with only modest elite display, even if rock art and house architecture show continued affiliation with the Nordic tradition. A related development took place in Scania and eastern Sweden. I concluded in 2013: 'during the Bronze Age a diversified economy developed that integrated a coastal maritime economy, an extensive forest economy and an intensive herding and farming regime in the central settlements through various forms of trade, gift exchange and tribute' (Kristiansen 2013: 251). During the Late Bronze Age, this led to a demographic and economic flourishing in east Scandinavia and the Baltic region, where a renewal of tradition took place (also visible in rock art; see Ling 2012). It extends well into Period VI of the Nordic Bronze Age (NBA), and it distinguishes itself from the south Scandinavian development with an emphasis on ship setting burials, as well as fortifications (Wehlin 2013).

However, it remains an unresolved question how the end of the Bronze Age unfolded, and the role of iron technology (Sörman and Ojala 2022). While a radical change of settlement organisation from single farms to villages takes place in Jutland after 500 BCE, perhaps an even earlier start might be considered in light of early Iron Age Urnfield cemeteries (Rose and Meadows 2024). No such change is observed in southeast Scandinavia. What we witness in southern Scandinavia is the fall of the royal centres of wealth by the end of NBA VI. For some of these (e.g. Seddin and Voldtofte), this may perhaps have taken place even earlier. How this process unfolded is still unknown. It leads on to a theoretical reflection about how we can find balance between long-term processes and the small-scale local processes of everyday life.

Conclusion

In Vandkilde's seminal book about the metal hoard from Pile (Vandkilde 2017), the subtitle is: 'places, things, metals and worlds around 2000 BC'. The attempt to embrace the life worlds of the past has often been opposed to the scientific goal of exposing those long-term historical processes that operated above and beyond the knowledge and experience of everyday individuals and communities. This dialectic has a long history, variously termed hermeneutics vs. social evolution, local agency vs. world systems, and more recently post-humanism vs. science, or non-Cartesian vs. Cartesian perceptions of the world (Kristiansen 2022: 22-26). Such dualisms I consider unproductive, because they are unable to grasp the complexities of both the real world and of history. When studied in isolation, or even worse: when confronted as true or false ontologies, they become political ideologies (Hornborg 2016). Instead, we should consider them to be bound to each other in a dialectic relationship. Both the past and the present are too complex to be represented by a single ontology. Several ontologies

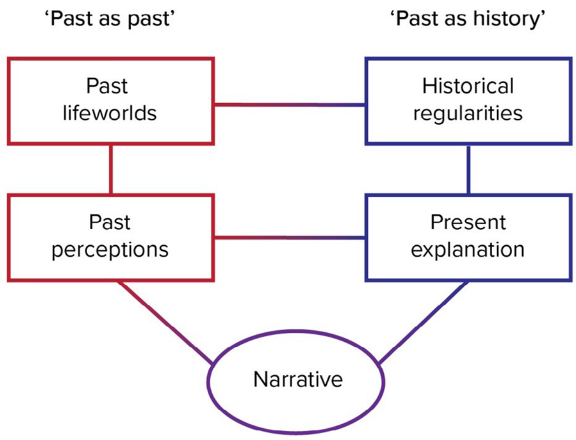


Figure 4: Model of the dialectic relationship between 'Past as past' and 'Past as history' (graph: K. Kristiansen; digital production: Rich Potter).

have always been at work simultaneously throughout history (Kristiansen 2022: fig. 8).

Thus, I propose that the observed long-term contradictions between environmental sustainability and social forces, supported by ritual practices and religious cosmologies, can be explained by an ongoing competition between different and sometimes competing ontologies. They represent an ongoing 'dialogue' or dialectic between lived experiences that would often lead to rational choices versus social and ritual practices sometimes leading to irrational choices, by maintaining existing power relations, or even re-enforcing them. When practice become institutionalised it tends to fossilise, which is the root of contradiction. But practices of everyday life can also fossilise and turn into traditions of 'what used to work'.

I suggest that when contradictions arose during the Late Bronze Age, e.g. between an unsustainable economic practice and existing social and political practices, religious ontologies were mobilised in an expansive ritual display to suppress social and economic reform. Instead, elites increasingly separated themselves in larger kingdoms or super chiefdoms where social connections were with other elites, rather than with the commoners who were impoverished and suppressed through the display of a combination of religious and military power. However, these processes in the Danish Islands and northern Germany were counterbalanced by an opposite process in parts of central and western Jutland, where we find no elite burials, and where the metal supply had declined (Kristiansen 1981: fig. 18.10). This may represent a flattening of social hierarchies. Consequently, this is also the region where iron was introduced earlier than in southeastern Scandinavia, and with that a more egalitarian social organisation. A related development can be observed in southwest Norway and further north along the Norwegian coast (Ljunge and Wehlin 2022). At the same time, we witness a demographic and economic flourishing of eastern Scandinavia and the Baltic region, where a renewal of tradition took place, extending well into NBA VI. It distinguishes itself from southern Scandinavian development with an emphasis on ship setting burials as well as fortifications (Wehlin 2013). These Late Bronze Age regional divergencies can be considered a prelude to continued regionalisation during the Pre-Roman Iron Age, a transformation that is still badly understood. However, it must represent the collapse of a shared Nordic Bronze Age ideology, that had been maintained for a thousand years, even if applied differently in the different regions of Scandinavia.

Bibliography

Austvoll, K.I. 2021. *Seaways to complexity: a study of sociopolitical organisation along the coast of northwestern Scandinavia in the Late Neolithic and Early Bronze Age*. Sheffield: Equinox.

Gosden, C. 1989. Debt, production, and prehistory. *Journal of Anthropological Archaeology* 8: 355-387.

Haak, W., M. Furholt, M. Sikora, A.B. Rohrlach, L. Papac, K.-G. Sjögren, V. Heyd, M.F. Mortensen, A.B. Nielsen, J. Müller, I. Feeser, G. Kroonen and K. Kristiansen 2023. The corded ware complex in Europe in light of current archaeogenetic and environmental evidence, in K. Kristiansen, G. Kroonen and E. Willerslev (eds) *The Indo-European Puzzle Revisited: Integrating Archaeology, Genetics, and Linguistics*: 63-80. Cambridge: Cambridge University Press.

Holst, M.K., M. Rasmussen, K. Kristiansen and J.-H. Bech 2013. Bronze Age 'Herostrats': Ritual, political, and domestic economies in Early Bronze Age Denmark. *Proceedings of the Prehistoric Society* 79: 265-296 (available at: CJO 2013 doi:10.1017/ppr.2013.14).

Hornborg, A. 2016. *Global Magic. Technologies of Appropriation from Ancient Rome to Wall Street*. New York: Palgrave Macmillan.

Kristiansen, K. 1981. Economic models for Bronze Age Scandinavia – Towards an integrated approach, in A. Sheridan and G. Bailey (eds) *Economic Archaeology – Towards an Integration of Ecological and Social Approaches*: 239-303. British Archaeological Reports International Series 96. Oxford: BAR Publishing.

Kristiansen, K. 1998. *Europe before History*. Cambridge: Cambridge University Press.

Kristiansen, K. 2013. Households in context: cosmology, economy, and long-term change in the Bronze Age of Northern Europe, in M. Madella, G. Kovacs, B. Berzsenyi and I.B. Godino (eds) *The Archaeology of Household*: 235-268. Oxford: Oxbow Books.

Kristiansen, K. 2018. The rise and fall of Bronze Age societies in Thy, northwest Jutland, in J.-H. Bech, B.V. Eriksen and K. Kristiansen (eds) *Bronze Age* *settlement and land-use in Thy, northwest Denmark, Vol. 1*: 107-132. Højbjerg: Jutland Archaeological Society.

Kristiansen, K. 2022. *Archaeology and the Genetic Revolution in European Prehistory*. Cambridge: Cambridge University Press.

Ling, J. 2012. *Rock Art and Seascape in Uppland Rock Art and Seascapes in Uppland*. The Swedish Rock Art Research Series. Oxford: Oxbow Books.

Ljunge, M.O. and J. Wehlin 2022. Outlining the study of Nordic Bronze Ages. Moving from singularity to diversity, in A. Tornberg, A. Svensson and J. Apel (eds) *Life and afterlife in the Nordic Bronze Age. Proceedings of the 15th Nordic Bronze Age Symposium held in Lund, Sweden, June 11-15, 2019*: 11-26. Lund: Lund University.

Prøsch-Danielsen, L., C. Prescott and E.D. Fredh 2020. Land cover and exploitation of upland resources on the Høg-Jaeren plateau, southwestern Norway, over the last 6500 years. *Journal of Archaeological Science. Reports* 32: 102443 (available at: https://doi.org/10.1016/j.jasrep.2020.102443).

Rose, H.A. and J. Meadows 2024. Dividing time - An absolute chronological study of material culture from Early Iron Age urnfields in Denmark. *PLoS One* 19(5): 1-55 (available at: https://doi.org/ 10.1371/journal.pone.0300649).

Sörman, A. and K. Ojala 2022. Iron in the Nordic Bronze Age and Early Pre-Roman Iron Age – Visibility, colour contrasts and celestial associations. *Norwegian Archaeological Review* 55(2): 107-139 (available at: https://doi.org/10.1080/00293652.2022.2068157).

Thrane, H. 2019. Lusehøj at Voldtofte, South East Funen in its chorological setting-the best parallel for Seddin?, in S. Hansen and F. Schopper (eds) *Der Grabhügel von Seddin im norddeutschen und südskandinavischen Kontext: internationale Konferenz, 16. bis 20. Juni 2014, Brandenburg an der Havel*: 91-104. Wünsdorf: Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum.

Vandkilde, H. 1996. *From Stone to Bronze. The Metalwork of the late Neolithic and earliest Bronze Age in Denmark*. Aarhus: Jutland Archaeological Society.

Vandkilde, H. 2016. Bronzization: The Bronze Age as pre-modern globalization. *Praehistorische Zeitschrift* 91(1): 103-123.

Vandkilde, H. 2017. *The metal hoard from Pile in Scania, Sweden. Place, things, time, metals, and worlds around 2000 BCE*. Aarhus: Aarhus University Press, The Swedish History Museum.

Wehlin, J. 2013. *Östersjöns skeppssättningar. Monument och mötesplatser under yngre bronsålder*. GOTARC Serie B. Gothenburg Archaeological Theses 59. PhD. Thesis, Gothenburg, Gothenburg University.

Wehlin, J. 2012. Accompanying the stone ships: circular stone settings in relation to the Gotlandic ship settings, in R. Berge, M. Jasinski and K. Sognnes (eds) *N-TAG ten: proceedings of the 10th Nordic TAG conference at Stiklestad, Norway 2009*. British Archaeological Reports International Series 2399. Oxford: Archaeopress.

Part 2

A Mobile Bronze Age – the Archaeological and Scientific Evidence of Mobility

"The geographical range of the Bronze Age is by comparison limited, but much more far-reaching than the area occupied by societies of the Chalcolithic period, when copper was first introduced and put to use. The Bronze Age is the widest-ranging area of cultural-economic connectivity known from pre-modern times. It can be defined by the use of history's first alloy and by societies dependent on copper-based metallurgy in general. It was preconditioned and enhanced by far-ranging traffic in metals, whose significance came to permeate and boost economy and culture in a fruitful partnership which had fundamental consequences for people and their societies."

(Vandkilde 2016: 104)

Chapter 7

Bronzization and the people: Bioarchaeological perspectives on Bronze Age individuals and populations in Southern Sweden

Anna Tornberg

Department of Archaeology and Ancient History, Lund University, Lund, Sweden
anna.tornberg@ark.lu.se

Abstract

Globalisation is characterised not only by long-distance exchange by commodities and people, but also by a microbial unification of the world (*une unification microbienne du monde*), as was described by Emmanuel Le Roy Ladurie in the 1970s. Proof of microbial unification can be seen through the dramatic consequences of the Black Death in the 14th century CE as well as the Covid-19 pandemic, which is still fresh in our memories. Contemporary globalisation which pushed forward and was boosted by industrialisation in the 19th century, resulted in modernisation and scientific advances. It also increased socioeconomic differences within and between states and populations. Countries that pushed industrial development generally represent today's strongest economies, which also exhibit the highest life expectancies at birth. For Sweden, the phenomenon resulted in a drastic decrease in infant mortality and a simultaneous increase in average adult male statures (180.5 cm) as Sweden transformed from a poor agricultural to an industrialised society with one of the world's highest income rates per capita (GDP) today. At the same time, Malawi, a country with one of the lowest GDP in the world, has average adult male statures 15 cm lower than those in Sweden. Thus, globalisation has substantially affected several different parameters of health and lifeways, both for individuals as well as for overall populations.

Although on a lesser scale, the intercommunity contact and development associated with the transition to the Bronze Age share many traits with contemporary globalisation. This phenomenon – which Helle Vandkilde coined 'bronzization' – is, thus, potentially cojoined with several changes in living conditions for both single individuals as well as for populations throughout Europe. Through recent advances in biomolecular archaeology and osteological analyses of pathological lesions, demography and stature, in the following I explore how bronzization affected health and lifeways in southern Scandinavia over the transition of the 3rd to 2nd millennium BCE.

Introduction: Globalisation and people – health effects and consequences

Is globalisation really good for us? Globalisation not only affects the economy, but also has a huge impact on health. Vandkilde (2016)[1] argues that, with bronzization, the Bronze Age should be considered as a form of globalised world. The onset of modern globalisation might be traced back to the long-distance mobility associated with pilgrimage and religious warfare, which brought new pathogens into previously unexposed communities. Emmanuel Le Roy Ladurie (1973) traced such a microbial unification back to the 12th century (with the sinister high point of the Black Death in the mid 14th century). Recently the origin of the plague has been traced back to present-day Kyrgyzstan (Spyrou *et al.* 2022). With modern industrialisation and faster travel, the spread of infectious diseases was amplified. While scholars working with public health primarily see globalisation as hazardous, economists tend to focus on aspects of economic growth (or lack thereof) and inequality (Deaton 2004). But perhaps it is wrong to separate them if we seek understanding of the knock-on effects on health due to globalisation; economic growth, poverty, and inequality definitely affect health outcomes. At the same time, they are also interconnected with infectious outbreaks. Generally, malnourished individuals suffer poor prognosis when it comes to surviving infections, as infections further deepen malnourishment. Inequality, likewise, promotes health in a subset of a populations while it suppresses it in others. Inherent in the term globalisation is also the interconnectivity of people over long distances. In the modern era we travel fast and far, quite literally around the globe. In a population of eight billion people, disease currently has the potential to infect the whole world within a very limited amount of time. Moreover, many of these people are city dwellers in often extremely densely populated areas. Therefore, they meet many other people daily. People living in large cities are also those who perform long-distance travels the most

[1] Helle, your work has been one of the main contributors for my interest in the Late Neolithic and Early Bronze Age. Not only has your work always been thorough and insightful, but it explores the large questions with a curiosity and ambition measurable against few others. Your ambition and curiosity have not diminished over the years but have instead led you to discover new methods and combinations thereof. You have embraced the opportunities the third science revolution has opened for archaeology and your own quest for answers. I am thankful for the pursuit for an understanding of past violence and warfare that we have shared, and I hope that this small interdisciplinary approach to bronzization can give you some new food for thought.

(Czepkiewicz *et al.* 2018). Together, these characteristics form the perfect storm for infections. The Covid pandemic and its effects remain unpleasantly fresh in the world's memory.

An example of the complexity in the question of globalisation benefits and disadvantages is provided in the work of Pim Martens and colleagues (2010). They analysed the correlation between the degree of globalisation and mortality on a global scale and found that there is a positive relationship between globalisation and health (infant, child, and adult <60 years mortality). The authors used the Maastricht Globalization Index (MGI) (Martens and Zywietz 2006), measuring variables such as frequencies of embassies and organisations, trade (both military and non-military), capital, migrants and tourists, Eco footprint and technology (i.e. phone and internet). Sweden, together with Denmark, Germany, France, and Britain score highest on the MGI. However, all these countries also have well-functioning health care systems, good economies and lack severe endemic infections, such as malaria. The countries that score lowest on the MGI are most countries in Africa and South America, as well as India, Pakistan, Kazakhstan, and Mongolia (Martens *et al.* 2010). These countries have long histories of suppression and meet one or several criteria from the United Nations' Least Developed Country (LDP) category (United Nations 2023) and are additionally plagued by many severe endemic infectious diseases. Nevertheless, there are ongoing changes towards economic development in these areas as well. So, instead of defining globalisation as favourable for health, it might be adequate instead to view globalisation as an effect of the relative abundance of means (health, economy) in a positive feedback loop in which economy (and functioning health care systems) and globalisation fuel each other. The work by Arno Tausch (2016) provides support for the argument that improvements in public health were directly associated with globalisation only in very limited cases, and that globalisation led to increased inequality in health between and within countries in a centre-periphery manner. Improvement in healthcare went hand-in-hand with globalisation instead of being a direct effect of it, and might as such be a prerequisite for high MGI in modern globalisation.

While modern globalisation both drove and was boosted by industrialisation and trade, it is pertinent to also consider prehistoric industrialisation as inherently linked to bronzization. While not at same scales, Jan Apel (2001) argues for flint dagger production in industrial proportions with increased specialisation and hierarchisation. Battle axe production and distribution in Chalcolithic Corded Ware groups might be relevant to consider as the onset of such specialisation, which developed and increased within later Bell Beaker and contemporaneous societies. Specialisation and the trade of specialised products, thus, had the potential to be cojoined by infections. New genetic-led research suggests that severe infections were present already in the Neolithic (e.g. Bergfeldt *et al.* 2024; Seersholm *et al.* 2024; Krause-Kyora *et al.* 2023; Fuchs *et al.* 2019; Rascovan *et al.* 2019). There are several examples of new pathogens entering areas with massive infectious outbreaks as a result. The spread of European pathogens into America in the early modern era and the subsequent decimation of some populations is well known.

So, based on knowledge of the effects of modern globalisation, what kind of biocultural responses can we expect in the bronzization process? Infectious disease is devilishly difficult to assess in skeletal remains due to most infections being acute, i.e. resulting either in recovery or death in a span of days or weeks. Hence, acute infections do not leave detectable traces on bones. There are, however, other measures that are relevant to assessing health that will be explored here. I will especially approach the bioarchaeology of bronzization through four different themes: 1) diet and stature; 2) general health; 3) demography; and 4) violence. Although the emergence and/or rapid propagation of new diseases are tightly coupled with urban settings, high intercommunity contact, especially over long distances, substantially increases the risk of spreading new types of hazardous pathogens. These pathogens affect health and, by extension, the demography of a society. As such, in a highly mobile Bronze Age, these aspects are relevant for exploring bioarchaeological consequences of bronzization. As a point of departure, I also outline evidence for increasing biocultural complexity based on burial practice and evidence for mobility.

Vandkilde (2016) proposes four different phases of bronzization: beginning (*c.* 2200-2000 BCE); growth (1600 BCE); decline (1200 BCE); and conclusion (*c.* 750 BCE). It is likely that biocultural consequences changed throughout the 1400 years of the bronzization process, as it did from the onset of modern globalisation and urbanisation in the Middle Ages (beginning), throughout the growth with industrialisation and the digital era. We still have not experienced the decline and conclusion of current globalisation. Nevertheless, the biocultural consequences of the early and mid-stages of modern globalisation are significantly different than what we experience today, at least in high-income countries. These dramatic changes in well-being and health are tightly connected to sanitation, nourishment, and modern health care (especially vaccinations). The effects are visible as a dramatic decrease in child mortality, coupled with a clearly elevated life expectancy and increased stature in globalisation centres. The demographic profile changed from a clear

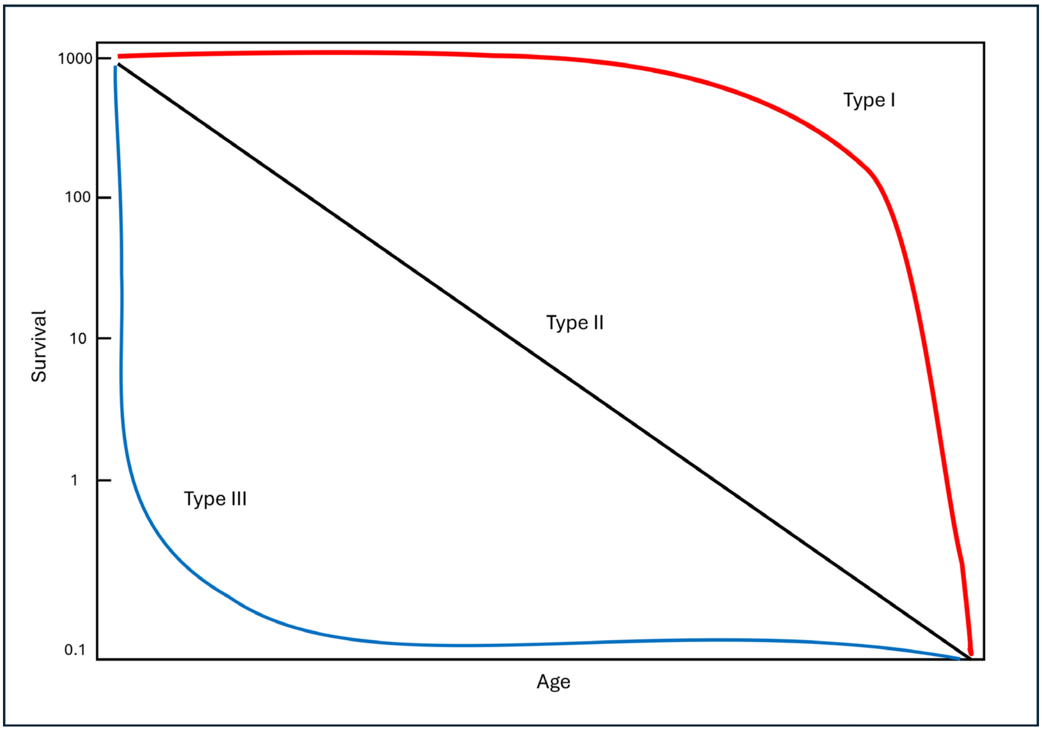


Figure 1: Schematic figure of demographic curves: Type 1: most deaths occur in early childhood. This mortality is typical for preindustrial urban societies; Type II: constant attrition throughout the lifespan. Several paleodemographic studies suggest this mortality pattern for many prehistoric societies (see Ahlström 2015; Tornberg 2018a); Type III: most deaths occur in late life and childhood mortality is very low. This is a mortality profile in well-developed countries of today (graphic: author).

bathtub shape (type I mortality), where only half of the population survived childhood, to a square shape (type III mortality), where most deaths occur in late life (Fig. 1). This change also brought about other changes such as decreased fertility and higher abundance of late-life diseases such as cancer. Unfortunately, the change towards cremation burial practice *c.* 1300 BCE leaves scant bioarchaeological health data in the bronzization decline and conclusion phases.

Outline of bronzization's development from grave data: burial complexity and mobility

Skeletal remains from Late Neolithic southern Sweden have in recent years gained new scholarly interest. While the work of Malou Blank has primarily been focusing on the chronology, diet and mobility of Late Neolithic-Early Bronze Age Västergötland in southwest Sweden (Blank 2021), I have primarily been focussing on questions related to health and demography in Scania, southernmost Sweden (Tornberg 2018a) (see Fig. 2). The area of Falbygden is known from the numerous megalithic graves from the Middle and Late Neolithic in a limited area. The area must have been vibrant and had substantial intercommunity contact. Megalithic graves are frequent in Scania but their counts are substantially less and more sparsely arranged than in the Falbygden area. While Scania also accounts for a noticeable number of flat grave inhumations, especially from the early part up until *c.* 2000 BCE, they are lacking in Falbygden. However, stray grave good finds are present and probably reflect ploughed-out flat graves.

The construction of gallery graves seems to have started *c.* 2000 BCE in both Västergötland and Scania. Malou Blank radiocarbon-dated skeletal remains from 125 individuals from 24 gallery graves in Västergötland (Blank 2021), while Sophie Bergerbrant and colleagues (2017) and Anna Tornberg (2016) have published radiocarbon dates from Scania. While the radiocarbon dates from Västergötland cluster in Late Neolithic II (LN II, *c.* 2000-1700 BCE), the vast majority of the dated gallery grave individuals from Scania were of Bronze Age date. In addition to megalithic inhumations, the Late Neolithic I (LN I, *c.* 2300-2000 BCE) flat grave tradition continues throughout the Late Neolithic and into the Early Bronze Age (Bergerbrant *et al.* 2017; Tornberg 2016). The introduction of mound burials in the Early Nordic Bronze Age period II (NBAII, 1500-1300 BCE) adds to the burial complexity of Scania, which might be linked to differential burial traditions in relation to social stratification (Bergerbrant *et al.* 2017; Tornberg 2016). Mound burials are lacking in Västergötland while prominent Bronze Age cairns are present in the core area of Bohuslän to the west, plausibly connected to a re-negotiation of regional centre due to changed trade network.

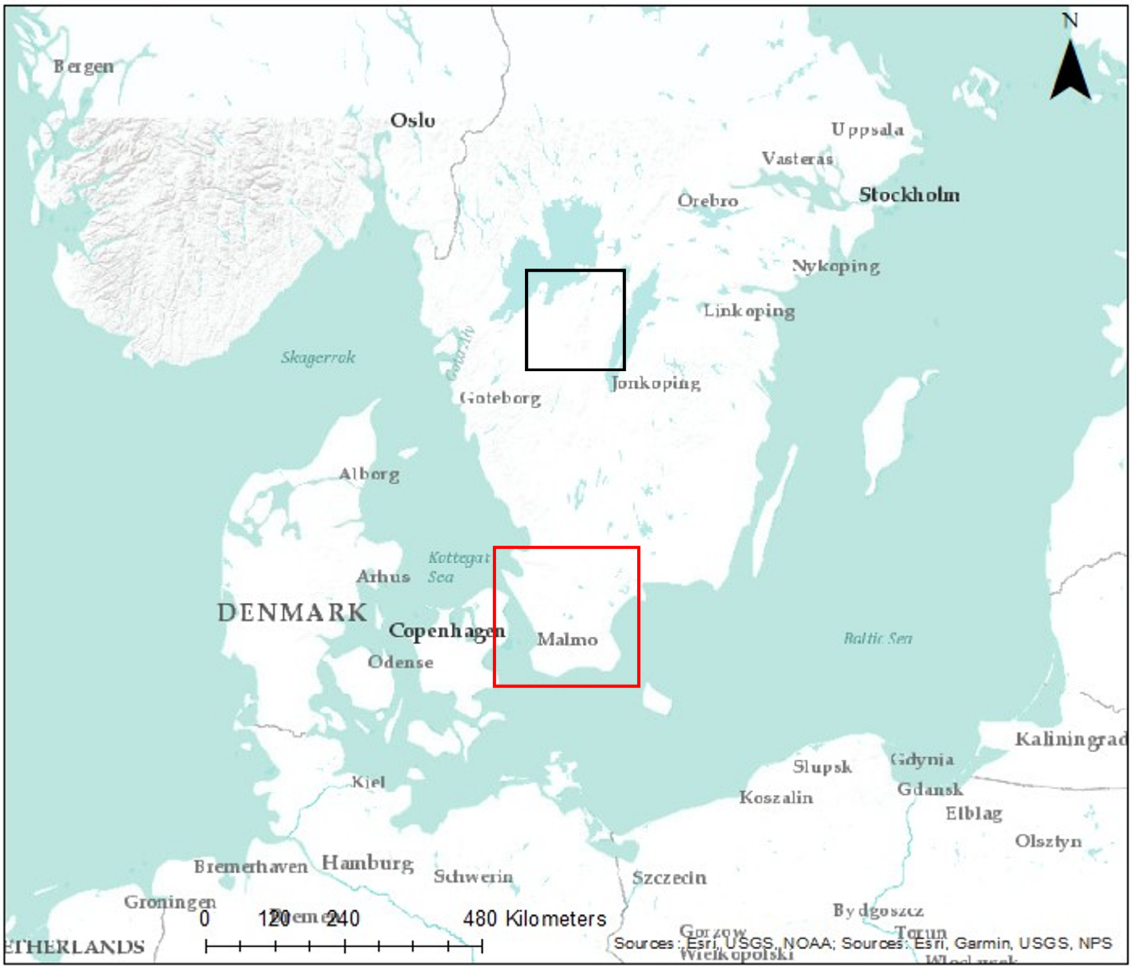


Figure 2: Map with the two focus areas marked. Västergötland = black; Scania = red (map: the author, using ArcMap by Esri).

There are clear tendencies which suggest that mobility in southern Sweden increased between the beginning and growth phases of the bronzization process, which plausibly could be linked to new and developed trade networks. Strontium isotope analyses allow separation between individuals of local and non-local origin, or rather, if the individuals grew up in the same area in which they were buried. To trace mobility, baselines with bioavailable strontium isotope values must be available and well established. Pernille Ladegaard-Pedersen and colleagues (2021) divide Scania into four different areas depending on bioavailable strontium data. However, the areas are large and partially overlap. This means that what is to be considered local might sometimes encompass all of Scania. Falbygden, on the other hand, is a geologically distinct area with bioavailable strontium values that are significantly different from the surroundings. This fact makes it easier to separate individuals local to Falbygden from non-locals. In her data set, Blank (2021: 81) clearly shows not only an increase in individuals of non-local origin in the LNII related to the Middle Neolithic (MNA/MNB) and LNI in Falbygden, but also that the variation in strontium values increases. Furthermore, the number of individuals with non-local signals from outside of Västergötland both increase in this period and reflect completely different origins than the equivalent from the MNA/MNB. While the extreme non-locals dating to the MNA/MNB exhibit signatures present in, e.g., Scania, the LNII individuals dating show signatures associated to the older bedrocks further north. It is likely that this change corresponds to a change in trade or social networks towards northeast instead of south.

Scania has not been subjected to the same level of detailed mobility studies of LN-EBA populations, probably due to the complexity of Scania's bioavailable strontium baseline. Bergerbrant and colleagues (2017), however, analysed 59 individuals, of which 31 were from the LN and 28 were from the EBA, with interesting results. Based on baseline data from Zealand (0.7090-0.7011; Frei and Frei 2011: 329) for south-west Scania and on the dominating values of the sampled individuals of 0.7100-0.7170 for eastern Scania, they found that 11 individuals were of non-local origin; one from LNI, two from LNII, and seven from the EBA (Bergerbrant *et al.* 2017). These numbers correspond to an estimated of 12.9% of the population with a non-local origin in the LN and 25% in the EBA – a clear increase. Four of the individuals with strontium isotope values between 0.7235-0.7272 were interpreted as non-local to Scania, but might be individuals with origins on the island of Bornholm, although other areas north of Scania are also possible. Archaeological evidence, e.g. the Bornholm fibula from NBA III, however, directs origin thoughts towards Bornholm rather than to the north (Bergerbrant *et al.* 2017). Ladegaard-Pedersen (2021) defines the local baseline values for Scania as 0.71350-72366 in area 1, 0.70918-0.71930 in area 2, and 0.70820-0.71412 in area 3-4. Hence, it is possible that some of the four individuals found to be non-local to Scania might also have originated in area 1 in the very north. The western part of Scania, furthermore, has a larger range of bioavailable strontium signatures than what was assumed by Bergerbrant and colleagues (2017), which might mean that some of the individuals identified as non-locals might in fact be of local origin.

To sum up, Scania seems to be characterised by an increase in burial complexity from the beginning of bronzization to the growth phase, likely reflecting similar increases in social complexity and hierarchisation. The same pattern is not visible in Västergötland, where the lack of monumental mound or cairn burials rather reflects a shift in the sociopolitical centre towards Bohuslän to the west in the EBA. This shift might reflect the increasing demand for proximity to the sea due to trade and political networks along the water. Both Scania and Västergötland, however, clearly demonstrate that mobility increases and changes in the later part of the LN and in the EBA. The data is stronger in Västergötland due to higher numbers of samples and better resolution in bioavailable strontium baselines, and the data supports a completely new area of origin for many individuals to the north-east. The network seems to expand not only in numbers but also in distance.

The secondary products revolution (SPR) and bronzization: dietary evidence

It might be somewhat surprising to delve into dietary patterns when discussing bronzization, but, in fact, subsistence and dietary patterns could be considered the very foundation of the development of Bronze Age societies. The secondary products revolution (SPR), as coined by Andrew Sherratt (1981), encompasses the shift in focus from primary agropastoral products, such as meat, to secondary products, such as milk, and traction. This shift in focus allowed increased access to food, as livestock could be milked but kept alive, while also increasing the amount of arable land as well as yields due to primitive ploughs drawn by oxen. Hence, the exploitation of secondary products made pastoralism a more favourable enterprise. Growing herds could graze on less fertile soils – where cultivation was hard or impossible (Sherratt 1981). This revolution not only enabled population growth, but also helped create a food surplus which could be traded. Sherratt clearly connects SPR with the rise of complex societies (Sherratt 1997; Greenfield 2010: 31). All the above are also considered as triggers for the development of Bronze Age societies (Earle 1989). Brian Hayden (1995: 21) argues that social inequalities and economically based hierarchies emerge when these kinds of continuous resource surpluses are available, and it is, therefore, of interest to evaluate both diet as such as well as biocultural health responses from skeletal remains.

Blank (2021) analysed the dietary patterns of Falbygden using stable isotopes in a substantial number of individuals (n=161). While both the MNA and the LN-EBA populations have clear evidence of a terrestrial diet, there are distinct differences between and within the datasets. Both farming and pastoralism were important in Falbygden throughout the Neolithic, a fact supported by studies of macrofossils, animal bones, and stable isotopes. When comparing collagen-apatite spacing, i.e. the protein versus total diet composition, there is no difference between the MNA and LN-EBA: both periods evidence a substantial intake of carbohydrates (Blank 2021: 93-97). However, the protein contribution in the LNII-EBA portion of the population seems to be from a lower trophic level, reflected in a decrease in $\delta^{15}N$ values (Nitrogen-15). The individuals also exhibit a more varied diet, possibly linked to migration and/or social differences. LNI values more closely resemble earlier than later ones. This difference might reflect a change in diet, climate, or farming practices. Animal bone assemblages in MNA settlement contexts are dominated by the omnivorous pigs, which could explain relatively higher values (Sjögren *et al.* 2019). LN-EBA bone assemblages are extremely scarce, which is why there is currently only a very vague understanding of species contributions to the LN-EBA diet. Proteomic analyses from dental calculus in Falbygden, however, give evidence of the consumption of cattle and goat milk in the LN (Fotakis *et al.* forthcoming), which at least confirms that products from cattle and goats were part of the diet. Blank (2021: 96) instead links the decrease in $\delta^{15}N$ values to a change in farming strategies, where farming was conducted more extensively on soils that were manured to a lesser degree than was previously the case. The argument is supported by similar reports from Denmark (Gron *et al.* 2021). The argument is sound

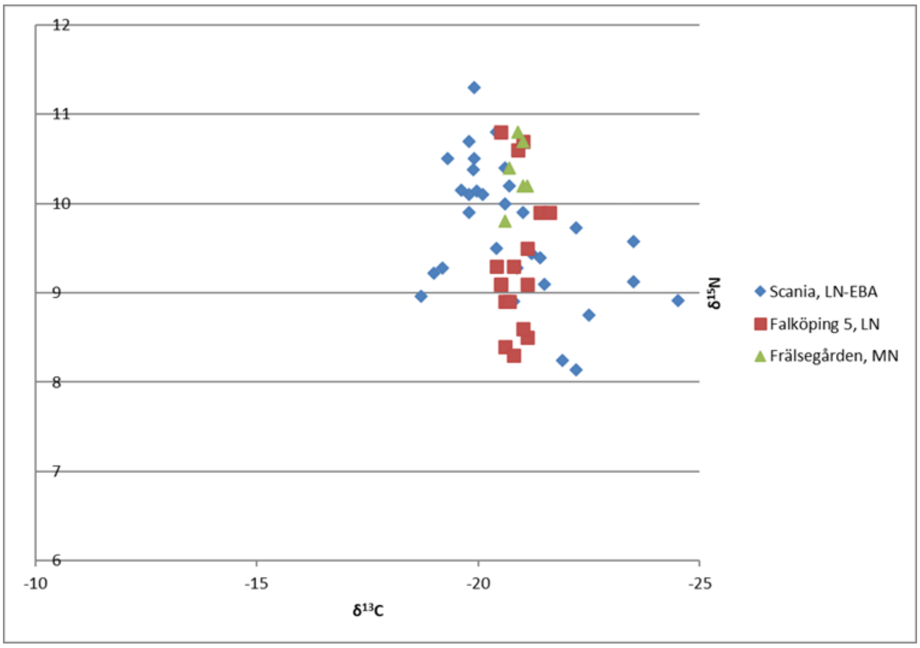


Figure 3: Dietary isotope variation ($\delta^{13}C$ and $\delta^{15}N$) in Late Neolithic-Early Bronze Age Scania (blue) in comparison to two sites from Västergötland: Late Neolithic Falköping5 (red) and Middle Neolithic Frälsegården (green). The Scanian sample evidences higher variance and more marine input in the diet, reflected as less negative $\delta^{13}C$ and somewhat elevated $\delta^{15}N$ values in some of the individuals (after Tornberg 2018a).

if we consider an increase in the importance of cattle in the LNII-EBA. Cattle in this period has been discussed as 'hard currency', with both religious and social importance, and, as such, a signal of wealth (Kristiansen 2006). Drawing on ethnographic studies, hard currency could, and was, stolen (cf. Evans-Pritchard 1940; Gray *et al.* 2003); thus it needed protection by being kept close to the settlement. Keeping cattle could be dangerous. Cattle raiding was probably the cause of many of the violent interactions visible as trauma in several of the individuals from this time. In times when cattle played a less important role and were fewer in numbers, cattle and farmlands could both be kept close to the settlement. The presence of cattle would also allow for easy manuring of the fields. When the number of cattle and the need for grazing areas grew, the area around the settlement became too small and there was a need for rearrangements; the farmlands were moved elsewhere while cattle were kept close.

Dietary differences in Scania are not as well explored, which makes long-term trends impossible to pinpoint at present. Even though isotope values in Scania suggest a diet predominant in terrestrial protein, they also show a higher reliance on marine foods, reflected as less negative $\delta^{13}C$ and somewhat elevated $\delta^{15}N$ values in some of the individuals in comparison to Falköping stad 5 and Frälsegården in Falbygden (Fig. 3). Thus, the variation in isotope data is somewhat larger in Scania. It is likely that the contribution of marine products reflects the proximity to the coast, which would grant additional nutrition and complement the diet.

For better and for worse: stature and general health

Living stature is influenced by both genes (80%) and environment (20%) (e.g. Carmichael and McGue 1995) and functions as a great tool for understanding health changes in the past. Briefly, an individual has a genetic potential for a specific stature, while the environment (e.g. nutrition and health history) affect how close an individual may reach to their genetic maximum stature. In a long-term perspective, average statures have fluctuated widely in accordance with variations in living conditions. Over the last 150 years, Sweden's average statures increased dramatically to be one of the highest in the world – as the country developed from a poor agricultural society to the welfare state of today. Generally, male statures fluctuate to a greater extent than for females; the reason being that it is evolutionary favourable for males to invest excess energy in lean weight (stature), while females invest excess energy in body fat (Wells 2012).

The statures of both males and females were high throughout the Late Neolithic and Early Bronze Age, with averages of *c.* 173 cm for males and 160-165 cm for females (Tornberg 2018b). These statures are equivalent to average modern statures in Canada and Turkey (NCD Risk Factor Collaboration 2016). Statures

Table 1: Sexual dimorphism in southern Scandinavia. The table shows the proportion of female vs. male calculated statures in %. Data from Tornberg (2018b). Ertebølle = Late Mesolithic, TRB = Funnelbeaker culture, PWC = Pitted Ware culture, BAC = Battle Axe culture, LNI = Late Neolithic I, LNII-EBA = Late Neolithic II-Early Bronze Age.

Relative dating	%F/M statures
Ertebølle	94.9
TRB	93.6
PWC	96.1
BAC	93.1
LNI	94.7
LNII-EBA	92.3

did not change notably with the Neolithic transition, but increased significantly in the Battle Axe Culture and then remained high (Fig. 4). Female statures increased linearly rather than in stages and were the highest in LNI, the initial phase of bronzization. The seeming decrease in female stature in the LNII-EBA might indicate changes in gender roles, but the sample is too limited for the drawing of definite conclusions. It is likely, however, that the dramatic increase in male statures can be traced to the new steppe ancestry, coupled with better nutrition relating to pastoral practices and a larger population in general (Tornberg 2018b). There seems to be no difference in average statures related to grave type. Jay T. Stock and colleagues (2023) provide support for the correlation between high stature and pastoral economy, especially dairy consumption, coupled with lactase persistence in prehistoric Eurasia. While diet seems contributory to adult stature in general, differences between the sexes might correspond to sociocultural differences. It is interesting that the biggest difference in stature between the sexes in southern Scandinavia are found in the Battle Axe Culture (BAC) and in the LNII-EBA, while the lowest are in the Pitted Ware Culture (PWC) (Table 1). The sample shows that female calculated statures are 7%-8% lower than male statures in the BAC and LNII-EBA, while they were only 4%-5% lower in the late Mesolithic, PWC, and LNI – where we do not see such accentuated gender differences in burial customs. Samantha L. Cox and colleagues (2023) found significant variation in sexual dimorphism associated with geographical region in Early Neolithic Europe, where the difference between the sexes varied between 4%-10%. The largest difference between the sexes was found in northern Central Europe. The lowest was in the Mediterranean. The difference was not found when comparing genotypic traits for stature and, thus, suggests sociocultural reasons for differing phenotypes. Although male statures tend to respond more readily to environmental circumstances, there are situations where female statures were reduced as an effect of sociocultural differences. Polygyny seems to reduce female stature in several examples (Kanazawa and Novak 2005). When sociocultural differences between the sexes are increased or reduced, female statures were affected accordingly (Castellucci *et al.* 2021; Baten and Murray 2000). The seeming decrease in female stature in the LNII-EBA might, thus, reflect worsening living conditions related to the growth period of bronzization. The lack of data for genotypes related to stature in southern Scandinavia hinders a more detailed analysis at present but would significantly increase our understanding of the relative impact of diet, health, and genes on stature in this region.

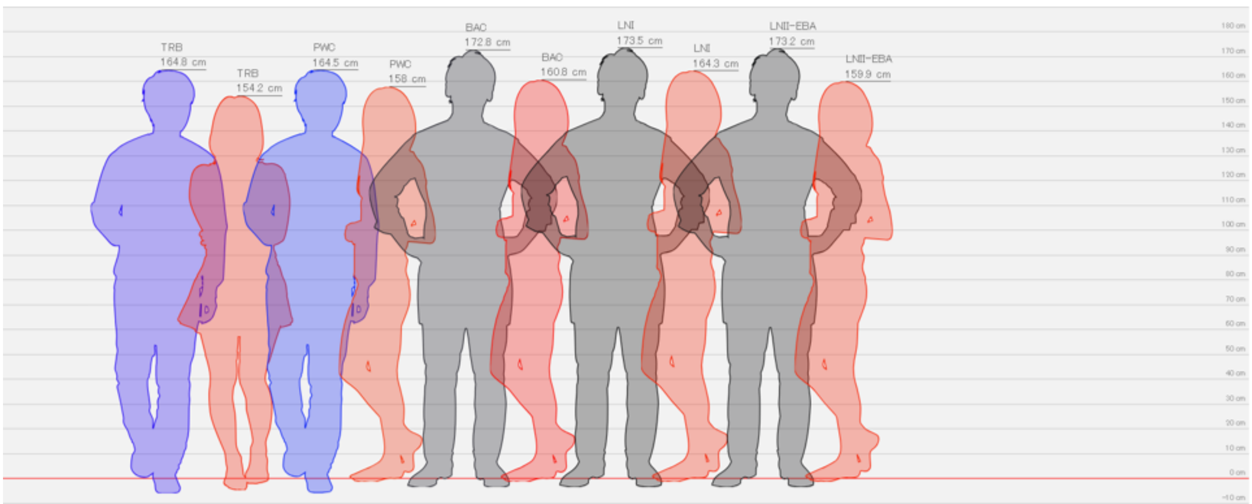


Figure 4: Statures in Neolithic to Bronze Age southern Sweden following data from Tornberg 2018b. Blue and black = males, Red = females (data: Tornberg 2018b; diagram: via https://hikaku-sitatter.com/en/).

The LN and EBA populations of southern Sweden evidence moderate levels of pathologies associated with physical stress, i.e. *Linear Enamel Hypoplasia* (LEH) and *Cribra Orbitalia* (CO). LEH are developmental defects of the tooth enamel and are associated with periods of starvation and/or illness in childhood. Although with insufficient sample size there might be similar underlying causes for LEH and reduced female statures in northern Central Europe during the Early Neolithic (Cox *et al.* 2023). CO is characterised by porosities in the eye sockets and has traditionally been associated with iron deficiency anaemia (Waldron 2009). Over the last decades, the growing scholarly view is that pathology can be multifactorial and, hence, should be considered as signs of general health stress (Walker *et al.* 2009; Wapler *et al.* 2004). There is usually substantial variation in the frequency of both LEH and CO between populations, even contemporaneous ones. Only 15% of the individuals from the LN-EBA individuals from Scanian Abbekås mound burials[2] evidenced LEH (Tornberg 2013), while 28.6% of the LNII individuals (n=28) from the gallery grave Falköping stad 5 in Västergötland were affected (Blank *et al.* 2018). Two of the eight individuals with LEH in Falköping stad 5 did not survive past the age of 12, which shows a correlation between LEH and premature death. These numbers are, however, substantially lower than in the Late Mesolithic (40%-60%), and in Danish Early Neolithic (63%) and Middle-Late Neolithic (40%) (Bennike and Alexandersen 2007). CO, on the other hand, was not found at all in the 19 investigated eye sockets from Falköping stad 5 and only in one single female adult in Abbekås (Blank *et al.* 2018; Tornberg 2013). These numbers are probably somewhat artificially low due to fragmentation and commingling, but Bennike and Alexandersen (2007) also report non-existent evidence of CO in Danish Mesolithic and Early Neolithic. Out of 310 individuals from LN-EBA southern Sweden included in my doctoral thesis, 41 individuals (13%) showed evidence of CO, perhaps supporting an increase in health stress relative to earlier periods (Tornberg 2018a). The commingling and fragmentation of the remains in many of these graves disallows analyses of possible differences in the presence of LEH and CO related to sex.

Intercommunity contact and mortality: paleodemographic insights

Paleodemographic modelling of the LN-EBA population of southern Sweden was carried out by Tornberg (2018a) using a Siler competing hazard analysis (Siler 1979; 1983) based on Transition Analysis 2 (TA2/ADBOU) age estimations. The TA2 method, which is based on Bayesian statistics, performed better than traditional methods (Boldsen 2022), but was still based on traits of the pubic symphysis, cranial suture closure, and changes of the surface of the auricular surface, which are likely not well-connected to aging (Boldsen *et al.* 2022). The new TA version (TA3), publicly launched in 2020, is based on machine learning statistics of traits from throughout the skeleton and performs significantly better than previous single and multiple trait methods in validation studies (Boldsen *et al.* 2022). New age estimations using TA3 would, hence, enrich our current understanding of LN-EBA demography.

The Siler analysis evidenced a mortality pattern with a high age non-specific residual mortality. Residual mortality consists of all mortality not linked to childhood and senescence, i.e. mortality due to accidents, childbirth, and violence. The risk of dying is as such equally high no matter the age, which contrasts with the normal pattern, where the risk of dying is the highest in young childhood and in old ages. The trend seems relatively general to Neolithic societies in southern Scandinavia and probably partly reflects high levels of violence in these communities (Tornberg 2022; Fibiger *et al.* 2013; Ahlström and Molnar 2012). Based on the mortality patterns in subadults, the LN-EBA demography indicates a society with intermediate intercommunity contact which was substantially higher than among Neolithic foragers, but somewhat lower than in the preceding Corded Ware Complex of southern Scandinavia (Tornberg and Vandkilde 2024). Richard R. Paine and Jesper Boldsen (2002) modelled subadult mortality in a large dataset spanning from the Mesolithic to Early Modern Times and showed how relative early to late childhood mortality varied distinctly. While Mesolithic groups showed relatively equal relative mortality, the late childhood mortality increased substantially with the Neolithic, peaking in the Bronze and Iron Ages. By contrast, early childhood mortality increased dramatically in the Medieval period with urbanisation. Paine and Boldsen (2002) argue that the variation is connected to intercommunity contact and the relative risk of lethal infections. Late childhood mortality increases when lethal infectious outbreaks strike on average once every generation, while early childhood mortality is elevated when these outbreaks occur more often. In communities with low intercommunity contact, neither early nor late childhood mortality is elevated. Comparing overall childhood mortality in the Scandinavian context to more urban (but relatively contemporaneous) settings, the urban counterparts suffer from significantly higher childhood mortality. The LN-EBA assemblage (n=305) of southern Sweden supports subadult mortality of 26% if compared to Bronze Age Karataş (Anatolia) or Lerna (Greece), where a compilation of published data suggests subadult mortality to be 74% and 40% respectively (Tornberg 2018a). Hence the assumption that low levels of young children in prehistoric contexts

[2] One of the mounds (mound 1) covered a LNI flat grave and a LNII gallery grave.

Table 2: Division of trauma frequency divided by grave type (after Tornberg 2022).

Burial type	MNI	Trauma MNI min	Trauma MNI max	Healed	Unhealed	% total
Gallery grave	164	11	17	10	8	6.7-10.4
Barrow	49	4	4	4	0	8.2
Flat burial	44	1	1	0	1	2.3

does not have to necessitate high taphonomic loss, but could rightly reflect differences in mortality profiles (Ahlström 2015).

Raiding and trading: evidence of violence

Rich male grave inventories of swords, razors, and tweezers have long been associated with warrior elites of the Bronze Age, and the 'beautiful warrior' (Treherne 1995; Vandkilde 2017). However, warfare is seldom beautiful and affects both individuals and populations on a variety of different levels. Peace and conflict researcher Johan Galtung (1990) divides violence into three levels: cultural (e.g. norms in language, ideology, and religion); structural (limitations of living and marginalisation due to power relations); and direct (physical and/or deadly). I dare to assert warriorhood as cultural norm in the Nordic Bronze Age, but what about the other levels? Somewhat following the ideas of Galtung, the World Health Organization (WHO), in their ecological model of violence (WHO 2002), argues how all these levels are interconnected and entangled; if violence is promoted on a cultural and state level, levels of violence in any form, be it structural or interpersonal, are higher. While cultural and direct violence might be easier to detect in the archaeological record, structural violence seems more difficult and needs to be addressed through deep studies of multiproxy data. Johan Ling and colleagues (2018) argue for unfree labour as a key commodity, hence clearly being in the realm of structural violence. The remarkable (yet terrifying) find of hundreds of war dead at the Bronze Age battlefield of Tollense, Germany, clearly shows the horrid effects of direct violence (Jantzen *et al.* 2011; Brinker *et al.* 2016). The bronzization process definitely entangled with these different aspects of violence in Bronze Age society.

When zooming in on the Scandinavian Bronze Age, direct violence is present as well. Hilde Fyllingen's (2003) report on Bronze Age war dead in Norway shows not only that violence was present, but that the presence of both healed and unhealed traumata shows that violent encounters happened repeatedly. There

Figure 5: Large penetrating injury of the posterior left parietal of one EBAII male from Abbekås, Scania. The large, healed penetration might be related to surgical intervention (trepanation) associated with blunt force trauma (BFT) (image: Tornberg 2013; 2022; photo: Anna Tornberg).

seems to be an increase in the frequency of conflict throughout the LN-EBA (Tornberg 2022). While levels of violence-related trauma were low in the LNI, the levels were substantially raised in the LNII-EBA gallery graves: gallery graves generally seem to indicate higher levels of violence than flat graves and mounds (Table 2). Unlike Tollense, all evidence of violence points to blunt force (BFT): examples of sharp force or projectile trauma are missing. However, use of bladed weapons, e.g. swords, would only rarely leave traces on bones, as they would target soft tissue. Comparing evidence of BFT between Tollense and southern Sweden shows that the number of individuals with evidence of BFT is 7% in Tollense in comparison of up to 13% of the adults in southern Sweden. However, arrowheads are commonly found in LNII-EBA graves and might to some extent have originally been embedded in soft tissue. Therefore, it is pertinent to assume even higher rates of violence than is visible in the skeletal material in the Nordic Bronze Age (Tornberg 2022). Healed and unhealed skull traumas were relatively evenly distributed, although healed traumas were found in some higher extent. Males were more often associated with healed injuries, while females were affected by deadly traumas as often as males. Children were unaffected (Tornberg 2022). The high levels of healed skull traumas also indicate surgical knowledge. Although most previously interpreted prehistoric trepanations should rather be considered BFT, there are examples where surgical interference cannot be ruled out. One such example is from Abbekås, where an older male, dating to NBA II, was documented with a large circular penetration to the left posterior parietal (Fig. 5), perhaps connected to the surgical cleaning of a BFT (Tornberg 2013). The first written document describing trepanations as being primarily conducted as treatment of war wounds is 5000 years old (Wilson *et al.* 2017; Walsh 1987: 1-4;), and both Valerie Andrushko and John Verano (2008), and Sarah Jolly and Danielle Kurin (2017), provide support for trepanations as connected to BFT in archaeological examples.

Bioarchaeological perspectives of bronzization: discussion and future directions

The methodological advances over the last decade have made bioarchaeological research key to a deepening understanding of past societies. The study of remains from humans who once populated the deep past provide unsurpassable data on mobility and migration, kinship practices, diet, demography, and health (to mention but a few fields of research). We are only at the beginning of understanding what kind of answers might help with the old 'mission impossible' questions, and what new questions will be advanced by these developments. By combining osteological and chemical analyses with archaeological data and statistical modelling we can create new creative approaches to evaluate effects of past events and processes, e.g. bronzization. This is truly transdisciplinary.

I have here outlined some of the proxies that are relevant for insights into some biocultural consequences of prehistoric globalisation for individuals and populations. I have used the consequences of modern globalisation as a point of departure for examining similarities and differences. Industrialisation pushed and was boosted by modern globalisation, where states with high-level globalisation ranking have some of the strongest economies and best health in the world today. However, globalisation also led to increased economic and health differences within and between states but also developed from the early to later phases thanks to improvements in sanitation and healthcare. The onset of modern globalisation was a devastating affair for human health. Ladurie's (1973) microbial unification of the world started with the long-distance travels in the Middle Ages and might have culminated with the Black Death in the 14th century, when one third of Europe's population died. New pathogens entered novel areas and the lack of immunity led to disastrous outcomes from sometimes relatively harmless diseases. We know all too well the effects of Europeans entering the Americas, or, more recently, the Covid pandemic; for most people, these infections are now not much more than a common cold. The diseases of early globalisation spread rapidly in urban settlements with poor sanitation, starvation, and crowded living. We cannot assume the exact same effects of bronzization, since population density severely affects recurring and sustained outbreaks of infectious disease. Nevertheless, we can assume that new pathogens entered southern Scandinavia through new and more distant trading routes and may very plausibly have had a significant impact on human health.

The development of the bronzization process from the start to the growth period is visible in several bioarchaeological parameters. Not only is there a continuous increase in burial complexity from the LNI to the EBA in Scania, hypothetically due to hierarchisation and substantial population increase (Bergerbrant *et al.* 2017; Tornberg 2016), the development is visible also in dietary patterns and mobility. The studies by Blank (2021) support a change in networks from the LNI to the LNII-EBA in Falbygden, southwestern Sweden, both regarding the variation of origin and the distance to Falbygden. The latter seems to have had substantial migration from the northeast in the LNII which was not present earlier. Furthermore, the diet in Falbygden became more varied between groups and individuals, and they were plausibly affected by a change in agropastoral practice with a move towards extensive farming (Blank 2021), perhaps to keep increasing stocks of cattle safe from thieves by keeping them close to the settlement. Unfortunately, the resolution of data is not as high in Scania but they nevertheless seem to follow the general trend of increased mobility in the LNII-EBA (Bergerbrant *et al.* 2017). Diets seem to have been predominated by terrestrial species, but show larger variation in isotope data, probably due to some coastal dependency on marine resources (Tornberg 2018a).

These changes in burial practices, diets, and mobility patterns function as a foundation for population dynamics and general health. I consider paleodemographic analyses of skeletal data a fruitful way to better understand living conditions in the past, especially when coupled with studies of mobility and health. There seem to be some differences in the early stages of bronzization in comparison to the growth phase, especially when it comes to levels of violence. Evidence of interpersonal violence seems to increase with the growth phase, and many times becoming lethal (Tornberg 2022). It is interesting that sex differences in stature seem to be the highest in periods where there seems to be a male dominance in the burial record, especially regarding connotations to warriorhood. It is plausible that these times favoured male over female general health, possibly linked to differences in nutrition, but other cultural phenomena might also have played a role. Male statures are high from the Battle Axe culture onwards, while female statures show a tendency to decrease in the Early Bronze Age. The data is scarce, however, and new detailed analyses linking phenotypic stature with geneotypic predisposition would aid considerably in understanding the possible sociocultural effects on stature between periods and between the sexes. Evidence of general stress, such as LEH and CO, is generally low in southern Sweden throughout the LN and EBA, however the dataset of 310 individuals evidence CO in a higher extent than has been reported from Neolithic Denmark (Bennike and Alexandersen 2007). Two children who died under the age of 12 in Falköping stad during the LN II might however have been witnesses to the danger of infectious disease in subadults. The demographic pattern of southern Sweden might indicate the mix of an elevated disease burden and high levels of violence. The modelled ages support a high risk of dying throughout the lifespan. This pattern is consistent with lethal infections having outbreaks approximately once every generation. However, high levels of violence would likewise affect the demography in similar ways. The data is currently not precise enough to determine the exact reason for this profile. However, ongoing developments in both osteological ageing methods and demographic modelling will substantially improve our understanding of these phenomena in the years to come.

Bibliography

Ahlström, T. 2015. Paleodemography of maritime hunter-gatherers and the quest for forager baseline demography, in K. Brink, S. Hydén, K. Jennbert, L. Larsson and D. Olausson (eds) *Neolithic diversities: perspectives from a conference in Lund, Sweden*: 11-20. Acta Archaeologica Lundensia, Series in 8°, Vol. 65. Lund: Lund University.

Ahlström, T. and P. Molnar 2012. The placement of the feathers: violence among sub-boreal foragers from Gotland, central Baltic Sea, in R.J. Schulting and L. Fibiger (eds) *Sticks, Stones, and Broken Bones: Neolithic Violence in a European Perspective*: 17-33. Oxford: Oxford University Press.

Andrushko, V.A. and J.W. Verano, 2008. Prehistoric trepanation in the Cuzco region of Peru: a view into an ancient Andean practice. *American Journal of Physical Anthropology* 137(1): 4-13.

Apel, J. 2001. *Daggers, knowledge & power*. Uppsala, Coast to Coast Books.

Baten, J. and J.E. Murray 2000. Heights of men and women in 19th-century Bavaria: economic, nutritional, and disease influences. *Explorations in Economic History* 37: 351-369.

Bennike, P. and V. Alexandersen 2007. Population plasticity in southern Scandinavia: from oysters and fish to gruel and meat, in N.M. Cohen and G.M.M. Crane-Kramer (eds) *Ancient Health: Skeletal Indicators of Agricultural and Economic Intensification*: 130-148. Gainesville: University Press of Florida.

Bergerbrant, S., K. Kristiansen, M.E. Allentoft, K.M. Frei, T.D. Price, K.G. Sjögren and A. Tornberg 2017. Identifying commoners in the Early Bronze Age: burials outside barrows, in S. Bergerbrant and A. Wessman (eds) *New perspectives on the Bronze Age: proceedings of the 13th Nordic Bronze Age Symposium held in Gothenburg 9th to 13th June 2015*: 37-64. Oxford: Archaeopress.

Bergfeldt, N., E. Kirdök, N. Oskolkov, C. Mirabello, P. Unneberg, H. Malmström and A. Götherström 2024. Identification of microbial pathogens in Neolithic Scandinavian humans. *Scientific Reports* 14(1): 5630 (available at: https://doi.org/10.1038/s41598-024-56096-0).

Blank, M. 2021. Mobility, Subsistence and Mortuary practices. An interdisciplinary study of Neolithic and Early Bronze Age megalithic populations of southwestern Sweden. Unpublished PhD doctoral thesis, Department of Historical Studies, University of Gothenburg.

Blank, M., A. Tornberg and C. Knipper 2018. New Perspectives on the Late Neolithic of south-western Sweden. An interdisciplinary investigation of the Gallery Grave Falköping stad 5. *Open Archaeology* 4(1): 1-35.

Brinker, U., A. Schramm, S. Flohr, D. Jantzen, J. Piek, K. Hauenstein and J. Orschiedt 2016. The Bronze Age battlefield in the Tollense valley, Mecklenburg-Western Pomerania, northeast 115 Germany – combat marks on human bones as evidence of early warrior societies in northern Middle Europe, in F. Coimbra, D. Delfino, V. Sîrbu and C. Schuster (eds) *Late Prehistory and Protohistory: Bronze Age and Iron Age*: 39-56. Proceedings of the XVII UISPP World Congress (1-7 September 2014, Burgos, Spain). Volume 9, Sessions A3c and A16a. Oxford: Archaeopress.

Carmichael, C.M. and M. Mcgue 1995. A Cross-sectional Examination of Height, Weight, and Body Mass Index in Adult Twins. *The Journals of Gerontology*: Series A, 50, 4: 237-244 (available at: https://doi.org/10.1093/gerona/50A.4.B237).

Castellucci, H., C. Viviani, G. Boccardo, P. Arezes, Á. Bartsch, M. Martínez and S. Bragança 2021. Gender inequality and sexual height dimorphism in Chile. *Journal of Biosocial Science* 53(1): 38-54.

Cox, S.L., N. Nicklisch, M. Francken, J. Wahl, H. Meller, W. Haak and I. Mathieson 2023. Socio-cultural practices may have affected sex differences in stature in Early

Neolithic Europe. *Nature Human Behaviour* 8(2): 243-255 (available at: https://www.nature.com/articles/s41562-023-01756-w).

Czepkiewicz, M., J. Heinonen, P. Næss and H. Stefansdottir 2020. Who travels more, and why? A mixed-method study of urban dwellers' leisure travel. *Travel behaviour and society* 19: 67-81.

Deaton, A. 2004. *Health in an Age of Globalization*. Working paper 10669, National Bureau of Economic Research (DOI:10.3386/w10669; available at: https://www.nber.org/papers/w10669).

Earle, T. 1989. The evolution of chiefdoms. *Current Anthropology* 30: 84-88.

Evans-Pritchard, E.E. 1940. The political structure of the Nandi-speaking peoples of Kenya. *Africa: Journal of the International African Institute* 13(3): 250-267.

Fibiger, L., T. Ahlström, P. Bennike and R.J. Schulting 2013. Patterns of violence-related skull trauma in Neolithic southern Scandinavia. *American Journal of Physical Anthropology* 150(2): 190-202.

Frei, K.M. and R. Frei 2011. The geographic distribution of strontium isotopes in Danish surface waters – A base for provenance studies in archaeology, hydrology and agriculture. *Applied Geochemistry* 26(3): 326-340.

Fuchs, K., C. Rinne, C. Drummer, A. Immel, B. Krause-Kyora and A. Nebel 2019. Infectious diseases and Neolithic transformations: Evaluating biological and archaeological proxies in the German loess zone between 5500 and 2500 BCE. *The Holocene* 29(10): 1545-1557 (available at: https://doi.org/10.1177/0959683619857230).

Fyllingen, H. 2003. Society and violence in the Early Bronze Age: an analysis of human skeletons from Nord-Trøndelag, Norway. *Norwegian Archaeological Review* 36(1): 27-43.

Galtung, J. 1990. Cultural violence. *Journal of Peace Research* 27(3): 291-305.

Gray, S., M. Sundal, B. Wiebusch, M. Little, P. Leslie and I. Pike 2003. Cattle raiding, cultural survival, and adaptability of East African pastoralists. *Current Anthropology* 44(5): 3-30.

Greenfield, H.J. 2010. The secondary products revolution: The past, the present and the future. *World Archaeology* 42: 29-54.

Gron, K.J., M. Larsson, D.R. Gröcke, N.H. Andersen, M.H. Andreasen, J.-H. Bech, P. Steen Henriksen, R.G. Hilton, M. Dengsø Jesse, N.A. Møller, F.O. Nielsen, P.O. Nielsen, A. Pihl, L. Sørensen, J. Westphal, P. Rowley-Conwy and M.J. Church 2021. Archaeological cereals as an isotope record of long-term soil health and anthropogenic amendment in southern Scandinavia. *Quaternary Science Reviews* 253: 106762 (available at: https://doi.org/10.1016/j.quascirev.2020.106762).

Hayden, B. 1995. Pathways to power, in T.D. Price and G.M. Feinman (eds) *Foundations of social inequality*: 15-86. New York: Springer Science and Business Media.

Jantzen, D., U. Brinker, J. Orschiedt, J. Heinemeier, J. Piek, K. Hauenstein, J. Krüger, G. Lidke, H. Lübke, R. Lampe, S. Lorenz, M. Schult and T. Terberger 2011. A Bronze Age battlefield? Weapons and trauma in the Tollense valley, north-eastern Germany. *Antiquity* 85(328): 417-433.

Jolly, S. and D. Kurin 2017. Surviving trepanation: approaching the relationship of violence and the care of 'war wounds' through a case study from prehistoric Peru, in L. Tilley and A.A. Schrenk (eds) *New developments in the bioarchaeology of care: further case studies and expanded theory*: 175-195. Cham: Springer International Publishing Switzerland.

Kanazawa, S. and D.L. Novak 2005. Human sexual dimorphism in size may be triggered by environmental cues. *Journal of Biosocial Science* 37: 657-665.

Krause-Kyora, B., J. Susat, M. Haller-Caskie *et al.* 2023. Neolithic humans and dogs – transient reservoirs for Yersinia pestis. *PREPRINT* (20 December 2023, Version 1) (available at Research Square: https://doi.org/10.21203/rs.3.rs-3745869/v1).

Kristiansen, K. 2006. Cosmology, economy and long-term change in the Bronze Age of Northern Europe, in K.-G. Sjögren (ed.) *Ecology and economy in Stone Age and Bronze Age Scania*: 171-218. Lund: Archaeological Excavations Department, National Heritage Board.

Ladegaard-Pedersen, P., S. Sabatini, R. Frei, K. Kristiansen and K.M. Frei 2021. Testing Late Bronze Age mobility in southern Sweden in the light of a new multi-proxy strontium isotope baseline of Scania. *PLoS one* 16(4): e0250279.

Ladurie, E.L. 1973. Un concept: l'unification microbienne du monde (XIVe-XVIIe siècles). *Schweizerische Zeitschrift für Geschichte* 23(4): 627-694.

Ling, J., T.K. Earle and K. Kristiansen 2018. Maritime mode of production: raiding and trading in seafaring chiefdoms. *Current Anthropology* 59(5): 488-524.

Martens, P., S.M. Akin, H. Maud and R. Mohsin 2010. Is globalization healthy: a statistical indicator analysis of the impacts of globalization on health. *Globalization and Health* 6: 1-14.

Martens, P., and D. Zywietz 2006. Rethinking globalization: a modified globalization index. *Journal of International Development* 18(3): 331-350.

NCD Risk Factor Collaboration 2016. A century of trends in adult human height. *Elife* (available at: doi: 10.7554/eLife.13410).

Paine, R.R. and J. Boldsen 2002. Linking Age-at-Death Distributions and Ancient Population Dynamics: A Case Study, in R.D. Hoppa and J.W. Vaupel (eds) *Paleodemography: Age Distributions from Skeletal Samples*: 169-180. Cambridge: Cambridge University Press.

Rascovan, N., K.G. Sjögren, K. Kristiansen, R. Nielsen, E. Willerslev, C. Desnues and S. Rasmussen 2019. Emergence and spread of basal lineages of Yersinia pestis during the Neolithic decline. *Cell* 176(1): 295-305.

Sherratt, A. 1981. Ploughs and pastoralism: aspects of the secondary products revolution, in D. Clark and I. Hodder (eds) *Pattern of the past: studies in honour of David Clarke*: 261-305. Cambridge: Cambridge University Press.

Sherratt, A. 1997. *Economy and society in prehistoric Europe: changing perspectives*. Edinburgh: Edinburgh University Press.

Seersholm, F.V., K.G. Sjögren, J. Koelman, M. Blank, E.M. Svensson, J. Staring and M. Sikora 2024. Repeated plague infections across six generations of Neolithic Farmers. *Nature* 632: 114-121 (available at: https://doi.org/10.1038/s41586-024-07651-2).

Siler, W. 1979. A competing-risk model for animal mortality. *Ecology* 60: 750-757.

Siler, W. 1983. Parameters of mortality in human populations with widely varying life spans. *Statistics in Medicine* 2: 373-380.

Sjögren K-G., T. Axelsson and M. Vretemark 2019. Middle Neolithic economy in Falbygden, Sweden. Preliminary results from Karleby Logården, in J. Müller, M. Hinz and M. Wunderlich (eds) *Megaliths – Societies – Landscapes. Early monumentality and social differentiations in Northern Europe*, Vol. 3: 705-718. Proceedings of the international conference 'Megaliths – Societies – Landscapes. Early Monumentality and Social Differentiation in Neolithic Europe' (16th-20th June 2015), Kiel. Bonn: Rudolf Habelt GmbH.

Spyrou, M.A., L. Musralina, G.A. Gnecchi Ruscone, A. Kocher, P.G. Borbone, V.I. Khartanovich and J. Krause 2022. The source of the Black Death in fourteenth-century central Eurasia. *Nature* 606(7915): 718-724 (available at: https://doi.org/10.1038/s41586-022-04800-3).

Stock, J.T., E. Pomeroy, C.B. Ruff, M. Brown, M.A. Gasperetti, F.J. Li and J.C. Wells 2023. Long-term trends in human body size track regional variation in subsistence transitions and growth acceleration linked to dairying. *Proceedings of the National Academy of Sciences* 120(4): e2209482119 (available at: https://doi.org/10.1073/pnas.2209482119).

Tausch, A. 2016. Is globalization really good for public health? *The International Journal of Health Planning and Management* 31(4): 511-536.

Tornberg, A. 2013. Diet, health and agriculture: the Late Neolithic-Early Bronze Age example of Abbekås, Southern Sweden. *Lund Archaeological Review* 19: 7-18.

Tornberg, A. 2016. Diet, Toothache and Burial Diversity: Tracing Social Status through Bioarchaeological Methods in Late Neolithic–Early Bronze Age Scania. *Lund Archaeological Review* 22: 21-37.

Tornberg, A. 2018a. Health, cattle and ploughs: Bioarchaeological consequences of the Secondary Products Revolution in southern Sweden, 2300-1100 BCE. Unpublished PhD doctoral thesis, Lund University.

Tornberg, A. 2018b. Stature and the Neolithic transition – Skeletal evidence from southern Sweden. *Journal of Archaeological Science: Reports* 17: 58-67.

Tornberg, A. 2022. A prehistory of violence: Evidence of violence related skull trauma in southern Sweden, 2300-1100 BCE, in A. Tornberg, A. Svensson and J. Apel (eds) *Life and Afterlife in the Nordic Bronze Age: Proceedings of the 15th Nordic Bronze Age Symposium held in Lund, June 11-15, 2019*. Acta Archaeologica Lundensia, Series Prima in 4°, no. 37. Lund: Department of Archaeology and Ancient History.

Tornberg, A. and H. Vandkilde 2024. Modelling age at death reveals Nordic Corded Ware paleodemography. *PREPRINT* (19 March 2024, Version 1) (available at Research Square: https://doi.org/10.21203/rs.3.rs-4125486/v1).

Treherne, P. 1995. The Warrior's Beauty: The Masculine Body and Selv-identity in Bronze Age Europe. *Journal of European Archaeology* 3(1): 105-144 (available at: https://doi.org/10.1179/096576695800688269).

United Nations 2023. Available at: https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/ldc_list.pdf (accessed: 19 August 2024).

Vandkilde, H. 2016. Bronzization: The Bronze Age as pre-modern globalization. *Praehistorische Zeitschrift* 91(1): 103-123.

Vandkilde, H. 2017. The Beautiful Warrior Twenty-one Years After – Bronze Age Warfare and Warriors. *European Journal of Archaeology* 20(1): 55-59.

Waldron, T. 2009. *Palaeopathology*. Cambridge: Cambridge University Press.

Walker, P.L., R.R. Bathurst, R. Richman, T. Gjerdrum and V.A. Andrushko 2009. The causes of porotic hyperostosis and cribra orbitalia: A reappraisal of the iron-deficiency-anemia hypothesis. *American Journal of Physical Anthropology* 139: 109-125.

Walsh, K. 1987. *Neuropsychology: a clinical approach* (2nd edn). Edinburgh: Churchill Livingstone.

Wapler, U., E. Crubezy and M. Schultz 2004. Is cribra orbitalia synonymous with anemia? Analysis and interpretation of cranial pathology in Sudan. *American Journal of Physical Anthropology* 123: 333-339.

Wilson, B.A., J. Winegardner, C.M. Van Heugten and T. Ownsworth 2017. *Neuropsychological rehabilitation. The international handbook*. London and New York: Routledge, Taylor & Francis Group.

Wells, J.C. 2012. Sexual dimorphism in body composition across human populations: associations with climate and proxies for short-and long-term energy supply. *American Journal of Human Biology* 24: 411-419.

World Health Organization 2002. *World report on violence and health: a summary*. Geneva: World Health Organization.

Chapter 8

Nothing comes from nowhere. A discussion of the European Bronze Age's cross-cultural communication, transfer of knowledge and trans-cultural artefacts

Paulina Suchowska-Ducke

Faculty of Archaeology, Adam Mickiewicz University, Poznań, Poland
pausuc@amu.edu.pl

Abstract

The Bronze Age derives its name from a newly discovered alloy and the spectacular items created from it. However, the long-distance networks of trade and exchange that emerged across and beyond Europe during the era are no less impressive. Since then, the Continent's history has been one of ever-increasing connectivity, of cultural exchange, complexity and ambiguity. In this respect, the Bronze Age can be considered the first precursor of a shared European cultural identity. This article discusses a selected variety of artefacts that represent aspects of cultural transmission, translation and adaptation between the Bronze Age cultures of temperate Europe and the Mediterranean. In doing so, it attempts to contribute towards a better understanding of the complex social processes that shaped objects through people, and people through objects during the emergence of the first European *koine*.

Introduction

The European Bronze Age was a unique period in human history. Social inequality, diversity in material culture and immense connectivity were characteristics of that era. Bronze Age societies were mobile and linked via a vast communication network, allowing artefacts and innovations to spread across the Continent like never before and not again, for a long time after (Ling *et al.* 2022; Kristiansen and Suchowska-Ducke 2015; Rowlands and Ling 2013; Kristiansen and Larsson 2005). The new knowledge and ideas transmitted by travelling individuals and groups of people, but also by warfare and raids, led to significant, even profound cultural and social transformations. After all, another, equally important aspect of mobility was how people responded to the movements of others in multiple, often creative ways (Vandkilde *et al.* 2015: 12). Consequently, in between the outermost edges of the European continent emerged and developed a large number of communities, many of which shared common features on the inter-regional scale, yet kept their uniqueness and distinctiveness, their cultural identities, on the local level (Fokkens and Harding 2013; Cline 2012). Over time, this mosaic of cultures had to face numerous changing conditions, socio-political, economic and climatic, to which each culture adapted differently. Some of them became main players in the (connected) Bronze Age system, some stayed on the (dis-connected) outskirts and got involved only occasionally, yet others were incorporated into the system, then transformed and changed significantly in the process. The main reasons for undertaking the effort (and often taking the substantial risk) to establish and maintain cross-cultural communication in its various manifestations – local, inter-regional and long-distance – are likely found in the unequal geographic occurrence of desirable raw materials and control over their further redistribution. Detailed studies point out that metals, whether as raw materials, blanks or finished products, were key to the development of Bronze Age economy (Kristiansen and Earle 2022; Ling *et al.* 2018; Earle *et al.* 2015; Earle 2002; see also Nørgaard *et al.* in this volume) along with other important trade items, e.g. textiles, amber, salt, etc. (Vandkilde *et al.* 2024; Sabatini and Bergerbrant 2020; Harding 2013; Day 2013). Securing access to these goods was a fundamental motivation for people to engage in creating and maintaining social networks and travel routes.

Long-distance communication became less of a problem, due to rapid advances and diversification in the construction of carriages and ships, which made overland and maritime transport safer and more efficient (Uckelmann 2013; Van de Noort 2013). As travelling got easier and distant regions more accessible and familiar, people became more accustomed to far-ranging mobility. Artefacts from across the Continent, iconography, and written sources from the Eastern Mediterranean inform us that not only merchants travelled during the Bronze Age, but also warriors, smiths and craftsmen, emissaries, migrants and settlers (Kristiansen 2023; Aslaksen 2015; Van Wijngaarden 2012; Van de Noort 2006). The exceptional role of women in maintaining long-distance social connectivity via marriage alliances, and possible other reasons that kept them on move, has been demonstrated extensively as well (Reiter *et al.* 2023; Bergerbrant and Wessman 2018; Frei *et al.* 2017; 2015; Knipper *et al.* 2017; Jockenhövel 1991). Finally, one should not forget those who travelled against their will, e.g. war captives and slaves (Gelb 1973). This latter, unique group of people is only occasionally visible in archaeological finds, mostly in written sources and artistic representations from the Mediterranean and the Near East (Nosch 2003; Zaccagnini 1983).

Such connectivity and mobility, even if forced, made the Bronze Age world seem smaller to its inhabitants and created a 'globalised' system without historical precedent in Continental Europe (thoroughly discussed by Vandkilde 2016). Evidence of this process is visible in the material culture of the era, particularly in foreign raw materials and extraordinary artefacts of non-local features or proveniences, categorised by archaeological research as imports, copies, hybrids, imitations or emulations. Such items have been long known in the archaeological discourse (lately with further reference Stockhammer 2017; Maran 2012; Stockhammer 2012). However, more recent scientific methods have allowed the shedding of more light on some of the most remarkable among them (as will be discussed later). The present chapter will discuss selected artefacts from the European Bronze Age that are evidence for cross-cultural travels and communication. These artefacts reflect the recent, significant progress in interpreting and understanding the material evidence for long-distance social dynamics of the ancient European past.

Prelude: The Proto-Bronze Age communication network and the emergence of the Early European Bronze Age

I will begin, however, with a brief description of the processes that led to the growth of Early Bronze Age interconnectivity among European societies, and later on to its significant intensification, resulting in the Late Bronze Age *koine* of material culture. These processes defined periods of large-scale change in European prehistory, leading to the rise, rapid growth, and decline of societies (for a summary, see Vandkilde *et al.* 2015: 17).

The vast communication network and long-distance exchange systems that characterised the societies of temperate Europe, the Mediterranean Basin, the Near East and Central Asia, particularly during the 2nd millennium BCE, had emerged much earlier, at least in the 4th millennium BCE (Heyd 2016; Maran 2007; 1998; Nicolis 2005; Renfrew 1972). The European Continent was then divided into many local and distinctive groups of people (communities), as well as into supra-regional cultural phenomena that covered vast spaces and connected regions and societies that had been previously separated. The northern part of the European Continent was dominated by two such entities: the Corded Ware culture and the Bell Beaker culture, while in the southeast, the circum-Aegean region developed under significant influence from the early Eastern Mediterranean civilisations. Regardless of their individual, distinguishing features, all of these are very good examples of both travelling people and travelling cultures. While the former have moved into the focus of recent aDNA-based research (e.g. Olalde *et al.* 2018; Price *et al.* 1998; see also Gebauer *et al.* in this volume), the latter are manifested by their material culture, which is the subject of a long-standing academic research tradition on concepts such as import, exchange, emulation, or imitation. Scientific and scholastic approaches have come to complement each other well, with methods such as metal analysis, use-wear analysis, and network analysis contributing to a fundamental understanding of how the Bronze Age's connected world emerged from its Neolithic roots (Brozio *et al.* 2023; Vandkilde *et al.* 2015: 10). On a regional scale, this connectivity resulted in the dissemination of new knowledge and material culture, as well as social inequality which, as in a chain reaction, embraced more people and further lands, to later on spread across the entire European Continent and the Near East. One should not forget that these processes, with an indisputably profound impact on contemporaneous societies, were very dynamic and over time took different courses, bringing about intensification, transformation, but also disintegration of the Bronze Age 'network of networks'.

In the first half of the 3rd millennium BCE, *c.* 2700 BCE, the areas of modern Greece and western Turkey were incorporated into communication networks established by the Mesopotamian kingdoms, which reached the Levantine coast – with Egypt and Anatolia on one side, and Central Asia and Indus Valley on the other (Maran 2007; Matthews 2003; Renfrew 1972). At that time, the Sumerian and Akkadian kingdoms were by far the most developed region world-wide, and their achievements, which reached southeast Europe, were the very first spirits of 'civilisation' (Matthews 2003): stratified society, prestige items characteristic for the elites, urbanisation and monumental architecture, complex administration with crafts specialisation, as well as standardised measuring and weighting system allowing international trade (Rahmstorf 2006; Kilian-Dirlmeier 2005; Maran 1998).

In the mid 3rd millennium BCE, the Corded Ware culture had already passed its peak, while the Bell Beaker culture was at its mature phase, characterised by very distinctive material assemblages and the knowledge of smelting copper and gold (Heyd 2016; 2013). The Bell Beaker peoples expanded geographically from the Iberian Peninsula and North Africa to France, Ireland and Great Britain, the Netherlands, Switzerland, Austria and Germany, Hungary, Slovakia, and the Czech

Republic (Besse 2004; Czebreszuk 2004). The material culture associated with the eponymous Bell Beakers has been also found in Poland, northern Jutland, Belarus, Romania, Serbia, Montenegro, Croatia, Albania, North Macedonia, and in some parts of Greece, northern Italy, Malta, Sardinia, and Sicily (Maran 2007). Without doubt, the Bell Beaker people were responsible for spreading the knowledge of the new metal technology across Europe. This included shared ideological values associated with communal feasting and drinking (symposia), almost in a ritual or religious manner (possibly connected to rites of passage, meetings of men's brotherhoods, etc.), and with the idea of individualisation and the superior position of the adult male represented by triangular daggers (from metal but also from flint), halberds, and archery equipment found in rich graves (see various contributions in the volumes edited by Fokkens and Nicolis 2012, as well as by Czebreszuk 2004). The dissemination of these innovations and novelties proceeded in a reciprocal manner: by direct mobility of Bell Beaker people and their integration into local populations, and by the adoption of well-defined components of the Bell Beaker cultural package by local societies (Olalde *et al.* 2018; Price *et al.* 1998). Merging so many various local and non-local traditions led to transformation of the Bell Beaker culture itself and to the forging of syncretic societies with new trans-cultural identities (Heyd 2007). Among these were: Proto-Cetina/Cetina, Iwno/Trzciniec, Proto-Mierzanowice, Pitvaros/Maros, and the Grotta Cappuccini phase of the Laterza-Cellino San Marco culture (Heyd 2007: 102). Interestingly, the latter two of these were located in the Aegean Early Bronze Age peripheral interaction zone. In fact, the emergence of these syncretic cultures led to the fall of the Bell Beaker culture and to the rise of the Early Bronze Age world (Heyd 2007: 102).

In the second half of the 3rd millennium BCE, the well-established and connected Anatolian-Aegean Early Bronze Age societies incorporated another system of inter-regional communication spaces, encompassing the Balkans and the central Mediterranean (Heyd 2013; 2007; Nicolis 2005). This newly emerged circum-Aegean and trans-Adriatic 'network of networks' was based on a system of prestige goods exchange and on local imitations or emulations of foreign objects. The archaeological record indicates that both neighbouring regions underwent significant change in material culture and witnessed an increase in complexity of their social structure, as visible in rich graves and hoards, as well as in the hierarchical organisation of the settlement system, with many sites located along the coast or navigable rivers (Heyd 2013; 2007; Fokkens and Nicolis 2012; Nicolis 2005). Undoubtedly, the closely connected societies of the Aegean, the Balkans and Adriatic-Ionian region played crucial roles in the transmission of features characteristic for the Early Bronze Age further north.

Significant changes in the material culture and in the settlement organisation have also been recorded in the area of the Carpathian Basin. Among the novelties in the material culture (e.g. halberds, triangular daggers, composite necklaces, diadems, and drinking vessels related most likely to ritual of the symposium), also changes in the settlement structure – with new tells developing mostly in defensive locations – can be observed (Heyd 2013; Gogăltan 2005; Bertemes and Heyd 2002). On the level of social organisation, the Carpathian Basin of the second half of the 3rd millennium BCE was composed of many regional cultural units, each with their own distinctive burial practices and artefacts – in particular pottery styles (Bertemes and Heyd 2002; Maran 1998). This process of creating new identities might have fostered the emergence of powerful chiefdoms in the region (Heyd 2013: 61).

The time between 2500 and 2200 BCE is clearly an impressive period of co-existence of very different cultural systems across the European Continent, manifested by inter-regional communication networks connecting the societies of Early Helladic Greece, the Balkans, the central Mediterranean, northern Italy, and the Carpathian Basin with the further European lands under the influence of the Bell Beaker culture.

The inter-connectivity of the Bronze Age

The shift from Bell Beaker traditions to other values and symbols took place *c.* 2200 BCE. Soon after 2000 BCE, the new elites of the Early European Bronze Age were formed and in some regions became archaeologically visible through monumental burials with lavish inventories, fortified settlements, hoarding, and deposition practises (Fokkens and Harding 2013; Harding 2000; see also Müller and Czebreszuk in this volume). Interestingly, these newly emerged societies adopted some of the artefacts and features characteristic of the Bell Beaker people and re-used their international communication routes. As Volker Heyd (2013, 65) summarised it: 'The privileged people of the Beaker period became the new elites of the Early Bronze Age'. The expansion of the Early Bronze Age way of life was a gradual process, more cultural then ideological, and it spread across the Continent from southeast to northwest (Heyd 2013). However, bronze as the key material of the time was adopted initially for cultural reasons and social reproduction, and only later became important in economic terms (Vandkilde 2016). Then, manufacturing and the exchange of goods, the acquisition of raw materials, increasing craft specialisation, and new values and symbols (including prestige and status objects) became the characteristic features of rising societies and local elites. The Aegean region witnessed the rise of palatial Crete, where indeed the first advanced European civilisation developed (Vasilakis 2001). Cretan Bronze Age society was characterised by its impressive acquisition of wealth, splendid art, monumental architecture, complex administration with a unique writing system, and connections to the dynamic and vast communication networks covering the Eastern Mediterranean and the Near East (see contributions in Cline 2012). The knowledge and innovations transmitted through these links, flourished in neighbouring societies (such as those of the Cycladic Islands and mainland Greece), allowing them to experience cultural and economic transformations.

In Continental Europe, social stratification is most clearly seen in the rich, 'princely' graves known from Germany, Poland, Great Britain, Switzerland, France, and the southern Urals (Harding 2000; see also Müller and Czebreszuk in this volume). The latter are known from the earliest examples of chariots coming from the Sintashta-Petrovka culture of the southern Urals (Chechushkov and Epimakhov 2018). The increased accumulation of wealth is also clearly visible in many Early Bronze Age depositions, in which metal object assemblages can be counted in the hundreds, e.g. at Dieskau II, Bennewitz, or Gubin-Bresinchen in Germany (Bradley 2013; 1990; Fontijn 2002). The exact intentions behind these depositions remain an intriguing, not yet fully understood, issue.

Another significant shift in the European Bronze Age, that occurred *c.* 1700/1600 BCE, coincided with the decline of the Únětice culture, and the rise of Tumulus societies and the Mycenaeans. Undoubtedly, a brand new world was then born (Vandkilde 2014). At that time, cross-cultural communication networks and exchange systems were consolidated, mostly as a result of people searching for new metal deposits, and resulting in cultural revivals and intense developments in many regions (Nørgaard *et al.* 2021). The Balkans, on the periphery of the Aegean world, became a destination for the political and economic expansion of the Mycenaeans, who also established contacts with the highly developed Terramare culture of northern Italy, as well as with the societies of the Carpathian Basin (Vianello 2005; Makkay 1999). In addition, prestige chain exchange between chiefs of individual groups allowed for (albeit indirect) communication with southern Scandinavia, especially Jutland (Kristiansen and Larsson 2005). It seems that it was predominantly the cultures of the Carpathian Basin that linked the Aegean and the Eastern Mediterranean with societies in Eastern and Northern Europe. This 'northern' direction of interests is confirmed by the inventory of rich Mycenaean graves that contained, e.g., Carpathian and Caucasian horse harnesses and Baltic amber (Maran and Van de Moortel 2014; Czebreszuk 2011). In temperate Europe, on the other hand, several items with Mediterranean analogies, as well as genuine imports, have been found, i.e. metal vessels, Cypriot pins and daggers, long rapiers, glass beads, and possibly also ornamentation motifs, e.g. running spiral (Purowski *et al.* 2018; David 1997; Varberg *et al.* 2016; Coblenz 1986).

From *c.* 1300 BCE onwards, the relations between Northern and Southern Europe became even more direct and closely linked to the rise of the Urnfield culture. During this period, numerous items of so-called 'northern origin' started to appear in Mycenaean Greece and in the Eastern Mediterranean, including weapons, dress fasteners, personal ornaments, and jewellery (Bouzek 1999; 1985). This phenomenon was often explained as the result of the mobility of warriors, craftsmen, and merchants (Kristiansen and Suchowska-Ducke 2015), but also whole families searching for a place to settle in difficult times, as is visible on Egyptian reliefs, e.g. from Medinet Habu, showing four-wheeled wagons with settlers and all their belongings travelling with the Sea Peoples (Drews 2000). Without a doubt, the items, innovations and knowledge that then spread created a new *koine* among European societies, mainly of metal artefacts.

In the period after 1200 BCE, societies of the Mediterranean Basin and Continental Europe underwent separate modes of development. In the Aegean, this period overlaps with the final phase of the Mycenaean civilisation and its later decline. It appears that significant political, social, and economic changes affected all Mediterranean societies, and are generally attributed to a series of major natural disasters (earthquakes, droughts), and migrations of the arcane Sea Peoples (Drews 2000; 1993). This combination of events had serious consequences, causing the collapse of exchange and communication networks and the decline of the political and economic entities of the region: the Mycenaean culture, the Hittite Empire, and the city states of the Levant, and weakened the civilisations of Egypt and Mesopotamia. It was the end of the Bronze Age in the Mediterranean Basin.

In temperate Europe, this period coincided with the expansion of the Urnfield culture, whose geographical domain stretched from modern-day Catalonia in Spain and southern France to the western parts of Ukraine and Belarus, and from northern Germany to Italy (Bouzek 1999). This period is characterised by great cultural standardisation, which, at the same time, followed regional variations in ornaments and pottery that were already visible previously. Then, a dense network of fortified settlements that played important roles as metalwork and agrarian centres, was established, cemeteries were occupied by generations, and the long-distance exchange of metal and amber was maintained. This was indeed a time of stabilisation and uninterrupted prosperity that lasted until 800-700 BCE in temperate Europe, and in some regions, e.g. in the case of the Lusatian culture, until much later (Kaczanowski 2003: 165).

Transfer of knowledge and trans-cultural objects

The abundant and varied body of evidence for long-distance mobility and cross-cultural connectivity in the Bronze Age has been discussed extensively in the literature. Numerous studies have employed traditional archaeological approaches, i.e. comparative artefact analysis and seriation, in search of similarities and differences in the material culture (see Harding 2000 for an overview). Reconstructions of past communication networks have been built, based on the geographic distributions of singular and exceptional objects, as well as on assemblages of more common artefacts, and even including computational network reconstructions and visualisations (e.g. Ducke and Suchowska 2022, with further references; Knappett 2011). Human mobility and its spatio-temporal patterns have been characterised based on aDNA and isotopic analyses (e.g. Reiter and Frei 2019). Current scientific methods and tools allow for more or less detailed provenience studies of artefacts made of various material (e.g. Suchowska *et al.* 2021; Nørgaard *et al.* 2019; Krause 1998; Purowski *et al.* 2018; Carlsen *et al.* 1997; Varberg *et al.* 2016; Pernicka 2010; Beck *et al.* 1964). In many cases, this has led to significant shifts in our understanding of European Bronze Age societies. New concepts introduced to the archaeological debate from a range of other disciplines, i.e. hybridity, trans-cultural, and gateway or borderlands societies, etc., have made the Bronze Age one of the most intensely studied eras of European prehistory.

As Vandkilde (2016: 108) summarised it: 'The Bronze Age is particularly rich in objects that were neither imports nor truly indigenous. Rather, their value may have emerged from the creative combination of local and foreign traits in terms of material, form or decoration.' Indeed, this trans-cultural creativity, and the ambiguity that arises from it, is a trait that characterises much of the European Bronze Age's most spectacular archaeological remains. Due to the limited scope of this present contribution, I will only address a small number of artefacts and artefact classes that are particularly representative of the social dynamics that constitute the connected world of the European Bronze Age.

The complex interplay of local and foreign tradition in the technology and design of Bronze Age items is well visible in the singular objects that represent combinations of local creative translation and across-the-border mobility, e.g. the slotted blade from the hoard of Kyhna (Coblenz 1986), and the bronze cup from Dohnsen (Suchowska-Ducke *et al.* in press; Suchowska-Ducke *et al.* 2021), both dated to the time of the Early Bronze Age Únětice culture. It is also visible in the processes of introducing trans-cultural meanings by the dissemination of Naue II swords (Suchowska-Ducke 2015) and the bird-head ornamentation motif (Bouzek 1999; 1985: 177-181), that both spread across the European continent and into the Mediterranean Basin at the end of the Middle and during Late Bronze Age.

The particularly intriguing hoard from Kyhna (Saxony, Germany) fits very well into the early tradition of depositions, dated to Br A1 (after Reinecke), and reflects rich female costume traditions (Coblenz 1986). Most of its items are typical for the Únětice culture (ring ingots known better as *Ösenhalsringe*, bronze spirals, amber). Some, however, indicate regional (i.e. a Horkheimer pin and ornamented discs with links to the Alpine region) and long-distance connections (a slotted spearhead and a knot-headed pin) of Cypriot origin, so called *Schleifennadel*). The copper spearhead with two hafting slots from Kyhna (Fig. 1) is the only such specimen found outside the Mediterranean where this type of weaponry is associated with high social status and prestige (Gerloff 1993: 92-93). According to the analysis of its metal composition, the spearhead corresponds well to the material properties of local bronze objects. Thus, it has been suggested that either a foreign smelting mould reached the Únětice region or that the object is a local emulation of Cypriot weaponry (Krause 1998: 178-179, 182). This would fit well with two other artefact types from the Khyna assemblage, whose distributions encompass both temperate Europe and the Mediterranean, i.e. the Cypriot pin (Gerloff 1993) and the *Ösenhalsringe* (Bartelheim 1998). The latter are generally ascribed a pre-monetary function ('ring-money' or 'token-money') in European Early Bronze Age exchange (Lenerz-de Wilde 1995; Pare 1999). However, typological comparisons of the Kyhna spearhead with specimens known from the Mediterranean Basin reveal that the European find has its tip rounded, while the Mediterranean ones are sharpened (Stockhammer 2017: 179). This might suggest that the weapon from Khyna was made by a less skilled smith or that it was used in a different manner: not as a weapon but more likely as a non-local item of prestige. Either way, the Kyhna spearhead is an example of immaterial exchange, where a foreign item with a long-distance connection was introduced into the local cultural framework. During this process, its original meaning was modified and 'creatively translated' into the Únětice socio-cultural context (Wiggering 2018: 71; Vandkilde 2014: 603-604; Stockhammer 2012: 107), making it a true

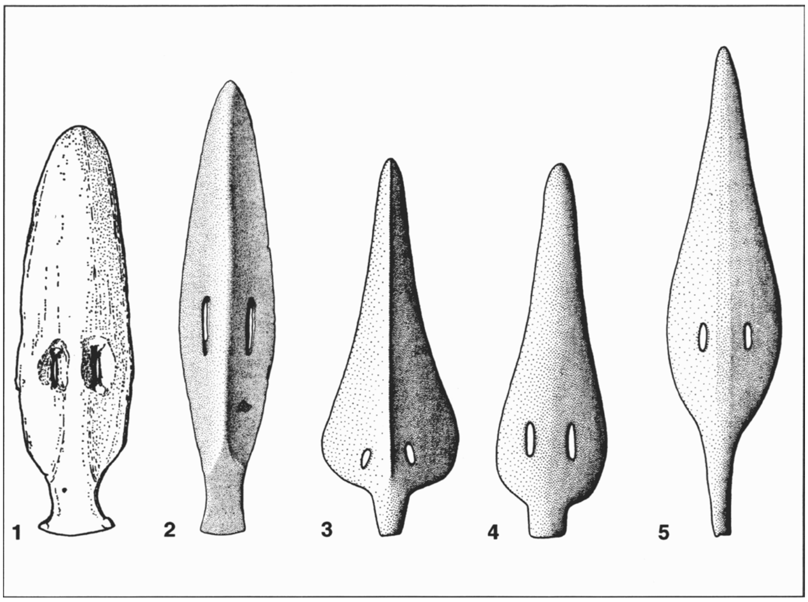


Figure 1: Comparison of the slotted spearhead from Khyna (1), found in Saxony, Germany, with various contemporaneous analogies from the Eastern Mediterranean (2-5) (unmodified reproduction of Stockhammer 2017: fig. 4, licensed under creative-commons.org/licenses/by-nc-sa/4.0).

trans-cultural object. The arrival of the Mediterranean slotted spearhead type in Central Europe was possible thanks to long-distance communication networks established by the aforementioned syncretic societies that pre-dated the Early Bronze Age.

The bronze cup from Dohnsen (Lower Saxony, Germany) is another such trans-cultural item of the European Early Bronze Age (*c.* Br A2 after Reinecke). Due to its striking resemblance in shape and decoration to contemporaneous vessels from the Aegean, particularly to a find from Akrotiri on Thera (Fig. 2), the Dohnsen cup has long been considered a genuine import of Minoan/Mycenaean origin (Matthäus 1978; Sprockhoff 1961). The circumstances of the cup's discovery have been reported in detail and clarified (Suchowska *et al.* in press; Suchowska *et al.* 2021; Sprockhoff 1961). However, as regards the results of its scientific analysis, we are still left with more questions than answers. The analyses of trace elements and isotopic composition of the cup suggest that it might have been produced from Central European ores, and that its individual parts were made from different lots of metal (Suchowska-Ducke *et al.* 2021). On the other hand, from a typological and technological point of view, the Dohnsen cup clearly represents a foreign object in the material culture of the Early Bronze Age Únětice culture of the North European Plain. Interestingly, careful observation of its surface marks indicates that the cup was reworked at least once, resulting in the addition of the ribbon ornamentation, and possibly that of a new handle (Suchowska-Ducke *et al.* 2021). This might be evidence of repairing an item important for the local community, or it might suggest that the vessel lost its original association and was then reworked. Either way, the Dohnsen cup represents a remarkably long-distance transfer of style and extraordinary metalworking knowledge and skills. It could have been manufactured from 'local' resources by an itinerant, clearly professional smith (of Aegean origin?) who, as a trans-cultural visitor, introduced foreign material concepts into the local culture.

A good confirmation of Burke's (2009: 67) statement that 'when cultures meet, some individuals and groups participate in the process more than others', is the case of the dissemination of flange-hilted Naue II swords (Fig. 3). The latter are an excellent example of a weapons technology that spreads fast and over vast areas because of its efficient design (Molloy 2011; Kristiansen 2002). Carried by a newly emerged social class of highly mobile warriors, and spurred on by the extreme intensity of warfare as a form of social interaction, the Naue II sword technology quickly became a dominant factor of Bronze Age warfare in Europe and beyond (Suchowska-Ducke 2018). Hundreds of these swords have been found in Central and Northern Europe and in the Balkans, dozens in Southern and Western Europe and in the Aegean; several are also known from Cyprus and the Near East, with the oldest specimens already dating to the end of the Middle Bronze Age (Suchowska-Ducke 2015, with further references).

In their associated archaeological assemblages, many Naue II swords are part of a specific package of objects that includes other types of weaponry, drinking vessels, and toiletry items, and which characterises travelling

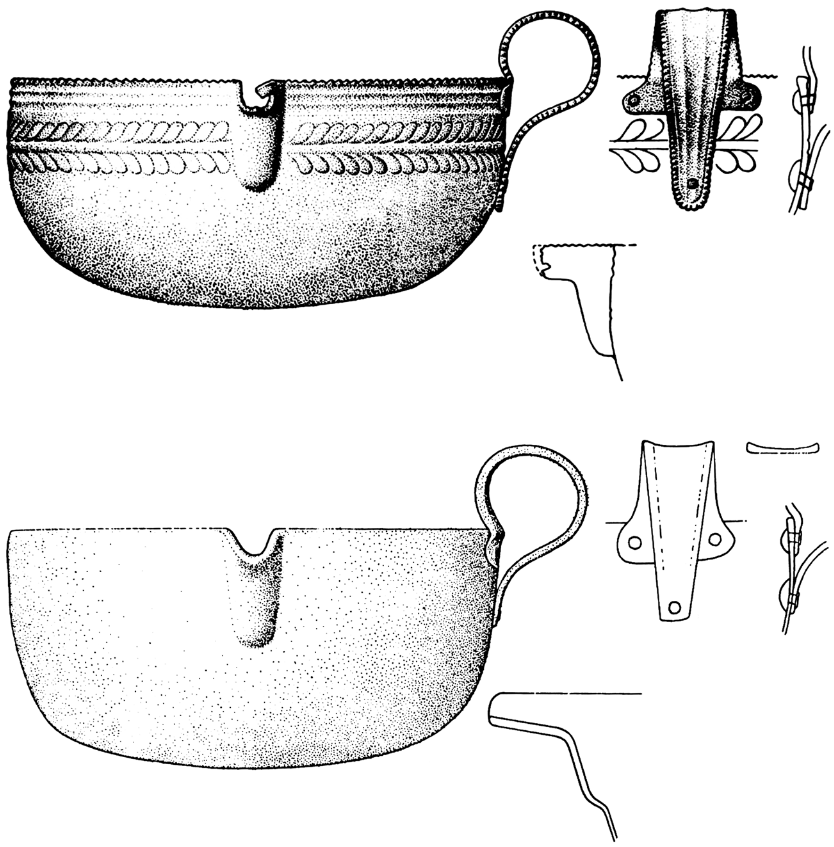


Figure 2: The bronze cup from Dohnsen (upper) and its closest relative in shape from Akrotiri on the island of Thera (lower) (Matthäus 1978: Abb. 1, 2; reproduced with kind permission of Hartmut Matthäus)

warriors or mercenaries and can be found across the European continent and in the Mediterranean Basin (Tarbay 2015; Deger-Jalkotzy 2006; Kristiansen 2002). The warrior swords of Naue II type appear in rich graves with local prestige goods that are indicative of the rise of a travelling warrior aristocracy in temperate Europe and its 'global' (into the Mediterranean world) expansion after 1300 BCE, with a profound impact on Late Bronze Age societies (Kristiansen and Suchowska-Ducke 2015). No inquiry into aspects of symbolism or transmission of 'cultural values' is necessary to explain the popularity of Naue II swords, as it is a weapon easy to manufacture, efficient and versatile in use. Therefore, it quickly became the trans-cultural signature weapon of a class of mobile warriors, who, upon returning to their homelands, introduced new ideas, innovations, and material wealth (Suchowska-Ducke 2018; Tarbay 2015). The importance of this social stratum and its transformative impact on society is preserved in Homer's epics as much as in the rich archaeological record of the era.

Carriers of trans-cultural expressions also include stylistic and artistic elements that might be applied to numerous types of objects. A prominent ornamental motif, that spread at the end of Middle and during the Late Bronze Age across the European Continent and Mediterranean Basin, was decorative bird heads, so-called bird *protomae*. According to some scholars their origins should be sought in clay models of birds, usually ships, known from the Danube region, and dating to Br A2 and Br B (Bouzek 1985: 178). Bird *protomae* became particularly popular during the time of the Urnfield and Protovillanova cultures (Bietti Sestieri 1973; Kossack 1954). In Central Europe, this type of decoration first appeared in Hungary, in assemblages dated to early Br D (Mozsolics 1973: 52-53). In the Aegean, the bird-head motifs became particularly popular *c.* 1300 BC, and there is no doubt that this was a foreign iconographical element in the region (Furumark 1941). One of the variants of this decoration were bird heads placed on the bows of ships, the so-called *Vogelbarke* or *Vogelsonnenbarke*, particularly common in the Urnfield culture, where they were associated with solar iconography (Bouzek 1999: 177-178). This motif, and possibly also the ideas behind it, spread across vast geographical spaces, thanks to trans-cultural travellers (merchants, smiths, warriors, settlers) who moved across the Continent and beyond. Bronze Age bird-head motifs are known, e.g., from the rock carvings and weaponry of Scandinavia, from the bronze models of the Carpathian Basin, from ceramic

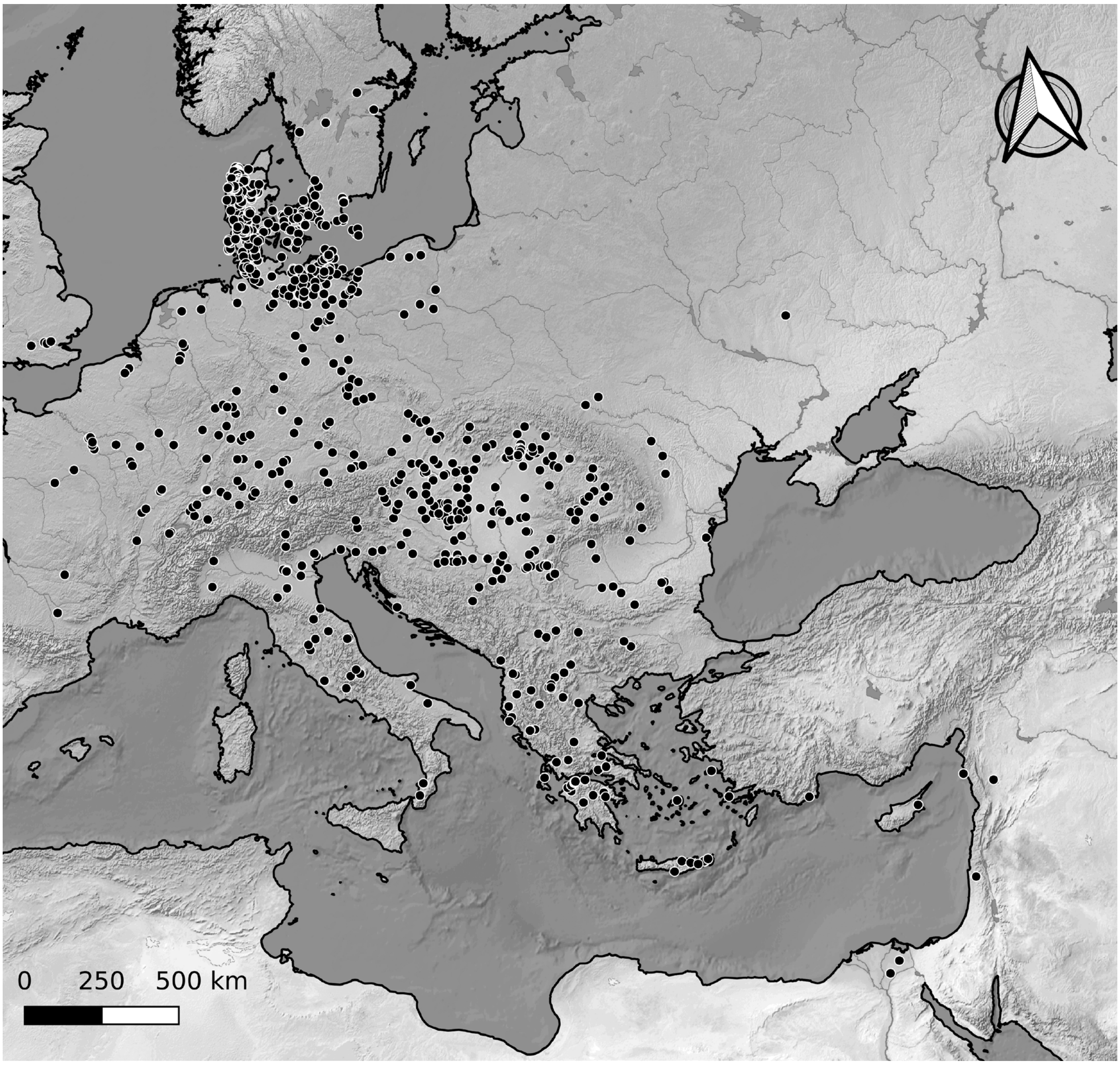


Figure 3: Map of all published find spots of flange-hilted 'Naue II' swords (map: Benjamin Ducke; background topography: Natural Earth Data, public domain).

vessels of Mycenaean Greece, and from the frescos in the Egyptian temple of Medinet Habu depicting the ships of the enigmatic 'Sea Peoples' (Drews 2000; Ling and Rowlands 2013). Thus, bird *protomae* represent a fascinating case of cultural elements that did not (unlike the Naue II swords) spread for technological or economical merits, but supposedly because they were symbols closely associated with a significant cultural identity that were both easily integrated into artistic designs and meaningful across cultural boundaries.

Conclusions

The European Bronze Age has often been depicted as an epoch dominated by warriors and chiefdoms (e.g. Vandkilde 2017; Kristiansen and Larsson 2007; 2005; Kristiansen 1999; Treherne 1995). However, such manifestations of hierarchical societies were only one aspect of a much more fundamental phenomenon of the strongly increasing connectivity and long-distance interactions between individuals and groups. The latter brought with it the exchange of objects (or, in archaeological terms, artefacts) that encapsulated foreign ideas, skills, and values. These artefacts, or rather the systems of trade and exchange, technology and knowledge that came with them, eventually brought about significant change in all those who were part of the connected Bronze Age world.

In this regard, one might say that bronze artefacts played an active role in the construction of Bronze Age peoples (Appadurai 1988). Networks of exchange link human and *artefactual* biographies, so that people do not simply make objects; rather, objects can be said to make or even to animate people (see an interesting discussion by Brück and Fontijn 2013). In their cultural role as active agents, artefacts are culturally inalienable, as they can neither be separated from their histories nor severed from the claims of former owners (Brück and Fontijn 2013: 202).

However, outside of their local, original contexts, all objects are in danger of losing their meanings, which are ultimately more precious than their economic values (Bradley 2013). Conversely, the meanings of objects can be transported, even as imperfect copies or imitations, by human carriers (e.g. skilled smiths, experienced traders, or knowledgeable diplomats) to distant areas, where they will either be (imperfectly) preserved or translated into something that is a better fit for the new cultural environment (Bradley 2013). These principles are further illustrated by another tradition of the Bronze Age – the exchange of gifts over remarkably long distances (Mauss 1990). Here, the form and character of the gift can be said to directly reflect the cultural values that are central to the relationship being created. The archaeological record of the European Bronze Age has preserved many ambiguous cultural 'carrier objects', e.g. the bronze cup from Dohnsen and the spearhead from Khyna, discussed above.

Identity is another of the many aspects that seem so remarkably modern about the Bronze Age (Kristiansen 2014; Sofaer 2008; Bergerbrant 2007; Brück 2004, Sørensen 2013; 1997). From an archaeological perspective, identity is naturally tied to the material record of the era. It is perhaps somewhat of a paradox that the Bronze Age material heritage is at the same time an enormously rich source of potential evidence for cultural identity, and, due to its complexity, defies the simple logic of traditional cultural labels, i.e. 'Únětice culture', 'Tumulus culture', 'Urnfield culture', etc. As Werbner (1997: 4-5) has already emphasised, 'there is no culture in and of itself'. Identity, as an ever-changing cultural construct that needs to adapt to social, technological and economical change, always has some way of negotiating and balancing power (with or without particular wealth, but always through cultural contracts) and social hierarchy (Wiggering 2018; Helms 1991; 1988). In an expanding social network, these aspects of identity have to be communicated and understood in a common material language, e.g. as ritual feasts, shared symbols and meanings. These dynamics are certainly visible in the widely distributed Bronze Age record, with its spectacular elite burials (princely graves) and range of highly developed weaponry (such as the famous Naue II swords). And yet, the European Bronze Age also shows, much like contemporary Europe, a continental patchwork in the degree to which these shared cultural expressions are locally adopted. This is illustrated by the proportions of graves with swords, which differ widely across the continent (up to 25% in Denmark, but only about 3% in Germany and the Netherlands; see Harding 2007: 125-133).

A possible and elegant way to bridge all of these seeming contradictions lies in the concept of hybridisation, as derived from biology, and its application to material culture (Werbner 1997). Hybrid objects encapsulate characteristics of different cultural environments and can thus be said to represent trans-cultural or inter-cultural items (see an interesting discussion on the subject in Vandkilde 2016; Maran 2012; Stockhammer 2012). Foreign forms and material expressions are subjected to transformation and translation, thus increasing a hybrid object's chances of local acceptance and integration into other societies. In turn, the act of creating hybridity, i.e. the mixing, borrowing, translation, and derivation are visible social responses to cultural contact and which is well represented in the archaeological record (Burke 2009). Given this broad definition and the abundant material evidence of cultural hybridisation, one might ask which culture would *not* be hybrid, and whether non-hybrid ('original') cultures ever existed (Hahn 2008; Said 1993)? Indeed, the very idea of the Bronze Age, as an epoch of change brought about by the diffusion of new technologies, defies notions of isolated development, and neatly drawn boundaries between cultural groups. In this general aspect, the Bronze Age is perhaps not different from any other time in the history of humanity. For the societies of Continental Europe, however, it is the first era during which the effects of a strongly connected world become predominant across the Continent, with 'bronzization' akin to the modern concept of globalisation (Vandkilde 2016).

Thus, whatever the individual nature of the era's cultural complexities might suggest, the overall picture of the European Bronze Age remains one of astoundingly intense and long-distance, almost modern, cultural connectivity – a feature that perhaps represents the true value of the Continent's first 'golden era' (see Demakopoulous *et al.* 1999).

Bibliography

Appadurai, A. (ed.) 1988. *The social life of things: Commodities in cultural perspective.* Cambridge: Cambridge University Press.

Aslaksen, O. 2015. Travellers of the Bronze Age. *Archaeologia Austriaca* 99: 11-30.

Bartelheim, M. 1998. *Studien zur böhmischen Aunjetitzer Kultur: Chronologische und chorologische Untersuchungen.* Bonn: Rudolf Habelt.

Beck, C.W, E. Wilbur and S. Meret 1964. Infra-red spectra and the origin of amber. *Nature* 201: 256-257.

Bergerbrant, S. 2007. *Bronze age identities: Costume, conflict and contact in Northern Europe 1600-1300 BC*. Lindome: Bricoleur Press.

Bergerbrant, S. and A. Wessman 2018. Women on the move in the Nordic Bronze Age: a case study based on rock art and costume, in J. Dodd and E. Meijer (eds) *Giving the past a future. Essays in archaeology and rock art, studies in honour of Dr. Phil. H.c. Gerhard Milstreu*: 121-135. Oxford: Archaeopress.

Bertemes, F. and V. Heyd 2002. Der Übergang Kupferzeit/Frühbronzezeit am Nordwestrand des Karpatenbeckens – kulturgeschichtliche und paläometallurgische Betrachtungen, in M. Bartelheim, R. Krause and E. Pernicka (eds) *Die Anfänge der Metallurgie in der Alten Welt*: 185-228. Rahden/Westf.: Verlag Marie Leidorf.

Besse, M. 2004. Bell Beaker common ware during the third Millennium BC Europe, in J, Czebreszuk (ed.) *Similar but Different. Bell Beakers in Europe*: 127-148. Poznań: Adam Mickiewicz University.

Bietti Sestieri, A.M. 1973. The metal industry of continental Italy, 13th to the 11th century BC and its connections with the Aegean. *Proceedings of the Prehistoric Society* 39: 383-424.

Bouzek, J. 1985. *The Aegean, Anatolia and Europe: cultural interrelations in the second millennium BC*. Studies in Mediterranean Archaeology 29. Gothenburg: Paul Åströms Förlag.

Bouzek, J. 1999. Communications in the Late Bronze Age Europe: the case of the Urnfields, in C. Orrling (ed.) *Communication in Bronze Age Europe*: 47-62. Stockholm: Historiska Museet.

Bradley, R. 1990. *The Passage of Arms. An archaeological analysis of prehistoric hoards and votive deposits*. Cambridge: Cambridge University Press.

Bradley, R. 2013. Hoards and the Deposition of Metalwork, in A.F. Harding and H. Fokkens (eds) *The Oxford Handbook of the European Bronze Age*: 121-139. Oxford: Oxford University Press.

Brozio, J. P., Z. Stos-Gale, J. Müller, N. Müller-Scheessel, S. Schultrich, B. Fritsch, F. Jürgens and H. Skorna 2023. The origin of Neolithic copper on the central Northern European plain and in Southern Scandinavia: Connectivities on a European scale. *PlosOne* 18: e0283007.

Brück, J. 2004. Material metaphors: The relational construction of identity in Early Bronze Age burials in Ireland and Britain. *Journal of Social Archaeology* 4(3): 307-333.

Brück, J. and D. Fontijn 2013. The Myth of the Chief: Prestige Goods, Power, and Personhood in the European Bronze Age, in A.F. Harding and H. Fokkens (eds) *The Oxford Handbook of the European Bronze Age*: 197-215. Oxford: Oxford University Press.

Burke, P. 2009. *Cultural Hybridity*. Cambridge: Polity Press.

Carlsen, L., A. Feldthus, T. Klarskov and A. Shedrinsky 1997. Geographical classification of amber based on pyrolysis- and infra-red spectroscopy data. *Journal of Analytical and Applied Pyrolysis* 43: 71-81.

Chechushkov, I. and A. Epimakhov 2018. Eurasian Steppe Chariots and Social Complexity During the Bronze Age. *Journal of World Prehistory* 31: 435-483.

Cline, E.H. (ed.) 2012. *The Oxford Handbook of the Bronze Age Aegean*. Oxford, Oxford University Press.

Coblenz, W. 1986. Ein frühbronzezeitlicher Verwahrfund von Kyhna, Kr. Delitzsch. *Arbeits- und Forschungsberichten zur sächsischen Bodendenkmalpflege* 30: 37-88.

Czebreszuk, J. (ed.) 2004. *Similar but Different: Bell Beakers in Europe*. Poznań: Adam Mickiewicz University.

Czebreszuk, J. 2011. *Bursztyn w kulturze mykeńskiej. Zarys problematyki badawczej*. Poznań: Wydawnictwo Poznańskie.

David, W. 1997. Altbronzezeitliche Beinobjekte des Karpatenbeckens mit Spiralwirbel oder Wellenbandornamnet und ihre Parallellen auf der Peloponnes und in Anatolien in frühmykenischer Zeit, in P. Roman (ed.) *The Thracian World at the Crossroads of Civilization*: 247-305. Bucharest: Institutul Român de Tracologie.

Day, J. 2013. Botany meets archaeology: people and plants in the past. *Journal of Experimental Botany* 64: 1-12.

Deger-Jalkotzy, S. 2006. Late Mycenaean Warrior Tombs, in S. Deger-Jalkotzy and I.S. Lemos (eds) *Ancient Greece: from the Mycenaean palaces to the age of Homer*: 151-179. Edinburgh: Edinburgh University Press.

Demakopoulous, K., C. Eluère, J. Jensen, A. Jockenhövel and J.-P. Mohen (eds) 1999. *Gods and Heroes of the European Bronze Age: Europe at the Time of Ulysses*. London: Thames & Hudson Ltd.

Drews, R. 1993. *The End of the Bronze Age: changes in warfare and the catastrophe ca. 1200 BC*. Princeton: Princeton University Press.

Drews, R. 2000. Medinet Habu: Oxcarts, Ships, and Migration Theories. *Journal of Near Eastern Studies* 59: 161-190.

Ducke, B. and P. Suchowska 2022. Exploratory Network Reconstruction with Sparse Archaeological Data and XTENT. *Journal of Archaeological Method and Theory 29: 508-539.*

Earle, T. 2002. *Bronze Age Economics. The Beginnings of Political Economies*. Cambridge: Westview Press.

Earle, T., J. Ling, C. Uhnér, Z. Stos-Gale and L. Melheim, 2015. The Political Economy and Metal Trade in Bronze Age Europe: Understanding Regional Variability in Terms of Comparative Advantages and Articulations. *European Journal of Archaeology* 18: 633-657.

Fokkens, H. and A.F. Harding (eds) 2013. *The Oxford Handbook of the European Bronze Age*. Oxford: Oxford University Press.

Fokkens, H. and F. Nicolis (eds) 2012. *Background To Beakers: inquiries in regional cultural backgrounds of the Bell Beaker complex*. Leiden: Sidestone.

Fontijn, D.R. 2002. Sacrificial Landscapes. Cultural biographies of persons, objects and 'natural' places in the Bronze Age of the southern Netherlands, c. 2300-600 BC. Analecta Praehistorica Leidensia 33/34. Leiden: University of Leiden Faculty of Archaeology.

Frei, K.M., U. Mannering, K. Kristiansen, M.E. Allentoft, A.S. Wilson, I. Skals, S. Tridico, M.L. Nosch, E. Willerslev, L. Clarke and R. Frei 2015. Tracing the dynamic life story of a Bronze Age Female. *Scientific Reports* 5: 10431.

Frei, K.M., C. Villa, M.L. Jørkov, M.E. Allentoft, F. Kaul, P. Ethelberg, S.S. Reiter, A.S. Wilson, M. Traube, J. Olsen, N. Lynnerup, E. Willerslev, K. Kristiansen and R. Frei 2017. A Matter of Months: High Precision Migration Chronology of a Bronze Age Female. *PlosOne* 12: 1-20 (available at: https://doi.org/10.1371/journal.pone.0178834).

Furumark, A. 1941. *The Mycenaean pottery: analysis and classification*. Stockholm: Kungl. Vitterhets Historie och Antikvitets Adademien.

Gebauer, A.B., M.L. Bendtsen and L.V. Sørensen (forthcoming). From Copper to Stone – boom and bust of early metallurgy during the fourth millennium BC in South Scandinavia, in H.W. Nørgaard and S. Reiter (eds) *Bronzization*. Oxford: Archaeopress.

Gelb, I.J. 1973. Prisoners of War in Early Mesopotamia. *Journal of the Near Eastern Studies* 32: 70-98.

Gerloff, S. 1993. Zu Fragen mittelmeerl.ndischer Kontakte und absoluter Chronologie der Frühbronzezeit in Mittel- und Westeuropa. *Praehistorische Zeitschrift* 68: 58-102.

Gogăltan, F. 2005. Der Beginn der bronzezeitlichen Tellsiedlungen im Karpatenbecken: Chronologische Probleme, in B. Horejs, R. Jung, E. Kaiser and B. Teržan (eds) *Interpretationsraum Bronzezeit. Bernhard Hänsel von seinen Schülern gewidmet*: 161-179. Bonn: Rudolf Habelt.

Hahn, H.P. 2008. Diffusionism, Appropriation, and Globalization. Some Remarks on Current Debates in Anthropology. *Anthropos* 103: 191-202.

Harding, A.F. 2000. *European societies in the Bronze Age*. Cambridge: Cambridge University Press.

Harding, A.F. 2007. *Warriors and Weapons in Bronze Age Europe*. Budapest: Archaeolingua.

Harding, A.F. 2013. *Salt in Prehistoric Europe*. Leiden: Sidetone Press.

Helms, M.W. 1988. *Ulysses sails. An ethnographic Odyssey of power, knowledge and geographical distance*. Princeton: Princeton University Press.

Helms, M.W. 1991. Esoteric knowledge, geographical distance, and the elaboration of leadership status: dynamics of resource control, in T.A. Rambo and K. Gillogly (eds) *Profiles in cultural evolution*: 335-350. Michigan: University of Michigan Press.

Heyd, V. 2016. Das Zeitalter der Ideologien: Migration, Interaktion und Expansion im prähistorischen Europa des 4. und 3. Jahrtausends v. Chr., in M. Furholt, R. Grossmann and M. Szmyt (eds) *Transitional landscapes? The 3rd millennium BC in Europe*: 53-85. Bonn: Rudolf Habelt.

Heyd, V. 2013. Europe 2500 to 2200 BC: Between Expiring Ideologies and Emerging Complexity, in A.F. Harding and H. Fokkens (eds) *The Oxford Handbook of the European Bronze Age*: 47-67. Oxford: Oxford University Press.

Heyd, V. 2007. When the West meets the East: the eastern periphery of the Bell Beaker phenomenon and its relation with the Aegean Early Bronze Age, in I. Galanaki, Y. Galanakis, H. Tomas and R. Laffineur (eds) *Between the Aegean and Baltic Seas: Prehistory across Borders*: 91-107. Liège: Université de Liège.

Jockenhövel, A. 1991. Räumliche Mobilität von Personen in der mittleren Bronzezeit des westlichen Mitteleuropa. *Germania* 69: 49-62.

Kaczanowski, P. 2003. Epoka brązu – pomiędzy centrami cywilizacyjnymi Bałkanów i Alp a Skandynawią. Kraków: Fogra.

Knappett, C. 2011. *An Archaeology of Interaction: network perspectives on material culture and society*. Oxford: Oxford University Press.

Knipper, C., A. Mittnik, K. Massy, C. Kociumaka, I. Kucukkalipci, M. Maus, F. Wittenborn, S.E. Metz, A. Staskiewicz, J. Krause and P.W. Stockhammer 2017. Female exogamy and gene pool diversification at the transition from the Final Neolithic to the Early Bronze Age in central Europe. *Proceedings of the National Academy of Sciences of the United States of America* 5 (September): 1-6.

Kossack, G. 1954. *Studien zum Symbolgut der Urnenfelder- und Hallstattzeit Mitteleuropas*. Berlin: Walter de Gruyter.

Krause, R. 1998. Zur Entwicklung der frühbronzezeitlichen Metallurgie nördlich der Alpen, in B. Hänsel (ed.) *Mensch und Umwelt in der Bronzezeit Europas*: 163-192. Kiel: Oetker Voges Verlag.

Kristiansen, K. 1999. The emergence of warrior aristocracies in the later European prehistory and their long-term history, in J. Carman and A.F. Harding (eds) *Ancient Warfare. Archaeological Perspectives*: 175-189. Stroud: Sutton Publishing.

Kristiansen, K. 2002. The tale of the sword – swords and swordfighters in Bronze Age Europe. *Oxford Journal of Archaeology* 21: 319-332.

Kristiansen, K. 2014. Bronze Age identities: from social to cultural and ethnic identity, in J. McInery (ed.) *A*

Companion to Ethnicity in the Ancient Mediterranean: 82-96. Oxford: Wiley Blackwell.

Kristiansen, K. 2023. Bronze Age Travelers, in M. Fernández-Götz, C. Nimura, P.W. Stockhammer and R. Cartwright (eds) *Rethinking migrations in late prehistoric Eurasia*: 89-109. Oxford: Oxford University Press.

Kristiansen, K. and T. Earle 2022. Modelling Modes of Production: European 3rd and 2nd Millennium BC Economies, Frontiers in Economic History, in M. Frangipane, M. Poettinger and B. Schefold (eds) *Ancient Economies in Comparative Perspective: Material Life, Institutions, and Economic Thought*: 131-163. Cham: Springer.

Kristiansen, K. and T. Larsson 2005. *The Rise of Bronze Age Society: travels, transmissions and transformations*. Cambridge: Cambridge University Press.

Kristiansen, K. and T. Larsson 2007. Contacts and travels during the 2nd millennium BC. Warriors on the move, in I. Galanaki, Y. Galanakis, H. Tomas and R. Laffineur (eds) *Between the Aegean and Baltic Seas: Prehistory across Borders*: 25-33. Liège: Université de Liège.

Kristiansen, K. and P. Suchowska-Ducke 2015. Connected Histories: The Dynamics of Bronze Age Interaction and Trade. *Proceedings of the Prehistoric Society* 81: 361-392.

Lenerz-de Wilde, M. 1995. Prämonetäre Zahlungsmittel in der Kupfer- und Bronzezeit Mitteleuropas. *Fundberichte aus Baden-Württemberg* 20: 229-327.

Ling, J., R. Chacon and K. Kristiansen (eds) 2022. *Trade before Civilization Long Distance Exchange and the Rise of Social Complexity*. Cambridge: Cambridge University Press.

Ling, J., T. Earle and K. Kristiansen 2018. Maritime Mode of Production. Raiding and Trading in Seafaring Chiefdoms. *Current Anthropology* 59: 488-525.

Makkay J. 1999. The Mycenaean world, the Mycenaean periphery and the Carpathian Basin, in F. Dakoronia (ed.) *H periphereia tou mykenaïkou kosmou*: 47-54. Lamia: Ε.Π.Κ.Α.

Maran, J. 1998. *Kulturwandel auf dem griechischen Festland und den Kykladen im späten 3. Jahrtausend v. Kr*. Bonn, Rudolf Habelt.

Maran, J. 2007. Seaborne Contacts between the Aegean, the Balkans and the Central Mediterranean in the 3rd Millennium B.C.: The Unfolding of the Mediterranean World, in I. Galanaki, Y. Galanakis, H. Tomas and R. Laffineur (eds) *Between the Aegean and Baltic Seas: Prehistory across Borders*: 3-25. Liège: Université de Liège.

Maran, J. 2012. One World Is Not Enough: The Transformative Potential of Intercultural Exchange in Prehistoric Societies, in P.W. Stockhammer (ed.) *Conceptualizing Cultural Hybridization*: 59-66. Berlin: Heidelberg: Springer.

Maran, J. and A. Van De Moortel 2014. A Horse-Bridle Piece with Carpatho-Danubian Connections from Late Helladic I Mitrou and the Emergence of a Warlike Elite in Greece During the Shaft Grave Period. *American Journal of Archaeology* 118: 529-548.

Matthews, R. 2003. *The Archaeology of Mesopotamia: Theories and Approaches*. London: Routledge.

Matthäus, H. 1978. Neues zur Bronzetasse aus Dohnsen, Kr. Celle. *Die Kunde: Zeitschrift für niedersächsische Archäologie* 28-29 (1977/78): 51-69.

Mauss, M. 1990. *The Gift: The Form and Reason for Exchange in Human Societies*. London: Routledge.

Molloy, B. 2011. Use-wear analysis and use-patterns of Bronze Age Swords, in M. Uckelmann and M. Mödlinger (eds) *Bronze Age Warfare: Manufacture and Use of Weaponry*: 67-84. British Archaeological Reports International Series 2255. Oxford: Archaeopress.

Mozsolics, A. 1973. *Bronze- und Goldfunde des Karpatenbeckens. Depotfundhorizonte von Forro und Opalyi*. Budapest: Akadémiai Kiadó.

Müller, J. and J. Czebreszuk (forthcoming). Burial Mounds and Social Practice of the Central European Early Bronze Age, H.W. Nørgaard and S. Reiter (eds) *Bronzization*. Oxford: Archaeopress.

Nicolis, F. 2005. Long-distance cultural links between northern Italy, the Ionian islands and the Peloponnese in the last centuries of the 3rd millennium BC, in R. Laffineur and E. Greco (eds) *Emporia – Aegeans in Central and Eastern Mediterranean*: 527-539. Liège and Austin: Université de Liège and University of Texas.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2019. On the trail of Scandinavia's early metallurgy: Provenance, transfer and mixing. *PlosOne* 14: e0227504 (available at: https://doi.org/10.1371/journal.pone.0227504).

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2021. Shifting Networks and Mixing Metals: Changing metal-trading routes to Scandinavia correlate with Neolithic and Bronze Age transformations. *PlosOne* 16: e0252376. (available at https://doi.org/10.1371/journal.pone.0252376).

Nørgaard, H.W., J. Ling, D. Berger, E. Pernicka, Z. Stos-Gale and A.L. Melheim (forthcoming). Bronze to Scandinavia, in H.W. Nørgaard and S. Reiter (eds) *Bronzization*. Oxford: Archaeopress.

Nosch, M.L.B. 2003. The Women at Work in the Linear B Tablets, in L.P. Loven and A. Strömberg (eds) *Gender, Cult, and Culture in the Ancient World from Mycenae to Byzantium*: 12-16. Sävedalen: Paul Aaströms Förlag.

Olalde, I., S. Brace, M. Allentoft, I. Armit, K. Kristiansen, T. Booth, N. Rohland, S. Mallick, A Szécsényi-Nagy, A. Mittnik, E. Altena, M. Lipson, I. Lazaridis, T.K. Harper, N. Patterson, N. Broomandkhoshbacht, Y. Diekmann, Z. Faltyskova, D. Fernandes, ... D.

Reich 2018. The Beaker phenomenon and the genomic transformation of northwest Europe. *Nature* 555(7695): 190-196 (available at: https://doi.org/10.1038/nature25738).

Pare, C.F.E. 1999. Weights and Weighing in Bronze Age Central Europe, in I. Kilian-Dirlmeier and M. Egg (eds) *Eliten in der Bronzezeit: Ergebnisse zweier Kolloquien in Mainz und Athen*: 421-514. Mainz: Verlag des Römisch-Germanischen Zentralmuseums.

Pernicka, E. 2010. Archäometallurgische Untersuchungen am und zum Hortfund von Nebra, in H. Meller and F. Bertemes (eds) *Der Griff nach den Sternen*: 719-734. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Price, T.D., G. Grupe and P. Schröter 1998. Migration in the Bell Beaker period of central Europe. *Antiquity* 72: 405-411.

Purowski, T., L. Kępa and B. Wagner 2018. Glass on the Amber Road: the chemical composition of glass beads from the Bronze Age in Poland. *Archaeological and Anthropological Sciences* 10: 1283-1302.

Rahmstorf, L. 2006. Zur Ausbreitung vorderasiatischer Innovationen in die frühbronzezeitliche Ägäis. *Praehistorische Zeitschrift* 81: 49-96.

Reiter, S.S. and K.M. Frei 2019. Interpreting Past Human Mobility Patterns: A Model. *European Journal of Archaeology* 22: 454-469.

Reiter, S.S., N.A. Møller, M.L.S. Jørkov, J.-H. Bech, R. Frei and K.M. Frei 2023. Tales from Ginderup Mound in Thisted County, Denmark: Further Investigations of Female Mobility in the Nordic Bronze Age. *Danish Journal of Archaeology* 12: 1-25 (available at: https://doi.org/10.7146/dja.v12i1.134830).

Renfrew, C. 1972. *The Emergence of Civilisation: The Cyclades and the Aegean in the Third Millennium BC*. London: Methuen.

Rowlands, M. and J. Ling 2013. Boundaries, flows and connectivities: mobility and stasis in the Bronze Age, in S. Bergerbrant and S. Sabatini (eds) *Counterpoint: Essays in Archaeology and Heritage Studies in Honour of Professor Kristian Kristiansen*: 517-529. British Archaeological Reports International Series 2508. Oxford: Archaeopress.

Sabatini, S. and S. Bergerbrant (eds) 2020. *The Textile Revolution in the Bronze Age Europe: Production, Consumption and Specialisation*. Cambridge: Cambridge University Press.

Said, E.W. 1993. *Culture and Imperialism*. London: Chatto & Windus.

Sofaer, J. 2008. *Material Identities*. Oxford: Wiley-Blackwell.

Sørensen, M.L.S. 1997. Reading Dress: The Construction of Social Categories and Identities in Bronze Age Europe. *Journal of European Archaeology* 5: 93-114.

Sørensen, M.L.S. 2013. Identity, Gender, and Dress in the European Bronze Age, in A.F. Harding and H. Fokkens (eds) *The Oxford Handbook of the European Bronze Age*: 216-233. Oxford: Oxford University Press.

Sprockhoff, E. 1961. Die mykenische Bronzetasse von Dohnsen, Kr. Celle. *Germania* 39: 11-22.

Stockhammer, P.W. 2012. Conceptualizing cultural hybridization in archaeology, in P.W. Stockhammer (ed.) *Conceptualizing Cultural Hybridization*: 43-58. Berlin, Heidelberg: Springer.

Stockhammer, P.W. 2017. The Dawn of the Copy in the Bronze Age, in C. Forberg and P.W. Stockhammer (eds) *The transformative power of the copy: a transcultural and interdisciplinary approach*: 169-189. Heidelberg: Heidelberg University Publishing.

Suchowska-Ducke, P. 2015. The dissemination of Naue II swords – a case study on long-distance mobility, in P. Suchowska-Ducke, S.S. Reiter and H. Vandkilde (eds) *Forging identities. The mobility of culture in Bronze Age Europe*: 257-265. British Archaeological Reports International Series 2772. Oxford: BAR Publishing.

Suchowska-Ducke, P. 2018. New technologies and transformation in the European Bronze Age: the case of Naue II swords. *Bulgarian e-Journal of Archaeology* 8: 145-162.

Suchowska-Ducke, P., F. Klimscha and B. Ducke 2024 (in press). Die Bronzetasse aus Dohnsen: Ägäischer Stil und nordisches Handwerk imprähistorischen Niedersachsen? *Die Kunde: Zeitschrift für niedersächsische Archäologie*.

Suchowska-Ducke, P., S.S. Reiter and H. Vandkilde (eds) 2015. *Forging identities. The mobility of culture in Bronze Age Europe*. British Archaeological Reports International Series 2771/2772. Oxford: BAR Publishing.

Suchowska-Ducke, P., Z. Stos-Gale, E. Pernicka, H.W. Nørgaard and B. Ducke 2021. The bronze cup from Dohnsen in the light of old and new evidence. *Archaeometry* 64: 728-743.

Tarbay, J.G. 2015. A new Late Bronze Age warrior equipment from East Central Europe. *Archaeologiai Értesítő* 140: 29-70.

Treherne, P. 1995. The Warrior's Beauty: The Masculine Body and Self-Identity in Bronze Age Europe. *Journal of European Archaeology* 3: 105-144.

Uckelmann, M. 2013. Land Transport in the Bronze Age, in A.F. Harding and H. Fokkens (eds) *The Oxford Handbook of the European Bronze Age*: 398-413. Oxford: Oxford University Press.

Van de Noort, R. 2006. *Argonauts of the North Sea: a social maritime archaeology for the 2nd Millennium BC. Proceedings of the Prehistoric Society* 72: 243-266.

Van De Noort, R. 2013. Seafaring and Riverine Navigation in the Bronze Age of Europe, in A.F. Harding and H. Fokkens (eds) *The Oxford Handbook of the European Bronze Age*: 382-397. Oxford: Oxford University Press.

Van Wijngaarden, G.J. 2012. Trade goods reproducing merchants? The materiality of Mediterranean

Late Bronze Age exchange, in J. Maran and P.W. Stockhammer (eds) *Materiality and Social Practice: transformative capacities and intercultural encounters*: 61-72. Oxford: Oxbow Books.

Vandkilde, H. 2014 Breakthrough of the Nordic Bronze Age: transcultural warriorhood and a Carpathian crossroad in the sixteenth century BC. *European Journal of Archaeology* 17: 602-633.

Vandkilde, H., S. Hansen, K. Kotsakis, K. Kristiansen, J. Müller, J. Sofaer and M.L.S. Sørensen 2015. Cultural Mobility in Bronze Age Europe, in P. Suchowska-Ducke, S.S. Reiter and H. Vandkilde (eds) *Forging identities. The mobility of culture in Bronze Age Europe*: British Archaeological Reports Internation Series 2771). Oxford: BAR Publishing.

Vandkilde, H. 2016 Bronzization: The Bronze Age as pre-modern globalization. *Praehistorische Zeitschrift* 91: 103-123.

Vandkilde, H. 2017. The Beautiful Warrior Twenty-one Years After – Bronze Age Warfare and Warriors. *European Journal of Archaeology* 20: 55-59.

Vandkilde, H., C. Fischer Stephansen, P. Suchowska-Ducke, L. Ahlqvist, C. Skaaning Andersen, L. Felding, M. Bjørnevad-Ahlqvist, J. Czebreszuk and H.W. Nørgaard 2024. Metal-for-Amber in the European Bronze Age. *Praehistorische Zeitschrift* 99(1): 280-338 (available at: https://doi.org/10.1515/pz-2024-2003).

Varberg, J., B. Grantuze, F. Kaul, A.H. Hansen, M. Rotea and M. Wittenberger 2016. Mesopotamian Glass from Late Bronze Age Egypt, Romania, Germany, and Denmark. *Journal of Archaeological Science* 74: 184-194.

Vasilakis, A. 2001. *Minoan Crete; from Myth to History*. Athens: Adam Editions.

Vianello, A. 2005. *Late Bronze Age Mycenaean and Italic Products in the West Mediterranean: a social and economic analysis*. British Archaeological Reports International Series 1439. Oxford: Archaeopress

Werbner, P. 1997. Introduction: The Dialectics of Cultural Hybridity, in P. Werbner and T. Modood (eds) *Debating Cultural Hybridity: Multi-Cultural Identities and the Politics of Anti-Racism*: 1-26. London: Zed Books.

Wiggering, L. 2018. Dealing with the 'foreign': the movement of artefacts in Bronze Age Europe, in H.P. Hahn and G. Schmitz (eds) *Market as Place and Space of Economic Exchange. Perspectives from Archaeology and Anthropology*: 5975. Oxford: Oxbow Books.

Zaccagnini, C. 1983. Patterns of Mobility among Ancient Near Eastern Craftsmen. *Journal of Near Eastern Studies* 42: 245-264.

Chapter 9

Late Bronze Age ‘Horsification’ connects south Scandinavia, Italy, and Greece

Flemming Kaul

The National Museum of Denmark, Copenhagen, Denmark
flemming.kaul@natmus.dk

Abstract

The Nordic Late Bronze Age sun-horse renderings include a large range of variants, from ‘naturalistic’ figures to virtually incomprehensible, stylised figures, including stylised double horses. On this background, the sun-horse phenomenon can be traced into northern and central Italy in the Italian Iron Age Villanova Culture context. Here, during a period (900-600 BCE), where a burst of creativity and vigour characterised art and iconography in both regions, we may be able to find some remarkable connections and indications of the sharing of the sun-horse phenomenon. In Italy, as in South Scandinavia, the sun-horse can be found in different variants; the relatively ‘naturalistic’ variants appeared ‘side by side’ (in a chronological sense) with the highly stylised variants (including double horses) as seen by different art media. One particular variant of the stylised Italian sun-horse seems to have materialised as part of Villanova Culture swastika designs (the swastika being formed by angular schematised horse-like figures). The horse figure emerged with a notable strength on painted Greek Late Geometric Period pottery (800-700 BCE), although there were great differences in design and setting. Nevertheless, a close horse-swastika connection can be followed into Geometric Period Greece.

Introduction

Various levels of the interpretation of prehistoric art have been in play over the course of research history into the subject. In some periods, non-religious interpretations were in favour. Over the last two centuries, there has been an interplay between interpretations which tend more towards the religious sphere and those which lean towards more secular fields (Kaul 2004; Kristiansen 2010). The so-called decorative art or ornamental art concepts have prompted many different opinions. For example, when considering the decoration on British late La Tène bronze mirrors (100-0 BCE) it has been pointed out that the abstract motifs did not represent anything in particular; they did not have an underlying symbolic meaning. The hatched motifs were placed there in order to decoratively underline the purpose of a mirror: reflecting light (Joy 2008: 94). When it seems possible to find zoomorphic motifs such as the aquatic bird or a bird of prey hidden in the decorative scrolls of the mirrors, could the ‘abstract art’ then incorporate a specific meaning, or layers of meanings (Kaul 2014) so as to act as a visual communication of certain religious ideas? Some scholars do not deny that most La Tène art had a meaning far beyond aesthetics. That also includes what we could call abstract or decorative art, though admittedly the borderlines between different art concepts do not seem to work as well in the consideration of prehistoric art as they do for the consideration of art from other periods (Megaw and Megaw 1989). For Vincent Megaw (2002), Celtic art is basically religious.

When considering the art of the Nordic Late Bronze Age (1100-500 BCE), similar differential views have been expressed. The leading Danish archaeologist Jens Jacob Asmussen Worsaae (1821-1885) regarded the images of ships on bronze objects and on the rock carvings (as well as the circular designs, fish, snakes and horses connected with the ships) as religious images related to a solar cult (Worsaae 1882: 93-96). Worsaae’s successor at the National Museum of Denmark, Sophus Müller (1846-1934), was much more restrained in interpreting such Late Bronze Age (LBA) imagery. He did not consider such pictures as symbolic representations with a religious content (Müller 1897: 419-420).

When it comes to the miniature art on bronze objects, Müller relied upon arguments founded in certain concepts of art. The art on the bronzes is called decorative art or ornamental art (Danish: *prydkunst*). Decorative art within this category has no deeper meaning, apart from ornamentation. (Of course, decorative art in and of itself can have a meaning in an aesthetic sense, since it establishes harmony and balance.) When a ship is seen on a razor, then it is because the ship’s shape is simply a nice ornament (Müller 1897: 352-354). Further to this point, Müller underlined that when a pictorial motif (i.e. the ship) became increasingly stylised, then it totally lost any meaning as it became a mere ornament. The same principle also applies to horse and other zoomorphic motifs; when a horse figure lost its naturalistic appearance as a result of repeated artistic treatment, it has no meaning. According to Müller: ‘It is thoughtless art that has brought about these figurative constructions. If the representation of the horse had had a greater significance as being dedicated to, or otherwise associated with, the divinity, it would have been better able to assert its position' (Müller 1920: 139-140, author's translation). Müller's comments about NBA period V (900-700 BCE) bronze work are also extremely relevant in this regard: 'Animal heads are still present, but in a new and distorted shape. What is known of this kind has a character of fortuitousness, which must be denoted as degenerated, caused by wishing to fill the space' (Müller 1921: 38-40, author's translation). By claiming that when a motif, such as the horse, became solely decorative by stylisation, Müller has consequently dissociated himself from religious interpretations. In my opinion, however, there was no loss of meaning even with the most pronounced stylisation (Kaul 2018a).

Examination of 'the Chariot of the Sun' (*c.* 1400 BCE) after its discovery in 1902 prompted Müller to conclude that it threw new light on spiritual life and religion in the distant past (Müller 1903: 303). It may seem strange that while 'the Chariot of the Sun' was understood as embodying religious thoughts, the miniature art on the LBA razors (including horse figures) were not considered to have had any religious associations. It seems that Müller's concepts of art impeded him from including the pieces of miniature art on the bronzes into the sphere of religious or cosmological understanding. It is important to note that for Müller, the horse figure of 'the Chariot of the Sun' was considered as 'real art' or 'high art', a true plastic piece of sculpture in a classical sense.

In the 1930s, interest in religious interpretations was increasing. For instance, Johannes Brøndsted of the National Museum of Denmark reached the conclusion that beliefs about the journey of the sun and its various means of transportation were significant features in Bronze Age religion as expressed on Danish LBA bronze razors (Brøndsted 1938). Here, the idea of the sun drawn by a divine horse across the heavens was proliferated; words like 'sun-horse' and 'sun-ship' were employed. Furthermore, Brøndsted mentioned that the horse-and-sun combination still maintained its meaning, even though the horse was heavily ornamentally transformed (Danish: '*Ret stærkt ornamentalt omdannet*') insofar as only the mane remained as a 'naturalistic' feature (Brøndsted 1938: 95). Also, the word 'snake-horse' (Danish: '*Slangehest*') was used, thus already at that time making note of the presence of hybrid creatures taking part in the mythological voyage of the sun (Ahlqvist and Vandkilde 2018).

Also in the 1930s, a corresponding interest arose in Germany in relation to understanding the pictures on the bronzes as regards religion. The focus was on the interplay between ship and horse as the sun's means of transport (Jacob-Friesen 1934; Sprockhoff 1936). Karl

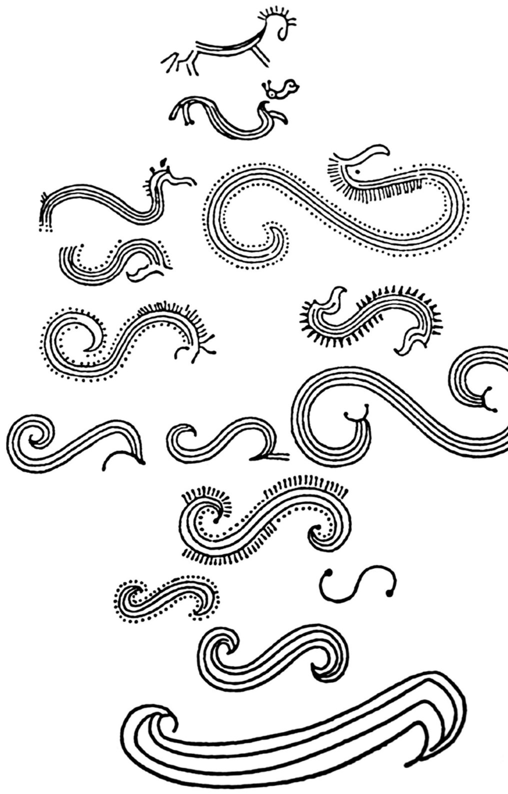


Figure 1: The process of stylisation from recognisable horse figures to totally stylised figures for the sun-horse based on Nordic Late Bronze Age bronzes. The changes represented by this illustration do not represent a chronological sequence (after Sprockhoff 1954).

Hermann Jacob-Friesen's work is an iconographical analysis of the motifs on some richly decorated razors from Niedersachsen; the religious and mythological background for the pictures was considered obvious at the time. He suggests that a comprehensive treatment of all the Danish decorated LBA razors would give further insight into the mythology of the voyage of the sun (Jacob-Friesen 1934: 375). In the works by Ernst Sprockhoff (1936; 1954; 1955) and Peter Gelling and Hilda Ellis Davidson (1969) ideas about the voyage of the sun were further developed and discussed (Kaul 2004; 2010).

The stylisation of the Nordic sun-horse

Through some of the works mentioned above it has been clarified that the stylisation of the horse figure did not implicate any loss of meaning. The pictorial context and position of the somehow 'naturalistic sun-horses' is the same as that of highly stylised sun-horses. Sprockhoff (1954) convincingly demonstrated how the horse figure lost its zoological elements in a stepwise fashion. Though initially difficult to distinguish, it

Figure 2: Detail of a bronze razor from Farsø, north Jutland (Denmark), *c.* 900-700 BCE. The sun is inside the ship and a fish is being devoured by a bird of prey/waterbird. The stylised S-shaped sun-horse/sun-horses are ready to take over the transport of the sun from the sun-ship (photo: F. Kaul).

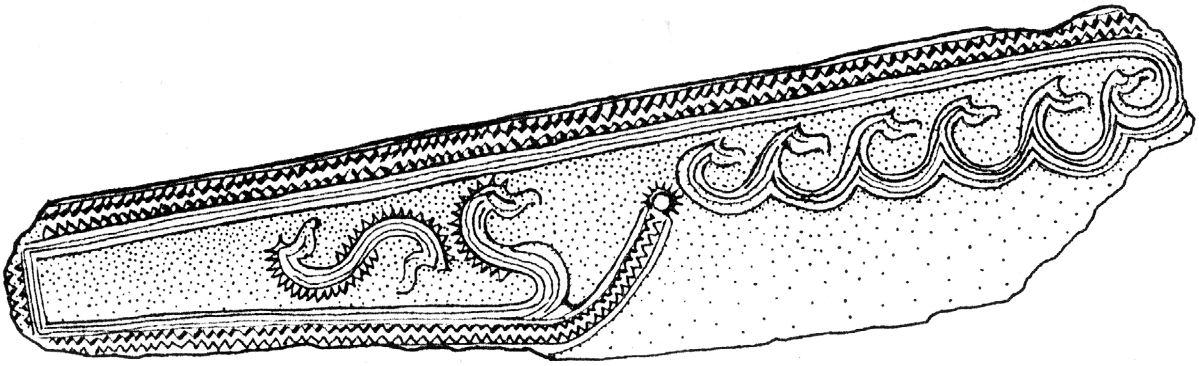


Figure 3: Bronze razor from Veerst, west Jutland (Denmark), *c.* 700-500 BCE. A stylised double horse over or onboard the sun-ship. The sun is seen on the raised keel extension (drawing: B. Skaarup, the National Museum of Denmark).

is possible to follow increasing levels of stylisation, thus establishing a recognisable progression between recognisable horses and the stylised figures (Ahlqvist 2024).

While the S-shape of the body became exaggerated, the legs faded away and some of the features of the horse's head disappeared. Often, the last remaining determinable attributes of the horse were the mane and ears. In many cases, the horse figure was transformed in such a way as to become unrecognisable: it simply became a horizontal S-figure (Fig. 1). It is important to note that this does not relate to a chronological stylisation sequence; the 'naturalistic' horse figures and the highly stylised S-shaped horse figures appear during the same period of time. In fact, they were most pronounced in NBA Per. V (900-700 BCE), a time of artistic vigour and creativity. Apparently, it was possible for the artist him or herself to choose between different levels of stylisation.

The Nordic stylised sun-horse regularly appears in front of or over the sun-ship, in some cases as a row of S-shaped horses which probably represent points in the movement of the sun (Kaul *et al.* 2018). A fine example is provided by a razor from Farsø, north Jutland (Denmark) (Kaul 1998: cat. no. 205), where the stylised horse figures are seen in front of the stem of the ship

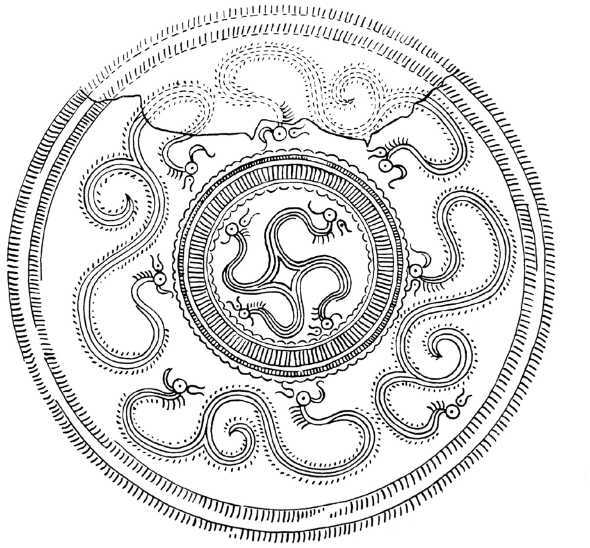


Figure 4: Bronze hanging bowl ornament with whirling horses from Vegestorp, south Bohuslän, western Sweden, 900-700 BCE (after Sprockhoff 1955).

which holds the sun inside (Fig. 2). Another example on a razor from Veerst, west Jutland (Denmark) shows a double horse figure either over or in the sun-ship with the sun seen on the protruding stem (Kaul 1998: cat. no. 313, see Fig. 3).

The horse figure appears in different stylised versions on the heavy Late Bronze Age NBA V and VI (900-500 BCE) bronze female belt ornaments with the disintegrated horse body forming repeated spiralling curls. In some cases, the central motif consists of a triquetra or a swastika-like figure, albeit one with a curling or bending shape rather than angular as with the 'normal' swastika. An interesting example comes from a votive deposition at Vegestorp, south Bohuslän (Sweden) (Sprockhoff 1955; Sprockhoff and Höckmann 1979; Kaul 2004), in which the central part of the belt ornament is dominated by a swastika-like figure formed by softly bending lines. Each of the four arms of the figure terminate in stylised animal heads (probably horses, although these may perhaps have horns). The 'horse-headed swastika' is encircled by stylised double horses or hybrid zoomorphs of double snake-horses (Ahlqvist and Vandkilde 2018; Ahlqvist 2024; and see Fig. 4). In general terms, this motif could be understood as a symbolic rendering of the round-and-round movement of the sun (also represented by hybrid sun-horses, encircled by other stylised animal motifs, further emphasising the circular or cyclic nature of the eternal voyage of the sun.

Italian versions of the sun-horse

In the preceding section, the Nordic Late Bronze Age sun-horse renderings are presented (including everything from 'naturalistic' figures to virtually incomprehensible stylised figures and their double variants). Against this background, we can trace the sun-horse phenomenon into northern and central Italy within the context of the Italian Iron Age's Villanova Culture. During the period 900-600 BCE, there was a burst of creativity and vigour which characterised the art and iconography in both Italy as well as the Nordic region. Examination of this may show some remarkable connections and some shared ideas regarding the sun-horse phenomenon. The sun-horse can be found in the same variants (the 'naturalistic' variants appeared 'side by side', chronologically speaking, with highly stylised variants – including double horses – on different media in Italy as well as in southern Scandinavia. A particular variant of the stylised Italian sun-horse seems to materialise as part of Villanova Culture swastika designs in which the swastika was formed by angular schematised horse-like figures.

From one of the cemeteries at Este (a cultural centre of the early North Italian Iron Age, south of Padova) a couple of pottery urns give evidence of the sun-horse phenomenon. The urns belong to the Este phase 2, *c.* 800-700 BCE (Müller-Karpe 1959), thus chronologically corresponding with parts of NBA V (900-700 BCE). An urn from Este grave 137 is decorated with relatively 'naturalistic' horses – with legs, mane, and ears – seen in front of a wheel-cross (Sprockhoff 1936). In this pictorial context, the wheel-cross should be understood as a solar representation with connotations related to the movement of the sun. The same sun-horse/wheel-cross configuration is seen on the Late NBA Kalleby rock carving in Bohuslän, Sweden (Kaul 2018b). On another decorated vessel from Este, a swastika appears in the same position as the wheel-cross, behind the horse (Sprockhoff 1936) (Fig. 5). The Italian horse figure is unlike the 'pliable' Nordic horse. Under the influence of the geometric style, it has lost its soft or curved outline. The horse is drawn with sturdy strokes and has become sharp and angular. Like the horse figure, the solar-disc (wheel-cross) has changed its appearance; it has become geometricised (Sprockhoff 1936: 6; Kaul 1998: 286; 2004: 210). The arms of the Este swastika carry extra angular extensions. This specific feature is shared with many other Italian swastikas of the time (see below).

During the same period (Este 2, c. 800-700 BCE), we meet the angular sun-horse on a pottery vessel in a rich burial in central Padova (on the Via Tiepolo); the

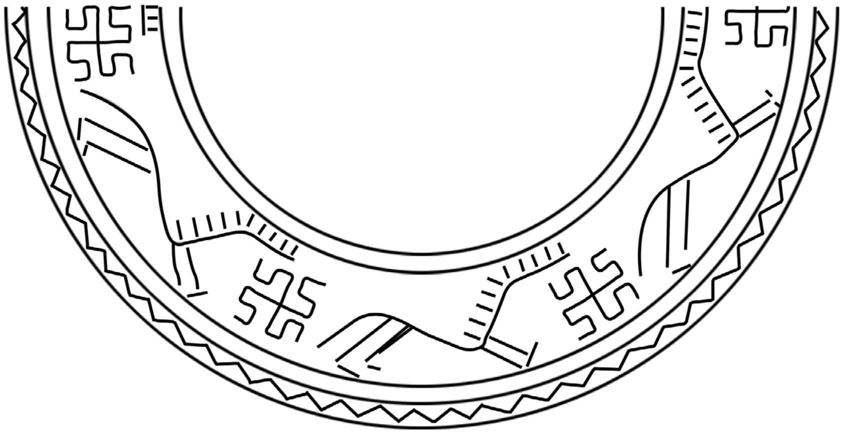


Figure 5: Pottery vessel from grave 137 in Este, north Italy, with a sun-horse frieze on its upper part, the sun being represented by a swastika, *c.* 800-700 BCE (after Sprockhoff 1936).

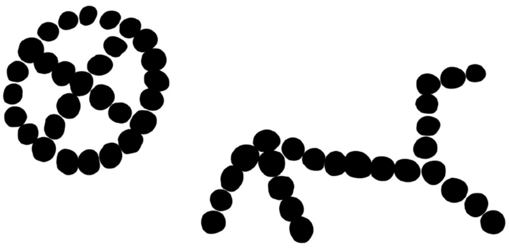


Figure 6: A sun-horse on an urn from the burial at Via Tiepolo, Padova, north Italy, *c.* 750-700 BCE. The decoration is made of bronze studs (graphic representation: Rikke Søgaard, the National Museum of Denmark after a photo by F. Kaul).

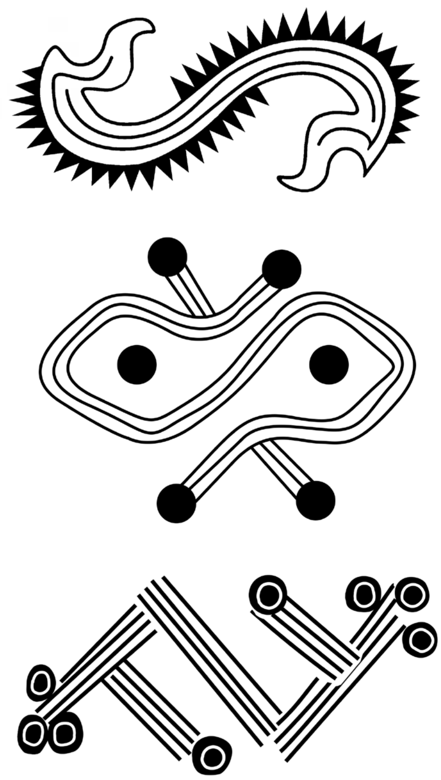
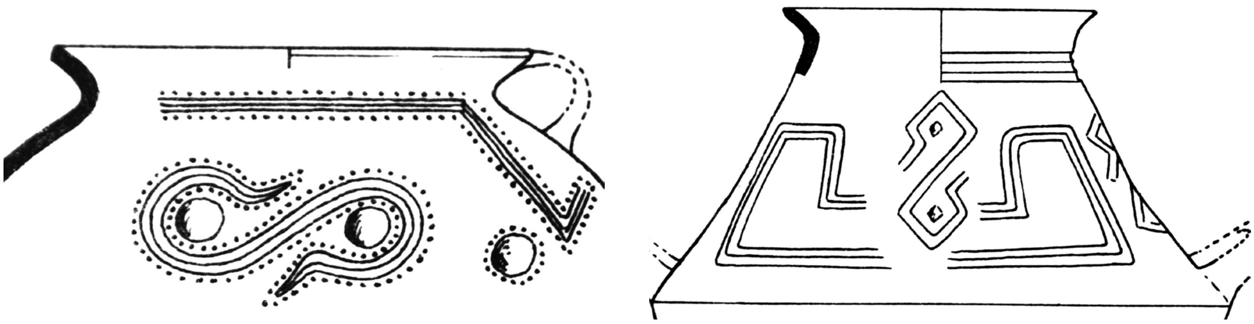


Figure 7: Stylised double horses: A) The Nordic 'soft' double horse, bronze razor from Veerst, West Jutland, Denmark; B) Pottery decoration, Caselle di Villanova, Bologna, Italy; C) Pottery decoration, Vulci, Italy (not to scale; graphics: Rikke Søgaard, the National Museum of Denmark).

grave is called '*Tomba dei Vasi borchiati*'. The upper part of the urn is decorated with a frieze of angular horse figures, each with a 'wheel-cross sun' behind its tail. The figures were formed by pressing small bronze studs into the clay before the vessel was fired (Fig. 6). The lower part of the vessel is decorated with swastikas. In the small, stone-built burial chamber, a large number of vessels representing a splendid drinking/feasting gear were recovered (Gamba *et al.* 2011). Much of the pottery features motifs made of bronze studs, including horse figures, wheel-crosses, solar-rosette symbols, and swastikas.

If we accept that even more stylised variants of the horse (including the double horse motif) retained their sun-horse connotations, as was argued above, with regards to the double horse motif of south Scandinavia, then we can follow the (sun)horse figure through larger parts of Italy, albeit as a geometrised variant. A fine example of a double horse figure comparable with the Nordic figures comes from a burial at Caselle di Villanova in Bologna (Morigi Govi and Vitali 1994). Another example comes from a burial at Vulci, with solar images related to the stylised horse figures (Fig. 7).



Figures 8a and b: Details of the decoration from two pottery vessels from the cemetery at Pianello, Marche, eastern Italy. Renderings of more or less angular variants of double animals, birds or horses (after Müller-Karpe 1959).

Other S-shaped double animal figures (to be compared with 'Nordic shapes') may not represent horses but aquatic birds. On pottery from a cemetery at Pianello at Ancona, eastern Italy, a 'softer', almost Nordic, variant can be discerned (Fig. 8a), while a more angular variant is also worth noticing, seemingly being placed in a stylised ship (Fig 8 b) (Müller-Karpe 1959; Kaul 1998: 285).

Even a double snake-horse (comparable with 'Nordic' shapes) may be represented among the decorated funerary vessels of the Villanova Culture, albeit in an angular variant from Tomba 70 at Necropoli di Ca'dell'Orbo, Bologna, *c.* 850 BCE. Above the 'snake-horse-zone' is a frieze of interconnected double horses (Morigi Govi *et al.* 1994: 34).

Even though variants can be observed, some closely connected with solar images, the angular double horse (animal) motif was very popular in a rather formalised version as pottery decoration, during the 9th and 8th centuries BCE, from the Bologna area in the north (through Tuscany to Latium), as seen represented at burial sites at Frattesina, Cortona, Chiusi, Vulci, Vetulonia, Tarquinia, and Castel Gandolfo (Montelius 1904; Müller-Karpe 1959; Hencken 1968; Bartolini *et al.* 1987).

A frieze of these stylised horse figures is seen on a vessel, the precise findspot, uncertain, although probably from a cemetery at Colle Baroncio at Vetulonia (Morandi 2013). In this case, solar images are connected to the stylised animals. An upper panel of the vessel shows a row of highly stylised aquatic birds. As in many other treatments of the (stylised) decoration on Villanova Culture pottery, the literature suggests no iconographic interpretations. Here, the stylised double horse motif is merely characterised as 'broken meander' (Morandi 2013: 4).

Figure 9: The roof of a house urn from Castel Gandolfo, in the hills close to Rome, Lazio (Italy), *c.* 850-800 BCE. The roof carries complex swastika and double-horse designs. This example is currently in the Vatican Museum (after Montelius 1904).

The complex swastika

A sun-horse figure with a swastika (likely representing the sun) placed behind the horse from Este, north Italy, has been mentioned above (see Fig. 5). The arms of the swastika are characterised by an additional angular extension. This specific type of swastika has the same wide Italian distribution as the stylised double horse and circulated during the same period. Such swastikas have also been called complex swastikas (Hencken 1968). In quite a few cases, this swastika appears alongside the double horse motif on pottery vessels.

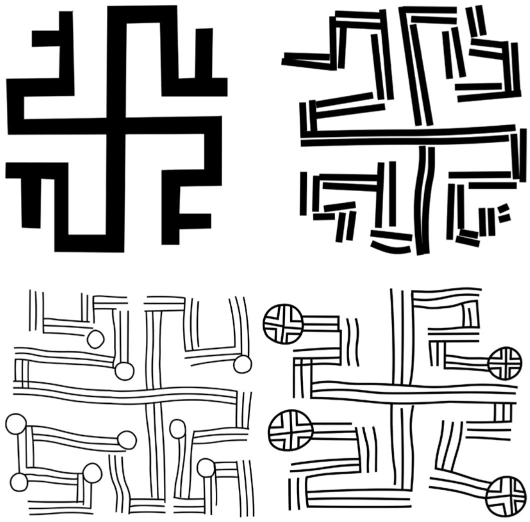


Figure 10: Four examples of the complex Italian swastika interpreted as whirling sun-horses, *c.* 850-800 BCE, from cemeteries at Vulci (upper) and Bologna (lower) (graphic representations: Rikke Søgaard, the National Museum of Denmark).

On the roof of a hut urn from Castel Gandolfo, Lazio, this particular swastika motif appeared with the double horse pattern (Montelius 1904: pl. 140). Some intermediate designs can be observed. It is as though the artist played with connectiveness of these two related motifs (Fig. 9). The swastika type can also carry an extended line, indicating a stylised horse's ear. Examples of these can be found on richly decorated house urns from Tarquinia (Müller-Karpe 1959: Abb. 46; Bartoloni *et al.* 1987; Sabatini 2017).

Basically, it is the swastika with the arm extension (as seen in Fig. 5) that predominates. The same variant can also be seen on certain bronze objects (Montelius 1895; Montelius 1904; Müller-Karpe 1959; Bartolini *et al.* 1987; Tovoli 1989; Morigi Govi *et al.* 1994), both with and without attached solar images (Fig. 10).

Iconography, stylisation and connections

As hinted at above, it is the opinion of the author that this specific Italian swastika motif had several ontological layers. It should also be considered a sun representation, but one which had additional solar connotations. The stylised horse pattern (and/or the aquatic bird pattern) epitomised the widely spread sun-horse (sun-bird) idea. The repetition of the horse motif and the whirling appearance of the swastika connect symbolic layers which are related not only to the sun in itself, but also to what must have appeared to be the cyclic movement of the sun. Of course, we can still discuss whether this motif has lost its cosmological meaning when totally stylised, or whether it remained simply a pleasing decorative motif. However, the wide distribution and the repetition of the same patterns shows us that we are not dealing with coincidental phenomena.

In Italy, as in southern Scandinavia, the (sun)horse motif appears in varied degrees of stylisation. A fine example of a 'naturalistic' horse figure (with a soft, rather than angular, design), pulling a wheel-cross sun over its back, is seen on a Bucchero pottery pyxis from the Necropoli di Banditella at Marsaliana, Tuscany (Italy), *c.* 700 BCE (Roes 1933: 22; Cianferoni 2010: 57). On bronze objects such as round flasks from burials at Volterra and Ansedonia, (Bartolini 2000; Vatican Museum no. 12632), and on shields like the one from a burial at Palestrina (Tomba Castellani, currently exhibited in Villa Giulia Archaeological Museum), all *c.* 700 BCE, circular arrangements of horse figures and solar images (concentric circles), go round and round, alternating between horse and sun.

The preceding sections suggested a connection between certain horse or sun-horse motifs in southern Scandinavia and Italy. During the same period, Late Nordic Bronze Age/Italian Early Iron Age, stylised S-shaped horses and double horses, as well as 'horsificated' swastika designs, appear in both regions. In the north, the lines of the figures are smooth and rounded, while in the south, the lines of the figures are sharp and angular. We could speak of stylistic variants covering the same basic iconographical theme, or cosmological ideas exemplified by the swastika-like design on the Nordic bronze belt ornaments observable in Fig. 4 compared with the angular designs seen in Fig. 10.

If these observations related to the highly stylised sun-horse pattern stood alone, they might be dismissible as simple coincidence. Nevertheless, from the same period, other evidence testifies to relations between northern and southern Europe (Vandkilde *et al.* 2022). The house urn/hut urn phenomenon connects southern Scandinavia and north and central Germany with Etruscan Italy. There are great morphological differences between the Nordic and Italian house-shaped urn, but some general ideas or traditions were shared between people living great distances from each other (Sabatini 2017: 159, 169). During the Nordic LBA/Italian EIA, religious ideas as reflected in iconography were seemingly shared and somewhat chosen via long-distance contacts, related to the established trade networks. Such ideas could have been transmitted when observing the sacred bonds of guest-friendship, *xenia*, securing long-distance connections (Kaul 2018c). It is worth noting that some of the Italian hut urns are decorated with the stylised, angular S-shaped horses and double horses, as well as 'horsish' swastika designs, both seemingly having Nordic connections.

The face urn phenomenon tells the same story about (selected) shared ideas. Although morphologically different, face urns appear in southern Scandinavia, north and central Germany, and Etruscan Italy (Kneisel 2018), giving further fodder to support thinking that suggests people, ideas, and practices move and have moved across short and large distances. Ideas and thoughts do not move by themselves, but are instead carried in the brains of travellers engaged in, e.g., the trade of metals or amber. Significant objects illustrate the existence of articulated circulations of goods, which in turn also imply the circulation of persons and ideas (Sabatini 2017: 160). Bronze vessels, such as different amphora types – among these the richly decorated amphorae of type Veio-Gevelinghausen – provide an example of contacts among the highest social echelons between Etruscan Italy (through Central Europe) and the areas along the Baltic Sea, north Germany and southern Scandinavia between 900-700 BCE (Jockenhövel 1974; Kristiansen 1998; Hansen 2018; Desplanques 2022). In the north, the richly furnished burial at Seddin, north Germany, which contains an amphora, even suggests the transfer of burial practices from Italy (Hansen 2018). These amphorae also appear in votive depositions, such as the Rørbæk find in north Jutland, Denmark (Thrane 1975). Most recently, the deposition of an amphora very similar to the Rørbæk amphora came to light at Kaliska, Pomerania (Poland), not far from the Baltic Sea. Among many other objects, the amphora was accompanied by two typically Nordic and richly decorated female dress ornaments (hanging bowls) (Kaczmarek *et al.* 2022). Thus, within a single deposition, north and south met. The north German Gevelinghausen amphora (Westphalia) and the Italian Veio amphora are most closely connected in terms of their decoration: the bird-sun-ships (*Vogel-Sonnenbark*; *barca solare*) (Jockenhövel 1974; Kristiansen 1998) were probably made in the same Italian workshop or workshop tradition.

The solar-barque as such is the most dominant iconographic motif across large areas of Late Bronze Age/Early Iron Age Europe – from south Scandinavia to central Italy. It can be seen on many different media, has many local variants, and (as we have seen) also appears on objects which were brought over long distances (Kaul 1998; Kristiansen 1998; Kossack 1999; Iaia 2004; Sabatini 2017). The solar-barque (the sun-ship) was a motif shared across different cultural groups, seemingly reflecting common religious notions, and which functioned as a trans-cultural pictorial language by which people were connected.

The solar-barque frequently appears with stems in the shape of an aquatic bird (in German called the *Vogel-Sonnenbark*). The bird (the aquatic bird or waterbird) is well known as an iconographic motif all over Europe, both in its two-dimensional form and in miniature as a sculpture. The waterbird figure can be understood as equivalent to the sun-horse; the sun-bird was another helper of the sun on its eternal journey round and round (Kaul 1998: 245; Goldhahn 2019: 109 ff.). The waterbird is often seen as closely related to solar images.

Thus far, we have discussed the different variants of the stylised sun-horse pattern that appeared between 900-700 BCE, and a north-south, Scandinavian-Italian, connection has been suggested. When juxtaposing a broader picture of iconographical evidence with the long-distance dissemination of ideas (house urns, face urns, sun-ships, aquatic birds), the proposed 'horsification' connections do not seem problematic. The stylised sun-horse motif can be appreciated as yet another aspect of a ritual/religious *koine* at the time of the Urnfield Cultures.

Greek Late Geometric pottery: horse, waterbird, snake, and fish

When moving from Italy to Greece we can examine the iconographically rich phase of Geometric pottery that appeared between 800-700 BCE (Late Middle Geometric and Late Geometric Periods). In this case, there are many aspects that seem quite different from the Italian sphere. The (bird-)sun-ship as an important motif has disappeared. However, the aquatic bird/waterbird motif is a most prominent one on Late Geometric pottery, in differentially stylised variants, although these appear without a ship association. However, the horse is the most prominent motif on these highly decorated vessels. Interestingly, the arrangement of the horse in the context of Geometric pottery vessels is often antithetically arranged in relation to waterfowl. On Geometric pottery, the horse is represented more 'naturalistically' than its Italian and Nordic expressions. The swastika seems more dominant in Greek Geometric art than in Italy. However, the complex or hooked swastika, which was so popular in Italy, occurs only rarely in Greece. The snake appears in Greece, Italy, and southern Scandinavia, though in very different variants. In Greece, the snake appears most imposingly as a plastic rim decoration. The fish (a motif rarely seen in Italy, but present in the art of southern Scandinavia) appears with remarkable strength in Greece, particularly on Argive Geometric pottery, and with close associations to the horse.

As was the case in southern Scandinavia, different ways or levels of understanding the art have been proposed by various researchers. In the 1920s, Sophus Müller wrote the following in relation to Nordic Bronze Age Period V bronze-work (900-700 BCE): 'Animal heads are still present, but in a new and distorted shape. What is known of this kind has a character of fortuitousness, which must be denoted as degenerated, caused by the wish to fill out the space' (Müller 1921: 38-40, author's translation). In the 1970s, John Carter wrote (about Late Geometric pottery, *c.* 800-700 BCE): 'They [the horses] are in origin no more than the expression of the primitive and universal desire to model and to embellish, and even at the height of their popularity they remain relatively unsophisticated' (Carter 1972: 30).

A basic problem when discussing the possible meaning behind the pictorial animal art of the period across these three areas are certain art conceptions in themselves. Decorative or ornamental art has often been treated in most important chronological and stylistic analyses as having no deeper meaning. It has been suggested that its main purpose was simply to be decorative. Another problem is the idea that a motif lost any meaning when it became stylised, and, therefore, also ended as nothing more than a mere ornament (see introduction). Furthermore, the ideas of a 'decorative' order, in which the placement of certain animal elements are understood to have served merely to fill empty space (a nearly meaningless *horror vacui* expression), have prevailed in some works on Greek Geometric art. For instance, we learn that filling patterns often include fish (Boardman 1998: 50), but that those fish should not be understood as more than a decorative space filler (Carter 1972: 34). Or, perhaps more interestingly, it was also suggested that the fish did not have much symbolic value, since they could easily be altered into fully stylised patterns (e.g. lozenges or leaf-shaped patterns). The change from a 'proper' fish figure into an unrecognisable, stylised figure indicates, according to Paul Courbin, that it, *peu à peu*, left behind its figurative value to become a decorative motif (Courbin 1966: 481). But has the motif lost its meaning in this process?

Even though motifs like the bird, snake, fish, and horse are identified as these animals in and of themselves, any deeper symbolic or mythological meaning has been discarded by some scholars (Courbin 1966; Coldstream 2003). Motifs like snakes (or eels), fish, and waterbirds represent scenes from nature: life in marshes and wetlands. Such recurring elements yield references to the physical environment of the Argolid: a fertile pastureland, ringed with marshes, where the breeding of horses connoted important social and economic status.

When looking at specific combinations of the snake or serpent motif, it may seem difficult just to reduce it (or the waterbird) to a representation of the natural environment. On Geometric pottery from, i.e., the Agora cemetery in Athens (Greece), a wheel-cross (with 'sunbeam halo') is flanked by rearing serpents. Such a motif begs for interpretation, especially when considering the wheel-cross as being a solar representation (Kaul 2004). The sun-wheel/wheel-cross is often attended by birds as logical inhabitants of the heavens, though only rarely by snakes, who are guardians of the underworld. Eva T.H. Brann asks 'whether the Dipylon Painter intended the complementary forces of life and death with this motif, and what efficacy he expected it to it to have when painted on the pot, is not, of course, revealed' (Brann 1962: 13). This has inspired me to attempt a short interpretation here presented with broad mythological and cosmological references.

The swastika is another highly popular motif within Bronze Age contexts in various parts of Europe that should be considered as having more than just a decorative function filling the empty spaces between animal motifs. Again, the swastika should be seen as a solar symbol whose arms underline the movement of the sun. Some interesting combinations on Late Geometric pottery are worth bearing in mind. When a swastika is seen inside the body of a bird (Argolis) (Roes 1933: 13), then we should consider the meaning behind the combination of the 'swastika-sun-bird'. Among other close swastika-animal combinations are four stylised snakes (zigzags) inside the swastika. They are found on Late Geometric pottery from Kerameikos, Athens (Coldstream 1968: pl. 15 e), and from an unknown provenance in Athens (National Museum of Denmark, Copenhagen, Antique Collection, inv. no. 4741). Four stylised fish are seen inside the swastika on Late Geometric pottery from Mycenae, in this case in a swastika of the hooked or complex shape (Coldstream 1968: 66, pl. 27 e).

Horse, fish, and waterbird – some interpretative approaches

As the most dominant motif (especially on Attic and Argive Late Geometric pottery), the horse was obviously not a meaningless space-holder. With is many positions and contexts, the horse could have had different (though potentially interrelated) symbolic values. The finely executed plastic horses on the lids of elaborately painted pyxides could perhaps be related to sporting games or chariot driving. The horse appears in a large number of different contexts on the painted bodies of amphorae, kantharoi, pyxides, oinochoe, etc. A ritual context is represented through the rendering of funeral processions (in which horses pull a funeral wagon and scenes of chariot driving) probably related to burial festivals (Coldstream 1968; Pedley 1993). In other contexts, the horse figures appear antithetically, often with a man placed in between them as if he were controlling the horses.

When examined from a social/political angle, it is likely that the presence of the horse motif on Late Geometric Period pottery may have referenced the horse as a symbol of high social and political status. When the horse was depicted on burial pottery, it signified the very elevated status of the deceased as only the wealthy could afford the expense of a horse (Hurwit 1985: 58; McK. Camp II 1998: 10). The most characteristic motif of Late Geometric (8th century BCE) vase painting is the so-called 'horse-leader': a standing male who controls one or two horses. When two horses are present, they are always antithetically positioned. This theme is a favourite Argive motif. A fish or (more rarely) a waterbird usually appears as a companion, which is placed beneath the horse (Langdon 1989: 185).

A Late Mycenaean (LH III B-C) pictorial krater recovered from the north Syrian city of Ugarit (but probably produced in Cyprus) presents the same antithetical arrangement: a man standing between (and holding the muzzles) of two horses. The horses are accompanied by fish placed over their flanks. The similarities with the much later Late Geometric Argive pottery renderings are noticeable, even though the Argive pottery only rarely shows fish above the horses. Another vessel from Ugarit of the same fabric, and likely the same artistic hand, features a man identical to those on the previous vessel. His left hand is placed on his dagger and he holds a fish by its tail in his right hand. The scene is related to a (sacrificial) altar surmounted by a pair of horns of consecration and spiral volutes. The presence of the fish in a cult context leads to discussions of the importance of the fish in Near Eastern and Mycenaean/ Minoan iconography and sacrificial practices (Langdon 1989: 188-197). The association of fish and horse in a potential religious context recalls Homeric and Classical attributes of Poseidon, who was both a sea god and helper of fishermen as well as the father of the horse (Barnett 1997). As Poseidon Hippios he was associated with fertility and the taming of horses, and was celebrated with chariot races. In Athens, Poseidon and Athena together served as protectors of horses and the patrons of horsemanship and equestrian activities. On Kolonos Hippios there was an altar to Poseidon Hippios and Athena Hippia (Langdon 1989: 191; McK. Camp II 1998: 5-6). The Poseidon/fish iconographical relationship is shown by an Archaic Period bronze fish from Amyklai, Laconia which carry the inscription *Pohaidanos* (Poseidon) (Schweitzer 1969: 64; Kahane 1973: 131). The fish that so often accompanied the horse-leader motif on Argive pottery has been seen as a 'determinative' of Poseidon. In this iconographic setting, the fish may represent an older, 'pre-Dorian' substratum which here still remains vivid: 'A mighty, not sharply delimited god, the chthonic Poseidon, the master of springs and waters, father of many heroes' (Schweitzer 1969: 65, author's translation).

A different approach from the interpretative sphere of religion was taken by Anna Roes, who turned to the Italian Villanova Culture and the Central European Urnfield and Hallstatt cultures (Roes 1933: 10-11). For Roes, the wheel-cross and the swastika were obvious solar symbols, considering the iconography of regions northwest and north of Greece. The swastika, likewise, was also seen as a solar image that was even related to the horse/sun-horse (Sprockhoff 1936). Iconographically speaking, the waterbird, which spread from Late Bronze Age/Early Iron Age Italy to southern Scandinavia, is closely related to the sun. It has been seen as a prominent helper of the sun, or even as a sort of solar manifestation (Kaul 1998; Kossack 1999; Kaul 2004; Goldhahn 2019). Consequently, there should be no problems in following Roes' arguments suggesting that the waterbird was a solar-bird; this bird on Late Geometric pottery is closely related to solar symbols like the wheel-cross and the swastika. At the same time, the waterbird is also closely related to the horse. Thus, the horse on Geometric pottery could be considered the same sun-horse which is represented in Italy and Northern Europe. The Greek vase painters placed their solar emblems around the horse (Roes 1933: 22-23) rather than in direct association, as can be seen on contemporary Danish bronzes. Thus, according to Roes, the frequent presence of the horse-leader motif could be understood as follows: 'A man who holds two solar-horses, characterised by swastika and wheel, cannot be anybody else but the sun-god himself' (Roes 1933: 25).

In this religious/cosmological scenario, we should not forget the god Helios as the personified sun who rode his sun-chariot over the heavens. Helios' sun-chariot rose from the sea at dawn and was drawn by four divine hoses across the sky for the duration of the day (Roes 1953: 95). We cannot forget the general sanctity of the horse, whether related to Helios, Poseidon, or another of the gods. The sanctity of this animal is reflected by depositions of bronze votive horse (and waterbird) figures during the Geometric period at sacred places such as Olympia and Delphi.

Basically, there are two interpretations of the horse-leader motif: as a (chthonic) Poseidon Hippios (Schweitzer 1969; Langdon 1989); and as a sun god (Roes 1933). While these interpretations could be seen as contradictory (Courbin 1966), they could just as well be united or complementary when viewed from a broader cosmological viewpoint in which the eternal voyage of the sun is in focus. The Chthonic or underworld references reflect the nighttime portion

Figure 11: A) Antithetic horse motif on a krater from Mycenae, with fish, waterbird, snake and wheel-cross motifs, dating from 735-700 BCE. Currently curated at the National Museum of Athens 231 (after Courbin 1966). B) Opposite panel of the same krater from Mycenae, showing fish, dominant snake and swastika motifs (after Courbin 1966).

of the voyage of the sun, while the sun-god references reflect the daytime phase. The fish and the snake should, therefore, not be understood as creatures related to the world below the surface of sea and earth, but rather as creatures which cross the horizon to make the transition between below and above, and between day and night.

The fish in a particular position

The fish, which is so closely related to the horse and the horse-leader motif (particularly in the case of Argive Late Geometric pottery), was not placed randomly. Almost without exception, it was positioned beneath the body of the horse and between its front and hind legs. In such cases, the body of the fish takes an oblique, sometimes nearly vertical position, with its head (or mouth) facing or nearly touching the place where the body and hind legs of the horse meet. This distinctive composition is repeated again and again in Argive Geometric pottery decorations. Some conventions have been observed among Argive artists which may reflect the presence of a deeper meaning behind this configuration. Thus, in my opinion, we are far away from the art historical concepts of meaningless shape holders discussed earlier, and equally distant from the idea that fish renderings may merely have been representations of nature and life in the Argive wetlands. The repeated position of the fish underneath the horse is far distant from the natural environments of fish.

Even though this particular fish-and-horse motif appears in large numbers with significant regularity, there are nevertheless some exceptions. The fish may sometimes be placed in front of or behind the horse. Alternatively, the waterbird may be seen under the horse's belly instead of the fish (Courbin 1966; Coldstream 1968; Pappi 2006). Given that the fish and the waterbird changed positions on some occasions, we may consider that they were homologue symbols which were deeply interconnected and which were both related to the very same cosmological (sun) narrative.

A krater from Mycenae provides a fine example of the antithetic horse motif (Courbin 1966; Coldstream 1968; see Fig. 11a). In this case, all the basic animal elements are present: the fish lies in its usual position under the horse's belly, the waterbird is situated between the horses, the snake is there, though not dominant Furthermore, the wheel-cross is present under the neck of each horse. Around this basic motif are rows of highly stylised waterbirds, in addition to what I regard as highly stylised fish in what might be called a rhomboid pattern. The same motif appears once again on the krater's opposite panel, though with some minor changes. The waterbird has been switched out with a dominant geometricised snake and the wheel-crosses have been swapped with swastikas (Fig. 11 b).

On this krater, there is no horse-leader between the horses. If said horse-leader could be considered the sun-god (Roes 1933), then the god is seemingly missing in these variants. In my opinion this is not problematic. Wheel-crosses, swastikas, waterbirds, and even the horse are representatives or manifestations of the sun. Although not present in this example, as was the case elsewhere in Europe, this was a region in which the divine sun(-god) can materialise in human shape as well as through solar symbols, images and/or solar animals. The question which remains is as follows: What is the fish doing under the belly of the horse, close to the genitals of the stallion (which are sometimes clearly marked)? Is it an angry fish, representing negative forces, attacking the sun-horse? Or, perhaps, is a 'gentler' interpretation possible? A more placid or easy-going interpretation could be that the fish (perhaps at dawn?) 'spits' new life into the sun-horse. In this way the fish, as a representation of the underworld journey of the sun, gives life to the new day (represented by the sun-horse). Here once again, we basically have two very different interpretations: A hostile fish or a friendly and supportive fish? Our limited comprehension of the motifs should not impede us from trying to identify and interpret re-occurring patterns. It might be easier to reduce the motifs to a decoration without deeper meaning; if that were the case, matters would be more easily solved!

On a basic structural level, the fish could represent a god who is not clearly defined, such as a chthonic Poseidon (Schweitzer 1969: 65). Alternately, it could be related to the sun-god and the voyage of the sun. Together with the horse, the fish could represent an older 'pre-Dorian' substratum: the 'nameless' forces of nature, earth, sky. and sea (Schweitzer 1969; Kahane 1973: 132). The idea of non-personified deities representing cosmic powers may seem strange from a Greek point of view, where many of the names of various gods can be followed back to Minoan-Mycenaean Linear B inscriptions. Nevertheless, non-personified representations of the gods related to cosmological order could still refer to a substratum of some earlier notions of the Minoan-Mycenaean world (Kahane 1973).

When looking in other directions (particularly Late Bronze Age/Early Iron Age Italy, Central Europe, Northern Europe, and south Scandinavia), we may find hints about where we might seek an older 'pre-Dorian' substratum. For example, one might speak about the general iconographic roots related to basic European solar religion ideas, which also appear quite markedly on Argive Late Geometric pottery. The same principal iconographic elements identifiable within Argive Late Geometric pottery appear throughout Europe: the wheel-cross, swastika, (sun)horse, waterbird, snake, and fish. However, in context of the Late Geometric pottery, these are translated into new compositions at a time of remarkable artistic creativity. It must be admitted that the fish is rarely seen in Italy and Central Europe. However, in Northern Europe, north Germany and southern Scandinavia, fish appear as a prominent motif on NBA V (900-700 BCE) bronzes, also in close association with the voyage of the sun (Kaul 1998: 216-221; 2004: 320-324).

The fish in the horse combination described above seemingly *only* appears on Argive Late Geometric pottery. This combination should, therefore, be considered a local Argive-Laconian feature which never appears on Attic pottery (Kahane 1973: 132). However, on Late Geometric pottery in Athens, Attica, and neighbouring regions, a fish-like rhomboid (decorative) pattern occurs in the very same position as the 'naturalistic' fish on Argive pottery (underneath the horses in the horse-leader motif, in a horse-crib motif, where the horses are eating from a tripod crib, or under a singular horse figure, often together with the same overarching ensemble, which includes waterbirds and snakes). Such patterns have been labelled as filling ornamentations, otherwise referred to as quartered and cross-hatched lozenges or leaf-lozenges (e.g. Coldstream 1968: 144). A connection between the fish figure proper and the rhomboid/lozenge design has been pointed out in relation to a Late Geometric vase from Tiryns or Mycenae, Argolis, which has a horse-crib motif. Instead of a fish, there is a leaf pattern which should be taken as a degenerative form of a fish (Rombos 1995: 237); a degenerative form of a fish could be denominated as a stylised fish.

Figure 12: The bottom motif of an Athenian pyxis decorated with a wheel-cross, solar beams, stylised fish, and snake, dating *c.* 750-700 BCE (without find provenance). A similar pyxis is known from the Kerameikos cemetery (photo: The National Museum of Denmark).

Conclusion

This chapter has examined the stylisation of the Nordic Late Bronze Age sun-horse motif specifically in relation to the potential for the loss of meaning over the course of this process. It was noted that the Nordic sun-horse appears in many variants ranging from 'naturalistic' to virtually incomprehensible stylised figures. The 'naturalistic' variants turn up in the very same pictorial contexts as do the fully stylised variants. A similar course of stylisation may have taken place in Geometric Greece, albeit more closely related to the fish motif rather than the sun-horse. On Greek Geometric pottery, the 'naturalistic' fish is located under the horse's belly in the same vertical and oblique position as the highly stylised rhomboid fish pattern. Thus, in Greece, too, 'naturalistic' and stylised variants appear in the very same pictorial contexts.

The different degrees of stylisation occur in Greece and in southern Scandinavia during the same approximate time period (800-700 BCE). This suggests that in both Greece, as well as in the north, an artist could choose from different levels of stylisation with no clear chronological sequence. However, in Greece, the artist's choice was not as free as it was in southern Scandinavia, since the degree of stylisation was conditioned by geographical setting. It was in Argolis that the 'naturalistic' fish was accepted as standard, while the stylised versions were standard in Athens, Attica, and the regions north of Athens. Even though the geographical preferences relative to the stylisation of the fish motif are quite clear-cut, matters are not totally black and white. In Argolis you can find different levels of stylisation of the fish motif (Courbin 1966; Rombos 1995), even on the very same piece of pottery.

If we acknowledge the fish as a truly iconographical motif dispersed throughout Greece, rather than just a local Argive phenomenon, broader perspectives come into view. Together with the waterbird, the snake and the horse, the fish represents a wider European phenomenon accentuated by wheel-crosses and swastikas. Though occurring on different media and expressed in different styles, examination of the iconography suggests that some ideas seem to have been shared over long distances (from Greece to north Germany, Denmark and Sweden). The time bracket in which these motifs were in use, and created and adapted by craftspeople, is worth noting, i.e. between 900-700 BCE. While I do not claim that the iconographic evidence reflects direct contacts between Geometric Greece and Denmark during this span of time (though more direct contacts between Italy and south Scandinavia should be taken into account), I do suggest that the co-occurrences of these motifs represent an underlying common background rooted in the Bronze Age cultures of Europe. Everywhere, artists articulated a wish to express and communicate a sense of cosmological order.

Naturally, it remains an open question as to who or how many persons in the different societies were able to appreciate the depth of the symbolic world conveyed in their own contemporary art. A beautiful pyxis adorned with four plastic horses with swastikas on its body in the Athenian Dipylon style provides an excellent example for further discussions (The National Museum of Denmark, Antique Collection, inv. no. 4741). The bottom is decorated with a complex circular solar motif. Around a central wheel-cross, a star-like shape represents the beams of the sun; pointing into the solar beam pattern that marks the edges of this pattern is a fully stylised fish; this is surrounded by a circular panel of spirals, finally bordered by an encircling snake (Fig. 12).

If we consider that the rhomboid motif was a representation of fish, coupled with the Nordic role of the fish as the divine helper of the sun at dawn, then we may allow ourselves to read this motif in a dynamic and specific way. Here we face a group of morning-fish, which assist with the rising of the sun at sunrise. The sun is represented by the wheel-cross, symbolising the very movement of the sun in the centre. While there can be no doubt that the paintings on the bottom of this pyxis should be appreciated as a splendid example of decorative art, when ordering and scrutinising the decorative elements the question remains open: What is purely decoration, and what is art with its range of layers of religious and/or cosmological meaning?

Acknowledgements

Without my stay at the Danish Institute at Athens (September 2023), it would not have been possible to write this contribution. Thank you! Many thanks to the Research Committee of the Danish Ministry of Culture for supporting the research project 'Øksen, manden og hestene ('the Axe, the Man and the Horses'), covering studies at a range of Italian Museums in 2023.

Bibliography

Ahlqvist, L. 2020. 'Sol-guden' i nyt lys. Gensyn med en velkendt ragekniv. *Kuml* 69: 85-107.

Ahlqvist, L. 2024. Reshaping Gendered Narratives: Reinterpreting Female Art, Identity and Social Change in the Late Nordic Bronze Age. *Norwegian Archaeological Review* 2024: 1-18 (available at: https://doi.org/10.1080/00293652.2023.2298445).

Ahlqvist, L. and H. Vandkilde 2018. Hybrid beasts of the Nordic Bronze Age. *Danish Journal of Archaeology* 7.2: 180-194.

Barnett, M. 1997. *Gods and Myths of the Ancient World*. London: Grange Books.

Bartolini, G. 2000. The origin and diffusion of Villanovan Culture, M. Torelli (ed.) *The Etruscans*: 52-71. Venice: Palazzo Grassi (Bompiani).

Bartolini, G., F. Buranielli, V. D'atri and A. De Santis 1987. *Le Urne a Capanna Rinvenute in Italia*. Roma: Giorgio Bretschneider Editore.

Boardman, J. 1998. *Early Greek vase painting*. London: Thames & Hudson.

Brann, E.T.H. 1962. *Late Geometric and Protoattic Pottery. Mid 8th to Late 7th Century B.C.* The Athenian Agora Results of Excavations Conducted by The American School of Classical Studies at Athens, Vol. VIII. Princeton: The American School of Classical Studies at Athens.

Brøndsted, J. 1938. Bronzealderens Soldyrkelse. *Fra Nationalmuseets Arbejdsmark* 1938: 81-100.

Carter, J. 1972. The beginnings of Narrative art in the Greek Geometric Period. *The Annual of the British School at Athens* 67: 25-58.

Cianferoni, G.C. 2010. Marsiliana d'Albegna, in F. Moscati, S. Sarti and R. Settesoldi (eds) *Signori di Maremma. Elites Etrusche fra Populonia e Vulci*: 55-58. Firenze: Museo Archaeologico Nazionale Firenze.

Coldstream, J.N. 1968. *Greek Geometric Pottery A survey of ten local styles and their chronology*. London: Methuen & Co.

Coldstream, J.N. 2003. *Geometric Greece, 900-700 BC*. London: Routledge.

Courbin, P. 1966. *La Céramique Géométrique de l'Argolide*. Paris: Editions E. Boccard.

Desplanques, E. 2022. Protohistoric metal-urn cremation burials (1400-100 BC): a pan-European phenomenon. *Antiquity* 96: 1162-1178.

Gamba, M., G. Gambacurta, L. Millo, A. Nardo and N. Onisto 2011. Per una revisione della tomba patavina 'dei vasi borchieto'. *Archeologica Veneto* XXIII-2010: 49-115.

Gelling, P. and E. Davidson 1969. *The Chariot of the Sun and other Rites and Symbols of the Northern Bronze Age*. London: J.M. Dent & Sons.

Goldhahn, J. 2019. *Birds in the Bronze Age. A North European Perspective*. Cambridge: Cambridge University Press.

Hansen, S. 2018. Seddin: ein "homerisches Begräbnis", S. Hansen and F. Schopper (eds) *Der Grabhügel von Seddin im norddeutschen und südskandinavischen Kontext*: 65-84. Arbeitsberichte zur Bodendenkmalpflege in Brandenburg 33. Wünsdorf: Brandenburgisches Landesamt für Denkmalpfege und Archäologisches Landesmuseum.

Hencken, H. 1968. *Tarquinia, Villanovans and Early Etruscans*. Cambridge, MA: American School of Prehistoric Research, Peabody Museum, Harward University.

Hurwit, J.M. 1985. *The Art and Culture of Early Greece*. Ithaca: Cornell University Press.

Iaia, C. 2004. Lo stile della 'barca solare ornitomorfa' nella toreutica italiana della prima età del ferro, in N. Negroni Catacchio (ed.) *Miti simboli decorazioni. Ricerche e scavi*: 307-318. Preistoria e Protostoria in Etruria VI. Milano: Centro Studi de Preistorica e Archeologica.

Jacob-Friesen, K.H. 1934. Verzierte Bronzerasiermesser aus Niedersachsen und ihre kultische Bedeutung. *Altschlesien* 5: 364-375.

Jockenhövel, A. 1974. Eine Bronzeamphore des 8. Jahrhunderts v. Chr. von Gevelinghausen, Kr. Meschede (Sauerland). *Germania* 52: 16–54.

Joy, J. 2008. Reflections on Celtic Art: a re-examination of mirror decoration, in D. Garrow, C. Gosden and J.D. Hill (eds) *Rethinking Celtic Art*: 78-99. Oxford: Oxbow Books.

Kaczmarek, M., A. Krzysiak, L. Kowalski, P. Niedzielski, D. Sych, M. Grzeskowiak, M. Fleszar, J. Wisniewski, T. Sawoszczuk, J. Zurowski, K. Betyna, S. Pietrzak, T. Stepnik, M. Przymorska-Sztuczka, M. Mackiewicz, T. Chmielewski and G. Szczurek 2022. Kaliska I: a Late Bronze Age metal hoard from Pomerania (Poland). *Antiquity* 96: 1612-1620.

Kahane, P.P. 1973. Ikonologische Untersuchungen zur griechisch-geometrischen Kunst. Der Cesnola-Krater aus Kourion im Metropolitan Museum. *Antike Kunst* 16: 114-138.

Kaul, F. 1998. *Ships on Bronzes. A Study in Bronze Age Religion and Iconography*. Copenhagen: PNM Publications from the National Museum.

Kaul, F. 2004. *Bronzealderens religion. Studier af den nordiske bronzealders ikonografi*. Nordiske Fortidsminder, Serie B, Bind 22. Copenhagen: Det Kongelige Nordiske Oldskriftselskab.

Kaul, F. 2010. The sun image from Trundholm ('The Chariot of the Sun') – a commented history of research, in H. Meller and F. Bertemes (eds) *Der Griff nach den Sternen. Wie Europas Eliten zu Macht und Reichtum kamen. Internationales Symposium in Halle (Saale) 16.-21. Februar 2005*: 521-536. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Kaul, F. 2014. The not so ugly duckling – an essay of meaning, in C. Gosden, S. Crawford and K. Ulmschneider (eds) *Celtic Art in Europe. Making Connections. Essays in honour of Vincent Megaw on his 80th birthday*: 105-112. Oxford: Oxbow Books.

Kaul, F. 2018a. The Nordic Razor as Medium of Creativity, in J. Sofaer (ed.) *Considering Creativity, Knowledge and Practice in Bronze Age Europe*: 105-115. Oxford: Archaeopress.

Kaul, F. 2018b. The Chariot of the Sun and other sun horses of The Nordic Bronze Age – including some interesting anatomical details, in J. Dodd and E. Meijer (eds) *Giving the Past a Future. Essays in Archaeology and Rock Art Studies in Honour of Dr. Phil. h.c. Gerhard Milstreu*: 58-69. Oxford: Archaeopress.

Kaul, F. 2018c. Middle Bronze Age Long Distance Exchange. Early Glass, Amber and Guest-Friendship, *Xenia*, in B. Nessel, D. Neumann and M. Bartelheim (eds) *Bronzezeitlicher Transport, Akteure, Mittel und Wege*: 189-211. Ressourcenkulturen Band 8. Tübingen: Tübingen University Press.

Kaul, F., B.H. Nielsen, M.B. Henriksen and O.T. Kastholm 2018. Nye fund af gamle skibe: Bronzealderens skibsbilleder som danefæ. *Nationalmuseets Arbejdsmark* 2018: 152-163.

Kneisel, J. 2018. *Gesischtsurnen. Menschenbilder der Vergangenheit*. Kiel: Deutsche Forschungsgemeinschaft.

Kossack, G. 1999. *Religiöses Denken in dinglicher und bildlicher* Überlieferung *Alteuropas aus der Spätbronze- und frühen Eisenzeit (9.-6. Jahrhundert v. Chr. Geb.)*. Bayerische Akademie der Wissenschaften, Abhandlungen, Neue Folge, Heft 116. München: Verlag der Bayerischen Akademie der Wissenschaften.

Kristiansen, K. 1998. *Europe before history*. Cambridge: Cambridge University Press.

Kristiansen, K. 2010. Rock Art and Religion, in Å.C. Fredell, K. Kristiansen and F.C. Boado (eds) *Representations and Communications. Creating an Archaeological Matrix of Late Prehistoric Rock Art*: 93-115. Oxford: Oxbow Books.

Langdon, S. 1989. The Return of the Horse-Leader. *American Journal of Archaeology* 93: 185-201.

McK. Camp II, J. 1998. *Horses and Horsemanship in the Athenian Agora*. Excavations of the Athenian Agora, Picture Book No. 24. Athens: American School of Classical Studies at Athens.

Megaw, J.V.S. 2002. Figuration and abstraction in early Celtic art: who is smiling now?, in Z. Karazová and M. Licka (eds) *Figuration et Abstraction dans l'Art de l'Europe Ancienne (VIII'ème-I'er S. a. J.-C.), Actes du Colloque International du Praque, Musée National, 13.-16. Julliet 2000*: 57-64. Praque: Historia.

Megaw, J.V.S. and M.R. Megaw 1989. *Celtic Art. From its Beginnings to the Book of Kells*. London: Thames & Hudson.

Montelius, O. 1895. *La Civilisation primitive en Italie. I. Italie Septentrionale*. Stockholm: Impremerie Royale.

Montelius, O. 1904. *La Civilisation primitive en Italie. Deuxieme Partie, Italie Centrale*. Stockholm: Impremerie Royale.

Morandi, L. 2013. Early Iron Age finds from the Villanovan cemetery of Colle Baroncio: Remarks on early Vetulonia and its connections. *Mediterranean Archaeology* 26: 1-14.

Morigi Govi, C. and D. Vitali 1994. Villanova – Le Caselle, in S. Tovoli and D. Vitali (eds) *La Necropoli Villanoviana di Ca' dell'Orbo a Villanova di Castenaso*: 101-126. Bologna: Bologna Museo Civico Archeologico.

Morigi Govi, C., S. Tovoli, D. Vitali and P. Von Eles 1994. Villanova – Ca' dell'Orbo, in S. Tovoli and D. Vitali (eds) *La Necropoli Villanoviana di Ca' dell'Orbo a Villanova di Castenaso*: 19-62. Bologna: Bologna Museo Civico Archeologico.

Müller, S. 1897. Vor *Oldtid*. Copenhagen: Det Nordiske Forlag.

Müller, S. 1903. *Solbilledet fra Trundholm*, Nordiske Fortidsminder, I, 6. Copenhagen: Det Kongelige Nordiske Oldskriftselskab.

Müller, S. 1920. Billed- og Fremstillingskunst i Bronzealderen. *Aarbøger for Nordisk Oldkyndighed og Historie* 1920: 125-161.

Müller, S. 1921. *Bronzealderens Kunst i Danmark*. Copenhagen: C.A. Reitzel.

Müller-Karpe. H. 1959. *Beiträge zur Chronologie der Urnenfelderzeit nördlich und südlich der Alpen*. Berlin: Walter de Gruyter.

Pappi, E. 2006. Argive Geometric Figured Style. The rule and the exception, in E. Rystedt and B. Wells (eds) *Pictorial pursuits. Figurative painting on Mycenaean and Geometric pottery*: 229-237. Papers from two seminars at the Swedish Institute at Athens in 1999 and 2001. *Skrifter utgivna av Svenska Institutet i Athen, 4°*. Stockholm: Svenska Institutet i Athen.

Pedley, J.G. 1993. *Greek Art and Archaeology*. London: Cassell.

Roes, A. 1933. *Greek Geometric Art. Its Symbolism and its Origin*. Oxford: Oxford University Press.

Roes, A. 1953. Fragments de potterie Géométrique trouvés sur les citadelles d'Argos. *Bulletin de Correspondance Hellenique* 77: 90-104.

Rombos, T. 1995. An Argive late geometric vase, in C. Morris (ed.) *KLADOS, Essays in Honor of J.N. Coldstream*: 235-238. Bulletin of the Institute of Classical Studies, Supplement 63. London: University of London.

Sabatini, S. 2017. *House Urns. A European Late Bronze Age Trans-cultural Phenomenon*. Gotarc Series B. Gothenburg Archaeological Theses N. 47. Gothenburg: Gothenburg University.

Schweitzer, B. 1969. *Die geometrische Kunst Griechenlands*. Köln: DuMont.

Sprockhoff, E. 1936. Sonnenwagen und Hakenkreuz. *Germania* 20: 1-9.

Sprockhoff, E. 1954. Nordische Bronzezeit und frühes Griechentum. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz* 1: 28-110.

Sprockhoff, E. 1955. Das bronzene Zierband von Kronshagen bei Kiel. *Offa* 14: 5-120.

Sprockhoff, E. and O. Höckmann 1979. *Die gegossenen Bronzebecken der Jüngeren nordischen Bronzezeit*. Kataloge vor- und frühgeschichtlicher Altertümer 19. Mainz: Römisch-Germanisches Zentralmuseum Mains.

Thrane, H. 1975. *Europæiske forbindelser. Bidrag til studiet af fremmede forbindelser i Danmarks yngre bronzealder (periode IV-V)*. Nationalmuseets Skrifter, Arkæologisk-historisk række, Bind 16. Copenhagen: Nationalmuseet.

Tovoli, S. 1989. *Il Sepolcreto Villanoviana Benacci Caprara di Bologna*. Bologna: Museo Civico Archeologico di Bologna.

Vandkilde, H., V. Matta, L. Ahlqvist and H.W. Nørgaard 2022. Anthropomorphised warlike beings with horned helmets: Bronze Age Scandinavia, Sardinia, and Iberia compared. *Praehistorische Zeitschrift* 97(1): 130-158 (available at: https://doi.org/10.1515/pz-2021-2012).

Worsaae, J.J.A. 1882. *The Industrial Arts of Denmark. From the Earliest Times to the Danish Conquest of England* . London: Chapman and Hall Ltd.

Chapter 10

Bronze Age Russia: cultural receptivity and identity in the Yamnaya and Catacomb communities of the Lower Don region

Dalia Pokutta,[1,2*] Dmitry Zenyuk,[3,4] Kerstin Lidén[1]

[1] Department of Archaeology and Classical Studies, University of Stockholm, Stockholm, Sweden
[2] Institute of Archaeology, University of Rzeszow, Rzeszow, Poland
[3] Department of Archaeology, Southern Federal University, Rostov-on-Don, Russian Federation
[4] LLC 'Delta-L', Rostov-on-Don, Russian Federation
[*] dalia.pokutta@arklab.su.se

Abstract

The Bronze Age in Russia is marked by cultural and economic asymmetry, particularly pronounced among the steppe, forest-steppe, and forest regions. During the Early and Middle Bronze Age, distinct cultural traditions emerged, shaped by influences from the west, including the Yamnaya, Catacomb, Abashevo, and Srubnaya cultures. Within this dynamic milieu, the nomadic tribes of the steppe played a crucial role as intermediaries of cultural exchange, introducing new ideas to the northern territories and driving transformative developments. Unlike the gradual and stable cultural evolution observed in the northern regions, the steppe experienced episodic bursts of development, primarily driven by waves of migration, setting it apart in terms of cultural progression. Our research explores the complexities of cultural receptivity and the intricate interplay of collective and individual identities during the transition from the Yamnaya to Catacomb cultures in the Lower Don region, situated along the northern coast of the Black Sea. The recent excavation of a large barrow at Litvinovka provides an invaluable perspective on the diverse and nuanced cultural characteristics of the Yamnaya and Catacomb communities. Employing multi-isotopic analytical techniques, this research elucidates the chronology, burial customs, social structures, and daily life practices of Bronze Age populations in this region.

Introduction: Bronze Age cultures of the Rostov region

The Rostov region is situated in the steppe zone of the southern East European Plain and lies along the northeastern coast of the Black Sea (Fig.1). The Don, one of Europe's largest rivers, flows through this region. The specificities of this geographic location significantly influenced the development and dissemination of prehistoric metalworking in this part of Europe.

In the 6th millennium BCE, prior to the Bronze Age, the Lower Don region saw the emergence of the first native copper artefacts, marking the onset of the Eneolithic (Table 1; Kiyashko 1994). This transitional period, characterised by significant changes in lifestyle, saw the steppe become the foundation for a new cattle-breeding economy. The exploitation of the steppe fostered population growth, new connections, and the exchange of technological achievements, while also eroding established lifestyles and leading to conflicts and cultural transformations (Bratchenko 1976; Bochkaryov 2010). These changes are evident in the diverse archaeological findings, varied ritual practices, and production technologies of the time. Small coastal camps of hunters and fishermen with nascent agriculture and cattle breeding (e.g. Rakushechny Yar; see Belanovskaya 1995), expanded into large settlements and new sites emerged (e.g. Samsonovskoe and Liventsovskoe; Belanovskaya 1995; Kiyashko 1994; Sinyuk 1996). During this period, the adoption of wheeled transport enhanced mobility. Unlike in Trans-Dnieper, where populations were traditionally linked to Balkan agrarian cultures, mobile communities along the Don River increasingly fell under Caucasian cultural influence and pressure. Alongside the typical Neolithic-style flint and obsidian exchange, copper began arriving from the south (Caucasus), supplementing limited resources from the distant Carpathian Mountains and enabling broader access to copper ores in the Donbass region (Bochkaryov 2010). By the late Eneolithic period, *c.* 5th millennium BCE, southern groups of the Maykop culture migrated from the Kuban region into the Don steppes, introducing adobe architecture, distinctive ceramics, and metal casting technology (Bochkaryov 2010; Korenevsky 2004; Munchaev 1975). The convergence of newcomers and Eneolithic Middle Dnieper populations gave rise to a unique syncretic phenomenon, known as the Konstantinovka culture (Table 1; Kiyashko 1994).

In the Lower Don region the Bronze Age is typically divided into three subphases: the Early Bronze Age (mid-5th to 4th millennium BCE), the Middle Bronze Age (4th to 3rd millennium BCE), and the Late Bronze Age (2nd to early 1st millennium BCE; see Bratchenko 1976; Sinyuk 1996; Table 1). Numerous archaeological

Table 1: Simplified archaeological outline: Rostov-on-Don region from Palaeolithic to Early Iron Age (adapted after Kiyashko 2013).

Black Sea Palaeoecological environment	Key sites Highlights	Period/Culture	Chronology
Middle Pleistocene Glaciations (600,000-200,000 BCE) The Black Sea is isolated as a freshwater lake Pleistocene Ice Age (40,000-10,000 BCE) Sea level 120 m lower than today Climate cold and dry but no ice sheets 12,000 BCE Climate change – warmer climate Black Sea is still isolated from the Mediterranean – a large freshwater lake Sea levels are rising	Gerasimovka Levallois technique Neanderthals Costal settlements	PALAEOLITHIC	600,000-10,000 BCE Middle Palaeolithic 250,000-150,000 to 40,000 BCE Late Palaeolithic 40,000-10,000 BCE
10,800-9500 BCE Abrupt cooling of climate Dry glacial climate Black Sea still isolated Holocene Climatic Optimum (9500-5000 BCE)	Horse and bison hunting Zhukovskaya 8 River valleys microlithisation	MESOLITHIC	10,000-8000 BCE
The Black Sea Deluge Hypothesis (*c.* 6800 BCE) Mediterranean waters breached the Bosporus Strait Black Sea connected with the Mediterranean Sea Sea level rises by 7 m	Early from the Near East Pottery Rakushechny Yar site Open steppe animal husbandry Horticulture-no 'real' agriculture on steppe Stone axes Organised cults and religions	NEOLITHIC	8000-5000 BCE
Mid-Holocene climate 5000-3000 BC Stabile climatic conditions Warm and humid Integration of Mediterranean and Black Sea water systems	Konstantinovka culture Native copper Cattle-breeding Wheeled transport Maykop migrations from the Caucasus	ENEOLITHIC	5000-4000 BCE
Stabile coastal line Stabile seismic activity Late Holocene cooling (*c.* 3000-2000 BCE)	Repnin culture Early Yamnaya culture Bronze sceptres Rock art Maritime trade Increased mobility of pastoral communities 3800-3000 BCE Steppe Maikop culture	EARLY BRONZE AGE	4500-3000 BCE

Black Sea Palaeoecological environment	**Key sites Highlights**	**Period/Culture**	**Chronology**
Bronze Age warm period 4.2-kiloyear event (*c.* 2200-1900 BCE) Abrupt cooling and drying of climate	3000-2600 BC Yamnaya culture Bronzes Barrows Changes in religion 2500-1950 BCE Catacomb Catacombs Ceramics 2300-2000 BCE East Manych Catacomb culture 2200-1800 BCE Lola culture	MIDDLE BRONZE AGE	3000-2000 BCE
Rain shortages	Babyno culture 2200-1750 BCE 1900-1200 BCE Srubnaya culture Barrows Cremations Human migrations from the East	LATE BRONZE AGE	2000-1300 BCE
Late Bronze Age collapse (*c.* 1200 BC) Multiple ecological stressors Strong climate variability Black Sea level stabile	Otradnenskaya culture Kobyakov culture Bondarikha culture Nomadic pastoralism Mass human migrations and conflicts Fire and destruction layers on settlements North Caucasian (Koban) influence in bronze making	FINAL BRONZE AGE	1300-900 BCE
Stabilisation of climate	Beginning of Greek exploration and colonisation Chernyakov culture Skeletal inhumations Iron arrowheads Maritime fortified settlements	EARLY IRON AGE	900-650 BCE Pre-Scythian period

findings from the Early Bronze Age, including bronze scepters, stone stelae, rock carvings, and other artefacts, indicate that by this time, the Lower Don was intricately linked to the cohesive cultural development of the rest of Europe.

In the northern forest-steppe regions of this vast territory, the Repin culture emerged, characterised by coarse, sharp, round-bottomed ceramics featuring distinctive surface combing, shell additives, and ornamental designs incorporating impressions of pearls and large, twisted cords impressions. Metal resources were scarce, and tools made from flint successfully competed with bronze making (Bochkaryov 2010; Kiyashko 1994). These cultural characteristics are notably similar to those found in the Yamnaya culture, which exhibits strong affinities with the Repin culture. Archaeological evidence, including the stratigraphy of sites like Razdorsk and Konstantinovka, suggests that Repin pastoralists migrated extensively southwards, displacing the Konstantinovka culture and clearing the right bank of the Don (Kiyashko 1987). These mobile cattle herders, bringing with them a unified and relatively simple material culture, inhabited the steppe and laid the groundwork for the flourishing Bronze Age in the 3rd to 2nd millennia BCE (Sinyuk 1981). All economic, political, and social transformations of this period occurred in conjunction with changes in the ritual and religious spheres. The transition from the collective burials of the Eneolithic – characterised by extended burial positions, ochre, flint tools, and decorations made from shells and bone (as seen at archaeological sites such as Mariupol and Karataeva) – to the crouched, elaborate individual burials of the Maykop elite in kurgans underscores this significant cultural shift. By the beginning of the Bronze Age, the spread of the so-called Kurgan cultures across the steppe signaled a growing sense of regional unity.

The Middle Bronze Age (see Table 1) is marked by the establishment of the Donets-North Caucasian cultural centre. Within this framework, the Lower Don and Seversky Donets regions acted as critical links connecting the copper-bronze metallurgical hubs of the North Caucasus and the Donbass (Bochkaryov 2010; Kiyashko 1994; Munchaev 1975). The emergence of the Yamnaya culture heralded the beginning of the Middle Bronze Age, as evidenced by the transformation in metalworking practices among the Yamnaya tribes, which were influenced by post-Maykop traditions. By the early 3rd millennium BCE, the Yamnaya culture had evolved into the Early Catacomb culture, particularly in the Lower Don and northeastern Azov regions (Faifert 2019).

The Middle Bronze Age population of the Lower Don region was predominantly composed of the Yamnaya and Catacomb cultures. Reconstructing their daily life remains challenging due to the limited archaeological evidence of long-term settlements in the area. Sparse settlement sites, e.g. those identified at Liventsovka and Razdorskoe I, point to a pastoral economy and a largely nomadic lifestyle during this period (Bratchenko 2001a; 2001b; Fedosov 2010; 2012; Sinyuk 1996). Despite this scarcity, the number of burial sites increased threefold compared to the Eneolithic and Early Bronze Age. This significant rise suggests not only a population increase in the Lower Don steppes but also that the kurgan burial tradition had its origins in earlier cultural practices (Fedosov 2010).

Yamnaya burials are primarily characterised by multiple interments beneath kurgans, housed in large, carefully constructed terrestrial pits with reinforced walls (Bratchenko 2001a; 2001b). The deceased were usually placed in a flexed position on their backs, oriented either to the right or, less frequently, to the left side, and aligned in an east-west direction. In the western Lower Don region, burials commonly feature a westwards head orientation, while in the eastern areas, an eastwards alignment – reminiscent of burial practices in the Lower Volga and Kalmykia regions – becomes more prevalent (Faifert 2019). Adult burials generally lack ceramic grave goods, as the associated mortuary rituals did not involve food offerings in clay vessels. However, arsenical bronze knives and stone axes are occasionally discovered at these sites (Klochko 2023).

The development of the Yamnaya culture, similar to that of preceding Early Bronze Age populations, was significantly influenced by neighbouring regions. The emergence of post-Maykop phenomena in the North Caucasus, such as dolmens and vaulted catacombs, contributed to the transformation of the Yamnaya culture in the Lower Don into the distinct and dynamic Catacomb culture of the Middle Bronze Age (Bratchenko 2001a; 2001b; Faifert 2019; Fedosov 2012). This emergence of the Catacomb culture in the Lower Don and northeastern Azov regions represented a local evolution characterised by significant changes in the spiritual practices of the Yamnaya tribes, who began the construction of underground tombs. This cultural evolution was the result of a synthesis of material culture influenced by universal cult practices among both steppe inhabitants and mountaineers. As a consequence, Catacomb populations engaged in the mass production of North Caucasus-style bronzes, as well as stone weapons and tools. They also played a significant role in disseminating polished Caucasus ceramics throughout the steppe, alongside a variety of bronze ornaments. Notable new features of the Catacomb culture included the catacombs themselves, a fire cult represented by hearths, the inclusion of small cattle effigies with the deceased, the post-mortem displacement of buried skulls, and elaborate vertical ornamentation on ceramics, which contrasts sharply with the monotonous decoration of Yamnaya pottery (Faifert 2019; Fedosov 2012).

By the second quarter of the 3rd millennium BCE, the catacombs in the Lower Don region exhibited increasing diversity in ritual practices and burial furnishings. Despite this diversity, the variations adhered to systematic patterns: local customs, i.e. orienting the deceased towards the east or west and positioning them on either the right or left side, reflected principles of binary opposition. Over time, the growing differentiation in burial practices led to cultural fragmentation, resulting in the identification of numerous local variants within the Catacomb community of the Lower Don Basin. These include the Donetsk, Eastern Manych, Lower Manych (Western Manych), Middle Don, Volga-Don, and Bahmut cultures (Kiyashko 1994).

At the end of the Middle Bronze Age, the Lower Don region saw the emergence of the post-Catacomb Babyno culture (Litvinenko 2002). In the first half of the 2nd millennium BCE, tribes of the Srubnaya culture from the east replaced the Babyno culture in this area, resulting in the spread of Srubnaya cultural monuments throughout the Lower Don territory. The Srubnaya culture, which dates from the 20th to the 15th centuries BCE, is known to have left over 1,000 burials and only 12 settlements in the discussed region (Chernykh 2008; Iljukow 2009; Kiyashko 1994).

Initially, during the early Srubnaya period, settlements were situated on river terraces near valleys, while burial mounds (kurgans) were consistently located separate from these settlements. As the Srubnaya culture reached its peak, settlements expanded onto floodplain terraces, leading to the common practice of placing adjacent kurgans near residential areas. During this period, it became widespread to place graves near kurgans with small mounds, and cremation practices were adopted (Kachalova 1985; Kazakow 1991). Climate changes at the end of the Late Bronze Age led to significant transformations in the lifestyle and agricultural practices of local populations. Global environmental shifts, along with local fluctuations in the Black Sea level – of which the Sea of Azov was interconnected – were the primary factors influencing the migrations of prehistoric populations in the region (Fedorov 1982; Gerasimenko and Gorbov 1997; Kulkova 2021; Shilik 1977).

During the Final Bronze Age period – spanning *c.* the 13th/14th to the 10th centuries BCE – there was a gradual transition from settled pastoralism to a nomadic lifestyle. These changes not only affected the basic economic structure but also had a significant impact on material culture (Atishov *et al.* 2013; Matishov 2007).

The site: Litvinovsky burial mound complex and its surroundings

The Litvinovsky burial mound complex is located in the village of Litvinovka, within the Belokalitvinsky District of Rostov Oblast, part of the Southern Federal District of the Russian Federation. This small village features several barrows and includes three burial mound complexes: Litvinovsky, Litvinovsky II, and Litvinovsky III (Fig. 1). The site was first identified in 1992 by a team of archaeologists from Rostov State Pedagogical University, led by Viktor Pavlovich Kopylov. In June 2017, two previously unknown barrow complexes, designated Litvinovsky II and III, were discovered. Originally, Litvinovsky III consisted of two burial mounds. This study focuses specifically on barrow no. 1, and therefore, our comments regarding the second burial mound will be limited. Topographically, the mound is situated on a terrace along the right bank of the Kalitva River, which is a left tributary of the Seversky Donets River (part of the Don River Basin). This location is *c.* 177 km northeast of the northeastern corner of the Taganrog Bay of the Sea of Azov, which is the nearest point to the modern coastline. Geomorphologically, the site is positioned within the Don-Donets alluvial plains and rests on the Voronezh Massif, a tectonic anticline in the southern part of the Central Russian Upland, where Precambrian bedrock is prevalent (Atishov *et al.* 2013). The natural environment surrounding the site features a hilly plain intersected by numerous ravines, gullies, and meandering rivers.

Until recently, the western part of the archaeological landscape of Rostov Oblast had been relatively understudied. In 1976, Vladimir Evgenevich Maksimenko examined a single barrow near the settlement of Sholokhovsky, *c.* 16 km southeast of Litvinovka (Maksimenko 1981). The excavations indicated that this mound dates to the 8th century BCE. In 1999, Tatiana Aleksandrovna Prokhorova investigated burial mounds on the northern outskirts of the settlement of Golovka, a few kilometers from Litvinovka. This work led to the excavation of barrow no. 3 of the Golovka II complex, as well as individual barrows from the Golovka III and Golovka IV complexes. Barrow no. 3 of the Golovka II complex, measuring 0.45 m in height and 22 m in diameter, contained 24 burials from the Late Bronze Age, with half attributed to the early phase of the Srubnaya culture (15th-14th centuries BCE).

The Golovka III barrow, which stood 1.0 m tall and also measured 22 m in diameter, was constructed during the

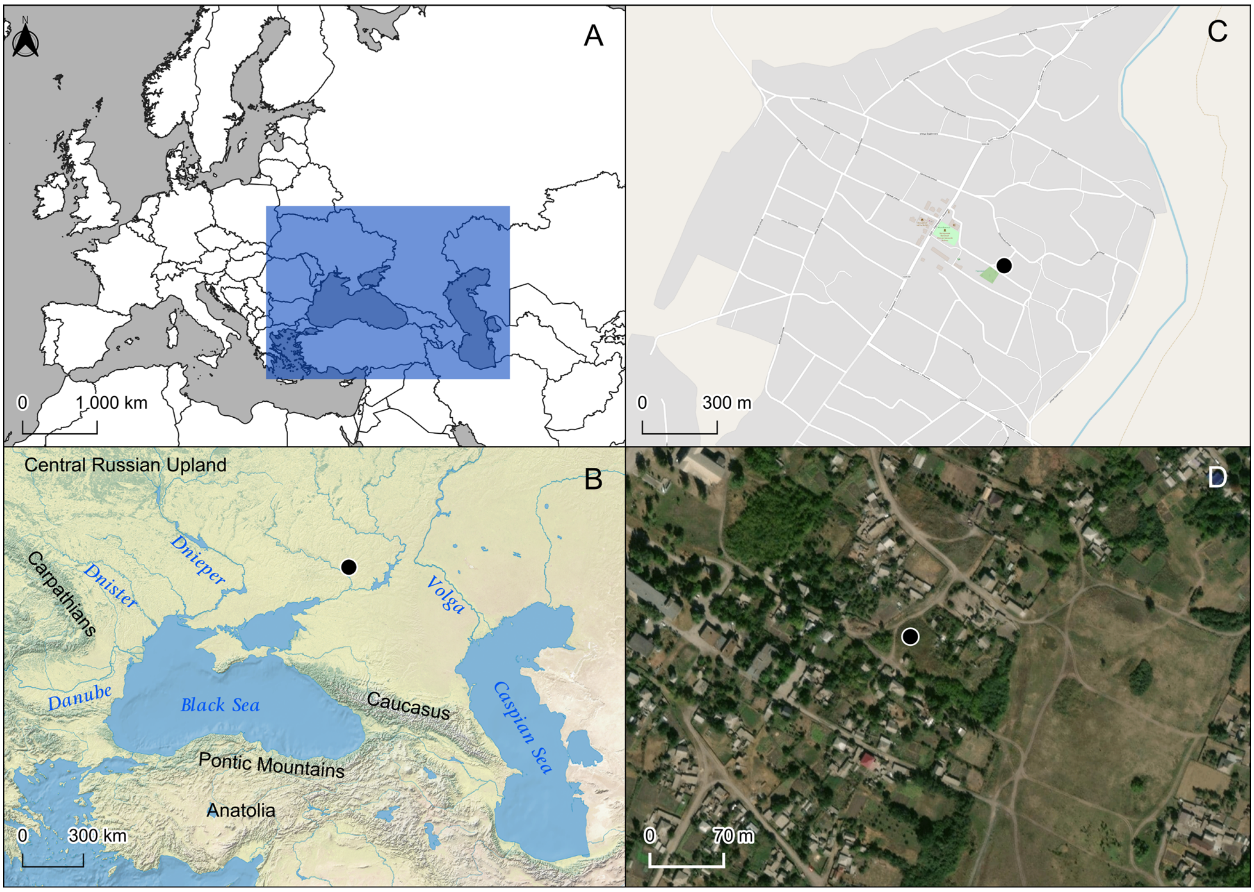


Figure 1: Geographic location of the Litvinovka III archaeological site. (A) Overview map showing the region in eastern Europe and western Asia. (B) Detailed map highlighting the Central Russian Upland, with major rivers including the Dnieper and Volga. (C) Local map of the settlement area surrounding Litvinovka III, with the site's location marked by a black circle. (D) Satellite view zoomed into the immediate surroundings of the Litvinovka III site, providing context within the present-day settlement (graphics: Peter Tóth, using ArcGIS and Google Earth Pro software).

Middle Bronze Age (Prokhorova 2001) and contained six burials from this period, as well as three from the Late Bronze Age. The Golovka IV barrow, with a height of 1.27 m and a diameter of 32 m, featured 15 burials from various periods of the Bronze Age, with the second and third barrows being constructed during the Middle Bronze Age and containing ten catacomb burials (Prokhorova 2001).

Numerous other barrows and sepulchral monuments dating to the Bronze Age have been documented in the vicinity of the Litvinovsky complex. Within a 40 km radius, significant findings include the Boguraevsky sepulchral complex, which consists of several barrows excavated in 1994 near the village of Kakichev (Kopylov and Kuznetsov 1997). Approximately 35 km from Litvinovka, Marat Arturovich Bakushev conducted excavations in 2008 at barrow no. 1 of the Medvezhy V burial ground, 4 km southeast of the village of Bogatov, along the left bank of the Seversky Donets River (Bakushev 2009; 2010).

From 2000 to 2007, Vladimir E. Maksimenko and his team excavated the Nizhnedonskie Chastye Kurgany, a burial mound complex 3 km northeast of the village of Krasnodonetskaya (Ilyukov 2004; Ilyukov *et al.* 2002; Ilyukov *et al.* 2006; Klyuchnikov 2008; Maksimenko 2001; Maksimenko *et al.* 2004; 2006). In 2007, the Russian Academy of Sciences conducted excavations of the Yasinovsky III mound, led by Roman Alekseevich Mimokhod. This mound, on the right bank of the Seversky Donets River, is 2 km east-southeast of the village of Chapaev. Most burials at this site belong to the final stage of the Middle Bronze Age and the Late Bronze Age (Mimokhod 2018). Our study is based on unpublished materials and data retrieved from Litvinovsky III barrow 1 during excavations conducted in 2018-2019.

The tomb: Litvinovsky III, barrow no. 1

The complete excavations of barrow no. 1 within the Litvinovsky III sepulchral complex covered an

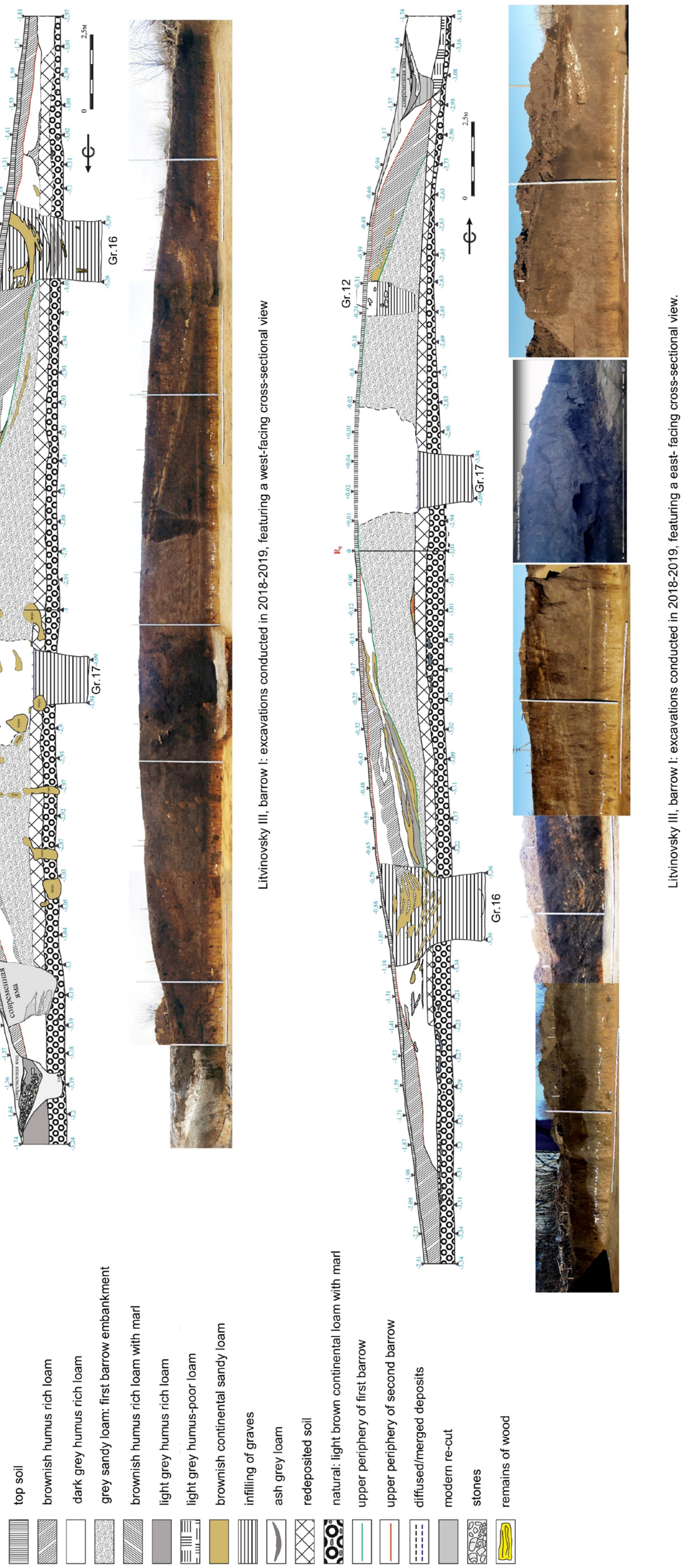


Figure 2: Litvinovka III barrow 1: stratigraphy with cross-sectional views (graphics: Dmitry Zenyuk).

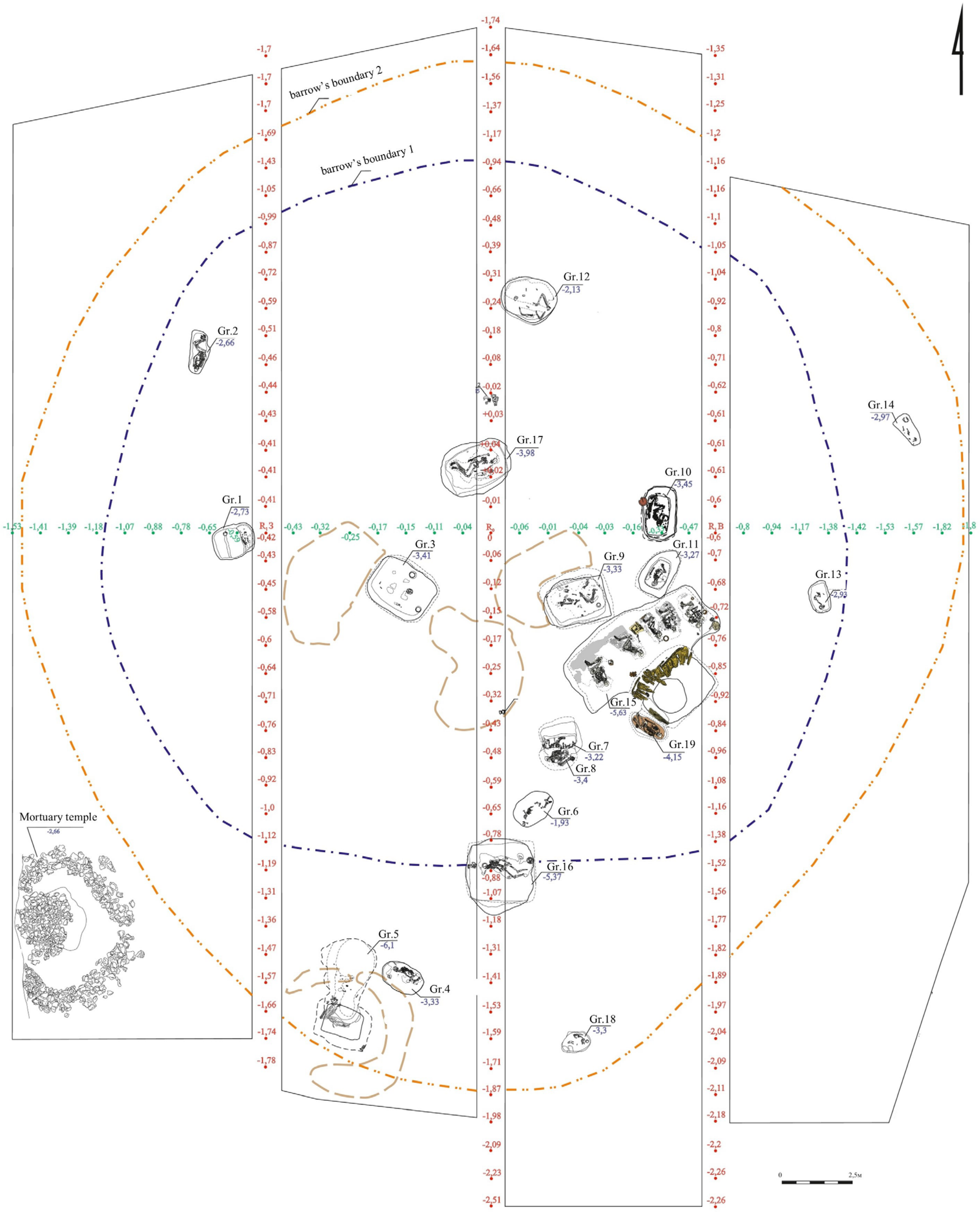


Figure 3: Litvinovka III barrow 1: plan in scale (graphics: Dmitry Zenyuk).

area of 1,100 m². This monument consisted of two superimposed barrows, both circular in shape, with a height of 2 m and a diameter of 35 m (Fig. 2). The mound contained multiple burial structures, including catacombs and the so-called stepped pits, which reflect the diversity of burial practices primarily associated with the late Yamnaya and Catacomb cultures. These structures indicate that the mound was in prolonged use, characterised by multiple phases of construction and modification. In the southwestern corner outside

Figure 4: Litvinovka III barrow 1: burials: A) grave no.10; B) grave no.17 (photos: Dmitry Zenyuk).

the barrow, the remains of a round stone building were uncovered, likely representing the remnants of a funerary shrine. Aside from a single vessel, no artefacts were found within this mortuary temple.

19 burials were identified within the mound, containing a minimum of 25 individuals (Fig. 3). The grave goods recovered during the excavations included a wide range of artefacts, e.g. ceramic vessels, objects made of bronze, bone, and stone, weaponry, jewelry, textiles, ornately decorated colorful carpets, and substantial amounts of ochre.

The earliest burial, dating to the Early Bronze Age, was centrally positioned along the axis of the lower barrow. This burial (no. 17) was aligned along an east-west axis and had a rectangular shape with heavily rounded corners. The individual interred was a male aged 35-45 years, placed on his back with a slight leftward tilt, legs flexed, arms extended along the body, and head facing east. The cause of death appears to be a fatal injury, as a flint arrowhead was found lodged between the ribs of the deceased (Fig. 4B). This burial also contained the poorly preserved remains of an infant. The grave goods included a decorated ceramic vessel, a flint scraper, and two flint flakes.

Of particular interest were two large catacomb burials: graves nos. 15 and 19, which date to the Middle Bronze Age (Catacomb culture) and were connected by a

Figure 5: Litvinovka III barrow 1: catacomb no. 15 – overall view and (A1-A2) close ups (photos: Dmitry Zenyuk).

shared entrance pit (see Fig. 3). Tomb no. 15 contained seven skeletons, primarily of females and children, accompanied by ceramic vessels, bronze items, carpets, ochre, and a unique altar structure (Fig. 5). This altar, located between the burials in the central part of the tomb, provides valuable insights into Bronze Age symbolism and funerary rituals. The square altar was primarily constructed from the long bones of large birds, identified as the steppe eagle, great bustard, swan, and grey heron, though it also incorporated fox jaws and dog limbs. Additionally, solar symbols (commonly referred to as 'swastikas') on decorated ceramic vessels and other symbolic items further indicate the importance of ritual and symbolic practices in the burial customs of the period (Fig. 6). Notably, several adult females buried in this tomb exhibited elongated skulls and cranial modifications.

Methods and materials

Ceramic vessels and their contents

During the excavations, various organic materials were selected for analysis, including wood remains from burials 3, 7, 9, 10, 11, 15, 16, and 17 (see Fig. 3); remains from the base of the burial pit in burial 12; organic residues from the bottoms of vessels in burials 3, 9, and 10; charcoal from the southeastern part of the shaft in burial 5 and charcoal from burial 16. These samples were sent for examination to the Laboratory of Archaeological Soil Science, Russian Academy of Sciences, in Pushchino. Preliminary results suggest that the ritual vessels from burials 3, 9, and 10 likely contained large quantities of animal fat (Prof. Alexander V. Borisov, pers. comm.). This conclusion is supported by the fact that the concentrations of lipolytic microorganisms in the bottom layer of the vessels from burials 3 and 10 were 1.7 times higher than the highest concentration observed in other vessels.

Isotopic analyses

In January 2020, following the anthropological assessments, bone and tooth samples were collected from the following burials: 4, 9, 10, 11, 12, 15 (in grave 15: all seven skeletons), 16, 17, and 19 for radiocarbon dating and dietary analyses. Additionally, small,

Figure 6: Litvinovka III barrow 1: A) miniature ceramic vessel decorated with dotted triangular motifs, Late Bronze Age, feature no. 2; B) miniature ceramic vessel decorated with diamonds, squares and swastika solar symbol, feature no. 2, Late Bronze Age (photos and graphics: Dmitry Zenyuk).

fragmented bird bones from burial 15 (object 1, 'altar') were also gathered.

The analysis of stable carbon and nitrogen isotopes is based on the key concept that an individual's diet is the primary source of the elements present in their body. These elements are integrated and stored within bodily tissues during processes of growth, repair, and remodeling throughout an individual's life. Consequently, tissues such as bone, teeth, and hair retain the isotopic signature of the diet consumed. The basic principles underlying carbon and nitrogen isotope analysis were first outlined by DeNiro and Epstein (1981), with significant methodological improvements emerging over the years (see, e.g., Hedges and Reynard 2007).

Stable isotopes from collagen predominantly reflect protein consumption. However, in low-protein diets, stable carbon isotopes may also provide insights into the contributions of lipids and carbohydrates (Schulting 2018). The rate at which bone tissue turns over varies depending on the skeletal element, the individual's age, and physiological conditions, i.e. pregnancy or starvation, both in humans and animals. Stable nitrogen isotopes typically indicate an organism's trophic level within the food chain, usually showing an enrichment of 3-5‰ in $\delta^{15}N$ relative to their diet (Schoeninger and DeNiro 1984; Hedges and Reynard 2007). Organisms in aquatic ecosystems tend to exhibit higher $\delta^{15}N$ values due to their position at higher trophic levels, reflecting the complexity of aquatic food chains (Schoeninger and Moor 1992; Schulting 2015). Regular consumption of animal protein – whether from milk, meat, or blood – results in elevated $\delta^{15}N$ values in consumers compared to those with purely herbivorous diets (Minagawa 1992; O'Connell *et al.* 2012). Stable carbon isotopes differentiate between primary and secondary consumers of terrestrial C_3 plants (e.g. wheat, barley) and C_4 plants (e.g. millet). C_3 plants generally have $\delta^{13}C$ values ranging from -21 to -35‰, with an average *c.* -28‰, while C_4 plants range from -12 to -16‰, averaging approximately -14‰. As with $\delta^{15}N$, consumer $\delta^{13}C$ values reflect those of their diet, with a fractionation of up to 5‰ (Lee-Thorp *et al.* 1989).

Collagen was extracted from both human and animal bones using the protocol established by Tom Brown and colleagues (1988) at the Archaeological Research Laboratory of the University of Stockholm. The measurements were carried out using the Finnigan Elemental Analyzer Delta-V Advantage, at the FTMC in Vilnius. The carbon and nitrogen stable isotope ratios were normalised against the VPDB standard for carbon and atmospheric nitrogen (AIR) for nitrogen (Schwarcz *et al.* 1999). The C:N ratios, along with the $\delta^{13}C$ and $\delta^{15}N$ values for all samples, are presented in Table 3. Despite the less than ideal preservation levels, all samples met the established collagen quality standards (Ambrose 1990).

Results

Radiocarbon dating and chronology of monument

The chronology of the tomb was established through radiocarbon dating of selected skeletons, alongside a comprehensive analysis of the artefacts and their cultural affiliations. The dating results are presented in Table 2 (Fig. 7). Two key observations emerge from

Table 2: Litvinovka III barrow 1: chronology and radiocarbon data from burials.

Lab ID	Sample	Grave no.	Bone element	Species	$\delta^{13}C$‰ PDB	^{14}C BP	SD 1σ	Cultural affiliation
Ua-71217	LIT3/17/LB	17	long bone	*Homo sapiens*	-18.8	4106	31	Late Yamnaya
Ua-71492	LIT3/4	4	long bone	*Homo sapiens*	-18.9	4089	32	Late Yamnaya
Ua-71494	LIT3/9	9	long bone	*Homo sapiens*	-18.6	4039	32	Early Catacomb
Ua-71493	LIT3/10	10	long bone	*Homo sapiens*	-20.2	4006	31	Early Catacomb
Ua-71491	LIT3/15/AV	15/altar/ bird	long bone	*Aquila nipalensis*	-11.5	3991	32	Early Catacomb
Ua-71216	LIT3/15/ LB/6	15 sk 6	long bone	*Homo sapiens*	-18.4	3990	31	Early Catacomb
Ua-71215	LIT3/12/LB	12	long bone	*Homo sapiens*	-19.0	3594	32	Late Catacomb/Lola cultures

Table 3: Litvinovka III barrow 1: human and animal bone collagen $\delta^{13}C$ and $\delta^{15}N$ data.

Sample no.	Sample ID	Bone element	$\delta^{13}C$ (‰) vs VPDB	$\delta^{15}N$ (‰) vs AIR	C:N
Animals					
1	LIT3/gr15/AV	long bone	-11.5	6.8	3.3
Humans: femurs and skulls					
2	LIT3/gr12/LB	long bone	-19.0	12.5	3.3
3	LIT3/gr15/LB/sk6	long bone	-18.4	12.9	3.2
4	LIT3/gr17/LB	long bone	-18.8	12.2	3.2
5	LIT3/gr4	long bone	-18.9	18.3	3.2
6	LIT3/gr10	long bone	-20.2	17.2	3.2
7	LIT3/gr9	long bone	-18.6	18.0	3.2
8	LIT3/gr10/LB	long bone	-22.5	12.1	3.3
Humans: dentition					
9	LIT3/gr15/sk7/CAN	canine	-21.2	12.9	3.2
10	LIT3/gr15/sk2/M3	molar 3	-22.1	13.1	3.3
11	LIT3/gr15/sk3/M3	molar 3	-21.3	13.2	3.3
12	LIT3/gr12/M2	molar 2	-21.6	13.5	2.9
13	LIT3/gr9/M3	molar 3	-21.7	13.1	3.1
14	LIT3/gr10/M3	molar 3	-19.8	14.8	3.0
15	LIT3/gr10/PM	premolar	-20.9	14.5	3.2
16	LIT3/gr9/M1	molar 1	-22.1	12.7	3.4

the data: first, the site consists of two burial mounds superimposed upon each other, with the earlier mound associated with the Late Yamnaya culture, while the second structure, which covers the former, served as a burial site for the Catacomb culture. Second, the data suggest a continuity of cultural practices in the studied area and indicate that this burial complex was in use for an extended period (Fig. 7).

The following chronological outline of the Litvinovka barrows is based on a detailed study of stratigraphy, radiocarbon dating, and artefact analysis. Two types of burial structures were identified: typical catacombs (burials no. 1, 5, 8, 15, 19) and the less common stepped graves (burials 3, 9, 10, 11, 16). The excavations revealed 19 prehistoric burials or features that provided chronological insights: one grave from the Early Bronze

Age, 16 from the Middle Bronze Age, one dated *c.* 1800 BCE, and one from the Hellenistic period (3rd-1st centuries BCE). Additionally, three features indicated Late Bronze Age activity, including a stone 'temple' structure and a pit containing ceramic materials, both dating from the mid-2nd to early 1st millennium BCE.

It was determined that the initial mound was constructed during the Middle Bronze Age, specifically in the last quarter of the 3rd millennium BCE, covering a central burial (no. 17) (Fig. 3; Fig. 4B). Subsequently, another burial (no. 1), representing the early stages of the Catacomb culture, was placed in the western portion of the first mound. This indicates that the second mound was built over an earlier burial from a slightly later period.

Burials numbered 2-11, along with 13, 15, 16, 18, and 19, were dated to the Middle Bronze Age, specifically within the Catacomb culture (Late Middle Bronze Age). It was established that burial no. 15 was inserted into the first mound, after which the mound was further elevated, resulting in the formation of what is referred to as the second mound. Burial no. 19 was interred into the southwestern wall of the entrance shaft of burial no. 15 after the latter was covered, but before the second mound was added, ensuring its placement within the entrance shaft. In the central section, burial no. 16 was added to the second mound. Burials numbered 4, 5, and 18 were likely also incorporated into the second mound, as they were situated outside the boundaries of the first mound.

A comparison of burial levels with the mound stratigraphy indicated that burials 6 and 8 were similarly placed into the second mound, with their fill spots recorded above the layer of the first mound. Around 1800 BCE, grave no. 12 was added to the monument. A stone temple-like structure located at the southwestern edge, along with a central pit, dates to the Late Bronze Age, from the mid-2nd to early 1st millennium BCE. The stone structure and the associated ritual context may relate to interment no. 12, though further investigation is required to confirm this association. The most recent inhumation within the barrow (no. 14) was placed at the northeastern edge and dated to the period between the 3rd and 1st centuries BCE.

The complex stratigraphy of the monument may be partially attributed to the region's modern history. In the 18th century, the settlement of Chernov (now known as Litvinovka) was established near the barrow. Local accounts suggest that a windmill was once situated atop the mound, and this, along with other possible activities during the modern period, may account for the elevated central portion of the mound and the absence of the second mound in the central section, which may have been levelled or removed.

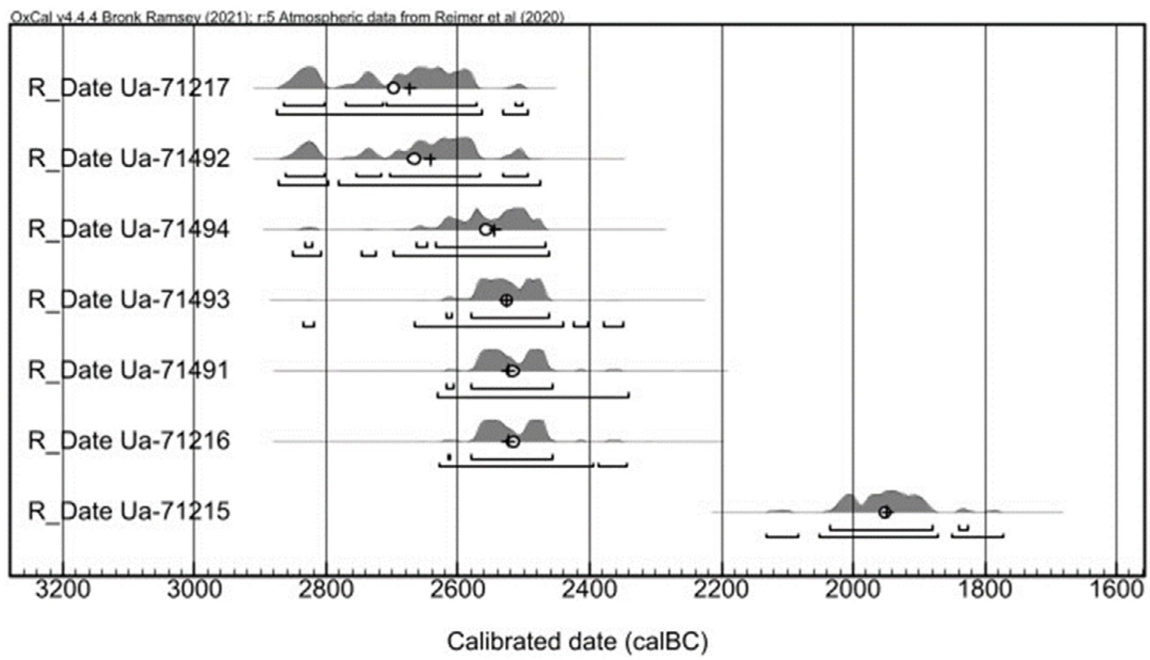


Figure 7: Litvinovka III barrow 1: radiocarbon data Oxcal plot (based on Table 2; graphics: authors).

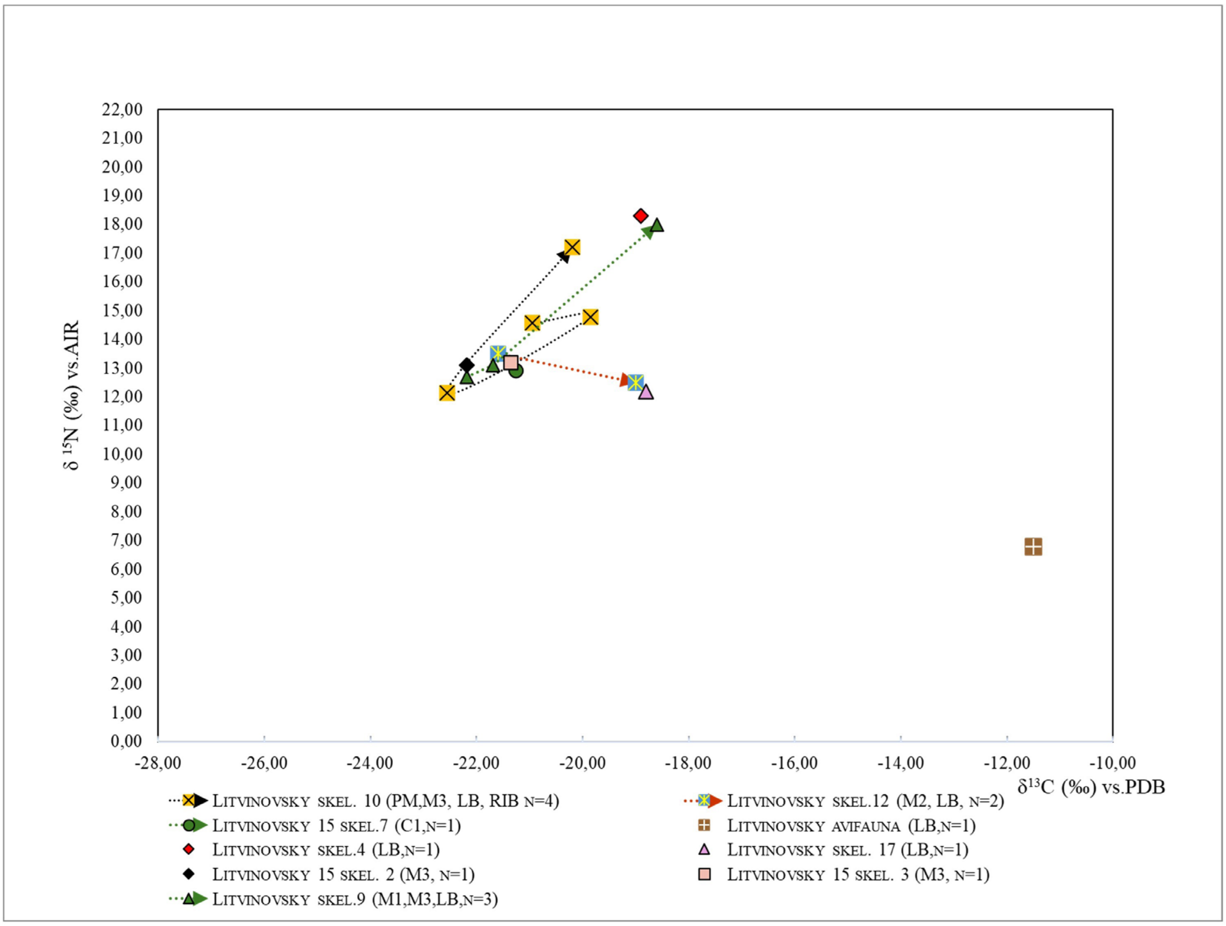


Figure 8: Litvinovka III barrow 1: individual life histories – stable carbon and nitrogen isotopes $\delta^{13}C/\delta^{15}N$ plot (based on Table 3; graphics: the authors).

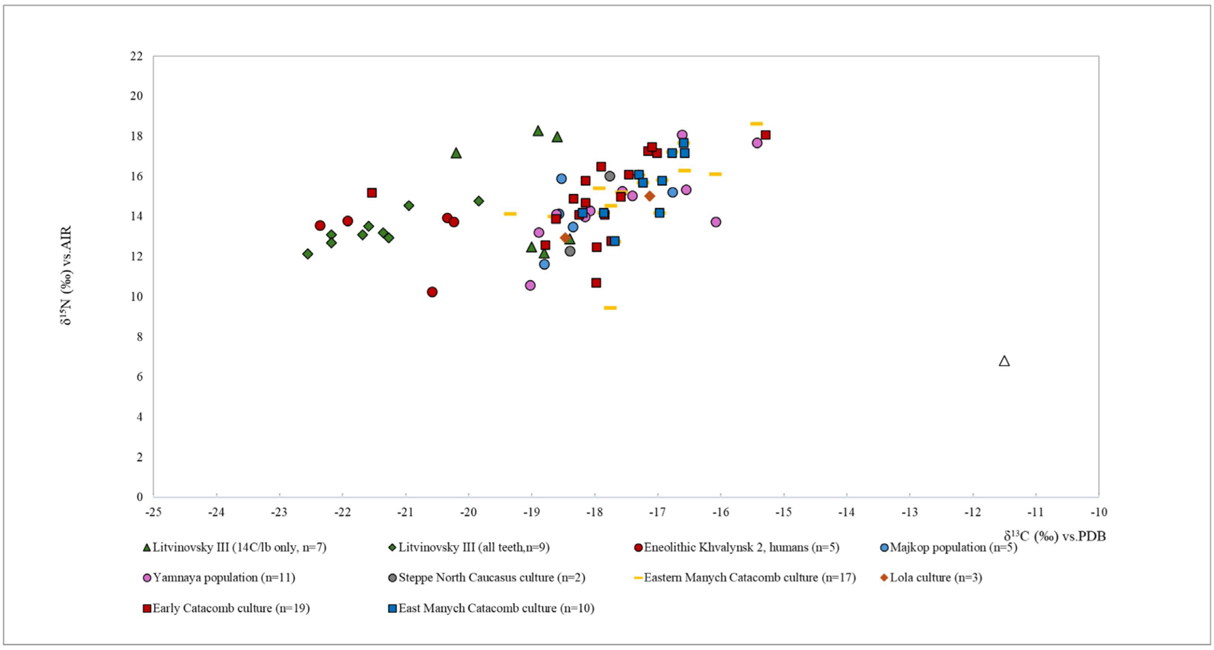


Figure 9: Litvinovka population in transregional perspective (comparative data after Shishlina *et al.* 2007; 2009) (based on Tables 2 and 3; graphics: the authors).

Dietary analysis

Dietary practices generally evolve slowly over centuries or millennia, shaped by locally available food sources and culturally based customs and taboos, while remaining resilient through significant divergent events. Nine skeletons from Litvinovka have been analysed, incorporating 15 measurements. Several individuals were measured multiple times using different bones and teeth (graves 9, 10, and 12). The results of the $\delta^{13}C$ and $\delta^{15}N$ analyses of humans are presented in Table 3 (Figs 8-9). Additionally, a single faunal specimen, a long bone from a steppe eagle (*Aquila nipalensis*) found in the 'altar' deposit of grave 15 was analysed (Tables 2-3). The isotopic analysis of the steppe eagle's long bone reveals a $\delta^{13}C$ value of -11.5‰, indicative of a diet based on C_4 plant-consuming prey or organisms from mixed environments. The $\delta^{15}N$ value of 6.8‰ suggests a trophic level consistent with a diet of higher-order consumers or omnivores, reflecting a position in the food web associated with consuming animals that feed on both plants and other herbivores.

For the human samples, the average $\delta^{13}C$ value is -20.4±1.1‰, with a range between -18.4‰ and -22.1‰, while the average $\delta^{15}N$ value is 14.2±2.5‰, ranging from 12.2‰ to 18.3‰. It should be noted that no children's remains were analysed; all results are derived from adult individuals.

The findings suggest a stable long-term diet primarily based on C_3 plants, supplemented by substantial quantities of fish as a main protein source. In a few cases, the isotopic data allow for the reconstruction of individual life histories, such as in burial 9 (Fig. 3). The adult individual buried in grave 9, located in the central part of the barrow, exhibited the following $\delta^{13}C$ and $\delta^{15}N$ isotopic values: -22.8‰ and 12.7‰ for the first molar (early childhood); -21.7‰ and 13.1‰ for the third molar (early adulthood); and -18.6‰ and 18‰ for the long bones (Fig. 8). Similarly, very high $\delta^{15}N$ values were recorded for all analysed individuals. However, in some cases (burials 4, 10, and 18), the $\delta^{15}N$ values are exceptionally high, ranging from 14‰ to 18‰. It is also important to note that the site is located nearly 200 km from the coast of the Azov Sea.

The isotopic analysis of human remains from the Litvinovka III barrow, detailed in Tables 2 and 3, provides significant insights into potential indicators of social status. Elevated $\delta^{15}N$ values, such as those observed in samples LIT3/gr4 (18.3‰) and LIT3/gr9 (18.0‰), suggest access to diets rich in animal protein, a privilege often associated with higher social standing in ancient societies. The $\delta^{13}C$ values, ranging from -18.4‰ to -22.5‰, indicate a diversity of dietary sources. Individuals with less negative $\delta^{13}C$ values may have consumed more C_4 plants, or animals that fed on these plants, hinting at dietary diversity potentially tied to different social roles or levels of status, with some having preferred access to specific food resources.

Lower $\delta^{15}N$ values in dentition samples, compared to bone collagen, indicate that dietary access – and perhaps social status – evolved over an individual's lifetime. This pattern implies that dietary habits shifted with age or changing social roles. The difference, where $\delta^{15}N$ values in early-life dentition were lower than those found in long bone collagen, suggests that access to protein-rich foods may have increased as individuals aged or advanced socially.

One notable outlier, LIT3/gr10/LB, has a significantly more negative $\delta^{13}C$ value of -22.5‰, pointing to a diet with a higher proportion of C_3 plants (such as grains and vegetables) or reduced animal product consumption. Despite this, the $\delta^{15}N$ value for this sample aligns with others, indicating a primarily plant-based diet that still included some protein-rich foods. This outlier may represent cultural dietary variation or an individual with a distinct social or health status.

The observed ranges in $\delta^{13}C$ (-18.4‰ to -22.5‰) and $\delta^{15}N$ (12.1‰ to 18.3‰) could also reflect cultural or seasonal dietary practices. It is feasible that higher protein consumption occurred during specific seasons or life events, affecting the isotopic signatures and reflecting seasonal or ritual dietary variations.

Overall, the variation in $\delta^{15}N$ values and subtle differences in $\delta^{13}C$ suggest a hierarchical distribution of dietary resources, likely linked to social status or societal roles. Individuals with particularly high $\delta^{15}N$ values appear to have had privileged access to protein-rich diets, marking them as members of higher social standing in the Catacomb community. A strong preference for fish (and/or carnivore wild game) consumption might indicate that, alongside well-developed agriculture, there was also an equally advanced trade in perishable goods between coastal and inland communities during the Yamnaya/Catacomb periods (for comparison see Fig. 9).

Discussion: Bronze Age Russia: identity, food culture, and lifestyle

Bronze Age cranial modifications and identity

Cranial modifications were identified on several female skeletons from grave no. 15 at Litvinovsky III. This burial chamber was adorned with carpets, an altar structure made from selected animal bones, and substantial quantities of ochre (Fig. 5). The centrally located altar within the grave was also covered in pigments, suggesting ritual burning activities before the tomb was sealed. Cranial deformations of Bronze Age elites interred in burial mounds in southern Russia are regarded as one of the earliest examples of intentional and widespread head-shape modification in Eurasia (Mednikova 2006). This phenomenon attracted the attention of anthropologists immediately after initial discovery (Artamonov 1937; Ginzburg 1949). It was recognised as a pivotal breakthrough in Russian physical anthropology during the first two-thirds of the 20th century (Ginzburg 1967) and has been extensively studied in subsequent decades (Balabanova 2004; 2018; Batieva 2008; Dobrovolskaya 2006; Mednikova 2006; Pererva 2013; Shevchenko 1986). According to Aleksey Kazarnitsky and colleagues (2021), the earliest form of cranial deformation among the Bronze Age steppe populations was occipital-parietal flattening, which shows only slight variation in its localisation. This type of deformation is characteristic of the Yamnaya, Yamnaya-Catacomb and Early Catacomb cultures of the northwest Caspian Sea region and is only very rarely found in skulls from later burials. A significant portion of individuals from the East Manych Catacomb culture exhibited more complex artificially deformed skulls. Similar forms are infrequently observed in the skulls of the Late Sarmatian culture. In the Early Iron Age, a different type of artificially modified sagittal contour becomes predominant in which the area of greatest convexity of the vault shifted towards the back (Kazarnitsky *et al.* 2021).

Intentional annular and/or fronto-occipital cranial deformation (resulting in elongated, cylindrical shape of the skull) was a prominent feature among individuals from the Bronze Age Catacomb cultures. Within these populations, individuals with deformed skulls constitute *c.* one-third of the male sample and more than two-thirds of the female sample (Kazarnizki and Panasyuk 2018). Aleksey Kazarnizki and Nathalia Panasyuk (2018) have identified a correlation between the presence of certain grave goods (i.e. incense burners) and cranial deformities among the deceased. Specifically, highly decorated incense burners are most frequently found in female graves exhibiting cranial modifications. It seems possible that the use of incense and/or psychoactive substances could (aside from their obvious ritual functions) have been a regular component of lifestyle aimed at improving the quality of life for individuals with modified skulls (see also Guerra-Doce *et al.* 2023).

Food culture as collective identity – some remarks

The dietary analysis of the Litvinovka skeletons offers some intriguing insights. The exceptionally high $\delta^{15}N$ values observed in the Litvinovsky III group can be better understood through a transregional comparison of isotopic data (see Fig. 9). Studies by Nathalia Shishlina and colleagues (2007; 2009) indicate that a substantial portion of the everyday diet for all Eneolithic and Bronze Age groups in this region consisted of aquatic products. However, climatic variations led to shifts in vegetation patterns and changes in the food resources available in the steppe environment.

The $\delta^{13}C$ and $\delta^{15}N$ values for animals from cultures that existed during milder and cooler climates (Eneolithic, Maykop, Yamnaya) differ from the isotopic values for humans of the same cultures. As aridification began, this pattern changed. Many animal species associated with the Eneolithic, Maykop, Yamnaya, and some Catacomb cultures exhibited stable isotope ratios typical of herbivores. However, some sheep from the Early Catacomb, Steppe North Caucasus, Eastern Manych Catacomb, and Lola cultures show different or elevated $\delta^{15}N$ and $\delta^{13}C$ values. These changes in isotopic values in animal bones can be attributed to ecological factors, i.e. shifts in vegetation and water scarcity (Shishlina *et al.* 2009).

The progressive aridification during the Bronze Age is a key focus in current isotopic analyses, particularly concerning the Catacomb culture. Another significant focus is the consumption of millet. The question of millet consumption traditions is of particular interest both for reconstructing the subsistence economy of the Catacomb culture tribes in the Middle Don region and in the context of an hypothesised *Isotopic Millet Route* from China to Europe across Eurasia. There are indications of an independent center of millet cultivation in northern Italy during the Early Bronze Age, with the millet cultivation zone gradually spreading into eastern Europe (Tafuri *et al.* 2009). Although we cannot confirm millet consumption at Litvinovka, the sporadic occurrence of individuals with high $\delta^{13}C$ values warrants further investigation.

Games, fun and lifestyle

The funerary structure of the Litvinovka barrow complex offers a unique perspective on the more elusive aspects of Bronze Age life, including communal activities, recreation, and entertainment within the Catacomb culture community. Grave no. 10, in the central part of the barrow and dating to 4006±31 BP, contained the remains of a young man, estimated to have a maximum age of 20 years. The deceased was buried with a large bowl, a portion of lamb, bronze ornaments, and weaponry, including a spear with a bronze spearhead. Notably, he was also accompanied by 55 astragali gaming pieces. Two of these pieces were found near his right hand, alongside other grave goods, likely belonging to the individual himself. The remaining pieces, however, were deliberately placed on the opposite side of the grave, behind his back (Fig. 4A). This suggests that the young man had a particular fondness for the game, and other players may have offered their gaming pieces to honour his passion. The arrangement of the grave goods clearly indicates a deliberate offering.

Of the vast diversity of material objects created by humans, only a few items can be compared to animal astragali in terms of the simplicity of their transition from the ‘world of living nature’ to the ‘world of culture’ (Umitkaliev *et al.* 2021). According to archaeological data, the earliest known faunal upper tarsal bone finds date from the Neolithic period (Gryaznov 1953). However, the use of such bones became more common in the Bronze Age and continued to appear in subsequent periods, found in various contexts. It is likely that among the pastoral societies of Eurasia in the Bronze Age, these astragali began to be distinguished as sacred objects, becoming a universal cultural symbol. Astragali were used for two primary purposes: as gaming dice and for divination. The distinction between these functions was marked by the presence of symbols on the dice used for divination; gaming dice typically feature no painted symbols (Umitkaliev *et al.* 2021).

According to Svetlana Sotnikova (2019), burial sites from the early Late Bronze Age, particularly those of the Sintashta and Petrovka types, contain the remains of young men along with a substantial number of astragali. These burials frequently include weapons, including those associated with chariot warriors, as well as adornments. Sotnikova compared the ancient Indian texts of the *Rigveda* and *Atharvaveda* with the archaeological evidence from these graves and concludes that various groups of young warriors likely existed within the chariot cultures of the Late Bronze Age. In these groups, young men not only developed martial skills, but also engaged in dice games, perceived as symbolic of battle, and refined their skills in music and dance (Sotnikova 2019).

Closing remarks

In the Rostov region, the Bronze Age was a period marked by significant cultural and technological transformations (Bochkaryov 2010; Bratchenko 2001a; 2001b; Sinyuk 1996). The process of *bronzization* (Vandkilde 2016) characterised by the adoption of bronze metallurgy, the intensification of pastoralism and changes in agricultural practices, played a crucial role in shaping the subsistence strategies and social structures of the communities in this area. Isotopic analyses of human and animal remains from the region provide evidence of a stable diet heavily reliant on C_3 plants, wild game and aquatic resources. These findings underscore the complexity of Bronze Age lifeways in the Black Sea region, highlighting the region’s integration into wider cultural and economic systems across Eurasia.

Bibliography

Ambrose, S. 1990. Preparation and characterization of bone and tooth collagen for isotopic analysis. *Journal of Archaeological Science* 17: 431-451 (available at: doi: 10.1016/0305-4403(90)90007-R).

Artamonov, M.I. 1937. Excavations of mounds in the valley of the Manych River. *Soviet Archaeology* IV: 93-132 (in Russian).

Atishov, G.G., I.V. Tolochko, V.V. Potapov, M. Nabozhenko, V.V. Polshin, K.V., Dyuzhova, G. Kovaleva and A.E. Zolotareva 2013. The Lower Don region during the Late Bronze and Early Iron Ages: paleogeographic reconstructions. *Bulletin of the Southern Scientific Center* 9: 56-65 (in Russian).

Bakushev, M.A. 2009. The Medvezhiy V burial mound on the Seversky Donets. *Archaeology of the Eastern European Steppe* 7. Saratov: Saratov State University (in Russian).

Bakushev, M. A. 2010. “Research of Monuments in the Belokalitvensky and Tatsinsky Districts in the Construction Zone of the 500 kV Overhead Line ‘Frolovo - Substation Shakhty.’” In *Historical and Archaeological Studies in the City of Azov and the Lower Don in 2007–2008*, edited by V. Ya. Kiyashko, 24. Azov: Azov Historical, Archaeological, and Paleontological Museum-Reserve (in Russian).

Balabanova, M.A. 2004. On ancient macrocephali of Eastern Europe. *OPUS: Interdisciplinary Studies in Archaeology* 3: 171-187 (in Russian).

Balabanova, M.A. 2018. The anthropological aspect of the custom of artificial skull deformation among the population of the Middle Bronze Age in the Lower Volga region and adjacent territories. *Samara Scientific Bulletin* 7(4): 219-227 (in Russian).

Batieva, E.F. 2008. On the issue of artificial skull deformation in the Lower Don region during the Middle Bronze Age. in A.P. Buzhilova, M.V. Dobrovolskaya and M.B. Mednikova (eds) *Current Directions in Anthropology: A Collection Dedicated to the Anniversary of Corresponding Member of the RAS T.I. Alekseeva*: 26-33. Moscow: IA RAN (in Russian).

Belanovskaya, T.D. 1995. *From the Ancient Past of the Lower Don Region: Neolithic and Eneolithic Settlement Rakushechny Yar*. Sankt Petersburg: Sankt Petersburg State University (in Russian).

Bochkaryov, V.S. 2010. *Culturogenesis and Ancient Metal Production in Eastern Europe*. Sankt Petersburg: Info Ol (in Russian).

Bratchenko, S.N. 1976. *The Lower Don Region in the Middle Bronze Age*. Kyiv: Naukova Dumka (in Russian).

Bratchenko, S.N. 2001a. *The Donets Catacomb Culture of the Early Stage*. Part I. Luhansk: Shlyakh (in Russian).

Bratchenko, S.N. 2001b. *The Donets Catacomb Culture of the Early Stage*. Part II. Luhansk: Shlyakh (in Russian).

Brown, T.A., D.E. Nelson, J.S. Vogel and J.R. Southon 1988. Improved collagen extraction by modified Longin method. *Radiocarbon* 30: 171-177.

Chernykh, E.N. 2008. The formation of the Eurasian 'Steppe Belt' of pastoralist cultures: a perspective through archaeometallurgy and radiocarbon chronology. *Archaeology, Etnography and Antropology of Eurasia* (3)(35): 36-53 (in Russian).

Deniro, M.J. and S. Epstein 1981. Influence of diet on the distribution of nitrogen isotopes in animals. *Geochimica et Cosmochimica Acta* 45: 341-351 (available at: doi: 10.1016/0016-7037(81)90244-1).

Dobrovolskaya, M.V. 2006. Artificial head deformation among the bearers of the Middle Don Catacomb archaeological culture (based on materials from the First Vlasovsky Burial Ground). *OPUS: Interdisciplinary Studies in Archaeology* 5: 37-46 (in Russian).

Faifert, A.V. 2019. Changes in the burial rituals of the Yamnaya culture of the Lower Don region, in N. L. Morgunova (ed) *Phenomena of Cultures of the Early Bronze Age of the Steppe and Forest-Steppe Zone of Eurasia: Paths of Cultural Interaction in the 5th-3rd Millennia BC*: 150-154. Orenburg: Orenburg State Pedagogical University (in Russian).

Fedorov, P.V. 1982. Post-glacial transgression of the Black Sea and the problem of changes in the World Ocean level over the last 15,000 years, in *Sea and Ocean Level Fluctuations over 15,000 Years*. Moscow: Nauka (in Russian).

Fedosov, M.Y. 2010. Burials with ceramics decorated with tree ornamentation in the context of the antiquities of the Donets Catacomb culture of the Lower Don region, in *Ancient Cultures of Eurasia: Materials of the International Scientific Conference Dedicated to the 100th Anniversary of the Birth of A.N. Bernshtam*: 71-75. Sankt Petersburg: Institute for the History of Material Culture of the Russian Academy of Sciences (in Russian).

Fedosov, M.Y. 2012. Catacomb Cultures of the Donets-Don-Volga Region (Based on Burial Monuments). Unpublished PhD dissertation, Sankt Petersburg (in Russian).

Gerasimenko, N.P. and V.N. Gorbov 1997. The natural environment of human habitation in the southeast of Ukraine during the Late Glacial and Holocene (based on paleogeographic studies of archaeological sites). *Archaeological Almanac, Donetsk* 6: 3-64 (in Russian).

Ginzburg, V.V. and E.V. Zhirov 1949. *Anthropological materials from the Kankol Catacomb burial ground in the Talas Valley, Kirghiz SSR*: 213-265. Collection of the Museum of Anthropology and Ethnography 10. Moscow: Leningrad: AN USSR (in Russian).

Ginzburg, V.V. 1967. 50 years of anthropology in the Soviet Union. *Archive of Anatomy, Histology, and Embryology* LII(2): 3-21 (in Russian).

Gryaznov, M.P. 1953. Neolithic burial near the village of Bateni on the Yenisei, in A.P. Okladnikov (ed.) *Materials on the Archaeology of the USSR, 39*: 332-335. Moscow-Leningrad: AN USSR (in Russian).

Guerra-Doce, E., C. Rihuete-Herrada, R. Micó, R. Risch, V. Lull and H.M. Niemeyer 2023. Direct evidence of the use of multiple drugs in Bronze Age Menorca (Western Mediterranean) from human hair analysis. *Scientific Reports* 13(1): 4782 (available at: doi: 10.1038/s41598-023-31064-2).

Hedges, R.E.M. and L.M. Reynard 2007. Nitrogen isotopes and the trophic level of humans in archaeology. *Journal of Archaeological Science* 34: 1240-1251 (available at: doi: 10.1016/j.jas.2006.10.015).

Ilyukov, L.S. 2004. *Investigation of Bronze Age mounds in the burial ground Lower Don Numerous Tumuli in 2003. Historical and Archaeological Research in the City of Azov and on the Lower Don in 2003*, 20. Azov: Azov Ethnographic Museum (in Russian).

Ilyukov, L.S. 2009. *Innovative processes in the Late Bronze Age on the steppes of the Lower Don region*, in *Problems and Perspectives of Socio-Economic and Scientific-Technological Development of Southern Regions: Proceedings of the All-Russian Scientific Conference*: 136-138. Rostov-on-Don: Southern Scientific Center of the Russian Academy of Sciences (in Russian).

Ilyukov, L.S., V.E. Maksymenko and V.V. Klyuchnikov. 2006. *Research on the burial ground 'Lower Don Numerous Tumuli' in 2005. Historical and Archaeological Research in the City of Azov and on the Lower Don in 2005*, 22. Azov: Azov Ethnographic Museum (in Russian).

Ilyukov, L.S., V.E. Maksymenko, V.V. Klyuchnikov and S.V. Gurkin. 2002. *Research on the Lower Don 'Numerous Tumuli' in 2001. Historical and Archaeological Research in the City of Azov and on the Lower Don in 2001*, 18. Azov: Azov Ethnographic Museum (in Russian).

Kachalova, N.K. 1985. *Periodization of Timber-Grave Monuments in the Lower Volga Region*. Kuibyshev: Kuibyshev State University (in Russian).

Kazakow, E.P. 1991. *Cemeteries of the Srubnaya Culture in the Trans-Kama Region*, in *Archaeological Research in the Forest-Steppe Region of the Volga*. Samara: Samara Regional Museum (in Russian).

Kazarnitski, A. and A. Grigorev. 2021. *Artificial deformation of skulls in the steppe cultures of the Bronze Age*. *Stratum Plus* 2: 307-318 (in Russian).

Kazarnizki, A. and N. Panasyuk. 2018. *Craniology and archeology of the East Manych Catacomb Culture: perspectives on analyzing the consistency of signs*. *Journal of World History* 10: 250-260 (available at: doi: 10.22363/2312-8127-2018-10-3-250-260) (in Russian).

Kiyashko, V.Y. 1987. *The multilayer settlement Razdorskoe I on the Lower Don. Brief Communications of the Institute of Archaeology (KSIA)* 192: 73-80 (in Russian).

Kiyashko, V.Y. 1994. *Between Stone and Bronze (Lower Don Region in the 5th-3rd Millennia BC)*, in *Don Antiquities* 3. Azov: Azov Ethnographic Museum (in Russian).

Klochko, V.I. 2023. *The Impact of Cucuteni-Trypillia Cultural Society on the Genesis of Bronze Age Cultures from Northern Pontic Area (the overview on the Problem through the History of Copper-Bronze Metallurgy in the Region)*, in L.V. Dergacheva (ed.) *Aere perennius. More lasting than bronze. Essays in honour of Valentin Dergachev on the occasion of his 80th birthday*: 353-363. *Stratum Plus Library*. Kyiv: Stratum Publishing (in Russian).

Klyuchnikov, V.V. 2008. *Research on the burial mound site Lower Don Numerous Tumuli in the Belokalitvensky District of the Rostov Region in 2007 (Scientific Report)*. Rostov-on-Don: Aksai Military-Historical Museum (in Russian).

Kopylov, V.P. and V.V. Kuznetsov. 1997. *Study of mounds in the Belokalitvensky district of the Rostov region*. *Historical and archaeological research in Azov and the Lower Don in 1994*, 14. Azov: Azov Ethnographic Museum (in Russian).

Korenevsky, S.N. 2004. *The Earliest Farmers and Pastoralists of the North Caucasus: The Maikop-Novosvobodnaya Community, Issues of Internal Typology*. Moscow: Nauka (in Russian).

Kulkova, M.A. 2021. *Adaptation of ancient societies to environmental changes in the Holocene in the regions of the Near East, Western Europe, the Balkans, and the Northern Black Sea: Part 1*. Sankt Petersburg: Russian Academy of Sciences (in Russian).

Lee-Thorp, J.C., J.C. Sealy, and N.J. Van Der Merwe. 1989. *Stable isotope ratio difference between bone collagen and bone apatite, and their relationship to diet*. *Journal of Archaeological Science* 16: 585-599.

Litvinenko, R.A. 2002. *The Babino Culture (multi-handled pottery) and problems of the Bronze Age in the Don Basin*, in *Archaeological Monuments of Eastern Europe*: 76-85. Voronezh: Voronezh Regional Museum (in Russian).

Maksimenko, V.E. 1981. *Works of the Tatsin detachment of the Azov-Donetsk expedition*, in *Materials for the seminar Results of research of the united Azov-Donetsk archaeological expedition of the Azov Ethnographic Museum, the Rostov Order of the Red Banner of Labor State University and the Rostov Order of the Badge of Honor of the State Pedagogical Institute in 1976-1981*. Azov: Azov Ethnographic Museum (in Russian).

Matishov, G.G. 2007. Seismic profiling and mapping of the latest deposits of the Azov Sea bottom. *Bulletin of the Southern Scientific Center* 3(3): 32-40 (in Russian).

Mednikova, M.B. 2006. The phenomenon of cultural head deformation: Eurasian context. *OPUS: Interdisciplinary Studies in Archaeology* 5: 206-229 (in Russian).

Mimokhod, R.A. 2018. Stratified Bronze Age burial mounds on the right bank of the Seversky Donets. *Materials of rescue archaeological research* 23: 4, 5, 128, 146, 147 (in Russian).

Minagawa, M. 1992. Reconstruction of human diet from $\delta^{13}C$ and $\delta^{15}N$ in contemporary Japanese hair: a stochastic method for estimating multi-source contribution by double isotopic tracers. *Applied Geochemistry* 7: 145-158 (available at: doi: 10.1016/0883-2927(92)90033-Y).

Munchaev, R.M. 1975. *The Caucasus at the Dawn of the Bronze Age*. Moscow: Nauka.

O'Connell, T.C., C.J. Kneale, N. Tasevska and G. Kuhnle 2012. The diet-body offset in human nitrogen isotopic values: a controlled dietary study. *American Journal of Physical Anthropology* 149: 426-434 (available at: doi: 10.1002/ajpa.22140).

Pererva, E.V. 2013. Radiological study of deformed skulls from the Middle Bronze Age in the Lower Volga Region (paleopathological aspect). *Bulletin of Volgograd State University*, Series 4, History, 24(2): 7-19 (in Russian).

Prokhorova, T.A. 2001. *Study of mounds near Kh. Head of the Belokalitvensky district in 1999*. Historical and archaeological research in the city of Azov and the Lower Don in 1999-2000, 17. Azov: Azov Historical, Archaeological, and Paleontological Museum-Reserve (in Russian).

Schoeninger, M. and M. Deniro 1984. Nitrogen and carbon isotopic composition of bone collagen from marine and terrestrial animals. *Geochimica et Cosmochimica Acta* 48: 625-639 (available at: doi: 10.1016/0016-7037(84)90091-7).

Schoeninger, M.J. and K. Moore 1992. Bone stable isotope studies in archaeology. *Journal of World Prehistory* 6: 247-296 (available at: doi: 10.1007/BF00975551).

Schulting, R. 2015. Stable isotopes and Neolithic subsistence: pattern and variation, in C. Fowler, J. Harding and D. Hofmann (eds) *The Oxford Handbook of Neolithic Europe*: 362-383. Oxford: Oxford University Press.

Schulting, R.J. 2018. Dietary shifts at the Mesolithic-Neolithic transition in Europe: an overview of the stable isotope data, in J. Lee-Thorp and M.A. Katzenberg (eds) *The Oxford Handbook of the Archaeology of Diet*. Oxford: Oxford University Press (available at: doi:10.1093/oxfordhb/9780199694013.013.35).

Schwarcz, H.P., T.L. Dupras and S.I. Fairgrieve 1999. ^{15}N enrichment in the Sahara: in search of a global relationship. *Journal of Archaeological Science* 26: 629-636 (available at: doi: 10.1006/jasc.1998.0380).

Shevchenko, A.V. 1986. Anthropology of the population of the Southern Russian Steppes in the Bronze Age, in I.I. Gokhman and A.G. Kozintsev (eds) *Anthropology of the Modern and Ancient Population of the European Part of the USSR*: 121-215. Leningrad: Nauka (in Russian).

Shilik, K.K. 1977. "Changes in the Level of the Black Sea during the Late Holocene and the Paleotopography of Archaeological Sites in the Northern Black Sea Region during Antiquity." In *Paleogeography and Pleistocene Deposits of the Southern Seas of the USSR*, edited by P.A. Kaplin and F.A. Shcherbakov, 158-163. Moscow: Nauka.

Shishlina, N.I., J. Van Der Plicht, R.E.M. Hedges, E.P. Zazovskaya, V.S. Sevastyanov and O.A. Chichagova 2007. The Catacomb Cultures of the North-West Caspian Steppe: 14C Chronology, Reservoir Effect, and Paleodiet. *Radiocarbon* 49(2): 713-726.

Shishlina, N.I., E.P. Zazovskaya, J. Van Der Plicht, R.E.M. Hedges, V.S. Sevastyanov and O.A. Chichagova 2009. Paleoecology, subsistence and 14C chronology of the Eurasian Caspian Steppe Bronze Age. *Radiocarbon* 51(2): 481-500.

Sinyuk, A.T. 1981. The Repin Culture of the Chalcolithic–Bronze Age in the Don Basin. *Soviet Archaeology* (4): 8-19 (in Russian).

Sinyuk, A.T. 1996. *Bronze Age of the Don Basin*. Voronezh: Voronezh Pedagogical University (in Russian).

Sotnikova, S. 2019. Warrior burials of the Later Bronze Age with sets of astragals: problem of interpretation. *The Volga River Region Archaeology* 1(27): 72-83 (available at: doi: 10.24852/2019.1.27.72.83) (in Russian).

Tafuri, M.A., O.E. Craig and A. Canci 2009. Stable isotope evidence for the consumption of millet and other plants in Bronze Age Italy. *American Journal of Physical Anthropology* 139(2): 146-153 (available at: doi: 10.1002/ajpa.20955).

Umitkaliev, U.U., O.A. Mityko and L.V. Lbova 2021. Painted astragals of the Bronze Age (Kyrykungir burial site, Eastern Kazakhstan). *Volga River Region Archaeology* 1(35): 232-246 (available at: doi: 10.24852/pa2021.1.35.232.246) (in Russian).

Vandkilde, H. 2016. Bronzization: The Bronze Age as pre-modern globalization. *Praehistorische Zeitschrift* 91: 103-123.

Chapter 11

A network of watercrafts: New perspectives on the Bronze Age boat from Varpelev, Denmark

Ole Thirup Kastholm[1] and Morten Ravn[2]

[1]Museum ROMU, Roskilde, Denmark

[2]Viking Ship Museum, Roskilde, Denmark
(mr@vikingeskibsmuseet.dk)

Abstract

The discovery of the Varpelev Boat in 1973 was an archaeological sensation that attracted significant attention from both the media as well as scholars. In consultation with specialists, Køge Museum initiated a salvage operation and conservation plan. However, the process faced setbacks which led to the boat's deterioration. In 2005, a rescue operation enabled its re-conservation, which was completed in 2016. The boat was transferred to the Viking Ship Museum in 2017. The boat, dated to 1220-788 BCE, was partially preserved. It had a flat 'platform' at the aft end, hewn from the trunk's root, and featured three hewn-out ridges inside. It measured *c.* 12.4 m in situ, with reconstructions estimating its original length to be *c.* 13 m, *c.* 50 cm high, and weighing *c.* 1300 kg. During the boat's era of use, sea levels were higher, making the river valley in which the boat was found a navigable, brackish fjord. This suggests that the Varpelev Boat was part of a broader maritime transit network. It would have served as a cargo and crew carrier in a key geographical area in which sea and land routes intersected. This is furthermore supported by the boat's design, which shows similarities to other watercraft from the period. A new research project (2024-2025), aims to provide deeper insights into the boat's construction and its role in Bronze Age maritime networks, utilising dendrochronology and 3D reconstructions. The project is a collaborative effort, with plans for a scientific publication and a temporary exhibition to showcase the boat's historical and technological significance.

Lost but not forgotten

When archaeologists from Køge Museum encountered the Bronze-Age boat find from Varpelev in eastern Denmark, it created quite a buzz. Just a few days after the discovery, in June 1973, two local newspapers, *Køgeposten* and *Dagbladet Køge*, published cover stories and Danish national television visited the excavation to broadcast a feature in prime time. The Varpelev Boat also attracted attention from the archaeological community. As the first (and still the only) unequivocally dated Bronze Age boat found in Denmark, its discovery was truly a sensation (Fig. 1).

To ensure the highest standards in handling the boat, Køge Museum consulted several specialists from the National Museum of Denmark, discussing how to best salvage and conserve the find. In October 1973, everything was ready: the salvage operation transported the Varpelev Boat from the find spot to Vasebækgård, where Køge Museum had constructed a combined conservation lab and exhibition room for the find (Mathiesen 1975).

Unfortunately, something went wrong during the conservation process. The treatment of the boat was stopped before the conservation process was finalised. This resulted in the Varpelev Boat slowly decaying over a long period of time. The boat seemed lost. But in its darkest hour, Køge Museum initiated a rescue operation applying for funding to continue the conservation process. In 2005, the Danish Heritage Agency granted the resources required for such a crucial operation.

A collaboration between Køge Museum and the National Museum developed a re-conservation plan. The boat was transported from Vasebækgård to the National Museum's conservation workshop in Brede. The new plan involved the use of the National Museum's vacuum freeze-drying tank: to fit this, the very long boat had to be cut in half (Botfeldt *et al.* 2008).

The conservation was no easy task. It was especially challenging to restore the form of the hull and the surface of the boat. However, in 2016 the conservation process was complete and the boat was preserved for future generations to admire and study. Decisions then had to be made about display. Museum South-East Denmark discussed how to best store and display the unique find. After deliberation, they decided that further research and the safeguarding of the boat would be best handled by a museum specialising in maritime archaeology. Museum South-East Denmark, therefore, approached the Viking Ship Museum in Roskilde with a proposal to transfer the boat to the Viking Ship Museum's collection.

The Viking Ship Museum swiftly accepted the offer. On 23 March 2017, the Varpelev Boat was transported from the conservation workshop in Brede to the Viking

Figure 1: The Varpelev Boat at dawn, shortly before the recovery operation in autumn 1973. The photograph is taken from the aft end. Farthest away is amateur archaeologist Vagner Hansen. Standing at the front of the boat is conservator Karl Christian Mathiesen, and in the middle the archaeology student Mogens Schou Jørgensen (photo: photographer unknown, but likely the excavation director, curator, and archaeologist Helge Nielsen; © Viking Ship Museum).

Ship Hall in Roskilde (Fig. 2). Today, the Varpelev Boat rests safely in its two white boxes in the Hall. However, this is not to be its permanent resting place. The Viking Ship Museum is writing a scientific publication (Ravn *et al.* in prep.) and planning a temporary exhibition to disseminate not only the many fascinating technical aspects of the Varpelev Boat, but also the maritime world of Bronze Age Europe, anew.

A new research project launched

The forthcoming scientific publication (Ravn *et al.* in prep.) will present the methods applied and results and insights gained from the ongoing 'The Varpelev Boat – Seascape & Maritime Mobility in Bronze Age Europe' project (2024-2025), conducted as a collaboration between the Viking Ship Museum in Roskilde and

Figure 2: The first of the two white boxes containing the Varpelev Boat is carried into the Viking Ship Hall and placed next to the Viking Age ship, Skuldelev 1 (photo: Werner Karrasch, Viking Ship Museum).

the Museum organisation ROMU, with funding by the Danish Ministry of Culture and the Krogager Foundation.

Two brand-new digital interpretations of the shape of the Varpelev Boat's hull and its dimensions have already emerged ('description of the boat' below). Through a collaboration with the Gothenburg University-based 'Maritime Encounters' research project, these reconstructions are now being tested at the Wolfson Unit, Southampton University (UK) to analyse its sailing capabilities, cargo capacity, and crew size of the two different reconstructions.

The research project also includes new dendrochronological and ^{14}C analysis (conducted in collaboration with dendro.dk) to date the Varpelev Boat more accurately than was previously possible. Additionally, the project includes a detailed investigation of the boat find's context, with regards to landscape, boatbuilding technology, and cultural aspects (e.g. maritime trading networks and the political and social organisation of North European Bronze Age societies). The latter was made possible through collaboration with the 'Maritime Encounters' research project.

The following briefly presents the Varpelev Boat's history and technological features, the latter describing the results of a comparative analysis between the Varpelev Boat and other finds of Bronze Age watercraft from NW Europe, as well as reflecting on how the maritime network of that era distributed ideas – both technological and cosmological. An in-depth presentation of these aspects will be unfolded in the forthcoming publication, which will also include a detailed description of the conservation efforts, written by the conservators involved from Køge Museum and the National Museum of Denmark (Ravn *et al.* in prep.).

The Varpelev Boat

In the early 1970s, Køge Museum on eastern Zealand initiated surveys along the Tryggevælde and Stevns rivers to localise the fords, bridges, and trackways that crossed the wetlands of the river valley in antiquity (Hansen and Nielsen 1979; see Fig.3). These were found at several sites, occasionally where they showed continuous use over long periods; in several places the use duration lasted from the Roman Iron Age up to the Middle Ages, and, in some places, the oldest features were dated from the Neolithic and Bronze

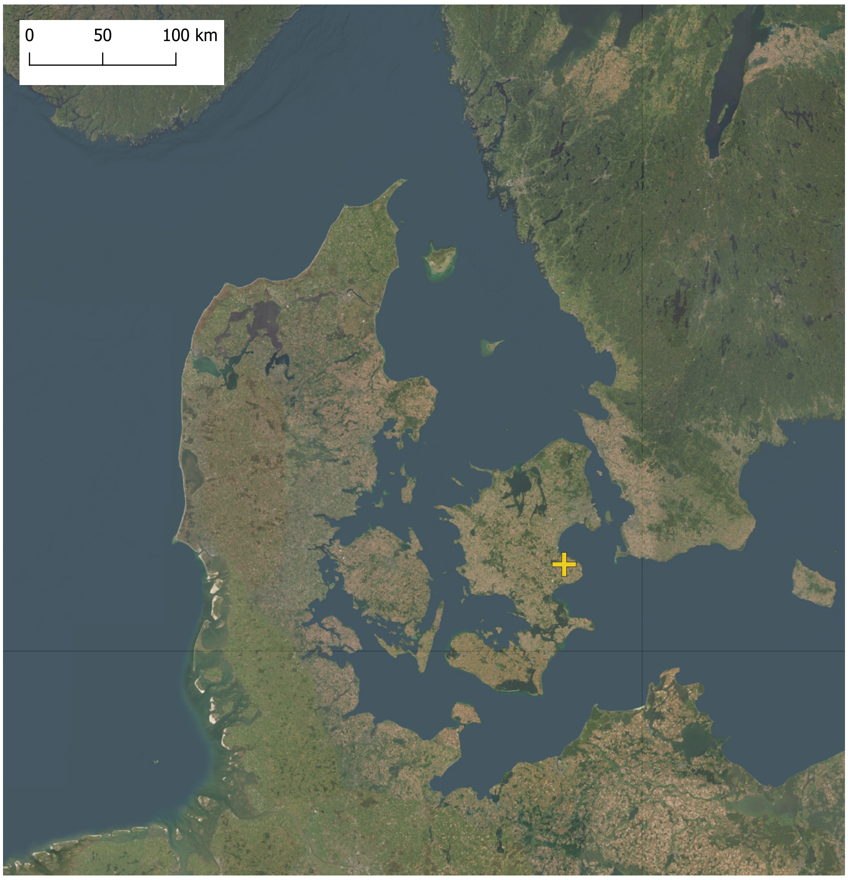


Figure 3: The find spot of the Varpelev Boat on the Stevns peninsula, eastern Denmark (map: Ole Thirup Kastholm, ROMU; background: ESRI Imagery).

Age. At Varpelev, a particularly narrow place in the Tryggevælde River Valley, a complex of fascine- and stone-paved trackways was investigated in 1972-1973; it was during this investigation that a large oak logboat was unexpectedly encountered (Nielsen 1973: 15; Hansen and Nielsen 1979: 99-108).

Discovery of the boat

In mid June 1973, a trial trench was cut alongside the western edge of the river valley to clarify the stratigraphy between the trackways. Halfway in through the trench, the excavator hit a large piece of timber lying crossways, which eventually turned out to be a logboat. The find was exposed and investigated in the following days. The excavation team was aware that the boat was probably from the Bronze Age and was, thus, a significant find. The preliminary dating was done on stratigraphic observations. This assessment was confirmed later the same year by a ^{14}C date, from a fragment from the gunwale, to 1220-788 BCE (lab. no. K-2228: BP 2780±100; 2σ cal. with OxCal/IntCal20). This rather broad dating will hopefully be narrowed down as a result of our project.

The bottom surface of the boat lay *c.* 0.44 m below the present-day sea level, embedded in a gyttja/peat layer. The boat superimposed a fascine layer marking the transition to the subsoil with marine shell gyttja. The fascine layer under the boat was not ^{14}C-dated. Nevertheless, it likely represents the remains of one or more man-made fascine layers that are contemporary with (or just slightly older than) our boat.

Description of the boat

The boat had a SSW-NNE orientation, with the fore placed to SSW (closest to the edge of the river valley) and the aft stretching towards the river. The fore, as well as a considerable part of the frontal port side, was missing. Probably the boat was worn and old already when it was left behind. The aft of the boat was better preserved. Here, the sides were left more or less at full height, and, although fragmented, the design of the aft was relatively clear, i.e. shaped as a flat 'platform' hewn out of the root end of the trunk. Other characteristics that were observed at the time of excavation, or shortly after, were – apart from the size of the boat itself – three hewn-out ridges in the inner bottom of the boat and

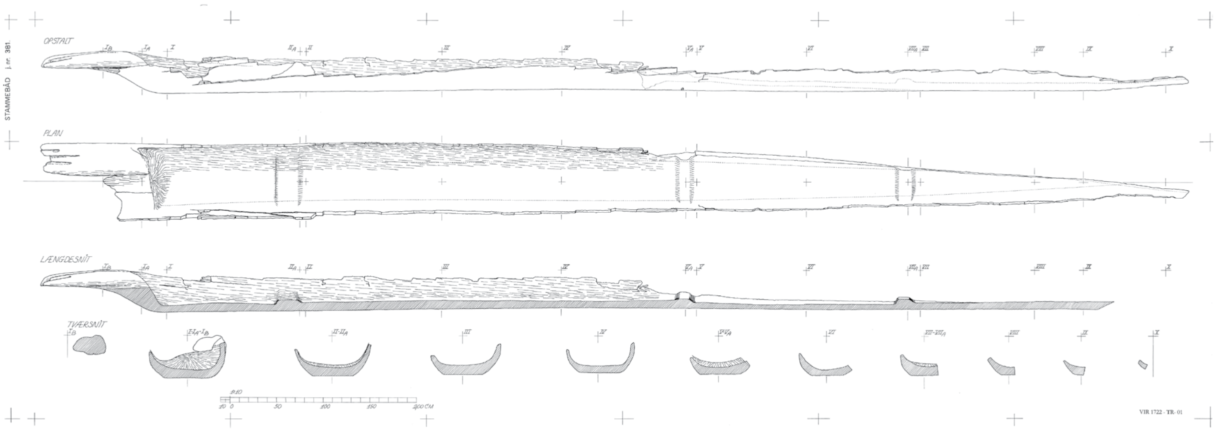


Figure 4: The Varpelev Boat measured and drawn by Morten Gøthche (drawing: M. Gøthche, Viking Ship Museum).

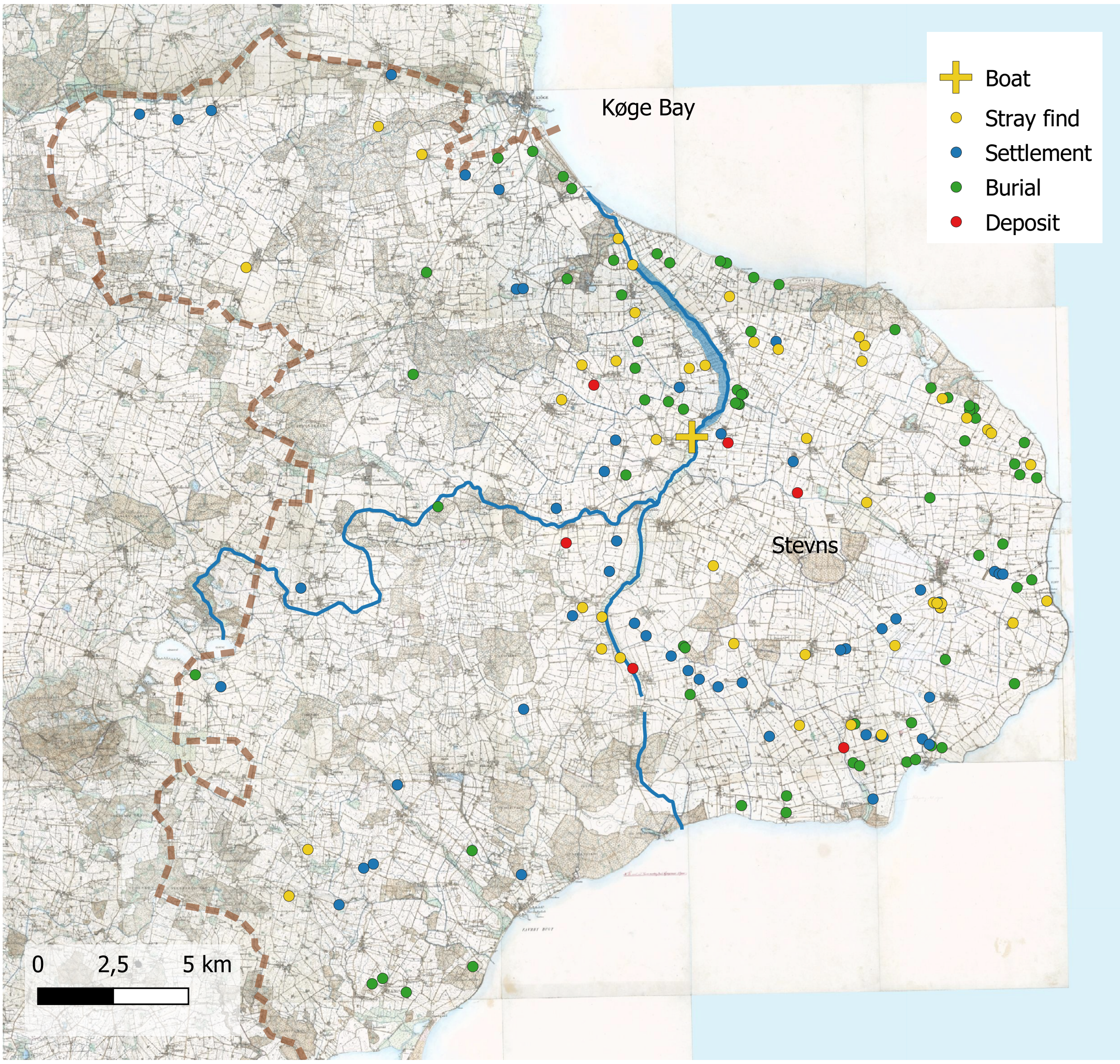


Figure 5: Bronze Age finds around the Varpelev Boat. The boat find is marked with a cross, and the rivers are highlighted in blue (map: Ole Thirup Kastholm, ROMU; background: Topographical 4-cm map, 1870-1899, SDFI).

the quality of the straight and knotless trunk (Nielsen 1973: 13; see Fig.4).

According to the excavation plan, the boat measured 12.40 m in length and had a maximal width of 0.85 m in situ. However, since a significant part of the port side fore was missing (the fore stem was also completely lacking), the original boat must clearly have been longer. The reconstruction project conducted in 2024 resulted in two different (but equally probable) reconstructions of the original boat. One reconstruction included platforms at both ends, while the other included one with a platform aft and a pointed stem with no platform to the fore. The reconstruction with platforms at both ends is estimated at *c.* 40 cm longer than the other reconstruction (that measures *c.* 13 m). Both reconstructions have aft width estimated to 94 cm, a midship width of 84 cm, and a fore width of 72 cm. The height of the reconstructed boat is *c.* 50 cm and the total weight of the hull is estimated to have been *c.* 1300 kg (Ravn *et al.* in prep.).

Landscape of the boat

The Stevns peninsula includes the aforementioned Tryggevælde and Stevns rivers and is situated in the southeastern part of the island of Zealand. The area is known for rich finds in later prehistoric periods. Notable among these are the Late Iron Age residence of Strøby-Toftegård (Tornbjerg 1998; Baastrup 2012) and the Roman Iron Age centre of Himlingøje (Lund Hansen 1987; 1995), both characterised by elite networks with distant regions. One of the major reasons for this is most certainly due to the geographical position of Stevns, especially when seen from a maritime perspective. Stevns is centrally placed and protrudes into the sea, providing access to the strait of Øresund to the north, the Swedish coast to the east, the Baltic to the south-east, as well as the archipelago south of Zealand. This, together with easily accessible and fertile land, formed the prerequisites for many human activities in the Iron Age.

Bronze Age finds around the boat

These above characteristics also applied in the Bronze Age. Stevns peninsula holds a concentration of Bronze Age finds, even though archaeological fieldwork has been limited because of the region's rural character. Due to the latter, many finds are old registrations of burial mounds, as well as bronze deposits and stray finds. However, in the recent years, Bronze Age settlements have also appeared (Fig. 5). For Late Nordic Bronze Age (NBA) IV-V, Stevns has produced a moderate cluster of metal objects (see Jensen 1997: fig. 104). In particular, the landscape surrounding the lower course of the Tryggevælde River, i.e. from the boat site and to the river mouth, has yielded a cluster of Bronze Age finds from several Early Bronze Age burial mounds with secondary Late NBA cremations, as well as handful of deposit finds (see also Kastholm 2016: 65-67, fig. 5). A find of particular interest is a Late Bronze Age soapstone casting mould, probably imported from Norway (Kastholm 2016: Cat. B, no. 18).

A maritime transit point

From Køge Bay to Varpelev the river valley is almost flat (*c.* 0.5 m a.s.l.). Excepting a narrowing near the mouth, the valley is characterised by its width (up to *c.* 500 m). At Varpelev, it narrows significantly, and a little further upstream the valley bottom begins to rise. At the boat's time of use (*c.* 1000 BCE), the general sea level around Stevns is estimated to have been 0.6 m - 0.7 m higher than the present level. Considering the stratigraphy of the boat find, a cautious assessment would give the area a water depth of *c.* 1 m in the valley from Varpelev through to open sea. Even though these estimates are associated with some uncertainty, it seems fairly certain that the area from around Varpelev to the sea represented not just a narrow, meandering watercourse, but instead was more similar to a narrow, brackish fjord. This would have provided waters that would have been easy to navigate for a flat-bottomed watercraft, such as the Varpelev Boat. Nevertheless, these wider waters would have ended just south of Varpelev, making further navigation a challenge due to the narrowing and rising of the onward watercourse (Ravn *et al.* in prep.).

This narrowing of the waterway, and its changes in navigability, form the preconditions for a maritime transit point (see Westerdahl 1989: 198 ff; 1992: 5 ff), which is further supported by the existence of fords and the cluster of Bronze Age finds at Varpelev, consisting, inter alia, of numerous Early Bronze Age barrows with secondary Late NBA cremations, as well as two settlements and a deposit from the Late NBA (see Kastholm 2016: Catalogue B, nos. 6-17; to be further developed in Ravn *et al.* in prep.). The boat's find spot was most likely a place in the landscape where a maritime transport route to and from the sea met regional land routes, and where the Varpelev Boat served as a cargo and crew carrier (Kastholm 2016: 66-68).

Interrelated watercrafts – NW European boat-types scrutinised

As stated in earlier research (Kastholm 2015; 2016), a considerable number of West European Bronze Age and Early Iron Age logboats exhibit a pronounced uniformity when compared to logboats from both earlier and later periods. This homogeneity seemed to emerge around the beginning of the 2nd millennium BCE and coincided with the earliest known plank-built watercrafts in North-West Europe. The latter are predominantly found in Britain and Ireland. However, re-evaluation of a number of old Scandinavian finds indicates that plank-built boats in the same tradition also existed in this region (e.g. Wehlin 2013; Wickler 2019). It has been proposed that: 'This synchronic appearance of homogeneous logboats and plank-built watercrafts is probably not a coincidence; instead, it points towards the existence of a complex bond between the plank-built boat and the logboat. Furthermore, the distribution of these logboats suggests that plank-built boats of Bronze Age Scandinavia were part of an interregional Western European tradition' (Kastholm 2015: 1353; see further Kastholm 2008; 2014; 2015; 2016).

This homogeneity, though, is not unambiguous. Differences can be seen between boats from the Scandinavian Peninsula and the Continent/British Isles, mainly in terms of the design of the boats at the ends, with the former often having massive bows, sometimes with platforms, while the latter have been constructed with loose transom boards and inner transverse ridges. The Varpelev Boat comprises elements from both regions. The following provides a short review of the finds from the two regions.

Scandinavian logboats

Although Denmark may indeed be rich in terms of Mesolithic and Neolithic logboat finds, only one other boat find can be linked to the Bronze Age besides the Varpelev Boat: the Vestersø Boat. However, since the Vestersø Boat is ^{14}C-dated to the period 772-376 BCE, it lies within the Bronze/Iron Age transition, making the Varpelev Boat the only Danish boat find unequivocally dated to the Bronze Age.

In 1953, when Lake Vestersø in northern Jutland was drained, a logboat appeared where the lake's Bronze Age shore presumably had been. It was surrounded by stepping stones and it looks like it was left at its landing place. The boat was carved out of an oak trunk and had been preserved for its full length (*c.* 6.2 m). The Vestersø Boat is 48 cm - 65 cm wide. The outer sides of the trunk were hewn so that the bottom is flat and the sides are vertical. The aft is designed with a groove for a loose transom board, which, however, has not been found. The interior of the boat is characterised by three transverse ridges, carved out of the log itself, *c.* 8 cm -10 cm wide and 2 cm - 4 cm high. The latter are only visible at the bottom, not up the sides. The ridges divide the boat into four compartments of roughly uniform size.[1]

If we turn to the rest of Scandinavia, the boat-finds from before 1 CE are few, and they are mainly logboats (Kastholm 2014). In addition, it should be briefly remarked that there is a unique find of a watercraft built from bark from Byslätt in Sweden, dated to 940-810 BCE (Lindberg 2012), as well as a few newly recognised Norwegian plank-built boat fragments from the end of the Bronze Age and the Early Iron Age (Sylvester 2009; Wickler 2019).

From the time before 1 CE, a total of seven logboats are known. These include the boats from Strö (1130-930 BCE), Skäggered (810-400 BCE), Fiskeby (770-400 BCE), Martebo Myr (730-390 BCE), Låssby (520 BCE - 10 CE), and Kvillehed (400-60 BCE) from Sweden; from Norway we have the boat from Sørum (360 BCE - 5 CE) in Norway.[2] These finds are spread out geographically as well as in terms of age. Although the material is quite diverse, there are some shared features.

Topographically, the watercrafts always appear in a fossil marine context. They are linked to old fjords, bays and straits, which in the time of the watercrafts themselves had access to the sea. This does not imply that these were ocean-going watercrafts, but it nevertheless feeds a presumption that they were able to engage in coastal navigation.

From a technological point of view, the most important common feature of these Scandinavian logboats is the platform, which occurs on all six of the finds where the ends are preserved. On the boats from Låssby and Skäggered, platforms can be seen at both ends; otherwise, it is usually just at the aft. The platform is a feature that links to the Varpelev Boat, but which apparently does not otherwise occur outside the Scandinavian area in this period, with the north German Lathen Boat as the single exception to date (Hirte 1987; Kastholm 2016: Cat. A: no. 19). The aft ends are massive, with a single exception in the boat from Kvillehed, which is constructed with a loose transom board in combination with a platform. The watercrafts are often hewn into shape on the outside. All have a flat bottom, with the exception of the Strö Boat, which follows the roundness of the trunk.

The Scandinavian source material thus has distinctive features, as well as shared ones, when compared to the Danish logboats. A striking difference is the absence of the transverse ridges. A shared feature with the Varpelev Boat is the massive aft stem and platform. A linked feature with the European Bronze Age logboats in general is the processing of the outside of the hull, which is particularly expressed through the flat hewn bottom.

[1] For a detailed presentation of the Vestersø Boat, see Kastholm 2016: 68-75.

[2] For a detailed review of the finds and further references, see Kastholm 2014.

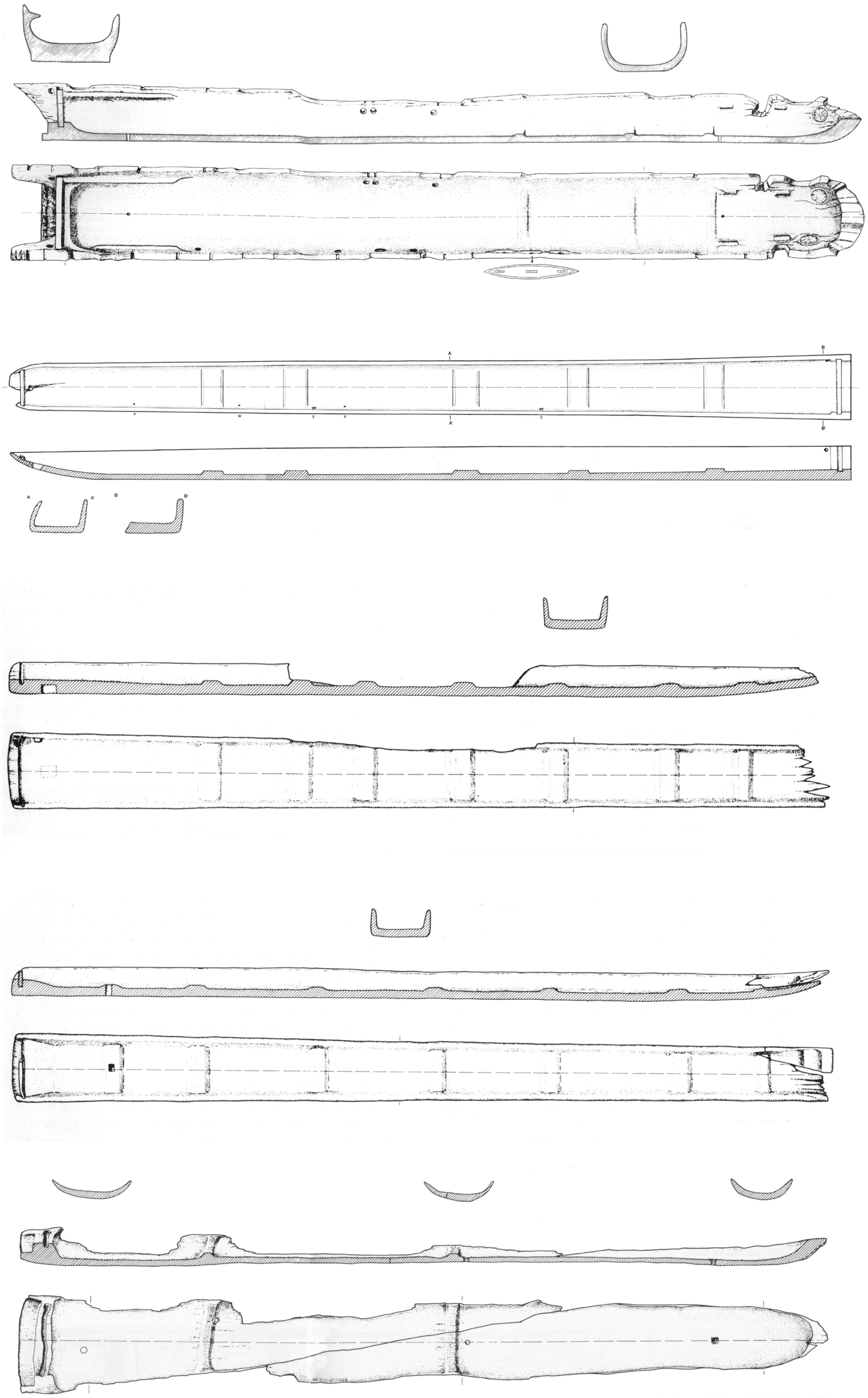


Figure 6: A selection of logboats with transverse ridges from Britain. From the top: Brigg 1, Peterborough, Clifton 1, Clifton 2, and Poole (not to the same scale; after McGrail 1978).

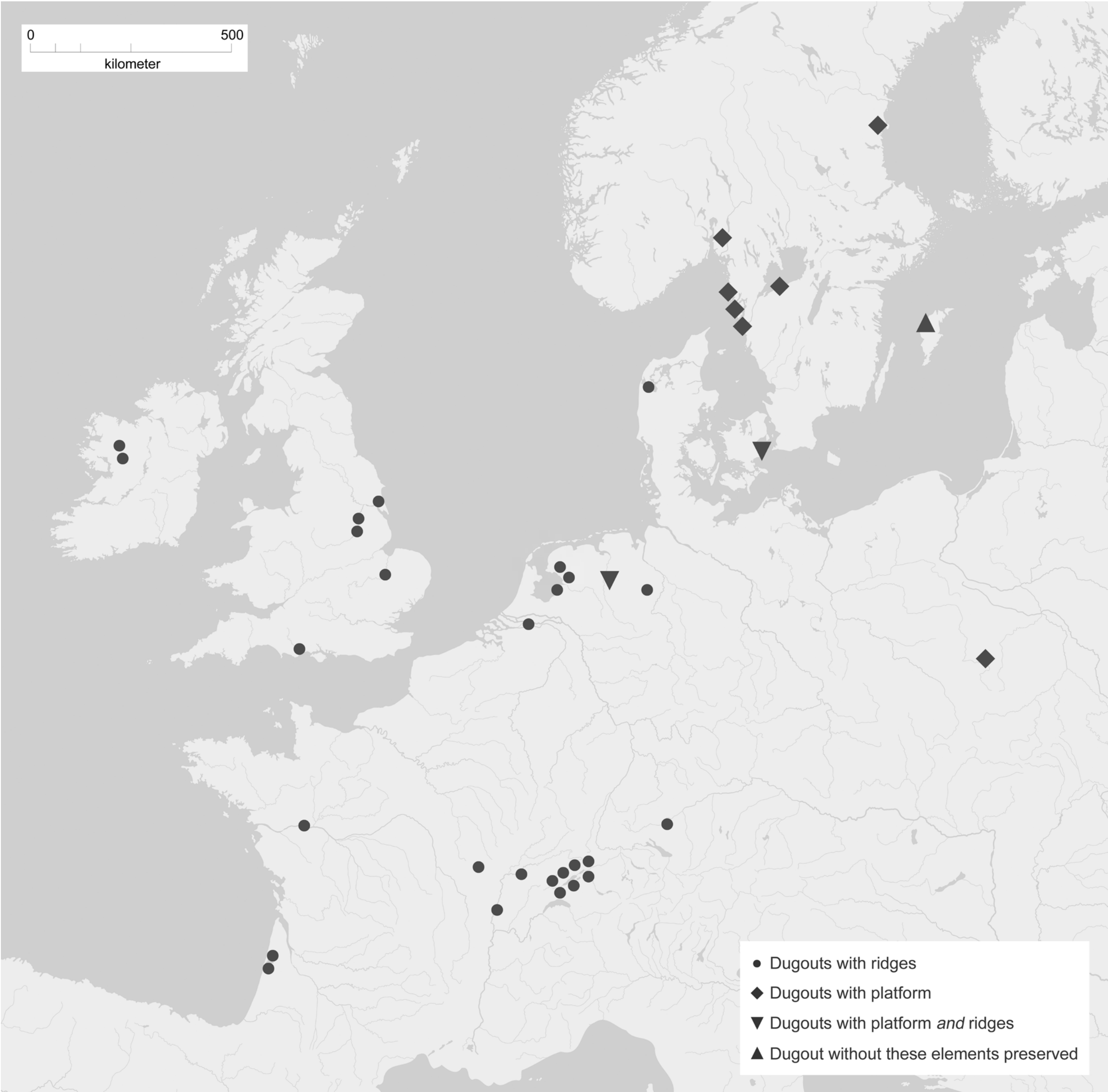


Figure 7: The distribution of Late Neolithic and Bronze Age logboats with platforms and/or ridges (after Kastholm 2015).

European logboats

Over 100 logboats have been dated from the Middle Neolithic to 1 BCE by ^{14}C-dating or dendrochronology within the Western European mainland, Britain, Ireland, and Scandinavia, with the majority coming from Switzerland, France, Britain, and Ireland; they occur in more limited numbers in the Netherlands, Germany, Poland, and Scandinavia.[3]

From Switzerland and France, as well as the British Isles, more than 20 logboat finds[4] have features in common with the Varpelev Boat, and, thus, have a direct impact on our interpretation of the Varpelev vessel (Fig. 6).

Often they are unusually long, many being over 10 m (the largest *c.* 15 m). They are sturdily built, with thick bottoms, and were often equipped with hewn-out transverse ridges, and hewn into shape on the outside as well as inside, so that they have a more or less rectangular cross-section, replacing the round trunk-shaped cross-section common in the Mesolithic

[3] For a detailed review and further references, see Kastholm 2016.

[4] For details of these, see Kastholm 2015; 2016: 80-92, Catalogue A.

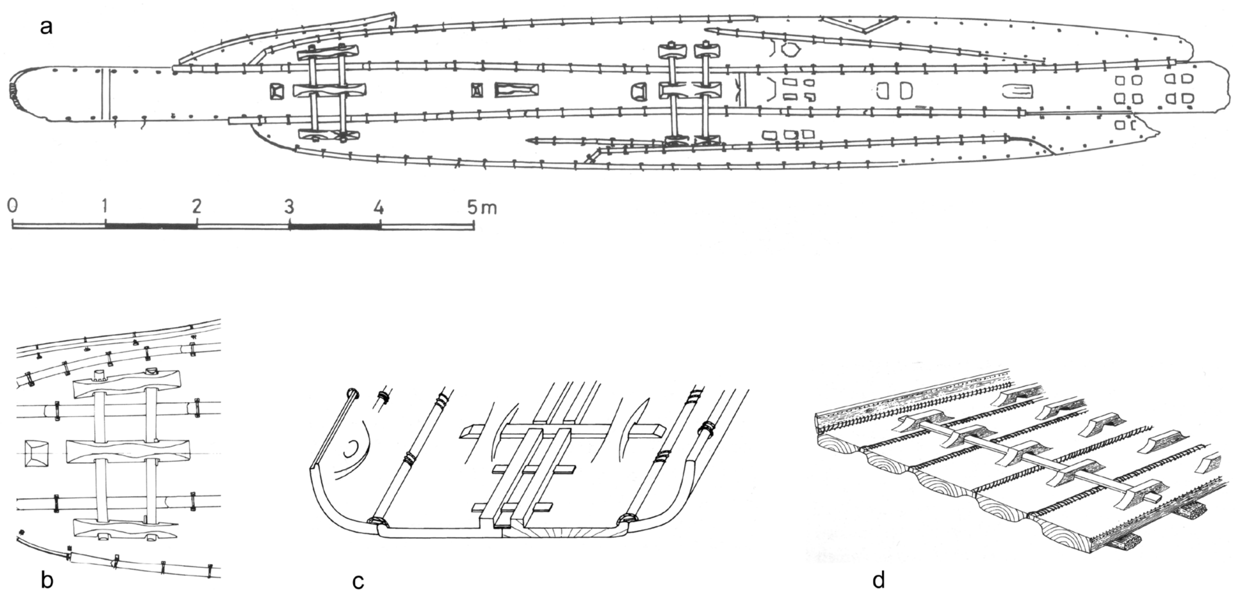


Figure 8: Bottom constructions in plank-built vessels from the second and early 1st millennia BCE: a) plan of Ferriby Boat 1; b) detail in bottom of Ferriby Boat 1 (after Wright 1990); c) schematic cross section of the Dover Boat; d) detailed reconstruction of Brigg 2 (after McGrail 2001).

and Neolithic (see Christensen 1999: 49). As there is extensive source material, just a few examples are mentioned here.

The boat from Grandson-Corcelettes on Lake Neuchâtel in Switzerland is just over 11 m long, hewn on the outside with vertical sides and a flat bottom. The inside is characterised by five hewn-out ridges; the fore stem is pointed, while the aft stem is constructed with a loose transom board. The two identical logboats from Clifton on the River Trent are good examples of British logboats from this period. Their length is just over 9 m, the hulls are hewn on the outside with vertical sides and a flat bottom, and each show seven hewn-out ridges inside. The fore stems are cut straight and the aft stems have loose transom boards. The Swiss find is dated to 1530-1170 BCE, while the two British ones are somewhat younger (410-50 BCE). Interestingly, on the British Isles, these characteristics go back to the Late Neolithic, as can be seen on the Irish Lurgan Boat (Arnold 1995; McGrail 1978; Robinson *et al.* 1999; Kastholm 2016: Cat. A: no. 4, 10, 25, 27).

Two special features: ridges and the hewn outer surface

The most striking shared denominators for these watercrafts – and what links them to the Varpelev Boat – are the transverse ridges and the box-like cross section. The ridges vary in shape as well as in their distribution in the boats. Frequently, though, they are evenly distributed along the length of the boat. They are hewn out of the bottom and do not generally continue up the sides. If they do it is just for a few centimetres (Kastholm 2015: 1366). Thus, they should not be confused with the essentially different frame-like structures and bulkheads seen in numerous logboats from later periods; such ridges hardly had any structural purpose with regard to the stiffening of the hull (Kastholm 2015, with reference to Paret 1930: 114).

Had these ridges a secondary practical purpose or not? A variety of purposes have been proposed, i.e. foot supports for paddlers, a base for floor timbers, or to keep cargo secure (e.g. McGrail 1987: 76; 2001: 174-75; Berntsson 2005: 58-60). Considering the vast distribution area of these logboats, and the variations in maritime topography, it seems more plausible to seek an explanation other than pure functionality. It has been suggested by Kastholm (2015) that the transverse ridges are to be seen as skeuomorphs originating from the contemporary plank-built boats, predominantly known from Britain and Ireland. Thus, the ridges may reflect a widespread cultural influence (Kastholm 2015: 1366-1367; see Fig. 7).

The idea that the ridges are skeuomorphs has been briefly proposed by others (Robinson *et al.* 1999; McGrail 2001: 174-175; Berntsson 2005: 58-60), without the implications being fully developed. The precise model for such skeuomorphs is probably the transverse timbers of these composite watercrafts, as seen on the North Ferriby boats (2030-1680 BCE) and the boats from Dover (1575-1520 BCE) and Brigg (810-775 BCE) (Kastholm 2015: 1367; see Fig. 8).

Another feature, pointed out by Kastholm (2015), which occurs on the logboats from around 2000 BCE and onwards, is the shaped outer surface. The bottom and the sides are hewn flat contrasting with earlier boats. This new hull shape gives a functional advantage, as the watercraft gains more stability, but the fact that the introduction of this element seems to coincide with the oldest plank-built watercrafts again calls for an explanation that is not purely functional related. Echoing the case of the transverse ridges, a skeuomorph from the plank-boats probably is a reasonable interpretation. This is evident in the Dover plank-built boat, which, besides having box-like cross section, gives the impression of being a monoxylous logboat, split in two and widened across the bottom and at the sides with extra planks (see Crumlin-Pedersen 2010: 60; Kastholm 2015: 1367; see Fig. 8c).

An image of the plank-built boat

As earlier stated (Kastholm 2015), the cross-beam timbers and the box-like cross section are fundamental characteristics of the plank-built boat. Plank technology made it possible to construct wider, sturdier watercrafts than logboats, and the tree trunk's physical limitation was now to be exceeded – a decisive moment in maritime technology. This plank-technology occurs in the archaeological record *c.* 2000 BCE and continues throughout the Bronze Age, and probably already had forerunners by the end of the 3rd millennium BCE. Subsequently, some of this technology's most characteristic elements were imitated in contemporary logboats.

A matter of concern, therefore, is why the distribution of Bronze Age plank-built watercraft is apparently restricted to Britain, and here the most plausible explanation is to do with preservation: i.e. linked to the exceptional conditions in the tidal zones of river estuaries, where sediments deposited by the rivers and tidal waters generate unique conditions for organic preservation. This is well illustrated in the Humber Estuary (also an important maritime transit point), from which parts of no less than six plank-built watercrafts (see McGrail 2001: 184; Van de Noort 2004), as well as a number of logboats, are known. It seems fair to presume that the plank-built watercraft was not necessarily an exclusively 'British' type (Kastholm 2008; 2015: 1367-1368), a presumption that is supported by constructional features common between plank-built British watercraft and Scandinavian finds from the Bronze and Early Iron Ages, not least the hewn-out cleats on the ship planks (Kastholm, ongoing research project; see also Eskeröd 1956). An interesting connection between the British Isles and Southern Scandinavia already in the Late Neolithic is the existence of three crescent shaped 'lunuale' on Funen and Zealand (see Vandkilde 1996: 182-184; 2007: 93-94).

A network of watercraft

The skeuomorphic nature of these characteristic features – the transverse inner ridges and the hewn shape of the sides and bottom, providing a rectangular cross section – that we see on a considerable number of Bronze Age logboats, among these being the Danish Varpelev find, indicates that they were a part of a larger maritime network. The waters of this network might well be characterised as a 'maritory', an area of sea that is 'a high-flux sphere of maritime interaction', and which is based on 'a set of shared and reciprocal interests' (Needham 2009: 18-19).

This network distributed not only goods, but also ideas. In terms of goods, the exchange of metals from different European regions, as well as amber from the Scandinavian area, fuelled long-distance networks (Vandkilde *et al.* 2024). We see evidence for the exchange of ideas through a remarkably similar cosmological understanding and a strikingly uniform use of religious, ideological, and political symbols from Scandinavia to the Near East (Kaul 1998: 273-289).

The Bronze Age, perhaps, was the first prehistoric period during which a somewhat common 'European' identity was established. When we think of European identity today, when we acknowledge that Europeans share a connected history, it is, of course, a dynamic narrative with countless complex and intertwined components. But one of the most important aspects in a connected early European history was, without doubt, the extensive maritime-based transportation of goods, people, and ideas during the Bronze Age. In this network, Scandinavian mariners, merchants, and explorers played a large role. Thus, the network shaped the boats themselves. The factor that linked these logboats was, most probably, the plank-built boat, suitable for crossing the open sea. Such plank-boats must have been built in roughly the same way as the watercraft whose preserved remains have, hitherto, been known only from Britain.

Through these uniform logboats, including the Varpelev find, we catch a glimpse of an extensive distribution system covering at least the northern part of Atlantic Europe in the Bronze Age. It was characterised by plank-boats which made overseas journeys, probably from one maritime transit point to another (be they situated on the coast, fjords, river estuaries). Farther inland, distribution following the rivers and lakes was undertaken by logboats with widely shared characteristics, i.e. their great length, naturally implying considerable cargo capacity.

Bibliography

Arnold, B. 1995. *Pirogues monoxyles d'Europe centrale. Construction, typologie, evolution, Tome 1*. Archéologie neuchâteloise 20. Neuchâtel: Éditions Alphil.

Baastrup, M.P. 2012. Kommunikation, kulturmøde og kulturel identitet – tingenes rejse i Skandinaviens vikingetid. Unpublished PhD dissertation, Det Humanistiske Fakultet, København, Københavns Universitet.

Berntsson, A. 2005. *Två män i en båt – om människans relation til havet i bronsåldern*, Report series, University of Lund, Institute of Archaeology, Vol. 93. Lund: University of Lund.

Botfeldt, K.B., J.B. Jensen, L.R. Jensen, K. Strætkvern and J.L. Lanschot, 2008. Restoring a dried-up Bronze Age dugout: plan and practice, in J. Bridgeland (ed.) *15th ICOM-CC Triennial Conference in New Delhi*: 1067-1081. New Delhi: Allied Publishers.

Christensen, C. 1999. Mesolithic boats from around the Great Belt, Denmark, in B. Coles, J.M. Coles and M.S. Jørgensen (eds) *Bog bodies, sacred sites and wetland archaeology*: 47-50. WARP Occasional Paper 12. Exeter: WARP Wetland Archaeology Research Project.

Crumlin-Pedersen, O. 2010. *Archaeology and the Sea in Scandinavia and Britain*. Maritime Culture of the North, Vol. 3. Roskilde: The Viking Ship Museum.

Eskeröd, A. 1956. Early Nordic-Arctic Boats. A Survey and some Problems, in A. Furumark (ed.) *Arctica. Essays presented to Åke Cambell 1.5.1956*: 57-87. Uppsala: Almqvist & Wiksell.

Hansen, V. and H. Nielsen 1979. Oldtidens veje og vadesteder, belyst ved nye undersøgelser ved Stevns. *Aarbøger for Nordisk Oldkyndighed og Historie* 1977: 72-117.

Hirte, C. 1987. Zur Archäologie monoxyler Wasserfahrzeuge im nördlichen Mitteleuropa: eine Studie zur Repräsentativität der Quellen in chorologischer, chronologischer und Konzeptionelle Hinsicht, Bind 1-6. Unpublished PhD dissertation, Christian-Albrechts-Universität zu Kiel.

Jensen, J. 1997. *Fra Bronze- til Jernalder. En kronologisk undersøgelse*. Nordiske Fortidsminder, Serie B, Bind 15. København: Det Kgl. Nordiske Oldskriftselskab.

Kastholm, O.T. 2008. Skibsteknologi i bronzealder og jernalder. Nogle overvejelser om kontinuitet eller diskontinuitet. *Fornvännen* 103: 165-175.

Kastholm, O.T. 2014. Stammebåde på den skandinaviske halvø før år 1. *Fornvännen* 109: 153-166.

Kastholm, O.T. 2015. Plankboat skeuomorphs in Bronze Age logboats. A Scandinavian perspective. *Antiquity* 89(348): 1353-1372 (available at: https://doi.org/10.15184/aqy.2015.112).

Kastholm, O.T. 2016. Bronzealderbådene fra Varpelev og Vestersø i et europæisk perspektiv. *Aarbøger for nordisk Oldkyndighed og Historie* 2015: 59-115.

Kaul, F. 1998. *Ships on Bronzes. A Study in Bronze Age Religion and Iconography*. Publications from the National Museum. Studies in Archaeology & History, Vol. 3:1. Copenhagen: The National Museum.

Lindberg, M. 2012. The Byslätt Bronze Age Boat – A Swedish Bark Canoe, Unpublished Master's Thesis, Maritime Archaeology Programme, Esbjerg, University of Southern Denmark.

Lund Hansen, U. 1987. *Römischer Import im Norden. Warenaustausch zwischen dem Römischen Reich und dem freien Germanien*. København: Det Kgl. Nordiske Oldskriftselskab.

Lund Hansen, U. 1995. *Himlingøje – Seeland – Europa: Ein Gräberfeld der jüngeren römischen Kaiserzeit auf Seeland, seine bedeutung und internationale Beziehungen*. København: Det Kgl. Nordiske Oldskriftselskab.

Mathiesen, K. 1975. Beretning fra konserveringsværkstedet. *Køge Museum* 1973-1975: 73-75.

Mcgrail, S. 1978. *Logboats of England and Wales with comparative material from European and other countries*. British Archaeological Reports British Series 51, National Maritime Museum, Greenwich, Archaeological series, 2. Oxford: British Archaeological Reports.

Mcgrail, S. 1987. *Ancient boats in NW Europe. The archaeology of water transport to AD 1500*. London: Longman.

Mcgrail, S. 2001. *Boats of the World. From the Stone Age to Medieval Times*. Oxford: Oxford University Press.

Needham, S. 2009. Encompassing the Sea: 'Maritories' and Bronze Age maritime interactions, in P. Clark (ed.) *Bronze Age Connections. Cultural Contact in Prehistoric Europe*: 12-37 Oxford: Oxbow Books.

Nielsen, H. 1973. Båden ved vejene. *Skalk* 6: 12-15.

Paret, O. 1930. Die Einbäume im Federseeried und im übrigen Europa. *Praehistorische Zeitschrift* 21: 76-116.

Ravn, M., O.T. Kastholm, A.C. Sørensen and A. Trakadas (eds) (in preparation). *The Varpelev Boat. Seascape & Maritime Mobility in Bronze Age Europe*. Ships and Boats of the North, 10. Roskilde: Viking Ship Museum.

Robinson, M.E., D.W. Shimwell and G. Cribbin 1999. Re-assessing the logboat from Lurgan Townland, Co. Galway, Ireland. *Antiquity* 73: 903-908 (available at: http://dx.doi.org/10.1017/S0003598×00065662).

Sylvester, M. 2009. The Haugvik Boat – A Pre-Roman Iron Age boat find from northern Norway, in R. Bockius (ed.) *Between the Seas – Transfer and Exchange in Nautical Technology*: 53-59. Proceedings of the 11th International Symposium on Boat and Ship Archaeology, September 2006, Mainz, Germany. RGZM-Tagungen, Vol. 3. Mainz: Römisch-Germanisches Zentralmuseum.

Tornbjerg, S.Å. 1998. Toftegård – en fundrig gård fra sen jernalder og vikingetid, in L. Larsson and

B. Hårdh (eds) *Centrala platser – centrala frågor. Samhällsstrukturen under järnåldern*: 217-232. Uppåkrastudier 1. Acta Archaeologica Lundensia, Series in 8^{0}, No. 28. Stockholm: Almqvist & Wiksell International.

Van De Noort, R. 2004. The Humber, its sewn-plank boats, their contexts and the significance of it all, in P. Clark (ed.) *The Dover Bronze Age Boat in Context: Society and Water Transport in Prehistoric Europe*: 90-98. Oxford: Oxbow Books.

Vandkilde, H. 1996. *From Stone to Bronze. The Metalwork of the Late Neolithic and Earliest Bronze Age in Denmark*. Aarhus: Jutland Archaeological Society.

Vandkilde, H. 2007. A Review of the Early Late Neolithic Period in Denmark: Practice, Identity and Connectivity. *Offa* 61/62, 2004/05: 75-109.

Vandkilde, H., C. Fischer Stephansen, P. Suchowska-Ducke, L. Ahlqvist, C. Skaaning Andersen, L. Felding, M. Bjørnevad-Ahlqvist, J. Czebreszuk and H. Nørgaard 2024. Metal-for-Amber in the European Bronze Age. *Praehistorische Zeitschrift* 99(1): 280-338 (available at: https://doi.org/10.1515/pz-2024-2003).

Wehlin, J. 2013. Östersjöns *skeppssätningar. Monument och mötesplatser under yngre bronsålder*. Gothenburg Archaeological Theses 59. Göteborg: Göteborgs Universitet.

Westerdahl, C. 1989. *Norrlandsleden 1 – källor till det maritima kulturlandskabet*. Arkiv for norrländsk hembygdsforskning XXIV, 1988-1989. Härnosand: Länsmuseet – Murberget.

Westerdahl, C. 1992. The maritime cultural landscape. *International Journal of Nautical Archaeology* 21(1): 5-14 (available at: https://doi.org/10.1111/j.1095-9270.1992.tb00336.x).

Wickler, S. 2019. Early Boats in Scandinavia: New Evidence from Early Iron Age Bog Finds in Arctic Norway. *Journal of Maritime Archaeology* 14: 183-204 (available at: https://doi.org/10.1007/s11457-019-09232-1).

Wright, E.V. 1990. *The Ferriby Boats. Seacraft of the Bronze Age*. London: Routledge.

Chapter 12

Narrating mobility and marital practices in the Early Bronze Age

Philipp W. Stockhammer

Institut für Vor- und Frühgeschichtliche Archäologie und Provinzialrömische Archäologie, Ludwig-Maximilians-Universität, München, Germany

Max-Planck-Institut für evolutionäre Anthropologie, Leipzig, Germany

Department of Heritage Studies, School of Culture and Society, Aarhus University, Denmark

philipp.stockhammer@lmu.de

Abstract

Archaeological and bioarchaeological studies have revolutionised our knowledge of the European Bronze Age and have enabled us to go far beyond the antiquarian approaches which dominated central European archaeology especially up to the 2000s. Now, we can trace mobility, biological relatedness and the exchange of goods and ideas in fascinating new ways. However, this also raises the question of whether these new scientific insights may also force us to rethink the way we narrate the past. Before the advent of the latest approaches in bioarchaeology, Postmodern Archaeology had long raised this question. However, the new scientific data was not perceived as a chance but rather as a threat by many scholars. In my contribution, I want to bridge postmodern approaches, e.g. the archaeology of the senses and reflections on how to narrate the past, with the latest scientific datasets – in particular our present-day knowledge about the enormous scale of especially female mobility during the central European Early Bronze Age and the role of transregional marital practices in this context.

Introduction

With her notion of 'Bronzization', Helle Vandkilde has encouraged us to rethink the scale of human mobility during the Bronze Age from a Eurasian perspective (Vandkilde 2016). At the same time, she inspired more integrative and transregional thinking about the Eurasian Bronze Age. Inspired by Helle Vandkilde,[1] my study will, therefore, focus on two main topics which are of keen interest not only to myself but also to a wide range of Bronze Age scholars, as I assume: mobility and transregional interaction during the late 3rd and early 2nd millennium BCE in Europe (the Early Bronze Age in central European terminology) and the question of how to narrate the (pre-)history of that time beyond the increasingly rich archaeological sources with which we work.

The last 20 years have revolutionised our knowledge of the past. The 'Third Science Revolution' – following Kristian Kristiansen's (2014) now widely accepted terminology – has presented multiple challenges to archaeological thinking and interpretation in terms of what evidence is and how it can (or must not) be interpreted, which terms are adequate, and how a constructive interdisciplinary dialogue and vocabulary can be found. Countless contributions by scholars and ongoing constructive debates have resulted in an increasing number of publications which meet the expectations and scientific requirements of both archaeologists and natural scientists and have also led to the emergence of a new generation of scholars who have grown up between disciplines and would not even want to be attributed to one group or the other.

So far, only a small number of studies have started asking if the new insights into the human – and especially individuals' – pasts should also lead to a new way of narrating the past. How can we do justice to the (pre-)history of persons whose individual and sometimes very touching biographies are suddenly appearing in the newly generated datasets? Do we do justice to these individuals by reducing our narration to numbers or should we rather develop new ways of narration in accordance with our new insights? Together with colleagues, I raised the question of whether creating artificial names for past individuals, in addition to the usual number-based denomination systems, could be an option for narrative purposes (Hofmann *et al.* 2023). We advocate taxonomic practices that can be perceived of as dehumanising and stress otherness and difference. At the same time, suggest the use of creative nomenclator practices which emphasise the human individuals behind the bones and datasets. Yet this runs the risk of losing the mental distance necessary to interpret the past scientifically,

[1] Helle Vandkilde has always been an endless source of inspiration for my own research and has forced me to rethink the way I write about the past. This contribution would not be possible without her, and particularly my days spent in her company at the beautiful Moesgaard Mansion.

even possibly approaching disrespectfulness. We were unable to find a general solution for this challenge but aimed to instigate it in further discussions.

In the same line of thinking, I have argued that neither our previous, and usually species-focused approach to past food practices, nor the emerging new bioarchaeological insights which unravel individual dietary habits in unexpected ways correlate with most recent approaches to food in anthropological studies (Stockhammer 2016). Scholars from the field of Food Studies analyse food as a sensory experience, with eating as an evocation of memories, of landscapes and connectedness, reflecting on the notions of the 'chef', 'authenticity', and transculturality that are inherent in food and foodways (Abbots 2016; Abbots and Lavis 2013; Klein and Watson 2016; Mintz 1996; West 2013; Wilk 2012). Based on anthropological thinking, archaeologists have argued for an archaeology of the senses (Day 2013; Hamilakis 2000; Hamilakis 2015; Kuijpers 2013; Papadopoulos and Moyes 2022). But the application of the respective theories to the archaeological record has been challenging in many cases. There is a thin line between interpretation and speculation, just as there is a dynamic continuum between probabilities and possibilities. Which degrees of possibilities are we still willing to think with – without drowning within hyper-constructivist and all-is-possible approaches that run the risk of stripping archaeology of its claim as a scientific discipline? Nevertheless, we agree that we must not deprive archaeological narratives of the aspect of the senses and we need to think about how we introduce this into our scientific writing.

In the following, I want to exemplify my previous reflections by narrating a particular detail of the past in order to test how far we can or should get on the increasingly thin ice of interpretation. I will focus on a period and region from which a large number of bioarchaeological studies, as well as innovative archaeological approaches – not least also from Helle Vandkilde – have managed to revolutionise our understanding: the Early Bronze Age in central Europe (*c.* 2200-1700/1500 BCE). I will first summarise the archaeological and bioarchaeological evidence relevant for my subsequent thoughts. Secondly, I will argue how my own thinking about narrating Early Bronze Age prehistory has developed over the last years so as to make visible the situatedness of my own thinking. Finally, I will focus on two particular topics, namely travel and marital practices. I will integrate (bio)archaeological sources and insights from anthropological and historical studies which have the potential to inspire narration beyond mostly empirical approaches on the one hand and purely speculative approaches on the other.

Archaeological Background

Within our collaborative project 'Zeiten des Umbruchs? Gesellschaftlicher und naturräumlicher Wandel am Beginn der Bronzezeit' ('Times of Upheaval: Changes of Society and Landscape at the Beginning of the Bronze Age'), funded by the Heidelberg Academy of Sciences from 2013 to 2018, we analysed a large number of Final Neolithic, Early Bronze Age and early Middle Bronze Age burials in the Lech Valley south of the present-day city of Augsburg in southern Germany. Here, single farmsteads were continuously built along a fertile loess terrace between 2500 and 1500 BCE, and each of the farmsteads was accompanied by a small or medium-sized cemetery where their respective inhabitants were buried. The settlement evidence has not yet been evaluated; rather, we focused on the 33 cemeteries, with *c.* 450 human inhumations altogether. These were thoroughly studied by Ken Massy (Massy *et al.* 2018). Based on the archaeological evaluation, we selected more than 100 individuals for a multi-perspective scientific approach including archaeogenetic analysis, comprehensive radiocarbon dating, strontium isotope analysis on the second and third molar, and stable isotope analysis. The rich metal findings were analysed with p-XRF, lead isotopy, and trace element analyses.[2] As well as the monograph presenting the archaeological evidence (Massy *et al.* 2018), we published a large number of studies – from very method-focused papers to broader integrative ones. Together, this research makes the Early Bronze Age Lech Valley one of the best studied prehistoric microregions in Europe (Andrades Valtueña *et al.* 2017; Friedrich *et al.* 2023; Knipper *et al.* 2017; Massy *et al.* 2017; Massy and Stockhammer 2019; Massy *et al.* 2022; Massy 2023; Mittnik *et al.* 2019; Mittnik *et al.* 2023; Olalde *et al.* 2018; Stockhammer *et al.* 2015a; Stockhammer *et al.* 2015b; Stockhammer 2023; Stockhammer and Massy 2023).

One of our most important findings was that all adult women buried in the Lech Valley during the Bell Beaker Complex and the Early Bronze Age originated from outside the valley and reached the valley at the age of *c.* 17 as marital partners. Some of the women came from elsewhere in southern Germany or another neighbouring region which has the same range of bioavailable strontium as the Lech Valley. These women were the biological mothers of all the children we studied archaeogenetically. The other non-local women originated from more than 400 km away. Based on their strontium isotopic signatures, they most probably originated in the Mittelelbe-Saale region and/or Bohemia, both core regions of the Únětice societies.

[2] So far, only the stable isotopic analysis and the archaeometallurgical analyses remain unpublished.

Figure 1: Woman leaving her home in the Early Bronze Age (artwork by Tom Björklund 2017).

We assumed that the women with Únětice backgrounds had a key role in the transmission of metallurgical knowledge to the Lech Valley (Knipper *et al.* 2017). Furthermore, I proposed that they also acted as wet nurses and social mothers for the children born in the farmsteads (Stockhammer 2023).

When we published our study on the role and importance of female mobility in the transfer of metallurgical knowledge from the regions of the Únětice societies (Knipper *et al.* 2017), we attracted the greatest interest from the national and international media, but we were also surprised to receive a lot of messages and comments, usually from male individuals, informing us that our results must be wrong, as women could never have had such a role in the past. We were told that women would have only travelled if they were robbed or enslaved. These reactions of course inform us more about individual and outdated present-day male perceptions of the past rather than female roles in prehistory. Personally, I took this reaction very seriously and have subsequently devoted a great deal of time and energy to informing the general public about our results in different contexts and through a variety of channels. For example, we gave several radio interviews, produced YouTube clips[3] and were involved in documentaries like *Terra X* and *Planet Wissen*, which have the potential to reach a very large audience, at least in German-speaking parts of Europe.[4] In order to also reach a young audience, irrespective of the social background of their parents, I developed the idea of creating a computer game. Together with the game producer Milkroom Studios and the marketing agency Elfgenpick, we were able to attract funding by the Volkswagen Foundation, which we then used to create the computer game 'Bronzeon' in 2019 (Stockhammer 2020). The game was created to teach the Bronze Age

[3] e.g. „Frauen waren schon immer sehr mobil": https://www.youtube.com/watch?v=WT3HOR0LcFY&list=LLyAFGf-cQGesXxg1Ox5bwOA&index=5&t=121s

[4] e.g. ARTE (2020) „Geschlechterkonflikt - Frauenbilder der Geschichte" (in French and German), ARD alpha (2020) „Die Bronzezeit: Über Mobile Frauen und soziale Ungleichheit" (https://www.br.de/fernsehen/ard-alpha/sendungen/campus/geschichte-archaeologie-phillip-stockhammer-bronzezeit-campus-talks-100.html); ARTE (2020) „Xenius: Bronzezeit. Wie haben unsere Vorfahren gelebt?", ARD (2020) „Planet Wissen: Bronzezeit – Die vergessene Epoche" (https://www.ardmediathek.de/ard/video/planet-wissen/bronzezeit-die-vergessene-epoche/ard-alpha/Y3JpZDovL3dkci5kZS9CZWl0cmFnLTczYmEwN2UzLWFlMmQtNDM0NC04NzJjLWY2OTBjMGIxNTlhMg),ZDF (2021) „Terra X: Deutschland in der frühen Bronzezeit" (https://www.zdf.de/dokumentation/terra-x/deutschland-in-der-fruehen-bronzezeit-mit-mirko-drotschmann-100.html)

within German high school curriculums. However, the game has also found large interest beyond school contexts and can be freely downloaded and played on mobile phones and tablets from the Google PlayStore and the Apple Store (see https://www.bronzeon.de/). Creating the game forced me to reflect on aspects of Early Bronze Age life in the Lech Valley beyond what we had written in our scientific publications and communicated in our outreach activities. The rules of 'Bronzeon' follow the results of our research as much as possible. However, additional aspects had to be added based on our imagination about Bronze Age clothing and housing, as well as general assumptions, e.g. that hunting wild boar or wolves is often more dangerous for the hunter than the animal, that producing enough food for the winter is an all-year struggle, that children die in larger numbers when sufficient food is lacking, that possessing oxen accelerates building activities, and many further aspects.

Furthermore, I was very much inspired by an artwork created by the Swedish artist Tom Björklund, who was asked to illustrate a mobile woman from the Lech Valley for the *Phox Pop* magazine (Fig. 1). Since then, and with Tom Björklund's kind permission, I have continuously used this image to illustrate past human mobility (Fernández-Götz *et al.* 2023).

Narrating Travel

When we wrote about the non-local women who arrived as marital partners in the Lech Valley, as well as the young adult females who must have been born in the valley and who also had to leave home at the age of *c.* 17, we spoke about individual graves, the related grave goods, and about strontium and genetic datasets. When I have given public talks about these women, I have emphasised that, whereas our scientific approaches can show the place where they spent their childhood, and who their biological parents were, we cannot trace the tears and worries of those leaving and those staying behind – as these acts of mobility were likely eternal farewells. I asked the audience to reflect on what it would mean to them, if they had to send their daughters away, never to see them again. Although we cannot trace sorrow in our archaeological record, I argue that narrating the exchange of marital partners over long distances should force us to speak also about grief and despair as key topics of human experience (Prade-Weiss 2022). Yes, we should emphasise the advantages of establishing long-distance networks as a basis for subsequent exchange of goods and ideas and the potential of the non-local women to educate the children within a farmstead in new technologies, ideas and possibly even different languages, but we must also keep in mind the experiences and emotions entwined within these processes.

We have avoided speculating in our publications about how these young women travelled over 400 km and more. We think it likely that they did not travel alone. These movements required the crossing of rivers, bogs, and mountains that would have required extensive knowledge of local environments. There would have been a constant prospect of encountering dangerous animals – wolves, bears, boars – not to mention inevitable encounters with strangers. Combined, these conditions would have made travel so unsecure that the 800 years of stability that we can see documented in this system in the Lech Valley would not have been possible. Therefore, these women needed to travel with others, and their companions needed to include individuals with weapons, as well as different local experts. Anthony Harding and Kristian Kristiansen recently emphasised the necessity of better understanding the agents and social context of travel in the European Bronze Age (Harding 2021; Kristiansen 2023). In 'Bronzeon', we decided to introduce the idea of caravans that these women might have joined. Caravans as a means of long-distance travel are well known for the early 2nd millennium BCE, albeit from the Near East, where donkeys played a crucial role in long-distance transport (Atici 2014). However, donkeys had not yet been introduced to central Europe during the Bronze Age (Todd *et al.* 2022). Moreover, I also assume that the young women did not leave their farmsteads on their own with a caravan but were accompanied by their parents, or at least one close relative.

We hardly understand how long-distance travel functioned and was organised. There must have been caravan leaders and specialised companions accompanying the caravan in challenging landscapes, armed fighters, probably also traders and wandering specialists, often referred to in research as itinerant craftsmen (Stockhammer 2004). Ferrymen must have helped the caravans to cross rivers where no ford existed. Individuals who only travelled a short part of the way were likely to have joined the trek, while others may have spent the majority of their lives moving from place to place with such caravans – analogous to the nomads of the sea, as Michal Artzy (1997) has assumed for Late Bronze Age trade in the eastern Mediterranean region. The non-material details of these journeys may only be guessed at, but some aspects may be logically speculated upon. The caravans must have repeatedly stopped at inhabited places to rest, stock up on food, leave injured or sick people behind, and to trade. We do not know in what form travellers paid for safe accommodation and food, or whether some travellers paid individually on the spot or at the beginning of their journey to the leader of a caravan, whom we may presume would also guarantee protection and supplies along the way with the payment. It is also possible that different languages or dialects were spoken locally and that interpreters accompanied the caravans, or that the leaders of the caravans themselves spoke a variety of languages. Structurally, such caravans were probably not dissimilar to boat journeys in historical times. Historians have shown the transformative power of group togetherness during a journey; the steamships of the 19th century have been analysed accordingly as transcultural spaces where travellers gathered knowledge and ideas with which they could trigger transformative processes once they arrived at their destinations (Wenzlhuemer 2016; Dusinberre and Wenzlhuemer 2016). Moreover, these caravans might not always have taken the direct route, but could have introduced detours to include interesting markets or suppliers of raw materials and goods along their way. Other detours might have been forced by river flooding, impassable terrain, at the request or command of supernatural forces, or due to unrest or even emerging armed conflicts between local groups. On these detours, the travellers gained additional experiences and new insights. But sometimes detours might also have prevented travellers from reaching their destination on time, perhaps delaying important developments (e.g. a planned festival or fair) (Dogramaci 2021). On their envisaged way, as well as during detours, the travellers also left traces – not only their footprints in the mud but also by speaking with local people, exchanging thoughts and goods, telling stories about their gods and families, among others, and would have experienced different ways of speaking and conducting daily activities and local practices.

When a young woman and her companions reached the destination of their travel after several days, weeks, or possibly even months, they were no longer the same individuals who had left their farmsteads. They had gained new insights into 'the world' (Maran 2012). Indeed, their world, in the sense of their lifeworld (Habermas 2019; Schütz and Luckmann 2003), was no longer the same. When we tell the story of these non-local women and emphasise the knowledge they brought to the Lech Valley, for example, we must always bear in mind that they not only gathered their knowledge in the homestead of their childhood and youth but also along the way to their destinations, during the many detours made on the way to the next stage of their lives as wives.

Narrating marital practices

Before speaking about marital practices in Early Bronze Age central Europe, I need to emphasise that when I use the word 'marriage' I am aware that this term is often associated with bourgeois and/or romantic ideas of the union of two people of different biological sexes and that these associations are often unconscious and difficult to avoid. In the context of this article, I use the term 'marriage' to refer to the union of two people from which biological offspring have been produced who are then evidenced by archaeogenetic data. I assume that, at least in the Early Bronze Age Lech Valley, there was some kind of institutionalised connection between the two sexual partners, as there is no evidence in our data that any one individual had offspring with different partners (Mittnik *et al.* 2019), which again points to rather strict rules and traditions with regard to mating practices among the inhabitants of the valley.

Furthermore, I assume that the selection of a marriage partner in the central European Early Bronze Age was based on strategic ideas of close kin rather than on notions of love and/or sexual attraction. Arranged marriage has been the dominant way of creating partnerships all around the globe wherever and whenever literary and/or ethnographic sources inform us about marital practices (Beck-Gernsheim 2011; Parkin 2021) and is still the customary way of selecting marital partners in many societies, though the decisive role of close kin has increasingly been replaced by a marriage brokering industry on an international level (Lu 2005).

I propose that the necessary exchange of knowledge about available marriage partners during the central European Early Bronze Age contributed to the existence of marriage markets, where women and men of marriageable age came to such events with their close relatives to find a partner. I assume that negotiations probably took place between kin groups, during which information about the potential partner's kin group was requested and where perhaps a kind of bride price would have been paid. The bride would then have joined her new husband's group directly at the end of such a marriage market, and her own kin group members would have returned home without her. Archaeologically, such festival-style events are more often than not impossible to infer from the archaeological record (Harrison and Schofield 2010; White 2020), but the archaeogenetic evidence from the Lech Valley might provide some indication for the existence of such institutions. From a population genetics point of view, the non-local women who came to and were finally buried in the Lech Valley seem genetically rather diverse, based on the Principal Component Analysis (PCA) (Mittnik *et al.* 2019). However, a word of caution is necessary, as, due to admixture with incoming groups of individuals with high steppe ancestry, there is a significant diversity of genetic signatures in Early Bronze Age Europe, even in rather small regions (Papac *et al.* 2021; Penske *et al.* 2024). Preliminary data on long-distance biological relatedness with the help of 'identical by descent' (IBD) approaches (Ringbauer *et al.* 2023; Ringbauer *et al.* 2024), seems to be revealing a network of long-distance biological relatedness of women buried in the

Lech Valley which points to different regions of central Europe. Here, future comprehensive IBD analysis of Early Bronze Age genetic datasets all over Europe will enable us to unravel the complexity of marital networks.

These Early Bronze Age marriage markets that I propose would not only have functioned as the hub of an extensive marriage network but also as places for the exchange of goods and technologies and places of exposure to different world views. Even if we can only speculate in this regard, it can be assumed that such events were accompanied by special ceremonial and ritual practices as well as the presence of mobile traders and specialists. These events were, therefore, more than just places for matchmaking. Depending on their geographical placement, local decision makers might have had the chance to impact such events, raise fees, or control the exchange of particular goods (or people). However, irrespective of their entanglement with other social practices, these marriage markets would have enabled the participants to obtain knowledge from distant places and learn more about 'the world' (Maran 2012).

Upon return

Those individuals who returned from such journeys were not the same people that had left some weeks or months before. Their knowledge about the world beyond their valley may have dramatically changed, and their perspectives on 'their own worlds' could have been challenged or even drawn into question. From afar, they brought not only foreign objects and knowledge and/or a bride, who again brought with her new knowledge, practices, and even dialects or languages. However, such events were no singular once-in-a-lifetime experiences, as such journeys must have taken place every time a female born into the household reached marriageable age. Neighbouring farmsteads exchanged their experiences and knowledge gained on such journeys and informed each other about 'the worlds beyond their own world', helping shape something like a globalised understanding of the Early Bronze Age world.

Conclusion

Being a prehistorian, I feel the necessity to write a prehistory, not the true or the only one (which does not exist anyway), but a prehistory which enables us to understand human past in a better way. Writing prehistory requests narration, and archaeologists have always struggled to turn the silent and dismembered fragments of the past into a coherent and/or entertaining narrative. Scientific analysis has now enabled us to gain insights into past worlds in a previously unforeseeable and most exciting way. However, these scientific results run the risk to be as positivist as antiquarian approaches in archaeology have long been, as both approaches fail to trace emotions and sensory perceptions of past humans. To understand past humans in a humanist way as human beings, we need to develop innovative ways of narrating the past. My contribution aims to further inspire these lines of thinking.

Bibliography

Abbots, E.-J. 2016. Introducing a Special Issue on Food Stuffs. Materialities, Meanings, and Embodies Encounters. *Gastronomica: The Journal of Critical Food Studies* 16(3): 1-4.

Abbots, E.-J. and A. Lavis 2013. *Why We Eat, How We Eat. Contemporary Encounters between Foods and Bodies*. Aldershot: Ashgate.

Andrades Valtueña, A, A. Mittnik, F.M. Key, W. Haak, R. Allmäe, A.B. Belinskij, M. Daubaras, M. Feldman, R. Jankauskas, I. Janković, K. Massy, M. Novak, S. Pfrengle, S. Reinhold, M. Šlaus, M.A Spyrou, A. Szécsényi-Nagy, M. Tõrv, S. Hansen, K.I. Bos, P.W. Stockhammer, A. Herbig and J. Krause 2017. The Stone Age Plague and Its Persistence in Eurasia. *Current Biology* 27(23): 3683-3691.e8 (available at: https://doi.org/10.1016/j.cub.2017.10.025).

Artzy, M. 1997. Nomads of the Sea, in S. Swiny, R.L. Hohlfelder and H.W. Swiny (eds) *Res maritimae. Cyprus and the Eastern Mediterranean from Prehistory to Late Antiquity. Proceedings of the Second International Symposium 'Cities on the Sea', Nicosia, Cyprus, 18-22 October 1994*: 1-16. Atlanta: Scholars Press.

Atici, L. 2014. *Current Research at Kultepe-Kanesh. An Interdisciplinary and Integrative Approach to Trade Networks, Internationalism, and Identity*. Atlanta: Lockwood Press.

Beck-Gernsheim, E. 2011. The Marriage Route to Migration: of border artistes, transnational matchmaking and imported spouses. *Nordic Journal of Migration Research* 1(2): 60 (available at: https://Doi.Org/10.2478/V10202-011-0008-Y).

Day, J. 2013. *Making Senses of the Past. Toward a Sensory Archaeology*. Carbondale: Southern Illinois University Press.

Dogramaci, B. 2021. *Detours 2021* (available online at: https://www.globaldisconnect.org/09/03/burcu-dogramaci-speaks-on-exile/).

Dusinberre, M. and R. Wenzlhuemer 2016. Editorial – being in transit: ships and global incompatibilities. *Journal of Global History* 11(2): 155-162 (available at: https://doi.org/10.1017/S1740022816000036).

Fernández-Götz, M., C. Nimura, P. Stockhammer and R. Cartwright 2023. *Rethinking migrations in late prehistoric Eurasia*. Oxford: Oxford University Press.

Friedrich, R., K. Massy and P.W. Stockhammer 2023. Calibration of 14C dates using biological kinship, in H. Meller, J. Krause, W. Haak and R. Risch (eds) *Kinship, Sex, and Biological Relatedness. The contribution of archaeogenetics to the understanding of social and biological relations*: 101-110. Halle (Saale)/Heidelberg: Propylaeum.

Habermas, J. 2019. *Theorie des kommunikativen Handelns* (11th edn). Frankfurt/Main: Suhrkamp.

Hamilakis, Y. 2000. The Anthropology of Food and Drink Consumption and the Aegean Archaeology, in S.J. Vaughan and W.D.E. Coulson (eds) *Palaeodiet in the Aegean. Papers from a Colloquium held at the 1993 Meeting of the Archaeological Institute of America in Washington D.C.*: 55-62. Oxford: Oxbow Books.

Hamilakis, Y. 2015. Food as Sensory Experience, in K.B. Metheny and M.C. Beaudry (eds) *Archaeology of Food. An Encyclopedia. Volume 1*: 205-206. Lanham: Rowman & Littlefield.

Harding, A. 2021. *Bronze Age Lives*. Berlin: De Gruyter.

Harrison, R. and A.J. Schofield 2010. *After modernity. Archaeological approaches to the contemporary past*. Oxford: Oxford University Press.

Hofmann, K.P., Ch. Sanchez-Stockhammer and P.W. Stockhammer 2023. Sollen wir den Knochen einen Namen geben? (De-)Personalisierung und Objektifizierung prähistorischer Menschen. *Theorie | Archäologie | Reflexion* 1 (available at: https://doi.org/10.11588/PROPYLAEUM.1092.C15033).

Klein, J.A. and J.L. Watson 2016. *The Handbook of Food and Anthropology*. London: Bloomsbury Academic.

Knipper, C., A. Mittnik, K. Massy, C. Kociumaka, I. Kucukkalipci, M. Maus, F. Wittenborn, S.E. Metz, A. Staskiewicz, J. Krause and P.W. Stockhammer 2017. Female Exogamy and Gene Pool Diversification at the Transition from the Final Neolithic to the Early Bronze Age in Central Europe. *Proceedings of the National Academy of Sciences of the United States of America* 114(38): 10083-10088 (available at: https://doi.org/10.1073/pnas.1706355114).

Kristiansen, K. 2014. Towards a New Paradigm? The Third Science Revolution and Its Possible Consequences in Archaeology. *Current Swedish Archaeology* 22: 11-71.

Kristiansen, K. 2023. Bronze Age Travellers, in M. Fernández-Götz, C. Nimura, P.W. Stockhammer and R.M. Cartwright (eds) *Rethinking migrations in late prehistoric Eurasia*: 89-109. Oxford: Oxford University Press.

Kuijpers, M.H.G. 2013. The Sound of Fire, Taste of Copper, Feel of Bronze, and Colours of the Cast:. Sensory Aspects of Metalworking Technology, in M.L. Stig Sørensen (ed.) *Embodied Knowledge. Perspectives on Belief and Technology*: 137-150. Oxford: Oxbow Books.

Lu, M.C.-W. 2005. Commercially Arranged Marriage Migration. *Indian Journal of Gender Studies*, 12 (2-3): 275-303 (available at: https://doi.org/10.1177/097152150501200206).

Maran, J. 2012. One World is not Enough. The Transformative Potential of Intercultural Exchange in Prehistoric Societies, in P.W. Stockhammer (ed.) *Conceptualizing Cultural Hybridization. A Transdisciplinary Approach. Papers of the Conference, Heidelberg, 21.- 22. September 2009*: 59-66. Heidelberg: Springer.

Massy, K. 2023. Traditionen und Veränderungen endneolithischer und frühbronzezeitlicher Gesellschaftsstrukturen in Süddeutschland - eine bioarchäologische Neubewertung aus dem Lechtal, in K. Massy, J.-H. Bunnefeld and C. Horn (eds) *Soziale Hierarchien zwischen Tradition und Innovation in der Bronzezeit Europas. Beiträge der Sitzungen der AG Bronzezeit im Rahmen der 83. Tagung des NWVA vom 12.-15. September 2018 in Heide (Holstein) und der 85. Jahrestagung des WSVA und des MOVA vom 1.-5. April 2019 in Würzburg*: 77-107. Langenweißbach: Beier & Beran.

Massy, K., R. Friedrich, A. Mittnik and P.W. Stockhammer, 2022. Pedigree-based Bayesian modelling of radiocarbon dates. *PLoS ONE* 17(6): e0270374 (available at: https://doi.org/10.1371/journal.pone.0270374).

Massy, K., N. Hoke, A. Staskiewicz, W.-R. Teegen and S. Panzer 2018. *Die Gräber der Frühbronzezeit im südlichen Bayern. Untersuchungen zu den Bestattungs- und Beigabensitten sowie gräberfeldimmamenten Strukturen*. Kallmünz/Opf.: Verlag Michael Lassleben.

Massy, K., C. Knipper, A. Mittnik, S. Kraus, E. Pernicka, F. Wittenborn, J. Krause and P.W. Stockhammer 2017. Patterns of Transformation from the Final Neolithic to the Early Bronze Age: A Case Study from the Lech Valley South of Augsburg, in P.W. Stockhammer and J. Maran (eds) *Appropriating Innovations. Entangled Knowledge in Eurasia, 5000–1500 BCE. Papers of the Conference, Heidelberg, 15.–17. Januar 2015*: 241-261. Oxford: Oxbow Books.

Massy, K. and P.W. Stockhammer 2019. Testing Reinecke's Chronology of the Early Bronze Age with Radiocarbon Dating. New Evidence from Southern Bavaria. *Studia Hercynia* 23(2): 22-35.

Mintz, S.W. 1996. *Tasting Food, Tasting Freedom. Excursions into Eating, Culture, and the Past*. Boston: Beacon Press.

Mittnik, A., K. Massy, C. Knipper, R. Friedrich, J. Krause and P.W. Stockhammer 2023. Kinship, status and mobility in the Bronze Age Lech Valley, in H. Meller, J. Krause, W. Haak and R. Risch (eds) *Kinship, Sex, and Biological Relatedness. The contribution of archaeogenetics to the understanding of social and biological relations*: 195-217. Halle (Saale)/Heidelberg: Propylaeum.

Mittnik, A., K. Massy, C. Knipper, F. Wittenborn, R. Friedrich, S. Pfrengle, M. Burri, N. Carlichi-Witjes, H. Deeg, A. Furtwängler, M. Harbeck, K. Vom Heyking, C. Kociumaka, I. Kucukkalipci, S. Lindauer, S. Metz, A. Staskiewicz, A. Thiel, J. Wahl, W. Haak, E. Pernicka, S. Schiffels, P.W. Stockhammer and J. Krause 2019.

Kinship-based Social Inequality in Bronze Age Europe. *Science* 366: 731-734.

Olalde, I., S. Brace, M.E. Allentoft, I. Armit, K. Kristiansen, T. Booth, N. Rohland, S. Mallick, A. Szécsényi-Nagy, A. Mittnik, E. Altena, M. Lipson, I. Lazaridis, T.K. Harper, N. Patterson, N. Broomandkhoshbacht, Y. Diekmann, Z. Faltyskova, D. Fernandes ... and Reich 2018. The Beaker phenomenon and the genomic transformation of northwest Europe. *Nature* 555(7695): 190-196 (available at: https://doi.org/10.1038/nature25738).

Papac, L., M. Ernée, M. Dobeš, M. Langová, A.B. Rohrlach, F. Aron, G.U. Neumann, M.A. Spyrou, N. Rohland, P. Velemínský, M. Kuna, H. Brzobohatá, B. Culleton, D. Daněček, A. Danielisová, M. Dobisíková, J. Hložek, D.J. Kennett, J. Klementová, M. Kostka, P. Krištuf, M. Kuchařík, J.K. Hlavová, P. Limburský, D. Malyková, L. Mattiello, M. Pecinovská, K. Petriščáková, E. Průchová, P. Stránská, L. Smejtek, J. Špaček, R. Šumberová, O. Švejcar, M. Trefný, M. Vávra, J. Kolář, V. Heyd, J. Krause, R. Pinhasi, D. Reich, S. Schiffels and W. Haak 2021. Dynamic changes in genomic and social structures in third millennium BCE central Europe. *Science Advances* 7(35): eabi6941 (available at: https://doi.org/10.1126/sciadv.abi6941).

Papadopoulos, C. and H. Moyes 2022. Illuminating Sensory Archaeologies, in C. Papadopoulos and H. Moyes (eds) *The Oxford Handbook of Light in Archaeology*: 1-18. Oxford: Oxford University Press.

Parkin, R. 2021. Arranged marriages: Whose choice and why? Reflections on the principles underlying spouse selection worldwide. *History and Anthropology* 32(2): 271-287 (available at: https://doi.org/10.1080/02757206.2021.1905255).

Penske, S., M. Küßner, A.B. Rohrlach, C. Knipper, J. Nováček, A. Childebayeva, J. Krause and W. Haak 2024. Kinship practices at the early bronze age site of Leubingen in Central Germany. *Scientific Reports* 14(1): 3871 (available at: https://doi.org/10.1038/s41598-024-54462-6).

Prade-Weiss, J. 2022. *Language of ruin and consumption. On lamenting and complaining*. London: Bloomsbury Academic.

Ringbauer, H., Y. Huang, A. Akbari, S. Mallick, I. Olalde, N. Patterson and D. Reich 2024. Accurate detection of identity-by-descent segments in human ancient DNA. *Nature Genetics* 56(1): 143-151 (available at: https://doi.org/10.1038/s41588-023-01582-w).

Ringbauer, H., Y. Huang, A. Akbari, S. Mallick, N. Patterson and D. Reich 2023. ancIBD – Screening for identity by descent segments in human ancient DNA. *bioRxiv* (available at: https://doi.org/10.1101/2023.03.08.531671).

Schütz, A. And T. Luckmann 2003. *Strukturen der Lebenswelt*. Konstanz-Stuttgart: UVK.

Stockhammer, P.W. 2004. *Zur Chronologie, Verbreitung und Interpretation urnenfelderzeitlicher Vollgriffschwerter*. Tübinger Texte 5. Rahden/Westfalen: Marie Leidorf.

Stockhammer, P.W. 2016. Past Food for Thought. The Potential of Archaeology. *Gastronomica: The Journal of Critical Food Studies* 16(3): 91-101 (available at: https://doi.org/10.1525/gfc.2016.16.3.91).

Stockhammer, P.W. 2020. BRONZEON: Learning by Gaming. *The Archaeologist* 110: 24-25.

Stockhammer, P.W. 2023. Fostering Women and Mobile Children in Final Neolithic and Early Bronze Age Central Europe, in K. Kristiansen, G. Kroonen and E. Willerslev (eds) *The Indo-European puzzle revisited. Integrating archaeology, genetics, and linguistics*: 303-307. Cambridge: Cambridge University Press.

Stockhammer, P.W. and K. Massy 2023. Mobility at the Onset of the Bronze Age: A Bioarchaeological Perspective, in M. Fernández-Götz, C. Nimura, P.W. Stockhammer and R. Cartwright (eds) *Rethinking migrations in late prehistoric Eurasia*: 170-188. Oxford: Oxford University Press.

Stockhammer, P.W., K. Massy, C. Knipper, R. Friedrich, B. Kromer, S. Lindauer, J. Radosavljević, E. Pernicka and J. Krause 2015a. Kontinuität und Wandel vom Endneolithikum zur frühen Bronzezeit in der Region Augsburg, in H. Meller, H.W. Arz, R. Jung and R. Risch (eds) *2200 BC. Ein Klimasturz als Ursache für den Zerfall der alten Welt? 7. Mitteldeutscher Archäologentag vom 23. bis 26. Oktober 2014 in Halle (Saale)*: 617-641. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Stockhammer, P.W., K. Massy, C. Knipper, R. Friedrich, B. Kromer, S. Lindauer, J. Radosavljević, F. Wittenborn and J. Krause 2015b. Rewriting the Central European Early Bronze Age Chronology. Evidence from Large-Scale Radiocarbon Dating. *PLoS ONE* 10(10): e0139705 (available at: https://doi.org/10.1371/journal.pone.0139705.

Todd, E.T., L. Tonasso-Calvière, L. Chauvey, S. Schiavinato, A. Fages, A. Seguin-Orlando, P. Clavel, N. Khan, L. Pérez Pardal, L. Patterson Rosa, P. Librado, H. Ringbauer, M. Verdugo, J. Southon, J.-M. Aury, A. Perdereau, E. Vila, M. Marzullo, O. Prato, U. Tecchiati, G. Bagnasco Gianni, A. Tagliacozzo, V. Tinè, F. Alhaique, J.L. Cardoso, M. João Valente, M. Telles Antunes, L. Frantz, B. Shapiro, D.G. Bradley, N. Boulbes, A. Gardeisen, L. Kolska Horwitz, A. Öztan, B.S. Arbuckle, V. Onar, B. Clavel, S. Lepetz, A. Akbar Vahdati, H. Davoudi, A. Mohaseb, M.M. Mashkour, O. Bouchez, C. Donnadieu, P. Wincker, S.A. Brooks, A. Beja-Pereira, D.-D. Wu and L. Orlando 2022. The genomic history and global expansion of domestic donkeys. *Science* 377: 1172-1180.

Vandkilde, H. 2016. Bronzization. The Bronze Age as Pre-Modern Globalization. *Praehistorische Zeitschrift* 91(1): 103-123.

Wenzlhuemer, R. 2016. The ship, the media, and the world: conceptualizing connections in global history.

Journal of Global History 11(2): 163-186 (available at: https://doi.org/10.1017/S1740022816000048).

West, H.G. 2013. Thinking Like a Cheese. Towards an Ecological Understanding of the Reproduction of Knowledge in Contemporary Artisan Cheesemaking, in R.F. Ellen (ed.) *Understanding cultural transmission in anthropology. A critical synthesis*: 320-345. New York: Berghahn Books.

White, C.L. 2020. *The archaeology of Burning Man. The rise and fall of Black Rock City*. Albuquerque: University of New Mexico Press.

Wilk, R. 2012. The Limits of Discipline. Towards Interdisciplinary Food Studies. *Physiology & Behavior* 107(4): 471-475 (available at: https://doi.org/10.1016/j.physbeh.2012.04.023).

Part 3

Bronzification

"The transculture of bronze – and the interactions with materials and with people that it both encouraged and required – literally made the Bronze Age. This multifaceted process in place and space is here termed bronzization."
(Vandkilde 2016: 108)

Chapter 13

On the diffusion of technological knowledge in prehistory

Svend Hansen

Eurasia Department, German Archaeological Institute, Berlin, Germany
Institute for Prehistoric Archaeology, Freie Universität Berlin, Berlin, Germany
svend.hansen@dainst.de

Abstract

This contribution uses various examples to discuss the extent to which prehistoric archaeology can contribute to the development and dissemination of technical knowledge. The knowledge stored in the artefacts makes it possible to reconstruct the stock of knowledge in a region at a particular time. The passing on of knowledge is seen as one of the basic conditions for the preservation of knowledge in oral societies.

Bricolage, science and technology

Over the last two centuries – the tail end of the Industrial Revolution and the associated technological rationalisation of production processes – a number of traditional professions have disappeared. Quite often these processes came as a rapid surprise for those concerned and were accompanied by social friction. For example, the weaver revolts in Silesia (1844) were a consequence of the introduction of the steam-driven loom. In Spain, over the course of just a few years in the 1960s, traditional pottery disappeared as a consequence of plastic packaging and the spread of the refrigerator. Additionally, the end of lead typesetting in the 1970s not only changed the aesthetics of reading, but also dissolved the once highly closed and politically influential social milieu of typesetters.

Part and parcel with the disappearance of professions such as those mentioned above was the loss or transformation of the associated knowledge which, although learned individually, were skills mostly located among close social milieus and embedded the knowledge transfer from generation to generation (Gideon 1948). At the very least, the disappearance of such professions reminds us of the fact that some of them rested on centuries- or even millennia-old knowledge and/or techniques which had been passed down and whose 'origins' cannot be exactly identified or chronologically fixed. With the disappearance of these crafts, often also the bodies of associated knowledge disappeared, as the latter were documented only in rare cases.

Without techniques, there would be no human society. In the 19th century, the making of tools became almost a defining criterion for distinguishing man from animal. It was only much later that we learned that apes also make and use tools. Meanwhile, it has even become clear that chimpanzees have developed a variety of culturally different techniques, which is why we have, as a discipline, been speaking of chimpanzee cultures for quite some time (Wrangham *et al.* 1994).

History cannot be imagined without the history of hunting and the history of the techniques of animal husbandry, that is to say without the achievements of the Palaeolithic hunter-gatherers and the Neolithic farmers. Techniques structure social processes and relations. In the Greek language, *technē* generally refers to an art or artisanship based on experience and, thus, learnable knowledge. The modern concept of technology, on the other hand, mostly refers to technological objects or larger infrastructures. Only the tradition founded by Marcel Mauss, which was continued by André Leroi-Gourhan, maintains an extended concept of technique which also considers body techniques or social techniques (Leroi-Gourhan 1943; 1945; 1964; 1965; 1984; Mauss 1989). The mechanical and matter-of-course working motions considered by Mauss for the first time are also called 'habitualisation'. This also includes 'embodied knowledge' or implicit knowledge (i.e. in the best case, skills which cannot be made explicit).

In contrast to this extended concept of techniques, Claude Lévi-Strauss established a well-known differentiation through his contrast of the figure of the bricoleur to that of the engineer. The bricoleur and the engineer represent two different kinds of thought which, nevertheless, are basically of equal value: the Neolithic one and the modern one:

> 'In the Neolithic Age the mastering of the essential skills of civilisation pushed through: pottery, weaving, agriculture and animal husbandry. These days nobody would consider explaining these enormous conquests as just an accumulation of a number of single inventions which either happened coincidentally or came to light due to the passive play of certain natural

> phenomena. Each of these techniques required centuries of active and methodical observation, bold and controlled hypotheses which were either rejected or verified by way of relentlessly repeated experimenting.' (Lévi-Strauss 1981: 26)

At the same time, Lévi-Strauss diagnosed a 'Neolithic paradox':

> 'Man in the Neolithic is thus the heir of a long scientific tradition; however had the spirit inspiring both him and all his predecessors been the same as that of modernity, how then were we to understand that he got *stagnated* and that several thousands of years of stagnation separate the Neolithic revolution from the sciences of today?' (Lévi-Strauss 1981: 27)

He saw only one solution to this supposed paradox, namely that there are two types of scientific thinking, one that is adapted to the sphere of perception and imagination and the other that is detached from it. In other words, as if the necessary relationships that form the object of every science could be achieved in two different ways. Lévi-Strauss was trying to explain the fact of the different historical developments on the five continents.

V. Gordon Childe and Jack Goody have also examined technological development in Eurasia since the Neolithic, and especially since the urban revolution, as a key to understanding global disparities (Childe 2009; Goody 2010). These continue to have an impact today, so that Dan Diner, for example, speaks of the scientifically inspired research cultures of the West and the 'application cultures' in other parts of the world (Diner 2017: 16).

Nevertheless, we have reason enough to call into question whether 'Neolithic' societies really stagnated and whether Neolithic science was just a kind of *bricolage*. Childe already pointed out that the explanation of the technological difference between Europe and Australia or America 'must of course be sociological not biological. Science, like technology, is the creation of societies not race' (Childe 2009: 9).

Non-European tribal societies look back upon a rich history of change and innovation, which also has changed over the past 10,000 years. However, of course there is no written tradition by which light could be shed on this. The observation that it is because of written tradition that the people of Europe are aware of the fact that corn, potatoes, and tomatoes were crops which originated in the New World and came to Europe in the 16th century is very revealing in this regard. The horse, on the other hand, which arrived in America together with the Spanish *conquistadors*, was, according to the tradition of the North American Assiniboin, created by their progenitor together with the first humans (Kohl 2011: 12). Such an integrative mode of tradition makes it almost impossible to pursue how technological knowledge was adopted by oral societies.

Compared to the two Americas, Africa and Australia, a specific model of Neolithisation (i.e. the Eurasian one, and its rapid dynamisation until the development of civilisations based on writing) is particularly striking. In Eurasia, the connection of technological innovation with processes of social hierarchisation has been particularly close and, as early as 250 generations after the transition from hunting and gathering to agriculture, resulted in the building of the first cities and in the development of states.

That is why it is important to analyse how technologies develop and spread. For this purpose, there is no need to postulate two different kinds of thought. Additionally, other 'natural' phenomena are not thought to sufficiently explain these different developments (e.g. Diamond 1999). Rather, in an open way, invention should be understood to be a social practice of 'establishing, by way of creative and experimental action, new and socially acceptable solutions to self-defined, concrete problems as long-lasting innovations' (Rammert 2006: 16).

Yet science can still no longer be imagined without the figure of the bricoleur. Accordingly, André Gorz distinguished living and formalised knowledge (Gorz 2004). Living knowledge is part of the cultural heritage in a comprehensive sense. It includes everyday competences and usable service skills built on them. Business enterprises demand individual skills from their staff, in particular the capability to cooperate and to establish relationships; this is what is called 'human capital' these days. In contrast to living knowledge, technical scientific knowledge can be formalised. It can be separated from its living bearers and can be distributed and used by everybody. According to Gorz, it develops by the interaction between researchers, scientists, and bricoleurs (Gorz 2004). In Gorz's work, technical knowledge is completely subsumed under scientific knowledge.

However, technological knowledge may also be defined by differentiating from pure science, and this by stating that it is oriented at problems which are application-oriented and cannot be systematically formulated (Heidenreich 1997). In this respect, experiential knowledge and communication relations across the disciplines are said to be important. The capability for combining knowledge in new ways and the application of existing knowledge are considered crucial

(Heidenreich 1997). In this context, the inclusion of implicit, pre-scientific or practice-related, everyday knowledge gains much significance. According to these considerations, technological knowledge may be located somewhere between everyday knowledge and the sciences.

The historical and social context is key for the development of techniques/technologies. Our understanding of the development and introduction, as well as the spread of techniques/technologies and the resulting social processes in prehistoric and ancient times, is only just beginning and is a research field which must still be established, as many questions still remain open.

Inventions in the Holocene

A diagram of the chronological sequence of basic innovations since *c.* 10,000 BCE (Fig. 1) provides a rough illustration of our current knowledge of the introduction of technologically relevant innovations. It becomes obvious that there seem to be periods in which innovations cluster. The first cluster of innovations is visually striking within the Neolithic, and includes an early agricultural economy with the domestication of sheep, pig and cattle, pottery, the building of houses, polished stone axes, and the construction of wells. This includes what Gordon Childe described by the term 'Neolithic revolution' (Çilingiroğlu 2005).

A second cluster of innovations is very apparent in the 4th millennium BCE, with the introduction of the wheel, the wagon, the plough, the weight scale, writing, the sailboat, new kinds of metal (such as silver), new types of weapons, etc. According to Childe, these are the preconditions for an 'urban revolution'. Andrew Sherratt grouped part of these innovations under the term 'secondary products revolution', over the course of which animals were kept to a previously unknown degree not only for the consumption of meat but also for the use of other things they produce, e.g. milk or wool (Hansen 2011; Sherratt 1997). Chronologically sandwiched between the innovations of the Neolithic and the urban revolution there appeared the mastering of pyrotechnics, with the first pottery kilns in the 6th millennium BCE and extractive metallurgy (i.e. mining and metallurgy) in the 5th millennium BCE. Metallurgy is an innovation whose consequences cannot be overestimated (Hansen 2013a: 237ff). The consequences of this innovation are correctly described by the slogan 'no modern industry without metallurgy'.

The clustering of innovations in the Neolithic and the 4th millennium seem to confirm the observation concerning modernity: i.e. that technological innovations do not happen continuously and individually but discontinuously and occur in groups. According to Gerhard Mensch, they seem to appear in times of crisis and are the precondition for a wave of economic prosperity (Mensch 1975: 149).

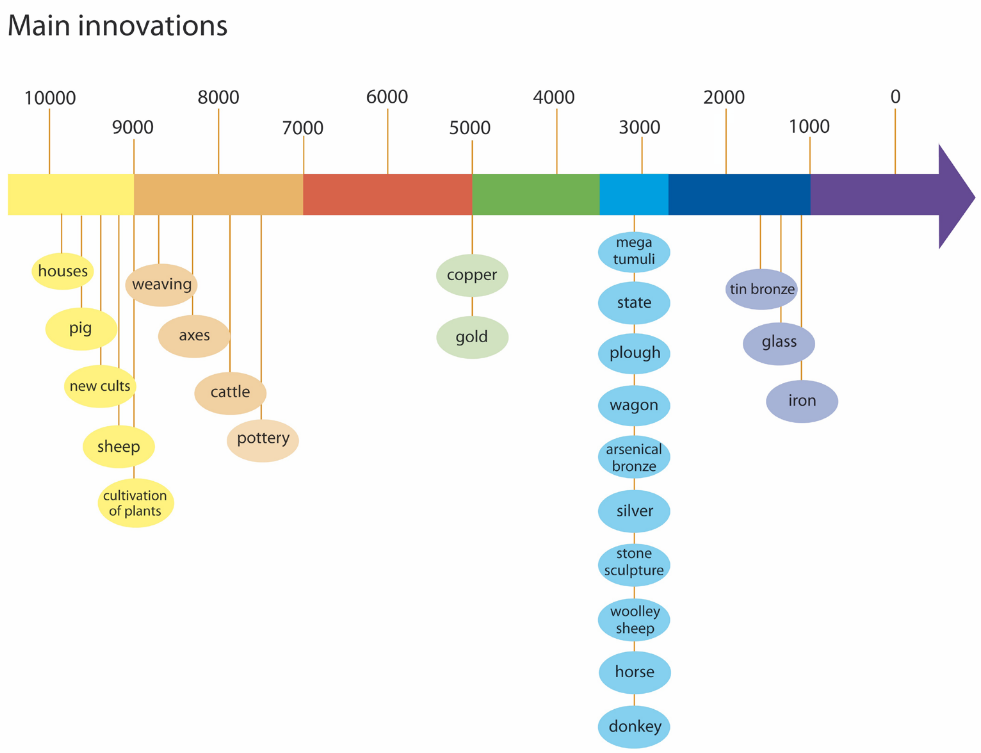


Figure 1: Draft scheme for the introduction of basic technologies (Svend Hansen/Anke Reuter).

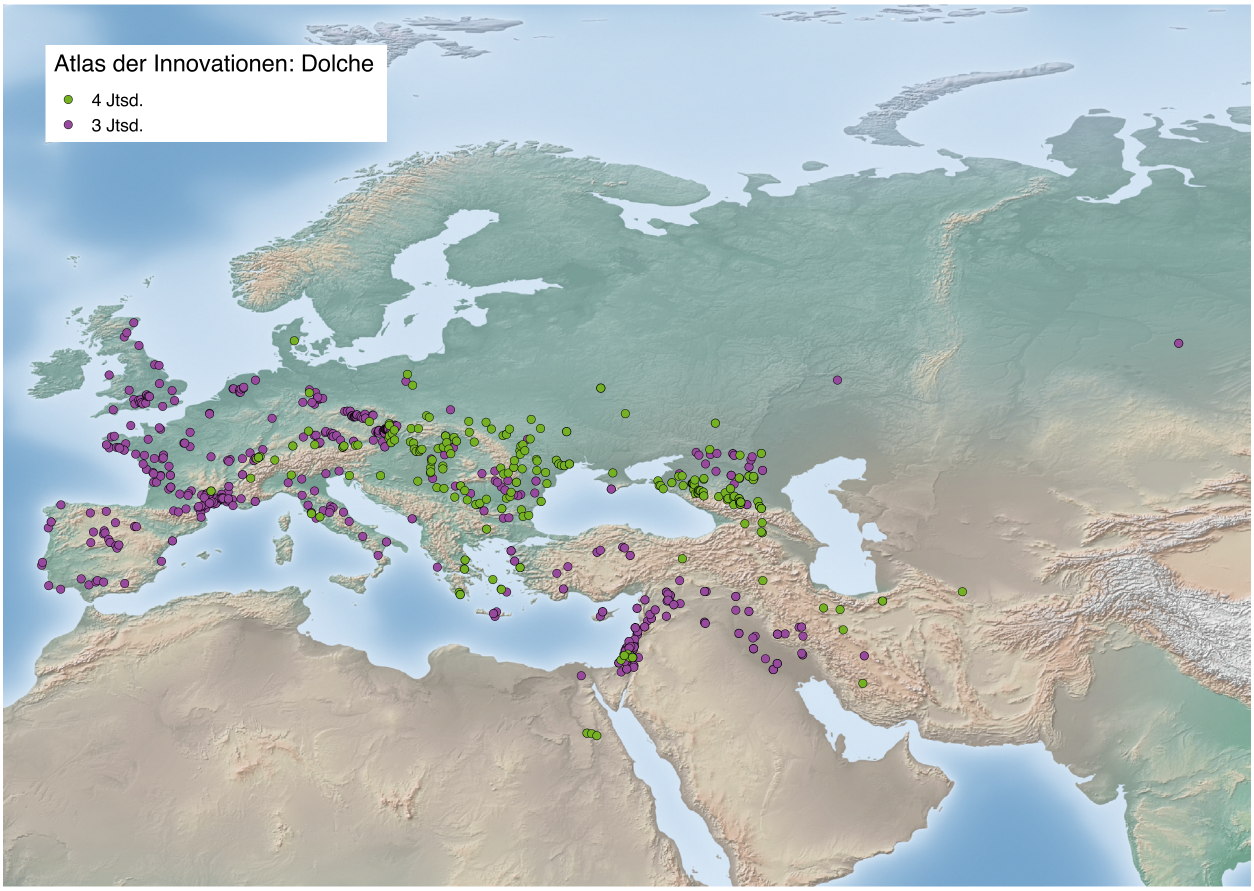


Figure 2: Distribution of Early daggers (Svend Hansen/*Digital Atlas of Innovations*).

Usually, archaeology also interprets technological innovations in this way. New technologies allow for an intensification of production. This, in turn is a means for accumulating surplus and the concentration of economic power in the hands of the few. At the same time, these clusters of innovations might indicate framework conditions which were favourable for the development of new technological methods. Generally, innovative technology is the product of social processes which themselves do not happen according to rules. In a best-case scenario, we may imagine particular support and latitude for creative individuals. However, innovative solutions may as well be the forced answers to situations in which the production process is controlled. Based on ethnographic material, Christian Sigrist drew the conclusion that the process of political centralisation may trigger chains of innovations and that at least the transition period between acephalous and centralised society shows a markedly higher potential for innovation than does acephalous society itself (Sigrist 1975: 248). Among these innovations, of course, one must also count changes in kinship, and within the legal system, for which there may be no immediate archaeological evidence.

There are only few possibilities to exactly determine the chronological distance between invention and innovation. In the 19th century, it was often the case that the lag time between the discovery of a material, or the development of a method and its application in the form of factory production, was as long as 50-90 years.

Technological knowledge: three examples from archaeology

The description of those processes as resulting in technological key innovations is a challenge for archaeology. However, it is no less important to consider the mechanisms for the transfer of technological knowledge within non-literate societies. Jürgen Renn rightly notes, 'the history of science and technology has traditionally privileged innovation over the transmission, transformation and transfer of knowledge' (Renn 2019: X). By way of three examples of the diffusion of products, formulas and technological methods, it is possible to illuminate the chronological and spatial dimensions of the transfer of knowledge.

The dagger

In the 4th millennium the dagger, a technological innovation with far-reaching consequences, became common between the Caucasus and the western Mediterranean. It seems as if Europe north of the Alps was mostly untouched by this development (Fig. 2). For the spread of technological knowledge, the integration of local or regional cultures into the metallurgy chain, from the acquisition of raw materials as far as to the end product, was precondition number one.

The casting of dagger blades, especially of long dagger blades, was a particular challenge. First of all there was the problem of finding a suitable alloy. Pure copper is a soft material. By adding other kinds of metal, such as arsenic, antimony, or tin, a harder kind of metal could be produced (i.e. bronze). For the making of long blades it is furthermore crucial that pure copper, in the molten state, attracts oxygen and produces bubbles. These bubbles then form cavities in the cast object. Accordingly, such an object is more prone to breaking. This risk is increased the thinner the cast object is. Thus, in particular in the case of dagger blades, the alloy was necessary. Indeed, it seems to appear for the first time only in the late 5th or early 4th millennium. Insofar as it is possible, the identification of regionally specific methods of producing early alloys is part of the project 'Digitaler Atlas der Innovationen' (*Digital Atlas of Innovations*).[1] The demand for metal blades was high – they were efficient weapons – accordingly there was considerable interest in making them. Thus, for early daggers, there is evidence of a variety of designs as well as of different regional solutions for mounting. That is to say that there are indications for the development of different traditions.

Recipes

Concerning the spread of a technological innovation such as the dagger, several models may be imagined. Theoretically, it is possible that one imported finished product was copied or recreated by way of experimentation. Actually, however, there are indications that the spread of technological knowledge may even have included recipes for production. For example, in recent years, a number of objects have become known which are made of copper-silver alloys with high percentages of silver (up to 35%). These include daggers, axes and one spearhead, for which the objects' high percentage of silver cannot be interpreted to be in line with any equivalent increase in functionality (Hansen 2001). Rather, these items are instead (usable) ceremonial weapons. The meaning of the proportions of silver included in these objects is unclear because, aesthetically speaking, the same silvery gleam could also have been achieved by way of lower additions of silver. As these objects are not imports from a production centre, but rather local designs, the appropriate recipe must have been widespread. All these finds can be dated to the period between 3200-2750 BCE.

Lost-wax casting

Another example of the rapid and wide-ranging spread of technological knowledge can be identified through an examination of metal animal figurines from the 4th millennium BCE. Among these are the masterpieces represented by the two silver cattle figures from the large Maykop kurgan in the northwestern Caucasus (Piotrovskij 2013: 313, fig. 20.15-16). They were part of the burial equipment of a 10 m-high burial mound, most likely dating to the mid 4th millennium BCE. These cattle figurines (which are just 7.6 cm and 9.2 cm long respectively) show an extraordinary wealth of details, quite different from the two cattle figurines from Bytýn, Voivodship of Wielkopolskie, which can be dated to the second half of the 4th millennium (Łęczycki 2004). Together with six flat axes, they were found near a large stone. The cattle are shown as stubby, short-legged animals whose massive spread outwards to provide the figurines with stability. Both cattle are connected by a yoke, which was broken in the process of their discovery, thus they served as draught animals for a wagon, plough, or a leveller. However different the plastic skills of the sculptors may have been, both in the Caucasus and in Greater Poland the casters were masters of their craft. These animal figurines count among the earliest secure evidence for the use of the lost wax technique (which allowed for the creation of almost any design) (Born 2001: 182ff; Goren 2008: 376ff; Levy 2007: 93ff).

To this end, a wax model of the object to be cast had first to be made. This was then covered in clay and finally fired, so that the wax would melt away. Finally, with the help of a funnel, the liquid metal could be filled into the earthen mould that had been created.

Research underestimates the importance and frequency of this casting technique for the Copper and Bronze Age caster. No doubt, the making of a wax model and the details of the very complex construction method of the earthen mould required significant time investment. On the other hand, with the lost-wax method, the laborious and no less time-consuming reworking of the metal burrs resulting from casting in bivalve moulds was no longer necessary. Furthermore, the lost wax technique is almost the only one which allows for the accurate creation and recreation of fine decoration. Nevertheless, every successful casting is accompanied by a number of failures.

The earliest evidence of lost-wax casting dates back even as far as the 5th millennium BCE. In 1961, in a cave near Nahal Mishmar on the Dead Sea in Israel, a hoard consisting of more than 400 metal objects was found (Bar-Adon 1980; Goren 2008; on dating see Klimscha 2013: 37). The objects include mace-heads, crowns, a

[1] In cooperation with Barbara Helwing and Jürgen Renn.

Figure 3: Small, cast metal vessel from the Nahal Mishmar find (after Bar-Adon 1980).

small vessel (Fig. 3) and standards, as well as simple tools. Among those objects, which must have been made by applying the lost-wax technique, was found one attachment showing ibex heads, a 'crown' with attachments designed as animals, one sceptre with two ibex figurines, and small, cast vessels. Thus, for the time being, the finds from Nahal Mishmar are the earliest evidence of the application of the lost-wax technique. However, they were certainly not the only objects of their kind, e.g. among the gold finds from Varna on the Bulgarian Black Sea coast we also have evidence of lost-wax casting (Pernicka 2013: 72).[2]

The distribution of metal animal figures in the 4th millennium BCE from the Persian Gulf as far as southern Germany naturally shows large gaps. However, it also becomes obvious that all cultural borders were crossed over a distance of *c.* 5000 km. The find from Nahal Mishmar is proof that this casting technique existed for at least 500 years before we encountered it in the form of an entire group of animal figures dating from almost the same period.

What these three examples have in common is that they demonstrate that technological knowledge spread across large geographic areas within a 'short' timespan. The daggers, the silver alloys, and the animal figures must be understood as belonging to local milieus and, thus, to be the result of knowledge transfer which included both knowledge of alloys and of casting techniques. This technological knowhow did not remain within 'cultural' boundaries or political entities. The actual spread of daggers may have been even wider than that shown by the distribution map, as this only shows those areas where daggers were put into a grave or buried in the ground as offerings to imaginary powers, according to local ritual practices. All these examples are comparably few in terms of finds, given the large area and the long period of time. They must, in actual fact, represent a much more voluminous production, as this mastery of making blades or animal figures can only be achieved over the course of extensive practice. To achieve this routine, there must have been an appropriate demand, which then resulted in specialisation. Technological innovations become visible when they have generally pushed through and become embedded in social practice. The beginnings of such an innovation, however – such as in the case of lost-wax casting – cannot easily be grasped archaeologically. In the case of metal craft, the production of knowledge, the handing over of knowledge, and the spread of knowledge require that the network of specialists be both sufficiently dense and stable.

The spread of technological knowledge

Older ideas (most of all those influenced by Gordon Childe) expressed little doubt that all significant technological innovations developed within civilisation hubs, i.e. in Mesopotamia or in Egypt, and only afterwards spread out towards the peripheries. It was in Mesopotamia that we found the 'cradle of civilisation'. Now, with the calibration of radiocarbon data and the establishment of systems of chronology that are independent of typology, it is possible to assess this idea empirically. As a result, new prospects have opened up concerning the question of innovation hubs for certain technologies and their spread. For example – as in the case of wheeled vehicles – the older idea of '*ex oriente lux*' has come into conflict with radiocarbon data. As a matter of fact, it turns out that the oldest evidence of wheeled vehicles between Mesopotamia and the North Sea must be dated to *c.* 'the same time', i.e. *c.* the mid 4th millennium BCE (Burmeister 2004).[3] Thus, on the one hand, the ^{14}C method opens up unimagined possibilities of dating, while, at the same time, there remains a degree of chronological vagueness in many cases. It is important to say this first so as to keep expectations realistic.

The most important Neolithic innovations, i.e. the domestication of sheep/goat, cattle and pigs, the invention of pottery, the production of clay figurines, and much more, happened in the Fertile Crescent, between the Levant in the west via the Taurus Mountains in the north and the Zagros in the east. According to common opinion, the spread of the Neolithic was achieved by humans who carried the

[2] On the lost-wax casting of Copper Age hammer axes, see Schubert and Schubert 1999: 671.

[3] Here, 'at the same time' must be understood in the sense of chronological selectivity in the field of archaeology. It may be that an actual difference of 100 years could hide behind phenomena that seem to us to appear to have happened at the same time.

'Neolithic package' west and east on their search for arable land (Çilingiroğlu 2005; Özdoğan 2011). This scenario is supported by paleo-genetic analyses of the four above-mentioned livestock species, all of which indicate an origin in the Fertile Crescent (for sheep, see Rohrlach *et al.* 2021; Vigne *et al.* 2017).

In the case of the invention of pottery, it has been recognised in recent years that the earliest (still Palaeolithic) pottery appeared in the hunter-gatherer societies of East Asia and that this innovation spread across the broad northern belt of the Russian forest zone as far as the Baltic region, where Late Mesolithic fishermen and hunters made use of it (Piezonka 2011: 121ff). However, pottery has also been found in West Africa that can be dated to the 10th millennium BCE (Huysecom *et al.* 2009). In this respect, there remains a considerable need for research to either identify possible connections between these two developments of early pottery or to prove them to have been autochthonous developments.

When compared to the 'Neolithic package', the 4th millennium innovation cluster nevertheless shows a different structure. It is likely that these innovations were not all achieved in the same region. The spread of innovations shows different patterns – they cannot, thus, be understood as one 'package'.

At first glance, one might be inclined to imagine the rapid spread of innovations as a normal occurrence, indeed because there is, or would have been, an (alleged) interest in them. In the case of the 'Neolithic package', this was not the case. Those who spread this new type of economy and this new way of life towards the west did so while displacing the local groups of hunter-gatherers. The knowledge of the farmer, on the other hand, was dysfunctional within the milieu of the hunters. Thus, the rapid spread of innovations was not at all a matter of course. Nevertheless, this may have occasionally happened (such as in the case of the wagon, whose usefulness is evident). Quite often, however, there was an attempt to monopolise technological knowledge and to withhold it from others. The spread of fire by Prometheus is the classic example of the first betrayal of secrets, and the punishment the gods inflicted on this cultural hero could hardly be more visible and severe: to prevent any future spread of knowledge, he was chained in the far-away Caucasus.

Ethnological and historical cases

Gordon Childe presented a much more optimistic view. His figure of the wandering craftsman became an influential model for the transfer of knowledge in the early period of the mining and processing of metal. For Childe, the metal craftsman was the first full-time specialist – one who did not only have complex technological knowledge but also possessed magic: matter-transforming knowledge which in a way separated him from society (Childe 1930: 10). This particular status served as protection and allowed him to offer his products across long distances. It was the mobile metal craftsman who spread the knowledge of metallurgy from the Middle East to Europe (Childe 2009: 171). Some doubt was cast on this model from an ethnological point of view in the early 1970s. The smith, it was said, had in many cases not been a full-time specialist, and the smith's social status had been very different; far from being stigmatised, he or she was instead highly respected (Neipert 2006). Most smiths, however, had been nonmobile, although there were indeed examples of wandering metal craftsmen (Rowlands 1971: 210ff.). The last to discuss ethnographic examples of the social status of the metal craftsman and his mobility has been Oliver Dietrich; he came to the conclusion that seasonal or permanent mobility appears only seldomly, and then usually based only on a particular specialisation in particular products. Mobility, says Dietrich, is limited to a few moments in the life of the smith, such as when founding a new workshop in a new place. Apart from this, there is evidence of long-distance travels to purchase certain raw materials (Dietrich 2012: 212-214). Recently, arguments have been put forward which have suggested that, in the Early Bronze Age, the smith originated from an appropriate family environment (Kienlin 2007: 17). Apart from acquiring the necessary knowledge, this came alongside the adaptation of social norms. Spatial communication had been happening within a network of family relations. Kinship, it was claimed, opens up a space of communication and allows for interaction over longer distances. Seclusion within the family environment, however, may instead reduce the spread of knowledge and limit its increase.

In the Bronze Age states of the Middle East and Egypt, metal craftsmen were tied to the palace. This also applied in terms of craftsmen's working spaces as well, as can be seen at Qatna in Syria or in Argive Tiryns, where workshops are localised at the palace (regarding Qatna, see Morandi Bonacossi 2009: 147-149; Rahmstorf 2015). It seems as if the organisation of crafts was orchestrated in such a way as to limit and seclude the transfer of knowledge, instead of supporting and facilitating it. This applies first of all to those specialists involved in the production of technological premium products in metal, glass, or ivory.

Dietrich quite rightly points to the limited explanatory range of ethnographic examples. For, in most cases the focus is on iron smiths in Africa. The production and processing of bronze and iron, however, are very different from each other. As a result, we may suppose that those disparities resulted in different ways of organising the craft. Furthermore, there are some basic reasons to no longer believe, with Lévi-Strauss (2012: 24), that such societies could 'illustrate our distant past'. In most cases, the ethnographic case studies are not particularly enlightening: they have no chronological depth and are just snapshots. However, there are several studies with chronological depth from younger historical epochs.

Between 1576 and 1844, in Languedoc in the south of France, in the small town of Saint-Jean-de-Fos, there were a total of 426 active potters, 28 of whom had come from abroad (Vaysettes 1986: 17ff). Most of them stayed in the region, however some crossed considerable distances. For example, Paul Caussy, born in 1659 into a family of potters in Clermont-l'Hérault, went first to Saint-Jean-de-Fos in 1680, then to Aix-les-Bains in the Alps, and finally as far as Hagenau in Alsace and Rouen in Normandy. There, his son Pierre-Paul became a famous maker of faience (Lecomte *et al.* 2009: 272ff). This now demonstrates that we have to assume only a few mobile individuals and that family relations were not necessarily the crucial criterion for the direction of mobility, but rather that belonging to a craft was the main criterion. Still today this is still the situation among carpenters (Lemke 2002). The mobility of potters is also well documented elsewhere, e.g. the immigration of families of potters between the Westerwald region in Germany and Alsace, France. In the 16th century it was the potters Anno and Christian Knütgen from Siegburg, Jacques Remy from Lorraine, and the Mennicken and Kalb families who, at their new home at Höhr-Grenzhausen in Westerwald, contributed their technological experience with salt glaze and blue colours to the creation of earthenware (*Steinzeug*), which soon became market-leading (Höltken 2000: 118).[4]

The earthenware potters evaded the armed conflicts of their time. A massive transfer of technology and knowledge can also be read from the cases of persecuted groups. For example, northern Hesse and Brandenburg benefitted significantly from the crafting skills of the French protestants (Huguenots) in the 17th century. Trades such as leather, silk, velvet, and wool production contributed to the upswing thanks to new techniques and better tools (Benecke and Ottomeyer 2005: 285ff). The Ottoman Sultan Bayezid, who granted protection and accommodation to Jews expelled from the Iberian Peninsula in 1492, is reported to have said: 'How foolish the Spanish kings are, to expel their best citizens and to leave them to their worst enemy' (Bossong 2008: 57).

How precisely did the spread of technological knowledge work? The spatial communication of technological knowledge is likely to have happened in the same ways as did the local continuation of traditions, i.e. by personal communication. Over the course of several studies, Claude Lévi-Strauss pursued the transformation of legends on the American continents, thus contributing to our understanding of the spread and transformation of narrative motifs (in part, see Lévi-Strauss 1993). The oral communication of knowledge is a constant process, based on an economy of remembering. Only what is most important is stored, and what has become unimportant is left to oblivion.[5] Selective oblivion is a precondition for the functioning of the collective memory. Karl-Heinz Kohl put this succinctly: 'Thus, only seemingly does tradition determine presence. For, actually, precisely the opposite is the case. It is the presence which, after all, decides what in each case is considered the real tradition'(Kohl 2010: 167). This is also a precondition for technological innovation.

The evidence suggests that, in oral societies, perception and imitation are of crucial significance for the passing on and spreading of crafts and technological knowledge. In the case of specialised crafts, we must assume real apprenticeships. Richard Sennett (2009) estimates that to achieve mastery, practical exercises of at least 10,000 hours are necessary; probably it is much more. Jack Goody (2010: 44) emphasises practical exercise when he remarked that 'no farmer [has] learned agriculture by reading an agricultural handbook'. This also holds for metalcraft. Lost-wax casting is a complex technique which is connected to choosing and processing the necessary raw materials (copper, arsenic, tin, clay, wax) for which both experience and a variety of 'tricks' (*Kniffe* in German) are important.

The preservation and transfer of knowledge

When it comes to passing on and spreading technological knowledge, the form of organisation is crucial to how knowledge is updated and reproduced. In the case of oral cultures, we may at first assume a family or personal relations environment for crafts specialisation. With the introduction of writing, schools were in charge of communicating this new technology and, increasingly, also of communicating the knowledge they had stored. Regulation by stable power structures minimises uncertainties, which is an important precondition for the further development of collective knowledge.

We must also assume the existence of a common identity for the bearers of technological knowledge, which may also be combined with strategies of social seclusion.

[4] See Schindler 2007: 72 on the decline due to a changed drinking culture.

[5] Thus, the situation is precisely the opposite of today's obsession with the archive.

In this way 'communities of thought' could stabilise, which is indispensable for the further development and passing on of practical experiences and for the swift exchange of relevant information (Heidenreich 1997).

This is why the concept of 'communities of practice' is remarkable (i.e. Wenger 1998). A 'community of practice' is defined by the existence of craftsmen trained in different professions and who share and pass on their knowledge. A 'community of practice' may be formed by different specific social groups. Communities of practice may quite probably have emerged sometimes for very practical reasons. Advanced pyrotechnics were just as important for pottery as they were for metallurgy. Both potters and metal casters transformed the material. I have explained elsewhere that the idea of alloying copper with other metals probably originated in pottery production (Hansen 2017). There, adding straw or small stones or other tempering material to the clay was a method that made firing the vessel easier and also changed the properties of the vessel.

In the context of Bronze Age civilisations, these 'communities' were the palace workshops themselves. In this context, it was possible to transform knowledge from one craft to another, thus forming the basis for further innovation. The exchange of knowledge was, and is, not only a precondition for technical innovations. Knowledge transfer is also a prerequisite for the preservation of that knowledge for the future. In societies without writing, technical knowledge could only be passed on through direct personal instruction. Without this transfer, knowledge would simply have become extinct with the death of its bearer.

This mechanism may also be the reason for the global technological differences discussed by Childe and Lévi-Strauss. The special characteristic of the Eurasian region is that Neolithisation took place over a wide geographical area with more or less the same domesticated animals and plants; thus, very similar technical equipment existed between central Asia and the Atlantic already in the 6th millennium BCE. The special features of this Neolithisation, in combination with the geography of the continents, have been described very clearly by Jared Diamond (1997: 177-191). With the spread of the Neolithic mode of production, a huge economic area was created in western Eurasia. It was based on the same animal husbandry (sheep/goat, cattle, pig) in different proportions. In the 7th and 6th millennia, basically the same tools were made from stone, bone or antler. At the beginning, each colonisation step of the Neolithic settlers was accompanied by characteristic pottery and small clay figurines, symbolising the common origin of the settlers. It remains pure speculation whether or not they were speaking similar dialects. However, we may assume that the increasing size of the population and the increase in communication and knowledge transfer probably played an important role in an 'epistemic evolution' as one part of the cultural evolution, which ultimately led to the development of the sciences (Renn 2019: 323-358; Renn and Laubichler 2017). Even if the numbers of the earliest Neolithic settlers in Europe were insufficient to settle the whole landscape, exchange in raw materials, e.g. flint, was one of the many aspects for the sustainment of networks.

In the 5th millennium BCE, economic space became much more diverse, caused by the emergence of metallurgy in the east and the erection of megalithic tombs in the west of Europe. In this process, geographical space and existing technological development were not abstract variables. Rather, they were controlled and directed by chiefs and early kings. Christian Jeunesse wrote: 'Generally speaking, one could say that the existence of a king explains the invention of the lost wax technique in Varna or in the Maikop culture and drives the processes that led to the erection of the Er Grah broken menhir at Locmariaquer, and certainly not the reverse' (Jeunesse 2017: 184).

For the transfer of knowledge, we must, therefore, also consider its control by the ruling families from the outset. Unlike Childe, we nowadays know that large parts of Europe in the 5th millennium BCE were highly networked and that the transfer of knowledge was directed through these networks (Pétrequin *et al.* 2002). One of these networks was created by the production and exchange of jadeite prestige axes in the western parts of Europe, and another by the production and exchange of heavy copper axes. It is obvious that both networks of the 5th and 4th millennia were also connected with each other. The strong ties in these networks were the result of a certain type of gift exchange which served as a social institution, as described by Bronislaw Malinowski and Marcel Mauss 100 years ago (Hansen 2023; Malinowski 1922-1932; Mauss 1968).

Acknowledgement

'Forging Identities' was the name of our joint research project, which was prepared over a long period of time and finally realised in 2009-2012. Helle was the coordinator and led the project. It was a great time with incredibly fruitful academic discussions. I would like to thank Samantha Reiter and Heide Wrobel Nørgaard, who were also part of this project, for inviting me to contribute to this Festschrift.

Bibliography

Bar-Adon, P. 1980. *The Cave of the Treasure. The Finds from the Caves in Nahal Mishmar*. Jerusalem: The Isreal Exploration Society.

Benecke, S. and H. Ottomeyer (eds) 2005. *Zuwanderungsland Deutschland. Die Hugenotten*. Berlin: Deutsches Historisches Museum.

Born, H. 2001. Die Herstellungstechnik der Helme und Waffen, in H. Born and S. Hansen (eds) *Helme und Waffen in Alteuropa*: 167-268. Mainz: Philipp von Zabern.

Bossong, G. 2008. *Die Sepharden. Geschichte und Kultur der spanischen Juden*. München: C.H. Beck.

Burmeister, S. 2004. Der Wagen im Neolithikum und in der Bronzezeit: Erfindung, Ausbreitung und Funktion der ersten Fahrzeuge, in M. Fansa (ed.) *Rad und Wagen. Der Ursprung einer Innovation. Wagen im Vorderen Orient und Europa*: 13-40. Oldenburg: Phillip von Zabern.

Childe, V.G. 1930. *The Bronze Age*. Cambridge: Cambridge University Press.

Childe, V.G. 2009 [1958]. *The Prehistory of European Society*. London: Spokesman Press.

Çilingiroğlu, Ç. 2005. The concept of 'Neolithic package': considering its meaning and applicability. *Documenta Praehistorica* 32: 1-13.

Diamond, J. 1997. *Guns, Germs, and Steel. The Fates of Human Societies*. New York: W.W. Norton & Co.

Diamond, J. 1999. *Arm und Reich. Die Schicksale menschlicher Gesellschaften*. Frankfurt: Fischer.

Diner, D. 2017. *Aufklärungen. Wege in die Moderne*. Stuttgart: Reclam.

Dietrich, O. 2012. Travelling or not? Tracing Individual Mobility Patterns of Late Bronze Age Metalworkers in the Carpathian Basin, in L. Marta (ed.) *The Gáva Culture in the Tisa Plain and Transylvania. De Gáva-Kultur in der Theißebene und Siebenbürgen*: 211-229. Symposium Satu Mare 17-18 June 2011. Studii **şi** Comunicări 28. Satu Mare: Muzeu.

Gideon, S. 1948. *Mechanization Takes Command. A Contribution to Anonymous History*. Minneapolis: University of Minnesota Press.

Goody, J. 2001. Wissen und die Arten seiner Weitergabe, in J. Fried and J. Süssmann (eds) *Revolutionen des Wissens. Von der Steinzeit bis zur Moderne*: 40-55. München: C.H. Beck.

Goody, J. 2010. *The Eurasian Miracle*. Cambridge: Polity.

Goren, Y. 2008. The Location of Specialized Copper Production by the Lost Wax Technique in the Chalcolithic Southern Levant. *Geoarchaeology* 23: 374-397.

Gorz, A. 2004. *Wissen Wert und Kapital. Zur Kritik der Wissensökonomie*. Zürich: Rotpunktverlag.

Hansen, S. 2001. Waffen aus Gold und Silber während des 3. und frühen 2. Jahrtausends v. Chr. in Europa und Vorderasien, in H. Born and S. Hansen (eds) *Helme und Waffen Alteuropas*: 11-59. Mainz: Philipp von Zabern.

Hansen, S. 2011. Technische und soziale Innovationen in der zweiten Hälfte des 4. Jahrtausends v. Chr., in S. Hansen and J. Müller (eds) *Sozialarchäologische Perspektiven: Gesellschaftlicher Wandel 5000-1500 v. Chr. zwischen Atlantik und Kaukasus*: 153-191. Archäologie in Eurasien 24. Mainz: Philipp von Zabern.

Hansen, S. 2013a. Innovative metals: copper, gold and silver in the Black Sea region and the Carpathian Basin during the 5th and 4th millennia BC, in S. Burmeister, S. Hansen, M. Kunst and N. Müller-Scheessel (eds) *Metal Matters. Innovative Technologies and Social Change in Prehistory and Antiquity*: 137-170. Rhaden/Westf.: Verlag Marie Leidorf.

Hansen, S. 2017. Key Techniques in the Production of Metals in the 6th and 5th Millennia BC: Prerequisites, Preconditions and Consequences, in J. Maran and P.A. Pisteper (eds) *Appropriating innovations: entangled knowledge in Eurasia 5000-1500 BC*: 136-148. Papers of the Conference, Heidelberg, 15-17 January 2015. Oxford: Oxbow Books.

Hansen, S. 2023. Bronisław Malinowski, Marcel Mauss und die Entdeckung der Gabe: Ein Gesellschaftsvertrag vor dem Staat, in A. Abar, M.B. Thuesen, G. Cyrus, V. Egbers, J. Eger, I. Heit, B. Irvine, C. Kainert, J. Köhler, M. Mishmastnehi, B. Öğüt, S. Parsa, G. Russo, J. Schönicke, S. Schreiber, F. Tourtet and L. Wolf-Heger (eds) *'What Does This Have to Do with Archaeology?' Essays on the Occasion of the 65th Birthday of Reinhard Bernbeck*: 83-94. Leiden: Sidestone Press.

Heidenreich, M. 1997. Die soziale Strukturierung technischen Wissens, in B. Blättel-Mink and O. Renn, (eds) *Zwischen Akteur und System. Die Organisation von Innovation*: 177-206. Opladen: VS Verlag für Sozialwissenschaften.

Höltken, T. 2000. Die Keramik des Mittelalters und der Neuzeit aus dem Elsbachtal. Unpublished dissertation, Rheinische Friedrich-Wilhelms-Universität Bonn (available at: https://bonndoc.ulb.uni-bonn.de/xmlui/handle/20.500.11811/1739).

Huysecom, E., M. Rasse, L. Lespez, K. Neumann, A. Fahmy, A. Ballouche, S. Ozainne, M. Maggetti, Ch. Tribolo and S. Soriano 2009. The emergence of pottery in Africa during the 10th millennium calBC: new evidence from Ounjougou (Mali). *Antiquity* 83(322): 905-917.

Jeunesse, CH. 2017. From Neolithic kings to the Staffordshire hoard: Hoards and aristocratic graves in the European Neolithic: The birth of a 'Barbarian' Europe?, in P. Bickle, V. Cummings, D. Hofmann and J. Pollard (eds) *The Neolithic of Europe: Papers in Honour of Alasdair Whittle*: 175-187. Oxford: Oxbow Books.

Kienlin, T.L. 2007. Von den Schmieden der Beile: Zu Verbreitung und Angleichung metallurgischen Wissens im Verlauf der Frühbronzezeit. *Praehistorische Zeitschrift* 82: 1-22.

Kohl, K.-H. 2010. Die Ethnologie und die Rekonstruktion traditioneller Ordnungen, in J. Fried and M. Stolleis (eds) *Wissenskulturen. Über die Erzeugung und*

Weitergabe von Wissen: 159-180. Frankfurt: Campus Verlag.

Kohl, K.-H. 2011. Einleitung, in C. Carstensen, S. Jauernig, H. Kammler and K.-H. Kohl (eds) *Transfer und Wiederaneignung von Wissen*: 9-20. Altenstadt: ZKF Publikationen.

Lecomte, C., J. Thiriot and J.-L. Vaysettes 2009. Évolution et immobilisme chez le potiers-faïenciers du Pila-Saint-Gély à Montpellier au XVIIe siècle: le rôle de la migration des artisans dans la transmisson des savoir-faire, in N. Meyer-Rodrigues and M. Bur (eds) *Les arts du feu. Actes de congrès nationaux des sociétés historiques et scientifiques*: 272-295. Paris: Editions du CTHS.

Łęczycki, S. 2004. Kietrz, Bytyń, Szczecin-Śmierdnica. Einige Anmerkungen zur Kulturzugehörigkeit des Hortfundes von Bytyń. *Sprawozdania Archeologiczne* 56: 33-59.

Lemke, G. 2002: *Wir waren hier, wir waren dort. Zur Kulturgeschichte des modernen Gesellenwanderns*. Köln: PapyRossa Verlag.

Leroi-Gourhan, A. 1943. *Évolution et techniques – tome 1 – L'Homme et la Matière*. Paris: Albin Michel.

Leroi-Gourhan, A. 1964. *Le Geste et la Parole – tome 1 – Technique et Langage*. Paris: Albin Michel.

Leroi-Gourhan, A. 1965. *Le Geste et la Parole – tome 2 – Mémoire et les Rythmes*. Paris: Albin Michel.

Leroi-Gourhan, A. 1984. *Hand und Wort. Die Evolution von Technik, Sprache und Kunst*. Frankfurt am Main: Suhrkamp Verlag.

Lévi-Strauss, C. 1981. *Das Wilde Denken*. Frankfurt: Suhrkamp Verlag.

Lévi-Strauss, C. 1993. Die Luchsgeschichte. Zwillingsmythologie in der Neuen Welt. München: Carl Hanser.

Lévi-Strauss, C. 2012. *Anthropologie in der modernen Welt*. Berlin: Suhrkamp Verlag.

Levy, T.E. 2007. *Journey to the Copper Age. Archaeology in the Holy Land*. San Diego: Museum of Man.

Malinowski, B. 1922-1932. *Argonauts of the Western Pacific. An Account of Native Enterprise and Adventure in the Archipelagoes of Melanesian New Guinea*. London: George Routledge & Sons.

Mauss, M. 1968 [1923]. *Die Gabe. Form und Funktion des Austausches in archaischen Gesellschaften*. Frankfurt am Main: Suhrkamp Verlag.

Mauss, M. 1989. Die Techniken des Körpers, in M. Mauss (ed.) *Soziologie und Anthropologie 2*: 199-220. Frankfurt am Main: Fischer.

Mensch, G. 1975. Das technologische Patt. Innovationen überwinden die Depression. Frankfurt am Main: Umschau Verlag.

Morandi Bonacossi, D. 2009. Massenproduktion – Die Werkstätten im 2. Jahrtausend v. Chr., in M. Al-Magdisi, D. Morandi Bonacossi and P. Pfälzner (eds) *Schätze des Alten Syrien. Die Entdeckung des Königreichs Qatna*: 147-159. Stuttgart: Theiss Verlag.

Neipert, M. 2006. *Der Wanderhandwerker*. Rahden/Westf.: Verlag Marie Leidorf.

Özdoğan, M. 2011. Archaeological Evidence on the Westward Expansion of Farming Communities from Eastern Anatolia to the Aegean and the Balkans. *Current Anthropology* 52: S415-S430 (available at: https://www.journals.uchicago.edu/doi/full/10.1086/658895).

Pernicka, E. 2013. Die Ausbreitung der Metallurgie in der Alten Welt, in Y. Piotrovsky (ed.) Бронзовый Век Европа без Границ Bronzezeit - Europa ohne Grenzen. Katalog zur Ausstellung Eremitage St. Petersburg, 2013: 66-78. St. Petersburg: Tabula Rasa.

Pétrequin, P., S. Cassen, C. Croutsch and M. Errera 2002. La valorisation sociale des longues haches dans l´Europe néolithique, in J. Guilaine (ed.) *Matériaux, productions, circulations du néolithique à l´âge du Bronze*: 67-98. Paris: Editions Errance.

Piezonka, H. 2011. Wildbeuterkeramik zwischen Weißrussland und Weißem Meer. Neue Forschungen zur Ausbreitung früher Tonware in das Gebiet östlich und nördlich der Ostsee. *Eurasia Antiqua* 17: 121-156.

Piotrovskij, Y. 2013. Maikop-Kultur, in Y. Piotrovsky (ed.) *Бронзовый Век Европа без Границ Bronzezeit – Europa ohne Grenzen. Katalog zur Ausstellung Eremitage St. Petersburg*: 308-340. St. Petersburg: Tabula Rasa.

Rahmstorf, L 2015, Workshop activities and pyrotechnology at Mycenaean Tiryns, in A.-L. Schallin and I. Tournavitou (eds) *Mycenaeans up to date. The archaeology of the northeastern Peloponnese – current concepts and new directions*: 143-149. Stockholm: Swedish Institute at Athens.

Rammert, W. 2006. *Technik, Handeln und Sozialstruktur: Eine Einführung in die Soziologie der Technik*. TUTS – Working Papers, 3-2006. Berlin: Technische Universität Berlin.

Renn, J. 2019. *The Evolution of Knowledge. Rethinking Science for the Anthropocene*. Princeton: Princeton University Press.

Renn, J. and M. Laubichler 2017. Extended Evolution and the History of Knowledge, in F. Stadler (ed.) *Integrated History and Philosophy of Science. Problems, Perspectives, and Case Studies*: 109-125. Cham: Springer International Publishing.

Rohrlach, A.B., L. Papac, A. Childebayeva, M. Rivollat, V. Villalba-Mouco, G.U. Neumann, S. Penske, E. Skourtanioti, M. Van De Loosdrecht, M. Akar, K. Boyadzhiev, Y. Boyadzhiev, M.-F. Deguilloux, M. Dobeš, Y.S. Erdal, M. Ernée, M. Frangipane, M. Furmanek, S. Friederich, E. Ghesquière, A. Hałuszko, S. Hansen, M. Küßner, M. Mannino, R. Özbal, S. Reinhold, S. Rottier, D.C. Salazar-García, J.S. Diaz, P.W. Stockhammer, C.R. De Togores Muñoz, K.A. Yener, C. Posth, J. Krause, A. Herbig and W. Haak 2021. Using Y-chromosome capture enrichment to resolve haplogroup H2 shows new evidence for a two-path Neolithic expansion to Western Europe. *Scientific Reports* 11: 15005 (available at: https://doi.org/10.1038/s41598-021-94491-z).

Rowlands, M.J. 1971. The archaeological interpretation of prehistoric metalworking. *World Archaeology* 3: 210-224.

Schindler, T. 2007. Marburger aufgelegte Ware. Dimensionen von Sachkultur. Unpublished dissertation, Philipps-Universität Marburg.

Schubert, E. and F. Schubert 1999. Die Hammeräxte vom Typ Handlová, in F.R. Herrmann (ed.) *Festschrift für Günter Smolla*: 657-671. Wiesbaden: Landesamt f. Denkmalpflege Hessen.

Sennett, R. 2009. *Handwerk*. Berlin: Berliner Taschenbuch Verlag.

Sherratt, A. 1997. *Economy and Society in Prehistoric Europe. Changing Perspectives*. Edinburgh: Edinburgh University Press.

Sigrist, C. 1978. Gesellschaften ohne Staat und die Entdeckungen der social anthropology, in F. Kramer and C. Sigrist (eds) *Gesellschaften ohne Staat*: 28-44. Frankfurt: Syndikat.

Vaysettes, J.-L. 1986. Les potiers de terre de la région Saint-Jean-de-Fos dépuis le Moyen-Age. Thèse de Doctorat, Université Aix-Marseille 1.

Vigne, J.-D., L. Gourichon, D. Helmer, L. Martin and J. Peters 2017. The Beginning of Animal Domestication and Husbandry in Southwest Asia, in Y. Enzel and O. Bar-Yosef (eds) *Quaternary of the Levant: Environments, Climate Change, and Humans*: 753-760. Cambridge: Cambridge University Press (available at: https://doi.org/10.1017/9781316106754.084).

Wenger, E. 1998. *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press.

Wrangham, R.W., W.C. McGrew, F.B.M. De Waal and P. Heltne (eds) 1994. *Chimpanzee Cultures*. Harvard: Harvard University Press.

Chapter 14

The Copper Age in the western Baltic

Anne Birgitte Gebauer,[1*] Mads Lou Bendtsen[1] and Lasse Vilien Sørensen[1]

[1]Department of Prehistory in Denmark, The National Museum of Denmark, Copenhagen, Denmark

[*]abgebauer3@hotmail.com

Abstract

The western Baltic area is exceptionally rich in copper artefacts from the Early Neolithic period of the Funnel Beaker culture, dating to 4000-3300 BCE. Copper artefacts were imported in such quantities that, in terms of weight, the quantity of metal far exceeds the amount found in the Alpine region and the areas between Scandinavia and the Alps. Evidence of metallurgy in the western Baltic during the Neolithic is demonstrated by a holding crucible and a possible tuyère from Lønt, Denmark, examples of the deliberate fracture of flat axes by hot-shorting at Neuenkirchen and Nadrensee, Germany as well as Lackalänga, Sweden in addition to reworking of numerous copper flat axes according to local preferences. For decades, the importance of copper artefacts in the western Baltic area and their origins have been intensively discussed, not the least because local copper deposits were not exploited during the Neolithic or Bronze Age. Engagement of the western Baltic area in the copper-based, pan-European network of raw material from mines in Southeastern Europe facilitated information exchange on a range of cultural aspects including extensive imitations of copper objects in flint and stone. The pan-European network collapsed after 3300 BCE, resulting in the exchange of very few copper objects in the later parts of the Funnel Beaker culture. The reasons behind this sudden change are discussed in this chapter.

Introduction

The introduction of early metallurgy in the western Baltic area is a topic that Helle Vandkilde has written about many times based on comprehensive assessments of the finds and the inclusion of metal analyses directed at a social understanding of innovations in metal technology (Vandkilde 1996; 2014). This contribution examines the origin of the earliest copper objects in the western Baltic area, the long-distance connections that brought them to the region, as well as the social significance of the introduction of metal. The first copper objects reached the western Baltic area towards the end of the 5th millennium BCE, resulting in an exceptional amount of copper artefacts circulating during the 4th millennium. In contrast to northern Europe, the first copper objects made of malachite and azurite appear *c.* the late 7th and the early 6th millennium in southeastern Europe, with mining, smelting, and casting of copper being attested c. 5000 BCE (Lutz *et al.* 1997; Rosenstock *et al.* 2016; Nørgaard and Vestergaard 2019; Radivojević and Roberts 2021). In the western Baltic area, an increase in copper artefacts is evident from 4100/4000 BCE onwards with the advancing process of Neolithisation, and a pronounced peak from 3500-3300 BCE (Klassen 2000; Brozio *et al.* 2023: fig.1). Metallurgical skills like cold forging and pyrotechnical processes, e.g. copper melting, can be reconstructed for this phase (Lutz *et al.* 1997). However, hot-shorting of a flat axe at Neuenkirchen, Mecklenburg, dated as early 3800/3700 BCE, provides even earlier evidence of metallurgy in the western Baltic area. Another example of hot-shorting from Lackalända, Sweden, belongs to Klassen's phase 3 from 3500-3300 BCE, while a third example from Nadrensee, Mecklenburg, is only dated at the Early Neolithic due to fragmentation (Klassen 2000: Tafel 27, 100A-B; Skorna 2022, 2024). A crucible from Lønt, Denmark, is dated at the late Early Neolithic *c.* 3800-3300 BCE (Gebauer *et al.* 2020). From *c.* 3300 BCE onwards, a sharp decline in imported material and a discontinuation of local processing can be observed (Klassen 2000). This lasted for almost 1000 years, until a local metal-processing economy evolved around c. 2350 BCE. New exchange routes emerged which became increasingly important from 2000 BCE on and into the Bronze Age. These linked the economies of the western Baltic area primarily with Únětice groups as well as with the British Isles (Nørgaard *et al.* 2021; Brozio *et al.* 2023). This chapter begins with new analyses of the origins of the copper objects in the north and proceeds to look at the chronology and distribution of metalworking north of the Alpine copperworking centres. In the following, the use of copper and the impact of the associated long-distance connections are discussed, as well as the unravelling of these networks as copper imports decline. Finally, an argument is made for the presence of a Copper Age in the early Neolithic in the western Baltic area.

Origins of Early Neolithic copper in the north

For many years, details of the origins of the raw material for early Neolithic copper artefacts from within the western Baltic area remained unclear and needed to be reassessed. Sourcing the origins was of particular importance since local copper deposits in the western

Baltic area were not exploited during the Neolithic or Bronze Age (Ling *et al.* 2012). Thus, any raw material must have been imported (Hansen *et al.* 2015; Nørgaard *et al.* 2021). It has been suggested that the copper mainly came from deposits in southeastern Europe; analysed examples were identified as a type of arsenical copper, the so-called 'Mondsee copper' sourced from the eastern Alps (Matuschik 1998; Klassen 2000; Klassen and Stürup 2001; Krause 2003; Frank and Pernicka 2012; Nørgaard *et al.* 2019). After many years of scientific research and controversial disputes, comparative lead isotope and chemical analyses of ancient metals and ores from known ore deposits are now accepted as the best method to determine the origins of copper, lead, and silver from archaeological contexts (Stos-Gale and Gale 2009; Pernicka 2014; Artioli *et al.* 2020).

Studies by Heide W. Nørgaard and colleagues (2019 and 2021) included 11 samples from early, middle, and late Neolithic periods, nine of which were dated between 3800-2850 BCE and two between 2850-2300 BCE. These data show exclusive links between early copper imports to the north, at the beginning of the 4th millennium BCE, and southeast European copper ore deposits. For finds of ten Danish Bygholm-type flat axes and two Danish arm spirals from the period between 3800-2850 BCE, researchers could establish not only a southeast European origin but could also pinpoint Serbian mining areas as the origins of the copper used in the production of these objects (Nørgaard *et al.* 2021). Further analyses as part of this study also included the flat axe and arm spiral from the Søby Hede hoard, a tongued-shaped flat axe from Viborg, the thick-butted axe from Slusegård, an axe from Moesgaard, and the Bygholm-type flat axe from Kjelstrup. The latter has been interpreted as deriving from Bosnian ores (Klassen 2000; Nørgaard *et al.* 2021), while the isotopic signatures of the others partly overlap with those corresponding to the Bulgarian copper mines of Stara Zagora (Ai Bunar) and Burgas (Mendi Rid) in addition to those of the East Serbian Copper Belt. Included in these studies was the re-analysis of nine samples of the so-called Neolithic 'Riesebusch' copper already measured by Lutz Klassen and Stefan Stürup, which indicated that these earlier results should be regarded as unreliable (Klassen and Stürup 2001; Nørgaard *et al.* 2021).

Examination of the Neuenkirchen hoard by means of two kinds of XRF analysis identified two types of copper known from the early metal horizon of the European Chalcolithic (Skorna 2022, 2024). Furthermore, a synthesis of typological analysis and trace element composition showed that the dagger, large arm spiral, band spirals, and sheet metal fragment included in the hoard originated in western Slovakia and Moravia in the western Carpathian region and had a chronological position *c.* 4000-3800 BCE (Skorna 2022: 149). Typo-chronological studies suggest that the Neuenkirchen dagger is a representative of an independent type, the form of which can probably be traced back to examples from the Black Sea region (Matuschik 1998; Skorna 2022: 158). The band spiral and the sheet metal piece were made of Nógrádmarcal copper, which was used in production of copper artefacts, including sheet metal jewellery in western Slovakia and Moravia *c.* 4000 BCE, from which point it was imported by the northern group of the Funnel Beaker culture (Skorna 2022: 143, 149). The fragmented and difficult to classify flat axe fragment made from Mondsee copper was considered an early northern Alpine import, with a date range between 3800-3500/3300 BCE. Lead isotope analysis on the flat axe fragment revealed that the copper most likely ultimately originated from the Majdanpek mine in eastern Serbia, although the use of copper from deposits in Ai Bunar, Bulgaria, cannot be completely excluded. The earliest possible date of the Neuenkirchen hoard was established at 3800/3700 BCE.

Jan Piet Brozio and colleagues (2023) researched the provenance of the raw material of 45 copper objects of the 4th and 3rd millennia BCE, and compared the material with the geochemical characteristics of prehistoric copper mining sites. The samples included 26 objects from Germany, 12 from Denmark, and seven from Sweden. According to this study, ten flat axes dating *c.* 4000-3500 BCE most likely originated from the copper deposits in the Majdanpek region of Serbia (Pernicka *et al.* 1993; Radivojević *et al.* 2010), while the last axe in this group (from Pantelitz) showed lead isotope ratios consistent with the ores from the Burgas region of Bulgaria (Gale *et al.* 2003). All 11 artefacts were made from very pure copper containing small amounts of arsenic (0.01-2.5%).

The chemical compositions of 17 artefacts dating *c.* 3500-3000/2800 BCE likewise indicate the use of very pure copper with small quantities of arsenic (0.01-1.4%, with an average of about 0.5%). The provenience of this copper raw material points to the ores from the eastern Alps, such as the Inn Valley of north Tyrol or Italy's Trentino-Bolzano region, as well as to the Slovakian Ore Mountains. However, the artefacts are also isotopically consistent with the ores from Serbian deposits in the region of Majdanpek. Thus, the lead isotope analyses point to an integration of south-central European copper ores with raw material deriving from the southern Balkans. The connection to southeast European copper ore deposits continued until *c.* 3300 BCE at the latest, especially during the peak of copper production (3500-3300 BCE), while eastern Alp and Slovak ore deposits were exploited at the earliest *c.* 3300 BCE (Brozio *et al.* 2023).

The uncertainty regarding the origin of the raw material from Early Neolithic copper artefacts from the western Baltic area especially concerned the so-called Mondsee copper, a very pure type of copper with small quantities of arsenic (Obereder *et al.* 1993; Frank and Pernicka 2012). This type of arsenical copper is named after the eastern Alpine Mondsee Group, which is C^{14}-dated between *c.* 3800 and 3200 BCE (Klassen 2000: 221). Local processing of Mondsee copper in the northern Alpine region has been attested by finds of crucibles as well as copper artefacts (Maurer 2014: 174). Mondsee copper replaced the import of artefacts from the western Carpathian region and southeastern Europe over the course of the 39th century BCE. Carolin Frank and Ernst Pernicka (2012: 124) excluded the Alpine region as the origin of Mondsee-type copper based on lead isotope and chemical analyses for the deposits they studied. Striking similarities to the Serbian Majdanpek deposit were evident but could not be matched beyond doubt. Nørgaard and colleagues (2021: 9) likewise rule out an eastern Alpine origin for the Mondsee copper and argue for an origin from deposits in Serbia and Bulgaria. The proportion of arsenic in the Mondsee variety of copper can possibly be attributed to an intentional addition of arsenic in the form of iron arsenide (Nørgaard *et al.* 2021: 10). This innovation is only attested with certainty in Iran at the end of the 4th millennium (Thornton *et al.* 2009; Rehren *et al.* 2012), though it may possibly also have taken place earlier in southeastern Europe. Cuprous ore with a natural association of arsenic and copper occur in the southern Caucasus, but whether it was used in artifact production is still unknown (Courcier 2008: 31; Nørgaard *et al.* 2021: 9). Arsenical copper was the dominant type of copper in the 4th millennium in southeastern Europe as well as in Funnel Beaker societies, where flat axes show a lead isotope signature corresponding to deposits in Bulgaria and Serbia (Nørgaard *et al.* 2021: 10). This copper may have reached the western Baltic area from, or via, the Mondsee Group. Following a decrease and gap in copper supplies between *c.* 3300-2300 BCE, from *c.* 2300 BCE onwards, only copper ores from south-central Europe and (from 2000 BCE) the British Isles were used as raw material supplies (Brozio *et al.* 2023).

These new analyses of the origins of copper artefacts are very significant for the reconstruction of long-distance connections, as we will discuss below. The copper sources point to connections with the copper-processing communities in the northern Alpine region, perhaps especially Mondsee (Gebauer and Sørensen 2022: 334), but also further into southeastern Europe, the east Serbian Copper Belt, and perhaps the copper mines of Stara Zagora (Ai Bunar) and Burgas (Mendi Rid) in Bulgaria. Other types of copper come from Bosnian ores (Klassen 2000; Nørgaard *et al.* 2021) and western Slovakia and Moravia in the western Carpathian region. The new provenance of the early Neolithic copper in the western Baltic area points to more intensive connections with southeast Europe than were previously thought.

Local metallurgy in the western Baltic area

The import of copper to the western Baltic area had ramifications beyond a simple exchange of objects. The appearance of copper artefacts was also associated with the introduction of metallurgical processes, the production of flat axes according to local styles and preferences, as well as the imitation of copper objects in a range of other raw materials. Thus, the role of the copper import within the receiving societies far exceeded simple imports of exotic goods.

Evidence of pyrotechnic processing skills are shown by a crucible and a possible nozzle from Lønt, Denmark, dating to a span from *c.* 3800-3300 BCE (Gebauer *et al.* 2020; see Fig. 1). The fragmented crucible from Lønt was once probably oblong, oval in shape, with a rounded rim edge and a heavy base, but without a handle or spout. Similar bathtub-shaped crucibles were used in both the Pfyn and the Mondsee groups, alongside the more common spoon-shaped crucibles, and date from the same period, i.e. *c.* 3800-3600 BCE (Altorfer and Conscience 2005: 72; Altorfer 2010: 128; Matuschik 2016: 59). Copper residues and studies of heat impact show that bathtub-shaped crucibles were indeed used as crucibles, but perhaps as a special kind of casting crucible. The crucible and possible tuyère were discovered in a settlement layer preserved beneath a long dolmen, including four megalithic tombs, at Lønt in Haderslev in southern Jutland. The early Neolithic pottery in this layer dates from 3800/3500-3300 BCE. The oldest of the four chambers was a small, rectangular, and closed dolmen dating from 3500-3300 BCE. A deposition of nine pots along the perimeter of the associated circular mound date from 3300 BCE, but might represent a secondary burial.

The hoard at Neuenkirchen in Mecklenburg provides even earlier evidence of the melting of copper in the northern group of the Funnel Beaker culture. The deliberate fracture of a flat axe through hot-shorting suggests the presence of comprehensive material and metallurgical knowledge as early as 3800/3700 BCE (Skorna 2022). Similar use of pyrotechnical skills is seen in the destruction of the flat axes from Lackalänge, Sweden, dating from Klassen Phase 3 (3500-3300 BCE) and the undated fragment from Nadrensee, Mecklenburg (Klassen 2000: cat. no. 100A-B; Skorna in press).

While metallurgy appears to be introduced to the western Baltic area no sooner than 3800 BCE, knowledge

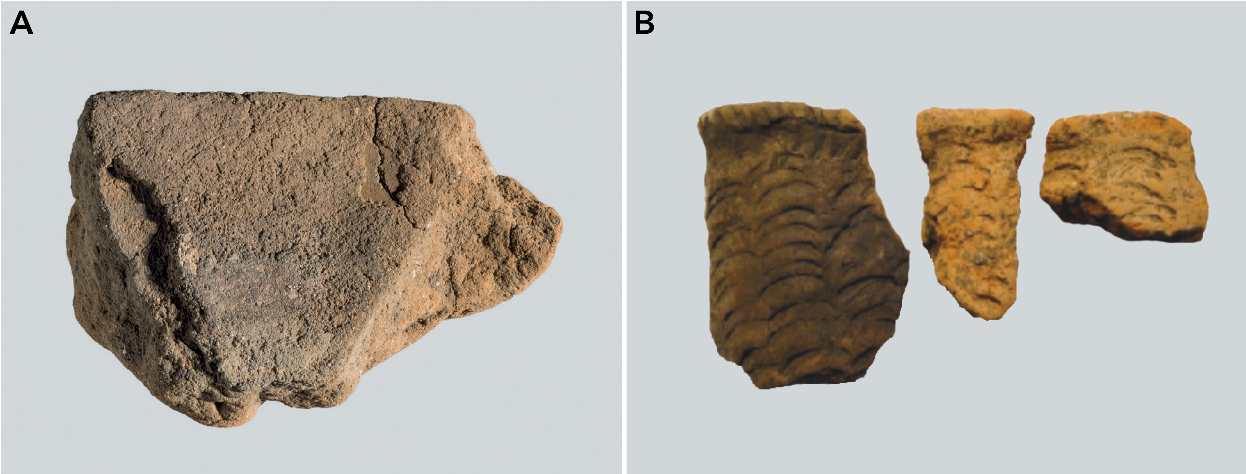


Figure 1: A) Crucible from Lønt, Denmark. The largest and best-preserved fragment is depicted with a view of the interior, with a whitish, burnt area with copper residue at the bottom. The piece is lightly curved along the outer perimeter. It measures 9.1 cm long, 6.4 cm high, 0.7 cm thick at the rim, and 3.6 cm thick towards the bottom of the object. B) Tuyère from Lønt, 5 cm long, the narrow end is missing, exterior and interior rim diameter 5 cm and 3 cm respectively (after Gebauer *et al.* 2020: figs 4 and 8).

of copper metallurgy is observable among Lengyel and Tisza communities and other Carpathian Basin groups already in the early 5th millennium BCE. The earliest evidence of metallurgy in central Europe – in the form of pieces of slag and two ceramic tuyères – comes from the site of Brixlegg, distr. Kufstein, in the Tyrol Alps at a Münchshöfen-culture settlement dated to *c.* 4500 BCE (Höppner *et al.* 2005; Nørgaard and Vestergaard 2019). The oldest metallurgical workshop in north-central Slovakia was identified at the site of Slovenské Pravno, Turèianske Teplice, where a roasting furnace holding slag and copper lumps was found at a Ludanice-culture settlement dated to 4100-3800 BCE (Czajlik 2014). In Moravia, the oldest finds evidencing the knowledge of copper metallurgy are tied to the Funnel Beaker culture (Fig. 2). A ceramic tuyère and pieces of slag come from a feature at the site of Podoli, Brno-Venkov, that was radiocarbon dated to 3796-3708 cal. BCE (probability of 95.5%; Poz-60110, 4990±35 BP, after Kos and Šmíd 2013). In the Bohemian Basin, a fragment of a ceramic tuyère was found with Baalberg-group material, marking the early phase of the Funnel Beaker culture (3800-3400 BCE), at the site of Cimburg, Kutná Hora (Zápotocký 2000: 72, Taf. 7:21; Żurkiewicz *et al.* 2023).

In Poland, metallurgy was first practised by Lengyel-Polgár communities during the second half of the 5th millennium BCE. Metalworking is documented by production debris such as slag, crucibles, various forms of raw material, and characteristic ceramic objects, i.e. blowpipes and tuyères (Roden 1988). In the early 4th millennium BCE, Funnel Beaker communities took an interest in copper processing. Most Funnel Beaker sites where metallurgical relics were recovered were settled earlier by Lengyel-Polgár communities, which might suggest that among Funnel Beaker populations metal-working skills could have been acquired from communities within the Lengyel-Polgár circle. The oldest evidence of Funnel Beaker metallurgy is a single specimen of a tuyère, excavated at Site 1 in Kotowo, Koscian Commune, central Greater Poland, C^{14}-dated at 3911-3714 cal. BCE (probability of 68.3%) and 3942-3708 cal. BCE (probability of 95.4%) (Żurkiewicz *et al.* 2023). Metalworking in Kotowo cannot be tied to any specific copper goods. Other remains of Funnel Beaker culture copper metallurgy are slightly younger, including crucibles from Cmielów (Wlodarczak 2006) and Gródek Nadbużny (Gumiñski 1989), as well as a burnt tuyère from Janówek (Wojciechowski 1973) dating from 3513-3372 cal. BCE (probability of 68.2%), 3600-3400 BCE and 3400-2700 cal. BCE respectively.

Thus, the innovation of copper pyrotechnical processing seems to be introduced contemporaneously in the western Baltic area, as similar evidence occurs in the southern Funnel Beaker culture, Baalberg, and production centres in Alpine areas, e.g. Mondsee, while earlier evidence of metal-working, besides Poland, is found further south in eastern central Europe (Slovakia, Hungary, Austria), and in southeastern Europe (Schlichterle and Rottländer 1982; Midgley 1992: 296; Klassen 2000: 283; 2004; Gebauer *et al.* 2020: 12-13, fig. 9).

The western Baltic Copper Age

An impressive quantity of *c.* 150 copper objects, including 36 ornaments, 108 flat axes, as well as a couple of daggers, polygonal battle-axes, and adzes, are known from the western Baltic area (Klassen 2000: fig. 111;

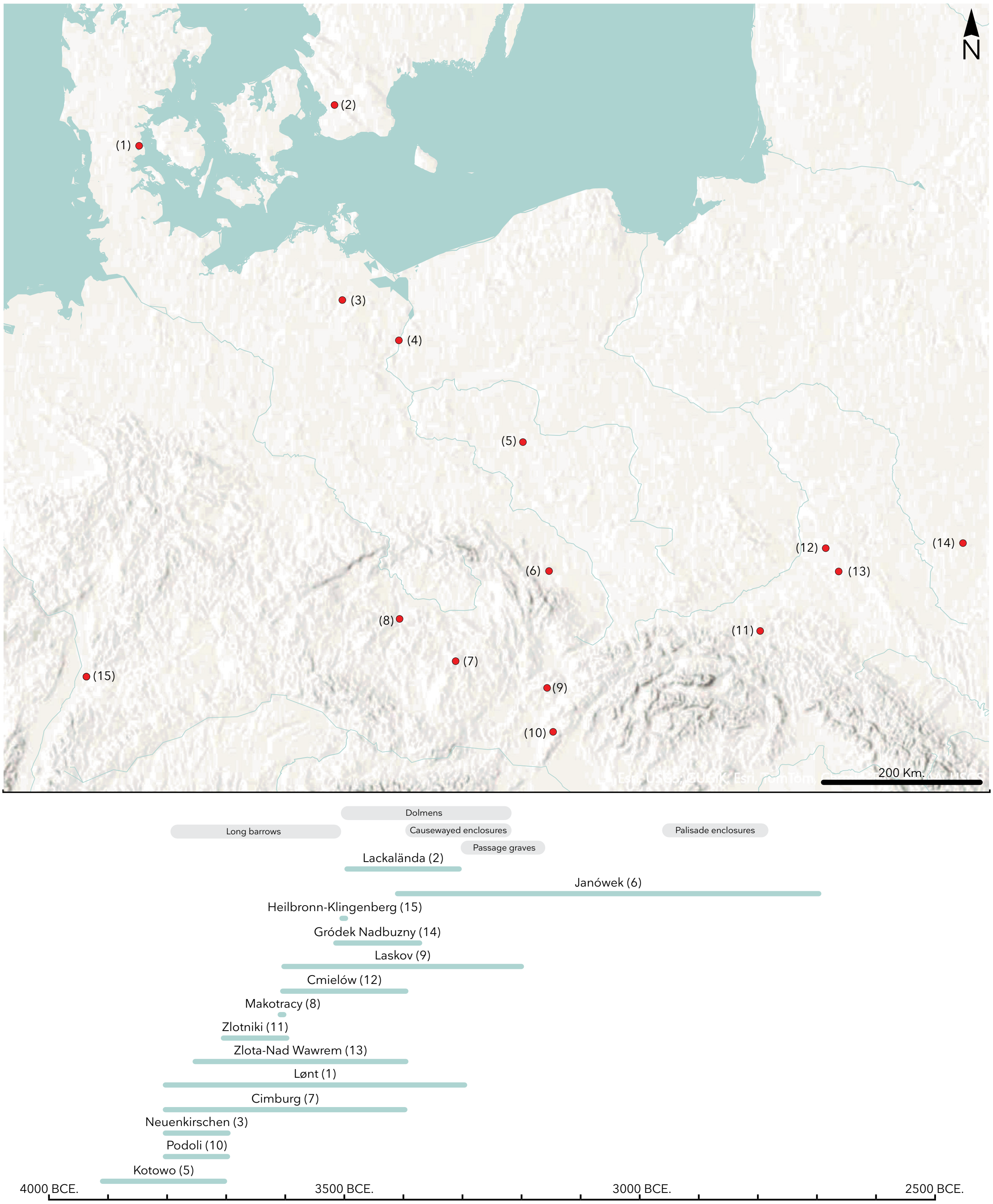


Figure 2. Funnel Beaker sites with evidence of metallurgy. Yellow stars: tuyère. Red dots: crucible. Blue squares: hot-shorting: 1) Lønt, Denmark, crucible and tuyère; 2) Lackalända, Sweden, hot-shorting; 3) Neuenkirschen, Germany, hot-shorting; 4) Nadrensee, Germany, hot-shorting; 5) Kotowo, Poland, tuyère; 6) Janówek, Poland, tuyère; 7) Cimburg, Bohemian Basin, tuyère; 8) Makotracy, Bohemia (Baalberg), crucible; 9) Laskov, Moravia, Czech Republic, crucible; 10) Podoli, Moravia, tuyère: 11) Zlotniki, Poland, crucible; 12) Cmielów. Poland, crucible; 13) Zlota – Nad Wawrem, Poland, crucible; 14) Gródek Nadbuzny, Poland, crucible; 15) Klingenberg bei Heilbronn, Baden-Württemberg (Michelsberg), crucible (references: 1) Gebauer *et al.* 2020; 2) Klassen 2000: cat. nos. 100A-B, 2-4: Skorna, in press; 5-14) Zurkiewics 2023; 8) Rosenstock 2016).

Price and Gebauer 2017; Sørensen 2014: 159; Brozio *et al.* 2023: 5). In terms of weight, the Scandinavian copper exceeds that of the combined finds from the northern Alpine area between 3800-3300 BCE (Klassen 2000: 273). According to Klassen (2000: 235) the import of copper and the mastery of metallurgical know-how in southern Scandinavia followed a three-step development. About a dozen axes were imported from the Balkan area between 4500-3750 BCE, with the number increasing from 4000 BCE. During the second phase (from 3750-3500 BCE), a smaller number of trapezoidal flat axes and ornaments in arsenical copper were modified according to local preferences by annealing and hammering. Furthermore, during the third phase (from 3500-3300 BCE), mastery of the pyrotechnical process was fully achieved, and local types of flat axes were produced by the dozens, together with some ornaments

Metallurgical skills were used especially to create larger and heavier flat axes, which were more impressive than the original imports. The average weight of copper flat axes in the Funnel Beaker culture is 381 g (range 100-1200 g), while the average weights of two groups of flat axes from the Alpine area are 222 g (range 50-650 g) and 151 g (range 50-250 g) respectively (Klassen 2000: 227, fig. 105; 2014: 228; Gebauer *et al.* 2020). According to Klassen (2000: 225), more than half of the flat axes found in Scandinavia (58 trapezoidal and tongue-shaped flat axes), five-arm spirals, and several other ornaments, were produced within the northern Funnel Beaker group area using arsenical copper. The hoard at Neuenkirchen, Mecklenburg, dating from 3800-3700 BCE provides an even earlier sign of copper melting than envisioned by Klassen (Skorna 2022: 142; in press), while the crucible and nozzle from Lønt, Denmark, supply direct evidence of metallurgy (Gebauer *et al.* 2020).

The use of copper and the design of copper objects had a significant impact on other aspects of the material culture in the western Baltic area. One of the most commonly found artefacts in the northern early Neolithic, the four-sided, thin-butted flint axe, was shaped according to copper prototypes from the Gumelniţa culture along the lower Danube in northeast Bulgaria. The four-sided flint axes spread further north via the Cucuteni-Trypillia culture and the southeastern Funnel Beaker groups in Poland to the Baltic area (Klimscha 2007: 24, fig. 10; Sørensen 2014: 175). Both the typology of these axes, as well as the idea of hoarding axes, stress the connection between the Black Sea area and the northern European Plain, which continued into the late 4th millennium BCE (Klimscha 2016: 88). Alternatively, the thin-butted, four-sided flint axes have been interpreted as a local Scandinavian imitation of imported copper Kaka-type flat axes (Klassen 2004: 215).

A few polygonal copper battle-axes have been found in the western Baltic region (Oxie and Steinhagen), suggesting possible contacts with the Mondsee region in Austria (Klassen 2000: 143; Sørensen 2012: 177). The oldest battle-axes were found in lake dwellings around the Alps in the 39th century BCE. The earliest F-type axes (with a flat neck) were associated with the Pfyn, Michelsberg, and Cortaillod ceramic styles (Zápotocký1992: 39), while the later type K (with a knob at the butt end) appeared slightly later in the classical phase of the Lesser Polish Funnel Beaker culture, later Pfyn and Altheim (Klimscha 2016). Imitations in stone of both the early and the later polygonal battle-axe types were produced locally in large quantities in southern Scandinavia (Ebbesen 1998; Klassen 2000: 146, fig. 62). Variations in the distribution of certain subtypes suggest different regional connections between the eastern part of southern Scandinavia and Mondsee or Mecklenburg-Western Pomerania (types K I-II and IV respectively; Sørensen 2012: 177).

A dagger from the Neuenkirchen hoard was made of the Nógrádmarcal copper variety with an origin in the western Carpathian area (Skorna 2022: 119). Another Cucuteni type dagger from the Bygholm hoard provides a connection to the north Alpine area as well as to southeastern Europe and the Black Sea region (Klassen 2000: 52, 160-163; 2014: 243, fig. 141).

Central European copper daggers probably served as role models in the production of flint halberds in southern Scandinavia, although Mesolithic pointed weapons have also been suggested as preforms (Nielsen and Nielsen 2020: 144). The function of these objects as daggers or halberds is debated (Klassen 2000: 260; Horn 2014: 174; Price and Gebauer 2017).

Amber was used to copy copper jewellery such as tubular beads and copper discs decorated with buckles. Amber pendants were also made as miniature copper axes (Klassen 2000: 262; Larsson 2001: fig. 7). The combination of both copper jewellery and amber beads in graves suggest that ornaments made of both materials could be part of the personal belongings of the same person. Amber beads were very important in the early Funnel Beaker culture and the significance of amber beads follows the introduction and decline of copper artefacts, perhaps due to the shiny and gold-coloured appearance of both materials (Axelsson *et al.* 2015: 657-658, 665; Larsson 2001: 68).

Almost all copper flat axes recovered so far have been single finds. Eight hoards include combinations of copper axes or axes combined with jewellery of copper and amber, while only copper jewellery is found in burial contexts (Klassen 2000: 79). Thus, specific depositional rules are reflected in copper distribution and probably

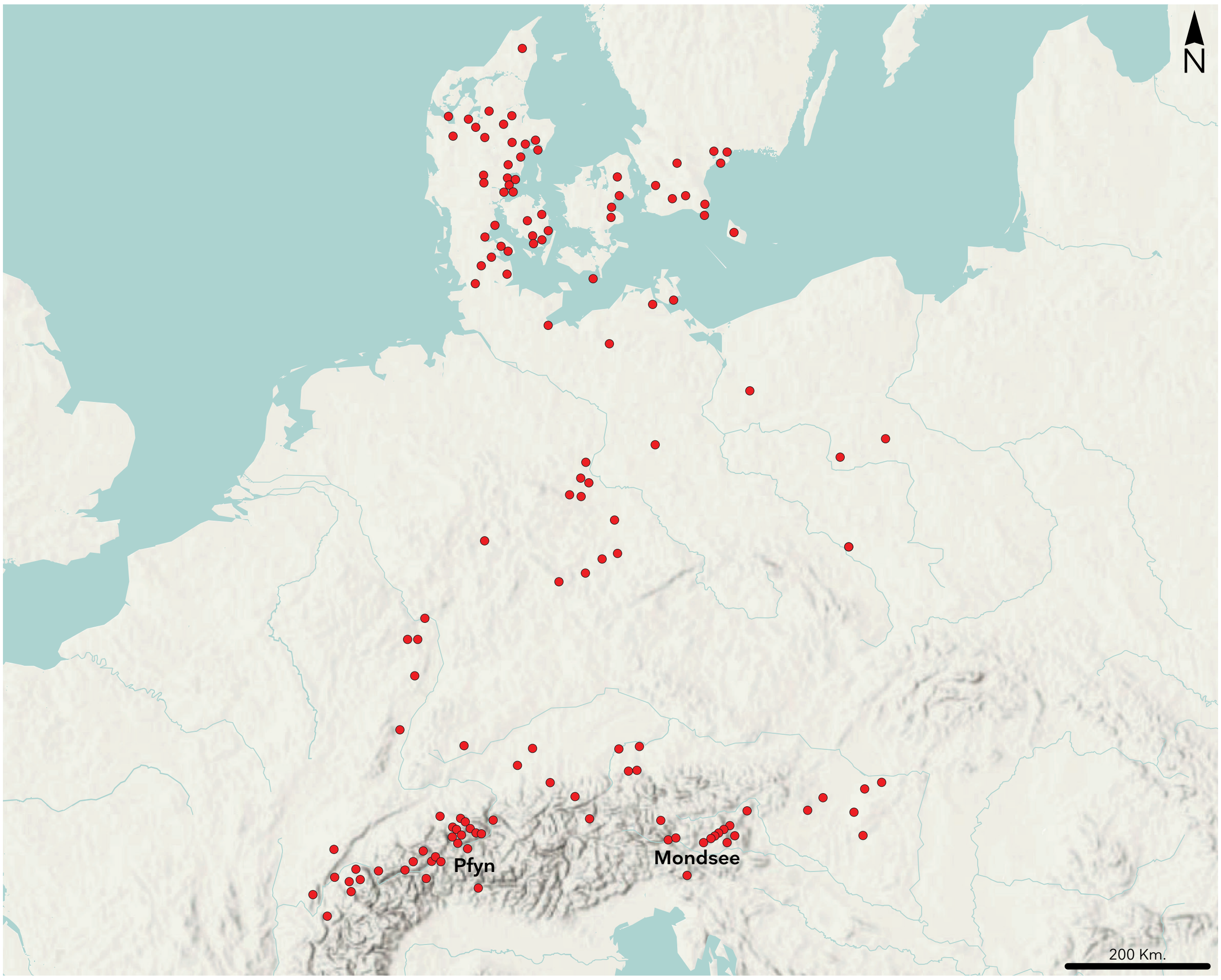


Figure 3. Distribution of artefacts made from Mondsee copper in central and northern Europe (after Gebauer *et al.* 2020: fig. 1).

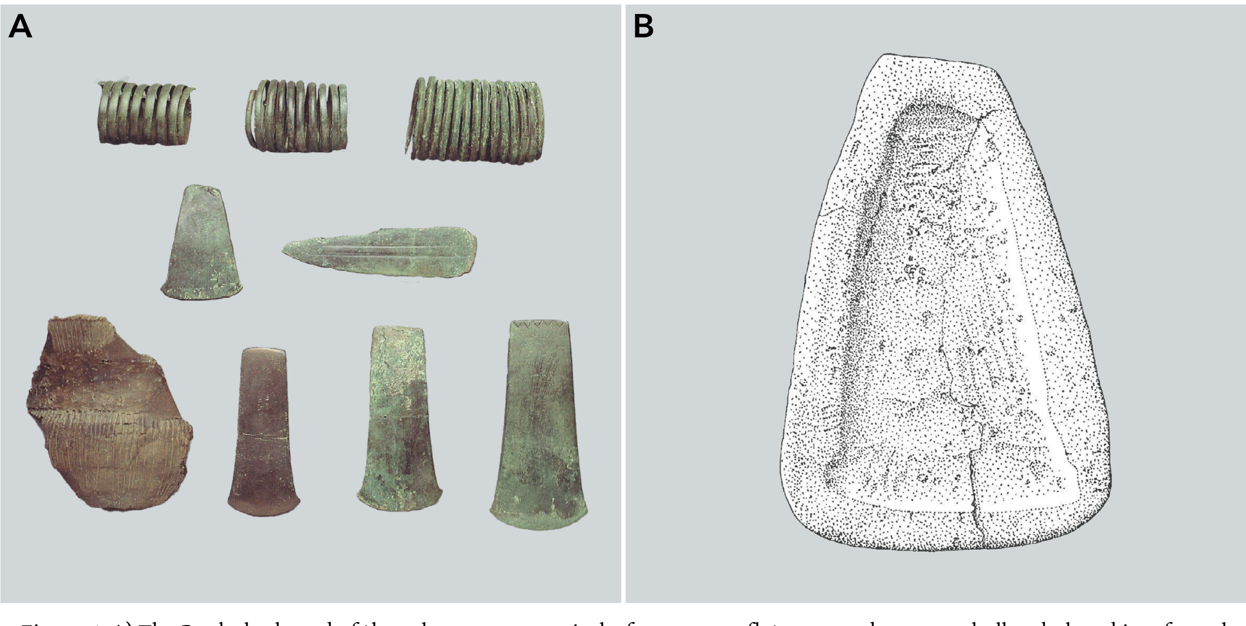


Figure 4: A) The Bygholm hoard of three large copper spirals, four copper flat axes, and a copper halberd placed in a funnel beaker (photo: Lennart Larsen, National Museum of Denmark). B) A mould from Mondsee resembling the only imported object, the smallest flat axe (Klassen 2000: 161, fig.70).

can be interpreted as expressing social values about how the objects should be used. Metal objects, along with flint and stone weapons, have been interpreted as elite grave goods (Woll 2003), perhaps associated with important warriors or older males (Midgley 1992: 457; Zápotocký 1992: 154; Brinch Petersen 2008: 33). The flat axe stray finds are difficult to interpret. Like the hoards, they might have been deposited as gifts to the higher powers on behalf of a social group. The presence of prestige objects in single finds or hoards, rather than in graves, might indicate that these items were highly valued resources for social negotiation and prestige accumulation outside of the mortuary domain.

Imported goods, like copper from central and southeastern Europe, reflect the integration of the northern Funnel Beaker culture into supra-regional networks covering enormous distances (Fig. 3). A regular fall-off pattern is not observed in the distribution of either copper or Alpine jade axes (Klassen 2004: 269, fig. 145; Pétrequin *et al.* 2013: 73). Intermediate sites are scarce or non-existent, as in the case of the distribution of Cucuteni-type daggers, copper polygonal battle-axes and large arm spirals (Turck 2010: 58; Klassen 2014: 132, fig. 141; Sørensen 2014: 200, fig. 147; Skorna 2022: 126, fig. 66). Cultural and social norms rather than accessibility appear to regulate the exchange of copper items north of production centres in central Europe (Bogucki 1988: 190). Typological links between the copper flat axes in the western Baltic and the north Alpine region suggest that the latter area played a key role in communication (Klassen 2004: 107, fig. 84). A Mondsee crucible matching the smallest axe in the Bygholm Hoard (Fig. 4) illustrates this close connection (Klassen 2000: 161, fig. 70). Direct contacts possibly existed between people in the Baltic and the Mondsee area (Klassen 2000: 161, 277). Certainly, some kind of apprenticeship would be expected in the communication of pyrotechnical know-how. However, the new aspects of the provenance of the copper described above reveal further connections to southeastern Europe and the Balkan area. Influences from areas as far away as the Black Sea are the probable source of cultural changes in central Europe and further north, i.e. metallurgy, animal traction, wagon transportation, and the construction of enclosures (Klimscha 2008; 2016; Klassen 2014: 243). In fact, metalworking tends to be associated with enclosures north of the pile-dwelling communities in the Alpine area (Klassen 2014: 231). The crucible and nozzle from Lønt, Denmark, were found a few hundred metres from the Starup enclosure, with its unusual clavicle-shaped ditches similar to those at the Sandomierz, in which metalworking is documented, in southeastern Poland (Klassen 2014: 255; Gebauer *et al.* 2020). Furthermore, the Årupgård hoard (Denmark) was likely located within an enclosure setting (Madsen 1982: 211; Klassen 2000: 81). Presumably river transportation via the Oder and Vistula drainage basins, with further connection to the courses of the Prut, Siret, and Dnjestr rivers, would connect the western Baltic area with southeastern Europe.

Collapse of the western Baltic Copper Age

Copper disappeared in the western Baltic area at the end of the early Neolithic, *c.* 3300 BCE, perhaps as metal supplies vanished in central Europe, and was only re-introduced in the late Neolithic (Klassen 2000: 238). The strong continuity between the early Neolithic and middle Neolithic Funnel Beaker culture makes it unlikely that local changes in depositional or recycling practices would explain the end of metal use. Furthermore, copies of flat axes made in amber, bone, slate, and flint continue to be deposited in the

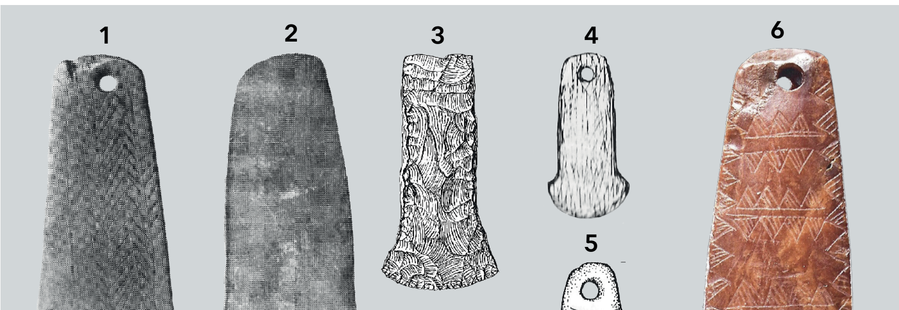


Figure 5: Middle Neolithic Funnel Beaker copies of copper axes with splayed edge corners produced after 3300 BCE. The copies were made of bone (1), amber (2, 5, 6), flint (3), and slate (4). Shown 1:1 (Klassen 2000: 261 Abb. 119 (fig. 5.1-5); Nielsen 2010: 50, fig. 1 (fig. 5.6); photo: Arnold Mikkelsen, Nationalmuseum).

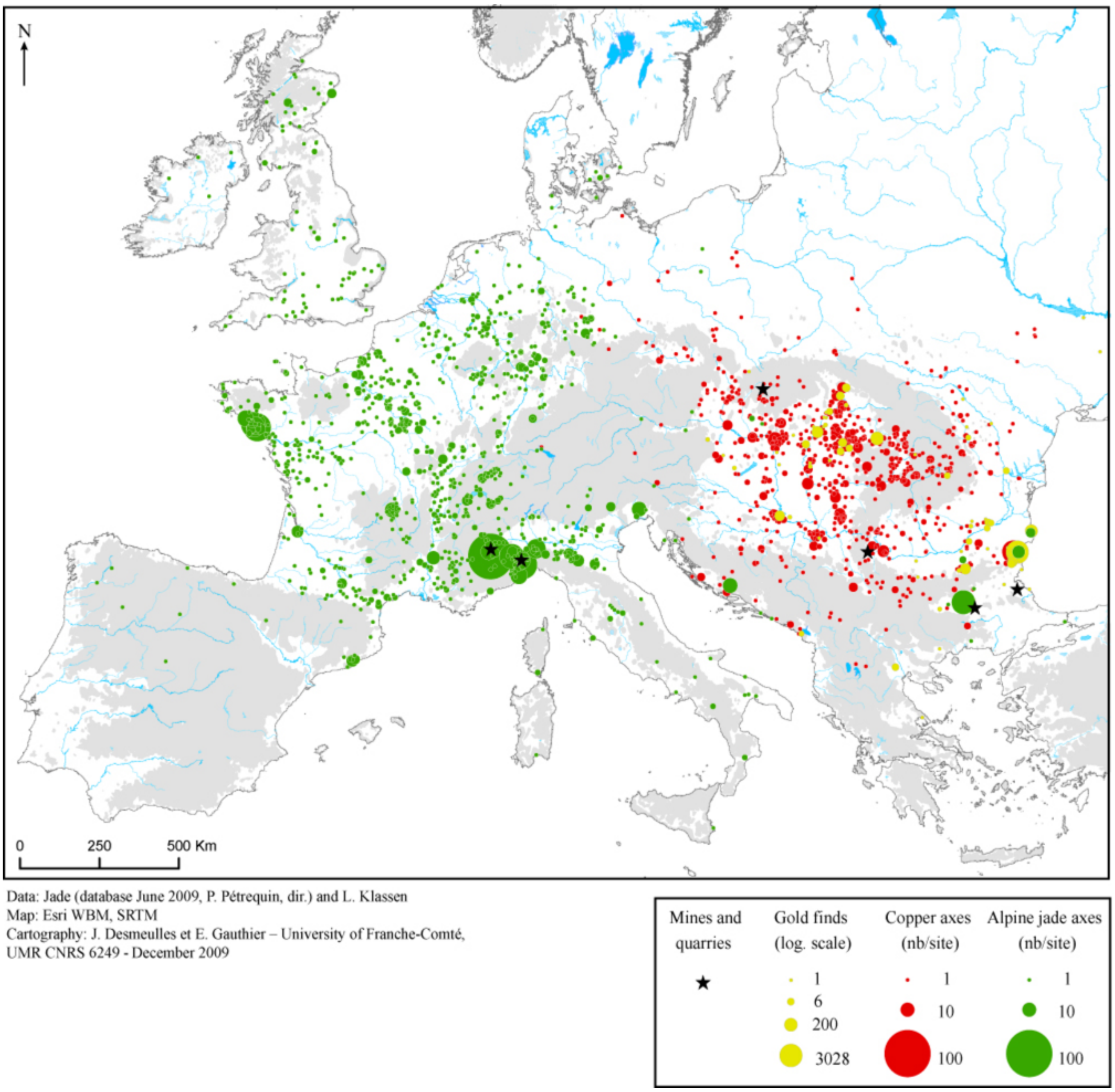


Figure 6: Distribution of Alpine jade axes of type Bégude (green) and heavy copper implements (red) from the late 5th millennium BCE. The western Baltic area and a part of southeast Europe were the only areas where the two trans-European networks met (after Pétrequin *et al.* 2012).

megalithic tombs for the following 200-300 years (Fig. 5). The demand for copies of copper flat axes may have been a reaction to the interruption of metal supply (Klassen 2000: 292-293). In general, the diffusion of metal technology across central Europe ground to a halt in the second half of the 4th millennium BCE. The northern Alpine communities were not able to transmit metallurgical knowledge further west until the early 3rd millennium BCE (Strahm and Hauptmann 2009). Moreover, habitation within pile-dwelling communities in the northern Alps was interrupted between 3600-3200 BCE, perhaps due to climatic deterioration and elevated lake levels (Hafner 2013: 100-104). Thus, a key component in the long-distance networks connecting the western Baltic area with central and southeast Europe disappeared. Furthermore, a regression in the production and use of copper in southeast Europe led to a collapse in metal supplies from southeast Europe (Strahm *et al.* 2013: 74). The causes of these changes in cultural dynamics in the Balkans are unclear (Dolfini 2013; Heyd and Walker 2015: 679; Roberts and Frieman 2015: 720). However, metal making practices and the use of copper continued along the fringes of the core metallurgical area (Radivojevic and Roberts 2021: 247) as well as south of the Alps in the central and western Mediterranean area (Dolfini 2013). Even so, the long-distance network of copper exchange that connected southeast, central, and northern Europe fell apart. In addition, the supra-regional networks for the exchange of obsidian, amphibolite, and alpine greenstone (Fig.

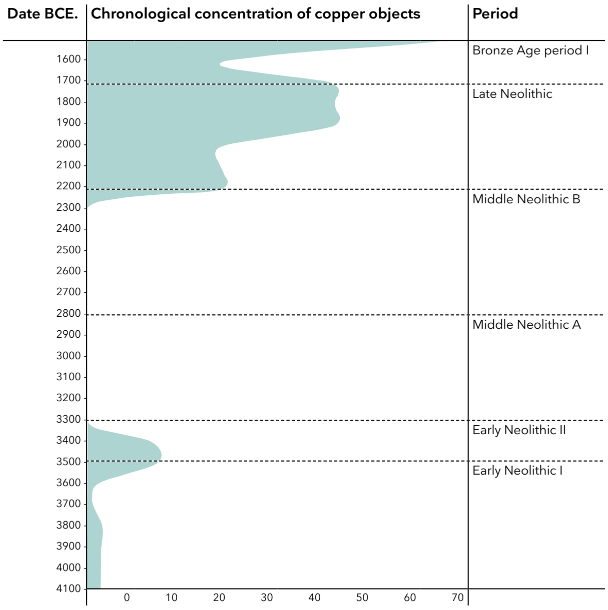


Figure 7: Relative frequency of copper in the western Baltic area in the 4th and 3rd millennia BCE, measured by number of objects per century (after Brozio *et al.* 2023: fig. 1).

6) had already collapsed (Klassen 2000: 251, fig. 116; Pétrequin *et al.* 2008: 276; Sørensen 2012: 84; Sørensen *et al.* 2017; Gebauer and Sørensen 2022: 331). These exchange networks formed a complex pattern of alliances which involved people in several communities across Europe. The transfer of ideas and technology was regulated by such large-scale communication networks (Klimscha 2016). In the absence of wide-scale networks, the northern Funnel Beaker culture reinforced its regional identity with a strong emphasis on monument construction, votive offerings, and an ancestor cult over the last quarter of the 4th millennium.

Conclusion

The term 'Copper Age' is not traditionally used about Early Neolithic Funnel Beaker culture in the western Baltic area, but this label seems appropriate considering the impact that use of copper had on these communities. Copper objects and metalworking played a significant role in the early Neolithic societies in the western Baltic area. The amount of copper itself is astounding. Clear evidence of local metallurgy is reflected in technical ceramics, the practice of hot-shorting, and the fact that more than half of flat axes are local products. Copper objects were copied by the thousands in flint, stone, and amber and must have been common knowledge among the public. In addition to strong influence on material culture, participation in the copper-exchange networks had considerable social significance in western Baltic communities. Influences from areas as far away as the Black Sea are the probable source of cultural changes such as animal traction, ploughing, and possibly wagon transportation. These new technologies led to substantial agricultural expansion followed by a population increase (Nielsen and Nielsen 2020: 179). Together with the increased import of copper *c.* 3700/3800 BCE, monumental burials of single individuals, even children and teenagers began in earthen long barrows (Skaarup 1975: 29-32; Rønne 1979; Papiernik *et al.* 2018). Such burials indicate the high status of certain lineages, and perhaps prominent individuals, reflecting an increased stratification of society (Nielsen and Sørensen 2018: 25; Sørensen 2020: 80). The construction of enclosures is another example of the ability to mobilise a significant workforce to create gathering places in the landscape. The desire of the elite to achieve wealth and prestige reinforced the acquisition of exotic and visually distinct copper objects, as well as the organisation of foreign contacts and long-distance communication, but also required a certain level of domestic production to support the metal exchange. Thus, copper import had a significant impact on both the agricultural production and social structure, in addition to the far-reaching influence on material culture.

Copper fell out of fashion rather abruptly *c.* 3300 BCE, following a general trend in most of Europe (Figure 7). Instead of exotic imports and communication via large transcontinental European networks, western Baltic communities focused on their regional tradition of ancestor cult and monument building. Later, new impulses came with the Globular Amphora and Corded Ware cultures, but the hiatus in copper circulation continued until the arrival of the Bell Beaker culture *c.* 2350 BCE. Following a slow reintroduction of metal in Scandinavia, metallurgy was fully adopted *c.* 2000 BCE in a way that permeated Nordic society and engaged the region in a global 'bronzization' between 1600-1200 BCE (Vandkilde 2016; 2019).

Bibliography

Altorfer, K. 2010. *Die prähistorischen Feuchtbodensiedlungen an Südrand des Pfäffikersees. Eine archäologische Bestandaufnahme der Stationen Wetzikon-Robenhausen und Wetzikon-Himmerich/*. Mono- graphien der Kantonsarchäeologie Zürich 41. Zürich: Egg.

Altorfer, K. and A.-C. Conscience 2005. *Meilen-Schellen. Die neolitischen und spätbronzezeitlichen Funde und Befunde der Untersuchungen 1934-1996*. Züricher Archäologie 18. Zürich: Egg.

Artioli, G., C. Canovaro, P. Nimis and I. Angelini 2020 (with erratum). LIA of Prehistoric Metals in the Central Mediterranean Area: a review. *Archaeometry* 62 (S1): 53-85 (available at: 10.1111/arcm.12610. https://doi.org/10. 1111/arcm.12542).

Axelsson, T., M. Ramstad and A. Strinnholm 2015. Amber, in C. Fowler, J. Harding and D. Hofmann (eds) *The Oxford Handbook of Neolithic Europe*: 657-671. Oxford: Oxford University Press.

Bogucki, P.I. 1988. *Forest Farmers and Stockherders. Early Agriculture and Its Consequences in North-Central Europe*. New Studies in Archaeology. Cambridge: Cambridge University Press.

Brinch Petersen, E. 2008. Warriors of the Neolithic TRB-Culture, in Z. Sulgostowska and A.J. Tomaszewski (eds) *Man Millenia Environment. Studies in Honour of Roman Schild*: 33-38. Warsaw: Polish Academy of Sciences.

Brozio, J.P., Z. Stos-Gale, J. Müller, N. Müller-Scheessel, S. Schultrich, B. Fritsch, F. Jürgens and H. Skorna 2023. The origin of Neolithic copper on the central Northern European plain and in Southern Scandinavia: Connectivities on a European scale. *PLoS ONE* 18(5): e0283007 (available at: https://doi.org/ 10.1371/journal.pone.0283007).

Courcier, A., A. Casanova and A. Hauptmann 2008. Ancient metallurgy in the Caucasus during the Chalcolithic and Early Bronze Age: recent results from excavations in Western Azerbaijan. *Metalla* 15(1): 21-34.

Czajlik Z. 2014. Traces of Prehistoric Smelting Workshops in the Carpathian Basin, in S. Berecki (ed.) *Iron Age Crafts and Craftsmen in the Carpathian Basin. Proceedings of the International Colloquium from Târgu Mureş 10-13 October 2013*: 139-146. Târgu Mureo: Editura Mega.

Dolfini, A. 2013. The Emergence of Metallurgy in the Central Mediterranean Region: A New Model. *European Journal of Archaeology* 16: 21-62 (available at: https://doi.org/10.1179/1461957112Y.0000000023).

Ebbesen, K. 1998. Frühneolitische Streitäxte. *Acta Archaeologica* 69: 77-112.

Frank, C. and E. Pernicka 2012. Copper artifacts of the Mondsee group and their possible sources, in M.S. Midgley and J. Sanders (eds) *Lake Dwellings after Robert Munro. Proceedings from the Munro International Seminar: The Lake Dwellings of Europe; 2010, Oct 22-23*: 113-138. Leiden: Sidestone Press.

Gale, N.H., Z. Stos-Gale, A. Raduncheva, I. Panayotov, I. Ivanov, P. Lilov and T. Todorov 2003. Early Metallurgy in Bulgaria, P. Craddock and J. Lang (eds) *Mining and Metal Production Through the Ages*: 122-173. London: The British Museum Press.

Gebauer, A.B., L.V. Sørensen, M. Taube and D.K.P. Wielandt 2020. First metallurgy in Northern Europe. An Early Neolithic crucible and a possible tuyère from Lønt, Denmark. *European Journal of Archaeology* 24(1): 27-47 (available at: https://doi.org/10.1017/eaa.2019.73).

Gebauer, A.B. and L. Sørensen 2022. Supra-regional contacts and the earliest metallurgy in southern Scandinavia during the Mesolithic and Neolithic transition, in F. Klimscha, M. Heumüller, D.C.M. Raemaekers, H. Peeters and T. Terberger (eds) *Stone Age Borderland Experience: Neolithic and Late Mesolithic Parallel Societies in the North European Plain*: 321-335. Rahden/Westf.: Verlag Marie Leidorf.

Hafner, A. 2013, Seeufersiedlungen und Klima im 4. Jahrtausend v. Chr., in H. Meller (ed) *3300 BC. Mysteriöse Steinzeittote und ihre Welt*: 100-104. Halle: Nünnerich-Asmus Verlag.

Hansen, S., P. Raczky, A. Anders and A. Reingruber 2015. *Neolithic and Copper Age between the Carpathians and the Aegean Sea: chronologies and technologies from the 6th to the 4th Millennium BCE*. International Workshop Budapest 2012. Archäologie in Eurasien 31. Bonn: Rudolf Habelt.

Heyd, V. and K. Walker 2015. The First Metalwork and Expressions of Power, in C. Fowler, J. Harding and D. Hofmann (eds) *The Oxford Handbook of Neolithic Europe*: 673-691. Oxford: Oxford University Press.

Höppner, B., M. Bartelheim, M. Huijsmans, R. Krauss, K.-P. Martinek, E. Pernicka and R. Schwab 2005. Prehistoric copper production in the Inn Valley (Austria), and the earliest copper in central Europe. *Archaeometry* 47(2): 293-315 (available at: https://doi.org/10.1111/j.1475-4754.2005.00203.x).

Klassen, L. 2000. *Frühes Kupfer im Norden. Untersuchungen zur Chronologie, Herkunft und Bedeutung der Kupferfunde der Nordgruppe der Trichterbecherkultur*. Jutland Archaeological Society Publications 36. Aarhus: Aarhus University Press.

Klassen, L. 2004. *Jade und Kupfer: Untersuchungen zum Neolithisierungsprozess im westlichen Ostseer- aum unter besonderer Berücksichtigung der Kulturentwicklung Europas 5500-3500 BC*. Jutland Archaeological Society Publications 47. Aarhus: Aarhus University Press.

Klassen, L. 2014. *Along the Road. Aspects of Causewayed Enclosures in South Scandinavia and Beyond*. Aarhus: Aarhus University Press.

Klassen, L. and S. Stürup 2001. Decoding the Riesebusch-copper: Lead-Isotope Analysis applied to Early Neolithic Copper Finds from South Scandinavia. *Praehistorische Zeitschrift* 76(1): 55-73 (available at: https://doi.org/10.1515/prhz.2001.76.1.55).

Klimscha, F. 2007. Die Verbreitung und Datierung kupferzeitlicher Silexbeile in Südosteuropa. Fernbeziehungen neolithischer Gesellschaften im 5. und 4. Jahrtausend v. Chr. *Germania* 85: 275-305 (available at: https://www.researchgate.net/publication/281857616).

Klimscha, F. 2016. Axes and Allies: Long-range contacts in Northern Central Europe during the 4th and 3rd Millennia BC as exemplified by stone and metal artefacts, in M. Furholt, R. Grossman and M. Szmyt (eds) *Transitional landscapes? The 3rd Millennium BC in Europe*: 85-100. Proceedings of the International Workshop 'Socio-Environmental Dynamics over the Last 12,000 Years: The Creation of Landscapes III (15-18 April 2013)' in Kiel. Bonn: Rudolf Habelt.

Klimscha, F. 2018. Die ältesten Wagen im Kaukasus, in L. Giemsch and S. Hansen (eds) *Gold & Wein. Georgiens älteste Schätze*: 176-181. Begleitband zur Sonderausstellung 6. Oktober 2018 - 10. Februar 2019. Archäologisches Museum Frankfurt. Mainz am Rhein: Nünnerich-Asmus Verlag.

Kos, P. and M. Šmíd 2013. Objekt kultury nálevkovitých pohá- rùs doklady metalurgie mìdi z Podolî, okr. Brno-Venkov. *Pravìk* 23: 57-76.

Krause, R. 2003. *Studien zur kupfer- und frühbronzezeitlichen Metallurgie zwischen Karpatenbecken und Ostsee*. Vorgeschichtliche Forschungen 24. Rahden/Westf.: Verlag Marie Leidorf.

Larsson, L. 2001. The Sun from the Sea – Amber in the Mesolithic and Neolithic of Southern Scandinavia, in A. Butrimas (ed.) *Baltic Amber. Proceedings of the international interdisciplinary conference: Baltic Amber in natural Sciences, Archaeology and Applied Art*: 65-75. Vilnius: Vilniaus Dailes akademijos leidykla.

Ling, J., E. Hjärthner-Holdar, L. Grandin, K. Billström and P.O. Persson 2012. Moving metals or indigenous mining? Provenancing Scandinavian Bronze Age artefacts by lead isotopes and trace elements. *Journal of Archaeological Science* 40(1): 291-304 (available at: https://doi.org/10.1016/j.jas.2012.05.040).

Lutz, J., I. Matuschik, E. Pernicka and K. Rassmann 1997. Die frühesten Metallfunde in Mecklenburg-Vorpommern im Lichte neuer Metallanalysen. Vom Endmesolithikum bis zur frühen Bronzezeit. *Bodendenkmalpflege in Mecklenburg-Vorpommern* 45: 41-67.

Madsen, T. 1982. Settlement Systems of Early Agricultural Societies in east Jutland, Denmark. A Regional Study of Change. *Journal of Anthropological Archaeology* 1: 197-236.

Maurer, J. 2014. Die Mondsee-Gruppe: Gibt es Neuigkeiten? Ein allgemeiner Überblick zum Stand der Forschung, in L. Husty and K. Schmotz (eds) *Vorträge des 32. Niederbayrischen Archäologentages*: 145-190. Rahden-Westf.: Verlag Marie Leidorf.

Matuschik, I.1998. Kupferfunde und Metallurgie-Belege, zugleich ein Beitrag zur Geschichte der kupferzeitlichen Dolche Mittel-, Ost- und Südeuropas, in M. Mainberger (ed.) *Das Moordorf von Reute. Archäologische Untersuchungen in der jungneolithischen Siedlung Reute-Schorrenried*: 207-225. Staufen im Breisgau: Teraqua CAP.

Matuschik, I. 2016, Neufunde von Gusstiegeln aus Sipplingen am Bodensee. Ein Beitrag zum Einsetzen der "Gusstiegelmetallurgie" im nördlichen Alpenvorland und zur Frage nach der Herkunft des genutzten Kupfers, in G. Körlin, M. Prange, T. Stöllner and Ü. Yalcin (eds) *From Bright Ores to Shining Metal. Festschrift für Andreas Hauptmann on the Occasion of 40 Years Research in Archaeometallurgy and Archaeometry*: 49-68. Der Anschnitt Beiheft 29. Rahden-Westf.: Verlag Marie Leidorf.

Midgley, M. 1992. *TRB culture; The first farmers of the North European Plain*. Edinburgh: Edinburgh University Press.

Nielsen, P.O. 2010, En økse af rav fra Ejerslev Vang, in M. Andersen and P.O. Nielsen (eds) *Danefæ. Skatte fra den danske muld*: 49-84. Til Hendes Majestæt Dronning Margrethe 2. Copenhagen: Gyldendal.

Nielsen, P.O. and L. Sørensen 2018. The formation of social rank in the early Neolithic of northern Europe. *Acta Archaeologica* 89: 15-29.

Nielsen, P.O. and F.O. Nielsen 2020. *First Farmers on the Island of Bornholm*. Copenhagen: University Press of Southern Denmark.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2019. On the trail of Scandinavia's early metallurgy: Provenance, transfer and mixing. *PloS ONE* 14(7): e0219574 (available at: https://doi.org/10.1371/journal.pone.0219574, with a correction at: 10.1371/journal.pone.0227504).

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2021. Shifting networks and mixing metals: Changing metal trade routes to Scandinavia correlate with Neolithic and Bronze Age transformations. *PloS ONE* 16(6): e0252376 (available at: https://doi.org/10.1371/journal.pone.0252376).

Nørgaard, H.W. and C. Vestergaard 2019. Metallurgiens oprindelse og udvikling, in O. Høiris and P.K.A. Jensen (eds) *Evolutionens menneske og menneskets evolution*. Aarhus: Aarhus University Press.

Obereder, J., E. Pernicka and E. Ruttkay 1993. Die Metallfunde und die Metallurgie der kupferzeitlichen Mondseegruppe. Ein Vorbericht. *Archäologie Österreichs* 4(2): 5-9.

Papiernik, P., J. Wicha and D.K. Płaza 2018. Excavations of the Kuyavian megalithic long barrow no. 2 of the Funnel Beaker culture, situated on the site no. 1 at Gaj, commune of Izbica Kujawska, province of Kuyavia-Pomerania. *Prace I Materiały*, Seria Archeologiczna 47: 443-457.

Pernicka, E. 2014. Provenance Determination of Archaeological Metal Objects, in B.W. Roberts and C.P. Thornton (eds) *Archaeometallurgy in Global Perspective. Methods and Syntheses*: 239-268. New York: Springer.

Pernicka, E., F. Begemann, S. Schmitt-Strecker and G.A. Wagner 1993. Eneolithic and Early Bronze Age copper artefacts from the Balkans and their relation to Serbian copper ores. *Praehistorische Zeitschrift* 68(1): 1-55 (available at: https://doi.org/10.1515/prhz.1993.68.1.1).

Pétrequin, P., A. Sheridan, S. Cassen, M. Errera, E. Gauthier, L. Klassen, N. Le Maux and Y. Pailler 2008. Neolithic Alpine Axe heads, from the Continent to Great Britain, the Isle of Man and Ireland, in H. Fokkens, B. Coles, A. Van Gijn, J. Kleijne, H. Pomjee and C. Slappendel (eds) *Between Foraging and Farming*:

261-280. Analecta Praehistorica Leidensia 40. Leiden: Sidestone Press.

Pétrequin, P., S. Casssen, M. Errera, L. Klassen, A. Sheridan and A.-M. Pétrequin (eds) 2012. *JADE. Grandes haches alpines du Néolithique européen. Ve et IVe millénaires av J.-C.* Tome 1 and 2. Besançon, Presses universitaires de Franche-Comté et Centre de Recherche Archéologique de la Vallée de l'Ain.

Price, T.D. and A.B. Gebauer 2017. The Emergence of Social Inequality in the context of the Early Neolithic of Northern Europe, in S. Hansen and J. Müller (eds) *Rebellion and Inequality in Archaeology, Proceedings of the Kiel workshops 'Archaeology of Rebellion' and 'Social Inequality as a Topic in Archaeology'*: 135-152. Universitätsforschungen zur Prähistorischen Archäologie 308. Bonn: Rudolf Habelt.

Radivojevic, M., T. Rehren, E. Pernicka, D. Šljivare, M. Brauns and D. Boric 2010. On the origins of extractive metallurgy: new evidence from Europe. *Journal of Archaeological Science* 37(11): 2775–2787 (available at: https://doi.org/10.1016/j.jas.2010.06.012).

Radivojevic, M. and B.W. Roberts 2021. Balkan metallurgy and society, 6200-3700 BC, in M. Radivojevic, B.W. Roberts, M. Maric, J. Kuzmanovic-Cvetkovic and T. Rehren (eds) *The Rise of Metallurgy in Eurasia: Evolution, Organisation and Consumption of Early Metal in the Balkans*: 11-37. Oxford: Archaeopress.

Rehren, T., L. Boscher and E. Pernicka 2012. Large scale smelting of speiss and arsenical copper at Early Bronze Age Arisman, Iran. *Journal of Archaeological Science* 39(6): 1717-1727.

Roberts, B.W. and C.J. Frieman 2015. Early metallurgy in Western and Northern Europe, in C. Fowler, J. Harding and D. Hofmann (eds) *The Oxford Handbook of Neolithic Europe*: 711-727. Oxford: Oxford University Press.

Roden, C. 1988. Blasrordüsen. *Der Anschnitt* 6: 60-82.

Rønne, P. 1979, Høj over høj. *Skalk*, Vol. 5: 3-8.

Rosenstock, E., S. Scharl and W. Schier 2016. Ex oriente lux? – Ein Diskussionsbeitrag zur Stellung der frühen Kupfermetallurgie Südosteuropas, in M. Bartelheim, B. Horejs and R. Krauss (eds) *Von Baden bis Troia: Ressourcennutzung, Metallurgie und Wissenstransfer. Eine Jubiläumsschrift für Ernst Pernicka*: 59-122. Oriental and European Archaeology 3. Rahden/Westf.: Verlag Marie Leidorf.

Schlichterle, H. and R. Rottlander 1982. Gusstiegel der Pfyner Kultur in Südwestdeutschland. *Fundberichte aus Baden-Würtemberg*, Band 7: 59-71.

Skaarup, J. 1975, *Stengade. Ein Langeländischer Wohnplatz mit Hausresten aus der frühneolitischen Zeit*. Rudkøbing: Langelands Museum.

Skorna, H. 2022. *The Life and Journey of Neolithic Copper Objects. Transformations of the Neuenkirchen Hoard, North-East Germany (3800 BCE).* Scales of Transformation in Pre-historic and Archaic Societies 15. Leiden: Sidestone Press.

Skorna, H. 2024. Make and break: Intentional fragmentation of copper flat axes as evidence for metallurgy in the Northern Group of the Early Neolithic Funnel Beaker societies, in H. Meller, R. Risch and E. Pernicka (eds) *Der soziale Wert von prähistorischen Beilen: neue archäologische und archäometrische Ansätze/The social value of prehistoric axes: new archaeological and archaeometric approaches*. Halle (Saale): State Office for Heritage Management and Archaeology Saxony.

Sørensen, L. 2012. Fremmede økser som sædekorn for neolitisering. Agrarsamfundenes ekspansion mod Sydskandinavien, in F. Kaul and L. Sørensen (eds) *Agrarsamfundenes ekspansion i nord. Nordlige verdener. Symposium på Tanums Hällristningsmuseum, Underslös, Bohuslän, d. 25.-29. Maj 2011*: 8-30. København: Nationalmuseet.

Sørensen, L. 2014. *From Hunter to Farmer in Northern Europe. Migration and Adaptation during the Neolithic and Bronze Age*, Vols. I-III. Copenhagen: Acta Archaeologica & Centre of World Archaeology (CWA).

Sørensen, L. 2020. Monuments and social stratification within the early Funnel Beaker culture in south Scandinavia, in A.B. Gebauer, L. Sørensen, A. Teather and A.C. Valera (eds) *Monumentalising Life in The Neolithic*: 71-85. Oxford: Oxbow Books.

Sørensen, L., P. Pétrequin, A.-M. Pétrequin, M. Errera, B. Horejs and F. Herbaut 2017. Les limites sud-orientales des jades alpins (Grèce et Turquie), in P. Pétrequin, E. Gauthier and A.-M. Pétrequin (eds) *JADE Objets-signes et interprétations sociales des jades alpins dans l'Europe néolithique 3*: 491-520. Ain: Presses universitaires de Franche-Comté.

Stos-Gale, Z.A. and N.H. Gale 2009. Metal provenancing using isotopes and the Oxford archaeological lead isotope database (OXALID). *Archaeological and Anthropological Sciences* 1: 195-213.

Strahm, C., and A. Hauptmann 2009. The metallurgical developmental phases in the Old World, T.L. Kienlin and B.W. Roberts (eds) *Metals and Societies: Studies in Honour of Barbara S. Ottaway*: 116-128. Bonn: Rudolf Habelt.

Strahm, C., R. Wiermann and N. Müller-Scheessel 2013. Salzmünde – Kupfer: Erst Prestige, dann Technologie, in H. Meller (ed.), *3300 BC. Mysteriöse Steinzeittote und Ihre Welt*: 71-77. Halle: Nünnerich-Asmus Verlag.

Thornton, C.P., T. Rehren and V.C. Piggott 2009. The production of speiss (iron arsenide) during the Early Bronze Age in Iran. *Journal of Archaeological Science* 36(2): 308-316 (available at: https://doi.org/10.1016/j.jas.2008.09.017).

Turck, R. 2010. *Die Metalle zur Zeit des Jungneolithikums in Mitteleuropa: Eine sozialarchäologische Untersuchung*. Universitätsforschungen zur Prähistorischen Archäologie 185. Bonn: Rudolf Habelt.

Vandkilde, H. 1996. *From Stone to Bronze. The Metalwork of the late Neolithic and earliest Bronze Age in Denmark*. Aarhus: Jutland Archaeological Society.

Vandkilde, H. 2014. Breakthrough of the Nordic Bronze Age: Transcultural Warriorhood and a Carpathian Crossroad in the Sixteenth Century BC. *European Journal of Archaeology* 14(4): 602-633 (available at: https://doi.org/10.1179/1461957114Y.0000000064).

Vandkilde, H. 2016, Bronzization: The Bronze Age as Pre-Modern Globalization. *Praehistorische Zeitschrift* 91(1): 103-123.

Vandkilde, H. 2019. Bronze Age Beginnings – A Scalar View from the Global Outskirts. *Proceedings of the Prehistoric Society* 85: 1-27 (available at: https://doi.org/https%3A//doi.org/10.1017/ppr.2019.7).

Woll, B. 2003. *Das Totentitual der Frühen Nordischen Trichterbecherkultur*. Saarbrücker Beiträge zur Altertumskunde 76. Bonn: Rudolf Habelt.

Zápotocký, M. 1992. *Streitäxte des mitteleuropäischen Äneolitikums*. Weinheim: VCH Verlagsgesellschaft.

Zápotocký, M. 2000. *Cimburk und die Höhensiedlungen des frühen und älteren Äneolithikums in Böhmen*. Památky archeologické, Supplementum 12. Praha: Institute of Archaeology.

Żurkiewicz, D., M. Strózyk, A. Garbacz-Klempa, M. Szmyt and P. Silska 2023. The earliest traces of metallurgy in Greater Poland: tuyère from Kotowo, Poland. *Documenta Praehistorica* 50: 420-433 (available at: https://doi.org/10.4312/dp.50.9).

Chapter 15

How the 'bronzification' of Scandinavia happened: From travelling bronze smiths to communities of practice

Lene Melheim[1] and Heide W. Nørgaard[2]

[1] Department of Archaeology, Museum of Cultural History, University of Oslo, Oslo, Norway
[2] Department for Archaeology, Moesgaard Museum, Højbjerg, Denmark
a.l.melheim@khm.uio.no

Abstract

The Bronze Age metalworker has been important for how the period has been understood since V. Gordon Childe placed the bronze smith at the centre of economic evolution and the division of labour. Since then, many scholars have highlighted the significance of the metalworker in Bronze Age society. Due to methodological advances, a massive amount of new data has recently become available, shedding light on provenance and interregional networks. In their address of these new datasets, the authors introduce the concept of 'communities of practice' in a fresh discussion about the organisation of craft activities in the Nordic realm *c.* 2000-500 BCE. This is balanced against considerations of the 'craftsperson's habitus', which allows them to identify and discuss craft communities at several different levels, from the small and localised to larger congregations of connected metalworkers. A picture emerges of shared technological practices that were upheld and modified across the centuries by workshop communities with various forms of organisation, geared towards local or regional consumption, yet interacting with outside networks. In particular, they address the movement of craftspeople and how this may have contributed to change and to technological and stylistic similarities.

Introduction

Among the important contributors to the study of Late Neolithic and Bronze Age metalwork is Helle Vandkilde. She has contributed and influenced the field in many ways, including through research into the origins of the Nordic metalworking tradition and her coining of the term 'bronzization' to address large-scale processes related to networks of copper, tin, and other valuables (Vandkilde 2016; 2014; Vandkilde *et al.* 2024).[1] In this contribution, our point of departure will be Vandkilde's idea about centres of production during the Late Neolithic (Vandkilde 1996) and the Early Bronze Age (Vandkilde 2017). To highlight the agency of the metalworkers, we introduce 'bronzification', which derives from the active verb *to bronzify*, as an aspect of bronzization.

A brief contextualisation is needed before we proceed. The Bronze Age metalworker has played a significant role in understandings of the metal age since V. Gordon Childe (1939; 1930; 1929) positioned the bronze smith at the centre of what he saw as an emergent specialisation and division of labour. Since then, interpretations have highlighted the role of skilled craftspeople in the spread of metalworking technologies and the establishment of European-wide trade networks (see Molloy and Mödlinger 2020). Arguably, new ideologies related to the conspicuous consumption of metals emerged from a more hierarchical mindset and a stratified social structure. Childe's initial assumption of highly specialised, full-time craftsmen with high social status (Childe 1930: 4) who were socially independent, itinerant and 'liberated from the bonds of local customs' (Childe 1940: 163) has been challenged by later scholarship. Written sources (e.g. Zaccagnini 1983), ethnographic parallels (e.g. Neipert 2006), and evidence of the crafting process (e.g. Nørgaard 2018a; 2014) have allowed researchers to reposition the Bronze Age smith as community-based and less independent.

Today, various analytical methods are crucial for understanding aspects of metal craft, from technological proficiency and alloying practices (metallography and elemental analysis) to provenance (chemistry and lead isotopes). After the SAM project had paved the way for large-scale studies of metal types (i.e. Junghans *et al.* 1974; 1968; 1960), but before lead isotopy had been fully established as a crucial component in archaeological provenance analysis, Vandkilde's (1996) work on Late Neolithic and Early Bronze Age Scandinavian metalwork was formative for a new approach combining typology with metal types. Patterned shifts in metal supplies through time could, for the first time, be linked to typological features.

[1] Dear Helle, your enormous knowledge and passion for the Nordic Bronze Age have inspired us deeply over the years. It is very much thanks to your contributions that we can now collaborate across regional boundaries and examine similar topics from different perspectives. In celebration also of your mastery of language and ability to coin new concepts, we have taken the opportunity to play a bit with words and hereby add 'bronzification' to your concept of 'bronzization'.

While technical aspects and analytical programs were at the forefront of significant contributions to research on metal production in the Nordic realm during the post-war era, the late 1990s and early 2000s were characterised by innovative and sometimes speculative research, focusing on the social aspects of metal craft: know-how, transmission, and the ritual and organisational frameworks surrounding the craft (see Melheim 2015: 11-25; Melheim and Nørgaard in press, cf. Molloy and Mödlinger 2020). This was followed by a more empirical turn, and a shift of focus from the ritual sphere to everyday life. Following this (and based on closer analysis of workshop assemblages and objects), a picture is now emerging of shared technological practices that were upheld by workshop communities across the Nordic realm. Various forms of organisation have been suggested to explain the patterns observed: groups of travelling metalworkers, family enterprises, elite-controlled production, or a combination of all three (e.g. Melheim 2015; Nørgaard 2018a; Sörman 2018; 2017). With a few exceptions, most production sites seem to have been geared towards local markets (Nørgaard 2017). The interplay between the local and the interregional is, however, not well explained in current interpretations (Prescott 2018).

Knowing that there were many different human interactions and operational chains that contributed to the production of metalwork in the Nordic realm from *c.* 2000 BCE and through the Bronze Age, we shall place a particular emphasis here on trading practices. It is an established fact that metal arrived in many different forms: as ingots of copper and tin (e.g. Ling and Stos-Gale 2015), as alloyed ingots and preforms (e.g. Nørgaard 2024), and also as manufactured artefacts from craft environments outside the Nordic world (see Liversage 2000; Vandkilde 1996; 2017). This happened through networks which not only secured metal supplies, but probably also acted as sources of inspiration for metalworkers and their customers. Within the last ten years, extensive datasets based on combined lead isotope and elemental analysis of Scandinavian Bronze Age artefacts have been combined with typological discussions to contribute to an illumination of ancient metal supplies to the Nordic realm *c.* 2000-500 BCE (e.g. Ling *et al.* 2023; Ling *et al.* 2014; Melheim *et al.* 2018; Nørgaard *et al.* 2022; 2021; 2019; Vandkilde 2017).

We use the results of these studies to address the question about how access to metals and the quality of the metal supplies affected local workshop milieus and technological trends. Despite regional and temporal variation and shifting external influence, Nordic Bronze Age metalwork expresses a shared technological and stylistic *koiné*, which was firmly established *c.* 1600 BCE (Vandkilde 2014). To better understand how craft traditions or 'craft cultures' were reproduced across a geographically large and diverse region, and how both the craft itself and particular object types developed over time (Sørensen 2014), we find 'communities of practice' a very useful concept. However, the different and shifting social constellations surrounding the craft can be better understood, we argue, if we combine this concept with insights into the habitus of craftspeople.

How to approach bronzification

Craft studies focusing on individual tool traces, operational sequences and skill can aid the interpretation of interaction spaces and lead to the identification of workshop milieus, or 'analytical workshops' (Kuijpers 2017; Nørgaard 2018b; 2017). The 'craftsperson's habitus' is, according to Willeke Wendrich (2012), and with refinements by Heide Nørgaard (2018a), a combination of the craftsperson's capabilities and experiences and all other influences that affected their life. Wendrich's definition, drawing on Erwin Panofsky's (1951) idea of imprinting and how making relates to the *Zeitgeist*, is closer to how Marcel Mauss (1979: 101) defined habitus, than Pierre Bourdieu's (1977) conceptualised habitus. Because traditions and ideologies have been passed on through the learning process and the direct transmission of gestures and steps, the habitus of a craftsman can be seen as a mirror of the technological knowledge of a group. Since technological knowledge is the framework, there is also an individual aspect with regards to the craftsperson's skills and their ability to receive and process knowledge (Nørgaard 2018: 255-258). The personal or individual part of the habitus, including tacit knowledge (see e.g. Ingold 2000; Polanyi 1966), is in some respects comparable to concepts applied in archaeological studies, such as the 'body of knowledge' (Dobres 2000: 138; Roux *et al.* 1995: 65), 'know-how' (Apel 2008: 8; Høgseth 2012: 65; Karlin and Julien 1994: 156-162), 'motor know-how' (Costin 1995: 622; Creese 2012: 48; Minar 2001: 395; Pelegrin 1990: 118; Wallaert-Pètre 2001: 481), and even 'anticipation' (Caine and Caine 1994: 5; Sennett 2008: 154).

In terms of the definition of workshops, it is important to reveal patterns of technological behaviour. In the sense described here, technological behaviour can be distinctive and display overall technological influences or, when expressed in minor differences, can display innovations within a small group of related craftspeople (Nørgaard 2018a: 303-305). An 'analytical workshop' is, thus, defined by people and the close technical interactions between craftspersons, and not by the physical locations where these actions were executed (Nørgaard 2018a: 1-2). Nørgaard suggested that, until future field studies might reveal their actual locations in the landscape, the area in which such groups operated can be localised based on the distribution of artefacts crafted by the respective craftspeople.

The concept of communities of practice was coined by Jean Lave and Etienne Wenger (1991), and further developed by Wenger (1998), amongst others. It is closely related to learning theory and models for apprenticeship as well as to the field of situated learning, theoretically speaking. Although the concept is far from restricted to craft communities or material-based practices, it has turned out to be a useful analytical tool for archaeologists (e.g. Bukkemoen 2021; Fredriksen 2013), and has been successfully applied in Bronze Age research as a model, e.g. for barrow building practices in Scandinavia (Holst and Rasmussen 2012; 2015) and for practices related to metalworking and hoarding in the Carpathian Basin (Orfanou *et al.* 2024). Communities of practice are made up of people 'who engage in a process of collective learning in a shared domain' (Wenger-Trayner and Wenger-Trayner 2015). Members of such a community are practitioners who develop a shared practice or a shared repertoire of resources: tools, experiences, narratives, and problem-solving strategies.

Tim Ingold (2000: 316) pointed out that, whereas skilled practice or know-how is physically performed and context-bound, technology – the knowledge of a technique – can exceed the actions of individuals and be symbolically transmitted. Experience drawn from trial and error can be stored in language as technological knowledge, or recipes for action, and be shared with other craftspeople (see also Apel 2001: 18-22). Ingold's framework can thus be used also to approach Bronze Age metalcraft as a truly discursive (i.e. verbalised) phenomenon, where verbal explanation and cultural competence were integrated parts of the transmission and negotiation of techniques as well as artefact shapes and culturally significant symbols (Melheim 2015).

Within an imagined community of practice of Bronze Age metalworkers, informal learning would have been as important as more institutionalised apprenticeship, and individual craftspeople would have contributed to the creation and reproduction of metalworking styles. We also consider that differently organised workshops could exist in parallel and participate in wider communities of practice. This has been demonstrated for Middle Bronze Age northern Europe, *c.* 1400-1200 BCE, insofar as interaction was observed between workshops in Zealand and workshops in central Lower Saxony (Nørgaard 2018a: 362-369). Another interesting observation is that smaller kinship-based workshops contributed with single items to larger ritual depositions (Nørgaard 2018b; 2019). Similarly, in eastern Norway, there is evidence from the Late Bronze Age (*c.* 700-500 BCE) that typologically similar artefacts made by different craftsmen or workshops were hoarded together (Lund and Melheim 2011).

We argue here that the evolution of the Scandinavian metalworking tradition was a gradual process in which the stepwise establishment of artefact forms was closely connected to technical developments (Nørgaard 2018a). Thus, some general trends in craft developments within the Nordic realm can be established. Casting in simple moulds with decoration applied post-casting was dominant across Scandinavia until 1700 BCE, with a few exceptions. The cord-ornamented axe from the Pile hoard is an early example of decoration applied to the mould (Vandkilde 2017). The beehive cup of the Skeldal hoard is among the earliest examples of lost-wax casting in Scandinavia (Mörtz 2009; Vandkilde 1992; 1988). Although post-casting decoration dominated later Fårdrup and Valsømagle metalwork (Nørgaard *et al.* 2022), some Valsømagle axes seem to have been crafted with the lost-wax method. Casting techniques developed rapidly with the appearance of metal-hilted swords *c.* 1600 BCE, leading to the predominance of the lost-wax method in the Middle Bronze Age (Melheim and Nørgaard in press). With the introduction of high lead content bronze *c.* 1100 BCE, the lost-wax technique was further refined. Towards the end of the period, metalwork became more and more standardised. From the beginning to the end of the Bronze Age, craftspeople across larger parts of Scandinavia were working with almost identical refractory tools, techniques, and materials. This, too, suggests that they practiced a common technology which developed within larger communities (Melheim 2015: 101). We shall now look more closely into the development of craft communities in southern Scandinavia from a diachronic perspective.

Evidence of metalcraft within the Scandinavian metalworking tradition

The scanty Neolithic evidence

The earliest evidence of *in situ* metalcraft activities in Scandinavia dates to the 4th millennium BCE and comes from a megalithic burial monument in southern Scandinavia, at Lønt in Jutland (Gebauer *et al.* 2020, see also Gebauer *et al.* this volume). The first evidence of local metalworking in northern Scandinavia is roughly contemporary, as is exemplified by simple axes and ornaments of copper (Ikäheimo and Nordqvist 2017; Nordqvist and Herva 2013). Our knowledge concerning the earliest metalworking sites is still coalescing. Hopefully, future research will add contextual evidence for the many newly published copper artefacts from southern Scandinavia (e.g. Brozio *et al.* 2023; Klassen 2000; Skorna 2024).

In the Late Neolithic (LN), the amount of metal circulating in the Nordic realm had grown significantly, especially after the advent of tin-bronze *c.* 2200/2000

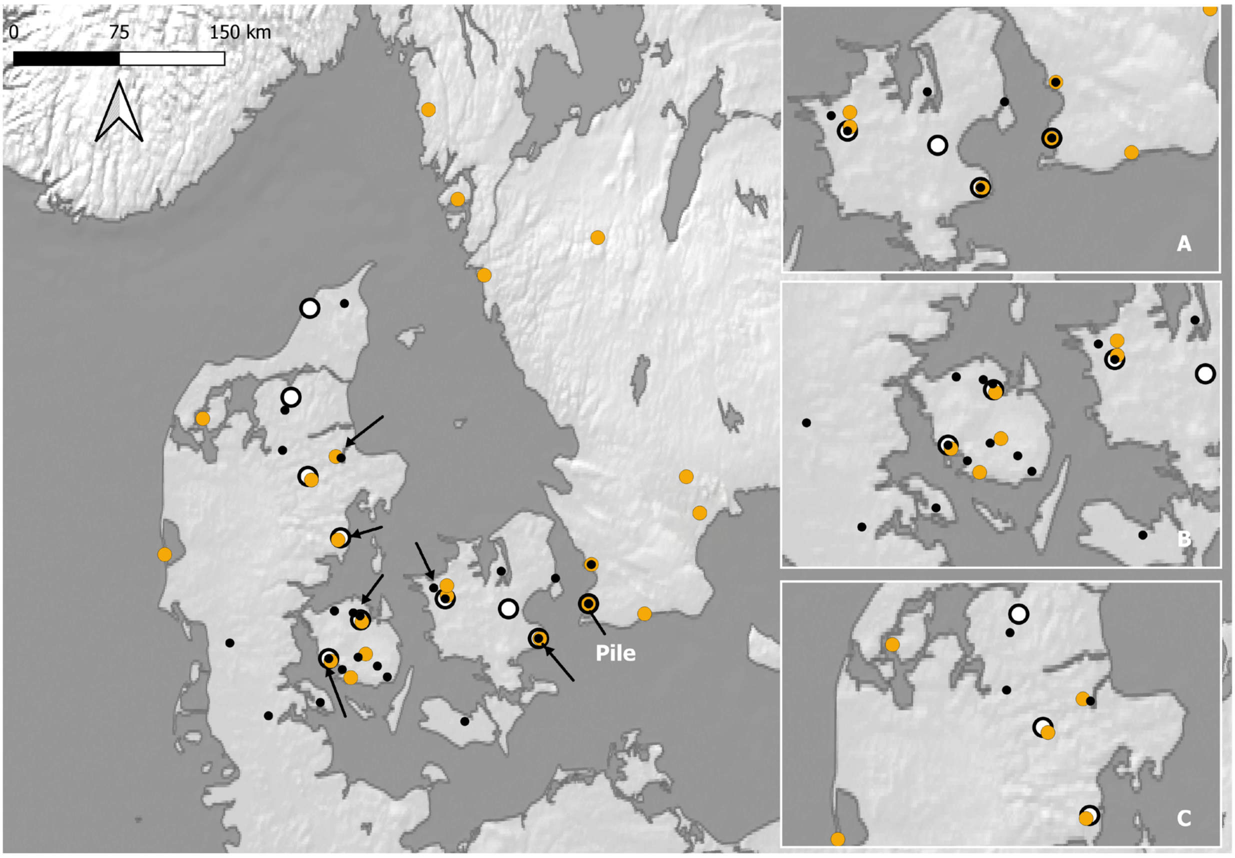


Figure 1: Distribution of the Anglo axe types in southern Scandinavia (yellow dots) during LN II compared to artefacts with English-Welsh metal signatures (black empty dots) and mixed signatures with Welsh metal (black dots). The Pile hoard and possible other ports of trade or entrepots are highlighted with arrows (data points based on Nørgaard 2024; Nørgaard *et al.* 2021; map by Nørgaard, based on QGIS and Natural Earth).

BCE. LN II hoard finds like those from Skeldal in Jutland and Pile in Scania suggest that metal entered Scandinavia from various copper-producing regions and was recast into local shapes (Melheim *et al.* 2018; Nørgaard *et al.* 2021; 2019, see also Vandkilde 2017; 1988). The Únětice culture of central and eastern Europe was clearly an important factor in the spread of metalwork and metal crafting technologies to southern Scandinavia. Únětice metal reached Denmark in LN I and in larger quantities from LN II (Nørgaard *et al.* 2021; Vandkilde 1996: 297-298). Typical Únětician artefacts in Scandinavia in the early phase include triangular copper daggers, flat copper axes, stone wrist-guards, flint arrowheads, *Noppenringe*, and clay drinking cups; later in LN II, halberds, metal-hilted daggers, flanged axes, and solid rings joined the ranks (Vandkilde 1996: 14-15, 294-302). Únětice metalwork in central Europe was cast in two-part (or bivalve) moulds (Krause 2002: 34-35) which are typically found in settlement contexts (Jaeger *et al.* 2015; Tarbay 2019).

Despite the fact that in the LN II *c.* 75% of the metalwork in southern Scandinavia seems to have been crafted locally (Vandkilde 1996: fig. 266), direct evidence of in situ metallurgy from this era is still very rare (see Jantzen 2008). Some of the few existent finds come from peripheral mountain areas, e.g. Sogn in western Norway (Prescott 1991; Diinhoff 2006). The lack of more solid evidence may relate to the use of sand or organic materials for casting (as argued by Engedal 2010: 163-167 on the basis of experiments), and not, as within the Únětice culture, more durable bivalve stone moulds. When it comes to a few very nice bivalve stone mould finds from north-central Norway, the technology is thought to have been adopted from the Seima-Turbino culture at the beginning of the Bronze Age, or at a slightly earlier date (Engedal 2010: 67). While these finds may relate to Arctic copper networks, we currently know too little about the local contexts to be able to relate them further to mechanisms of exchange and craft transmission.

A third sphere of contact has proven to be interesting indeed when it comes to interpretations of early craft centres in the Nordic realm: overseas contacts with an Atlantic network and, hence, Anglo-Irish craft traditions. Nørgaard and colleagues (2019) could show that what they coin 'Anglo-axes' (because those identified in Denmark are of Welsh or English origin), were recast to local forms to preserve the golden colour of the imported bronzes. Following this, the targeted import of high-tin metal through overseas networks may be assumed and can possibly be supported by the existence of axe-hack metal and amber imitations of decorated Anglo-axeheads in the Limfjord region in northern Jutland (Nørgaard 2024; Nørgaard *et al.* 2019).

It seems clear that the earliest trade networks to Scandinavia were organised in a way not unlike monetary systems, insofar as the value of an object (in this case, the quality of the metal) was represented by its form and function. Following this, by linking a specific metal and its origin with a particular object type and the properties this artefact is expected to have (a ring should be flexible, an axe should be hard and durable), cross-community understandings of quality can be approached. For instance, eastern Alpine ring metal (the so-called *Ösenring* metal), which spread within the Nordic LN II, had a low nickel content, making it suitable for hard-wearing objects (Nørgaard 2024).

Maritime connections and the establishment of ports of trade or entrepots, were certainly important for the circulation of metals from an early point in time, and also, we argue, for the development of craft practices. Vandkilde (2017: 130) linked the fragmentation of metal objects in the Pile hoard to metalworking practices and identified a nearby residential site as a potential entrepot, where local metalworking was practised. When looking at metallurgical evidence and distribution patterns, imported Anglo-axes and locally crafted artefacts made of Welsh or English metal are present in large parts of southern Scandinavia (Nørgaard *et al.* 2021). Especially in coastal regions, such as Pile, we see accumulations of Anglo-axes, local casts, and local metalwork made of mixed metal (Fig. 1). We consider this to be direct evidence of some of the earliest craft communities in Scandinavia.

The still scanty Early and Middle Bronze Age evidence

The physical evidence of workshop sites in southern Scandinavia in the early part of the Nordic Bronze Age (NBA), *c.* 1700-1100 BCE is still scanty (see Jantzen 2008: 224). During these 800 years, craft communities are likely to have been kinship-based institutions, but with craft centres connecting several regions (Nørgaard 2018a). The quality of the crafted artefacts seems to have been closely linked to the workshops' production volume and distribution area (Nørgaard 2019; 2017). In general, it seems that artefacts were produced for the local community or a restricted market. However, there are exceptions, indicating the presence of full-time specialists, e.g. in northern Zealand (Nørgaard 2017) and in some cult-house environments, e.g. Mälardalen in Sweden (Sörman 2018: 202-212). Direct contact and knowledge exchange between craftspeople in areas far apart are indicated by finds such as a disc-headed pin from Lower Saxony and a neck collar from Zealand, for which the exact same spiral stamp was employed. Both artefacts otherwise show locally specific ornamentation and their traces reflect local workshops (Nørgaard 2018a).

Additionally, metal analysis seems to support a pattern of regional metal networks within Scandinavia, allowing us to link the distribution of certain metal types to local workshop traditions and regionally distributed styles. This tendency can be observed already during NBA I, when axe metal was cast into various Nordic styles, e.g. the Fårdrup and Valsømagle horizons. These seem to have circulated out from central workshops or marketplaces as preforms (bronze ingots) or 'axe brands', to be further distributed and recast within regional markets (Ling *et al.* 2023; Melheim 2024; Nørgaard *et al.* 2022). Quite possibly, these practices evolved around the access to tin.

A scenario in which tin arrived in Scandinavia already alloyed with copper from Britain (high tin-content bronze) may explain the mixing patterns which are indicated by Early Bronze Age isotope plots (see Berger *et al.* 2021; Nørgaard 2014; Nørgaard *et al.* 2021). The mixing of batches of copper from different suppliers (both with and without tin) may have been an intentional act aimed at creating particular metal qualities. This metallurgical knowledge was probably based on established practices within craft communities, indicating a strong familiarity with the process. This scenario finds support in the somewhat later evidence from the Salcombe wreck site in England, *c.* 1300-800 BCE. A varied selection of ingots of tin and copper and bronze weapons from the site was recently analysed by Daniel Berger and colleagues. They argued that the mixing of copper-tin alloys is a more likely explanation of the compositional and isotopic patterns than the alloying of individual components of copper and tin, although copper ingots may have been added in the mixing process (Berger *et al.* 2022). Whereas the tin is argued to come from deposits in the UK, the copper has various other origins, underlining the complexity of Bronze Age metal trade.

Several of the large workshop sites that thrived in southern Scandinavia in the Late Bronze Age (see further below) show evidence of having been established sometime during NBA II or III (*c.* 1500-1100 BCE); this concerns sites such as Apalle and Broåsen in Sweden, and Hunn in Norway (Melheim 2015: Appendix 1). The majority of our knowledge about Middle Bronze Age workshop communities, however, draws on the identification of relations between craftspeople based on crafting traces on artefacts (Nørgaard 2018). Nonetheless, it has been argued

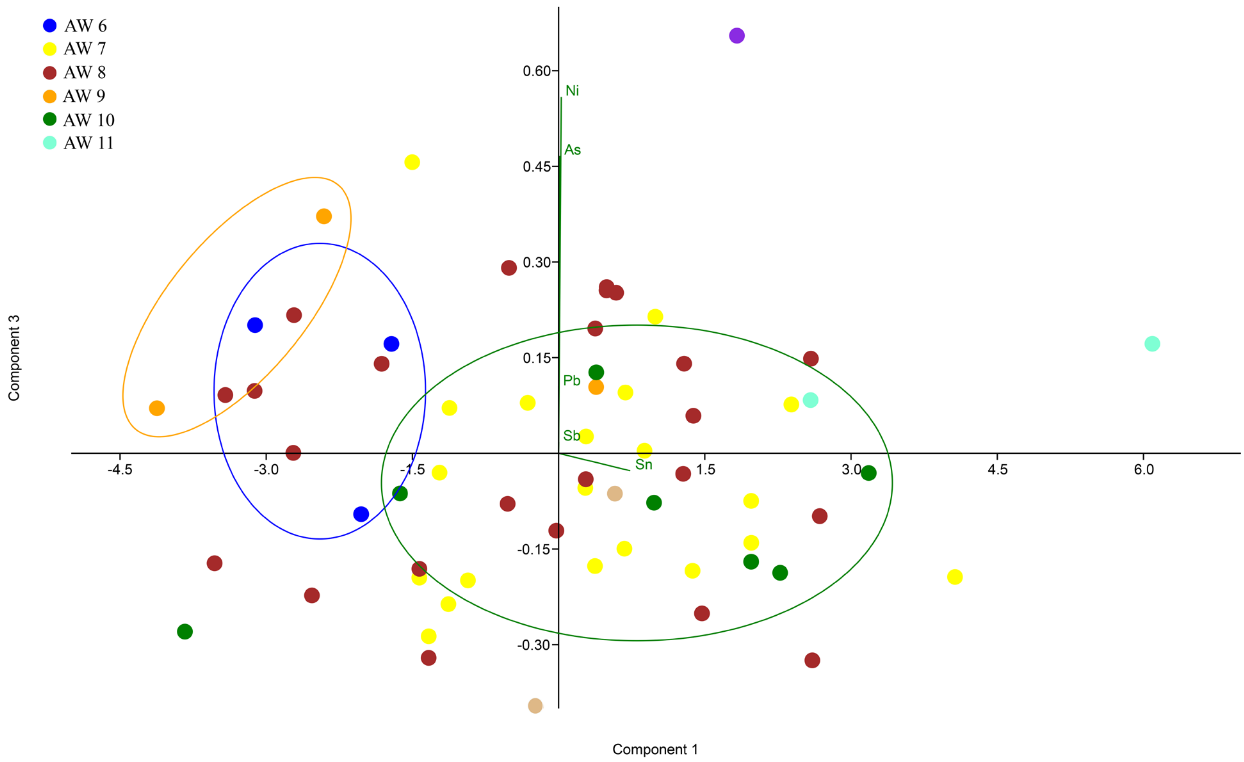


Figure 2: Perceptive component analysis of the artefacts that could be allocated to workshops (based on Bunnefeld 2016b; Nørgaard 2018). The trace elements included in the analysis are detectable by the human senses (for example, they can be identified by smell) even in minor amounts (see Mödlinger *et al.* 2017) and, hence, are named perceptive components. These include Sn, Sb, Pb, As, and Ni, which all have visible or technical effects on the alloy. The figure clearly divides the artefacts from small-scale workshops on Jutland (orange, blue) from the large-scale craft communities on the Danish isles (yellow, green, brown). Where yellow shows the artefacts considered to be produced by full-time workers in a relatively restricted area, the brown and green artefacts show a larger chemical diversity, which might reflect chronological issues or different metal sources, possibly indicating a larger community of craftspeople (workshop numbers based on Nørgaard 2018a; plot by Nørgaard using PAST 4.08).

that stylistic or typological groups do not necessarily relate to single workshops (Bunnefeld 2016a; Nørgaard 2014). Moreover, technological similarities between individual workshops seem to indicate the existence of so-called *Werkstattkreise* (Bunnefeld 2016b: 83-90) or, better, technological units that demonstrate a shared understanding of techniques and stylistic elements (see Nørgaard 2018: 305). Sometimes, covariation can be observed between workshop traditions and metal supplies. In a combined analysis of Middle Bronze Age ornaments and swords, it could be stated that not only did specific 'analytical workshops' or craft communities have different metal networks, but also that the repertoire of each workshop included many different kinds of artefacts (Nørgaard in press; see Fig. 2).

The rich and varied Late Bronze Age evidence

An increasing number of excavated workshop sites dating from the transition to the Late Bronze Age allows more insight into craft practices (Fig. 3) and further separation into various organisational forms, including the aspect of homecraft, seasonal craft activities, and specialised, productive craft centres (Melheim and Nørgaard in press). More permanent workshop sites appeared during the Early Bronze Age at several places along the coast of southern Scandinavia and the Baltic Sea (Fig. 3a); the number of sites increased from *c.* 1100 BCE (Fig. 3b). Sites with rich evidence of metal production and other craft activities during the Late Bronze Age have been excavated, e.g. at Håg, Voldtofte and Vindblæs in Denmark, Broåsen, Skälby, Hallunda, and Ryssgärdet in Sweden, and Hunn in Norway (see Boddum *et al.* 2015; Jantzen 2008; Melheim 2018; 2015; Sörman 2018, with references to the individual sites). Asva in Estonia is another example of such a site (Sperling 2011). The sizable assemblages and the physical structures surrounding them indicate that these sites were permanent or semi-permanent and were possibly indicative of a centralised production of weapons, tools and jewellery. Among the products often fabricated at such sites are rods of bronze, which possibly represented local preforms for further distribution.

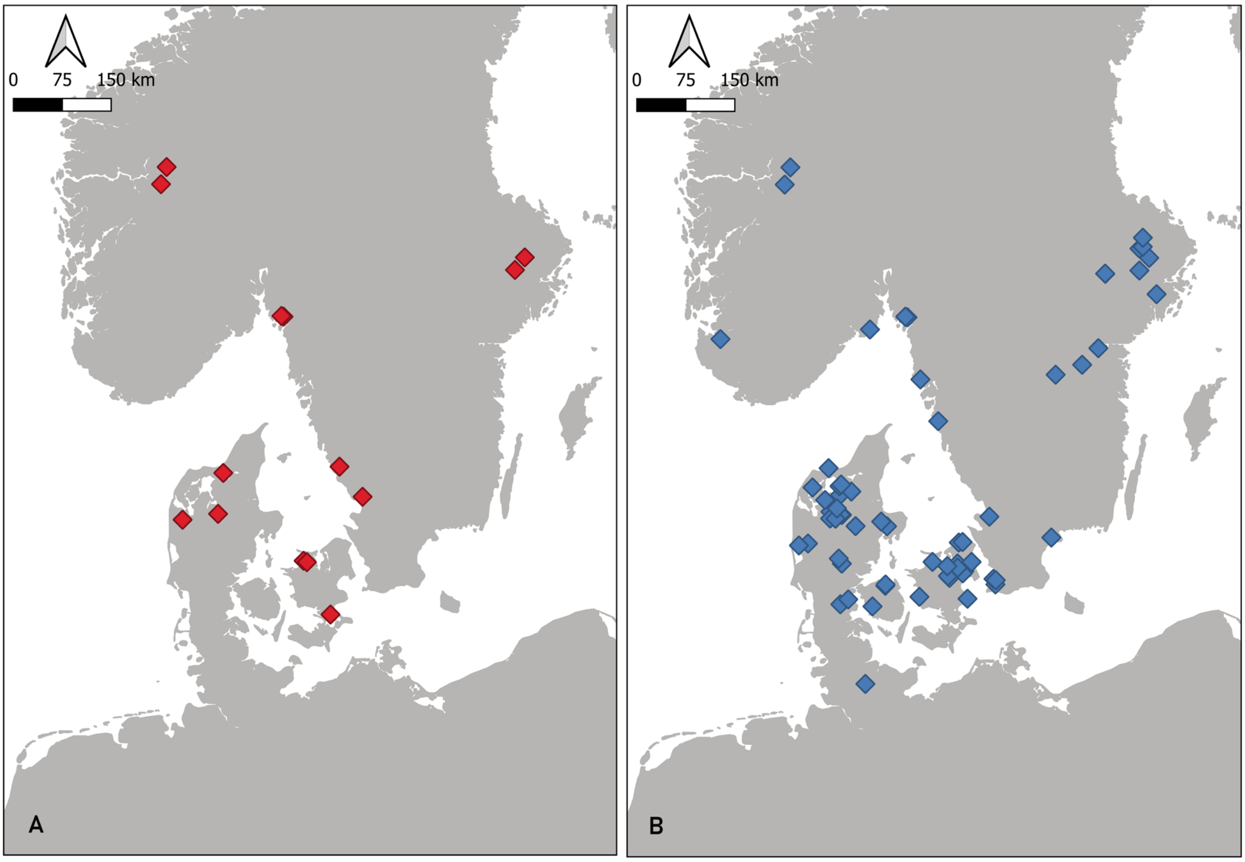


Figure 3: Larger metal workshop assemblages in southern Scandinavia during A) the Early (including the Middle Bronze Age) and B) the Late Bronze Age (based on Boddum *et al.* 2015; Jantzen 2008; Melheim 2018; 2015; Sörman 2018; map by Nørgaard with present-day sea levels).

The majority of these workshop sites occur in densely populated areas, with some exceptions (see Prescott 2000). Whereas most Danish sites lie at some distance from the shore, sites on the Scandinavian Peninsula tend to be situated closer to the seashore, on islands, and on what can be defined as strategic maritime positions. The maritime positions of some workshop environments can be linked to suggested maritime routes (e.g. Bech and Rasmussen 2018: 64-86; Eriksson 2002: fig. 15). Some have argued for seeing such sites as marketplaces, where imported metals and other raw materials were refined and redistributed (e.g. Melheim 2018). Some workshops, e.g. Ryssgärdet in Uppland (Eriksson and Grandin 2008), Asva on Saarema in the Baltic Sea (Sperling 2011), and Hunn in Østfold (Melheim *et al.* 2016) appear in aristocratic environments, on or near fortified hilltops.

Typical finds are fragmented clay refractories: crucibles, moulds, and tuyères, often accompanied by pottery, flint waste, burnt clay, animal bones, and, more rarely, metal objects and stone moulds (Boddum *et al.* 2015; Jantzen 2008; Melheim 2015: 20-24; Sörman 2018). Interestingly, similar technological choices and operational chains seem to characterise craft practices across southern Scandinavia, both when it comes to the selection of raw materials to produce technical ceramics, the shapes and sizes of the crucibles, the use of both bivalve and broken clay moulds, and particularities, e.g. the application of wooden sticks to prevent moulds from twisting. These elements are, in our opinion, reminiscent of a shared casting technology analogous with larger communities of practice, or technological units. Quite likely, the clay refractories were manufactured locally, together with other forms of pottery typical of the later part of the Nordic Bronze Age and related ceramic traditions such as the Lusatian. This has invited the characterisation of Bronze Age metal craft as a cross-craft technology (Melheim 2015; cf. Sofaer 2006). An interesting aspect indeed is the symbolism related to tools and preforms. For example, bellow nozzles found across southern Scandinavia show similar decorative matrices, and some of these can been identified as zoomorphic (Thrane 2006). This regards a conical figurine from Pryssgården in Östergötland as well as the more well-known horse-headed mouthpiece from Ørslev Skovgård on Funen (Melheim 2015: 101; Thrane 1993: fig. 10; 2006: 271).

Across Europe, the use of balance weights evolved alongside a growing trade in metals and textiles (e.g. Ialongo *et al.* 2021; Vandkilde 2021). Although a weight system with one or several weight units existed in Scandinavia (e.g. Malmer 1992; Melheim 2018; Weiler 1996), the northerners seem to have been late in adopting balance weights as tools for more precise measurements. What is striking, however, is that a similar wave or snake pattern as that present on rectangular bronze weights (e.g. those from the Salcombe cargo; Berger *et al.* 2022; Ialongo *et al.* 2021) also occurs on bivalve clay moulds from contemporary workshop sites in the Nordic realm (Melheim 2015: 98-99, and references herein). Hence, a possible connection can also be established between trade practices and the execution of the craft itself.

The connection between metalwork and workshops in the Late Bronze Age is largely lacking. The reason is twofold. First, the amount of material from the Late Bronze Age is massive, and artefact categories connected to the most typical mould shapes are so frequent that no comprehensive study of craft traces has to date been executed. Second, the material culture of the Late Bronze Age is more uniform across Europe than it was in the Middle Bronze Age. Thus, although the number of imported artefacts is traditionally considered to be low (Thrane 1975), many artefact types that were locally produced (e.g. axes, rings, sword blades) can be difficult to distinguish from imported ones. However, some local or regional subtypes show distribution patterns which probably reflect workshop milieus and their networks (Baudou 1960; Jensen 1997). For instance, the many different axe subtypes belonging the so-called Mälardalen or KAM theme can be traced to different parts of Scandinavia, and each with different technological trajectories (Engedal 2010: 95, 182-184; Melheim 2015: 73-81). An interesting observation is the mismatch between axe types known through artefact finds and those only known through imprints on bivalve stone moulds, indicating that we face a problem of representativity. When it comes to provenance studies, a wide range of sources, and a high degree of metal mixing from various overseas and continental sources, has been argued to be reflected in metal signatures from the Late Bronze Age (Ling *et al.* 2014; Melheim *et al.* 2018, see also Nørgaard *et al.* in this volume). We can only recommend a more detailed study of the metallic material culture of the Late Bronze Age for comparison against the rich material from recovered workshop sites so that we can better define the products of these craft communities and their work.

Communities of practice and mobile metalworkers

Vandkilde argued that that Late Neolithic metallurgy was first introduced to northern Jutland by the children of Beaker copper smiths, who settled in areas where metallurgy was not yet adopted, and from there it subsequently spread to other parts of Denmark (Vandkilde 1996: 263-265, 296; 2001: 352). The theory of redundant smiths utilising vacant niches emerged from Childe's theory of the itinerant smith of Beaker cultures in western Europe (Childe 1930: 4-11, 44; 1939: 113-117) and was formative in later understandings of the spread of tin-bronze metallurgy. The spread of crafts such as the pressure-flaking of flint weapons and metallurgy – technologies which would have required long training supervised by an expert (i.e. institutionalised apprenticeship) – is difficult to envision without also presupposing human movement in some form (Apel 2001: 116-122).

Childe was preoccupied with the autonomous role played by the smith. In later archaeological discourse, the theory of the mobile metalworker has embraced two inherently different social representations. One is that of the ambulating smith, similar to Childe's original configuration, who travelled from one village to the other, thereby providing local communities with metalwork. Another is the free-riding metallurgist who migrated to a 'virgin' area where metallurgy had not yet been adopted, thus spreading the technology. The theory of migrating metallurgists has been useful for understanding the initial spread of metallurgy (e.g. Apel 2001: 116-122; Butler 1963; Craddock 2003: 8; Harrison 1980; Janzon 1986). Childe's 'travelling tinker', on the other hand, remains a matter of controversy. Ethnographic evidence does not seem to support the idea of metalworkers being full-time specialists in premodern communities (e.g. Anfinset 2011; Herbert 1984: 23; Rowlands 1971, cf. Neipert 2006).

An interesting find in this context is a teenager's grave with metalworking tools from Kargaly in the Urals, which may suggest that the craft could have been inherited within families (Koryakova and Epimakhov 2007: 49). An alternative interpretation of this and other metalworkers' burials (e.g. the Hesselager burial from Scandinavia; Randsborg 1986), is that metalcraft was symbolically appropriated by the upper segment of society (see Metzner-Nebelsick 2003). Cross-culturally, however, the social status of metalworkers and their institutions appears to be highly diverse (Anfinset 2011).

The material culture of the Nordic Bronze Age allows us to identify yet another form in which larger communities of practice could convene regularly without pushing the idea of mobile craftspeople towards large-scale mobility, i.e. craft gatherings on a seasonal basis. The metal hoard from Vognserup Enge on Zealand, a bog find with ornaments dating to NBA II (Frost 2011), may serve as an example of an

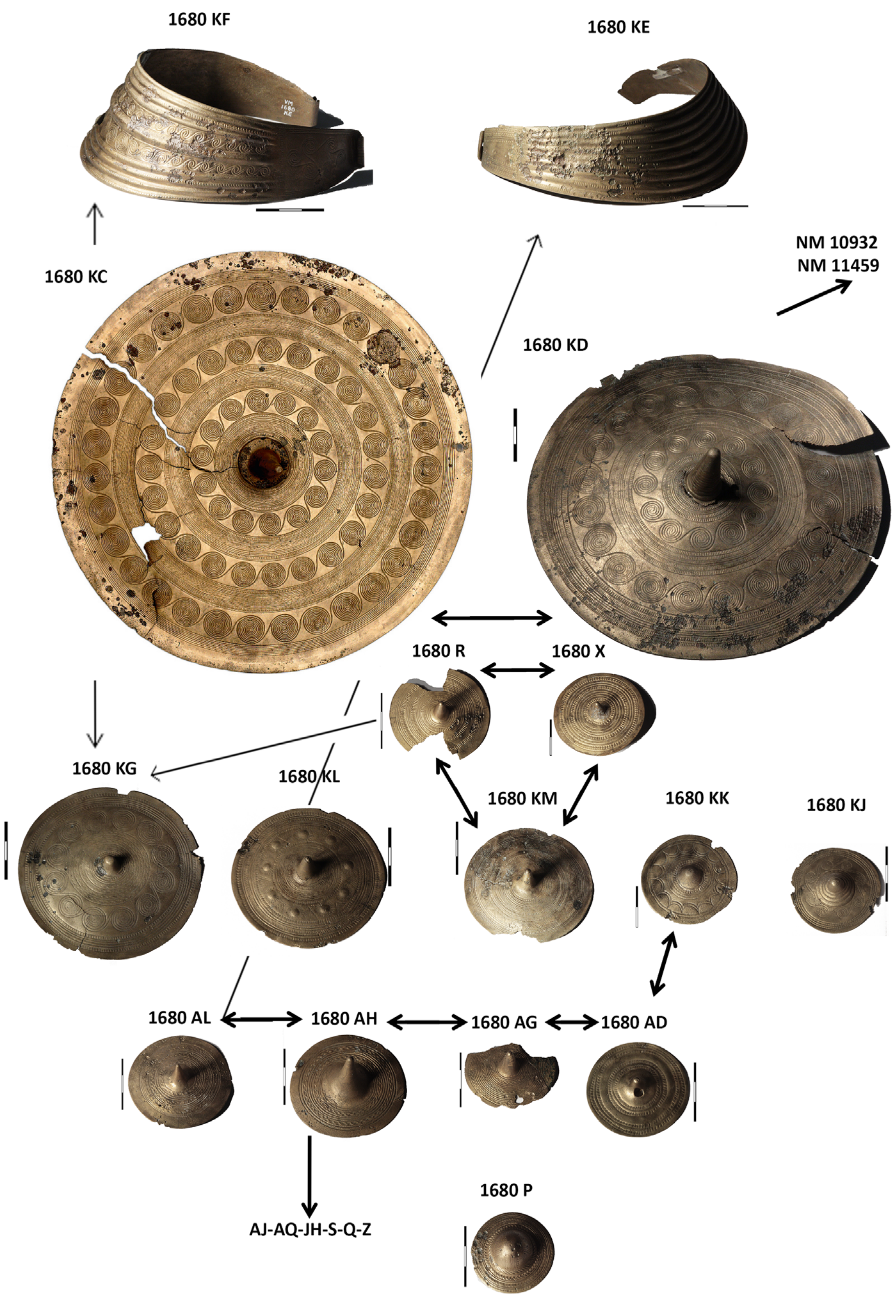


Figure 4: A selection of artefacts from the Vognserup Enge hoard from Zealand shows the connection between single items in terms of crafting. The technological knowledge used to craft these artefacts can be tied to contemporary analytical workshops and likely also to particular craftspeople (reproduced from Nørgaard 2018a: 338 with permission).

offering, perhaps at the end of a social gathering of craftspeople. These ornaments have been crucial for the identification of artefacts decorated solely via the lost-wax method (Nørgaard 2018a: 338, in contrast, see Savage *et al.* 1982) as they were deposited without reworking, hence displaying several casting mistakes. Although the items are made with similar tools, they show a wide spectrum of technological knowledge, probably indicating the involvement of different craftspeople (Fig. 4). Traces of the craftspeople who contributed to the hoard were identified on other artefacts from workshops on Zealand, Funen, and Jutland (Nørgaard 2018a: 338). This indicates a scenario in which the community of practice could be envisioned as a form of 'craft fair'. This is based on the as-cast deposition of the artefacts, the different skill levels represented, the present and visible mistakes, the groups of artefacts made by individual craftspeople, and the technological connections to other craft communities.

A group of Middle Bronze Age neck collars from Bornholm illustrates the challenges of recognising mobile craftsmen in the archaeological record. These specific collars are decorated with a double spiral row framed by head and triangle ornaments (Nørgaard 2011: 80-83). The main distribution area of this type appears to be in Jutland during NBA II, with three examples from Bornholm which date slightly later (Nørgaard 2014: 44). Seven collars (distributed from central Jutland over Bornholm and into Scania) are very similar from a craft technical point of view and, therefore, inspired a discussion about mobile craftspeople in the Middle Bronze Age (Nørgaard 2014). Four collars from Vorup near Ribe, Krasmose, Jomfrugård, and another unspecified site on Bornholm, are nearly identical in shape, size, and decorative details (Nørgaard 2014: fig. 9). The collar from Jomfrugård is the oldest and might have been traded to the island. The same could possibly be argued for the collar from Krasmose, if it did not show specific decorative elements (horizontal arches) typical for Bornholm. However, the most interesting technical detail is hidden in the spiral decoration on the 'Bornholm' collar – as the spirals run in opposite directions. Following this, and based on the craft technical evidence, we argue here that the Jomfrugård collar entered the island not as a trade object, but rather in the company of the smith who had crafted it, and who afterwards made one (or more) similar collars on the island, adjusted to the local needs. The same craftsperson interacted with other, possibly local craftspeople, through informal training (which is typical for communities of practice; Wenger 1998; Wendrich 2012). The mirrored spiral may indicate that this training took place without verbal instruction. While producing the tool needed to stamp the spirals in the wax, the local craftsperson must have copied the hand movements of the teacher without a clear knowledge and understanding of how the tool was supposed to work. The result is a collar that is technically very similar to its role model with one essential (although not eye-catching) mistake (Nørgaard 2014).

An investigation of written sources (the Mari archives) reporting on highly specialised craftspeople within the palace economies of the Near East *c.* 1000 BCE shows that Mari craftspeople were included in exchange systems and moved over vast distances (see Nørgaard 2014; Zaccagnini 1983). On the basis of, *inter alia*, the spectacular examples from Vognserup Enge and Bornholm, we contend that the exchange of apprentices and knowledge at occasional gatherings or markets – as is also known from other ethnographic examples (Neipert 2006) – may be a more appropriate model for the mature Nordic Bronze Age than Childe's autonomous, itinerant craftsman.

Concluding remarks

Inspired by Vandkilde's work, and in order to try to explain how a Nordic metalworking *koiné* could not only exist, but be upheld through centuries, we have used the concept of communities of practice to frame the many different social configurations that contributed to the spread and evolvement of metalcraft in the Nordic world from the Late Neolithic and through the Nordic Bronze Age. The social framework for metal crafting within the Nordic realm varied through time and between local communities and included a large variation ranging from homecraft and seasonal craft to specialised, productive craft centres and elite-controlled production. The participation of these into larger communities of practice is likely, and might be tied to mechanisms for apprenticeship, as well as social gatherings aimed at exchange, craft activities and, perhaps, feasting.

We have highlighted marketplaces, ports of trade or entrepots as potentially of crucial importance for technological evolution, tied to metal supplies, the quality of metal from different sources, and mixing and alloying practices. The recognition of analytical workshops through the identification of craft traces on artefacts from the Middle Bronze Age indicates that not only did small and flexible communities of practice exist during this period, but that craftspeople also interacted across large regions and that typology and style were broader phenomena that transgressed single workshops. Also, physical workshop evidence from the Late Bronze Age demonstrates that craft communities across southern Scandinavia employed very similar operational chains, refractory technologies, and abstract symbolisation. This is understood here as a reflection of over-regional communities of practice. Based on ethnographic evidence and written sources, craftspeople likely met regularly and exchanged technological knowledge at seasonal gatherings, a form of craft fairs, possibly at regional centres where elite control of craft products was more likely than in ordinary settlement contexts. Direct contact and the exchange of knowledge between craftspeople from different areas is not just indicated through the use of similar recipes and schemes for action, but also more directly, for instance through the use of the exact same tool in distant areas. This may suggest that some metalworkers travelled around more extensively than others, as part of an exchange or migration of apprentices or experts, contributing directly to the transmission of new ideas or ways of conduct. While it has not been our intention to reintroduce the 'travelling smith' as a paramount actor, we have tried to open up the discussion for a more flexible approach to craft communities, which also includes the movement of people.

Bibliography

Anfinset, N. 2011. *Social and technological aspects of mining, smelting and casting copper. An ethnoarchaeological study from Nepal*. Der Anschnitt 181. Bochum: Deutschen Bergbau-Museum Bochum.

Apel, J. 2001. *Daggers, Knowledge and Power*. Coast to Coast Books 3. Uppsala: Uppsala University.

Apel, J. 2008. Knowledge, Know-how and Raw Material – The Production of Late Neolithic Flint Daggers in Scandinavia. *Journal of Archaeological Method and Theory* 15(1):91-111 DOI:10.1007/s10816-007-9044-2

Baudou, E. 1960. *Die regionale und chronologische Einteilung der jüngeren Bronzezeit im Nordischen Kreis*. Acta Universitatis Stockholmiensis. Studies in North-European Archaeology 1 Stockholm: Almqvist & Wiksell.

Berger, D., G. Brügmann, J.-H. Bunnefeld and E. Pernicka 2021. Identifying mixtures of metals by multi-isotope analysis: Disentangling the relationships of the Early Bronze Age swords of the Apa-Hajdúsámson type and associated objects. *Archaeometry* 2022: 1-31.

Berger, D., Q. Wang, G. Brügmann, N. Lockhoff, B.W. Roberts and E. Pernicka 2022. The Salcombe metal cargoes: New light on the provenance and circulation of tin and copper in Later Bronze Age Europe provided by trace elements and isotopes. *Journal of Archaeological Science* 138: 105543.

Boddum, S., M. Mikkelsen and N. Terkildsen 2015. *Bronzestøbning i yngre bronzealders lokale kulturlandskab. Rapport fra seminaret "Bronzestøbning i yngre bronzealders lokale kulturlandskab" afholdt i Viborg, marts 2014*. Viborg/Holstebro. Viborg Museum/Holstebro Museum.

Bourdieu, P. 1977. *Outline of a Theory of Practice*. Cambridge: Cambridge University Press.

Brozio, J.P., Z. Stos-Gale, J. Müller, N. Müller-Scheessel, S. Schultrich, B. Fritsch, F. Jürgens and H. Skorna 2023. The origin of Neolithic copper on the central Northern European plain and in Southern Scandinavia: Connectivities on a European scale. *PLoS ONE* 18(5): e0283007.

Bukkemoen, G. 2021. An Archaeology of Commensal Spaces. Crafts, culinary practice and the household in the transition from the Early to the Late Iron Age in Norway. Unpublished doctoral thesis, University of Oslo.

Bunnefeld, J.-H. 2016a. Crafting Swords. The emergence and production of full-hilted swords in the Early Nordic Bronze Age. *Praehistorische Zeitschrift* 91(2): 379-430.

Bunnefeld, J.-H. 2016b. *Älterbronzezeitliche Vollgriffschwerter in Dänemark und Schleswig-Holstein. Studien zu Form, Verzierung, Technik und Funktion*. Mainz: Wachholtz.

Butler, J.J. 1963. Bronze Age Connections across the North Sea. *Paleaohistoria* 9: 1-286.

Caine, R.N. and G. Caine 1994. *Making Connections: Teaching and the Human Brain*. Menlo Park, CA: Addison-Wesley.

Childe, V.G. 1929. *The Danube in Prehistory*. Oxford: Clarendon Press.

Childe, V.G. 1930. *The Bronze Age*. Cambridge: Cambridge University Press.

Childe, V.G. 1939. *The Dawn of European Civilization*. London: Routledge.

Childe, V.G. 1940. *Prehistoric Communities of the British Isles*. London: Chambers.

Costin, C.L. 1995. Standardization, Labor Investment, Skill, and the Organization of Ceramic Production in Late Prehispanic Highland Peru. *American Antiquity* 60: 619-639.

Craddock, P. 2003. Introduction, in P. Craddock and J. Lang (eds) *Mining and Metal Production through the Ages*: 7-8. London: British Museum Press.

Creese, J.L. 2012. Social Context of Learning and Individual Motor Performance. *In:* WENDRICH, W. (ed.) *Archaeology and Apprenticeship. Body Knowledge, Identity, and Communities of Practice*: 43-60. Tucson: University of Arizona Press.

Diinhoff, S. 2006. En bronzealders bosætning ved Fremre Øygarden i Lærdal, in R. Barndon, S.M. Innselset, K.K. Kristoffersen and T.K. Lødøen (eds) *Samfunn, symbolder og identitet – Festskrift til Gro Mandt på 70-årsdagen*: 67-85. Bergen: University of Bergen.

Dobres, M.-A. 2000. *Technology and Social Agency. Outlining a Practice Framework for Archaeology*. Oxford: Blackwell Publishers.

Engedal, Ø. 2010. The Bronze Age of Northwestern Scandinavia. Unpublished doctoral thesis, University of Bergen.

Eriksson, T. 2022. Håga och Mälardalens nätverk, in K. Ojala and T. Østigård (eds) *Bronsålderns Håga Fornlämningar, fynd och förbindelser*: 61-114. OPIA 80. Uppsala: Institutionen för arkeologi och antik historia.

Eriksson, T. and L. Grandin 2008. Brons – den gyllene metallen, in E. Hjärthner-Holdar, T. Eriksson and A. Östling (eds) *Mellan himmel och jord. Ryssgärdet, en guldskimrande bronsåldersmiljö i centrala Uppland*: 325-369. Uppsala: Riksantikvarieämbetet.

Fredriksen, P.D. 2013. When knowledges meet: Engagements with clay and soil in southern Africa. *Journal of Social Archaeology* 11(3): 283-310.

Frost, L. 2011. Vognserup Enge – Et offerfund med kvindesmykker fra den ældre bronzealder. *Aarbøger for Nordisk Oldkyndighed og Historie* 2008: 7-58.

Gebauer, A.B., L.V. Sørensen, M. Taube and D.K.P. Wielandt. 2020. First metallurgy in Northern Europe: An Early Neolithic Crucible and a Possible Tuyére from Lønt, Denmark. *European Journal of Archaeology* 23(3): 1-21.

Harrison, R.J. 1980. *The Beaker Folk. Copper Age Archaeology in Western Europe*. London: Thames & Hudson.

Herbert, E. 1984. *Red Gold of Africa. Copper in Precolonial History and Culture*. Madison, WI: University of Wisconsin Press.

Høgseth, H.B. 2012. Knowledge Transfer. The Craftsmen's Abstraction, in W. Wendrich (ed.) *Archaeology and Apprenticeship. Body Knowledge, Identity, and Communities of Practice*: 61-78. Tucson: University of Arizona Press.

Holst, M.K. and M. Rasmussen 2012. Combined Efforts: The cooperation and coordination of barrow-building in the Bronze Age, in N. Johannsen, M. Jessen and H.J. Jensen (eds) *Excavating the Mind: Cross-sections through culture, cognition and materiality*: 255-279. Aarhus: Aarhus Universitetsforlag.

Holst, M.K. and M. Rasmussen 2015. Building together, in M.K. Holst and M. Rasmussen (eds) *Skelhøj and the Bronze Age Barrows of Southern Scandinavia, Vol. 2: Barrow building and barrow assemblies*: 307-322. Højbjerg: Jysk Arkæologisk Selskab.

Ialongo, N., R. Hermann and L. Rahmstorf 2021. Bronze Age weight systems as a measure of market integration in Western Eurasia. *PNAS* 118(27): e2105873118.

Ikäheimo, J. and K. Nordqvist 2017. Lost in narration: rediscovering the Suomussalmi copper adze. *Norwegian Archaeological Review* 50(1): 1-22.

Ingold, T. 2000. *The Perception of the Environment. Essays on livelihood, dwelling and skill*. London: Routledge.

Jaeger, M., J. Czebreszuk, J. Müller and J. Kneisel 2015. Metal Finds, in J. Czebreszuk, J. Müller, M. Jaeger and J. Kneisel (eds) Bruszczewo IV. Natural resources and economic activities of the Bronze Age people: 227-234. Bonn/Poznań: Rudolf Habelt GmbH/ Wydawnictwo Naukowe UAM.

Jantzen, D. 2008. *Quellen zur Metallverarbeitung im Nordischen Kreis der Bronzezeit*. Stuttgart: Franz Steiner Verlag.

Janzon, G. 1986. Stridsyxekultur och metallurgisk know-how, in C. Adamsen and K. Ebbesen (eds) *Stridsøksetid i Sydskandinavien. Beretning fra et symposium 28.-30.X. 1985 i Vejle*: 126-137. København: Københavns Universitet.

Jensen, J. 1997. *Fra Bronze- til Jernalder – en kronologisk undersøgelse*. København: Det Kongelige Nordiske Oldskriftselskab.

Junghans, S., E. Sangmeister and M. Schröder 1960. *Metallanalysen kupferzeitlicher und frühbronzezeitlicher Bodenfunde aus Europa*. Berlin, Mann.

Junghans, S., E. Sangmeister and M. Schröder 1968. *Kupfer und Bronze in der frühen Metallzeit Europas. Die Metallgruppen beim Stand von 12000 Analysen*. Berlin: Mann.

Junghans, S., E. Sangmeister and M. Schröder 1974. *Kupfer und Bronze in der frühen Metallzeit Europas*. Berlin: Mann.

Karlin, C. and M. Julien 1994. Prehistoric technology: a cognitive science?, in C. Renfrew and E.B.W. Zubrow (eds) *The ancient mind*: 152-164. Cambridge: Cambridge University Press.

Klassen, L. 2000. *Frühes Kupfer im Norden. Untersuchungen zu Chronologie, Herkunft und Bedeutung der Kupferfunde der Nordgruppe der Trichterbecherkultur*. Aarhus: Aarhus University Press.

Krause, R. 2002. The Cultural and Chronological Context of the Development of Early Bronze Age Metallurgy, in B. Ottaway and E. Wager (eds) *Metals and Society. Papers from a session held at the European Association of Archaeologists Sixth Annual Meeting in Lisbon 2000*: 33-44. British Archaeological Reports International Series 1061. Oxford: Archaeopress.

Kuijpers, M.H.G. 2017. The Bronze Age, a World of Specialists? Metalworking from the Perspective of Skill and Material Specialization. *European Journal of Archaeology*: 1-22.

Lave, J. and E. Wenger 1991. *Situated learning. Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.

Ling, J., L. Grandin, E. Hjärthner-Holdar, A.L. Melheim, Z. Stos-Gale, M. Vicze and J.G. Tarbay 2023. Moving metals V: The question of shared copper sources between Scandinavia and Hungary 1700-1500 BC. *Journal of Archaeological Science: Reports* 51: 1-26.

Ling, J., E. Hjärthner-Holdar, L. Grandin, Z. Stos-Gale, K. Kristiansen, A.L. Melheim, G. Artioli, I. Angelini, R. Krause and C. Canovaro 2019. Moving metals IV: Swords, metal sources and trade networks in Bronze Age Europe. *Journal of Archaeological Science: Reports* 26: 1-34.

Ling, J. and Z. Stos-Gale 2015. Representations of oxhide ingots in Scandinavian rock art: the sketchbook of a Bronze Age traveller? *Antiquity* 89: 191-209.

Ling, J., Z. Stos-Gale, L. Grandin, K. Billström, E. Hjärthner-Holdar and P.-O. Persson 2014. Moving metals II: provenancing Scandinavian Bronze Age artefacts by lead isotopes and elemental analyses. *Journal of Archaeological Science* 41: 106-132.

Liversage, D. 2000. *Interpreting impurity patterns in ancient bronze: Denmark*. København: Det Kongelige Nordiske Oldskriftselskab.

Lund, J. and L. Melheim 2011. Heads and tails – minds and bodies. Reconsidering the Late Bronze Age Vestby hoard in light of symbolist and body perspectives. *European Journal of Archaeology* 14(3): 441-464.

Malmer, M.P. 1992. Weight Systems in the Scandinavian Bronze Age. *Antiquity* 66(251): 377-388.

Mauss, M. 1979. Techniques of the Body, in M. Mauss (ed.) *Sociology and psychology: essays by Marcel Mauss*: 97-123. London: Routledge and Kegan Paul.

Melheim, A.L. 2015. *Recycling Ideas: Bronze Age Metal Production in Southern Norway*. British Archaeological Reports International Series 2715. Oxford: Archaeopress.

Melheim, A.L. 2018. Weight units and the transformation of value: approaching premonetary currency systems in the Nordic Bronze Age, in D. Brandherm, E. Heymanns and D. Hofmann (eds) *Gifts, Goods and Money: Comparing currency and circulation systems in past societies*: 67-83. Oxford: Archaeopress.

Melheim, A.L. 2024. Massive shaft-hole axes were axe currencies: the social life of the Fårdrup axes, in R. Risch, E. Pernicka and H. Meller (eds) *Der soziale Wert prähistorischer Beile – neue archäologische und archäometrische Ansätze/The social value of prehistoric axes – new archaeological and archaeometric approaches*: 403-420. Tagungen des Landesmuseum für Vorgeschichte Halle 31, Vol. 2: 403-420. Halle (Saale): State Office for Heritage Management and Archaeology Saxony.

Melheim, L. and H. Nørgaard (in press). Bronze Age metalcraft, in L. Hedeager, K. Kristiansen and C. Prescott (eds) *The Oxford Handbook of Scandinavian Archaeology to 1050 CE*. Oxford: Oxford University Press.

Melheim, A.L., L Grandin, P.-O. Persson, K. Billström, Z. Stos-Gale, J. Ling, R.A. Williams, I. Angelini, C. Canovaro, E. Hjärthner-Holdar and K. Kristiansen 2018. Moving metals III: Possible origins for copper in Bronze Age Denmark based on lead isotopes and geochemistry. *Journal for Archaeological Science* 96: 85-105.

Metzner-Nebelsick, C. 2003. Das „Königsgrab" von Seddin in seinem europäischen Kontext, in J. Kunow (ed.) *Das „Königsgrab" von Seddin in der Prignitz*: 35-60. Wünsdorf: Brandenburgisches Landesamt für Denkmalpflege.

Minar, J. 2001. Motor Skills and the Learning Process: The Conservation of Cordage Final Twist Direction in Communities of Practice. *Journal of Anthropological Research* 57: 381-405.

Mödlinger, M., M.H.G. Kuijpers, D. Braekmans and D. Berger 2017. Quantitative comparisons of the color of CuAs, CuSn, CuNi, and CuSb alloys. *Journal of Archaeological Science* 88: 14-23.

Molloy, B. and M. Mödlinger 2020. The Organisation and Practice of Metal Smithing in Later Bronze Age Europe. *Journal of World Prehistory* 33: 169-232.

Mörtz, T. 2009. Das erste Aunjetitzer Metallgefäß in der Fremde? Überlegungen zu Ursprung und Funktion der Schmuckschatulle von Skeldal, Dänemark, in L. Dietrich, O. Dietrich, B. Heeb and A. Szentmiklosi (eds) *Aes Aeterna. In Honorem Tudor Soroceanu* 17: 67-87. Timişoara: Analele Banatului S.N.

Neipert, M. 2006. *Der Wanderhandwerker*. Rahden/Westf.: Leidorf.

Nordqvist, K. and V.-P. Herva 2013. Copper Use, Cultural Change and Neolithization in North-Eastern Europe (c. 5500-1800 BC). *European Journal of Archaeology* 16(3): 401-432.

Nørgaard, H.W. 2014. Valued Craftsmen: As important as prestige goods? -Ideas about itinerant craftsmanship in the Nordic Bronze Age, in S. Reiter, H.W. Nørgaard, Z. Kolzce and C. Rassmann (eds) *Rooted in Movement. Aspects of Mobility in Bronze Age Europe*: 37-52. Aarhus: Jutland Archaeological Society.

Nørgaard, H.W. 2017. Bronze Age metal workshops in Denmark between 1500–1300 BC: elite-controlled craft on Zealand, in S. Bergerbrant and A. Wessman (eds) *New Perspectives on the Bronze Age: Proceedings from the 13th Nordic Bronze Age Symposium, held in Gothenburg 9th June to 13th June 2015*: 127-142. Oxford: Archaeopress.

Nørgaard, H. W. 2018a. *Bronze Age Metalwork. Techniques and traditions in the Nordic Bronze Age 1500-1100 BC*. Oxford: Archaeopress.

Nørgaard, H.W. 2018b. The Nordic Bronze Age (1500-1100 BC): Craft Mobility and Contact Networks in Metal Craft. *Praehistorische Zeitschrift* 93(1): 89-120.

Nørgaard, H.W. 2019. Spezialisierung in der Nordischen Bronzezeit (15001100 BC): Metallhandwerker, Werkstätten und deren Informationspotenzial zur Organisation des Metallhandwerks während der älteren und mittleren Bronzezeit in Nordeuropa, in G. Woltermann, D. Neumann and R. Gleser (eds) *Spezialisierungen in der Bronzezeit Archäologische Quellen und Modelle. Beiträge der AG Bronzezeit auf der 83 Tagung des Nordwestdeutschen Verbandes* für *Altertumsforschung e V am 18-21 September 2016 in Münster*: 91-113. Neolithikum und *ältere* Metallzeiten – Studien und Materialien 4. Münster: LIT Verlag.

Nørgaard, H.W. 2024. The use of axe and ring metal as a raw material source in the late Neolithic and early Bronze Age in southern Scandinavia, in R. Risch, E. Pernicka, H. Meller (eds) *Der soziale Wert prähistorischer Beile – neue archäologische und archäometrische Ansätze/The social value of prehistoric axes – new archaeological and archaeometric approaches*: 387-401. Tagungen des Landesmuseum für Vorgeschichte Halle 31, Vol. 2: 387-401. Halle (Saale): State Office for Heritage Management and Archaeology Saxony.

Nørgaard, H.W. (in press). Examining the Metal Supply of Middle Bronze Age Workshops in Denmark: how metallurgical data of bronze artifacts can be used to define and inform about networks and organization of metal workshops. *Danish Journal of Archaeology*.

Nørgaard, H.W., E. Pernicka and H. Vandkilde, H. 2019 On the trail of Scandinavia's early metallurgy: provenance, transfer and mixing. *PLoS ONE* 14(7): 1-32.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2021. Shifting Networks and Mixing Metals: Changing metal-trading routes to Scandinavia correlate with Neolithic and Bronze Age transformations *PLoS ONE* 16: e0252376.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2022. 1600 BC: Fårdrup and Valsømagle-type axes and the first evidence of southern Alpine metal. *Acta Archaeologica* 92.2(2021): 185-226.

Orfanou, V., C. Bruyère, A.G. Karydas, D. Jovanović, F. Franković, M. Spasić, J. Koledin, D. Jacanović, M. Cerović, J. Davidović and B. Molloy 2024. A community of practice approach to the management of metal resources, metalworking and hoarding in Bronze Age societies. *Scientific Reports* 14: 16153.

Panofsky, E. 1951. *Gothic architecture and scholasticism*. Latrobe, PA: Archabbey Press.

Pelegrin, J. 1990. Prehistoric Lithic Technology: Some Aspects of Research. *Archaeological Review from Cambridge* 9: 116-125.

Polanyi, M. 1966. *The Tacit Dimension*. Chicago: University of Chicago Press.

Prescott C. 2000. Symbolic Metallurgy – Assessing Early Metallurgic Processes in a Periphery, in D.S. Olausson and H. Vandkilde (eds) *Form, Function and Context. Material culture studies in Scandinavian archaeology*: 213-225. Lund: Wallin & Dalholm Boktryckeri AB.

Prescott, C. 2018. Review of Anna Sörman Gjutningens arenor: Metallhantverkets rumsliga, sociala och politiska organisation i södra Skandinavien under bronsåldern. *Current Swedish Archaeology* 26: 262-266.

Prescott, C. 1991. Late Neolithic and Bronze Age Developments on the Periphery of Southern Scandinavia. *Norwegian Archaeological Review* 24(1): 35-48.

Randsborg, K. 1986. A Bronze Age Grave on Funen Containing Metal Worker's Tools. *Acta Archaeologica* 55: 185-189.

Roux, V., B. Bril and G. Dietrich 1995. Skills and Learning Difficulties Involved in Stone Knapping: The Case of Stone-Bead Knapping in Khambhat, India. *World Archaeology* 27: 63-87.

Rowlands, M.J. 1971. Archaeological Interpretation of Prehistoric Metalworking. *World Archaeology* 3: 210-224.

Savage, R.D.A., P.R. Lowery and P.H.T. Shorer 1982. The technique of the decoration on a belt-plate from Vognserup Enge, Kundby Sogn, Tuse Herred, Zealand, in T. Hackens (ed.) *Second Nordic Conference on the Application of Scientific Methods in Archaeology. Helsingør (Elsinore), Denmark, 17-19 August 1981*: 459-475. Viborg: Special Trykkeriet Viborg.

Sennett, R. 2008. *The Craftsman*. London, Penguin Books.

Skorna, H. 2024. Make and break: Intentional fragmentation of copper flat axes as evidence for metallurgy in the Northern Group of the Early Neolithic Funnel Beaker societies, in R. Risch, E. Pernicka and H. Meller (eds) *Der soziale Wert prähistorischer Beile – neue archäologische und archäometrische Ansätze/The social value of prehistoric axes – new archaeological and archaeometric approaches*: 1-9. Tagungen des Landesmuseum für Vorgeschichte Halle 31, Vol. 2. Halle (Saale): State Office for Heritage Management and Archaeology Saxony.

Sofaer, J. 2006. *The Body as Material Culture. A Theoretical Osteoarchaeology*. Cambridge: Cambridge University Press.

Sörman, A. 2017. A place for crafting? Late Bronze Age metalworking in southern Scandinavia and the issue of workshops, in A. Brysbaert and A. Gorgues (eds) *Artisans versus nobility? Multiple identities of elites and commoners viewed through the lens of crafting from the Chalcolithic to the Iron Ages in Europe and the Mediterranean*: 53-78. Leiden, Sidestone Press.

Sörman, A. 2018. Gjutningens arenor: Metallhantverkets rumsliga, sociala och politiska organisation i södra Skandinavien under bronsåldern. Unpublished doctoral thesis, Stockholm University.

Sørensen, M.L.S. 2014. 'Paradigm Lost' – on the state of typology within archaeological theory, in K. Kristiansen, L. Smejda and J. Turek (eds) *Paradigm Found*: 84-94. Oxford: Oxbow Books.

Sperling, U. 2011. Aspekte des Wandels in der Bronzezeit im Ostbaltikum. Die Siedlungen der Asva-Gruppe in Estland. Unpublished master's dissertation, Freien Universität, Berlin.

Tarbay, J. 2019. Moulds for Large Daggers. Unique Finds from the Bronze Age Hatvan-Strázsa-hegy tell. *Acta Archaeologica Academiae Scientiarum Hungaricae* 70: 5-39.

Thrane, H. 1975. *Europæiske forbindelser. Bidrag til studiet af fremmede forbindelser i Danmarks yngre broncealder (periode IV-V)*. København: Nationalmuseet

Vandkilde, H. 1988. A Late Neolithic Hoard with Objects of Bronze and Gold from Skeldal, Central Jutland. *Journal of Danish Archaeology* 7: 115-135.

Vandkilde, H. 1992. Metal Analyses of the Skeldal Hoard and Aspects of Early Danish Metal Use. *Journal of Danish Archaeology* 9: 114-132.

Vandkilde, H. 1996. *From Stone to Bronze. The Metalwork of the late Neolithic and earliest Bronze Age in Denmark*. Aarhus: Jutland Archaeological Society.

Vandkilde; H. 2001. Beaker Representation in the Danish Late Neolithic, in F. Nicolis (ed.) *Bell Beakers Today. Pottery, People, Culture, Symbols in Prehistoric Europe. Proceedings of the International colloquium, Riva del Garda (Trento, Italy), 11-16 May 1998*: 333-360. Trento: Provincia Autonoma di Trento, Servizio Beni Culturali Ufficio Beni Archeologici.

Vandkilde, H. 2014. Breakthrough of the Nordic Bronze Age: Transcultural Warriorhood and a Carpathian Crossroad in the Sixteenth Century BC. *European Journal of Archaeology* 14: 602-633.

Vandkilde, H. 2016. Bronzization: The Bronze Age as Pre-Modern Globalization. *Praehistorische Zeitschrift* 91(1): 103-123.

Vandkilde, H. 2017. *The Metal Hoard from Pile in Scania, Sweden. Place, things, time, metals, and worlds around 2000 BCE*. Stockholm: Aarhus University Press/The Swedish History Museum.

Vandkilde, H. 2021. Trading and weighing metals in Bronze Age Western Eurasia. *Proceedings of the National Academy of Sciences* 118(30): e2110552118.

Vandkilde, H., C.F. Stephansen, P. Suchowska-Ducke, C.S. Andersen, L. Ahlqvist, L. Felding, M. Bjørnevad-Ahlqvist, J. Czebreszuk and H.W. Nørgaard 2024. Metal-for-Amber in the European Bronze Age. *Praehistorische Zeitschrift* 99(1): 280-338.

Wallaert-Pètre, H. 2001. Learning How to Make the Right Pots: Apprenticeship Strategies and Material Culture, a Case Study in Handmade Pottery from Cameron. *Journal of Anthropological Research* 57(4): 471-493.

Weiler, E. 1996. Metal Standard during the Bronze Age. *Lund Archaeological Review* 2: 17-30.

Wendrich, W. 2012. *Archaeology and Apprenticeship. Body Knowledge, Identity, and Communities of Practice*. Tucson: The University of Arizona Press.

Wenger, E. 1998. *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press.

Wenger-Trayner, E. and B. Wenger-Trayner 2015. *An introduction to communities of practice: a brief overview of the concept and its uses* (available online at: https://www.wenger-trayner.com/introduction-to-communities-of-practice [accessed 7 October 2024]).

Zaccagnini, C. 1983. Patterns of Mobility among Ancient Near Eastern Craftsmen. *Journal of near Eastern Studies* 42: 245-264.

Chapter 16

Gilded Bronze Networks? The golden artefacts from Arildskov Boest, Denmark

Constanze Rassmann

Department of Cultural History, Museum Midtjylland, Herning, Denmark
cr@museummidtjylland.dk

Abstract

This study explores the Arildskov hoard, a significant archaeological find for northern Europe which sheds light on Early Bronze Age societies. By focusing on golden artefacts, the research examines the interconnectedness of trade networks and technological advancements in metalworking. Utilising state-of-the-art analytical techniques (including portable XRF analyses), this contribution traces the origins of the gold used in the artefacts and draws connections to known bronze trade routes and production centres. The findings reveal exchange systems' shifting networks over the Late Neolithic/ Nordic Bronze Age transition. This approach underscores the importance of integrating archaeometallurgical data to deepen our understanding of prehistoric societies and their material culture. Future research should continue to expand the dataset and employ advanced analytical methods to further unravel the complexities of these ancient networks.

Introduction[1]

Much focus has been on the Bronze Age as a period shaped by cultural-economic connectivity (Vandkilde 2016: 104), an interconnectedness that has been understood to develop from and be maintained by the desire for copper and bronze. Consequently, focus has been very much on the archaeometallurgical analyses and provenance studies of copper and tin supply networks. While this research is not flawless (for a discussion see Radivojević *et al.* 2018), it has led to remarkable discoveries on how regions organised their supply networks and how these networks shifted (Ling *et al.* 2012; Ling *et al.* 2014; Nørgaard *et al.* 2019; 2021). In Scandinavian research, significantly less focus has been placed on golden artefacts in recent years. Nevertheless, like copper and tin, the prehistoric gold or golden artefacts found in Scandinavia must have travelled long distances to get there, as southern Scandinavia has no native gold sources (see Lehrberger 1995: fig. 1). While the data on gold and its provenance might not be as clear as their bronze alloy corollaries, it can be a good supplement to crafting an understanding of the interconnectedness of different regions as well as their networks. The recently published article on the evidence of gold forging in the Early Bronze Age central site of Bruszczewo shows, how intertwined gold and bronze working networks were (Müller *et al.* 2023).

One of the problems when trying to analyse golden artefacts is their uneven chronological distribution across south Scandinavia; while most golden objects date to the Late Neolithic I and II, only a few artefacts have been securely dated to Nordic Bronze Age period IA and B (NBA IA and IB). Here, the Arildskov hoard represents a significant archaeological find that provides valuable insights into the Early Bronze Age societies in northern Europe. This hoard, comprised of various gold artefacts, offers a unique glimpse into the material culture, trade networks, and technological capabilities of the time. Golden finds dating to NBA I are rare, as is information on their archaeometallurgy. In recent years, portable XRF analyses have been successfully applied to archaeological objects. By employing state-of-the-art analytical techniques, this chapter seeks to uncover the origins of the gold used in the artefacts and draw connections to known trade routes and production centres.

This case study aims to explore the golden artefacts from the Arildskov hoard in detail, focusing on the provenance of the materials and their broader archaeological context. The findings from this research contribute to ongoing discourse on the complexity of prehistoric societies and their networks. Additionally, this study highlights the importance of interdisciplinary approaches in archaeological investigations to yield a comprehensive understanding of the past.

Case Study: The Arildskov hoard and its finds

In Boest, 60 km southwest of Aarhus, close to an ancient trackway connecting the Jutland Peninsula from north to south (the so-called 'Oxen Road' or Hærvejen in Danish), a hoard was discovered by metal detectorists in 2015. An excavation revealed two in situ hoards as well as an at least two-phased timber avenue. The hoards, containing five massive bronze Virring-type axes, as well as golden ornaments and flint artefacts,

[1] To Helle, whose passion for the European Bronze Age has been a constant source of inspiration, with heartfelt gratitude for her invaluable guidance and support.

Figure 1: The golden spiral ring (X 182) and decorated (X 183) and undecorated armrings (X 184) found in Arildskov, Boest, Denmark (photo: Johannes Kalmbach, Romano-Germanic Commission of the German Archaeological Institute).

are extraordinary rare finds. Their position close to the timber structure, yet opposite one another, enhances their exceptionality. Relative chronology dates the axe hoard to NBA IA, resembling another deposition (Boest Mose) of flanged axes and spearheads *c.* 100 m to the north (Vandkilde 1996: 100). This date was corroborated by an absolute chronological date. Both depositions form part of a cultural landscape around a raised bog with other hoard finds dating to the late Neolithic and Early Bronze Age. An archaeological assessment of the Boest complex is forthcoming (Rassmann, in preparation).

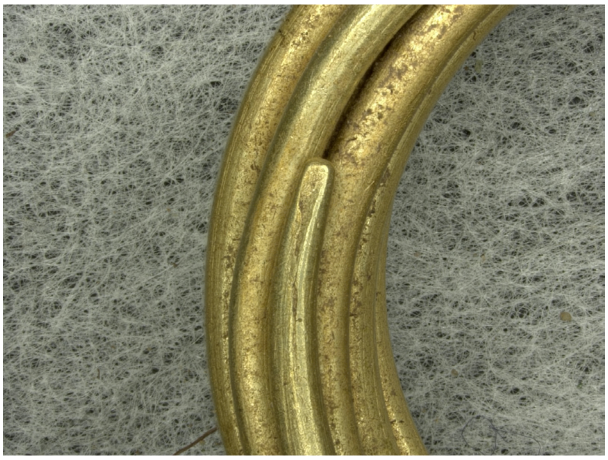


Figure 2: The spiral ring magnified by x20. The regular striation marks are visible (photo: author).

The flanged axes, as well as the spearheads, represent typical material of the period and are understood to be produced locally, as were the flint objects. The golden spiral ring resembles a well-known artefact group used over a long period. The golden armrings are simple in form and lack typological parallels in the Danish material (Fig. 1).

Figure 3: The decorated armring magnified by x20. The end parts with traces of hammering and decorative punches are visible (photo: author).

While the gold composition is the focus of this text, some remarks should be made regarding the production of the three artefacts. Microscopic examination of the spiral ring (Fig. 2) reveals notable features: firstly, it looks as if the end part of the spiral ring might be folded; secondly, the wire has parallel striation marks visible inside the ring. These striation marks are the primary visual evidence for drawn wire; however, the earliest existence of drawn wire is still debated (Oddy 1977: 80). The common understanding being that Bronze Age wire was produced by transforming an ingot via hammering and annealing (see Armbruster 2013: 465). These traces of hammering can be observed on the golden armring; here, a microscopic picture of the decorated armring (Fig. 3) reveals parts of the operational sequence, as traces of hammering are overlain by subsequent notches. These traces of hammering cannot be observed on the spiral ring, perhaps due to the striation marks. Future research may determine whether they are a result of wire drawing or grinding and smoothing of the object's surface.

Despite their simple form the golden armrings have no parallels in the Danish material to date. Furthermore, there is a slight colour difference between the decorated armring and the spiral ring and armring visible to the naked eye: the decorated armring appears more red-gold than the spiral ring and undecorated armring. This colour difference will be discussed further in the metallurgical analyses.

Arildskov and its Late Neolithic and Early Bronze Age surroundings

Datable golden artefacts are rare, as many of them are found either without context or as single finds. This is the case with the two possible hoards with golden artefacts found on the northern side of the bog just 15 km north of the Arildskov hoard. The northeastern hoard contains three golden *Noppenringe* with twisted ends (Vandkilde 1996: fig. 196), while the northwestern one contains only a fragment of a *Noppenring* (Broholm 1943: 235, app. d/5/22; Hartmann 1982: table 44). Helle Vandkilde (1996: 199) dates the hoard with the three *Noppenringe* to Late Neolithic II (LN II). The other *Noppenring* from Boest probably dates similarly. However, a younger date cannot be excluded, as they are a single-type hoard and a single find. The two *Noppenringe* from Tvillingegård (Vandkilde 1996: cat. no. 609) found just 15 km from the Arildskov hoard were discovered in a burial with a flint dagger type IA/B and IVC and a slate pendant, dating the artefacts to LN II.

Vandkilde (1996: 200) already noted that this area around Boest is a hotspot for golden artefacts dating to LN II. With the addition of the newfound artefacts from Arildskov, this area remained significant through the NBA IA period as well. The distribution of metalwork in both these phases (see Vandkilde 1996: figs 216 and 236) shows a concentration of bronze objects, including, but not limited to, eastern Jutland. Heide Nørgaard and colleagues (2019; 2021) demonstrated how networks shifted during LN II and NBA IA and B. While copper came from the eastern Alps, Slovakia, and the British Isles during LN II, supply stagnated during the NBA IA, leading to increased recycling, although Slovakia continued to provide material (Nørgaard *et al.* 2019: 30).

Zooming into the area around Boest, only two objects with information on their provenance and metal composition are available, i.e. the Torsted-Tinsdahl-type axes from Ejstrup (MA-166641)[2] and the Virring-type axe from Ejstrupholm (MA-170435). Both axes are associated with Cluster 4, with material probably originating from the British Isles (Nørgaard *et al.* 2019: 24). On the basis of these two objects, it is not possible to analyse the shifting networks in this micro-region. In other words, the concentration of golden jewellery concurs with a high spatial density of other metal objects during both LN II and NBA IA in this area of Jutland. Despite the concentration of bronze metalwork in the same area, analyses of only two objects cannot shed light on the metal networks.

[2] This number refers to the catalogue in Nørgaard *et al.* 2021.

Research on gold

Axel Hartmann published his work on the spectral analysis of prehistoric gold as part of the *Studien zu den Anfängen der Metallurgie* (Hartmann 1970: 1982), identifying several analytical groups with geographical, chronological, and cultural significance. However, with few exceptions (see, e.g., Vandkilde 1992; Vandkilde 1996), his work has been largely ignored in southern Scandinavia. Research on golden artefacts from the Late Neolithic and Early Nordic Bronze Age has mainly focused on their societal meaning (see, e.g., Steffgen 1995) and only partly on their metallurgy or manufacture (Pahlow 2006). This picture is different for other parts of Europe, where studies of different aspects of gold metallurgy are realised (e.g. Meller *et al.* 2014; Müller *et al.* 2023).

This oversight can partly be attributed to the criticism Hartmann's studies received (e.g. Thrane 1987), largely owing to their confusing statistical evaluation (Warner 2004: 72) and not the analyses themselves (Taylor 1980: 8ff). Additionally, the lack of integration of archaeology and the uneven chronological distribution of his samples were noted as deficiencies (Thrane 1987: 207). The geographical spread of analyses is also uneven, while data for the Nordic Bronze Age from Mecklenburg, Sweden, and Norway is lacking (see Pingel 1995: 386, fig. 1), Denmark has over 700 golden analyses, and Schleswig-Holstein over 200 (Hartmann 1970; Hartmann 1982). These objects correspond to 20% of the 5000 objects analysed in Europe (Pahlow 2006: 6), nevertheless forming a solid basis for further study.

Research on bronze technology, provenance, and metallurgy has advanced significantly, leading to remarkable discoveries (e.g. Ling *et al.* 2012; Ling *et al.* 2014; Nørgaard *et al.* 2021; Nørgaard *et al.* 2019). However, the study of gold in northern Europe has remained relatively stagnant. In contrast, research in Ireland has demonstrated the usefulness of Hartmann's data for their golden artefacts (as demonstrated by Warner 1993; 2004; Warner and Cahill 2011). A re-examination has shown different liabilities regarding Hartmann's trace elements; while his silver values may be unreliable due to the way these values were obtained, his tin and copper analyses are always based on optical-emission spectrometry and therefore far more precise (Warner and Cahill 2011: 45, 50-51).

Table 1: Gold analyses of the artefacts from Arildskov.

object number	object	Sn	Ag	Pb	Zn	Cu	Ni	Fe	Mn	Au
X 182_2	spiral ring	0,287	24,483	0,026	< LOD	0,322	0,076	0,289	< LOD	74,518
X 182_3	spiral ring	0,267	24,65	0,026	< LOD	0,315	< LOD	0,578	0,051	74,113
X 183_1	decorated armring	0,256	22,268	0,023	< LOD	0,281	0,08	0,198	0,122	76,772
X 183_2	decorated armring	0,28	22,922	< LOD	< LOD	0,303	< LOD	0,105	< LOD	76,39
X 184_1	armring	0,44	22,923	0,026	< LOD	2,546	< LOD	0,498	0,095	73,446
X 184_2	armring	0,369	23,065	0,026	0,042	2,786	0,036	0,073	< LOD	73,559

Recent advancements in portable XRF technology have expanded these more 'traditional' datasets. Portable XRF analyses are fast and non-destructive, making them suitable for archaeological applications. While there are certain issues with the change of surface patterns due to the corrosion of bronze alloys (Nørgaard 2017), gold and gold-rich alloys are relatively resistant, and their 'surface analytical results may be well and safely extrapolated to the bulk' (Karydas *et al.* 2004: 16). Studies such as the pXRF analyses of Hungarian golden armlets (Tarbay and Maróti 2022) have demonstrated the potential for correlating these results with Hartmann's data.

In summary, despite the initial neglect and criticism of Hartmann's work, his data on tin and copper trace elements in gold remain valuable. The uneven geographical and chronological distribution of analyses presents a challenge, but the substantial number of studies in Denmark and Schleswig-Holstein provides a robust platform for future research. The success of similar re-analyses in Ireland underscores the potential benefits of revisiting and expanding upon Hartmann's work for northern European gold artefacts, as well as correlating his analyses with the results obtained through pXRF.

Methods and Analysis

To understand whether shifting networks can be observed for gold sources in general, and in the area around Boest in particular, the focus was on artefacts dating to LN I/NBA II from Denmark and Schleswig-Holstein.[3] This data was supplemented by undated artefacts, e.g. simple golden wire and undated simple armrings, as these might be comparable to the simple armrings from Arildskov, which are, as mentioned above, otherwise without corollary. These data were complemented by Vandkilde's records on the Late Neolithic multi-type hoard from Skeldal. To have comparable data, Hartmann's data was transferred into a database.

Additionally, the pXRF data on the golden artefacts from Arildskov, Boest (Tab. 1) were added to the database. All three objects were measured twice in two different places on the object to minimise errors. Their composition of alloys was measured as the weight percentage of the total weight of the alloy, in contrast to the SAM data, where the values of trace elements are presented as weight percentage of the gold (Au=100). To compare the information, the values had to be changed according to Hartmann's equation (1970: 20, n. 23).

This resulted in a total of 256 artefacts with available data on gold and its trace elements that formed the basis of the following statistical analyses. For the case study on Arildskov, Boest, three datasets are available: the *Noppenring* found northwest of the bog (Hartmann 1970; 1982: cat. no. Au 3262)[4] and the two *Noppenringe* found in Tvillingegård (Au 3291 and 4967), all dating to LN II. Following the suggestion of Richard Warner and Mary Cahill (2011), the focus in the following will be on the tin and copper values within the gold artefacts.

Metallurgical insights and comparative analysis

Before we delve into plots on objects and their copper and tin content, the artefacts without tin should be discussed. These objects with zero tin (Hartmann 1970; 1982: cat. nos. Au 3725, 3726, 3727, 3736, 3738, 3746) date both to LN I and LN II (Au 3431, 3262, Skeldal NM 19/82). In the case of the *Noppenring* from Boest (Au 3262), Hartmann assigns this artefact to his material group B (Hartmann 1982: 24). This group has its main spatial distribution in the Danube area, although some examples can also be found in Greece, Spain, Portugal, and the British Isles (Hartmann 1982: fig. 1). As this gold

[3] Thrane (1987) criticised Hartmann's chronological division, as some objects were falsely dated. Thrane's re-dating of the objects was, therefore, followed where possible.

[4] These acronyms are adopted from Hartmann (1970; 1982) and refer to his unique catalogue numbers.

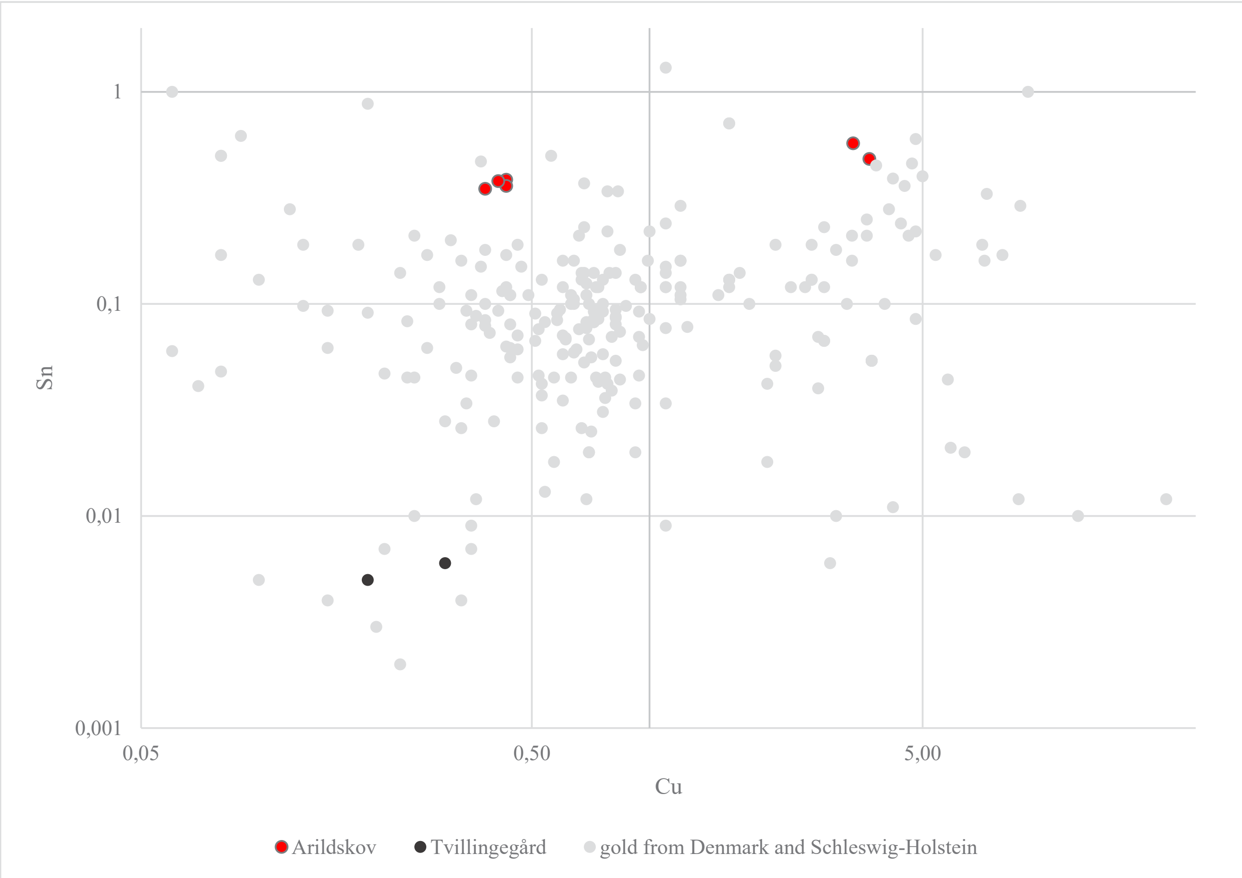


Figure 4: Logarithmic plot of the copper and tin values of gold artefacts based on the analyses of Hartmann (1970; 1982) and Vandkilde (1992) dating to LNI to NBA II. The artefacts from Boest and Tvillingegård, as well as the new analyses of the artefacts from Arildskov, are shown, the latter highlighted in red here. The artefacts from Arildskov are represented with their two measurements respectively. The X-axis depicts the copper values (with an upper range of 21%), while the y-axis represents the tin values (with a maximum of 11%) (graph: author).

type is tin-free, he assumes it cannot be alluvial gold but must have been mined, and, therefore, those mines must have been located in the eastern Mediterranean (Hartmann 1970: 42).

Figure 4 presents all the objects on the basis of their copper and tin content. The three golden objects from Arildskov, Boest are highlighted in red. The spiral ring (X 182) and the simple armring (X 184) are represented by the four plots on the left upper side, while the decorated armring (X 183) is placed on the right upper side. As mentioned earlier, a slight difference in colour is visible to the naked eye; this is also supported by data: the decorated armring contains close to 4% copper in contrast to the other two objects, whose copper content is less than 0.5%. While gold does naturally contain copper, the normal proportion of copper in any natural quantity of gold rarely exceeds 1-2% (Hartmann 1970: 9; Pingel 1995: 389). Therefore, the decorated armring might be alloyed. This is also discussed for the *Noppenringe* from Skeldal (Vandkilde 1992: 128).

In the plot, the undecorated armring and spiral ring are close to two objects from Schleswig-Holstein (Hartmann 1970; 1982: cat. nos. Au 1426 and 1148). Hartmann had difficulties finding parallels and categorising these two objects and thus places them in his *Restgruppe*. The decorated armring with its high copper content is plotted closely to artefacts from Schleswig-Holstein (Hartmann 1970; 1982: cat. nos. Au 1193, 1406, 1749, 1750), as well as the spiral (Au 3258) and *Lochhalsnadel* (Au 3257) from Buddinge. The other objects (X 183, Au 1193, 1406, 1749, 1750, 3258) are placed in material group N/NC. As objects of that variety are spread over a large swathe of Europe, it is difficult to fix a point of origin (Hartmann 1982: 35). The mapping of finds, however, shows a clear concentration in the British Isles as well as in Denmark (Hartmann 1982: fig. 5). This *Lochhalsnadel* from Buddinge is discussed by Hartmann (1982: 24) as possibly being of Danubian origin, given that it contains a high silver value (27%). This interpretation goes hand-in-hand with the typological point of origin of *Lochhalsnadeln* (Lomborg 1969: 101ff).

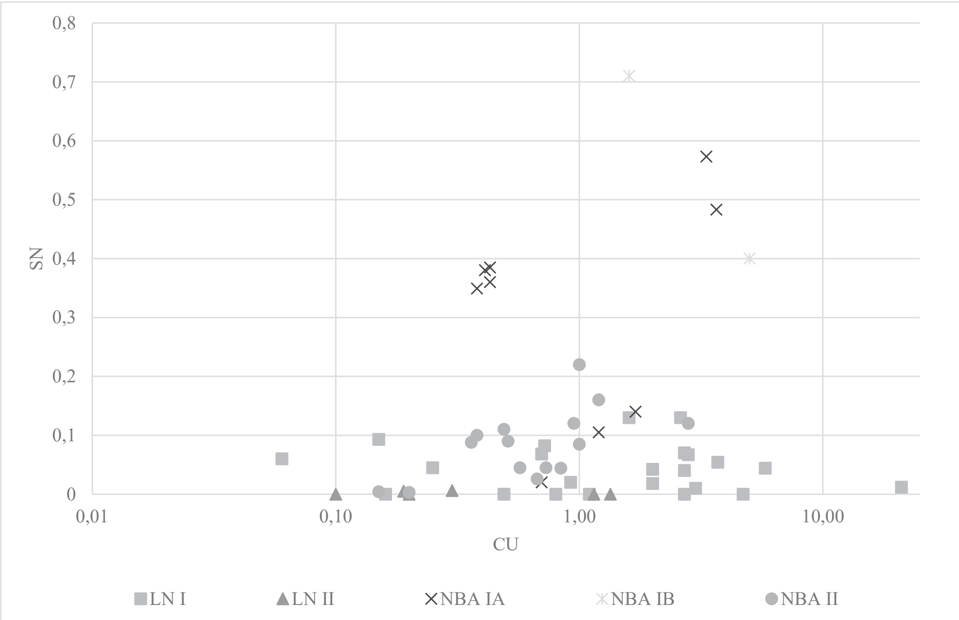


Figure 5: Semi-logarithmic plot of the copper and tin values of dated golden objects based on Hartmann (1970; 1982) and Vandkilde (1992), as well as the new analyses of Arildskov (graph: author).

It should also be pointed out here that the Buddinge burial contained two gold objects, pointing to two different regions of origin.

In addition to the artefacts from Arildskov, the golden *Noppenringe* from the Tvillingegård burial are also depicted on the plot. They are marked in black and appear in the lower left corner; their composition is quite similar. The same part of the diagram also features other objects from Schleswig-Holstein (Au 1432, 1401) and Denmark (Au 3769, 3876, 3879), all corresponding to Hartmann's material group L. Objects with gold L signature are mostly found in western Europe, mainly Iberia and Ireland.

Vandkilde (1992: 128) points out that, on the basis of the NBA IB artefacts from Buddinge, the 'composition of [the] "ring gold" from the Early Bronze Age is distinctly different from the *Noppenringe*'. The new data from Arildskov expands the dataset, and the chronological trends will be analysed in the following semi-logarithmic plot (Fig. 5). Only safely dated artefacts and the composition of their copper and tin are depicted. The different symbols represent the different chronological phases. The dataset contained 50 objects. While the chronological position of the objects is slightly off-balanced (only two objects from period IB versus 21 objects from LN II), general chronological trends can be observed and will be discussed in the following.

In LN I, the heterogeneous metallurgical composition of gold of an otherwise quite homogeneous artefact group places their manufacture consequently in Denmark, while sources are situated in western and central Europe (Vandkilde 1996: 188f). During LN II, only low-level or zero-level tin resources were used, with material groups pointing to different European regions. The gold composition is still quite heterogeneous and points both to a central European area (NM 19/82 Skeldal, Au 3431 – group A3), a western area (Au 3291, 4967 Tvillingegård – group L), as well as a Mediterranean source (Au 3262 Boest – group B). The ring from Bønhøj (Au 4968) dates into NBA IA; its content, however, is quite similar to LN II material and points to the material group A3 and its probable central European distribution. The artefacts from Schleswig-Holstein (Hartmann 1970; 1982: cat. nos. Au 1236 and 1417) show the continued use of material group M during this phase. With the new artefacts from Arildskov, the influx of new gold material is visible for the NBA IA. The source of this material is, however, difficult to place (X 182 and 184 are *Restgruppe*, X 183 is N/NC). The hoard from Buddinge dates to period NBA IB and points both to a Danubian origin (Au 3257) as well as to the widespread group N/NC (Au 3258). In contrast to the previous period, the artefacts of NBA II are lower in tin, and only a few objects appear to be alloyed with copper. Some of these objects (Au 3876 and 3879) are made of material group L as well as group M (Au 3422 and 4574), while most (Au 3275, 3282, 3349, 3397, 3874, 3892, 3893, 3990, 3994, 4063) are made from Q1/Q2 material. All material points to western and central Europe.

As has been mentioned before, the armrings from Arildskov lack parallels in the Danish material. However, some undated armrings appear in both Denmark and

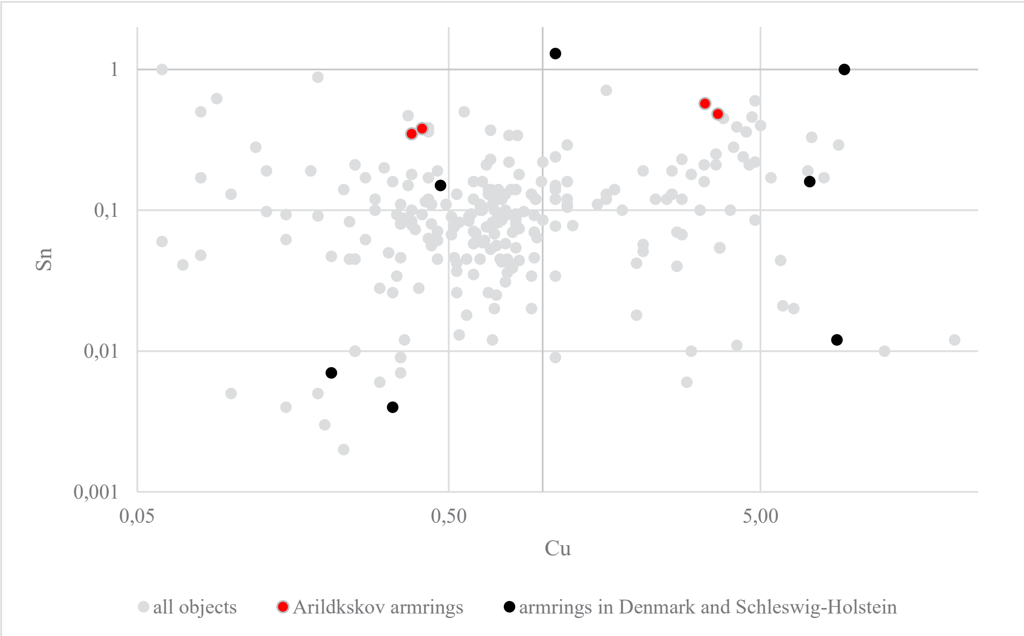


Figure 6: Logarithmic plot of the copper and tin values of golden artefacts based on Hartmann (1970; 1982) and Vandkilde (1992), as well as the new analyses of Arildskov. Highlighted are the armrings from Arildskov as well as undated armrings (graph: author).

Schleswig-Holstein. Therefore, these armrings were compared with one another on the basis of available copper-tin composition. The plot of this artefact group is depicted in Figure 6, where both the artefacts from Arildskov (red) and other undated armrings from Schleswig-Holstein and Denmark (black – Au 1127, 1207, 1401, 3762, 3763, 3764, 3769) are shown. On the basis of their copper and tin content, the armrings spread over the whole plot with no obvious cluster. Therefore, a correlation between these objects seems unlikely.

Golden networks?

The analyses showed that the golden objects from Arildskov are not only distinguishable on the basis of their slightly different forms and colour, but they are made from metals originating from different sources. The source of the material is difficult to establish for the decorated armring – the British Isles remain a possibility. The decorated armring was alloyed with copper, as its content is distinctly higher than the 1% (Hartmann 1970: 9) or 2% copper maximum (Pingel 1995: 389) for natural gold. The gold from the Arildskov spiralring and undecorated armring are of unknown origin.

In the immediate vicinity, three other archaeological contexts with gold can be taken into account, all dating from LN II. This concentration of golden artefacts primarily demonstrates the importance of this area, both in LN II and NBA IA, as is mirrored in the concentration of bronze metalwork. For three of these LN II objects, spectral analyses were available. Their compositions point both to sources in the Mediterranean as well as western Europe, suggesting, therefore, source networks different from their successive period.

Analysis of the chronological background of the objects showed that this chronological change in the influx of different golden material, as observed in Arildskov, can also be observed in general. In the following, the different changes in the golden material will be compared with the changes observable for copper-trade networks.

During LN I, most gold came from western and central Europe. Alloying with copper was a regular occurrence, and objects were supposedly produced locally (Vandkilde 1996: 263). We know, however, that copper flat axes are produced locally as well, probably with material from western and central European as well as Alpine material (Vandkilde 1996: 178f). Of these, only two bronze artefacts have been analysed in terms of the origin of the material – they were imports from the British Isles (Nørgaard *et al.* 2019: 7).

New gold sources become accessible in LN II; however, they were still mostly situated in central and western Europe (in one case the data suggests the Mediterranean). Even though the material points to southern Europe, it probably came to Scandinavia via a central European hub. This geographical picture is mirrored in the bronze artefacts, where British and Únětician material plays a major role, the overall picture also being very diverse (Nørgaard *et al.* 2019: fig. 4).

The metallic fingerprints from NBA IA are reminiscent both of previous periods and new tin-rich gold sources. This new material indicates the British Isles and lacks parallels in the analysed European material. It should be pointed out that not only is the spiral ring from Arildskov produced from the undefinable *Restgruppe*, but its wire even appears to be drawn – a technique we do not expect for several centuries in Scandinavia. Two bronze artefacts in the immediate vicinity could suggest a British Isles connection. Indeed, the overall picture of bronze networks points to the British Isles, as well as an expediting Carpathian and Slovakian network (Nørgaard *et al*. 2021: 31; Nørgaard 2024).

The pin and spiral ring from Buddinge date to NBA IB and show both the continuous use of gold from NBA IA as well as the influx of Danubian objects and material. The NBA IB bronze artefacts show the emerging importance of Carpathian material. This importance of bronze from the Carpathians, and a reduction in the British material, is also visible during NBA II (Nørgaard *et al*. 2021: 31f; Nørgaard 2024). While the picture is less clear for the Danish golden material, it is very distinct for Schleswig-Holstein, where a decrease of British gold and the increase of gold with Danubian origin can be observed (Pahlow 2006: fig. 54).

While the gold dataset is quite sparse for some periods, and should be increased by future work, it shows that the trend of shifting bronze networks is mirrored in the shifting source of gold. On this basis, it appears probable that the exchange of gold flowed through the same networks, perhaps only as a byproduct.

The approach chosen in this chapter also shows the usefulness of Hartmann's (1970; 1982) work for the Scandinavian material and its potential in combination with research on bronze networks. Future research should quantify the potential problems with Hartmann's silver data (as Warner and Cahill have done with the Irish material). Additionally, a more balanced geographical distribution and an increase of analyses in some areas are desirable. Here, the use of non-destructive analyses holds immense potential.

We have also illustrated the potential of studying diachronic processes in small-scale areas. Here, metal analyses of the three golden *Noppenringe* from north of the bog in Boest, as well as bronze axes and spearheads from Arildskov and Boest, are desirable.

The study of golden artefacts and their production holds potential as well, being only touched upon here. The association of artefacts made from metals coming from different gold sources should be remarked upon, as we can see in the examples from Arildskov and Buddinge. The deposition of material with different provenance has also been observed in other cases, i.e. the Ølby grave, where the bronze objects suggest different regions of origin (Reiter *et al.* 2019). Is this a coincidence or are these slight differences in colour result of deliberate decisions maybe even to highlight the access to different gold networks? Certainly, different alloys not only changed an artefact's colour, but also altered the melting point, raised hardness, and influenced wire-tearing (Pingel 1995: 394ff). Future research might be able to answer this question.

Conclusion

This study underscores the significance of the Arildskov hoard in understanding Early Bronze Age societies in northern Europe. The comprehensive analysis of golden artefacts from Arildskov reveals intricate trade networks and technological advancements in metalworking, comparable to those observed in bronze artefacts. By employing advanced analytical techniques, such as portable XRF, the origins of the gold can be traced, highlighting the complex exchange systems and shifting networks leading to southern Scandinavia over periods from the Late Neolithic to the Nordic Bronze Age.

The findings demonstrate that gold, like bronze, was subject to dynamic trade routes and regional interactions, with material sources shifting over time and with gold possibly flowing through the same networks as bronze and thus 'gilding' them. This research also reaffirms the importance of interdisciplinary approaches in archaeological investigations, integrating different archaeometallurgical data to provide a deeper understanding of prehistoric societies and their material culture.

The Arildskov hoard, with what may be the first wire-drawn artefact found thus far, adds valuable data to the broader context of northern European metallurgy. The variations in gold composition and the presence of alloying elements suggest different sources and possibly the flow of gold through the same channels of trade as bronze.

Future research should expand the dataset to include more artefacts from diverse regions and periods, utilising non-destructive analytical methods to enhance our understanding of ancient networks. The application of lead isotope data might clarify the question of origin, as has been demonstrated for Georgian gold mines (Hauptmann and Klein 2009). Additionally, re-examining Hartmann's data in conjunction with new findings could further elucidate the chronological and geographical patterns in gold sourcing and usage.

Acknowledgements

I would like to extend my sincere gratitude to our cooperation partners at Horsens Museum, as well as to the Romano-Germanic Institution of the German Archaeological Institute, whose expertise and collaboration were crucial to the success of this research. I am also deeply appreciative of the anonymous reviewers for their insightful comments and constructive feedback, which helped to improve and refine this contribution. The support and input from all involved have been invaluable for the completion of this research. Any remaining errors or omissions are solely my responsibility.

Bibliography

Armbruster, B. 2013. Gold and Goldworking of the Bronze Age, in H. Fokkens and A. Harding (eds) *The Oxford Handbook of the European Bronze Age*: 454-468. Oxford: Oxford University Press.

Broholm, H.C. 1943. *Danmarks Bronzealder I. Samlede fund fra den Ældre Bronzealder*. København: Nyt Nordisk Forlag.

Ehser, A., G. Borg and E. Pernicka 2011. Provenance of the gold of the Early Bronze Age Nebra Sky Disk, central Germany: geochemical Characterization of natural gold from Cornwall. *European Journal of Mineralogy* 23: 895-910.

Hartmann, A. 1970. Prähistorische Goldfunde aus Europa. Spektralanalytische Untersuchungen und deren Auswertungen, in K. Bittel, S. Junghans, H. Otto, E. Sangmeister and M. Schröder (eds) *Studien zu den Anfängen der Metallurgie*. Berlin: Gebr. Mann Verlag.

Hartmann, A. 1982. Prähistorische Goldfunde aus Europa II, in K. Bittel, A. Hartmann, H. Otto, E. Sangmeister, H. Schickler and M. Schröder (eds) *Studien zu den Anfängen der Metallurgie*. Berlin: Gebr. Mann Verlag.

Hauptmann, A. and S. Klein 2009. Bronze Age Gold in Southern Georgia. *Archeo Sciences* 33: 75-82 (available at: https://doi.org/10.4000/archeosciences.2037).

Karydas, A.G., D. Kotzamani, R. Bernard, J.N. Barrandon and C. Zarkadas 2004. A compositional study of a museum jewellery collection (7th-1st BC) by means of a portable XRF spectrometer. *Nuclear Instruments and Methods in Physics Research B* 226: 15-28.

Lehrberger, G. 1995. The gold deposits of Europe: An overview of the possible metal sources for prehistoric gold objects, in G. Morteani and J.P. Northover (eds) *Prehistoric Gold in Europe*: 115-144. Dordrecht: Kluwer Academic Publishers.

Ling, J., E. Hjärthner-Holdar, L. Grandin, K. Billström and P.-O. Persson 2012. Moving metals or indigenous mining? Provenancing Scandinavian Bronze Age artefacts by lead isotopes and trace elements. *Journal of Archaeological Science* 40: 1-14.

Ling, J., Z.A. Stos-Gale, L. Grandin, K. Billström, E. Hjärthner-Holdar and P.-O. Persson 2014. Moving Metals II: Provenancing Scandinavian Bronze Age artefacts by lead isotopes and elemental analyses. *Journal of Archaeological Science* 41: 106-132.

Lomborg, E. 1969. Den tidlige bronzealders kronologi. *Aarbøger for nordisk Oldkyndighed og Historie* 1968: 91-132.

Meller, H., R. Risch and E. Pernicka (eds) 2014. *Metalle der Macht – Frühes Gold und Silber*. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Müller, J., S. Delgado-Raack, N. Escanilla, L. Kienle, J. Kneisel, J. Czebreszuk, M. Jaeger, M. Szmyt and U. Schürmann 2023. First evidence for the forging of gold in an Early Bronze Age Site of Central Europe (2200-1800 BCE). *Journal of Archaeological Science: Reports* 47 (available at: https://doi.org/10.1016/j.jasrep.2022.103748).

Nørgaard, H.W. 2017. Portable XRF and Prehistoric Bronze Artefacts: Limitations and Use for the Detection of Bronze Age Metal Workshop. *Open Archaeology* 3: 101-122.

Nørgaard, H.W. 2024. The use of axe and ring metal as a raw material source in the late Neolithic and early Bronze Age in southern Scandinavia, in H. Meller, R. Risch and E. Pernicka (eds) *Der soziale Wert von prähistorischen Beilen: neue archäologische und archäometrische Ansätze / The social value of prehistoric axes: new archaeological and archaeometric approaches*. Halle (Saale): State Office for Heritage Management and Archaeology Saxony.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2019. On the trail of Scandinavia's early metallurgy: Provenance, transfer and mixing. *PLoS ONE* 14: 1-32 (available at: https://doi.org/10.1371/journal.pone.0219574).

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2021. Shifting networks and mixing metals: Changing metal trade routes to Scandinavia correlate with Neolithic and Bronze Age transformations. *PLoS ONE* 16: e0252376 (available at: https://doi.org/10.1371/journal.pone.0252376).

Oddy, A. 1977. The production of gold wire in antiquity. *Gold Bulletin* 10: 79-87.

Pahlow, M. 2006. *Gold der Bronzezeit in Schleswig-Holstein*. Bonn: Rudolf Habelt.

Pingel, V. 1995. Technical aspects of prehistoric gold objects on the basis of material analyses, in G. Morteani and J.P. Northover (eds) *Prehistoric Gold in Europe*: 385-398. Dordrecht: Kluwer Academic Publishers.

Radivojević, M., B.W. Roberts, E. Pernicka, Z. Stos-Gale, M. Martinóm-Torres, T. Rehren, P. Bray,

D. Brandherm, J. Ling, J. Mei, H. Vandkilde, K. Kristiansen, S.J. Shennan and C. Broodbank, C. 2018. The Provenance, Use, and Circulation of Metals in the European Bronze Age: The State of Debate. *Journal of Archaeological Research* 27(2): 131-185.

Reiter, S.S., K.M. Frei, H.W. Nørgaard and F. Kaul 2019. The Ølby Woman: A Comprehensive Provenance Investigation of an Elite Nordic Bronze Age Oak-Coffin Burial. *Danish Journal of Archaeology* 8: 1-22 (available at: https://doi.org/10.7146/dja.v8i0.114995).

Steffgen, U. 1995. Gold in Early Bronze Age graves from Denmark and Schleswig-Holstein, in G. Morteani and J.P. Northover (eds) *Prehistoric Gold in Europe. Mines, Metallurgy and Manufacture*. Dordrecht: Kluwer Academic Publishers.

Tarbay, J.G. and B. Maróti 2022. Handheld XRF analysis of gold armlets with crescent shaped terminals from the prehistoric collection of the Hungarian National Museum. *Communicationes Archaeologicae Hungariae* 2020: 71-80.

Taylor, J.J. 1980. *Bronze Age Goldwork of the British Isles*. Cambridge: Cambridge University Press.

Thrane, H. 1987. Review 'Axel Hartmann: Prähistorische Goldfunde aus Europa II. Spektralanalytische Untersuchungen und deren Auswertung'. *Journal of Danish Archaeology* 6: 204-208.

Vandkilde, H. 1992. Metal Analyses of the Skeldal Hoard and Aspects of Early Danish Metal Use. *Journal of Danish Archaeology* 9(1990): 114-132.

Vandkilde, H. 1996. *From Stone to Bronze. The Metalwork of the Late Neolithic and earliest Bronze Age in Denmark*. Aarhus: Jutland Archaeological Society.

Vandkilde, H. 2016. Bronzization: The Bronze Age as pre-Modern Globalization. *Praehistorische Zeitschrift* 91(1): 103-123.

Warner, R. 1993. Irish prehistoric goldwork: a provisional analysis. *Archaeomaterials* 7: 101-113.

Warner, R.B. 2004. Irish gold artefacts: Observations from Hartmann's analytical data, in H. Roche, E. Grogan, J. Bradley, J. Coles and B. Raftery (eds) *From Megaliths to Metal. Essays in Honour of George Eogan*. Oxford: Oxbow Books.

Warner, R.B. and M. Cahill 2011. Analysing ancient Irish gold: an assessment of the Hartmann database. *The Journal of Irish Archaeology* XX: 45-52.

Chapter 17a

The Nuragic civilization (1800-720 BCE): a fascinating Bronze Age culture in the middle of the Mediterranean Sea

Valentina Matta

Former PhD student, Aarhus University
valema990@gmail.com

«Dicono che nell'isola di Sardegna vi
siano degli edifici costruiti secondo l'antico uso
greco, e molti altri bei complessi ed in particolare
delle tholoi con magnifico rapporto delle proporzioni
»: edifici costruiti "alla antica maniera greca"
– i nuraghi – e le tholoi di mirabile proporzione,
forse i templi a pozzo ed alcune "rotonde".[1]
(Pseudo Aristotele, Racconti meravigliosi)

Abstract

This contribution provides a short overview of the cultural situation in Sardinia during the Bronze and Iron Age, *c.* 1800-700 BCE. It particularly focuses on the Nuragic culture, its monuments and material culture. The Nuragic culture is marked by monumental stone buildings, sanctuaries and concentric settlements. The unique material culture consists (among other things) of small bronze figurines: the so-called 'bronzetti'. These figurines are of great interest for the Scandinavian Bronze Age, as (in addition to daily figures) they depict warriors with horned helmets similar to the Late Bronze Age iconography known from the Scandinavian Bronze Age.

Introduction

The phenomenon of the Nuragic culture in Sardinia is undoubtedly one of the most fascinating in the central-western Mediterranean. Unique in its kind, the Nuragic civilisation emerged during the Bronze Age, *c.* the 18th century BCE, and developed over a thousand years, ending in the early Iron Age, *c.* the second half of the 7th century BCE (Depalmas 2009b). Despite the Nuragic civilisation being singled out by a strong local identity, as often happens on islands, it was actually at the centre of important commercial traffic, particularly involving metals (with Cyprus, Etruria, and the Iberian Peninsula), as well as wine and precious materials. Thanks to its position in the centre of the Mediterranean, Sardinia became one of the most important stops for maritime populations, e.g. the Greeks, Phoenicians, and Iberians. Thus, the Nuragic civilisation had the opportunity to develop its culture and traditions in an original and unique way, while also participating in cultural, political, and commercial exchanges that characterised the entire Bronze Age and the early Iron Age in Europe.

The Nuragic landscape: Sardinia, the Island of towers (1600-1200 BCE)

The term 'Nuragic civilisation' derives from the term 'nuraghe', which refers to the Bronze Age towers spread throughout the island of Sardinia. There are several theories about its origin: the first attestation of the term 'nurac' was found in the Roman inscription of the nuraghe Aidu Entos of Bortigali (Nuoro), which marked the boundary between the tribes[2] of the Ilienses and the Balari (Lilliu 1962). However, the origin of the term may actually be much older, probably dating back to the Bronze Age itself. In fact, the word nuraghe seems to derive from the root *nur-* or *nor-*, which is present in words such as *nurra* (Sardinian for an accumulation of stones, or cavity), or in Sardinian words such as *nuraxi*, *nurake*, and *naraku*, or indeed in place names e.g. Nuracci, Nora, Nurri, and Nuragugume, which refer to different places on the island (Ugas 2014).

What are nuraghi?

The term nuraghe refers generally to the architecture of a certain structure defined by a truncated conical tower with a circular plan whose top ended in a tholos. However, 'nuraghe' also encompasses the so-called 'nuraghe a corridoio' or 'archaic nuraghe', which do not have a tholos. The towers can be singular or complex, i.e. with multiple towers, and sometimes even a village of huts (e.g. Su Nuraxi-Barumini, Is Paras-Isili, Genna Maria-Villanovafranca, see Fig. 1). Nuraghi can reach up to 20 m in height and were built using a dry stone technique, i.e. without the use of mortar to bind the

[1] 'On the island of Sardinia they say that there are many fine buildings arranged in the ancient Greek style, and among others domed buildings, carved with many shapes; these are said to have been built by Iolaus the son of Iphicles, when he took the Thespians, descended from Heracles, and sailed to those parts to colonise them, on the grounds that they belonged to him by his kinship with Heracles, because Heracles was master of all the country towards the west' (Pseudo Aristotle, *de Mirabilibus Auscultationibus*; translation by author 2024).

[2] The names of these tribes go back to Roman times and might have been the names of different Nuragic communities living within different Sardinian territories.

Bronzization (Archaeopress 2025): 204–209

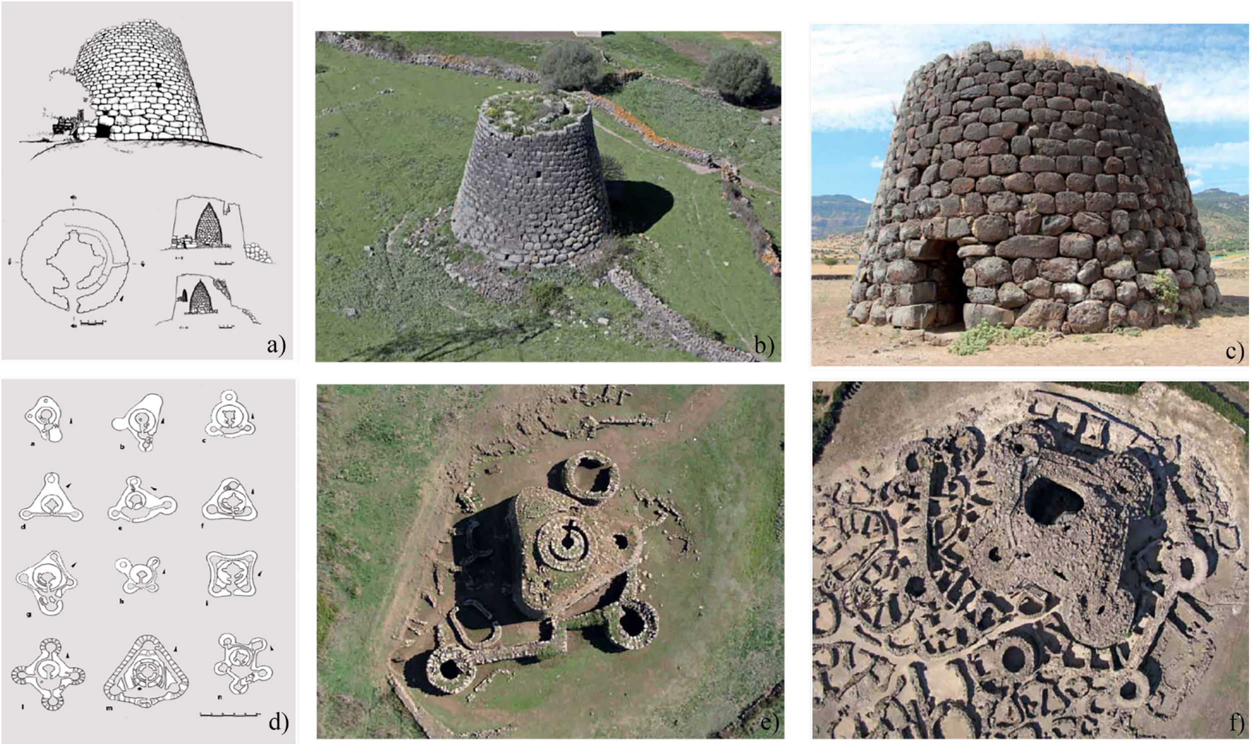


Figure 1: The stone -built towers named 'nuraghi' are divided into two main categories: nuraghe monotorre (a-b-c) and nuraghe complesso (d-e-f) depending on the number of towers annexed to the central tower. Figures a and d show the planimetry and the vertical section of the towers. Generally, the chambers are circular with corridors and niches of different dimensions laterally (Picture from Matta 2021, fig. 2-2 after Moravetti 2017).

stones (e.g. Lilliu 1988; Moravetti 2015; Vanzetti *et al.* 2013).

The monumentality of nuraghe and the presence of structures such as towers, defensive walls, and bastions led scholars – including the important Giovanni Lilliu – to believe that their function was predominantly militia, e.g. for the defense of the various Nuragic tribes (Lilliu 1962). However, research over the last 30 years, and in particular a more in-depth study of the Sardinian landscape and the materials found during excavations, have led to new interpretations. The study of the Nuragic landscape revealed that the nuraghi were not built randomly. It seems, instead, that their positions were strategic; their placement was intended to control routes that were vital for the control of key economic resources: agriculture and pastoralism (Cabras 2018, Schirru and Vanzetti 2023; Usai 2015). The study of the materials found inside the nuraghi, on the other hand, revealed the presence of everyday objects, e.g. vases, pots, cooking surfaces, millstones, grinders, grain storage jars, sickles, axes, weaving tools, etc. (Depalmas 2009a; 2009b; 2009c). Only rarely were cult objects found (and in any event these belonged to later periods). The nuraghe, therefore, served as more than fortified castles: they were multifunctional centres for the accumulation of goods, production, storage, and habitation. They made manifest the will of the various Nuragic tribes to assert their dominance and control over a territory and became the symbol of a community (Santoni 1980; Usai 2015; Vanzetti *et al.* 2013).

The collapse of the Bronze Age system (1200-720 BCE): the age of Nuragic sanctuaries

With the end of the Late Bronze Age and the beginning of the Final Bronze Age (1200-900 BCE), the Nuragic civilisation underwent a series of changes in architectural forms and settlement patterns, as well as in cultural and religious aspects. One reason for this change could be linked with a socio-political reorganisation of Nuragic society, in which a new social class emerged for which religion was predominant (Cámara Serrano and Spanedda 2014; Perra 2009). This new 'aristocracy' managed the control and redistribution of products and precious goods (including metal, which they carefully stored in hoards). Architecturally, the transition from the Bronze Age to the Iron Age marked the end of nuraghe construction and the rise of Nuragic villages and sanctuaries (Bernardini 2017; Usai 2015).

Many nuraghi were thus abandoned, and the Nuragic people changed their settlement system, moving from towers to extensive villages, typified by huts (Ialongo 2018). Additionally, a new religious phenomenon began to spread: the cult of water and the construction of

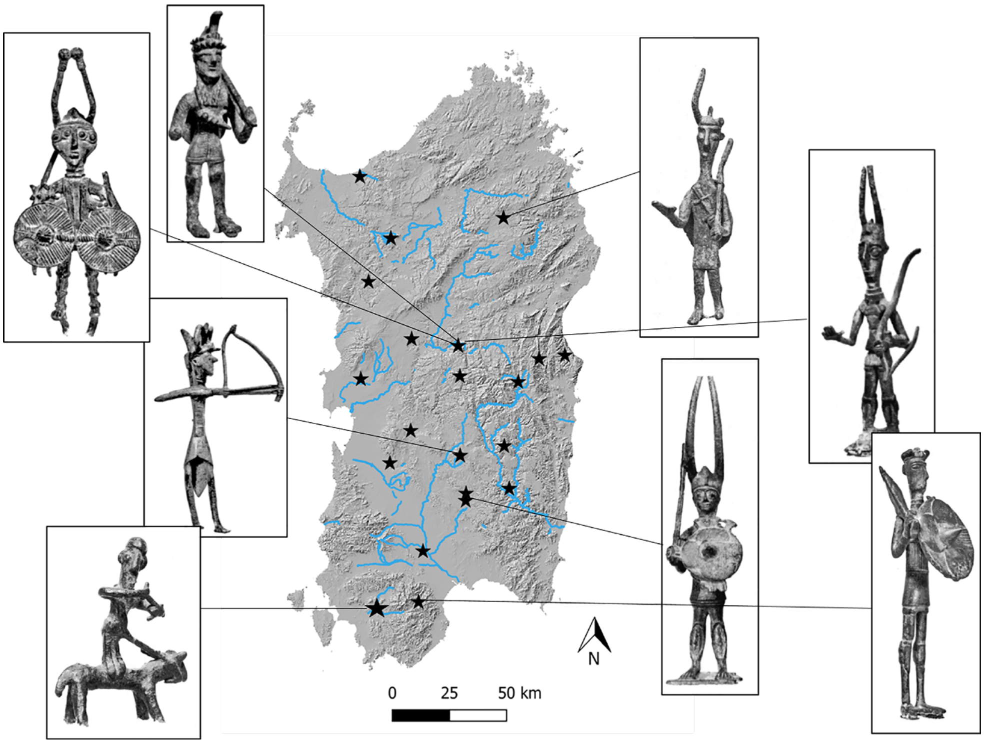


Figure 2: Distribution map of selected Nuragic warrior 'bronzetti' in Sardinia. Ralph Araque Gonzalez (2018) identified several workshops or styles. Most of the figurines, such as the warrior with four eyes and arms, were discovered in the archaeological site of Abibi-Teti, central Sardinia (map Matta 2021, 134).

well temples and megaron temples. Well temples are structures defined by an entrance vestibule leading to a staircase, which in turn descends to a deep cylindrical chamber, covered by a tholos, which reached down to a spring for the water cult.

Megaron temples, on the other hand, derive their name from their resemblance to Greek megarons and are characterised by a rectangular entrance vestibule leading to a rectangular chamber. Both structures were surrounded by an enclosure that delimited the sacred area for religious functions. Often, a Nuragic village is found near areas of well temples and megarons. Some of these areas also expanded between the final Bronze Age and the early Iron Age, becoming true sanctuaries with access areas for pilgrims, commercial exchange zones, and the production of sacred objects (Bernardini 2017; Lilliu 1988). The most famous example is the Nuragic sanctuary of Santa Vittoria di Serri, on the western summit of the Giara di Serri plateau (Canu and Cicilloni 2015; Zucca 1988).

As mentioned, Nuragic sanctuaries are notable for their multifunctionality. In addition to structures devoted to ritual activities they also included spaces for metallurgical production, as was the case for Funtana Coberta-Ballao and the sanctuary of S'Arcu Forros-Villagrande Strisaili (Manunza 2008; Salis 2017), with residences and spaces reserved for the elites (including the famous 'meeting huts' found at numerous Nuragic sanctuaries, e.g. Santa Vittoria-Serri, Santa Cristina-Paulilatino, Serra Orrios-Dorgali, and many others.

An example of local production: the case of Nuragic bronzes

The architectural evolution of the Nuragic civilisation was also accompanied by an evolution in the production of artefacts, both *quotidien* and ritual in nature. Among the most significant productions, the making of votive metal objects is one of the most characteristic for this culture. In particular, the famous Nuragic 'bronzetti' are among the most fascinating of artefacts found in the Mediterranean (see Fig. 2). To date, more than 500 have been recovered, mostly now preserved in the National Archaeological Museums in Sardinia. These represent small bronze statues placed at the entrances of temple areas. The Nuragic bronzetti represent various aspects of Nuragic civilisation: men and women, tribal chiefs, warriors, offerings, priests, musicians, demons, as well as animals, miniature nuraghi, and votive boats. The Nuragic bronzetti are dated between the end of the final Bronze Age (11th-10th century BCE) and the early Iron Age (9th-7th century BCE), and are predominantly found within Nuragic sanctuaries, although examples have also been found in nuraghi and some tombs (Ialongo 2013; Lilliu 1966).

The Nuragic civilization and trade in the Mediterranean

Numerous archaeological sites have yielded many artefacts from other areas in the Mediterranean, demonstrating the commercial activities and networks maintained by the Nuragic people with other cultures. Trade began *c.* 15th-14th century BCE, initially with the Aegean area: it was probably the Mycenaeans, Cretans, and Cypriots who were among the first to reach the Sardinian coast and establish contacts with the Nuragic peoples (Bernardini and Rendeli 2015). The discovery of Aegean-Mycenaean ceramics, dated between the 14th and 12th centuries BCE, at the Antigori-Sarroch nuraghe overlooking the Gulf of Cagliari, and at the Arrubiu nuraghe in Orroli, currently represent the most important reference assemblages for studying contacts between the Nuragic and Aegean populations (at present there are no other significant comparisons in Sardinia; Campus and Leonelli 2000; D'Oriano 2015; Vagnetti 2015). Additionally, the recent discovery of 13th-century BCE Nuragic ceramics at the Cretan sites of Kommos and Pyla-Kokkinokremos near Phaistos, adds another piece to the puzzle regarding the relationship(s) between Nuragic and Minoan peoples (Usai and Lo Schiavo 2009)).

Not only ceramics were exchanged: the trade of metals (particularly copper and tin) and other precious goods created focal points for the various populations of the Bronze Age, including the Nuragic people. The large quantities of 'oxhide' ingots (copper ingots shaped like ox hides from Cyprus (Lo Schiavo 2018)) and artefacts such as Atlantic swords from the Iberian Peninsula, or amber from the Baltic area found at the Su Romanzesu site in Bitti, all testify to the vitality of exchanges between Nuragic communities) with the Aegean, Iberian and continental areas in search of valuable materials to satisfy the demands of their elites (e.g. Lo Schiavo 2012).

How was Nuragic Sardinia linked to LBA Scandinavia?

The participation of Sardinia in the Bronze and Iron Age metal *koiné* (see Vandkilde 2014: 54) is reflected in the system of symbols, values, and images shared across Bronze Age Europe. As previously noted by other scholars (e.g. Kristiansen and Larsson 2005; Matta *et al.* 2020; Rowlands and Ling 2013), I also argue that the regions of Sardinia, the Iberian Peninsula, and Scandinavia are linked by warrior imagery depicted with attributes that are strikingly similar (Matta and Vandkilde 2023). The link between the three regions is the Iberian Peninsula. Iberian ores were among the sources that provided copper to Nuragic Sardinia, and even to Scandinavia, from 1100-700 BCE (Ling *et al.* 2014: 123; Melheim *et al.* 2018: 103). Although Iberian tin arrived in Sardinia, the issue of tin needs more research, especially in terms of the competing European sources from Cornwall, as well as in Sardinia proper. From the end of the LBA, there was evidence in the above regions for the use of warrior images, although on different material supports. Despite local and regional variances, the results point towards the existence of a supra-regional system of shared values and symbols connected to the metal trade in particular.

Conclusions

Studies of the Nuragic civilisation have revealed the complexity and originality of this phenomenon. However, there are still many aspects that require more attention and research, hopefully to be developed in the near future.

Bronze Age Sardinia is characterised on one hand by a marked and distinctive local development, in which the Nuragic towers, the so-called giants' tombs, and sacred wells, enhance the local landscape – always finding original architectural forms that often adapt to the morphology of the territory in which they are found. On the other hand, the island opened its ports to new peoples, at the same time creating and becoming part of a commercial, political, and social fabric that identified the entire European Bronze Age. The Nuragic civilisation did not isolate itself; on the contrary, it actively participated in the interactions and exchanges which took place in the Mediterranean, showing a keen interest in learning new techniques and trends in material production, such as seen via links with Cyprus, for example, but also capable of reformulating, through a local language, forms and contents which circulated in Bronze Age Europe.

Bibliography

Bernardini, P. 2017. Santuari, culti e ideologia del potere nella Sardegna Nuragica della Prima Età del Ferro, in A. Moravetti, P. Melis, L. Foddai and E. Alba (eds) *La Sardegna Nuragica, Storia e Monumenti- Corpora delle Antichità della Sardegna*: 212-222. Sassari: Carlo Delfino Editore.

Bernardini P. and M. Rendeli 2015. Il mare e gli scambi, in M. Minoja, G. Salis and L. Usai (eds) *L'Isola delle Torri. Giovanni Lilliu e la Sardegna Nuragica*: 142-147. Sassari: Carlo Delfino Editore.

Cabras, M. 2018. Patrones de asientamento de la Edad del Bronce en el Monte Arci y Alta Marmilla, Cerdeña centro-occidental. Unpublished doctoral thesis. University of Granada, Spain.

Cámara Serrano, J.A. and L. Spanedda 2014. L'organizzazione sociale nuragica: Note e ipotesi, in A. Moravetti, E. Alba and L. Foddai (eds) *La Sardegna Nuragica: Storia e materiali*: 151-159. Roma: Regione Autonoma della Sardegna.

Campus, F. and V. Leonelli 2000. *La tipologia della ceramica nuragica*. Sassari: BetaGamma.

Canu, N. and R. Cicilloni 2015. *Il Santuario di Santa Vittoria di Serri. Tra archeologia del passato e archeologia del futuro*. Roma: Edizioni Quasar.

Depalmas, A. 2009a. Il Bronzo finale della Sardegna, in C. Lugliè and R. Cicilloni (eds) *Atti della XLIV Riunione Scientifica, La preistoria e la protostoria della Sardegna*: 141-160. Firenze: Istituto Italiano di Preistoria e Protostoria.

Depalmas, A. 2009b. Il Bronzo medio della Sardegna, in C. Lugliè and R. Cicilloni (eds) *Atti della XLIV Riunione Scientifica, La preistoria e la protostoria della Sardegna*: 123-130. Firenze: Istituto Italiano di Preistoria e Protostoria.

Depalmas, A. 2009c. Il Bronzo recente della Sardegna, in C. Lugliè and R. Cicilloni (eds) *Atti della XLIV Riunione Scientifica, La preistoria e la protostoria della Sardegna*: 131-140. Firenze: Istituto Italiano di Preistoria e Protostoria.

D'oriano, R. 2015. La Sardegna nuragica e l'Oriente, in M. Minoja, G. Salis and L. Usai (eds) L'Isola delle torri. Giovanni Lilliu e la Sardegna Nuragica: 152-155. Sassari: Carlo Delfino Editore.

Gonzalez, R.A. 2018. *Inter-Cultural Communications and Iconography in the Western Mediterranean during the Late Bronze Age and the Early Iron Age*. Rahden/ Westfalen: Verlag Marie Leidorf.

Ialongo, N. 2013. Sanctuaries and the Emergence of the Elites in Nuragic Sardinia during the Early Iron Age (ca. 950-720 BC): The Actualization of a 'Ritual Strategy'. *Journal of Mediterranean Archaeology* 26(2): 187-209.

Ialongo, N. 2018. Crisis and recovery: The cost of sustainable development in Nuragic Sardinia. *European Journal of Archaeology* 21: 18-38 (available at: https://doi.org/10.1017/eaa.2017.20).

Kristiansen, K. and T.B. Larsson 2005. *The Rise of Bronze Age Society*. Cambridge: Cambridge University Press.

Lilliu, G. 1962. *I Nuraaghi: torri preistoriche della Sardegna*. Cagliari: La Zattera.

Lilliu, G. 1966. *Sculture della Sardegna Nuragica*. Cagliari: La Zattera.

Lilliu, G. 1988. *La civiltà dei sardi. Dal paleolitico all'età dei nuraghi*. Gennaio: Il Maestrale.

Ling, J., Z. Stos-Gale, L. Grandin, K. Billström, E. Hjärthner-Holdar and P.-O. Persson 2014. Moving metals II: provenancing Scandinavian Bronze Age artefacts by lead isotopes and elemental analyses. *Journal of Archaeological Science* 41: 106-132.

Lo Schiavo, F. 2012. Gli Altri: Nuragici e Ciprioti a confront, in P. Bernardini and M. Perra (eds) *I Nuragici, i Fenici e gli Altri. Sardegna e Mediterraneo tra Bronzo Finale e Prima Età del Ferro. Atti del I Congresso Internazionale in occasione del venticinquennale del Museo 'Genna Maria' di Villanovaforru, 14-15 dicembre 2007*: 14-40. Sassari: Carlo Delfino Editore.

Lo Schiavo, F. 2018. Lingotti oxhide e oltre. Sintesi ed aggiornamenti nel Mediterraneo e in Sardegna, in A. Giumlia-Mair and F. Lo Schiavo (eds) *Bronze Age Metallurgy on Mediterranean Islands*: 15-41. Drémil-Lafage: Éditions Monique Mergoil.

Manunza, M.R. 2008. *Funtana Coberta: Tempio nuragico a Ballao nel Gerrei*. Cagliari: Scuola Sarda.

Matta, V. 2021. Hub or backwater? Uncovering Sardinia´s role within the Bronze Age networks. Ph.D. dissertation, Aarhus University.

Matta, V., H.W. Nørgaard, D. Stott, H. Vandkilde and M.K. Holst 2020. The Mountain Sanctuary of Matzanni in Sardinia: Project Motivations and Preliminary Research Results. *Open Archaeology* 6: 206-213.

Matta, V. and H. Vandkilde 2023. The State of the Debate: Nuragic Metal Trade in the Bronze Age and Early Iron Age. *Open Archaeology* 9(1): 1-29.

Melheim, A.L., L. Grandin, P.-O. Persson, K. Billström, Z. Stos-Gale, J. Ling, R.A. Williams, I. Angelini, C. Canovaro, E. Hjärthner-Holdar and K. Kristiansen 2018. Moving metals III: Possible origins for copper in Bronze Age Denmark based on lead isotopes and geochemistry. *Journal for Archaeological Science* 96: 85-105.

Moravetti, A., Melis, M., Foddai, L. and E. Alba 2017. *La Sardegna nuragica. Storia e monumenti, Corpora delle Antichità della Sardegna*, Sassari: Carlo Delfino Editore.

Moravetti, A. 2015. Giovanni Lilliu e l´isoladelle tori, in M. Minoja, G. Salis and L. Usai (eds) *L´Isola delle Torri. Giovanni Lilliu e la Sardegna Nuragica*: 13-18. Sassari: Carlo Delfino.

Perra, M. 2009. Osservazioni sull'evoluzione sociale e politica in età nuragica. *Riviste Scienze Preistoriche* LIX: 355-368.

Rowlands, M. and J. Ling 2013. Boundaries, Flows and Connectivities: Mobility and Stasis in the Bronze Age, in S. Bergerbrant and S. Sabatini (eds) *Counterpoint: Essays in Archaeology and Heritage Studies in honour of Professor Kristian Kristiansen*: 517-529. British Archaeological Reports International Series 2508. Oxford: Archaeopress, 517-529.

Salis, G.F. 2017. Pozzi sacri, fonti e rotonde, in A. Moravetti, P. Melis, L. Foddai and E. Alba (eds) *La Sardegna Nuragica, Storia e Monumenti- Corpora delle Antichità della Sardegna*: 253-276. Firenze: Carlo Delfino.

Santoni, V. 1980. Il segno del potere, in D. Sanna (ed.) *Nur. La misteriosa civiltà dei Sardi*: 141-187. Milano: Amilcare Pizzi.

Schirru, D. and A. Vanzetti 2023. Climbing the Giara: A Quantitative Reassessment of Movement and Visibility in the Nuragic Landscape of the Gesturi Plateau (South-Central Sardinia, Italy). *PLoS ONE* 18(8): e0289023 (available at: https://doi.org/10.1371/journal.pone.0289023).

Ugas, G. 2014. La Sardegna nuragica. Aspetti generali, in A. Moravetti, E. Alba and L. Foddai (eds) *La Sardegna Nuragica: Storia e materiali*: 11-34. Sassari: Carlo Delfino.

Usai, A. 2015. Paesaggi nuragici, in M. Minoja, G. Salis and L. Usai (eds) *L'Isola delle torri. Giovanni Lilliu e la Sardegna Nuragica*: 58-69. Sassari: Carlo Delfino.

Usai, A. and F. Lo Schiavo 2009. Contatti e scambi, in C. Lugliè and R. Cicilloni (eds) *Atti della XLIV Riunione Scientifica, La preistoria e la protostoria della Sardegna*: 271-286. Firenze: Istituto Italiano di Preistoria e Protostoria.

Vagnetti, L. 2015. La Sardegna e il mondo miceneo, in M. Minoja, G. Salis and L. Usai (eds) *L'isola delle torri. Giovanni Lilliu e lla Sardegna Nuragica*. Sassari: Carlo Delfino.

Vandkilde, H. 2014. Cultural Perspectives on the Beginnings of the Nordic Bronze Age. *Offa* 67/68: 51-77.

Vanzetti, A., G. Castangia, A. Depalmas, N. Ialongo, V. Leonelli, M. Perra and A. Usai 2013. Complessi fortificati della Sardegna e delle isole del Mediterraneo Occidentale nella Protostoria, in G. Bartoloni and L.M. Michetti (eds) *Mura di legno, mura di terra, mura di pietra: fortificazioni del Mediterraneo antico, Atti del Convegno Internazionale, Sapienza Università di Roma, 7-9 maggio 2012*: 83-123. Rome: Edizioni Quasar.

Zucca, R. 1988. *Il Santuario Nuragico di Santa Vittoria di Serri*. Sassari: Carlo Delfino Editore.

Chapter 17b

Reflections on four Sardinian bronzes

Søren Dietz

Department of Cross-Cultural and Regional Studies, University of Copenhagen, Copenhagen, Denmark
s.dietz@hum.ku.dk

Abstract

In the Danish National Museum are kept four bronze artefacts from Sardinia which draw a picture of domestic and imported impulses in daily life and religious behaviours of Sardinian communities in the Bronze/Iron Age. These objects created the inspiration for the present contribution, which will shed light on how the objects arrived at the Danish National Museum. The author has collected information regarding their possible context and how these 'bronzetti' relate to other contemporary finds in contemporary cultural settings. The contribution also contains a short catalogue with detailed information on the objects and relevant literature.

Introduction

Mediterranean Bronze Age cultures were born in the Near East in the land between the two rivers known as the Tigris and Euphrates and spread before 3000 BCE to other parts of the Mediterranean. It is evident that the stable supply of metals (first and foremost of copper and, at a later stage, tin) was essential for the local social economy. Although Sardinia is an island rich in metals (lead, silver, copper, and even tin) (see Matta and Vandkilde 2023: fig. 3), the role of the island in the general trade system developed relatively late in spite of contact with Mycenaean Bronze Age peoples in the 14th century BCE (e.g. Ferrarese Ceruti *et al.* 1987). Of considerable importance for Bronze Age Sardinia are the finds of Mycenaean pottery at Sarroka in the Antigori nuraghe at the mouth of the Cagliari Gulf (see Ferrarese Ceruti 1987). Relations with the Mediterranean world increases considerably by the establishment of Phoenician colonies in western and southern Sardinia at the end of the 9th century. As described by Pausanias (X), Greece also became involved. From the 6th century BCE, Punic/Carthaginian dominance in the western Mediterranean changed conditions for the Etruscan towns on the Italian mainland as well as within central Europe and Sicily. Finally, Iberia and southern France left their stamp on life in society and the use of the island.

Evidence of the Sardinian material culture of the 1st millennium BCE in Denmark

The Danish National Museum curates four bronze artefacts from Sardinia which together form a picture of both the local and imported materials present in daily life, as well as the religious behavior of Sardinian communities in the Bronze/Iron Age (e.g. Dietz 1981; Guido 1963; Lilliu 1966; see catalogue). These objects were the inspiration for the present contribution (see Dietz 1981).[1]

The female figure with hat

The bronze figure (National Museum ID 5367, Fig. 1) was bought by Christian Sørensen Blinkenberg in Rome from Professor Simonetti of the Palazzo Odeschalchi with the stated provenance of Le Marche. The figure is usually identified as a woman. In a letter from Rome, dated 3 January 1903 Christian Blinkenberg wrote the following to the director of the National Museum of Denmark (Sophus Muller) concerning figure 5367, saying: 'It reminds me of the figures with large hats on the Trans Apennine bronze situlae and is probably at home in this context' (Blinkenberg 1903).

The figure with the large hat is extraordinary in many ways. Many details point towards a Sardinian origin, including the dress, the square body, and the position of the arms. Among the figures published by Lilliu (1966), only two have big hats. One is preserved only from the neck up (Lilliu 1966: no. 81) while the other (Lilliu 1966: no. 79) includes only the brim of the hat and the left hand. According to their contextual information, both figures were found at Terralba in western Sardinia, not far from the Phoenician colony of Tharros. We suggest that our figure is from the same area. Lilliu (1966) no. 79 from Terralba is called *donna offerente* (literally, 'the offering woman'; Bernardini 1985: Fig. 8). Other *donne offerente* with similar clothing are depicted by Bernardini from Urzulei, in the central part of the island (Bernardini 1985: fig. 19).

Several Greek and Etruscan objects were found in Sardinia (Guido 1963: 157-162; Matta and Vandkilde 2023: fig. 5). Protocorinthian and Rhodian pottery sherds were found in a 7th-century context in Su Nuraxi (Barumini), one of the few sites scientifically excavated on the island (Lilliu 1955; see Perra 2018). This can be seen as evidence of connections between Etruscans and

[1] I am grateful to Fulvia Lo Sciavo with whom I had the opportunity – in the summer of 2023 in Oristano – to discuss Sardinian 'bronzetti' and Nuraghic culture.

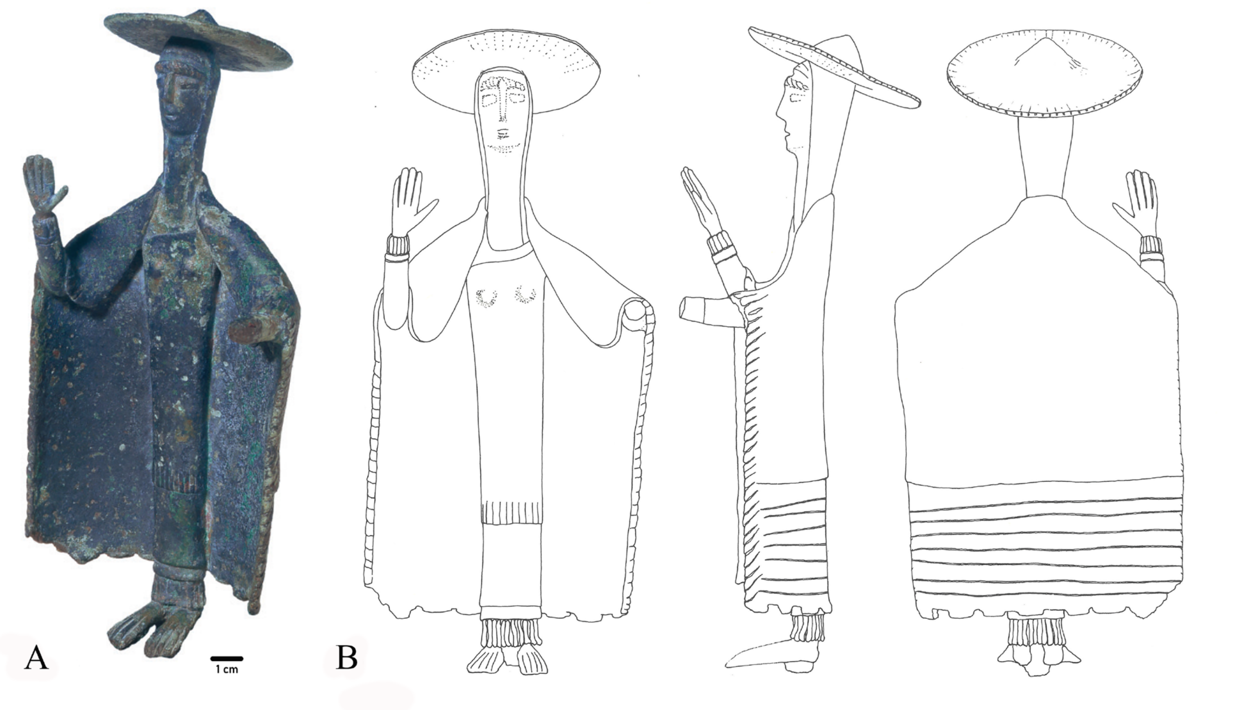


Figure 1: Female bronzetti with hat and raised hand: a) photograph (after Roberts 2021: cat no.1); b) drawing (after Dietz 1981).

the inhabitants of Sardinia, mainly under Carthaginian rule, which was restricted to the western part of the island. An important object indicating Etruscan and Sardinian relations was found in Cala Gonome, Darguli (eastern Sardinia): a biconical cauldron with a handle attachment with spiral decoration (Guido 1963: pl. 58). The handle with attachment has been compared to the San Fransesco hoard in Bologna found with a Benacci II fibula (Guido 1963 178; Lo Schiavo *et al.* 1985: 33). The cauldron is considered to be of Sardinian derivation, although perhaps of Cypriot inspiration.

Another Mediterranean Island, Corsica, became part of the Etruscan region in the 6th century BCE at a time when Carthaginian influences dominated larger parts of the central and western Mediterranean area – including Sardinia (510 BCE). At the same time, the Po Valley and the eastern Alps were included in the Etruscan political and cultural confederation. The Carthaginians took over Sardinia in 510. Sardinian bronzes in Etruscan contexts are important and provide the opportunity for estimating chronology. Importantly, the date firstly falls in the Orientalising phase, which lasted approximately from the 7th (Gras 1980: 126) to 6th century BCE. Eight boats were found – five from Vetulonia (an important bronze working centre), others from Populonia and Gravisca (6th century BCE) and one statuette from the Cavalupo grave in Vulci (late 9th/8th century).

On the Italian mainland, Sardinian bronzetti are mainly found in tombs. In Sardinia, they are connected with sanctuaries, often in association with water (see Matta and Vandkilde 2023). Excavations in the Po Valley (which was Etruscan from the 6th century BCE) have uncovered Sardinian bronze objects in Tristine in Umbria (probably procured via Vetulonia, the important metal producing centre mentioned above). Additionally, the so-called Terni hoard in the National Museum, Copenhagen (Dietz 1982: 43, fig. X), contains attachments (ornaments) of Sardinian origin. The Terni hoard is probably part of the famous Piediluco hoard[2] dated to 900 BCE or a little later (Dietz 1982; Lo Schiavo *et al.* 1985).

As mentioned above, the Etruscan influences visible on the bronze female with the broad-brimmed hat from the Danish National Museum (Fig. 1) could be related to the group of situlae in the Po Valley and the eastern Alpine region (Lucke and Frey 1962). The situla from Certosa near Bologna was found in the 19th century and contains a series of relief scenes, with men and women wearing large broad-brimmed hats (Lucke and Frey 1962: no. 4). It should be mentioned that broad-brimmed hats have also been found in Greece and areas under Greek influence and are known as *petaso*. There are no agreements as to whether these similarities are significant within the literature. It is important that, in both cases, the hats were part of male dress, while in Sardinia these hats were worn by women – a remarkable change! The situla group in northern Italy is dated to

[2] For the Piediluco hoard, see Lo Schiavo *et al.* 1985.

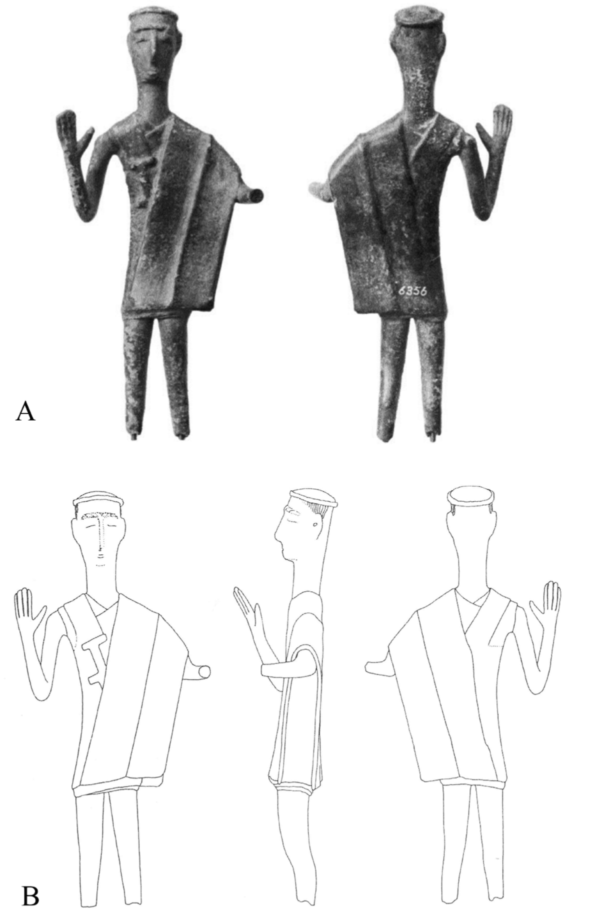


Figure 2: Male figure with raised hand: a) photo (after Roberts 2021: cat no.2); b) drawing (after Dietz 1981).

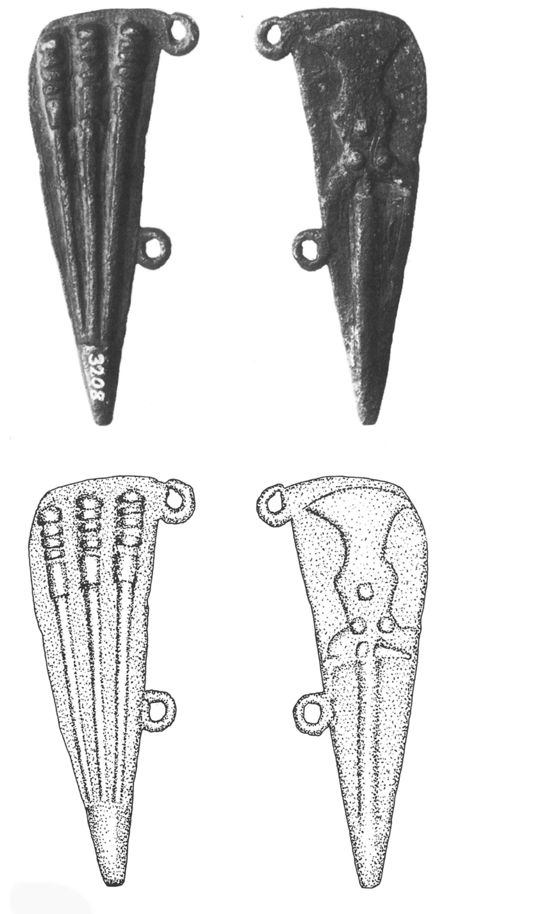


Figure 3: The bronze votive quiver (photo and drawing: after Dietz 1981).

the later part of 6th century BCE, as are the *petasos*. This date might be relevant for the lady with the hat, thus at the very end of the possible time of production of the bronzetti. The conclusion seems to be that the bronze figures were inspired from north Etruria but produced in Sardinia, transported to Etruria, and probably procured via Vetulonia.

The male figure with raised hand

The male figure (National Museum ID 6356, Fig. 2) was purchased by Christian Blinkenberg in Paris in 1907 without suggested provenance. The figure connects to a considerable number of bronzetti, of which none are absolutely identical. It follows, therefore, that we can exclude the chance that these comparable bronzetti were cast in the same mold. Lilliu (1966) counts 20 bronzes with flat skull caps, sleeveless double tunics, and gamma daggers placed on a flat rim. Of these, six have the characteristic cloak above the left shoulder. They were probably produced all over the island, though none have provenance. The figure might have been barefoot, and the left hand probably had a bowl or a plate on which cast copies of food products were placed: bread, or perhaps the first yield. The closest parallel is the piece from the Pigorini Museum in Rome (Thimme 1980: 289, fig. 116). The dress should be considered to be specifically Sardinian. The flat skull cap is depicted on a few eastern/Phoenician archers produced in Sardinia. These figures are from Sa Costa v. Sardara, south of Caglari (Lilliu 1966: nos. 4-25). The circular cap is, thus, probably Asian in origin. The Sardian dress differs from contemporary Italian dress insofar as it does not make use of fibulae. This is also supported by the evidence that the few fibulae found in Sardinia were imported.

The boat and quiver

The last two bronzes: one quiver (3208 in the catalogue, Fig. 3) and a boat (3209 in the catalogue, Fig. 4) are without doubt from Sardinia, as they were gifts from G. Spanos at the international archaeological conference in Bologna in 1881. At the time, Spanos was director of the museum in Cagliari and a busy excavator.

The quiver (Fig. 3) takes its name from the appearance of similar items placed on the backs of archers. Oddly,

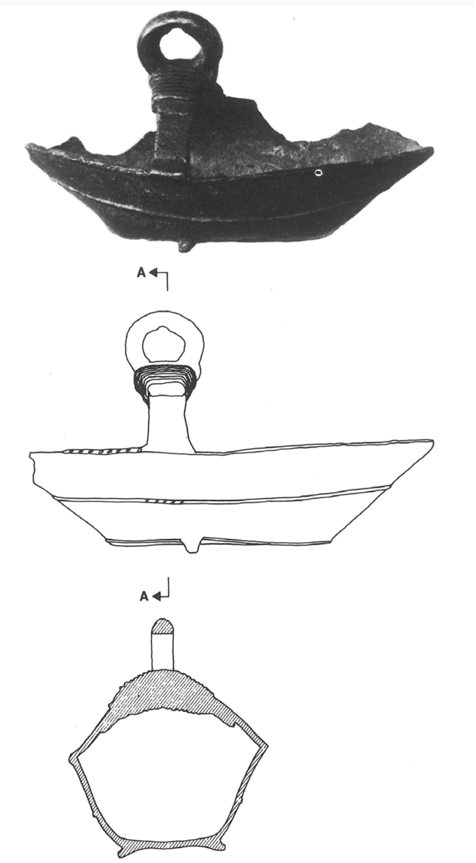


Figure 4: Bronze figure of a boat – a so-called 'navicella' (photo and drawing: after Dietz 1981).

nevertheless, what we see represented are not arrows but needles – similar needles were found at Abibi (Zervos 1954: fig. 127). The reverse side of the quiver is decorated with a protruding depiction of a dagger or, rather, a short sword with a curved hilt back, an extension in the middle, and three nails, filling the whole frame. At first glance, it might appear strange that this votive quiver is decorated on its reverse site with the depiction of a sword. However, the large number of archer bronzetti shows that it was common to carry a short sword strapped to the outside of the quiver (see Lilliu 1966: 66-91; Taramelli 1922: 326). That being said, the sword type is not Sardinian – the extension in the middle and the curved hilt is typical of the usual sword type found on the Italian mainland, classified as the Terni type (Peroni 1970: 90-95). Most of these swords measure *c.* 45 cm in length, giving a slight idea of the size of the quiver.

Anna Depalmas (2005: 55) includes the figure as type 3, no. 16 in her catalogue of Sardinian bronze boats. Usually, these boats have an animal protome in the front. It is possible that our boat originally had such a protome, although, as it is broken, it is impossible to know whether this was the case (see close parallels in Lilliu 1966: 393-394). Many boats also have cast bronze animals placed in between humans on the gunwale. Here again, we have no traces. More closely connected pieces have been found at Nuoro in central eastern Sardinia (Lilliu 1966: 394); it is possible that our piece was collected by Spanos during his activities in that area.

Chronology of the bronzes

The common market of the European Bronze Age not only provided metals transported from mining areas to clients in areas with no natural sources but also facilitated the exchange of social, political and religious ideas. The exchange of the latter at the same time changed both the societies and humans involved in their movement. Among the most significant evidence for this pan-European network is the presence of horned helmets: either the physical helmets themselves, representative helmets placed on bronze figurines, or helmets seen on rock carvings. The production of these warrior symbols was restricted to the Late Bronze Age: from 1200 to *c.* 750 BCE (Vandkilde *et al.* 2021: 6ff; Gonzalez 2012: 102). There were many religious connections between partners involved in the trade network (Kossack 1999). Vandkilde and colleagues (2021) consider the possibilities for communication between the Mediterranean and southern Scandinavia based on the exchange of tin. The possibility of obtaining tin from Cornwall required transport along the Atlantic coast from Portugal to France, the Netherlands, and then, finally, to Denmark. As suggested above, there remains another possibility – the old route from the eastern Alps to Scandinavia, closely associated with the Etruscans. Relations were probably close, considering the close similarities between Sardinian bronzetti and the Danish helmets from Viksø, and especially the figures from Grevensvaenge (Kaul 2004; Vandkilde *et al.* 2021).

Horned helmets in parts of Europe and the Mediterranean make the ideological and religious similarities between Sardinia and the European continent evident. Representations are found in bronze/copper, and in rock carvings in Sardinia, in southwest Iberia and in southern Scandinavia. Authors of the most recent contribution to the topic argue for a common ideological connection between the three areas (Vandkilde *et al.* 2021), promoted by the common need for tin in the production of bronze. It has been suggested for years that the British Isles (Cornwall) could have contributed this rare metal to meet demands in Mediterranean countries and northern Europe (Matta and Vandkilde 2023; see Nørgaard *et al.* 2019; 2021). This widely accepted suggestion supports transport by sea from south to north and vice versa. This contrasts with the model preferred for the transport of metal in the earlier Bronze Age, which is usually suggested to be land-based, originating from rich sources in eastern central Europe. Both possibilities are conceivable if we examine the chronological horizon 1100-800 BCE, including both religious and political aspects. However, the trade of metals between source areas and the north continued after this period.

From a geopolitical point of view, Italy and the Etruscans were socially and economically closely related to life in Sardinia and the western Mediterranean. In Sardinia, the bronzetti are usually found in sanctuaries when found in context. In Etruscan contexts they (mainly boats) are normally found in tombs: e.g. five boats were found at Vetulonia ('Tomba del duce', 'tomba della navicelle', 'Tomba della tre navicelle'), all dated 6th century BCE (see Gras 1980: 126). One of the bronzetti depicting a warrior or priest with shield was found in the Cavalupe tomb in Vulci, dated to the late 9th or 8th century BCE (Gras 1980: 298). All in all, eight Sardinian bronze boats have been found in Etruscan tombs to date. No doubt the bronzes changed meaning and religious function when they moved from the island to the mainland. One could consider an association with the boat as a means of expressing travel as a function of death, such as with the 'sun boat' (Depalmas *et al.* 2015; Gras 1980; Kaul 1998; Vandkilde *et al.* 2021).

To allow a closer chronological understanding of the Scandinavian-Sardinian connections, it is useful to have a look at the different crafting traditions of Sardinian bronzetti. Lilliu (1966) divides them into two clearly distinct styles: The 'Uta Abini' style and the 'Barbaricino' groups (known under the terms 'Old School' (Lilliu 1966) and 'New School'). Later, the original styles were regrouped as 'Mediterraneizzante' (see Gonzalez 2018; Tronchetti 1997).

1200 BC was a turning point in most parts of the Mediterranean region. In Greece, the bureaucratic Mycenaean state collapsed – the palaces of the Mycenaean Wanax changed character and the large eastern states dissolved. The production of bronzetti in Sardinia seems to have begun *c.* 1200 BCE in the Late Bronze Age (cf. Tronchetti 1997: 10-26). Stylistically, the four bronzes in the National Museum of Denmark are part of the Uta Abini group, linked to Lilliu's (1966) geometric group dating to the 9th-7th centuries BCE (see Gonzalez 2018: 68). The Uta Abini group is still found in Early Iron Age contexts, thus it seems to have enjoyed a long period of use (Gonzales 2012). The Mediterranean styles take over during the Orientalising period from the 8th to 7th century BCE. The lady with the broad-brimmed hat (NM 5367) from the National Museum in Denmark should be dated in the 6th century, being among the latest bronzetti. For comparison, the figurine from Vulci in Etruria is from the 9th century BCE (see Gras 1980: 127).

Catalogue

NM 5367. Figure of a woman in bronze (Fig. 1)

On her head she has a broad-brimmed hat with slightly raised rim and low, conical crown. The top of the hat is decorated by three concentric zones consisting of radial incisions. The uttermost incision zone is placed at the rim of the hat. The lower side of the hat is ornamented by a concentric zone consisting of radially placed incised lines. Under the hat, the hair on the forehead consists of incised lines. The coiffure is parted in the middle. The hair is covered by a cowl, which marks the upper end, while the lower dress hangs to the ground. The lower dress fits closely to the rectangular, board-shaped body and ends in a pleated or fringed edge. At the neck, the underdress ends in a u-shaped cut-out. The cowl of this continues under the dress while the other side is in evidence as a covering of the left shoulder. The sleeves end in a pleated or fringed edge. Above the inner dress is a coat, of which the slanting cut is visible below the u-shaped cut-out. The coat ends with fringes or borders around the level of the knee. A large two-piece cloak covers the shoulders and the upper arms and extends to the lower border of the underdress. The lower part of the cloak has seven (originally 8?) horizontal, parallel incisions and more or less half-circular edges. The rim of the cloak is decorated with slanting, incised lines. The face has a marked triangular nose, protruding eyes, and a unibrow marked as a bead with incised lines. The small mouth is slightly open. The right lower arm is raised, palm open in front; the left under arm is horizontally positioned, though the hand is missing. The breasts are marked as low, rounded mounds. Five toes are shown on each of the slightly spread feet. There are bronze tenons at the heels for fixing the figure.

<u>Dimensions</u>: H: 20.7 cm
<u>Context</u>: The figure was bought by Chr. Blinkenberg in Rome from Professor Simonetti of the Palazzo Odeschalchi. Provenance: Le Marche (formerly in Blacker collection, Paris, with provenance said to be Rome).
<u>Analyses</u>: The figure was analysed in 1981 (see Dietz 1981: 235) and the metal lump found on the right side of the cloak (still seen on older photos) was removed, as it was evident that it was a later addition with no connection with the figure. The lump was analyzed, revealing the following content: Sn: 0.4%, Pb: 5.7%, Fe: 6.0%, Mn: 0.05%, Ni: 0.02%, Cu: 89%. The analysis[3] of the

[3] The analyses were initiated by S. Dietz in 1981 and executed by the Nordic Cable and Wire Manufacturers' metal laboratory in Glostrup,

figurine revealed: Sn: 11.7%, Zn: 0.01%, Pb: 0.03%, Fe: 0.2%, Mn: <0.01%, Ni: 0.05%, Cu: 87.9%.
References: Dietz 1981; Guido 1963: 268, Pl. 49; Lilliu 1960: 26; 1966: no. 80; Pais 1884: 32.

NM 6356. Figure of a man in bronze (Fig. 2)

The feet and left hand are missing. A flat, oval skull cap is worn. The short hair is indicated by incised zones in the area in front of and behind the ears. There is no hair on the back, nor on the forehead. The ears have holes indicating the auditory meatus. The brows are shown as a unibrow marked as a bead with slanting, incised lines above the protruding eyes. The long and narrow face has a triangular nose and a narrow, low mouth. The dress consists of a sleeveless, double tunic extending to the middle of the thigh. A broad strap with a dagger of the so-called gamma type covers the right shoulder. The blade of the dagger is covered by a mantle placed around the left shoulder. The right arm and hand are raised with the palm outwards. The lower left arm is horizontal. The legs are slightly spread and the knees slightly bent, which means that the body is slightly turned backwards.

Dimensions: H: 16.8 cm
Context: The figure was bought by Chr. Blinkenberg in Paris (Rollin & Fouardent) in 1907. No provenance indicated.
Analyses: The figure was analysed in 1981 (see Dietz 1981: 235), revealing: Sn: 7.2%, Zn: 0.01% Pb: <0.01%, Fe: <0.1%, Mn: <0.01%, Ni: 0.03%, Cu: 92.9%.
References: Coles and Harding 1979: pl. 233; Guido 1963: Pl. 48; Larsen 1968: 72; Lilliu 1966: no. 53.

NM 3208. Model of quiver in bronze (Fig. 3)

Ethnographical collections protocol no. OA VIIc 18. Votive quiver of bronze with two lugs on the one rim. On one side are three needles with three profiled rings and a head on the top. On the other side is a dagger (or rather a short sword) with curved hilt, an extension in the middle, and three nails.

Dimensions: H: 10.4 cm; W: 4.1 cm; thickness: 0.9 cm
Context: The gift to Professor Valdemar Schmidt from curator G. Spano from the Museum in Cagliari was in connection with the archaeological conference in Bologna 1871. No other contextual information.
Analyses: The figure was analysed in 1981 (see Dietz 1981: 235), revealing: Sn: 7.7%, Zn: 0.01%, Pb: 0.7%, Fe: 0.1%, Mn: <0.01%, Ni: 0.04%, Cu: 91.2%.
References: Dietz 1981.

Denmark, using atomic absorption analysis and a semi-quantitative analysis for the elements Pb, Fe, Ni, and Mn (see Dietz 1981: 235).

3209. Model of boat in bronze (Fig. 4)

Ethnographical collection protocol no. OAVIIc 16. The boat is a shaped like a pointed oval with stem and stern turned slightly upwards. The bottom is slightly curved with two sticks for support. A flat bronze band with a scoop on top connects the two sides. There are seven bronze threads on each side of the bronze scoop. The stern and parts of the sides are missing.

Dimensions: H: 6 cm; L: 10.6 cm; W: 5.7 cm
Context: Gift to Professor Valdemar Schmidt by the curator G. Spano from the Museum in Cagliari in connection with the archaeological conference in Bologna 1871.
Analyses: The figure was analyzed in 1981 (see Dietz 1981: 235), revealing: Sn: 7.2%, Zn: 0.01%, Pb: <0.05%, Fe: <0.05%, Mn: <0.01%, Ni: 0.03%, Cu: 83.3%.
References: Dietz 1981; Lilliu 1966: 481.

Bibliography

Bernardini, P. 1985. Osservazione sulla bronzistica figurata sarda. *Nuovo Bulletino Archarologico Sardo* 2: 119-166.

Blinkenberg, C.S. 1903 (unpublished). RE: Brev til Sophus Müller, direktør for Nationalmuseet i København. Letter to S. Müller: Arkivmateriale fra Nationalmuseet.

Coles, A. and A.F. Harding 1979. *The Bronze Age in Europe*, London, Routledge.

Depalmas, A. 2005. *Le navicelle di bronzo della Sardegna nuragica*. Cagliari: Ettore Gasperini Editore.

Depalmas, A., C. Bulla and G. Fundoni 2015. To communicate the relationships between the Mediterranean Islands: the case of Menorca and Sardinia in Prehistory, in C. Mena and A. Rosario (eds) *Actas del II Congreso Internacional de Buenas Prácticas en Patrimonio Mundial: Personas y Comunidades*: 1104-1113. Madrid: Universidad Complutense de Madrid.

Dietz, S. 1981. Votivbronzer fra Sardiniens forhistorie, in R. Egevang (ed.) *Det skabende menneske (2 bind)*. København: Nationalmuseet.

Dietz, S. 1982. Etruriens forhistorie, in C. Ejlers (ed.) *Etruskernes Verden. Livet og døden hos et oltidsfolk i Italien*. København: Nationalmuseet.

Ferrarese Ceruti, M.L. 1987. Considerazioni sulla ceramica nuragica di Lipari, in G. Lilliu (ed.) *La Sardegna nel Mediterraneo tra il secondo e il primo millennio a.C. Atti del II Convegno di studi «Un millennio di relazioni fra la sardegna e i Paesi del Mediterraneo» (Selargius-Cagliari, 27-30 novembre 1986)*: 431-442. Cagliari: Administrazione Provinciale, Assessorato alla Cultura.

Ferrarese Ceruti, M.L., L. Vagnetti and F. Lo Schiavo 1987. Minoici, Micenei e Ciprioti in Sardegna alla luce delle più recenti scoperte, in M.S. Balmuth (ed.) *Studies in Sardinian Archaeology, III, Nuragic Sardinia* *and the Mycenaean World*: 7-14. British Archaeological Reports International Series 387. Oxford: BAR Publishing.

Gonzalez, R.A. 2012. Sardinian bronze figurines in their Mediterranean setting. *Praehistorische Zeitschrift,* 87(1): 83-109.

Gonzalez, R.A. 2018. *Inter-Cultural Communications and Iconography in the Western Mediterranean during the Late Bronze Age and the Early Iron Age*. Rhaden/Westfalen: Verlag Marie Leidorf.

Gras, M. 1980. Sardische Bronzen in Etrurien, in J. Thimme (ed.) *Kunst und Kultur Sardiniens vom Neolithikum bis zum Ende der Nuraghenzeit. Ausstellung Badisches Landesmuseum Karlsruhe im Karlsruher Schloß vom 18. April - 13. Juli 1980. Museum für Vor- und Frühgeschichte der Staatlichen Museen Preußischer Kulturbesitz Berlin in Berlin-Charlottenburg, Schloßstraße 2, vom 31. Juli - 14. September 1980*: 126-131. Karlsruhe: Badischen Landesmuseum Karlsruhe.

Guido, M. 1963. *Sardinia*. London: Thames and Hudson.

Kaul, F. 1998. *Ships on Bronzes. A Study in Bronze Age Religion and Iconography*. Copenhagen: Det Kongelige Nordiske Oldskriftselskab.

Kaul, F. 2004. *Bronzealderens religion. Studier af den nordiske bronzealders ikonografi*. Copenhagen: Det Kongelige Nordiske Oldskriftselskab.

Kossack, G. 1999. *Religioses Denken in Dinglicher und Bildlicher Uberlieferung Alteuropas aus der spatbronze- und frühen Eisenzeit (9.-6. Jh.v.Chr.)*. München: C.H. Beck.

Larsen, L. 1968. *Graekenland, Italien og Romerriget*. København: Nationalmuseet.

Lilliu, G. 1955. Il nuraghe di Barumini e la stratigrafia nuragica. *Studi Sardi* 12-13(1): 90-469.

Lilliu, G. 1966. *Sculture della Sardegna Nuragica*. Cagliari: La Zattera.

Lo Schiavo, F., E. Macnamara and L. Vagnetti 1985. Late Cypriot Imports to Italy and their influence on local Bronzework. *Papers of the British School at Rome* 53: 1-71.

Lucke, W. and O.-H. Frey 1962. *Die Situla in Providence (Rhode Island): ein Beitrag zur Situlenkunst des Osthallstattkreises*. Berlin: Walter de Gruyter.

Matta, V. and H. Vandkilde 2023. The State of the Debate: Nuragic Metal Trade in the Bronze Age and Early Iron Age. *Open Archaeology* 9/1: 1-29.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2019 On the trail of Scandinavia's early metallurgy: provenance, transfer and mixing. *PLoS ONE* 14(7): e0219574.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2021. Shifting Networks and Mixing Metals: Changing metal-trading routes to Scandinavia correlate with Neolithic and Bronze Age transformations. *PLoS ONE* 16: e0252376.

Pais, E. 1884. Il Ripostiglio di Bronzi di Abini. Presso Teti, in E. Pais (ed.) *Bullettino archeologico sardo ossia raccolta dei monumenti antichi in ogni genere di tutta l'isola di Sardegna*. Cagliari: Tip. Editr. Dell'Avvenire di Sardegna.

Peroni, V.B. 1970. *Die Schwerter in Italien. Le spade nell'Italia continentale*. München: C.H. Beck.

Perra, M. 2018. Nuraghe Su Nuraxi of Barumini, in R.S. Bagnall, K. Brodersen, C.B. Champion, A. Erskine and S.R. Huebner (eds) *The Encyclopedia of Ancient History* (available at: https://doi-org.ez.statsbiblioteket.dk/10.1002/9781444338386.wbeah30616).

Roberts, H.S. 2021. *Catalogue of the Sardinian, Etruscan and Italic Bronze Statuettes in the Danish National Museum*. Aarhus: Aarhus, Aarhus University Press.

Taramelli, A. 1922. Serri. Nuovi scavi nel santuario nuragico presso la chiesa di S. Maria della Vittoria sull'altipiano della Giara. *Notizie degli Scavi di Archeologia* 7-9: 296-334.

Thimme, J. 1980. *Kunst und Kultur Sardiniens vom Neolithikum bis zum Ende der Nuraghenzeit. Ausstellung Badisches Landesmuseum Karlsruhe im Karlsruher Schloß vom 18. April - 13. Juli 1980. Museum für Vor- und Frühgeschichte der Staatlichen Museen Preußischer Kulturbesitz Berlin in Berlin-Charlottenburg, Schloßstraße 2, vom 31. Juli - 14. September 1980*. Karlsruhe: Badischen Landesmuseum Karlsruhe.

Tronchetti, C. 1997. I Bronzetti 'nuragici': Ideologia, Iconografia, Cronologia. *Annali di Archeologia e Storia antica* (Nuova Serie) 4: 9-34.

Vandkilde, H., V. Matta, L. Ahlqvist and H.W. Nørgaard 2021. Anthropomorphised warlike beings with horned helmets: Bronze Age Scandinavia, Sardinia, and Iberia compared. *Praehistorische Zeitschrift* published online: 1-29.

Zervos, C. 1954. *La Civilisation de la Sardegna du debut de L'Eneolithique a la fin de la periode Nouragique*. Paris: Edité par Cahiers d'Art.

Chapter 18

Bronze to Scandinavia

Heide W. Nørgaard,[a]* Johan Ling,[b]* Daniel Berger,[c]* Ernst Pernicka,[c]
Zofia Stos-Gale,[b] Lene Melheim[d]

[a] Moesgaard Museum, Department for Archaeology, Højbjerg, Denmark.
[b] Department of Historical Studies, University of Gothenburg, Sweden
[c] Curt-Engelhorn-Zentrum Archäometrie, Mannheim, Germany
[d] Department of Archaeology, Museum of Cultural History, University of Oslo, Oslo, Norway
* hn@moesgaardmuseum.dk; johan.ling@archaeology.gu.se; daniel.berger@ceza.de

Abstract

This contribution sets out to summarise current knowledge about the metal trade to Scandinavia during the Bronze Age from a multidisciplinary perspective.[1] Based on studies on Scandinavian metal networks that have been carried out in the last decade, this article presents the flow of metal to Scandinavia from the onset of the Nordic Bronze Age *c.* 2000 BCE to its decline *c.* 700 BCE. Our aim is not to present fundamentally new methodologies or data sets, rather it will give the interested reader an overview of changing networks across time. Based on the work of several research groups in Scandinavia and Germany, this contribution puts its focus on case studies and material groups to define metal trade networks and the specific metal sources in use during specific time periods. Furthermore, the shifts within these networks are highlighted and the reasons for those changes are discussed. We conclude with a discussion of the most promising approaches for the future.

Introduction

The last decade has witnessed in a variety of archaeometallurgical studies and analyses that revealed the networks which enabled the rise of the Nordic Bronze Age (NBA), its establishment, and the changes which eventually emerged over the course of the Late Bronze Age (Berger *et al.* 2023a; Bunnefeld 2016a; 2016b; Ling *et al.* 2012; Ling *et al.* 2014; Ling *et al.* 2019; Ling *et al.* 2023; Melheim 2015; Melheim *et al.* 2018; Nørgaard *et al.* 2019; Nørgaard *et al.* 2021; Nørgaard *et al.* 2022; Vandkilde 2017; see Fig.1). These studies enable statistically valuable statements regarding the material analysed, ranging from the earliest evidence for local metal working in Scania (Vandkilde 2017) to the Late Bronze Age throughout the NBA. The data cover *c.* 45% of the metal artefacts recovered thus far, dating from the first 500 years of the NBA (from 2000-1500 BCE; LN I-NBA IB), 3.1% of the 400 years of the Middle Bronze Age (1500-1100 BCE; NBA II and III), and 4.6% of the beginning the Late Bronze Age (NBA IV and V)[2]. Although the number of objects analysed from the Middle and Late Bronze Age is lower, a wide variety of object types have been examined from this period (Fig. 2), including material from local workshop sites, a factor which has provided valuable insights.

The aim of the analyses executed by the respective research groups was to determine the origin of the metal used for the artefacts and to reveal changes in metal supplies across time. It was due to this goal that lead isotope analysis (LIA) and trace element analysis were in focus. Lately, and inspired by the large amount of analysed data, there has been a shift in the overarching research focus towards questions of influence and how the metal trade was organised. Scandinavia lay at the outskirts of central European metal-using societies. Therefore, it comes as no surprise that the patterns which characterise Scandinavia diverge somewhat from what is known for central Europe (in which the recycling of worked metal for local production and the mixing of raw material sources emerged as a point of discussion already from the Late Neolithic). The introduction of multi-isotope analyses – i.e. those which examine not only lead (Pb), but also tin (Sn), copper (Cu) and occasionally osmium (Os) isotopes – opened the way for a significantly better elimination process and the definition of possible end members (original/raw materials before mixing event) of mixing scenarios (e.g. Berger *et al.* 2021; Berger *et al.* 2023b; Berger *et al.* 2024; 2022; in preparation). This new approach has the potential to change (or enhance) our world-view of the Bronze Age by revealing the specific networks that, when seen from a bird's eye view resulted, for example, in the appearance and reproduction of the sword in southern Scandinavia (Berger *et al.* 2021). The aim of this chapter is to present the state-of-the-art of archaeometallurgical studies within the Nordic Bronze Age, and to summarise some of the insights and debates

[1] A field of research to which Helle Vandkilde's contributions have been invaluable.

[2] Calculated according to the bronze finds known (known up to 2011) from the respective publications.

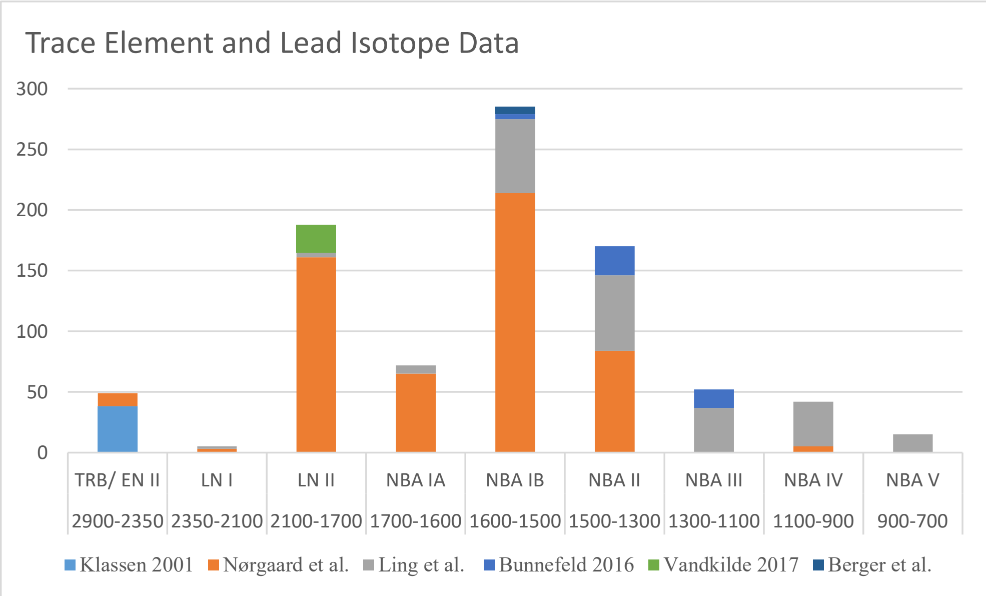


Figure 1: Number of lead isotope analyses (LIA) and trace element analyses executed on Scandinavian material (Denmark, Sweden, Norway, northern Germany). An overlap (double analyses) of max 10 items between the data of the specific teams is possible (graph: H. Nørgaard, based on data up to and including 2023 from Klassen 2001; Ling *et al.* 2012; 2014; 2019; 2023; Nørgaard *et al.* 2019; 2021; 2022 (incl. Berger *et al.* 2021; Bunnefeld 2016b; Melheim *et al.* 2018; Vandkilde 2017)).

that the recent large-scale analytical programmes have spurred.

Material, methods and definitions

The Bronze Age in Scandinavia is most often referred to as the Nordic Bronze Age (NBA), after Karl Kersten defined the cultural unit in southern Scandinavia as NBA; the NBA has also been referred to as the 'Nordic Group' or 'Nordic Circle' (Kersten 1936). Kersten defined a core zone or Zone I (cultural centre) based on the occurrence of the most magnificent artefacts that extended from Scania over the Danish islands to major parts of Jutland. Within Zone II were the adjacent regions in the south, namely the southern part of Jutland, Schleswig-Holstein, and the area above the Weser in Lower Saxony; within NBA III, this zone extended over Mecklenburg-West Pomerania. Despite some similarities in social habits and material culture, there are many regional culture groups within this area. These differences in local material culture from the central NBA region widen in the northern Hanoverian area and large parts of Brandenburg and Pomerania, to such an extent that these regions are, as Kersten argued, only 'influenced' by the NBA (Kersten 1936: 2). Based on Helle Vandkilde's seminal studies on the spread of metalwork in Scandinavia (e.g. Vandkilde 1998; Vandkilde 2017) we need to review this early definition of the NBA and consider the whole area of Gotland in Sweden as part of Kersten's Zone I (see here Vandkilde 2017: 160). Zone II should likewise be extended to the north, and include coastal Norway as far north as Nordland, and Svealand in Sweden (based on, e.g., Bakka 1976). Thus, the NBA as redefined above is the focus of our study.

At the beginning of the NBA (2100/2000-1700 BCE), the metal material culture was characterised by simple weapons and ornaments which were mostly undecorated. At its peak, large, massive bronze ornaments (some of which were extensively decorated) dominated the picture. This stylistic difference emerged from the technique used to craft the artefacts. Between 1700-1600 BCE, ornaments were mostly made by forging; only weapons and tools were cast in clay and stone moulds. From *c.* 1500 BCE, lost-wax casting almost completely replaced the way of production for ornaments, while weapons were cast in multiple ways (e.g. Nørgaard 2018; Sprockhoff 1941). This development and diversity of artefact categories is characteristic of the NBA, and it was also of utmost importance that the analysed objects mirrored the artefact diversity in the respective periods in all executed analytical studies.

Despite attempts to achieve an even distribution, there are different areas of concentration within the periods (Fig. 2). Some of these focal points can be explained by the available material, e.g. axes represent a significant proportion of the Early Bronze Age material, and the analysis of swords is only possible after they appear in the material culture beginning in NBA IB. Other heavily overrepresented artefact groups (such as NBA IB shafthole axes and the swords of NBA II and III) are the result of targeted material investigations (see

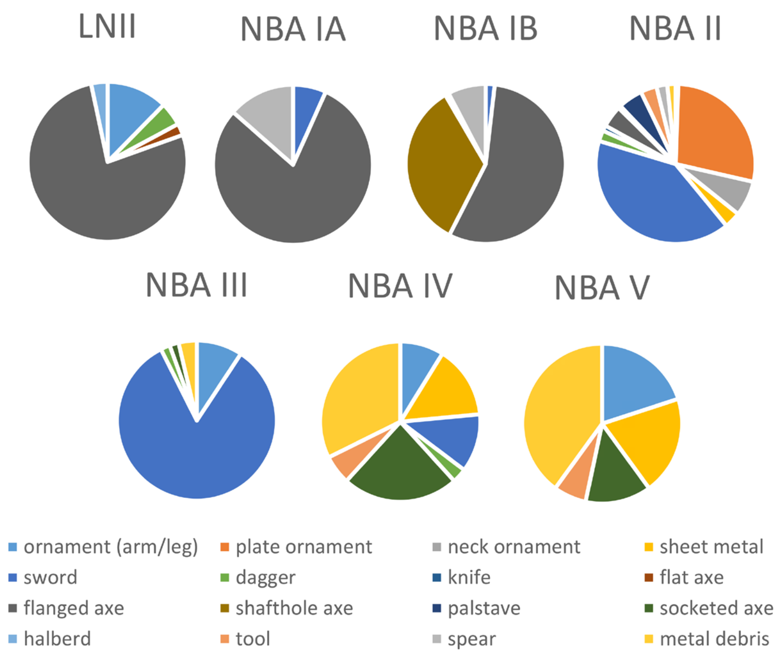


Figure 2: Artefact diversity in analytical studies of the Nordic Bronze Age. Data is based on the studies presented in this paper (graphs: H. Nørgaard, based on literature; see Fig.1).

Bunnefeld 2016b; Bunnefeld 2016b; Cornelis *et al.* 2023; Ling *et al.* 2019; Nørgaard *et al.* 2022). Future work will be able to compensate for these imbalances, to ensure an eventual unbiased view of metal craftsmanship in the Bronze Age.

From a methodological perspective, the data discussed here comes from the combination of LIA and trace element analysis for provenancing copper-based alloys, whose methodological breakthrough took place in the 1980s (Gale and Stos-Gale 1982). LIA (which has its roots in isotope geology and petrology (Faure 1986; Ixer 1999) has been used to narrow down the geological provenance of ancient metals since the mid 1960s (for a detailed research history, see Artioli *et al.* 2020; Pernicka 2014). As the isotopic composition of lead is not affected by those metallurgical processes which transform ore into artefact (Pernicka 2014), it is possible to compare the isotopic fingerprint of an object with those of mineral deposits. LIA is most effective when examined in concert with geochemical and geological information of the ore regions as well as archaeological background knowledge (Artioli *et al.* 2020; Ixer 1999; Killick *et al.* 2020) and is based on the exclusion of non-compatible ores (Cattin *et al.* 2011; Pernicka 2014; Radivojević *et al.* 2018). The data discussed in this study was determined using MC-ICP-MS[3] and TIMS,[4] respectively (depending on the study and year) for the ratios of $^{208}Pb/^{206}Pb$, $^{207}Pb/^{206}Pb$, and $^{206}Pb/^{204}Pb$ and as calculated for $^{208}Pb/^{204}Pb$ and $^{207}Pb/^{204}Pb$. The correction of the internal mass fractionation was made at the Curt-Engelhorn-Zentrum Archäometrie (CEZA) in Mannheim, Germany, and at the Laboratory for Isotope Geology at the Swedish Museum of Natural History (Stockholm) using thallium standards. For detailed methodological steps and the different methods applied for the determination of trace elements, see the respective studies stated in the first paragraph of the Introduction.

Chronology

The chronological frame of the NBA was set by Oscar Montelius in his periodic division of the material in 1885 (Montelius 1885) and has remained unchallenged as the backbone of chronology until today (Randsborg 1996: 63). The system by Montelius for the north towards the south in Europe can be juxtaposed with the chronology created by Paul Reinecke. Reinecke divided the Early Bronze Age into stages Bz A1 to A2, the Middle Bronze Age into levels Bz B to C2, and the Late Bronze Age into levels Bz D to Ha B (see Jockenhövel 2000; Vandkilde 2007: 121; Willroth 1997). Absolute chronological dates from the northern European Bronze Age have been fixed since the 1950s by an increasing amount of radiocarbon and dendrochronological dating (Randsborg and Christensen 2006; Rassmann 2004: 42;

[3] Multiple-collector inductively-coupled plasma mass spectrometry (MC–ICP–MS).
[4] Thermal ionisation mass spectrometry (TIMS).

Table 1: The chronological division of the Nordic Bronze Age compared to the Aegean and European chronology adjusted by H. Vandkilde from Nørgaard *et al.* 2021; ^{14}C range calculated from (Christensen *et al.* 2007; Hornstrup *et al.* 2012; Olsen *et al.* 2011; Vandkilde *et al.* 1996).

Approx. ^{14}C RANGE *	MAJOR DIVISION	S. SCANDINAVIA	AEGEAN	EUROPE NORTH OF ALPS
3800-2900 BCE		Earlier Neolithic		Neolithic Farmers
2900-2350 BCE		Younger Neolithic		Corded Ware
2350-2100 BCE		Late Neolithic I (LN I)		Bell Beaker
2100/2000-1700 BCE	EBA	Late Neolithic II (LN II)	MH III	EBA (Br A1-2b)
1700-1600 BCE		Nordic Bronze Age (NBA) IA	LH IA-B	Final EBA (Br A2c/A3)
1600-1500 BCE	MBA	NBA IB	LH II	Early MBA (Br B1)
1500-1300 BCE		NBA II	LH IIIA-B	Late MBA (Br B2/C)
1300-1200/1100 BCE		NBA III	LH IIIC	Final MBA/Early LBA (Br D-Ha A)
1100-900 BCE	YBA	NBA IV	Sub-Mycenaean	Ha A2
			Protogeometric	Ha B1
900-700 BCE		NBA V	Geometric	Ha B2/3
700-500 BCE		NBA VI	Early Archaic	Ha C
			Late Archaic	Ha D

Vandkilde *et al.* 1996), and have accumulated in fine chronological alignments for the transition phases of the NBA – especially the younger Bronze Age – partly with the help of cremation burials some ten years ago (Hornstrup *et al.* 2012; Olsen *et al.* 2011).

However, from a chronological perspective, there is one point of discussion which stands out quite clearly: When did the Bronze Age begin in the North? Metallurgical studies have lately shown that the first breakthrough in local Scandinavian metal production occurred as early as 2000 BCE within the Scandinavian LN II (see Melheim 2015; Nørgaard *et al.* 2019; Prescott 1991; Vandkilde 2017). The majority of researchers argue that the Bronze Age should be seen as a package of social and spatial changes and that the appearance of a new raw material does not justify re-dating a period in itself. However, new studies reconstructing the population dynamics in northern Europe based on paleoenvironmental data (Feeser *et al.* 2019) allow us to question whether the beginning of the Bronze Age in Denmark and southern Sweden should actually be chronologically placed at 1700 BCE. ^{14}C proxy data (Solheim 2021) evidences increased human activity *c.* 2200-2000 BCE and paleoenvironmental data supports severe changes in Scandinavia *c.* 2000 BCE (Bunbury *et al.* 2023; Feeser *et al.* 2019: 1601; Prøsch-Danielsen *et al.* 2018). Feeser's activity proxy curve (2019: 1601) drops in the next 200-300 years again to improve significantly around 1700 BCE. Similar developments can be recognised in studies of human mobility (Frei *et al.* 2019). Between 2000-2100 BCE, and again at *c.* 1700 BCE, the number of individuals with non-local backgrounds increases. While this contribution does not aim to open the discussion of a southern Scandinavian Copper Age (see below 3.2), we will include metallurgical activities and data from Late Neolithic II (2100/2000-1700 BCE) actively in our discussion.

The known sources of metal in Bronze Age Europe and their properties (Ernst Pernicka)

Knowledge of possible ore sources is essential for provenance studies of prehistoric metal objects. This was certainly already known to those scholars who applied chemical analyses for this purpose when appropriate methods became available in the 1930s. One of the pioneers in this respect was Richard Pittioni, professor of prehistoric archaeology at the University of Vienna, who not only initiated systematic trace element analyses of prehistoric metal objects (Pittioni 1957), but who, together with the mining engineer Ernst Preuschen, also performed systematic surveys of ancient mining regions, especially in Salzburg, Tyrol and the Italian Alps, including the Trentino (Cierny 2008; Preuschen and Pittioni 1937; Zschocke and Preuschen 1932). A first valuable overview of ancient mines in Europe was published by Oliver Davies (1935), which was updated concerning prehistoric mines by Weisgerber and Pernicka (1995) and then again more recently by O'Brien (2015), which included the research history of ancient mining. This is a necessary supplement to modern knowledge of the economic geology of copper deposits in Europe (Fig. 3),

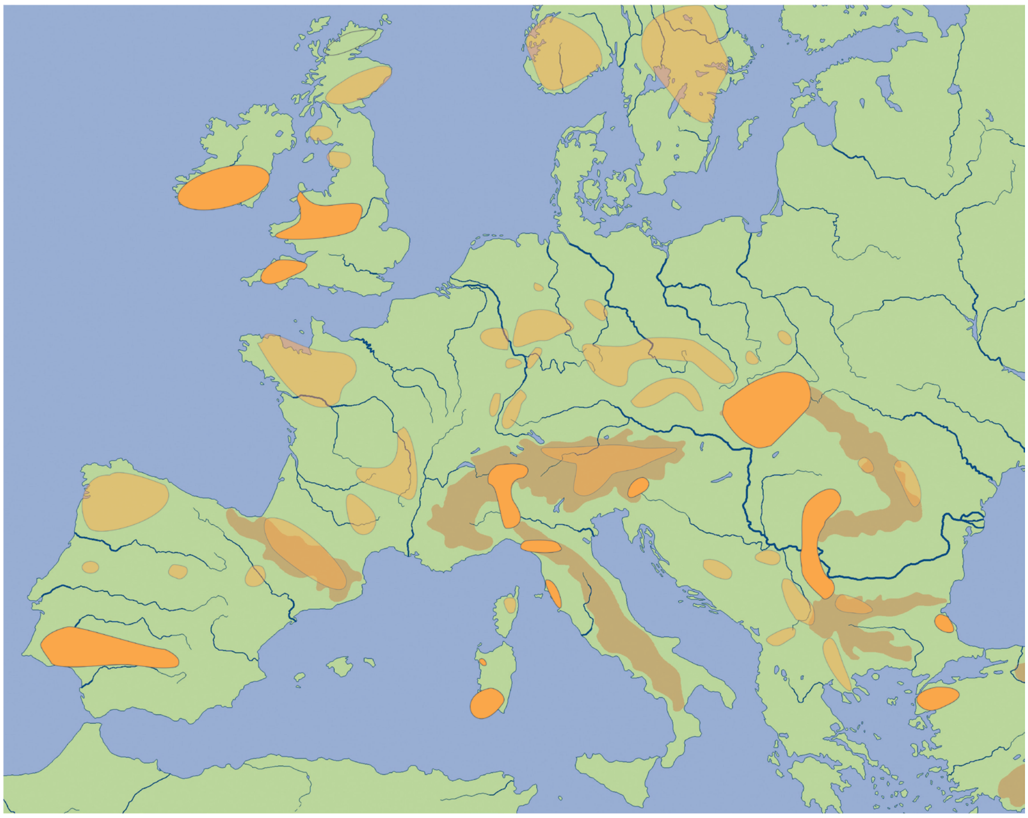


Figure 3: Distribution of copper mineralisations in Europe. Marked in solid orange are regions where prehistoric mining for copper is attested in the field or have provided abundant secondary evidence, e.g. grooved hammers in the field, as in the Slovakian Ore Mountains (or multiple prehistoric objects with matching lead isotope ratios, i.e. Majdanpek in Serbia). Marked in opaque orange are regions with copper deposits for which prehistoric mining has either no or only uncertain evidence (map: E. Pernicka, based on Borg 2019).

because the comparison of lead isotope ratios of prehistoric copper objects with copper mineralisations in an area as large as Europe necessarily leads to overlaps and ambiguities. In this case, it is necessary to take additional parameters into consideration, if a postulated relationship between object and possible geological source is at least conceivable. The most important of these parameters is chemical composition (Pernicka 1999; Pernicka 2014) and field observations of traces of ancient mining alongside the accessibility of copper ores. Especially in the case of postulated long-distance relationships, further consideration may include additional proxies (see Berger *et al.* 2023a) and any archaeological evidence for such a hypothesis.

It is, of course, not possible to obtain a representative lead isotope signature of all copper mineralisations in Europe, whereby there is even no consensus on what constitutes a significant signature, e.g. how many analyses are required for a single deposit. However, there are several thousand lead isotope analyses available of various ore types from locations all over Europe (e.g. Artioli *et al.* 2016; Killick *et al.* 2020; Saez *et al.* 2021; Tomczyk 2022), and it is almost inevitable that one is able to make a match among their number if only a single lead isotope analysis of an ancient copper object is available. Then, the secondary parameters and considerations come into play. Since the number of lead isotope analyses of ore deposits has steadily increased, there is also the possibility that important mineralised regions were missing in earlier publications.

To enable a reliable comparison between ore and artefact, both the mineralisation and the chemical properties of the ores should be taken into account and compared with the artefacts. Between 2000 and 1700 BCE, copper was produced from fahlore-dominated copper ores in some regions, e.g. Ross Island in southwest Ireland (O'Brien 2015) with the arsenic fahlore tennantite, the Inn Valley in the Austrian Alps (Höpner *et al.* 2005) with the antimony fahlore tetrahedrite, and the Slovak Ore Mountains (Modarressi-Teherani *et al.* 2016; Schreiner 2007) with fahlore types containing both arsenic and antimony but also associated with nickel minerals. Accordingly, these elements form major impurities in the copper produced, often together with silver and bismuth.

Generally, it is difficult to distinguish copper deposits with these elements alone, because arsenical copper can also be produced from copper ores associated with arsenopyrite, e.g. in the Iberian Pyrite Belt. However, in the SAM project, two types of arsenical copper could be distinguished whose spatial distributions were mutually exclusive in the British Isles and in southern Iberia across the late 3rd and early 2nd millennium BCE (Junghans *et al.* 1968: 128-138, maps 44-47, 52-56). Incidentally, this was not recognised by a later study which used the same data but a different classification procedure, thereby ending up with an incorrect conclusion regarding the Atlantic coast transport of such metal from Iberia into France and Britain in the early 2nd millennium BCE (Bray *et al.* 2015).

The example above shows that there is some value in the systematic analysis of prehistoric metal finds from a specific region and/or a specific time frame. It would have been impossible to relate these two types of arsenical copper to specific copper deposits, not only because of the substantial changes induced by smelting and refining, but also because it is much more difficult to 'characterise' the composition of a copper mine, not to mention a whole mining region like the eastern Alps or the Trentino with many single mineralisations. However, since copper minerals generally do not contain nickel, unlike arsenic, silver, and antimony, one can use the exclusion principle in a similar way to lead isotope ratios. If prehistoric copper of the fahlore type contains nickel, then certain deposits or group of deposits can be excluded as possible sources, i.e. Ross Island (O'Brien 2004) or the Inn Valley in Tyrol (Schubert and Pernicka 2013). Although minor occurrences of cobalt and nickel minerals are known in this region (Grundmann and Martinek 1994), they have apparently never been used. Similar situations can be assumed for the Swiss Valais and part of the Trentino mining region, as well as the Iberian Pyrite belt and the copper ores in use from *c.* 1000 BCE in Sardinia. Judging from abundant analyses of prehistoric copper objects from Iberia, it seems that nickel-rich copper ores were not used.

The Mitterberg region in the eastern Alps hosts several copper deposits with chalcopyrite as major copper mineral, but also with accessory fahlore and nickel minerals, including especially gersdorffite ($NiAsS_2$). This leads to copper with approximately equal concentrations of arsenic and nickel at variable concentration levels. Fahlore never dominated the composition of the ores used for smelting, so that the copper has a somewhat significant trace element pattern at least in central Europe (Pernicka *et al.* 2016). It later turned out that the Great Orme mine in northern Wales has a similar pattern, but it can be distinguished from Mitterberg by means of lead isotope ratios (Williams 2023; Williams and Le Carlier de Veslud 2019). Presently, fahlore dominated copper deposits associated with nickel minerals and evidence for prehistoric mining are only known from the Slovakian Ore Mountains (Schreiner 2007) and from Vallarde and Cabrières in southern France (Prange 2000).

Metal to southern Scandinavia

Could copper produced from local Scandinavian ores have contributed? (Lene Melheim)

Expedient copper ores are abundant on the Scandinavian Peninsula, especially sulfide ores (e.g. chalcopyrite, chalcocite, bornite), but also other even more easily exploitable copper minerals (e.g. malachite, azurite, cuprite). Early on, Montelius (1885) established as fact that every piece of copper and tin were imported to Scandinavia in the Bronze Age. He was aware of the availability of local copper ores but argued for a late start to local mining. He based this on the lack of evidence for prehistoric mines and the fact that tin deposits are rare (if not non-existent, as he argued), and importantly, that the Scandinavians could easily access already alloyed bronze through trade networks due to the high demand for Baltic amber in other parts of Europe.

Despite this, a number of scholars have considered small-scale mining on the Scandinavian Peninsula in prehistory a likely scenario (e.g. Janzon 1984; Melheim 2015; Myhre 1998: 62-66; Prescott 2006; Stenvik 1988). Attempts at proving that local ores were exploited during the Bronze Age have, however, so far been unsuccessful. Recent provenance programmes using lead isotope analysis have instead pointed to a high degree of importation of copper to the Scandinavian Peninsula (e.g. Ling *et al.* 2012; Ling *et al.* 2014; Nørgaard *et al.* 2019). It should be taken into account that the coverage of lead isotope data for the Scandinavian Peninsula is uneven and skewed towards the Caledonides, and that the majority of analyses come from galena and not copper minerals, a bias that needs to be mitigated by future research.

While the question of local mining remains to be settled once and for all (and may still be proven relevant for other periods), it seems clear that during the Early Bronze Age, huge amounts of bronze (and copper) were imported. To date, the earliest evidence of small-scale mining on the Scandinavian Peninsula dates to the pre-Roman Iron Age and comes from the Bergslagen region in Sweden. Here, sediment archives showed increased levels of metals already *c.* 375-175 BCE – especially of copper and lead – which have been interpreted as evidence of mining (Bindler *et al.* 2017). Signs of more stable production appeared *c.* 400 CE and continued through to the medieval period, when metal production escalated in Bergslagen, as was the case in other parts of Sweden and Norway.

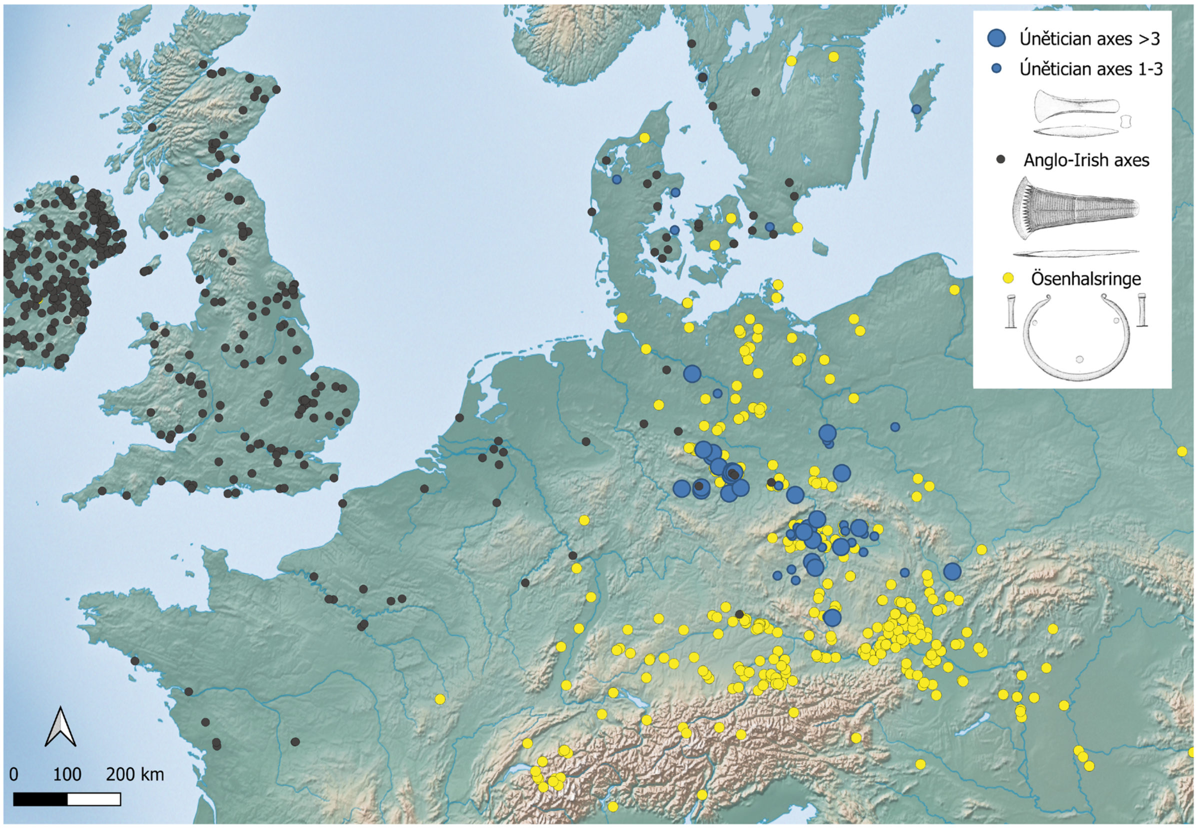


Figure 4: Distribution of the artefacts considered the major sources of metal for the southern Scandinavian Late Neolithic (LN II), and earliest Bronze Age (NBA IA): the Anglo-Irish axes, Únětician flanged axes and looped neck rings (Ösenhalsringe) in central and northern Europe (map: H. Nørgaard, using QGis and Natural Earth, based Burgess and Schmidt 1981; Harbison 1968; 1969; Megaw and Hardy 1938; Needham 1983; Vandkilde 1996; Vandkilde 2017, and data from the Stuttgarter Metallanalysendatenbank, Krause 2003; Junghans *et al.* 1960; Junghans *et al.* 1968; 1974. Mapping the distribution of Anglo-Irish axes in France and Belgium is still ongoing and the present map does not consider the latest publications by Henri Gandois).

Axe and ring metal and the rapid introduction of bronze (Heide W. Nørgaard)

Metallurgy in southern Scandinavia was advanced not by the import of raw materials, but by the import of metal objects and their reuse. The change from stone to bronze did not take place via developmental stages as was attested further south (where the use of pure copper objects over a long period introduced metallurgy and led to the use of bronze; see Gebauer *et al.* in this volume). It rather seems that the rapid development and introduction of tin bronze in LN II was actively triggered by the type of raw material supply (Fig. 4). Statistical evaluations of over 150 metallurgical analyses of typed LN II flanged axes reveal that high-tin flanged axes, imported from the British Isles already in artefact form, were actively reused in the production of particularly elaborately designed local axe types (Nørgaard 2024). Artefact assemblages, such as the Store Heddinge hoard (Vandkilde 1996), demonstrate the import of Anglo-style axes (e.g. Burgess and Schmidt 1981; Harbison 1968; Megaw and Hardy 1938) and the reuse of British and Welsh metal for local production.[5]

Additionally, provenance studies by Nørgaard and colleagues (2019; 2021) revealed two dominant fahlore types for the Early Bronze Age in Denmark. The nickel-rich fahlore, which probably came from the Slovakian Ore Mountains (Nørgaard *et al.* 2019) and is mostly attested in Únětician axe types, makes up a large part of the imported artefacts (Vandkilde 2017: 147). Low-nickel fahlore could be linked to the mineral deposits in the Inn Valley and was most widely used in looped neck rings (Ösenring); therefore, it is also called *Ösenring* metal. In the Late Neolithic material culture of southern Scandinavia, *Ösenhalsringe* appear occasionally as complete items (Nørgaard 2011; Vandkilde 2005). The reuse of the nickel-free *Ösenring* metal in local axe

[5] It should be highlighted here that none of the Anglo-Irish style axes investigated contained Irish metal. The LN II metallurgical analyses did not support the import of Irish metal (Ross Island) to Denmark (Nørgaard *et al.* 2019; 2021).

production could be identified in the Danish material (Nørgaard *et al.* 2021). The recasting of Únětician axes with high nickel content into local axe styles illustrates the reuse of these artefacts in local production. It is highly likely that Únětician axes, as well as loop neck rings, were the main suppliers for local production in Denmark during LN II. However, the majority of the locally produced axes cannot be clearly allocated to one of the source metals, nor can their chemical composition be matched with one of the known ore sources. It is likely that different artefacts, and thus different copper types, were mixed to achieve the right composition, colour, and hardness in the new artefact (see Berger *et al.* 2024; Nørgaard 2024).

Shifting networks in Early Bronze Age and the introduction of southern Alpine Metal (Heide W. Nørgaard and Ernst Pernicka)

As outlined above, it can be hypothesised that the trade of artefact metal was a driving force for the introduction and implementation of independent metallurgy in Denmark and highly probable in Sweden and Norway as well. However, we can by no means speak of a one-sided, unchanging supply of metal within the first 500 years of the emergence of the NBA. Metallurgical studies (Melheim *et al.* 2018; Nørgaard *et al.* 2019; 2021; 2023) from the last decade revealed distinct shifts in the metal trade networks to what is now Denmark in the Early NBA. Late Neolithic societies (2100/2000-1700 BCE) were supplied with metal from two major supply regions: the Slovakian Ore Mountains and the Welsh mining region and (occasionally) with metal from English mines, e.g. Alderley Edge. The latter could be successfully traced, for example, in one axe in the Pile hoard (see Melheim 2018: 90; Nørgaard *et al.* 2019: 22). One additional source is important during this early period, the eastern Alpine Inn valley. Based on the data analysed until 2023, roughly speaking, the majority of the copper used in local metalwork in LN II in Denmark is fahlore copper from Slovakia and the Inn Valley in Austria, while a representative part is very low impurity copper from the British Isles. The remaining minority is probably copper from the Slovakian Ore Mountains, although it is not identical to known fahlores. As this metal is characterised by minor impurities, it was defined by Nørgaard and colleagues as chalcopyrite copper from a new metal source in Slovakia (Nørgaard *et al.* 2021).

The subsequent period NBA IA (1700-1600 BCE) is archaeologically characterised by the appearance of a new artefact category (the spearhead), a shift in the orientation of metal trade and, most importantly, by a significant reuse of existing metal stocks. In this period, a large proportion (63%) of fahlore copper was still in circulation. However, the previous easily distinguishable high-nickel and low-nickel fahlore copper variants, which allowed for the identification of the *Ösenringkupfer* from the Inn Valley (see Melheim 2018: 90; Nørgaard *et al.* 2019), nearly disappeared. What was left was a copper mix that, being a fahlore, has no clear connection to one specific mining region. However, it is quite likely that the established networks with the Únětician culture ensured that Slovakian metal still arrived in Denmark. It was recently suggested that new metal sources could have possibly been introduced from the southeast in connection with the appearance of the spearheads (see Nørgaard 2024). Moreover, minor-impurity copper from chalcopyrite which was already visible in LN II increased, and Welsh metal continued to be important in Denmark.

The previous diversity of copper types in southern Scandinavia came to an end in NBA IB (1600-1500 BCE). A distinct decrease in fahlore copper indicates that the network which supplied Denmark with Slovakian copper dried up (based on Nørgaard *et al.* 2019; 2021). Low-impurity copper from chalcopyrite ores dominated the picture from this point onwards. This copper might partly originate from the Mitterberg mines; similar mineralisations are also known from Slovakia, but they differ in their lead isotope ratios. Contact with the British Isles was still maintained during this period. However, only 6% of the copper used in Denmark probably came exclusively from the Great Orme mine (Melheim *et al.* 2018; Nørgaard et al. 2021), while Great Orme metal seems to have been used intensively alongside other sources. The amount of Great Orme metal is even higher in Sweden (Ling *et al.* 2019; Ling *et al.* 2023). The recently completed re-investigation of the Great Orme mine in north Wales by Alan Williams (Williams 2018; Williams and Le Carlier de Veslud 2019) and his associated discovery that the metals extracted there partly originate from malachite and contain nickel and arsenic opens up new possibilities on the importance of Great Orme metal for southern Scandinavian trade connections.

One specific artefact category highlights the changes that occurred in NBA IB. Fårdrup and Valsømagle axes are of local Nordic style and craftsmanship, and it can be excluded that they were imported (Nørgaard *et al.* 2022). Recent analyses of these axes (based on Ling *et al.* 2023; Melheim *et al.* 2018; Nørgaard *et al.* 2022) show two copper types that previously had no significant impact on the southern Scandinavian metallurgy: namely copper from Mitterberg (Pernicka *et al.* 2016) and copper from the Italian southern Alps (see Artioli *et al.* 2016; Nimis *et al.* 2012). It is remarkable that the largest proportion of the analysed axes show characteristics of both Great Orme and Mitterberg copper. Single artefacts could clearly be allocated to purely Welsh ores, while others pointed to those of

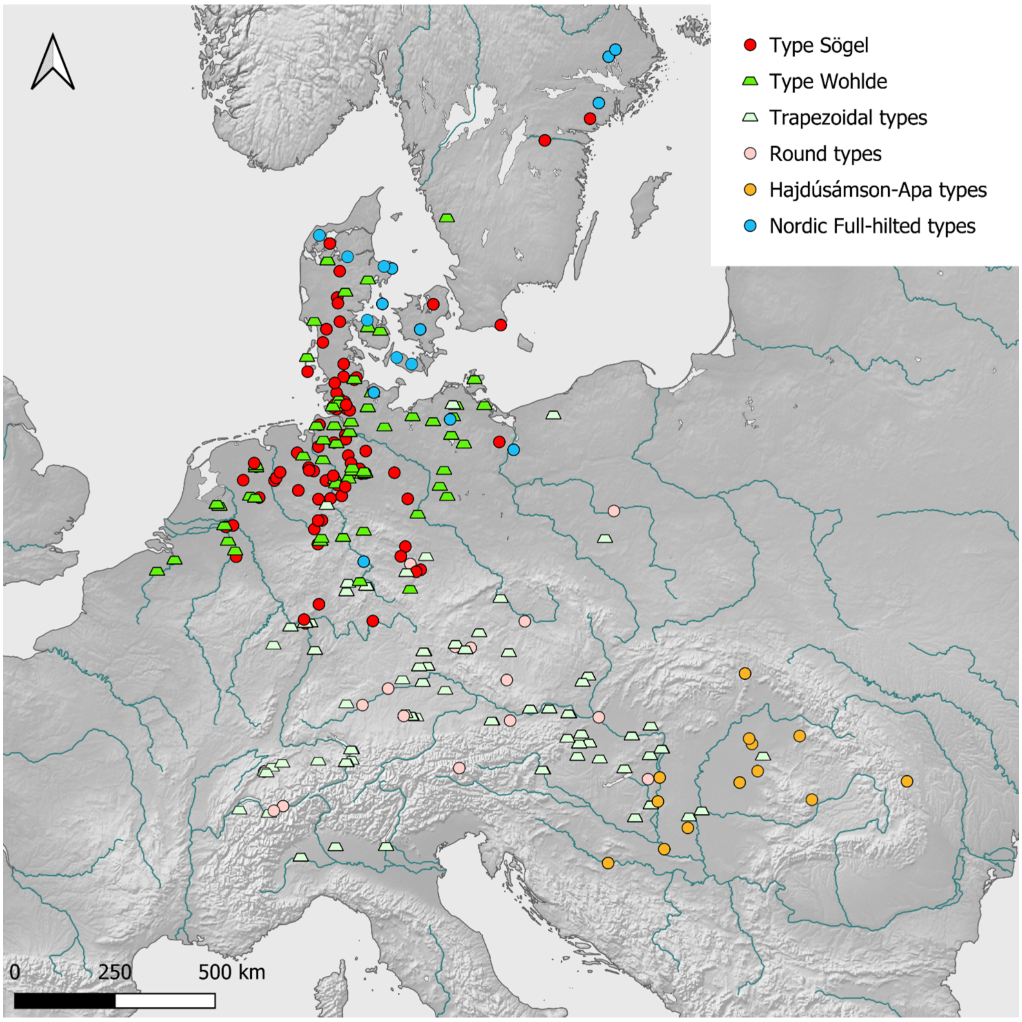


Figure 5: Distribution of the NBA IB Sögel and Wohlde type swords and daggers and their supposed prototypes in southern Germany and south-eastern Europe. Also shown are full-hilted swords with rounded hilt plates, which have also been identified as an important artefact group regarding the question of the provenance of the sword in the NBA (map: Bart Cornelis using QGis).

the Alps (Nørgaard *et al.* 2022: 138-140). However, the influx of the 'new' Italian copper from the Alto Adige, Trentino, and Veneto regions (AATV) in locally crafted Fårdrup axes is astonishing, access to which seems as such to have been directly related to the downfall of the Únětician culture in central Europe (Risch and Meller 2013; cf. Frei *et al.* 2019).

Development and origin of the early BA daggers and swords (Daniel Berger)

NBA IB (1600-1500 BCE) saw the introduction of metal daggers and swords, two material groups whose previous iterations were only flint daggers. Most of these weapons were bronze swords and daggers with organic handles made from wood or other materials, although full-hilted variants occasionally appeared. Especially in northern Germany (Lower Saxony and Schleswig-Holstein) and southern Jutland, swords or daggers became part of the standard repertoire in burial mounds, with the Sögel and Wohlde types predominating (Fig. 5). These two types are the type fossils of the so-called Sögel-Wohlde group (see Laux 1995) as part of the NBA, and differ in the shape of their hilt plates, which is rounded for the Sögel type and trapezoid for the Wohlde type. In addition, Sögel blades often feature decorative ogival bands of lines, dots or garlands along the blade, while Wohlde blades are typically plain.

Their appearance in the NBA and specific origins remain enigmatic. Since there are no local precursors in earlier periods, it is often hypothesised that these metal blades were either imported from southern regions or produced locally, imitating prototypes from southeastern Europe (Sögel type) or southern Germany and the Alps (Wohlde type) (e.g. Hachmann 1957; Laux 2009). It is also not exactly known how the metallurgy of the blades in particular, and of the Sögel-Wohlde culture in general, relates to that of more northern and northeastern regions of the NBA, as large-scale analytical initiatives as mentioned before are lacking (though some analysis of Sögel-Wohlde material can be found in Bunnefeld and Schwenzer 2011). It is possible that the Sögel-Wohlde culture participated in the same supply networks of copper and tin, but its peripheral position within the Nordic Circle might also suggest the use of different sources. The likelihood of this is further increased by the collapse of the controlling power of the Únětice culture over raw-metal supply chains between north and south *c.* 1600 BCE (see Risch and Meller 2013), which opened the door for new sources and suppliers, as suggested above for the Fårdrup axes. A related issue is whether the Sögel-Wohlde culture continued to import finished objects, as people did in earlier periods in order to reshape them into local forms through mixing and recycling.

The project 'Origin, development and technology of the Bronze Age blades of the Sögel-Wohlde-Kreis' addresses these aspects and currently investigates the origin of these sword types through *c.* 300 multi-proxy analyses. By combining lead, tin and copper isotopy with trace elements, the project aims to reconstruct the source regions of the metals and to decipher the relationships between the northern swords and their presumed southern prototypes. This approach builds on and expands the methodologies of former projects (Ling *et al.* 2019; Nørgaard *et al.* 2021) by including the stable isotope systematics of tin and copper (Berger *et al.* 2021; Berger *et al.* 2022). Although these latter two parameters are not directly useful in tracing the specific origins of copper and tin, they can be extremely helpful in understanding the relationships of objects and, consequently, their origins. Importantly, metal mixing or recycling can be reconstructed more precisely than is possible by using lead isotope ratios and trace elements alone, which in turn could provide clues about the ultimate origin of the object type (Berger *et al.* 2022).

The results obtained so far indicate that the daggers and swords of the Sögel and Wohlde types (as well as related types) were almost exclusively produced from low-impurity copper. Nickel and arsenic are the dominant impurities, while the concentrations of silver, antimony, lead, and bismuth tend to be low throughout, with only few exceptions. This suggests that the blades were made from chalcopyrite rather than the fahlore-based copper which was typical for LN II metalwork, and also made up a large proportion of the NBA IA metalwork (see above and Nørgaard *et al.* 2021). This conclusion is supported by the copper isotope composition, which is consistent with primary chalcopyrite copper ores, and which are different from the values of malachite ores (Berger *et al.* 2024; Jansen *et al.* 2018; Lockhoff *et al.* 2019). Conversely, lead isotope ratios span a wide range and primarily match copper ores from the Slovakian Ore Mountains, but now additionally from the Mitterberg region (Pernicka *et al.* 2016). In contrast, ores from the Great Orme Mine were only used for a few objects, while copper from the Inn Valley dominating NBA IA is completely absent. There is no discernible preference for copper from specific source regions associated with the different sword types, but overall, the findings align the Sögel-Wohlde artefacts with contemporaneous metalwork from other NBA regions (e.g. Nørgaard *et al.* 2022). The main difference is the significantly lower percentage of Welsh copper from the Great Orme mine. Also, based on the data so far available, the blades of the Sögel-Wohlde culture show a higher percentage of Mitterberg copper than metalwork from Denmark, such as Fårdrup and Valsømagle. Both observations possibly indicate a closer involvement of the Sögel-Wohlde culture in trade connections with central Europe. It is particularly noteworthy that the data of Sögel type swords and daggers tend to concentrate more frequently in the overlap range between Slovakia and Mitterberg, i.e. they show data clustering in isotope ratios and chemical values, which might be indicative of source mixing. In contrast, Mitterberg copper is more frequently represented by Wohlde type swords. Although these initial results are not yet statistically robust and have not been thoroughly assessed in conjunction with typology, they could manifest a relationship between the sword types and the source regions of the copper, and perhaps the area of their production (Cornelis *et al.* 2023; Cornelis *et al.* in preparation; Cornelis and Berger 2024).

The MBA and the stabilisation of north-south networks
(Johan Ling and Heide W. Nørgaard)

For the Middle Bronze Age in southern Scandinavia (NBA II and III; 1500/1450-1200/1100 BCE), more than 230 artefacts have been analysed covering objects related to the female and male sphere (according to Felding and Stott 2023) as well as tools and metal debris (see Fig. 2; e.g. Bunnefeld 2016b; Ling *et al.* 2019; Nørgaard *et al.* 2021). 77% of the collected data derives from the NBA II (1500/1450-1300 BCE), and it appears that the north German, Danish, and Swedish material display slightly different patterns. However, at *c.* 1500 BCE, there was a shift in the trading routes from Scandinavia towards the Italian Alps. The significant transition to Italian copper has been evidenced by multiple recent studies (Ling 2019; Melheim *et al.* 2018; Nørgaard *et al.* 2019; 2021) and can highly probably be related to the availability of new mines in the Italian Alps through the expansion of trade links with the Tumulus culture via the amber trade (i.e. Vandkilde *et al.* 2024).

In Denmark, previous analyses have shown that over half the analysed artefacts from NBA II can be related

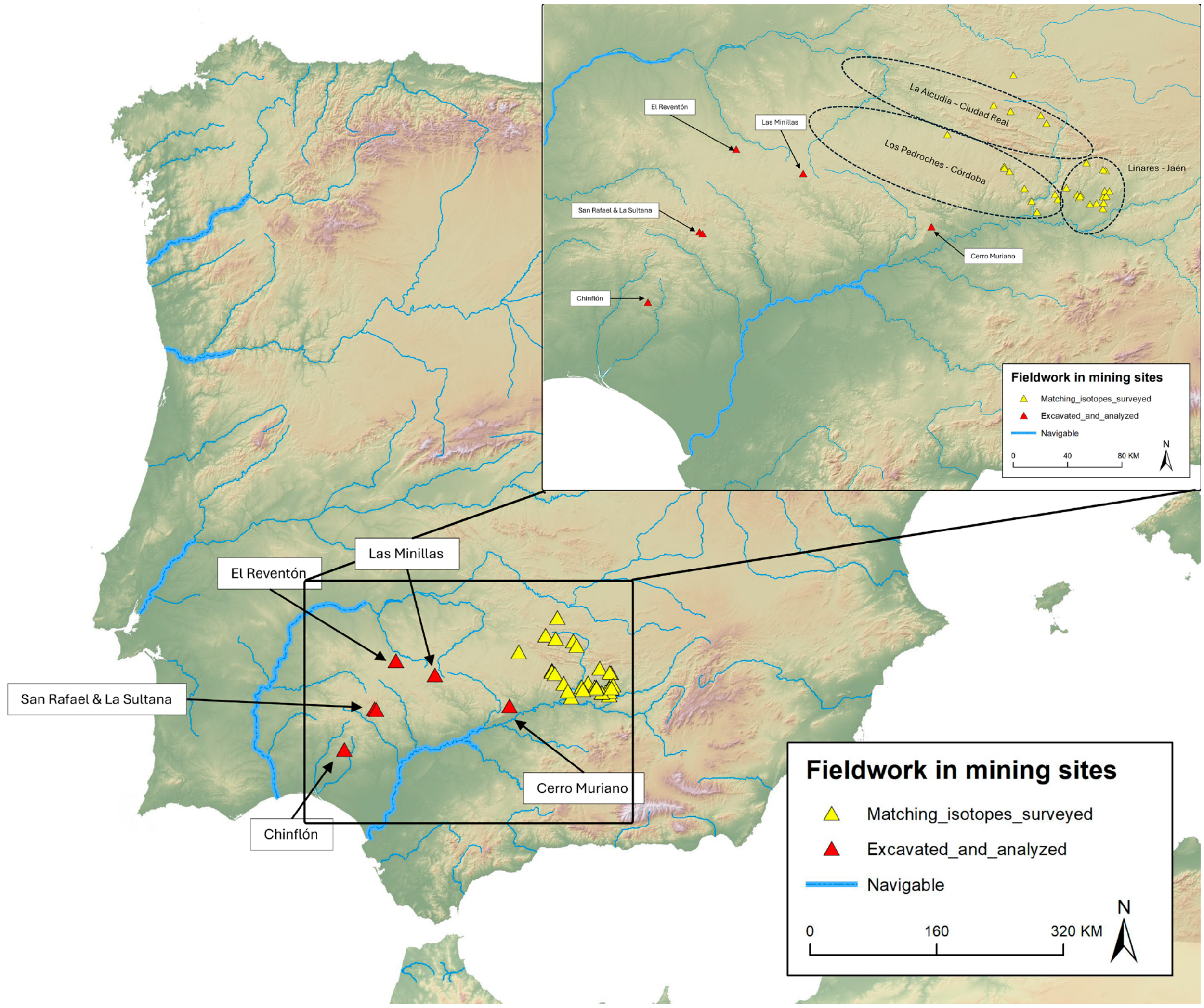


Figure 6: Map of the mines in Iberia studied by the Maritime Encounters project (map: Marta Diaz-Guardamino).

to metal from the Italian Alps; more precisely the AATV mining region (Nørgaard *et al.* 2021: 26; see also Canovaro 2016; Melheim *et al.* 2018). This number was recently extended by including artefacts from the adjacent regions of the NBA (Lower Saxony and Mecklenburg-Western Pomerania in Germany) in the analysis, mainly in the form of swords.[6] The new results, therefore, support the dominance of south Alpine copper, while also highlighting that a large proportion of the artefacts analysed were made of metal mixed with AATV copper.

The remnants of former supply networks can still be seen (and were probably used) in the mixtures. Metals from the eastern and southern Alps and Slovakia were still in circulation. Slovakian low-impurity copper had a comeback, especially within sword production (see Ling *et al.* 2019). Interestingly, Great Orme copper was still present at 6% and was often used as a component in mixed metal artefacts. It is striking that Great Orme copper often occurs in several objects found from a single find assemblage and only rarely as a single piece as part of an object group (hoard or grave) in Danish material culture.

On the other hand, northern German groups seem to have obtained copper primarily from the copper sources in the Slovakian Ore Mountains and the Mitterberg in the eastern Alps (Bunnefeld 2016a; 2016b). This divergence can be explained by considering three distinct riverine routes that connected the northern and southern regions, each potentially handled and overseen by different groups. One route followed the Weser River to southern Germany; another followed the Rhine River; the third originated in northern Germany and followed the Elbe River, ultimately leading to the Austrian Alps and Slovakia. It is quite likely that the Lüneburg culture in northern Germany exerted significant dominance over a significant portion of the Elbe River, which originates from the Karkonosze/Krkonoše Mountains,

[6] The data is the result of the KUF FORM.2020-0009 research project 'Female Mobility in a changing Bronze Age world: Investigating connections between mobility of people and shifting trading networks in southern Scandinavia' by Heide Nørgaard.

situated in the northern part of the Czech Republic and southwest Poland, in close proximity to the previously mentioned Slovakian copper deposits. Also, the route to the mines in the Mitterberg region is rather short from the location where the Elbe River originates. These findings suggest that northern German groups predominantly utilised the Elbe route, whereas the Scandinavian groups preferred the Weser or Rhine routes (Ling *et al.* 2019).

Moreover, another metal network seems to emerge from *c.* 1400-1300 BCE. The new sources on the Iberian Peninsula suggest that this area was more significant than previously thought.

New sources: the expansion to the southwest (Johan Ling, Zofia Stos-Gale, Lene Melheim)

Around 1300/1200 BCE, and contemporary with the rise of the Atlantic Bronze Age (1300-800 BCE), a shift in the lead isotope ratios of Scandinavian metals is once again observable, as indicated by a number of analyses that show consistency with the ore bodies in the Iberian Massif and the Ossa Morena Zone in southwest Portugal and Spain. This region has Europe's most extensive copper, lead and silver deposits, and some ores have been exploited nearly continuously for the past 5000 years (Hunt-Ortiz 2003). Hunt-Ortiz (2003) lists *c.* 60 potential mining sites from the Iberian Late Bronze Age (LBA) based on finds of stone hammers and pottery. Copper ore sources in the regions of Huelva and Andalucía (Guadalquivir Valley) were also likely to have been exploited (Barthelheim and Montero-Ruiz 2009). Recently, through fieldwork surveys and excavations, the Maritime Encounters project[7] identified LBA copper mining and smelting at Las Minillas near Azuaga in Badajoz-Caceres, Extremadura (Hunt-Ortiz *et al.*, in press) as well as several other potential LBA mines in Extremadura and Andalusia (Fig. 6).

The geological age of the Iberian copper ores being investigated is similar to those in the Italian Alps (Artioli *et al.* 2020) and Sardinia (Stos-Gale *et al.* 1995). Some of these ores were discussed as possible sources for Scandinavian metalwork early on (Ling *et al.* 2014), but the interpretations were reconsidered (Ling *et al.* 2019; Melheim *et al.* 2018) when the new reference data from the Trentino-Bolzano region in Italy were published (Addis *et al.* 2016; Artioli *et al.* 2016; Artioli *et al.* 2020). However, the hypothesis concerning the import of copper from southwestern Iberia to Scandinavia has recently gained new support in LIA and geochemical analyses of copper-based artefacts from England (Salcombe Bay), Ireland, Sardinia, and Poland dated to 1400-700 BCE (Berger *et al.* 2022; Nowak *et al.* 2023; O'Brien 2022) Also, recent lead isotope analyses of 37 copper ingots from key maritime landing sites in southern England, or on islands in the British Channel (previously analysed for their chemical compositions by Peter Northover), are consistent in their metal compositions with many of the Scandinavian objects from the LBA (1100-700 BCE) and copper ores from southwest Spain (Ling *et al.*, in prep.).

The excavation results at the mining site of Las Minillas have so far provided the most extensive evidence of LBA copper mining and on-site smelting in Iberia. The mine is considered one of the largest ever recovered from the LBA in Iberia and could in theory have produced as much copper as Great Orme (Hunt-Ortiz *et al.*, in press). The excavation demonstrated that an over 200 m-long copper vein was exploited between 1350-600 BCE. The process was confirmed by seventeen ^{14}C dates from different excavation units at the site. Over 1000 stone hammers were recorded at the site, together with *c.* one ton of copper slags, LBA pottery, and fragments of furnaces (Hunt-Ortiz *et al.*, in press). Thus, all this new mining evidence from Iberia coupled with the recent identification of Iberian copper in other European regions compels a fundamental reevaluation of Iberia as an important supplier of copper from *c.* 1300-700 BCE, also for Scandinavian artefacts.

Of particular interest is a group of 47 copper-based objects (Ling *et al.* 2014; Melheim *et al.* 2018, and some unpublished) dated to NBA III-V (Table 2) that have lead isotope ratios consistent with the ores from southwest Spain and very varied chemistry.[8] Many of these come from scrap hoards or metal workshops or are outstanding pieces considered to have been imported. The comparisons of the contents of lead, tin, antimony, and nickel in these 47 artefacts show interesting trends (for details, see Ling *et al.* 2014). A group of artefacts dated to period IV shows, e.g., exceptionally high antimony content (paired with silver and arsenic), indicating that for these metals copper was smelted from tetrahedrite minerals. However, in the same period – and with nearly identical lead isotope ratios – there are artefacts that contain antimony and silver below 0.1%. The lead isotope ratios indicate that these artefacts are all consistent with the ores from various mines in the region of Jaen, Los Linares, and further into the Guadalquivir Valley. In this region, there are many polymetallic mineralisations, including copper, lead, antimony, and other minerals (see IGME 2024).[9] Thus, it can be implied that the mining in the region

[7] Maritime Encounters | University of Gothenburg (gu.se).

[8] See the description in "The known sources of metal in Bronze Age Europe and their properties" by E. Pernicka.

[9] There is no large database of chemical and lead isotope compositions for copper-based artefacts from Spain. However, databases of chemical analyses of *c.* 700 low-lead bronzes dated to 1300-500 BCE is available for comparison: 17% of the objects (130) show antimony contents above 0.5% (average 1.5%) and high tin contents (average 13%) (see Garcia de Madinabeitia *et al.* 2021 and IBERLID http://www.ehu.eus/ibercron/data/IBERLID.xlsx).

Table 2: Overview of Scandinavian bronzes NBA III-V which are consistent with Spanish ores chemically and isotopically. The data is available in the publications by the authors (Ling *et al.* 2014; Melheim *et al.* 2018).

NBA	No. of analyses consistent with Spain	Regions	Artefacts with high Sb	Sb >0.3%	Museum nos.
III	9	**Denmark:** Thisted (3), Haderslev (1), København (1), Bornholm (1) **Sweden:** Skåne (1), Uppland (1) **Norway:** Rogaland (1)	Haderslev (1)	1	Ke 5129 (sword) Ke 5077 (sword) Ke 5002 (sword) B2295 (sword) B3810 (dagger) B14529 (fibula) LUHM 22268 (sword) GAL F 810 (rod) S7425 (sword)
IV	17	**Denmark:** Viborg (2) Bornholm (1), Vordingborg (1) **Sweden:** Dalsland (8), Värmland (2), Uppland (2), Östergötland (1)	Viborg (1) Dalsland (8) Uppland (1) Värmland (2)	12	B6640 (cup, **Fuchstadt**) B6643 (bracelet) B1880 (fibula) B31 (sieve) SHM 273741 (axe) SHM 362388 (melt) SHM 362390 (rod) SHM 362391 (sprue) SHM 971194 (sprue) SHM 411836 (sword) SHM 411852 (sickle) SHM 417322 (rod) SHM 414109 (sword) SHM 414117 (sickle) SHM 971149 (crucible) GAL F 1606 (tweezer) GAM8592 (palstave, **Hacha Talon**)
V	13	**Denmnark:** Funen (3), Ålborg (1) **Sweden:** Södermanland (4), Västergötland (3), Värmland (1), Småland (1)	Funen (3) Ålborg (1) Södermanland (3) Småland (1)	8	B17461 (belt ornament) B17457 (sprue) B17459 (sickle) ÅHM 3255p (coil) SHM 122890 (melt) SHM 971141 (melt) SHM 971142 (rod) SHM 971154 (rod) VG 11 (shield, **Herzsprung**) VG 5 (shield, **Herzsprung**) 1M16 104505:17 (shield, **Herzsprung**) SHM 148960 (rod) SHM 884947 (rod)
Total	**39**			**21**	

between Azuaga and Jaen (see Fig. 6) produced copper for export to Scandinavia and perhaps also to the British Isles. However, this theory needs further testing (which is already planned in the Maritime Encounters project).

Connectivity between the Iberian Peninsula and Scandinavia is further indicated by a typical Galician double-looped palstave found in Sweden, dated to 1100-900 BCE (Melheim *et al.* 2019; cf. Monteagudo 1977). The implications of this find and the similarities between Scandinavian and Iberian rock art were discussed already in the 1920s (Nordén 1925). The Swedish specimen from Lake Tåkern is the northernmost find of this palstave type, which otherwise occurs in southern England, western France, and Sardinia (Childe 1939). The archaeometallurgical fingerprint of the Lake Tåkern axe shows consistency with Iberian bronzes dated to the same period (Melheim *et al.* 2019), which in turn match the bronzes mentioned above. Also, the consistency between three investigated shields of the Herzsprung type (U-notched) from Sweden by Ling and colleagues (Ling *et al.* 2014) and copper ores in the Jaen-Linares area, both in terms of LIA and chemical fingerprints, is striking. Herzsprung shields occur frequently on Iberian rock art stelae from the LBA (Diaz-Guardamino *et al.*; 2022 Harrison 2004), some of which are located close to the mining sites in southern Spain and near navigable rivers, e.g. the Guadalquivir and Guadiana. The rivers are considered key infrastructures for connection to the Atlantic Bronze Age.

Later studies (Diaz-Guardamino *et al.* 2022; Ling and Koch 2018) have underlined the strong formal connections between Scandinavian rock art and Iberian 'warrior' stelae. Furthermore, a recent study by Vandkilde and colleagues (2021) also favours the drawing of parallels between Sardinian warrior-related iconography and that from Iberia and Scandinavia.

The LBA copper ingots made of Spanish copper found at key maritime sites in southern England and near the tin sources in Cornwall may indicate that the British Channel served as a nexus of metal exchange for the Atlantic network and that Baltic amber linked Scandinavia to this metal trading system (Ling *et al.* 2014). Indeed, access to tin may have been a driving factor in the emergence of trade routes that went via the British Isles (Berger *et al.* 2022). It is possible that Nordic traders actively searched for trading sites where they could obtain both copper and tin (if not already alloyed bronze). The maritime landing sites with finds of copper ingots in southern England may have served such a purpose during the LBA.

Recycling and mixing in LBA – true or false? (Johan Ling, Lene Melheim)

Questions related to how copper and bronze circulated, whether metals derived from single sources or were mixed products from multiple sources, or were first and foremost obtained from recycled materials, have sparked heated discussions in Bronze Age studies (O'Brien 2015). Our analyses of Scandinavian materials, from pure copper droplets via ingots, to artefacts with similar and homogenised impurity patterns indicate that metals were supplied in various forms (Ling *et al.* 2014; Melheim *et al.* 2018; Nørgaard *et al.* 2021).

Recycling is, of course, always a possibility which needs to be investigated. One must also consider that metals were intentionally mixed at the receiver's end to obtain certain metal qualities, e.g. the mixing of fahlore copper with low-impurity copper is argued to account for compositional patterns observed in LBA objects from the Alpine region (Pernicka *et al.* 2016: 33-34). Provenance analyses of LBA metalwork were previously regarded as futile, due to an assumed high degree of recycling and mixing. Nonetheless, patterned compositional changes can be observed which shed light on changes in metal supplies and trade networks (Liversage 2000; Melheim *et al.* 2018). In addition, as recently observed with Early Bronze metal objects, or LBA metalwork from other European regions, provenancing may still be possible, despite mixing, when sufficiently high numbers of artefacts are analysed, and additional proxies (e.g. copper and tin isotopes) are included (e.g. Berger *et al.* 2023b; Berger *et al.* 2024). Mixing lines with end members (i.e. the non-mixed raw materials) can then assist in pinpointing the origin of copper.

Most notably, the LBA witnessed an influx to Scandinavia of fahlore copper after a long period dominated by chalcopyrite. Also, there was a general tendency for lower contents of tin and elevated contents of lead (Liversage 2000: 80-84). Lead contents in LBA Scandinavian metal objects were significantly lower than in most other parts of Europe (Ling *et al.* 2014), except from Spain (Melheim *et al.* 2018). The explanation behind the elevated lead contents can be found in the metallurgical practices applied to improve casting properties, e.g. that lead was intentionally added, that copper was alloyed with lead-rich tin, or that copper ore was co-smelted with galena (O'Brien 2015: 80).

The demonstrated re-introduction of fahlore copper to Denmark at the transition to the LBA (Liversage 2000 33: 39-45) is noticeable in the NBA IV Swedish dataset (Ling *et al.* 2014), though it is not evident in a smaller sample of seven objects from Denmark from period IV (which instead showed continuity; Melheim *et al.* 2018). In the Danish and Swedish dataset from NBA V-VI both fahlore signatures and high nickel contents become more pronounced, accompanied by some low-impurity copper. Ling and colleagues (2014) proposed copper deposits in the Alpine region as potential sources for the fahlore copper in Sweden. Isotopic consistency was also found for the Massif Central in the Rhone Valley, but this was put aside because of lack of evidence for LBA copper production there.

The analysed LBA material from Sweden is interesting, among other things, because it contains primary material from casting and several large hoard finds with a wide variety of objects. For example, an NBA IV scrap hoard from Järn in Sweden (Oldeberg 1929) showed strikingly coherent isotopic and geochemical compositions, which likely came from one batch of metal with a common origin (Ling *et al.* 2014). The LIA data plot in the region of ores from Sardinia, Spain, and France, and the chemistry, shows a low-impurity metal. A similar interpretation was launched for casting debris from an NBA V workshop in Botkyrka (Jaanusson and Vahlne 1975). An alternative interpretation is that this metal represents recycled and chemically homogenised bronze. A common origin from copper ores in north Tyrol, perhaps mixed with high-lead tin, was suggested for most items from the NBA V hoards from Lysemosegård and Flø in Denmark (Melheim *et al.* 2018). A liable interpretation of the NBA VI Antvortskov hoard is a binary pattern with two different metal sources: a fahlore source potentially located in the Massif Central and a sulphide ore source in Huelva. Two torcs have high tin and LIA consistent with ores in the Huelva region; local tin was exploited at the time.

Discussion: Can we speak about the southern Scandinavian metal networks, or do we need to investigate metal trade from a regional or local perspective?

Are there any differences between the Danish, Swedish, and Norwegian metal trade networks? (Heide W. Nørgaard, Johan Ling, Lene Melheim)

The distribution and spread of specific artefact types already indicate different contact networks between the Scandinavian regions. One example are the MBA spiral-ended bracelets which, depending on whether they were made of a flattened sheet bracelet or a ring bracelet, spread towards Scandinavia via the western Rhine-Weser-route (flat) – or an eastern Elbe-Oder route (ring) (see Nørgaard and Stott, in prep.).

A similar difference was highlighted above for the northern German cultural groups, which seemed to get their access to specific metal sources via defined trade networks that are oriented on three distinct riverine routes (see above). Thus, we might assume that the metal networks that provided the Scandinavian north with the metal that was so in-demand also differed from region to region. Vandkilde suggested a model based on metal density of the spread of bronze in Scandinavia (Vandkilde 2017: 160-161), where Denmark and Scania were already entering the group of metal-using societies in LN I. Metal and, thus, also metallurgy spread in LN II to the central regions of Sweden and the Norwegian coastline, and in NBA IB, metallurgical knowledge was an established part of the NBA. Can we, as such, assume that the earliest metallurgical development was inspired by a united trade network supplying Denmark and Scania with the same metal and metallurgical knowledge? The idea is that ports of trade or entrepots (see Melheim and Nørgaard, this volume) in LN II indicate such a scenario. From the end of LN II, the coastal spread of metal might be the starting point, where regional differences appeared and the 'great rock carving endeavour' (Vandkilde 2017: 161) *c.* 1700-1600 BCE (based on Skoglund 2013), with its focus on ship iconography, possibly shows the time at which the region-controlled metal supply was established.

Furthermore, the amber networks in the MBA, with their two suggested major north-south transport lines (Vandkilde *et al.* 2024: figs 7A, 7B), highlight different networks. From a metallurgical point of view, it is at present still difficult to assess this question as the numbers of analysed objects in Norway, Sweden, and Denmark differ greatly. However, a tendency is visible. Especially Slovakian metal (during the whole BA) was far more frequently used in the Danish material culture than in Sweden and Norway. The same seems to be valid for metal from the Mitterberg mines from 1600-1100 BCE. However, the Norwegian analyses published until 2023 seem to indicate a more Danish related network (but see Melheim 2024). While slightly differently weighted in the early and middle NBA, the LBA networks seem again to be organised across a larger scale, as the Danish and Swedish material seems to correspond to each other.

Workshop-related metal supply and the idea of a regional metal pool (Heide W. Nørgaard)

The reuse of metal seems to characterise the metallic material culture of the Late NBA as well as the opening up of new trading partners and metals. On the other hand, an intensive study of the earliest metal networks could show that mixing the incoming metal for local production was most likely a common act at the outer fringes of metal-using societies from the Early Bronze Age onwards (see Nørgaard 2024; Nørgaard *et al.* 2022). This, however, makes it challenging for archaeologists to define trade networks and transport routes based on the traditional analytical procedures that aim to identify the origin of metals through ore/artefact correlation. Here, the use of additional proxies must be applied more frequently to disclose the material by means of another dimension (see above and Berger *et al.* 2023b; Berger *et al.* 2024).

A further solution to this problem (or more likely a way by which to bypass it) might be through the definition of local versus non-locally produced artefacts by identifying the archaeometallurgical fingerprint of metal workshops. The identification of the metal used in attested local production can reveal the pool of metal in circulation within a specific area. Following this, a production/debris/artefact correlation makes it possible to distinguish local production from imported goods in the first place. Secondly, based on sufficient data, the region in which the item was crafted and the workshop could be located. Finally, workshop-related trade networks could be identified.

The analysis of metallurgical debris related to settlement structures is essential for identifying possible local manufacture of artefacts. By defining the chemical and isotopic fingerprints of metallurgical waste from a specific site (e.g. sprouts, crucible remains, metal droplets), the metal in circulation from a particular site is characterised. Crucial here is the focus on workshop findings and, thus, the localisation of metal craft. Analyses of casting waste (see Ling *et al.* 2012; Ling *et al.* 2014) from the two Swedish Late Bronze Age metal workshops from Skälby, Vårfrukyrka (Oldeberg 1960) and Hallunda, Botkyrka (Jaanusson and Vahlne 1975) show very promising results as they form clearly divergent clusters. Despite their importance, workshop residues are the exception within large analytical projects. Lately, metallic remains from six metalworking sites in Danish settlements from NBA IV-V have been sampled and tested for their potential to reveal such a metallurgical fingerprint. The first test results could show that 80% of the crucible fragments are suitable for the determination of trace elements and lead isotopes (leaving around six samples per site), and the metallurgical fingerprint of the crucibles is comparable to these from sprues or metal droplets from the same site.

Metallurgical debris is an important part of depositions, especially in the Late NBA (Kristiansen 1974 (2016): 131; Jantzen 2008: 368-371), though production material in depositions lacks the connection to the archaeological evidence of workshops. However, LBA depositions occasionally contain ingots (Jantzen 2008), and more recent assessments of LBA hoards allow indeterminate fragments to be identified as parts of ingot shapes widespread in central Europe, such as the pieces in the NBA V hoards from Lerskov, southern Jutland, Kalstruplund, northern Jutland, and Nagelsti, Maribo (Thrane 1971). This group of materials should be included in future comparative analyses for the Late NBA, as they are more likely to shed light on the incoming metal and possible trade networks to the metal centres than the analysis of artefact types distributed throughout Europe.

The connection between workshops, artefacts and metal networks could be demonstrated for the Middle Bronze Age in Denmark, though from another point of view. A perceptive component analysis (these trace elements that visibly change the metal's quality, colour or fluidity) on artefacts allocated to specific workshops due to the traces of the crafting process (see Nørgaard 2018) have revealed differences in metal composition between workshops. These differences are less likely related to the crafting of different artefact categories; they probably mirror the different trading networks of contemporaneous workshops between the Danish Islands and the Danish mainland.

In regions where the import of all metals was a prerequisite for metallurgy, this approach will bring archaeometallurgical research to a new level in times of changing networks, increasing centralisation and the development of technologies. Identifying locally produced artefacts within a specific region's material culture will enable the understanding of the social and political developments in the Late Bronze Age.

Conclusion, reflections, and the way forward in research[10]

The combination of lead isotope ratios and the chemical composition of metal artefacts has yielded groundbreaking insights into the origins of copper, significantly shaping our understanding of metal trade networks over the past 50 years of research. From the enthusiastic elemental analyses of copper-based artefacts in the 1960s (see Junghans *et al.* 1960; 1968; 1974, and more) and somewhat later (Pernot and Rychner 1998) to complex projects being conducted by many teams in the last 20 years, supported by field surveys of ancient mines, research into the prehistoric metallurgy, particularly of metals from the European Bronze Age, has progressed enormously.

As the number of artefact data steadily increases, it becomes evident that metal consumption and trade in prehistory were often very complex, and a univariate solution is not always feasible. Data overlap, along with the mixing and recycling of metals, further complicates our conclusions, sometimes rendering clear answers elusive. However, with the advent of new analytical methods, e.g. the analysis of copper, tin, and osmium isotopes, and potentially others, we now have a broader array of tools at our disposal to unravel the history of metal objects.

New reference data have been immensely important for developments within this field of research. The future of archaeometallurgy undoubtedly lies in an holistic evaluation of artefacts and their *chaîne opératoires*, incorporating insights from archaeology, experimental and mining archaeology, isotopic and chemical data, and statistical analysis. Additionally, the inclusion of metallurgical analyses as a standard tool within development-driven archaeology might enable us to understand the whole picture, rather than only the selective picture we create by cherry-picking artefacts for analyses.

We should, however, understand well that we cannot rule out sources that have not yet been characterised and, likewise, that it is crucial that we critically examine decades-old typologies and their implications for exchange networks to open possibilities for the investigation of unexplored (mining) regions in Bronze

[10] Continued guidance from renowned academics, such as Helle Vandkilde, who introduced the concept of 'Bronzisation', is vital for the progress of research!

Age Europe. Similarly, we should be careful with making attributions to ores from which we have no evidence of mining. The ore-based approach applied by Williams (e.g. Williams 2018; see also *Pernicka et al.* 2016) should be taken seriously into consideration to guide the investigation of other areas so as to be able to obtain higher resolution and make more solid connections between prehistoric mines and their metals.

When we aim to combine the different approaches and continually question our research in the light of new results, we can take this field to a new level.

Acknowledgements

This article is the result of true cooperation between several laboratories, projects, and institutions. The research leading to these results received funding for H. Nørgaard from the Danish Council of Independent Research (grant agreement no. 6107–00030A to H. Nørgaard), the Ministry of Culture Denmark FORM.2020-0009 and FORMW.2022-0039 and the IPERION HS TNA fix_127; to D. Berger from the German Research Foundation DFG 'Origin, development and technology of the Bronze Age blades of the "Sögel-Wohlde-Kreis"' (project no. 460711574); to J. Ling the 'Maritime Encounters M21-0018, Scandinavia's role in the copper networks of Europe in the 2nd Millennium BC' (P14-0308:1), granted by Riksbankens Jubileumsfond; to L. Melheim through K. Kristiansen's 'The Rise', granted by the European Research Council under the European Union's Seventh Framework Programme (FP/2007-2013)/ERC Grant Agreement n. 269442 – THE RISE). However, research would not have been possible without the work of the many team members in the respective research groups. We especially thank Bart Cornelis, Andreas Wittke, Lena Grandin, Eva Hjärthner-Holdar, and Helle Vandkilde.

Bibliography

Addis, A., I. Angelini, P. Nimis and G. Artioli 2016. Late Bronze Age Copper Smelting Slags from Luserna (Trentino, Italy): Interpretation of the Metallurgical Process. *Archaeometry* 58(1): 96-114.

Artioli, G., I. Angelini, P. Nimis and I.M. Villa 2016. A lead-isotope database of copper ores from the Southeastern Alps: A tool for the investigation of prehistoric copper metallurgy. *Journal of Archaeological Science* 75: 27-39.

Artioli, G., C. Canovaro, P. Nimis and I. Angelini 2020. LIA of Prehistoric Metals in the Central Mediterranean Area: A Review. *Archaeometry* 62: 53-85.

Bakka, E. 1976. *Arktisk og nordisk i bronsealderen i Nordskandinavia*. Mus. Miscellania 25. Trondheim: Det kgl. norske Vidensk. Selsk.

Barthelheim, M. and I. Montero-Ruiz 2009. Many Ores and little Water – The use of resources during the bronze Age on the Iberian Peninsula, in E. Pernicka and M. Barthelheim (eds) *The Economic Foundations of the European Bronze Age*: 5-21. Rhaden/Westfalia: Verlag Marie Leidorf GmbH.

Berger, D., G. Brügmann, J.-H. Bunnefeld and E. Pernicka 2021. Identifying mixtures of metals by multi-isotope analysis: Disentangling the relationships of the Early Bronze Age swords of the Apa–Hajdúsámson type and associated objects. *Archaeometry* 2022: 1-31.

Berger, D., J.-H. Bunnefeld, A. Wittke and E. Pernicka 2024. Understanding metallurgical practices of the Únětice culture: The axes from Halle-Kanena III and the concept of mixing metals in the Early Bronze Age, in H. Meller, R. Risch and E. Pernicka (eds) *Der soziale Wert von prähistorischen Beilen: neue archäologische und archäometrische Ansätze/The social value of prehistoric axes: new archaeological and archaeometric approaches*. Tagungen des Landesmuseums für Vorgeschichte Halle 21. Halle (Saale): State Office for Heritage Management and Archaeology Saxony.

Berger, D., B. Cornelis and A. Wittke 2023a. Exploring the relationships of Early Bronze Age sword and dagger blades: A multi-parameter approach applied on large scale for the first time. *The Crucible* 110: 12-13.

Berger, D., V. Matta, H.W. Nørgaard, G. Salis and H. Vandkilde 2023b. Origin and mixing of metals for Nuragic bronzetti studied with isotopes and trace elements, in M. Perra and F. Lo Schiavo (eds) *Contacts and exchanges between Sardinia, continental Italy and the north-western Europe in the Bronze Age (18th–11th c. BC): The 'copper route', the 'amber route', the 'tin route'. Proceedings of the Fifth Festival of the Nuragic civilization (Orroli, Cagliari)*: 241-250. Cagliari: Arkadia Editore.

Berger, D., V. Matta, N. Ialongo, H.W. Nørgaard, G. Salis, M. Brauns, M. K. Holst and H. Vandkilde (in preparation). Multi-proxy analysis unwraps origin and fabrication biographies of Sardinian figurines: On the trail of metal-driven interaction in the early first millennium BCE. PlosOne.

Berger, D., Q. Wang, G. Brügmann, N. Lockhoff, B.W. Roberts and E. Pernicka 2022. The Salcombe metal cargoes: New light on the provenance and circulation of tin and copper in Later Bronze Age Europe provided by trace elements and isotopes. *Journal of Archaeological Science* 138: 105543.

Bindler, R., J. Karlsson, J. Rydberg, B. Karlsson, L.B. Nilsson, H. Biester and U. Segerström 2017. Copper-ore mining in Sweden since the pre-Roman Iron Age: lake-sediment evidence of human activities at the Garpenberg ore field since 375BCE. *Journal of Archaeological Science: Reports* 12: 99-108.

Borg, G. 2019. In Search of the Golden Sky: Cornwall as the source of the gold of the bronze Age sky disc of

Nebra. *Journal of the Royal Institution of Cornwall* 2019: 38-57.

Bray, P., A. Cuénod, C. Gosden, P. Hommel, R. Liu and A.M. Pollard 2015. Form and flow: The 'karmic cycle' of copper. *Journal of Archaeological Science* 56: 202-209.

Bunbury, M.M.E., K.I. Austvoll, E.K. Jørgensen, S.V. Nielsen, J. Kneisel and M. Weinelt 2023. Understanding climate resilience in Scandinavia during the Neolithic and Early Bronze Age. *Quaterary Science Reviews* 322: 1-20.

Bunnefeld, J.-H. 2016a. Crafting Swords. The emergence and production of full-hilted swords in the Early Nordic Bronze Age. *Praehistorische Zeitschrift* 91(2): 379-430.

Bunnefeld, J.-H. 2016b. *Älterbronzezeitliche Vollgriffschwerter in Dänemark und Schleswig-Holstein. Studien zu Form, Verzierung, Technik und Funktion.* Mainz: Wachholtz.

Bunnefeld, J.-H. and S. Schwenzer. 2011. Traditionen, Innovationen und Technologietransfer: Zur Herstellungstechnik und Funktion älterbronzezeitlicher Schwerter in Niedersachsen. *Praehistorische Zeitschrift* 86: 207-253 (available at: https://doi.org/10.1515/PZ.2011.012).

Burgess, C. and P.K. Schmidt 1981. *The Axes of Scotland and Nothern England*. München: C.H. Beck.

Canovaro, C. 2016. Diffusion of Alpine Copper in Friuli Venezia Giulia in the Middle-Late Bronze Age. Unpublished PhD dissertation, Università degli Studi di Padova.

Cattin, F., B. Guénette-Beck, P. Curdy, N. Meisser, S. Ansermet, B. Hofmann, R. Kündig, V. Hubert, M. Wörle, K. Hametner, D. Günther, A. Wichser, A. Ulrich, I.M. Villa and M. Besse 2011. Provenance of Early Bronze Age metal artefacts in Western Switzerland using elemental and lead isotopic compositions and their possible relation with copper minerals of the nearby Valais. *Journal of Archaeological Science* 38: 1221-1233.

Childe, V.G. 1939. Notes: about the distribution in Atlantic Europe and Scandinavia of the double looped Galician Axe. *The Antiquaries Journal* 19: 321-323.

Christensen, K., D. Eckstein and B. Schmidt 2007. Bronze Age oak coffins in Denmark and North Germany – Dendrochronological Dating and archaeological implications. *Germania* 85: 35-46.

Cierny, J. 2008. *Prähistorische Kupferproduktion in den südlichen Alpen, Region Trentino Orientale*. Bochum: Deutsches Bergbau-Museum Bochum.

Cornelis, B., A. Wittke and D. Berger (in preparation). The Sögel-Wohlde Melting Pot: Tracing the transfer of metals, ideas and warriorhood from the Carpathian crossroads to the Nordic Bronze Age. *Journal of Archaeological Science*.

Cornelis, B. and D. Berger 2024. The signs on the dotted line: The Sögel and Wohlde blades in the Landesmuseum Natur und Mensch collection. *Berichte aus dem Landesmuseum Natur und Mensch Oldenburg* 4: 99-106.

Cornelis, B., A. Wittke, D. Neumann and D. Berger 2023. Swords of the North: First results of the geochemical characterisation of Bronze Age blades of Sögel-Wohlde, in S. Klein, C. Berthold, D. Berger and E. Pernicka (eds) *Archäometrie und Denkmalpflege 2023: Jahrestagung an den Reiss-Engelhorn-Museen, Mannheim, 28. März bis 01. April 2023*: 69-71. Metalla Sonderheft 12. Bochum: Deutschen Bergbau-Museum.

Davies, O. 1935. *Roman Mines in Europe*. Oxford: Oxford University Press.

Diaz-Guardamino, M., J. Ling, J. Koch, B.S. Paulsson and C. Horn 2022. The local appropriation of warrior ideals in Late Bronze Age Europe: a review of the rock art site of Arroyo Tamujoso 8 and the 'warrior' stela of Cancho Roano (Badajoz, Spain). *Trabajos de Prehistoria* 79(2): 1-17.

Faure, G. 1986. *Principles of Isotope Geology*. New York: John Wiley and Sons.

Feeser, I., W. Dörfler, J. Kneisel, M. Hinz and S. Dreibrodt 2019. Human impact and population dynamics in the Neolithic and Bronze Age: Multi-proxy evidence from north-western Central Europe. *The Holocene* 29(10): 1596-1606.

Felding, L. and D. Stott 2023. What a Mesh: Network Approaches to Nordic Bronze Age Identity and Regionality. *Offa* 78(2021): 131-154.

Frei, K.M., S. Bergerbrant, K.-G. Sjögren, M.L. Jørkov, N. Lynnerup, L. Harvig, M.E. Allentoft, M. Sikora, T.D. Price, R. Frei and K. Kristiansen 2019. Mapping human mobility during the third and second millennia BC in present-day Denmark. *PLoS ONE* 14(8): e0219850.

Gale, N.H. and Z. Stos-Gale 1982. Bronze age copper sources in the Mediterranean: A new approach. *Science* 216: 11-19.

Garcia De Madinabeitia, S., J.L. Gil Ibarguchi and J.F. Santos Zalduegui 2021. IBERLID: A lead isotope database and tool for metal provenance and ore deposits research. *Ore geology Reviews* 137: 104279.

Grundmann, G. and K.P. Martinek 1994. Erzminerale und Gangarten des Bergbaugebietes Schwaz-Brixlegg in Tirol. *Lapis* 19(7): 28-40.

Hachmann, R. 1957. *Die frühe Bronzezeit im westlichen Ostseegebiet und ihre mittel- und südosteuropäischen Beziehungen.* Atlas der Urgeschichte, Beiheft 6. Hamburg: Flemmings Verlag.

Harbison, P. 1968. Irish early Bronze Age exports found on the continent and their derivatives. *Palaeohistoria* 14: 175-186.

Harbison, P. 1969. *The Axes of the Early Bronze Age in Ireland*. München: C.H. Beck.

Harrison, R.J. 2004. *Symbols and Warriors: Images of the European Bronze Age*. Bristol: Western Academic and Specialist Press.

Hornstrup, K.M., J. Olsen, J. Heinemeier, H. Thrane and P. Bennike 2012. A New Absolute Danish Bronze Age Chronology. As based on radiocarbon dating of cremated bone samples from burials. *Acta Archaeologica* 83: 9-53.

Hunt-Ortiz, M.A. 2003. *Prehistoric mining and metallurgy in South West Iberian Peninsula*. British Archaeological Reports International Series 1188. Oxford: Archaeopress.

Hunt Ortiz, A., M.A. De Dios-Pérez, J. Vázquez-Paz, M. Artursson, J. Latorre-Ruiz, M. Grueso-Montero, M. Díaz-Guardamino, Z. Stos-Gale and J. Ling (in press). Late Bronze Age copper mining in Southern Iberia: preliminary results of the archaeological research in Las Minillas (Granja de Torrehermosa, Badajoz, Spain), in J.T. Koch, M. Fauvelle, B. Cunliffe and J. Ling (eds) *Maritime Encounters. Volume 1. Presenting counterpoints to the dominate terrestrial narrative of European prehistory*. Oxford: Oxbow Books.

Höppner, B., M. Barthelheim, M. Huijsmans, R. Krauss, K.-P. Martinek, E. Pernicka and R. Schwab 2005. Prehistoric Copper Production in the Inn Valley (Austria), and the Earliest Copper in Central Europe. *Archaeometry* 47(2): 293-315.

IGME 2024. Cartografía del IGME. Mapa Metalogenético de España a escala 1:200.000 (available at: https://info.igme.es/cartografiadigital/tematica/metalogenetico200.aspx?%20).

Ixer, R.A. 1999. The role of ore geology and ores in the archaeological provenancing of metals, in S.M. Young, A.M. Pollard, P. Budd and R.A. Ixer (eds) *Metal in Antiquity*. British Archaeolgical Reports International Series 792. Oxford: Archaeopress.

Jaanusson, H. and G. Vahlne 1975. *Arkeologisk undersökning 1969-71. Hallunda, Botkyrka sn. Södermanland. Dell. II: Fornlämning 13, boplads*. Stockholm: Riksantikvarieämbetet.

Jansen, M., A. Hauptmann, S. Klein and H.-M. Seitz 2018. The potential of stable Cu isotopes for the identification of Bronze Age ore mineral sources from Cyprus and Faynan: results from Uluburun and Khirbat Hamra Ifdan. *Archaeological and Anthropological Sciences 10*: 1485–1502. https://doi.org/10.1007/s12520-017-0465-x

Jantzen, D. 2008. *Quellen zur Metallverarbeitung im Nordischen Kreis der Bronzezeit*. Stuttgart: Franz Steiner Verlag.

Janzon, G. 1984. *Stenredskap med skafttränna – indikation på tidig metallurgi?*. Stockholm: Jernkontoret.

Jockenhövel, A. 2000. Raum und Zeit – Gliederung der Bronzezeit, in A. Jockenhövel and W. Kubach (eds) *Bronzezeit in Deutschland*: 11-14. Hamburg: Nikol Verlagsgesellscchaft.

Junghans, S., E. Sangmeister and M. Schröder 1960. *Metallanalysen kupferzeitlicher und frühbronzezeitlicher Bodenfunde aus Europa*. Studien zu den Anfängen der Metallurgie 1. Berlin: Mann.

Junghans, S., E. Sangmeister and M. Schröder 1968. *Kupfer und Bronze in der frühen Metallzeit Europas. Die Metallgruppen beim Stand von 12000 Analysen* Studien zu den Anfängen der Metallurgie 2-3. Berlin: Mann.

Junghans, S., E. Sangmeister and M. Schröder 1974. *Kupfer und Bronze in der frühen Metallzeit Europas: Katalog der Analysen Nr. 10 041–22 000 (mit Nachuntersuchungen der Analysen Nr. 1–10 040)*. Studien zu den Anfngen der Metallurgie 2/4. Berlin: Mann.

Kersten, K. 1936. *Zur älteren nordischen Bronzezeit*. Neumünster: Karl Wachholtz Verlag.

Killick, D., J.A. Stephens and T.R. Fenn 2020. Geological constraints on the use of lead isotopes for provenancing in Archaeometallurgy. *Archaeometry* 62(Suppl. 1): 86-105.

Klassen, L. and S. Stürup 2001. Decoding the Riesebusch-copper: Lead-Isotope Analysis applied to Early Neolithic Copper Finds from South Scandinavia. *Praehistorische Zeitschrift* 76(1): 55-73.

Kristiansen, K. 1974 (2016). En analyse af yngre bronzealderens depotfund (Periode IV-V) i Danmark: kildekritik, kronologi og tolkning. Unpublished PhD doctoral thesis, Aarhus University.

Laux, F. 1995. Westeuropas Bedeutung für die Bronzezeit Niedersachsens. Zum Übergang von der Sögl-Wohlde-Zeitstufe zur älteren Bronzezeit, in A. Jockenhövel (ed.) *Festschrift für Hermann Müller-Karpe zum 70. Geburtstag*: 85-212. Bonn: Habelt.

Laux, F. 2009. *Die Schwerter in Niedersachsen*. Prähistorische Bronzefunde IV.17. Stuttgart: Franz Steiner.

Ling, J., L. Grandin, E. Hjärthner-Holdar, A.L. Melheim, Z. Stos-Gale, M. Vicze and J.G. Tarbay 2023. Moving metals V: The question of shared copper sources between Scandinavia and Hungary 1700-1500 BC. *Journal of Archaeological Science: Reports* 51: 1-26.

Ling, J., E. Hjärthner-Holdar, L. Grandin, K. Billström and P.-O. Persson 2012. Moving metals or indigenous mining? Provenancing Scandinavian Bronze Age artefacts by lead isotopes and trace elements. *Journal of Archaeological Science* 40: 1-14.

Ling, J., E. Hjärthner-Holdar, L. Grandin, Z. Stos-Gale, K. Kristiansen, A.L. Melheim, G. Artioli, I. Angelini, R. Krause and C. Canovaro 2019. Moving metals IV: Swords, metal sources and trade networks in Bronze Age Europe. *Journal of Archaeological Science: Reports* 26: 1-34.

Ling, J. and J.T. Koch 2018. A sea beyond Europe to the north and the west, in J. Dodd and E. Meijer (eds) *Giving the Past a Future. Essays in Archaeology and Rock Art Studies in Honour of Dr. Phil h.c. Gerhard Milstreu*: 96-111. Oxford: Archaeopress.

Ling, J., Z. Stos-Gale, L. Grandin, K. Billström, E. Hjärthner-Holdar and P.-O. Persson 2014. Moving metals II: provenancing Scandinavian Bronze Age artefacts by lead isotopes and elemental analyses. *Journal of Archaeological Science* 41: 106-132.

Ling, J., Z. Stos-Gale, P. Northover, M.A. Hunt-Ortiz and M. Díaz-Guardamino-Uribe (in preperation). Bronze Age copper ingots from key maritime landing sites in southern England, in J. Koch, M. Fauvelle, B. Cunliffe, J. Ling (eds) Maritime Encounters 3: Presenting counterpoints to the dominate terrestrial narrative of European prehistory. Oxbow books

Liversage, D. 2000. *Interpreting impurity patterns in ancient bronze: Denmark*. København: Det Kongelige Nordiske Oldskriftselskab.

Lockhoff, N., J. Lutz and E. Pernicka 2019. Neue isotopengeochemische Methoden zur Untersuchung archäologischer Metallobjekte: Eine Fallstudie zur Kupferisotopie an frühbronzezeitlichen Hortfunden aus Mitteldeutschland, in H. Meller, F. Bertemes (eds) *Der Aufbruch Zu Neuen Horizonten: Neue Sichtweisen Zur Europäischen Frühbronzezeit: Abschlusstagung Der Forschergruppe FOR550 Vom 26. Bis 29. November 2010 in Halle (Saale), Tagungen des Landesmuseums Für Vorgeschichte Halle*: 133-143. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt Landesmuseum für Vorgeschichte.

Megaw, J.W.S. and E.M. Hardy 1938. British Decorated Axes and their Diffusion during the Early Part of the bronze Age. *Proceedings of the Prehistoric Society* 4: 272-307.

Melheim, A.L. 2015. *Recycling Ideas: Bronze Age Metal Production in Southern Norway*. British Archaeological Reports International Series 2715. Oxford: BAR Publishing.

Melheim, A.L. 2024. Massive shaft-hole axes were axe currencies: the social life of the Fårdrup axes, in H. Meller, R. Risch and E. Pernicka (eds) *Der soziale Wert von prähistorischen Beilen: neue archäologische und archäometrische Ansätze/The social value of prehistoric axes: new archaeological and archaeometric approaches*: 403–420. Halle (Saale): State Office for Heritage Management and Archaeology Saxony.

Melheim, A.L., L. Grandin, P.-O. Persson, K. Billström, Z. Stos-Gale, J. Ling, R.A. Williams, I. Angelini, C. Canovaro, E. Hjärthner-Holdar and K. Kristiansen 2018. Moving metals III: Possible origins for copper in Bronze Age Denmark based on lead isotopes and geochemistry. *Journal for Archaeological Science* 96: 85-105.

Melheim, A.L., J. Ling, Z. Stos-Gale, E. Hjärthner-Holdar and L. Grandin 2019. The role of pre-Norsemen in trade and exchange of commodities in Bronze Age Europe, in X.-L. Armada, M. Murillo-Barroso, and M. Charlton (eds) *Metals, minds and mobility: Integrating scientific data with archaeological theory*: 135-146. Oxford: Oxbow Books.

Modarressi-Teherani, D., J. Garner and M. Kvietok 2016. Copper Production in the Slovak Ore Mountains – New Approaches, in G. Körlin, M. Prange, T. Stöllner and Ü. Yalçin (eds) *From Bright Ores to Shiny Metals. Festschrift für Andreas Hauptmann*: 109-123. Bochum: Deutsches Bergbaumuseum Bochum.

Monteagudo, L. 1977. *Die Beile auf der Iberischen Halbinsel*. München: C.H. Beck.

Montelius, O. 1885. *Om tidsbestämning inom bronsåldern med särskilt avseende på Skandinavien*. Stockholm: Akademiens Förlag.

Myhre, L.N. 1998. *Historier fra en annen virkelighet. Fortellinger om bronsealderen ved Karmsundet*. Stavanger: Arkeologisk museum i Stavanger.

Nimis, P., P. Omenetto, I. Giunti, G. Artioli and I. Angelini 2012. Lead isotope systematics in hydrothermal sulphide depsits from the central-eastern Southalpine (northern Italy). *European Journal of Mineralogy* 24: 23-37.

Nordén, A. 1925. *Ostergötlands bronsålder*. Linköping: Carlssons.

Nørgaard, H.W. 2011. *Die Halskragen der Bronzezeit im nördlichen Mitteleuropa und Südskandinavien*. Bonn: Rudolf Habelt.

Nørgaard, H.W. 2018. *Bronze Age Metalwork. Techniques and traditions in the Nordic Bronze Age 1500-1100 BC*. Oxford: Archaeopress.

Nørgaard, H.W. 2024. The use of axe and ring metal as a raw material source in the late Neolithic and early Bronze Age in southern Scandinavia, in H. Meller, R. Risch and E. Pernicka (eds) *Der soziale Wert von prähistorischen Beilen: neue archäologische und archäometrische Ansätze/The social value of prehistoric axes: new archaeological and archaeometric approaches:* 387–401. Halle (Saale): State Office for Heritage Management and Archaeology Saxony.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2019 On the trail of Scandinavia's early metallurgy: provenance, transfer and mixing. *PLoS ONE* 14(7): 1-32, e0219574.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2021. Shifting Networks and Mixing Metals: Changing metal-trading routes to Scandinavia correlate with Neolithic and Bronze Age transformations. *PLoS ONE* 16: e0252376.

Nørgaard, H.W., E. Pernicka and H. Vandkilde 2022. 1600 BC: Fårdrup and Valsømagle-type axes and the first evidence of southern Alpine metal. *Acta Archaeologica* 92.2(2021): 185-226.

Nørgaard, H.W. and D. Stott (in preparation). A long walk: modelling trade routes brings Bronze Age contact networks to life. Antiquity.

Nowak, K., J. Tarbay Gábor, Z. Stos-Gale, P. Derkowski and K. Sielicka 2023. A complex case of trade in metals: The origin of copper used for artefacts found in one hoard from a Late Bronze Age Lusatian Urnfield Culture in Poland. *Journal of Archaeological Science: Reports* 49: 103970.

O'Brien, W. 2004. *Ross Island. Mining, Metal and Society in Early Ireland*. Indreabhán: Clódóirí Lurgan Teo.

O'Brien, W. 2015. *Prehistoric Copper Mining in Europe 5500-500 BC*. Oxford: Oxford University Press.

O'Brien, W. 2022. *Derrycarhoon: a later Bronze Age copper mine in south-west Ireland*. British Archaeological Reports International Series 3069. Oxford: BAR Publishing.

Oldeberg, A. 1960. *Skälbyfyndet. En boplats från yngre bronsåldern*. Stockholm: Kungliga vitterhets historie och antikvitets akademien.

Oldeberg, A. 1929. *'Bräckanfyndet' – ett gjutfynd från bronsålderns fjärde period*. Stockholm: Svenska teknologföreningens förlag.

Olsen, J., K.M. Hornstrup, J. Heinemeier, P. Bennike and H. Thrane 2011. Chronology of the Danish Bronze Age Based on C-14 Dating of Cremated Bone Remains. *Radicarbon* 53: 261-275.

Pernicka, E. 1999. Trace Element Fingerprinting of Ancient Copper: A Guide to Technology or Provenance?, in S.M. Young, A.M. Pollard, P. Budd and R.A. Ixer (eds) *Metals in Antiquity*: 163-171. British Archaeological Reports International Series 792. Oxford: Archaeopress.

Pernicka, E. 2014. Provenance Determination of Archaeological Metal Objects, in B.W. Roberts and C.P. Thornton (eds) *Archaeometallurgy in Global Perspective. Methods and Syntheses*: 239-268. New York: Springer.

Pernicka, E., J. Lutz and T. Stöllner 2016. Bronze Age Copper Produced at Mitterberg, Austria, and its Distribution. *Archaeologia Austriaca, Band 100*: 19-55.

Pittioni, R. 1957. *Urzeitlicher Bergbau auf Kupfererz und Spurenanalyse. Beiträge zum Problem der Relation Lagerstätte- Fertigobjekt*. Wien: Deuticke.

Prange, M. 2000. La Roussignole – Geochemische Charakterisierung prähistorischer Abbaue in Cabrières/Hérault. *Metalla* 7.2: 47-54.

Prescott, C. 1991. Late Neolithic and Bronze Age Developments on the Periphery of Southern Scandinavia. *Norwegian Archaeological Review* 24(1): 35-48.

Prescott, C. 2006. Copper Production in Bronze Age Norway?, in H. Glørstad, B. Skar and D. Skre (eds) *Historien i forhistorien. Festskrift til Einar Østmo på 60-årsdagen*: 183-190. Oslo: Kulturhistorisk museum, Universitetet i Oslo.

Preuschen, E. and R. Pittioni 1937. *Untersuchungen im Bergbaugebiete Kelchalpe bei Kitzbühel, Tirol*. Wien: Österreichische Akademie der Wissenschaften (ÖAW).

Prøsch-Danielsen, L., C. Prescott and M.K. Holst 2018. Economic and social zones during the Late Neolithic/Early Bronze Age in Jæren, Southwest Norway. Reconstructing large-scale land-use patterns. *Praehistorische Zeitschrift* 93(1): 48-88.

Radivojević, M., B.W. Roberts, E. Pernicka, Z. Stos-Gale, M. Martinón-Torres, T. Rehren, P.J. Bray, D. Brandherm, J. Ling, J. Mei, H. Vandkilde, K. Kristiansen, S. Shennan and C. Broodbank 2018. The Provenance, Use and Circulation of Metals in the European Bronze Age: The State of Debate. *Journal of Archaeological Research* 27: 131-185.

Randsborg, K. 1996. *Absolute Chronology. Archaeological Europe 2500-500 BC*. København: Acta Archaeologica Supplementa.

Randsborg, K. and K. Christensen 2006. Bronze Age Oak Coffin Graves. Archaeology and Dendro-Dating. *Acta Archaeologica* 77: 1-246.

Rassmann, K. 2004. Chronologie – Die zeitliche Einordnung der Dinge als Schlüssel zur Geschichte der Bronzezeit, in H. Jöns and F. Lüth (eds) *Mythos und Magie. Archäologische Schätze der Bronzezeit aus Mecklenburg-Vorpommern*: 38-49. Lübstorf: Turo print GmbH.

Risch, R. and H. Meller 2013. Wandel und Kontinuität in Europa und im Mittelmeerraum um 1600 v. Chr., in H. Meller, F. Bertemes, H.-R. Bork and R. Risch (eds) *1600 – Kultureller Umbruch im Schatten des Thera-Ausbruchs? / 1600 – Cultural Change in the Shadow of the Thera-Eruption?*: 597-613. 4th Archaeological Conference of Central Germany, 14-16 October 2011 in Halle (Saale). Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Saez, R., F. Nocete, J. Giil Ibarguchi, M. Rodriguez-Bayona, N. Inacio, D. Quispe, J. Rodriguez and J.F. Santos-Zaldegui 2021. A lead isotope database for copper mineralisation along the Guadalquivir River Valley and surrounding areas. *Journal of Iberian Geology* 47: 411-427.

Schreiner, M. 2007. *Erzlagerstätten im Hrontal, Slowakei. Genese und Prähistorische Nutzung*. Rhaden/Westf.: Marie Leidorf GmbH.

Schubert, M. and E. Pernicka 2013. Die frühbronzezeitliche Kupferverarbeitung auf dem Buchberg im Unterinntal, Tirol, in K. Oeggl and V. Schaffer (eds) *Cuprum Tyrolense – 5550 Jahre Bergbau und Kupferverhüttung in Tirol*: 123-152. Brixlegg: Montanwerke Brixlegg AG.

Skoglund, P. 2013. Iron Age Rock Art: A View from Järrestad in South East Sweden. *European Journal of Archaeology* 16: 685-703.

Solheim, S. 2021. Timing the emergence and development of arable farming. *Radiocarbon* 63(5): 1503-1524.

Sprockhoff, E. 1941. Niedersachsens Bedeutung für die Bronzezeit Westeuropas. Zur Verankerung einer neuen Kulturprovinz. *Berichte der Roemisch-Germanischen Kommission* 31: 2-138.

Stenvik, L. 1988. Steinkøller med skaftfure, in S. Indrelid, S. Kaland and B. Solberg (eds) *Festskrift til Anders Hagen*: 4-88. Bergen: Historisk Museum, Universitetet i Bergen.

Stos-Gale, Z., N.H. Gale, J. Houghton and R. Speakman 1995. Lead Isotope data from the isotrace Laboratory, Oxford: Archaeometry Data Base 1, ores from the western Mediterranean. *Archaeometry* 37(2): 407-415.

Tomczyk, C. 2022. A database of lead isotopic signatures of copper and lead ores for Europe and the Near East. *Journal of Archaeological Science* 146: 105657.

Valera, P.G. and R. Valera 2005. Outline of geology and mineral deposits of Sardinia, in F. Lo Schiavo, A. Giumlia-Mair, U. Sanna and R. Valera (eds) *Archaeometallurgy in Sardinia from the Origins to the Beginning of the Early Iron Age*: 33-40. Montagnac: Éditions M. Mergoil.

Vandkilde, H. 1996. *From Stone to Bronze. The Metalwork of the late Neolithic and earliest Bronze Age in Denmark*. Aarhus: Jutland Archaeological Society.

Vandkilde, H. 1998. Metalwork, Depositional Structure and Social Practice in the Danish Late Neolithic and Earliest Bronze Age, in C. Mordant, M. Pernot and V. Rychner (eds) *L'atelièr du bronzier en Europe du XXe au VIIIe siècle avant notre ère. Actes du colloque international „Bronze '96", Neuchâtel et Dijon, 1996: L'atelier du bronzier, élaboration, transformation et consommation du bronze en Europe du XXe au VIIIe siècle avant notre ère*: 243-257. Paris: Comité des travaux historiques et scientifiques (CTHS).

Vandkilde, H. 2005. A Biographical Perspective on Ösenringe from the Early Bronze Age, in T.L. Kienlin, (ed.) *Kulturelles Wissen und Materielle Kultur*: 263-281. Bonn: Rudolf Habelt.

Vandkilde, H. 2007. *Culture and Change in Central European Prehistory 6th to 1st millenium BC*. Aarhus: Aarhus University Press.

Vandkilde, H. 2017. *The Metal Hoard from Pile in Scania, Sweden. Place, things, time, metals, and worlds around 2000 BCE*. Aarhus/Stockholm: Aarhus University Press/The Swedish History Museum.

Vandkilde, H., U. Rahbek and K.L. Rasmussen 1996. Radicarbon Dating and the Chronology of Bronze Age Southern Scandinavia, in K. Randsborg (ed.) *Absolute Chronology. Archaeological Europe 2500-500 BC*: 183-198. København: Munksgaard.

Vandkilde, H., C.F. Stephansen, P. Suchowska-Ducke, C.S. Andersen, L. Ahlqvist, L. Felding, M. Bjørnevad-Ahlqvist, J. Czebreszuk and H.W. Nørgaard 2024. Metal-for-Amber in the European Bronze Age. *Praehistorische Zeitschrift* 99(1): 280-338.

Weisgerber, G. and E. Pernicka 1995. Ore mining in prehistoric Europe: A short overview, in G. Morteani and J.P. Northover (eds) *Prehistoric Gold in Europe*: 159-182. Amsterdam: Kluwer Academic Publishers.

Williams, R.A. 2018. Characterising Bronze Age copper from the Great Orme mine in North Wales to determine and interpret its distribution. Unpublished PhD dissertation, University of Liverpool.

Williams, R.A. and C. Le Carlier De Veslud 2019. Boom and bust in Bronze Age Britain: major copper production from the Great Orme mine and European trade, c. 1600-1400 BC. *Antiquity* 93L 1178-1196.

Willroth, K.-H. 1997. Bronzezeit als historische Epoche, in G. Wegner (ed.) *Leben-Glauben-Sterben vor 3000 Jahren. Bronzezeit in Niedersachsen*: 1-36. Oldeburg: Isensee Verlag.

Zschocke, K. and E. Preuschen 1932. *Das urzeitliche Bergbaugebiet von Mühlbach-Bischofshofen*. Wien: Selbstverlag der Anthropologischen Gesellschaft in Wien.

Part 4

The Coded Bronze Age – Society, Value and Worldview

"Intersecting spheres of interaction might be the crux of Bronze Age hyper-scaled connectivity: the principle underscoring the effective movement across wide distances of tactile and intangible novelties... Interaction spheres overlapped in ways that would allow the resources of culture and economy to be pooled in the intersections, hence making them available to several outside parties."
(Vandkilde 2016: 116)

Chapter 19

Take me to your leader: Authority and inequality in Late Bronze Age Britain

Mike Parker Pearson

Institute of Archaeology, University College London, London, UK
m.parker-pearson@ucl.ac.uk

Abstract

In contrast to the evidence of social inequality across Europe during the later Bronze Age, the archaeological record in Britain is relatively resistant to interpretations of social differentiation that include chiefs and elites. The rarity of burials, let alone those with accompanying grave goods, is one of the reasons for this difficulty. The large quantities of metal finds from Britain, of both bronze and gold, have long been the main source from which Late Bronze Age social structure has been inferred, although many of these finds lack an adequate archaeological context. Evidence of social hierarchy within the settlement record is variable and uncertain, especially since much of that evidence derives from open settlements of roundhouses in which chronological resolution of relationships between households is difficult to achieve. Research since the 1980s has identified modules of multiple households, some of them within defended ring-forts and enclosures, as a key feature of social structure. Yet it is often difficult to recover together all these different lines of evidence – settlement, funerary and metalwork – on any single site or within a closely dated chronological framework.

This contribution considers the evidence for social inequality that may be inferred from Britain's Late Bronze Age settlement record. It presents results from the excavation of a deep-stratified, 500-year long sequence at Cladh Hallan in the Western Isles (Outer Hebrides) of Scotland that help us to explore social structure and authority and how these changed over half a millennium from the 11th to the 6th centuries BCE.

Introduction

In recent years,[1] as well as working on Stonehenge, I have been writing up the results of a long-running field project during 1989-2003 in the Outer Hebrides off the northwest coast of Scotland. The last two volumes in a sequence of 14 monographs are on the excavation of a remarkably well-preserved and deeply stratified settlement mound with activity spanning the Bronze Age and Early Iron Age from *c.* 2000 to *c.* 500 BCE.[2] The most interesting part of this sequence is the founding of a settlement of roundhouses in the 11th century BCE which proved to be unusually long-lived, with one house continuing in use for the next 500 years. Amongst the remarkable finds were two

[1] I have known Helle since we were students, when I was staying in the old house at Moesgård in 1980. I had arrived to begin research on the Danish Iron Age as the case study for my PhD thesis. I had heard in great detail about how the house was haunted by the ghost of a white lady. Yet, despite my being left entirely alone for several creepily still nights, there were no signs of an apparition. Helle thinks I may have been lucky. Many years later, when I was invited back as a visiting professor, she told me the story of a visiting academic and his partner who had a frightening experience in the house. Terrified that some malevolent force was actively pulling their bedclothes off the bed in the middle of the night, they packed up their belongings and fled in their car, driving to the nearby town of Horsens to find somewhere less alarming to stay the rest of the night.
Since 1980, my research interests have moved back in time, to include the Bronze Age and Neolithic as well as the Iron Age, especially within Britain. Helle started with the Bronze Age and has stayed with it, becoming an internationally recognised leader in her subject. At the same time, she has an outstanding grasp of the entire range of European prehistory as amply demonstrated by her excellent book *Culture and Change in Central European Prehistory* (Vandkilde 2007).

[2] The volumes are:
Branigan, K. and P. Foster 1995. *Barra: archaeological research on Ben Tangaval*. SEARCH vol. 1. Sheffield: Sheffield Academic Press.
Gilbertson, D., M. Kent and J. Grattan (eds) 1996. *The Outer Hebrides: the last 14,000 years*. SEARCH vol. 2. Sheffield: Sheffield Academic Press.
Parker Pearson, M. and N.M. Sharples 1999. *Between Land and Sea: excavations at Dun Vulan, South Uist*. SEARCH vol. 3. Sheffield: Sheffield Academic Press.
Parker Pearson, M. (ed.) 2012. *From Machair to Mountains: archaeological survey and excavation in South Uist*. SEARCH vol. 4. Oxford: Oxbow Books.
Branigan, K. and P. Foster 2000. *From Barra to Berneray: archaeological survey and excavation in the Southern Isles, Outer Hebrides*. SEARCH vol. 5. Sheffield: Sheffield Academic Press.
Branigan, K. 2005. *From Clan to Clearance: history and archaeology of the Isle of Barra c. 850-1850 AD*. SEARCH vol. 6. Oxford: Oxbow Books.
Parker Pearson, M., M. Brennand, J. Mulville and H. Smith 2018. *Cille Pheadair: a Norse farmstead and Pictish burial cairn in South Uist*. SEARCH vol. 7. Oxford: Oxbow.
Parker Pearson, M., J. Mulville, H. Smith and P. Marshall 2021. *Cladh Hallan: roundhouses and the dead in the Hebridean Bronze Age and Iron Age. Part 1: stratigraphy, spatial organisation and chronology*. SEARCH vol. 8. Oxford: Oxbow.
Parker Pearson, M. and M. Zvelebil 2014. *Excavations at Cill Donnain: a Bronze Age settlement and Iron Age wheelhouse in South Uist*. SEARCH vol. 9. Oxford: Oxbow.
Parker Pearson, M., J. Mulville, H. Smith and P. Marshall 2021. *Cladh Hallan: roundhouses and the dead in the Hebridean Bronze Age and Iron Age. Part 2: material culture, subsistence, skeletons and synthesis*. SEARCH vol. 10. Oxford: Oxbow Books.
Sharples, N.M. 2005. *A Norse Farmstead in the Outer Hebrides: excavations at Mound 3, Bornais, South Uist*. Oxford: Oxbow Books.
Sharples, N.M. 2012. *A Late Iron Age Farmstead in the Outer Hebrides: excavations at Mound 1, Bornais, South Uist*. Oxford: Oxbow Books.
Sharples, N.M. 2020a. *A Norse Settlement in the Outer Hebrides: excavations on Mounds 2 and 2A, Bornais, South Uist*. Oxford: Oxbow Books.
Sharples, N.M. 2020b. *The Economy of a Norse Settlement in the Outer Hebrides: excavations on Mounds 2 and 2A, Bornais, South Uist*. Oxford: Oxbow Books.

skeletons composed of multiple body parts which had been mummified before burial. This site of Cladh Hallan, on the island of South Uist, Scotland, might seem to have been peripheral to developments within Britain and the wider world of Bronze Age Europe but it appears to have been supported by a thriving economy with exchange links across the sea to Ireland as well as mainland Scotland. The calcareous sand of South Uist's *machair* environment has enabled exceptional survival of bone and antler alongside the usual range of artefactual and ecofactual materials. Most significantly, the settlements' house floors, artefact distributions and long-term sequence allow insights to be made into authority and inequality that are difficult to obtain from many other sites of the British Late Bronze Age.

The poverty of sources for the British Bronze Age

When viewed from the perspective of the Nordic Bronze Age, the Late Bronze Age in Britain can appear woefully limited in its range of evidence and quality of contextual data. Although there are large numbers of metalwork hoards and single finds of bronzes, many are chance finds, either from old discoveries or handed in by metal detectorists, and so lack adequate contextual information. Furthermore, the researcher expecting a similar diversity of styles of bronze ornaments, vessels, tools and weaponry to that found in the Nordic region would be sadly disappointed. Nor is there anything very much in terms of figurative depictions on rock or on bronzes. Nor are there many burials known from the British Late Bronze Age; most of these are cremation deposits and rarely do any include grave goods (Brück 1995; 2006). Added to that, until *c.* 40 years ago, British archaeologists were lamenting the rarity of Late Bronze Age settlement evidence although our knowledge of such sites has been transformed in recent years by excavations carried out in advance of development (see Johnston 2021 for a recent overview of the period).

Cladh Hallan: Authority and inequality in a Late Bronze Age settlement

Our excavations at Cladh Hallan uncovered a row of three roundhouses in the northern half of a settlement mound that may have been occupied by six houses in total (Fig. 1).[3] While the southern half of the mound remains unexcavated, the three roundhouses – in a north-south line with east-facing entrances – were constructed in 1090-1005 cal BCE with foundation deposits that included a human burial under each house (Fig. 2).

Figure 1: The row of roundhouses constructed in 1090-1005 cal BCE at Cladh Hallan, viewed from the north (photo: Mike Parker Pearson).

The northernmost house had not one but two burials, both of which were composites of up to three separate individuals' remains, all of which had been obtained from already mummified bodies (Parker Pearson *et al.* 2005). Only the burial under the central roundhouse appears to have been a fresh corpse when the row was built. This was the body of a young person, 10-12 years of age and probably female (Fig. 2). Her atypical non-marine, terrestrial dietary signal (an unusually negative $\delta^{13}C$ isotope value) marks her out from the rest of the Cladh Hallan population, raising the possibility that she might have been brought here from inland Ireland or Scotland and may even have been a human sacrifice at the founding of the settlement.

The central roundhouse was the largest of the three houses, although small by Scandinavian standards. After the young person had been buried beneath the floor, the house's central hearth was used for the casting of bronzes, evident from the distribution of clay mould fragments, crucible sherds and bronze droplets, and from the tell-tale phytolith slag from high-temperature firing in the basal layer of the house floor (Parker Pearson *et al.* 2021: fig. 5.45; Hamlet and Simpson 2021: 402, 405, 411, 412; Cowie and Parker Pearson, in press). Conjoins between mould fragments reveal that most of the mould debris was gathered up and deposited just

[3] The excavations were directed by myself, Jacqui Mulville, Helen Smith, and Peter Marshall for a number of universities, including Sheffield, Cardiff, Bournemouth, and Southampton.

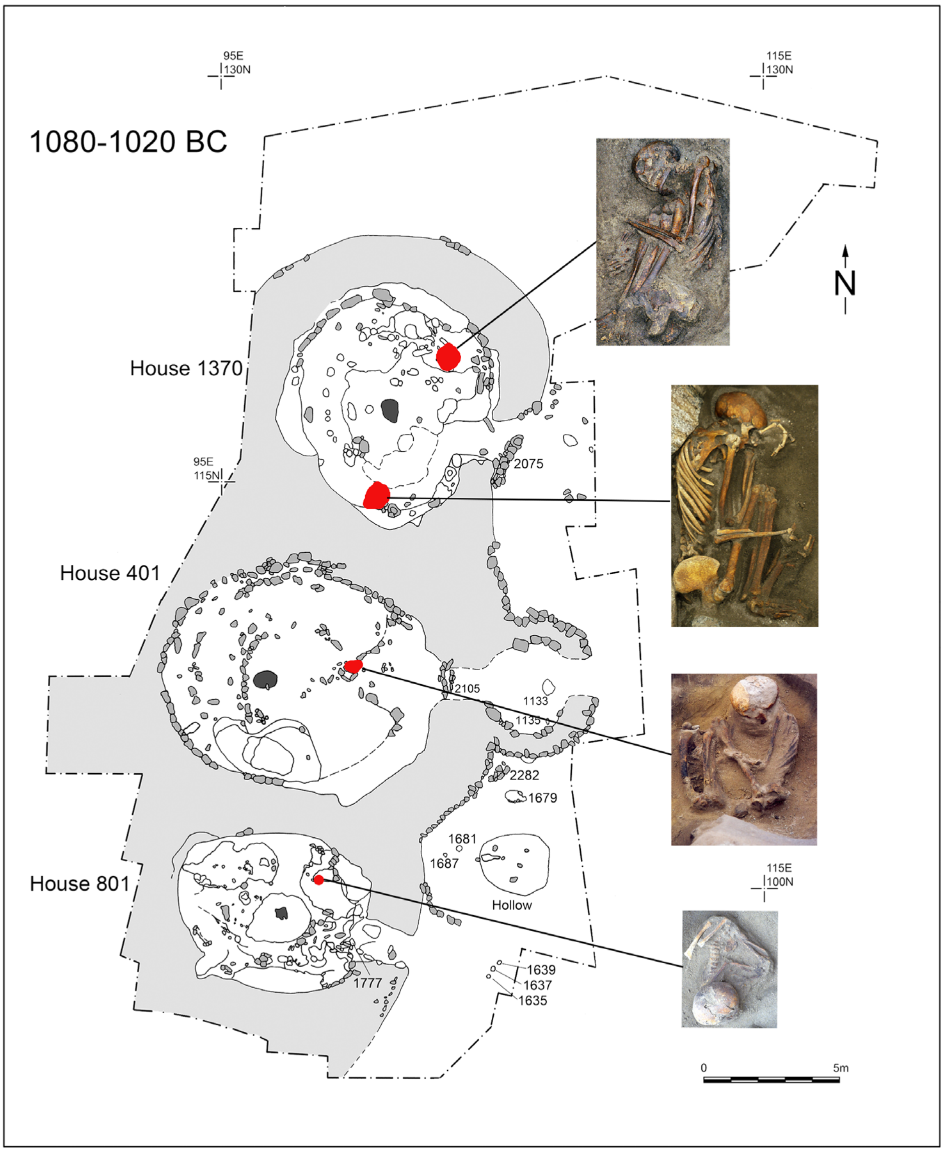


Figure 2: The four foundation burials beneath the floors of the roundhouses at Cladh Hallan. The atypical terrestrial isotope values of a 10-12 year-old probable female buried beneath the central roundhouse (House 401) suggest that she was not local to the islands (drawing: Irene DeLuis; inset photos: Mike Parker Pearson).

outside the entrance of the roundhouse, later covered over by a small round building that formed a forecourt or porch from which the roundhouse interior was accessed along a passage.

The mould fragments from this bronze-casting event derive from a minimum of two swords, a spearhead, one or more socketed axes, a corrugated sheet, two or more dress pins, and a penannular bracelet or annular ring (Fig. 3). We might characterise this as the bronze equipment required by a household – weapons, tools and ornaments that would serve for years to come. A second episode of bronze-casting (possibly no more than dress pins) took place in the northern roundhouse, followed by another casting in the central house about 50-60 years later at the time of this house's renewal; the cast bronzes included probably two spearheads, a socketed knife, and an axe-head. Finally, in 1015-930 BCE (at 95% probability; Parker Pearson *et al.* 2021: 413-417) another casting was carried out in the central house when it was rebuilt a second time. The products probably included a sword, a chape, and a razor. No bronzes appear to have been cast at the time of the central house's third rebuild during the bronze-iron transition, possibly because bronze scrap and raw materials were no longer available.

This periodicity of bronze-casting every 50-60 years at house foundation and renewal gives a useful insight into the organisation of the metalwork industry on

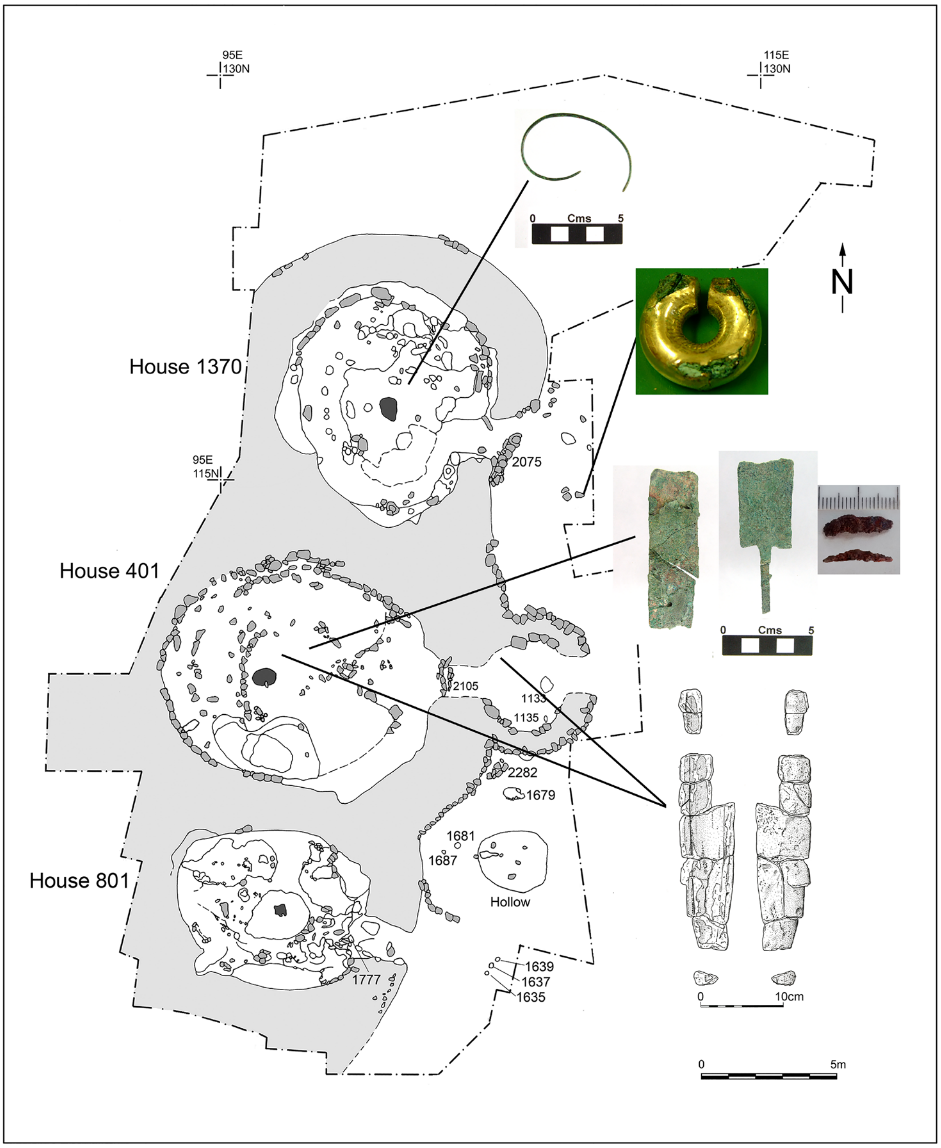


Figure 3: The 'closing' deposits of two bronze tools on the floor of the central roundhouse (House 401) and a bracelet on the floor of the northern roundhouse (House 1370), all dating to 1045-985 cal BCE, as well as a gold-plated penannular ring (18 mm diameter) from outside the northern house. Earlier, at the houses' foundation in 1090-1005 cal BCE, bronze-casting debris was deposited at the hearth and in the entrance of the central roundhouse, including conjoining fragments of a clay mould for a bronze sword. An unusually early piece of iron was found in the floor layer close to the two bronze tools. (image drawing: Irene DeLuis; inset photos: Mike Parker Pearson; inset drawing: Alan Braby).

Scotland's islands. The nearby settlement mound of Cill Donnain, just 7 km away, has also produced sword mould fragments, making it likely that each community within South Uist would have had their weapons, tools, and ornaments cast at such moments in the household cycle (Parker Pearson and Zvelebil 2014: 133-135). For the smith's skills to be continuously maintained, we might envisage a system in which metalworking specialists served multiple communities within and even beyond the islands. This peripatetic pattern of production is probably very different to the large-scale processing of scrap bronze in regions such as eastern England in the Late Bronze Age, where there is evidence for much greater centralisation of production (Rowlands 1976: 167). Yet it still implies a level of regional organisation well beyond a domestic mode of production, in which itinerant smiths plied their trade at rites of passage among varied communities (cf. Childe 1940: 163). Whether such artisans were under the protection of a higher, chiefly authority is unknown.

As well as moulds, metal items were also deposited at Cladh Hallan, primarily as ritual 'closing' deposits prior to house renewal. In the roundhouse row's first

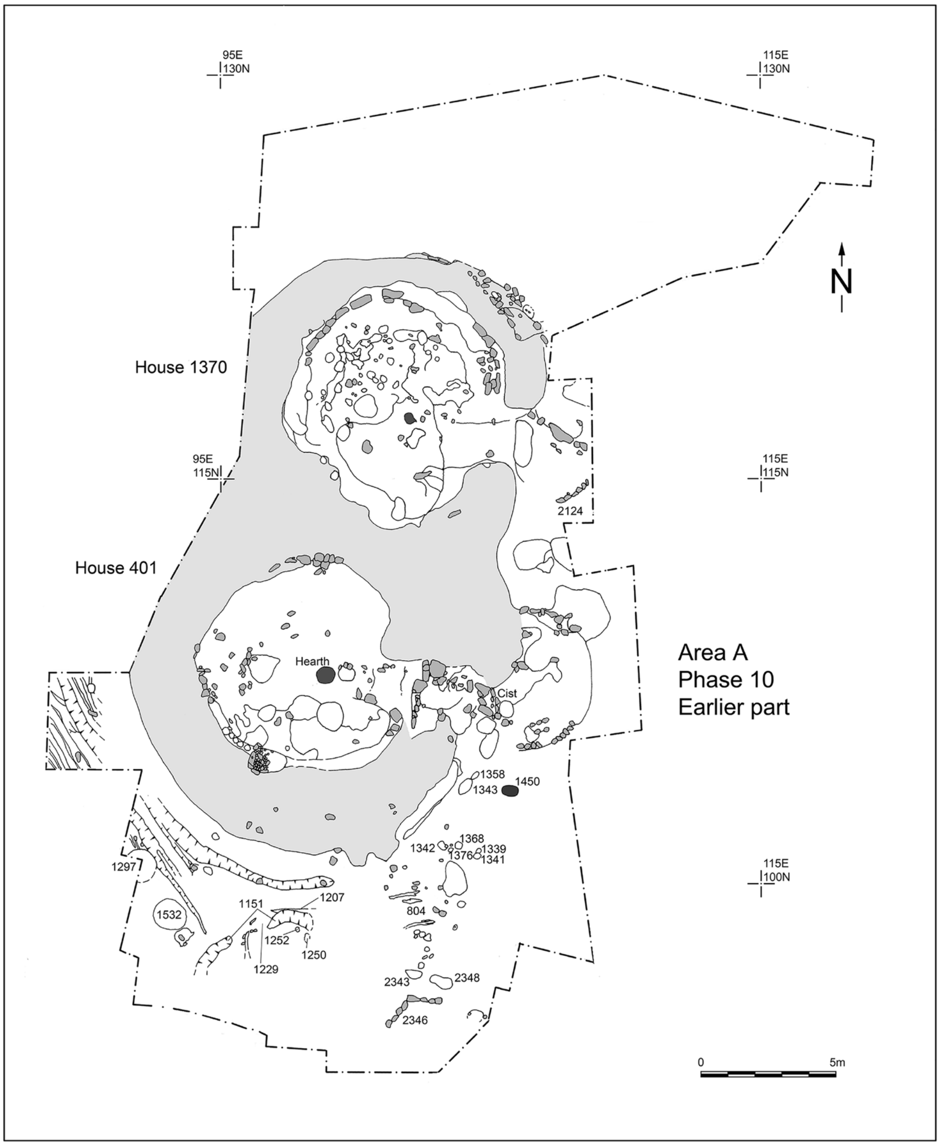


Figure 4: The second phase of the row of roundhouses constructed in 1045-985 cal BCE, forming a module of two houses in which House 401 continued as the main dwelling and the northern house served as a multipurpose ancillary building (drawing: Irene DeLuis).

phase of occupation, these include two tanged tools (possibly spokeshaves), a small chisel, a bracelet, and a gold-plated penannular ring (Fig. 3). The ring is the only item that was probably an accidental loss and it demonstrates the Cladh Hallan community's access to precious ornaments. Such rings (known as 'hair-rings'; Eogan 1997) are most common in Ireland, the likely origin of this fine item.

The weaponry and the gold ring suggest a level of social status at Cladh Hallan that might not necessarily be found on every settlement in the islands or even further afield. The central house's circular forecourt building is also highly unusual; the nearest parallel is 1000 km away at Stansted in Essex, southeast England. Yet the Cladh Hallan roundhouses also provide interesting insights into social structure within the settlement. Although its southern half remains unexcavated, the shared walls of the three roundhouses imply that they functioned as a modular unit. Such modularity, often as paired roundhouses, has been recognised for the Late Bronze Age elsewhere in Britain (Ellison 1987; Woodward 2002). In 1045-985 cal BCE, the roundhouses at Cladh Hallan were similarly rebuilt as a paired modular arrangement (Fig. 4).

The southern and northern roundhouses show features that suggest reliance on the large, central roundhouse. All three were provided with sleeping platforms (of banked sand covered by turf) in their northwest quadrants, that in the southern house being large enough for just two people, that in the northern house for four, and that in the central house for as many as eight. The inhabitants of the southern house carried out craft activities, especially hide-working. Limited quantities of cooking potsherds suggest that not much cooking took place here. Unusual quantities of fish heads on the floor reveal that saithe were processed here, an activity not found in the other houses. When it came to providing a 'closing' offering on the house's abandonment, the items placed in the auspicious northeast quadrant of this southern house (over the human burial) consisted of two hammerstones rather than bronzes, as was the case in the other two houses. We might imagine that the people living here were dependents – perhaps servants or even enslaved. They might well have been required to cook for others in the central house.

The central house was large enough for a good-sized family unit. Its deep floor layer of peat ash and sand was full of artefacts and small debris which reveal an ordered use of space in which the southeast was the kitchen area to the southeast of the hearth. The southwest was devoted to craft-working, including hide-working, potting, and the working of bone and wood. Some of the former activities extended to the southern edge of the raised sleeping platform in the northwest. The northeast quadrant, above the young person's grave, was unusually bare of artefacts except for some unusual items: a piece of iron, a fragment of coral, one cremated and one unburnt human hand bone, and a fine-ware pot. This was also where the two possible spokeshaves were deposited. We cannot say whether the piece of coral derived from afar, but the iron fragment, most likely part of a bracelet or a brooch, is exceptional since there is no other ironwork of 11th-century BCE date known from Britain.

The northern roundhouse has soil micromorphological evidence for animal stalling as well as possessing a sleeping platform, suggesting combined or intermittent occupation by both people and animals (sheep and/or cattle, most likely the young and vulnerable). Craft activities were carried out here, including a single episode of bronze-casting, but the lack of intensive use is in striking contrast to the other two roundhouses. It has the appearance of an ancillary house, dependent on the central house, its inhabitants in a similar position of servitude or enslavement to those in the southern house.

In summary, the Cladh Hallan roundhouses may have been inhabited by a group of about 14 people of various ages and statuses, most probably laid out as a central household with dependents. Those in authority had access to gold and exotic items, such as iron ornaments. Their voyaging may have included the taking of a young captive, sacrificed to ensure an auspicious future at the settlement's foundation. Those living in the central house had the power to commission the casting of a set of bronze tools, weapons, and ornaments which included two swords, possibly for two individuals of warrior status.

Exploring authority and inequality in the British Late Bronze Age

The Cladh Hallan settlement may have been typical of Late Bronze Age settlements in the Outer Hebrides or, by chance, we may have stumbled on one of the most powerful communities in these islands, perhaps with a chiefly residence. Similar mould assemblages from Jarlshof in Shetland (Curle 1933; Curle 1934) and Dún Aonghasa fort on the Aran Islands of western Ireland (O'Carroll 2013) imply that the range of items cast at Cladh Hallan were the standard products for a prosperous household on the northern and western margins of Britain and Ireland (Fig. 5). Within the more fertile region of eastern Britain, the inhabitants of a burnt-down lake settlement at Must Farm, Cambridgeshire, left behind an even larger range of complete bronze artefacts – spears, axes, sickles, gouges, awls, knives, a hammer, and a pair of tweezers – except that their ornaments and swords were absent, presumably carried off as they fled the blaze (Knight *et al.* 2024).

So how does the evidence for authority and inequality at Cladh Hallan compare with the rest of Britain and Ireland? Cladh Hallan was an open settlement, as was Jarlshof. Most Late Bronze Age settlements found in mainland Britain were similarly unenclosed. Some hillforts were occupied at this time, though the most distinctive enclosed settlements are a class of circular enclosures known as ring-forts or ringworks (Fig. 6). These are particularly well known in eastern England, especially within the Thames estuary, but they extend to Wales (Parker Pearson *et al.* 2018) and southwest England (Mudd *et al.* 2019) as well as to Ireland (Raftery and Becker 2024) and northern France (Mare 2005); there may be significantly more ring-forts in western Britain and Ireland, yet to be mapped. They are ditched enclosures with one or two entrances and often have post-built ramparts. Inside might be a main roundhouse and one or two other houses.

One of the most fully excavated is the ring-fort of Springfield Lyons, Essex, dating to the 10th century BCE (Brown and Medlycott 2013). Its central roundhouse with its entrance porch looks east towards a gateway and with its back to a western entrance into the circular enclosure. The northern terminals of the ditches at both entrances contained thousands of pieces of clay mould fragments from the casting of a minimum number of ten swords – perhaps many more – and a single sickle (Needham and Bridgeford 2013). The ring-fort lies at the centre of an unusually dense distribution

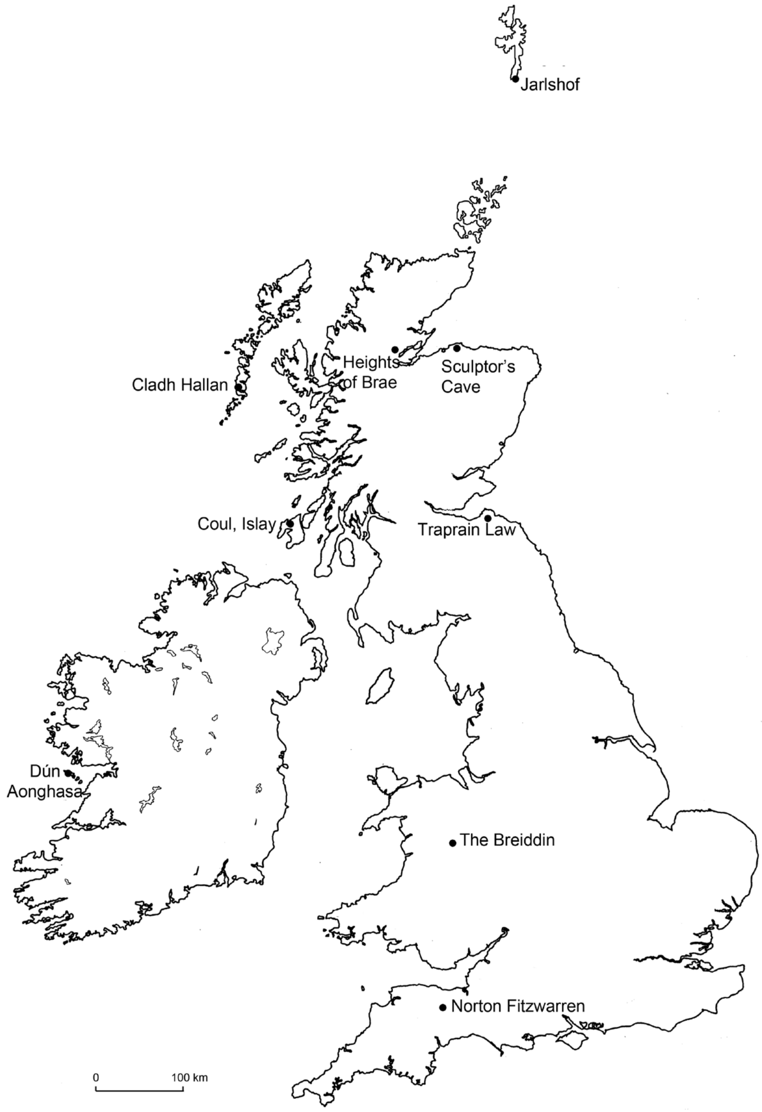


Figure 5: The location of Cladh Hallan and other Late Bronze Age sites mentioned in the text (drawing: Mike Parker Pearson).

of Late Bronze Age metalwork (5 km in diameter). It is tempting to see this as a zone controlled by those living within the ring-fort (Brown and Medlycott 2013: 153, fig. 5.2).

Weapon production is not otherwise evident from other British ring-forts, which may be to some extent a factor of preservation of the fragile mould fragments. Fragments of a single sword mould from another ring-fort at South Hornchurch, Essex (Guttmann and Last 2000) are no doubt remnants of what must have been a much larger quantity of metalworking debris. It is tempting to see the ring-forts as the uppermost level of a settlement hierarchy. That is certainly a strong possibility, at least for the regions in which they occur. Yet, there is more to the nature of their authority than control of the production of weaponry – many are located close to earlier monuments, sometimes of considerable antiquity, e.g. Springfield Lyons, Bayvil Farm (Pembrokeshire), and Kingsborough (Kent) lie adjacent to Early Neolithic causewayed enclosures from the mid 3rd millennium BCE (Brown and Medlycott 2013; Parker Pearson *et al.* 2018; Allen *et al.* 2008). The ring-forts' circular defences may also have deliberately referenced previous monuments, i.e. Neolithic henges from a thousand years earlier, thereby drawing on an authority of invented tradition and mythic history (Brown and Medlycott 2013: 155-159; Parker Pearson *et al.* 2018: 137; Bradley 2002).

Other large, enclosed sites of the Late Bronze Age include hillforts (see Fig. 5), several of which – notably Traprain Law (Cree and Curle 1922; Armit *et al.* 2017), Norton Fitzwarren (Ellis 1989) and the Breiddin (Musson

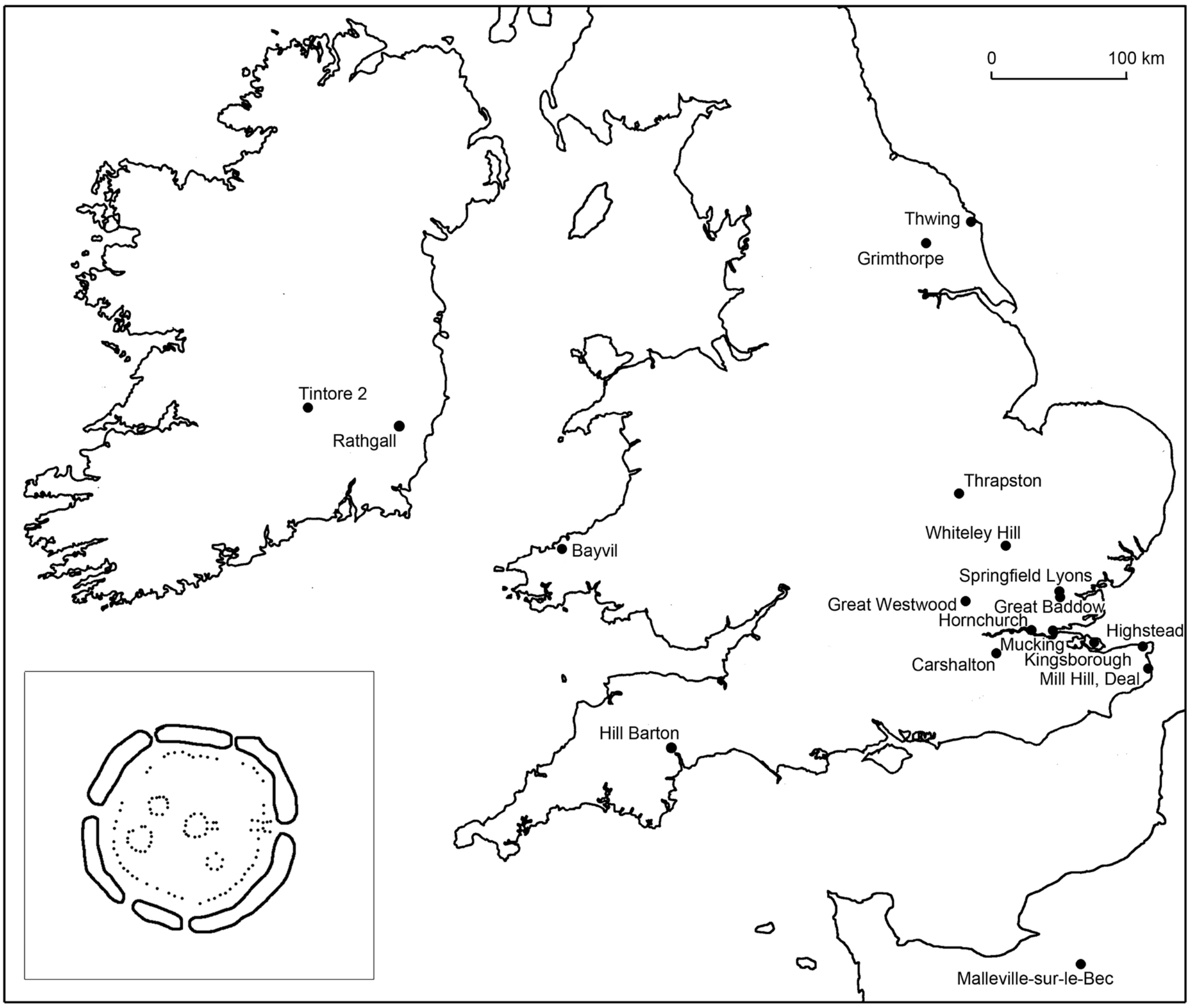


Figure 6: The distribution of Late Bronze Age ring-forts (drawing: Mike Parker Pearson).

et al. 1991) – have evidence of sword production. Yet the uneven geographical distribution and relative rarity of Late Bronze Age hillforts indicates that these too were unlikely to have formed a continuous landscape of competing territorial chiefdoms. Nor might they have been inhabited in any numbers or for any length of time. A study of the insect assemblage from a pond in the centre of the Breiddin hillfort reveals no impact from any human presence; it seems that, while its many interior structures were built, they were never used (Buckland *et al.* 2001). The absence of internal settlement within four Late Bronze Age hillforts in southern Ireland has led the excavators to suggest that such fortifications were visual statements of power and dominion over a territory, even if they were uninhabited (O'Brien and O'Driscoll 2017).

Weapon production was not the preserve of the defended settlements such as ring-forts or hillforts. There are numerous sites with such metallurgical debris that, like Cladh Hallan, were open and relatively small (Mörtz 2019; Needham 1980; Needham and Bridgeford 2013: table 3.7). If the control over weapon production was a marker of power and authority, then the overall picture is of regional and local variety in the architectural expression and manifestation of authority and inequality. It is tempting to consider sites such as Springfield Lyons as the seat of a chiefdom and an open settlement such as Cladh Hallan as a less complex authority structure, even though both could resort to violence and (certainly in the case of Cladh Hallan) could obtain precious objects such as gold ornaments, and potentially take captives as well as enslave and sacrifice them.

In some respects, the contrast between defended and undefended settlements may be unhelpful since it could be that those behind defences were protecting themselves from aggressors who needed no defences. In such circumstances, rapacious raiders based in scattered open settlements on Hebridean islands could have attacked and intimidated mainland communities who might have had to organise their own defence against them.

Gold: The Cladh Hallan penannular gold ring in context

The gold-plated ring from Cladh Hallan is of a type known as a 'hair-ring' or 'ring-money', found widely distributed throughout Britain, Ireland, and the near continent (Eogan 1997; O'Connor, in press). Most are stray single finds (especially with the rise in metal detecting in the UK) but some have been found in hoards and a handful have come from settlements and even burials. A group of ten were deposited with human remains and other items in the Sculptor's Cave at Covesea on the east coast of Scotland (see Fig. 5), probably during the 10th century BCE (Armit and Büster 2020: 119-130).

Eogan (1997: 318) concluded from their character, distribution and contexts that 'hair-rings' were symbols of status, worn by leaders or members of important families although not of the order of chiefdoms or complex hierarchies of the kind inferred for certain regions within mainland Europe. Within Britain, these 'hair-rings' are particularly numerous in the south and east of England, and are more sparsely distributed across Scotland (Davies 2012: map 2). Just two other single finds are known from northwest Scotland: from the isles of Skye and Coll in the Inner Hebrides (O'Connor, in press).

These hair-rings are just one type of Late Bronze Age gold ornament found throughout Britain and Ireland. There are *c.* 250 find-spots of Late Bronze Age gold in Britain. Bracelets, torcs, dress-fasteners, lock-rings, and other gold items are widely distributed, although scarce in western Scotland (Coles 1960: 34-36, map 7; Taylor 1980; Eogan 1994; Davies 2012; Murgia *et al.* 2022: fig. 2C). Most are single finds, or just two or three items found together, or minor components of bronze hoards and it is rare for gold artefacts to be found together in any numbers. Rare exceptions within Scotland include the nine ornaments from the Heights of Brae near Inverness (Clarke and Kemp 1984) and a now lost hoard of 36 gold armlets from Coul, Islay in the Inner Hebrides (Clarke 1976). Smaller hoards of gold ornaments, consisting of three or four gold items, such as bracelets, are also known from a handful of other sites in western and northern Scotland (Eogan 1994: 176-179; Curle 1913). Might the penannular ring lost at Cladh Hallan have been part of a similar set of two or three gold bracelets and other dress items worn by the inhabitants of its central roundhouse?

If gold ornaments can be taken as symbols of wealth and status (which seems a reasonable proposition since gold is unlikely to have been available to all) this lack of evident concentration in hoarded gold would support the assumption that social hierarchies based on such wealth acquisition were relatively flat. That said, power and status may have derived from the distribution and redistribution of items of wealth, thereby resulting in the dispersed pattern of largely single finds evident in the archaeological record. It is only in rare cases that social inequality becomes evident, such as from the ring-fort at Rathgall, Co. Wicklow, Ireland, where four gold items were found in addition to a cremation burial containing a gold 'hair-ring' (Raftery and Becker 2024). Even then, the range of bronze weapons, tools, and ornaments cast within that settlement is not dissimilar to that for Cladh Hallan.

And finally, the mummies: Ancestry and authority?

The two skeletons buried beneath the northern roundhouse at Cladh Hallan were not only composed of multiple body parts re-articulated together but had been treated to ensure soft tissue preservation after death, providing the first evidence of mummification in prehistoric Britain (Parker Pearson *et al.* 2005; Parker Pearson *et al.* 2007; Booth *et al.* 2015). Scientific analyses, such as histological thin-section analysis, FTIR and mercury porosimetry, revealed that post-mortem diagenesis within the bones had been halted and that the human remains had been subjected to acidic conditions, most probably in a peat bog, to preserve the soft tissue. Evidence of conjoining bones revealed that one of the mummies had been initially buried in a pit outside the northern roundhouse and subsequently exhumed, her head being replaced with that of a male before being buried beneath the roundhouse (Parker Pearson *et al.* 2021: 99-100).

The mummies of Cladh Hallan present as yet unanswerable questions about not only why certain individuals were mummified but why two of these were each composites of three separate individuals. Was mummification a rite chosen for certain of the illustrious dead? And were those whose remains were recombined in a composite body selected to represent particular lineages entwined together as real or fictive ancestors of the Cladh Hallan inhabitants? Although we await further genetic analysis which may answer such questions about their degree of relatedness, it is clear that mummification was practised across Bronze Age Britain (Booth *et al.* 2015). This may help to explain, at least in part, why formal burial was so unusual in this period; alternatively, like inhumation and cremation rites, it may have been a similarly infrequent practice employed by those families wishing to retain and present their ancestors in tangible form.

Conclusion

The people of Cladh Hallan and their island neighbours probably did not constitute a chiefdom in any way comparable to their medieval successors, the Clan Macdonald of Clanranald around 100 generations later (Williams 1984), but their access to precious objects, their manufacture of weaponry, and their likely internal hierarchy reveal a significant degree of social inequality. If the composite mummies buried beneath the floor of the northern roundhouse embody a concern with ancestry – on a shorter time-frame than the mythic history referenced by British and Irish ring-forts – then such instancing of ancestral past in the present may also have served an elitist strategy of legitimation. The potential child sacrifice under the central roundhouse further hints at socially sanctioned power over life and death, and the possibility that some were enslaved. Cladh Hallan's inhabitants may not have been chiefs as such but their social differentiation extended well beyond dimensions of age and gender.

Acknowledgements

The excavations at Cladh Hallan were carried out with co-directors Jacqui Mulville, Helen Smith and Peter Marshall, with funding from Historic Environment Scotland as well as our own universities, primarily the University of Sheffield, Bournemouth University, Cardiff University, and the University of Southampton. The metalworking moulds were analysed by Trevor Cowie, formerly of National Museums Scotland. I also thank Neil Wilkin of the British Museum for his advice on Late Bronze Age gold and Richard Bradley of Reading University for his helpful comments on this text.

Bibliography

Allen, M.J., M. Leivers and C. Ellis 2008. Neolithic causewayed enclosures and later prehistoric farming: duality, imposition and the role of predecessors at Kingsborough, Isle of Sheppey, Kent, UK. *Proceedings of the Prehistoric Society* 74: 235-322.

Armit, I. and L. Büster 2020. *Darkness Visible: the Sculptor's Cave, Covesea, from the Bronze Age to the Picts*. Edinburgh: Society of Antiquaries of Scotland.

Armit, I., A. Dunwell and F. Hunter 2017. Recycling Power and Place: the many lives of Traprain Law, SE Scotland, in D. Gheorghiu and P. Mason (eds) *Working with the Past: Towards an Archaeology of Recycling*: 27-36: Oxford: Archaeopress, 27-36.

Booth, T.J., A. Chamberlain and M. Parker Pearson 2015. Mummification in Bronze Age Britain. *Antiquity* 89: 1155-1173.

Bradley, R. 2002. *The Past in Prehistoric Societies*. London: Routledge.

Brown, N. and M. Medlycott 2013. *The Neolithic and Bronze Age Enclosures at Springfield Lyons, Essex: excavations 1981-1991*. East Anglian Archaeology 149. Chelmsford: Essex County Council.

Brück, J. 1995. A Place for the Dead: the role of human remains in Late Bronze Age Britain. *Proceedings of the Prehistoric Society* 61: 245-277.

Brück, J. 2006. Death, Exchange and Reproduction in the British Bronze Age. *European Journal of Archaeology* 9(1): 73-101.

Buckland, P.C., M. Parker Pearson and A. Wigley 2001. Is There Anybody Out There? A reconsideration of the environmental evidence from the Breiddin hillfort, Powys, Wales. *Antiquaries Journal* 81: 51-76.

Childe, V.G. 1940. *Prehistoric Communities of the British Isles*. London: Chambers.

Clarke, D.V. 1976. The Lost Hoard of Gold Objects from Coul, Islay, Argyll. *Proceedings of the Society of Antiquaries of Scotland* 107 (1975-1976): 307-309.

Clarke, D. and M.M.B. Kemp 1984. A Hoard of Late Bronze Age Gold Objects From Heights of Brae, Ross and Cromarty District, Highland Region. *Proceedings of the Society of Antiquaries of Scotland* 114: 189-198.

Coles, J.M. 1960. Scottish Late Bronze Age Metalwork: typology, distributions and chronology. *Proceedings of the Society of Antiquaries of Scotland* 93 (1959-1960): 16-134.

Cowie, T. and M. Parker Pearson (in press). Metallurgy: ceramic material associated with metalworking, in M. Parker Pearson, J. Mulville, H. Smith and P. Marshall. *Cladh Hallan: roundhouses and the dead in the Hebridean Bronze Age and Iron Age. Part 2: Material culture, subsistence, skeletons and synthesis*. Oxford: Oxbow Books.

Cree, J.E. and A.O. Curle 1922. Account of the Excavations on Traprain Law During the Summer of 1921. *Proceedings of the Society of Antiquaries of Scotland* 56: 189-259.

Curle, A.O. 1913. Two Penannular Gold Armlets, and the stone bowl in which they were found, from Hillhead, Caithness. *Proceedings of the Society of Antiquaries of Scotland* 47 (1912-1913): 433-435.

Curle, A.O. 1933. Account of Further Excavation in 1932 of the Prehistoric Township at Jarlshof, Shetland. *Proceedings of the Society of Antiquaries of Scotland* 67: 82-136.

Curle, A.O. 1934. An Account of Further Excavation at Jarlshof, Sumburgh, Shetland, in 1932 and 1933.

Proceedings of the Society of Antiquaries of Scotland 68: 224-319.

Davies, A. 2012. Beyond the Horizon: ornaments in the British Late Bronze Age and Early Iron Age. Unpublished MA dissertation, Cardiff University.

Ellis, P. 1989. Norton Fitzwarren Hillfort: a report on the excavations by Nancy and Philip Langmaid between 1968 and 1971. *Proceedings of the Somerset Archaeological Society* 133: 1-74.

Ellison, A. 1987. The Bronze Age Settlement at Thorny Down: pots, post-holes and patterning. *Proceedings of the Prehistoric Society* 53: 385-392.

Eogan, G. 1994. *The Accomplished Art: gold and gold-working in Britain and Ireland during the Bronze Age (c. 2300-650 BC)*. Oxford: Oxbow Books.

Eogan, G. 1997. 'Hair-Rings' and European Late Bronze Age Society. *Antiquity* 71: 308-20.

Guttmann, E.B.A. and J. Last 2000. A Late Bronze Age Landscape at South Hornchurch, Essex. *Proceedings of the Prehistoric Society* 66: 319-359.

Hamlet, L.E. and I.A. Simpson 2021. Thin-section Soil Micromorphology, in M. Parker Pearson, J. Mulville, H. Smith and P. Marshall 2021. *Cladh Hallan: roundhouses and the dead in the Hebridean Bronze Age and Iron Age. Part 1: stratigraphy, spatial organisation and chronology*: 393-412. Oxford: Oxbow Books.

Johnston, R. 2021. *Bronze Age Worlds: A social prehistory of Britain and Ireland*. London: Routledge.

Knight, M., R. Ballantyne, M. Brudenell, A. Cooper, D. Gibson and I. Robinson Zeki 2024. *Must Farm Pile-Dwelling Settlement: Volume 1 – landscape, architecture and occupation*. Cambridge: McDonald Institute for Archaeological Research.

Mare, E. 2005. Le Village de Malleville-sur-le-Bec (Eure), in C. Marcigny, C. Colonna, E. Ghesquière and G. Verron (eds) *La Normandie à L'Aube de l'Histoire: les découvertes archéologiques de l'âge du Bronze 2300–800 av. J.-C.*: 52-53. Paris: Somogy.

Mörtz, T. 2019. Once Unburied, Yet Unfound: a survey of the moulds for casting swords in Late Bronze Age Britain, D. Brandherm (ed.) *Aspects of the Bronze Age in the Atlantic Archipelago and Beyond. Proceedings from the Belfast Bronze Age Forum 9-10 November 2013*: 219-231. Hagen: Verlag für Kulturwissenschaften & Kunst.

Mudd, A., N. Garland and T. Brindle 2019. A Late Bronze Age Ringwork and Other Prehistoric, Roman and Later Occupation at Hill Barton, Exeter, Devon. Excavations 2012-2015. *Devon Archaeological Society Proceedings* 77: 147-221.

Murgia, A., B.W. Roberts and R. Wiseman 2022. What Have Metal-detectorists Ever Done For Us? Discovering Bronze Age gold in England and Wales. *Archäologisches Korrespondenzblatt* 44: 353-367.

Musson, C.R., W.J. Britnell and A.G. Smith 1991. *The Breiddin Hillfort. A later prehistoric settlement in the Welsh Marches*. CBA Research Report 76. London: Council for British Archaeology.

Needham, S. 1980. An Assemblage of Late Bronze Age Metalworking Debris from Dainton, Devon. *Proceedings of the Prehistoric Society* 46: 177-216.

Needham, S. 2007. 800 BC, The Great Divide, in C. Haselgrove and R. Pope (eds) *The Earlier Iron Age in Britain and the near Continent*: 39-63. Oxford: Oxbow Books.

Needham, S. and S. Bridgeford 2013. Deposits of Clay Refractories for Casting Bronze Swords, in N. Brown and C. Medlycott. *The Neolithic and Bronze Age Enclosures at Springfield Lyons, Essex: excavations 1981-1991*: 47-74. East Anglian Archaeology Report 149. Chelmsford: Essex County Council.

O'Brien, W. and J. O'Driscoll 2017. *Hillforts, Warfare and Society in Bronze Age Ireland*. Oxford: Archaeopress.

O'Carroll, F. 2013. Clay Moulds, in C. Cotter. *The Western Stone Forts Project: excavations at Dún Aonghasa and Dún Eoghanachta*, Vol. 2: 28-42. Dublin: Wordwell.

O'Connor, B. (in press). Discussion of the Gold Penannular Ring, in M. Parker Pearson, J. Mulville, H. Smith and P. Marshall 2021. *Cladh Hallan: roundhouses and the dead in the Hebridean Bronze Age and Iron Age. Part 2: Material culture, subsistence, skeletons and synthesis*. Oxford: Oxbow Books.

Parker Pearson, M. and M. Zvelebil 2014. *Excavations at Cill Donnain: a Bronze Age settlement and Iron Age wheelhouse in South Uist*. Oxford: Oxbow Books.

Parker Pearson, M., C. Casswell and K. Welham 2018. A Late Bronze Age Ring-fort at Bayvil Farm, north Pembrokeshire. *Archaeologia Cambrensis* 167: 113-141.

Parker Pearson, M., A.T. Chamberlain, M.J. Collins, O.E. Craig, P. Marshall, J. Mulville, H. Smith, C. Chenery, M.J. Collins, G. Cook, G. Craig, J. Evans, J. Hiller, J. Montgomery, J.-L. Schwenninger, G. Taylor and T. Wess 2005. Evidence for mummification in Bronze Age Britain. *Antiquity* 79: 529-546.

Parker Pearson, M., A.T. Chamberlain, M.J. Collins, C. Cox, G. Craig, O.E. Craig, J. Hiller, P. Marshall, J. Mulville and H. Smith 2007. Further evidence for mummification in Bronze Age Britain. *Antiquity* 89(347): 1155-1173 (available at: http://antiquity.ac.uk/ProjGall/parker312/html).

Parker Pearson, M., J. Mulville, H. Smith and P. Marshall 2021. *Cladh Hallan: roundhouses and the dead in the Hebridean Bronze Age and Iron Age. Part 1: stratigraphy, spatial organisation and chronology*. Oxford: Oxbow Books.

Raftery, B. and K. Becker 2024. *A Hillfort Through Time: excavations at Rathgall, County Wicklow*. Sandyford: Wordwell.

Rowlands, M.J. 1976. *The Production and Distribution of Metalwork in the Middle Bronze Age in Southern Britain*. British Archaeological Reports British Series 31. Oxford, BAR Publishing.

Taylor, J.J. 1980. *Bronze Age Goldwork of the British Isles*. Cambridge: Cambridge University Press.

Vandkilde, H. 2007. *Culture and Change in Central European Prehistory, 6th to 1st millennium BC*. Aarhus: Aarhus University Press.

Williams, R. 1984. *The Lords of the Isles: the Clan Donald and the early kingdom of the Scots*. London: Chatto & Windus.

Woodward, A. 2002. Sherds in Space: pottery and the analysis of site organization, in A. Woodward and J.D. Hill (eds) *Prehistoric Britain: the ceramic basis*: 62-74. Oxford: Oxbow Books.

Chapter 20

Gender as material expression in the Early and Late Bronze Age compared

Louise Felding

Department of Research and Collections, Vejlemuseerne, Vejle, Denmark
lofel@vejle.dk

Abstract

This contribution presents an overview of Nordic Bronze Age (c. 1700 - 500 BCE) burials and how this material has shaped our understanding of gender and identity in the Nordic Bronze Age. The Early Nordic Bronze Age is characterised by a rich record of inhumation graves with strongly gendered structures. The transition from the Early to the Late Bronze Age is seen in the burial record as the shift towards cremation practices and rising depositional practices. This results in fewer and more fragmented grave goods, making it challenging to trace the deceased's gendered identity based on material goods. The contribution aims to examine the shifting gendered expressions of identity in Nordic Bronze Age burials.

Male graves dominate the burial assemblage from the Nordic Bronze age and a shift in expressed masculinity can be seen over time where weapons are replaced by toiletries. Women are more seldomly recognised in the burial assemblages and are almost invisible in later Bronze Age burials. However, a gendered balance remains in Nordic Bronze Age society when turning to the depositions where female objects dominate the inventory in late Nordic Bronze Age. A changed focus from the individual towards the collective seem apparent towards the Late Bronze Age as the majority of bronze artefacts are then found in depositions.

Introduction – gender the Nordic Bronze Age

The contextual societal backdrop of this study is the Nordic Bronze Age (NBA), a period spanning 1200 years dating *c.* 1700-500 BCE. The period is divided into an Early and Late part from *c.* 1100 BCE. As the name indicates, it was the period when bronze became the favoured material for prestige objects and was a catalyst for far-reaching trade and alliance networks which had hitherto been unknown. This cultural transformation and unique pre-modern interconnectivity have been referred to by Helle Vandkilde as a societal '*bronzization*' (Vandkilde 2016). Geographically, the NBA spans a large area comprising the regions of southern and coastal Norway, southern and central Sweden, Denmark and northern Germany, with varied yet shared cultural and religious expressions (Austvoll *et al*. 2020).

This contribution wishes to examine gender in the Nordic Bronze Age (NBA). This is not an unproblematic pursuit as our understanding of gender in the past is biased by contemporary world understandings. Bronze Age research comes from a rich but biased academic tradition where a male focus has been at the forefront (Frieman *et al.* 2019; Ahlqvist 2023). An explicit division of agency between female and male gender has been put forward, where men have been regarded as active and outgoing agents, participating in trade, diplomacy, and warfare (Kristiansen 2018; Ling *et al.* 2018). Women have in turn, been regarded as situated in the domestic sphere, only participating in travel and diplomacy as passive participants as part of arranged alliance-formations (Vandkilde 2006; Kristiansen 1984; Kristiansen 2002; Frieman *et al.* 2019). Women's part in these actions has been interpreted as passive to a point where scholars have protested that our views on women's mobility have been reduced to a matter of seeing them as circulating wombs: 'women's mobility [...] is often no more than circulation of wombs and wealth among male-headed households' (Frieman *et al.* 2019: 156).

Luckily, we have a rich source of material from the NBA and when studying this record, we do see a gendered Bronze Age world. The burial record, and especially the famously well-preserved early oak-coffin graves (Boye 1986 (1896); Broholm and Hald 1939; Broholm and Hald 1935; Jensen 1998; Thomsen 1929), are well suited and demonstrate normative gender identities of women and men. Evidence from rock art, depositions, and figurines also provide insight into diverse gendered roles and it is generally apparent that status, religion, and power are not exclusively linked to the male gender (Ahlqvist 2024; Horn 2017; Kristiansen 2014).

The study of gender based on the burial record is however challenging. Not least because most graves from the NBA are viewed through a binary lens and are gendered based on the material grave goods. This is done because bone preservation is either lacking (typical in the early NBA) or too fragmented (typical in the late NBA) for osteological analyses. This approach is of course flawed as gender is not binary and because grave goods are not often tested against human skeletal remains. Gender is perceived here as a lived and experienced state of being, where gender categories (predominantly man and woman) intersect with many other categories, such as age and biological sex, in order to form a person's identity. Thus, gender transcends the normative division of biological sex of female and male categories. Binary gender divisions, therefore, continue to create a self-confirming bias and even more so because of the fragmented nature of the Late Bronze Age burials. This has resulted in female bodies especially being largely invisible in archaeological interpretative frameworks (Ahlqvist 2024).

This contribution accepts that it delivers an interpretation of the gendered norm based on a fragmented archaeological dataset which likely leaves us with a biased and simplified view of the past. However, studies from central Europe with better bone preservation show that a binary correlation between sex and expressed gender holds true for the majority of the tested individuals in prehistoric burial contexts but also shows a consistent, yet small, proportion who do not adhere to these gendered norms (Pape and Ialongo 2023).

Nordic Bronze Age society

Nordic Bronze Age society was a hierarchical society, highly connected yet decentralised in its organisation (Kristiansen 2007). Wealthy individuals were laid to rest in burial mounds or cairns, with burial rites changing from inhumation graves in the early NBA to cremations and urn burials in the later NBA. This change coincides with larger European transformations, such as the demise of the '*Hügelgräber*' culture and the following rise of the Urnfield culture *c.* 1300 BCE in central Europe. NBA material culture bears witness to normative gendered structures with feminine and masculine expressions (Ahlqvist 2023; Felding and Stott 2023; Kristiansen 2014; Sørensen 1997), yet also contains within it an ever-present and consistent group of minorities who do not adhere to broad normative gender categories (Felding and Stott 2023).

Burials of the Nordic Bronze Age

This chapter examines the burial record primarily from the core area of the NBA (present-day Denmark and north Germany) in order to understand Bronze Age society through a gendered lens. Grave inventories from the Early and Late Bronze Age are compared with the aim of examining possible changing expressions of gendered identities. During this time, the shift in burial practices from inhumation to cremation takes place and it is, therefore, the overall aim to investigate a potentially changed view on individuality, status, and gender in the transition towards cremation rites in the later stages of the Nordic Bronze Age.

Early Nordic Bronze Age Burials (c. 1700-1100 BCE)

Early Nordic Bronze Age burials are characterised by individual inhumation graves, often with distinct gendered grave goods and attire that demonstrate normative feminine and masculine genders (Bergerbrant 2007; Sørensen 1997). Gender-significant objects for women are typically jewellery, e.g. belt plates, neck collars, neck rings, tutuli, and hairring. Gender-significant objects for men are typically weapons, e.g. sword, axes, and spears. Both genders, however, share several artefacts, e.g. fibulas, pins, arm rings, knives, and daggers (Bergerbrant 2007; Felding 2020).

Burials in oak-log coffins are common, though other inhumation types – plank- and stone-built coffins, burial chambers, flat graves – are also known from this period (Bech *et al.* 2018; Beck 2018; Madsen and Davidson 1989). Most burials were placed under a mound or cairn. A veritable burial mound construction boom is observable in southern Scandinavia between 1500-1100 BCE (Holst and Rasmussen 2013).

The best information on gender in the early NBA we gain from the oak coffin burials. Seven such burials are famously well preserved to this day and reveal explicit gendered expressions from the early NBA (see Table 1). These burials remain intact with all personal belongings, including organic material such as textiles and costume, revealing otherwise perished information about clothing and appearance (Broholm and Hald 1935; Mannering 2017; Sørensen 1997).

The female burials from Egtved, Skrydstrup, and Borum Eshøj provide important information about female gendered appearance including clothing (Bergerbrant *et al.* 2013; Broholm and Hald 1939; Frei *et al.* 2017; Thomsen 1929). Two main types of costumes are apparent in the female graves from the early NBA: 1) a long full woven skirt, and 2) a short corded (string) skirt. Both skirts are worn with a woollen

Table 1: List of the most well-preserved oak-coffin burials. The graves' unique preservation of organic material (such as textiles) allows for insights into gendered clothing and personal appearance in the Bronze Age.

Female	Male
Egtved	Borum Eshøj (young)
Skrydstrup	Borum Eshøj (old)
Borum Eshøj	Trindhøj
	Muldbjerg

Figure 1: The Egtved Girl with preserved grave goods and costume. Oak-coffin burial early NBA II (1500-1300 BCE) (photo: Roberto Fortuna and Kira Ursem, National Museum Denmark; license CC-BY-SA).

blouse with three-quarter-length sleeves (see Fig. 1). The costumes would have been accompanied by personal adornments. Jewellery (in particular neck and armrings) is an important part of the female expression (Felding 2020). It has been suggested that the length of skirt could indicate marital status, but it has not been possible to really test such claims. Furthermore, the role of the corded skirt has been suggested to have been part of ritual attire, conferring on the bearer the role of ritual specialist or priestess (Thomsen 1929). This is a compelling argument, as several figurines from the Late Bronze Age wear such skirts whilst performing ritual acts. However, a counterargument is the fact that the corded skirt was widespread in Bronze Age society, making it a more common garment than one just worn for ritual purposes (Bergerbrant 2014). The possibilities remain open, but the proposed functions do not exclude one another and should, therefore, be regarded as possible scenarios in the Bronze Age.

The well-preserved male oak-coffin burials from Muldbjerg, Trindhøj, and Borum Eshøj provide equally detailed insights into the male gendered appearance (Boye 1986 (1896)). The male costume is more uniform and consisted of a kilt and cape, sometimes worn with a hat/cap (Bergerbrant 2007: 50-61; Broholm and Hald 1935) (see Fig. 2). Weapons were important for male expression – swords especially – but often in combination with personal items, e.g. jewellery and toiletries.

Figure 2: Male costume from Trindhøj, Early NBA II (1500-1300 BCE) (photo: Lennart Larsen, National Museum Denmark; license CC-BY-SA).

Late Nordic Bronze Age Burials (c. 1100-500 BCE)

The change in burial rites from inhumation to cremation begins *c.* 1300 BCE in the north. Here, we observe the beginning of change towards cremations burials that appear with fewer and less distinctive grave goods (Harvig 2017; Hornstrup 1999; Rose and Meadows 2024). The early cremation burials would for the most part be laid out in the space of an inhumation grave (in a mound), and artefacts would be placed as they would have been situated on the body (Feveile and Bennike 2002). During NBA III (*c.* 1300-1100 BCE), burials would gradually transition into cremations in pit or urn burials in the outer edges of existing mounds (Hornstrup 1999; Feveile and Bennike 2002; Reiter *et al.*

2021) and only a few cremation cemeteries are known. After the transition, urn cremations would become a custom that would dominate the Nordic area for the following millennia.

The individual becomes less visible in cremation burials because of the lower number of grave goods, and this has been suggested to be a sign of the growing importance of the community and a shared focus on collective identities (Hornstrup 1999; 1998). This is coherent with the growing number of depositions during the late NBA in which the individual is no longer clearly visible.

Late NBA gender that is assigned based on grave goods continues to broadly separate into a male and female sphere. Male graves dominate the finds assemblage, with toiletries (razors and tweezers) now as key markers for masculinity, as weapons are found less frequently. Swords were stylised in a miniature fashion and no longer dominated the artefact assemblage. A distinct difference from the earlier period is that a previously favoured grave good (the socketed axe) almost never occurred in late NBA grave assemblages (Verlaeckt 2000). Items of jewellery, i.e. arm- and neck rings, are commonly found in the female sphere (but not exclusively so).

An overall gendered representation of late NBA cremation and urn burials points towards an overrepresentation of men and an under-representation of women and children that is not just caused by taphonomy and preservation issues (Hornstrup 1999). The sex estimation of fragmented cremated bones is often difficult and, with the few gender-significant objects found in the graves, the majority of burials remain unsexed and ungendered. Advances in scientific and archaeological methods therefore hold potential for a better understanding of the demographic of the cremated individuals in the NBA. A study from Ringkøbing Amt, however, has listed 14 late NBA graves that have undergone osteological examination, but only two individuals were possible to sex and these graves did not contain diagnostic grave goods (Hornstrup 1999: 12). An interesting aspect here is the possibility to determine the age of the deceased. Two children were identified in the assemblage and buried with a double button and t-rod bar that is otherwise common for adult burials. This is valuable information, as children are often invisible in the archaeological record but crucial when discussing gender intersectionality and entangled human-object biographies in the Bronze Age. The field holds much promise, but requires further study.

Fewer graves stand out in the late NBA. One example is the male urn cremation burial from Lusehøj dated to NBA V (*c.* 900-700 BCE). The grave contained an axe, razors, drinking cups, gold and bronze buttons, amber, and cloth made of nettle fibre. The urn was made from a bronze bucket and sealed with resin; the lid decorated with amber. The person was buried under a great mound and would have held the highest status in contemporary society (Thrane 2019).

Another example is a rich female burial from Bevtoft (Thrane 1965) dated to NBA IV (*c.* 1100-900 BCE). The grave is an unusual cremation burial containing horse gear, an arm ring, and several bronze tubes (presumed to have been from a string skirt). Horse gear is otherwise not known from burial contexts but is more commonly found in depositions where a female connection with horse/and or wagon gear has been acknowledged and discussed (Kveiborg 2019; Sarauw *et al.* 2023; Varberg 2005). While it is still unclear how we might understand the female role in relation to horses, wagons, and Bronze Age religion, it is clear that women gained greater ritual and economic power during the late NBA (Kristiansen 2014).

Material

To gain an understanding of the gendered expressions of identity in the NBA, this chapter examines and compares the burial record as published in the catalogues of Ekkehard Aner and Karl Kersten (Aner and Kersten 1973-1995; Aner *et al.* 2001-2014) and Evert Baudou (1960). The early NBA burial dataset consists of 5,169 graves from Aner and Kersten (for data, see Felding and Stott 2023), and the late NBA burial dataset of 429 burials from Baudou (1960).

The geographical extent is mainly present-day Denmark, with a few examples from north Germany, Sweden, and Norway. The material record is not complete, but this catalogue-based study will be able to produce a comparison between the early and late material, thereby enabling discussion on the changing conceptions of gender between the early and late NBA.

Methods and results

To compare the burial record, data is visualised in histograms (Figs 3 and 4) and analysed through network analyses (Figs 5 and 6). The histograms show the frequency distribution of the artefact types, and the network graphs analyse the combination of artefact types in the graves. Together, these analyses allow for a broad comparison of changing ideals for the material expression of gendered identities in the early and the late NBA.

Artefact Frequency Distribution

The histogram of early NBA graves (Fig. 3) shows the frequency of the artefact types found in the graves. We see that the sword dominates the material expression,

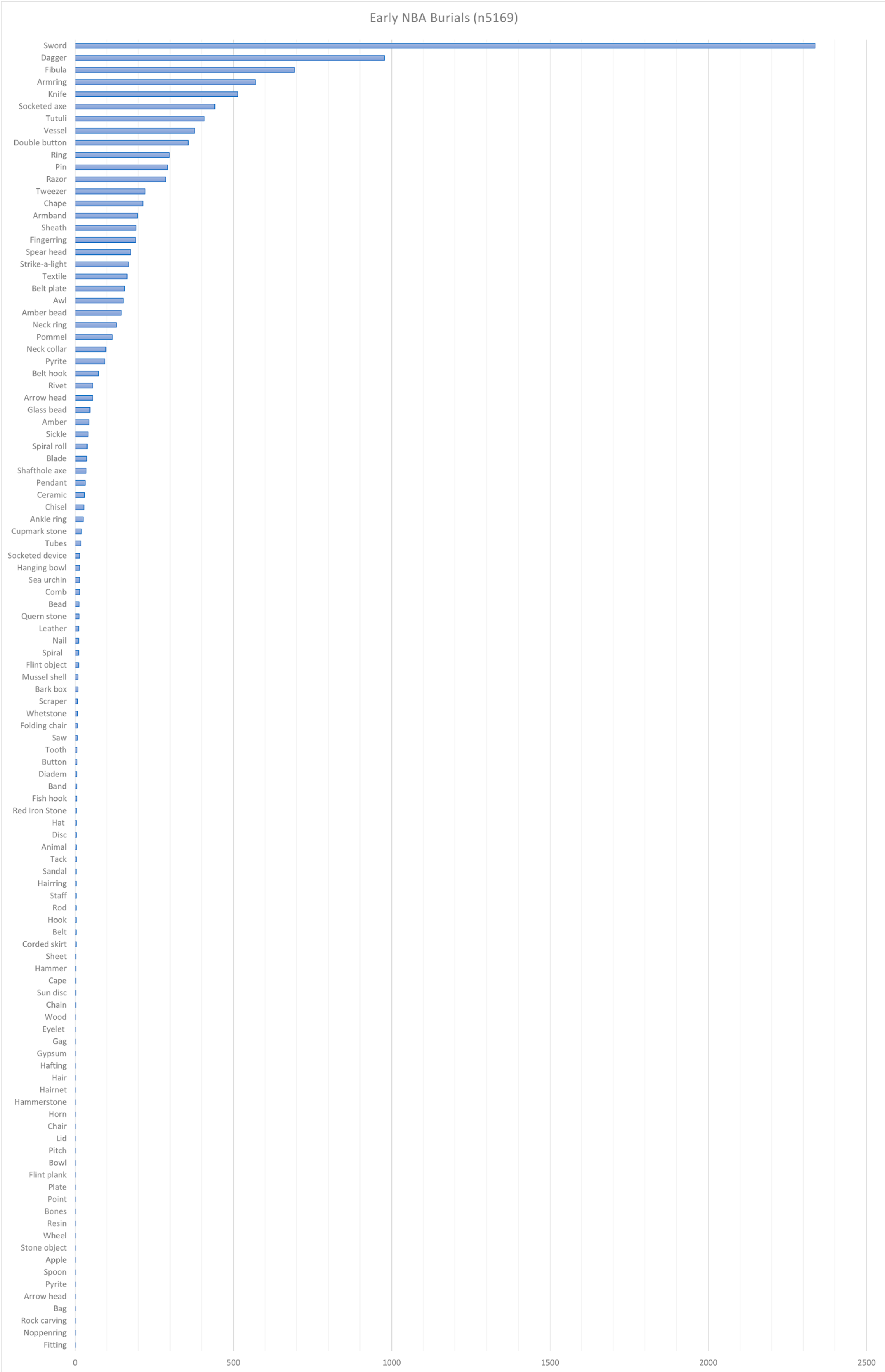


Figure 3: Histogram. Number and type of artefacts found in early NBA burials (n. 5169) (data: Aner and K. Kersten (1973-2014); graphics: the author).

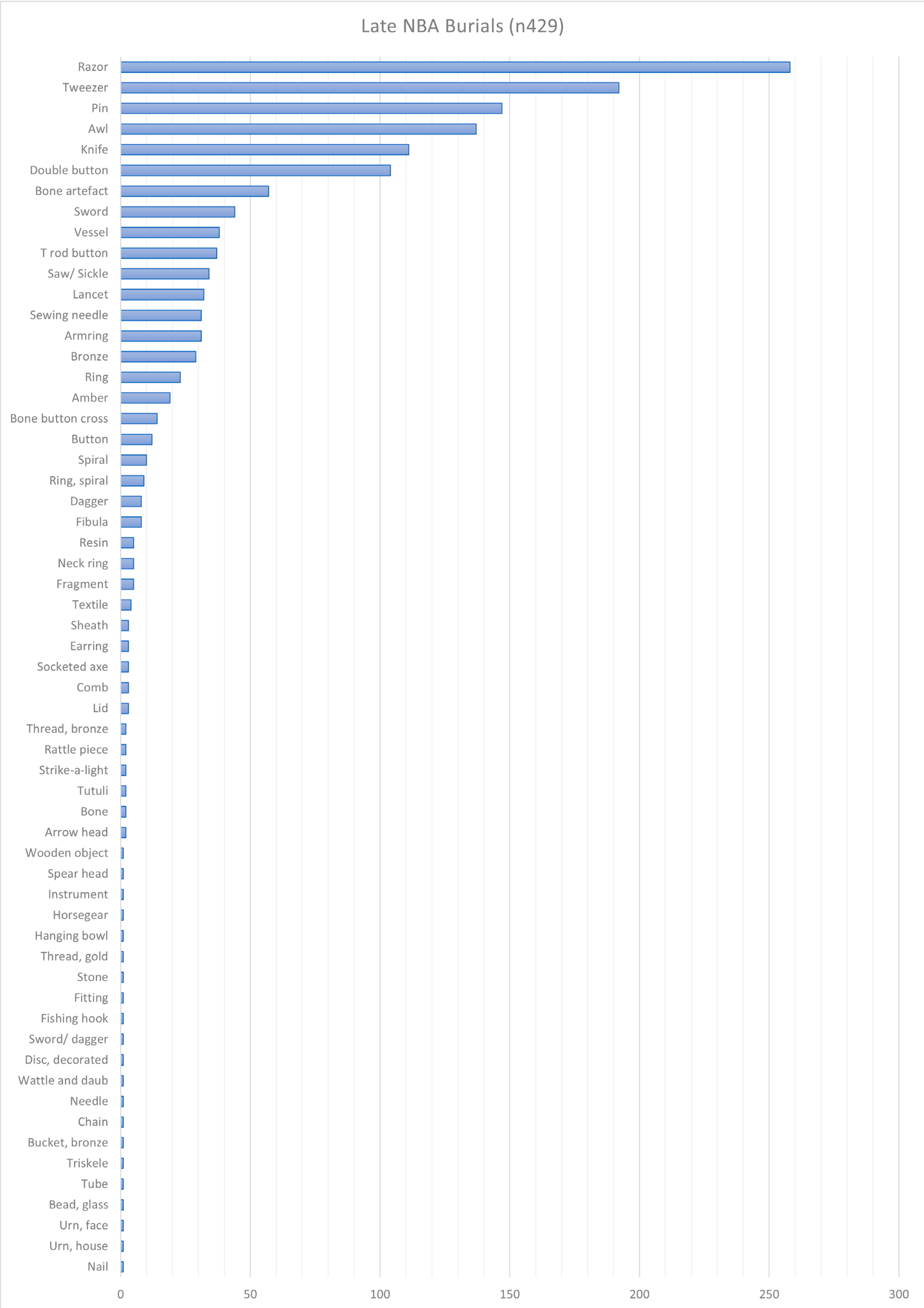


Figure 4: Histogram. Number and type of artefacts found in late NBA burials (n. 429) (data: Baudou (1960); graphics: the author).

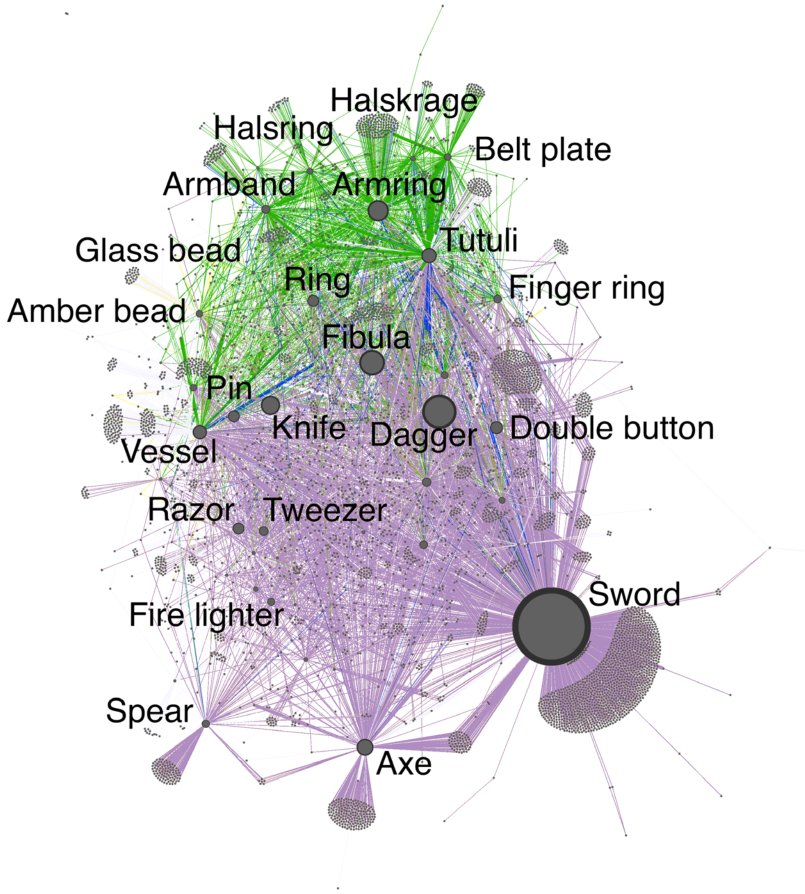


Figure 5: Network graph. Two-mode network, based on 5,169 burials from the catalogues by Aner and Kersten (1973-2014). A gendered division is apparent, with the sword dominating the male appearance. Nodes represent burials and artefacts; only selected (most frequent) artefacts are labelled. Node size by in-degree. Edge colour by gender: Green – female (n=576); Purple – male (n= 2690); Blue – mixed burials (n=83); Yellow – Child (n= 23); White – Not Categorised (n= 1797) (layout: ForceAtlas; software: Gephi; figure source: Felding and Stott 2023: fig. 3).

followed by unisex items (daggers, fibulas, arm rings, knifes). Further personal items, i.e. razors, pins, rings, double buttons, and tutuli are a prominent part of the artefacts found. Finally, vessels and axes are also commonly found in early NBA graves. Early NBA graves are somewhat contradictory insofar as they are characterised both by their standardised 'sets' of artefacts as well as by their extensive artefact type repertoire. We see a more diverse artefact spread accompanying the main characteristic artefact types. This is a pattern which contrasts with the following period.

The histogram of late NBA graves (Fig. 4) shows the frequency of the artefact types found in the graves. Here, the picture changes – there are fewer items with different ratios compared to the previous period. In the late NBA, the razor and tweezer dominate find assemblages. These items are closely followed by more unisex items (pins, awls, knives, double buttons, bone artefacts). A striking difference is the low number of swords. Only 3% of the graves in this data contain a sword. This is a clear indicator of a changed view of the expression of masculinity from the early to the late NBA and will be discussed further below.

Overall, we see a shared type inventory from the early to the late NBA only, with minor period-specific typological significant artefacts (however, the focus on this study has been on the overarching types and any typological sub-divisions have therefore not been made). What has been most useful is the discovery that the ratio of comparable artefact types changes from the early to the late period, thereby altering gendered expressions and appearance. These findings support previous observations by other scholars, particularly Pauline Asingh and Marianne Rasmussen (1984), Inge Bodilsen (1987), and Lisbeth Skogstrand (2016).

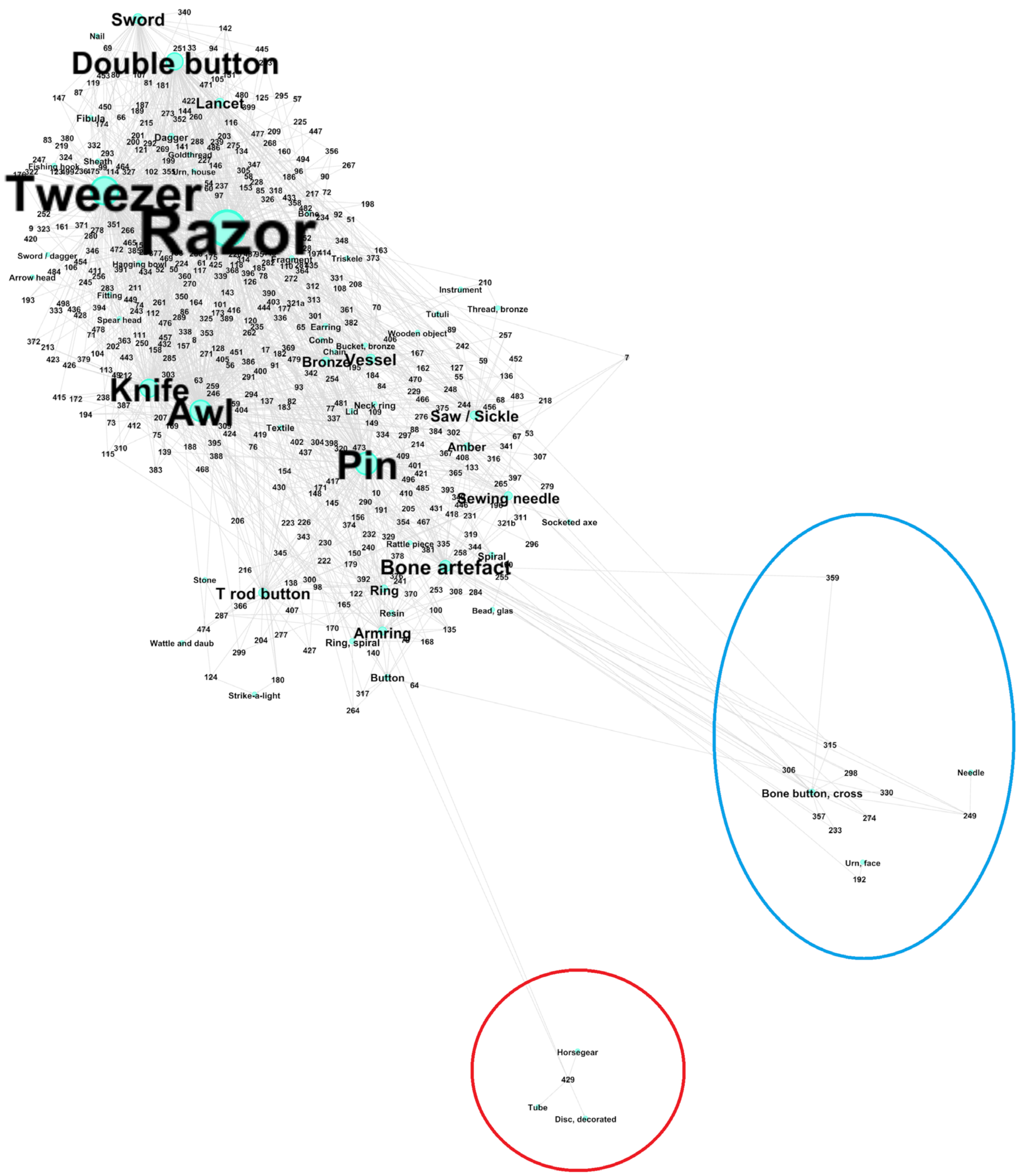


Figure 6: Network graph. Two-mode network based on 429 burials from the catalogue by Baudou (1960). Nodes represent burials and artefacts. Node size by in-degree. We see gendered groupings with a male sphere at the top of the graph and a lower, less-defined female sphere. Circles highlight graves and objects 'outside the norm'. A red circle marks a female grave with horsegear from Bevtoft, Haderslev (Baudou 1960: no. 429) and blue circles mark bone cross-buttons – a regional phenomenon in N/NW Jutland (layout: Open Order; software: Gephi; graphic: the author).

Network analyses

It is held here that identity (including gender) can be studied by examining the expression of sameness or difference in relation to others. In this case, it is done by applying network analyses that address the sameness and difference in grave artefact inventory. The resulting patterns can be interpreted as expressions of shared (or not shared) (gendered) identities.

The applied network analyses utilise two different force directed algorithms based on the same principles

(Jacomy *et al.* 2014; Martin *et al.* 2011).The patterns revealed by a force directed layout is based on the attraction of connected nodes and separation of unconnected nodes. This means that objects found together will group closer than objects not found together. The presented networks are two-mode networks consisting of two types of nodes represented in one network diagram. In this case, the two-mode networks offer an instant overview of any relationship between artefacts and graves and allow for detection of potential patterns (based on shared links and similarity (or not) with other nodes). The size of nodes in the network graphs are based on degree (i.e. the bigger the artefact type node, the more graves are found with this type of object).

The early NBA graves are visualised in a network graph (Fig. 5) that shows predefined gendered graves and their artefact associations. Gender-significant artefacts separate on each side of the graph with shared (unisex) types between them. Artefacts found in the female sphere are: rings, arm rings, arm bands, neck rings, neck collars, amber beads, glass beads, and belt plates. The arm ring is especially significant for the female graves (but is not exclusive to women). Artefacts found in the male sphere are: swords, axes, spears, belt hooks, strike-a-lights, razors, tweezers, chapes, and sheaths. Artefacts found in the 'unisex' zone are knives, daggers, pins, fibulae, finger rings, tutuli, and vessels (see also Felding and Stott 2023: 3).

The late NBA graves are visualised in the network graph (Fig. 6). The graph is dominated by the male artefacts of razors and tweezers but hints towards a gendered divide where weapons are separated from jewellery in the network. Interestingly, from the point of view of identity expressions, the graph demonstrates two groups of 'outliers' indicated with red and blue circles. The red circle represents the Bevtoft burial (a rare female grave with horse gear (Baudou 1960; catalogue no. 429). The blue circle highlights a regional variety of cross-shaped bone buttons commonly found in N /NW Jutland (Broholm 1949: 60).

The above network graphs have been able to detect sameness and differences in the grave inventory. Here this is seen as an indicator of shared (or not shared) group identities. This is of value for the following discussion of gender expressions based on material remains.

Discussion

Times of change?

As it happened very gradually, it not easy to pinpoint the origin of cremation rites in the north; what is nevertheless noteworthy is that the main part of the iconographic material remains the same (Goldhahn 1999; Kaul 2004: 187). Therefore, it is not apparent that it was not only outside factors that changed burial rites, but rather impulses from abroad which merged with an existing ideology (Kaul 2004: 234). The transformation period took a different form and had a different pace in different regions. It could take generations before burial practices changed fully (Rebay-Salisbury 2013: 21). The range of variation in the practice indicates that underlying ontologies were not fixed, but were under negotiation, and almost gives the impression of testing the new customs to see if they would fit in the lived lives of local Bronze Age societies. It was only at the end of the Bronze Age that there was a normative understanding of cremation rites (Sørensen and Rebay-Salisbury 2023). The main transitional period, however, was NBA III (*c.* 1300-1100 BCE), even though earlier examples of Bronze Age cremations are known (Kunwald 1955: fig. 22). During this time, different beliefs would intersect, be negotiated, and eventually resolved (Ahlqvist and Vandkilde 2018; Rebay-Salisbury 2013; Reiter *et al.* 2021; Sørensen 2010; Sørensen and Bille 2008). Studies show that the urn cremation tradition did not arrive as a 'full ideological package' that took place at one specific time in the transition between the Early and Late Nordic Bronze Age; it seems, rather, that it was a slow transition with regional variation (Hornstrup 1998; Reiter *et al.* 2021). Bodilsen has in her work also pointed out that the composition of archaeological assemblages shows continuity from NBA I -V, but with a visible break in this continuity from NBA VI onwards (Bodilsen 1987: 98).

Linking the transition to cremation rites with larger shifting networks of metal supply is tempting, yet there is no noticeable shortage of metals in cremation graves, as the latter still contain valuable bronzes (Felding 2022: 111). It has been put forward that in the time of change perhaps women may have been forerunners for new cremation rites. At Thy it was found that more women than men were cremated in NBA III (Hornstrup 1999: 114). However, such a trend was not observed when tested on burial assemblages from Vejle Amt (Felding 2022: 111). It must, therefore, be assumed that the transition happened at different paces in different regions. In this regard, it is crucial to consider the human actors that informed these transformation choices. Samantha Reiter and colleagues have pursued this view and examined the origin of the cremation rites in relation to in-migration but did not find a one-to-one relationship to support such a scenario (Reiter *et al.* 2021). It has also been noted that a strong connection between the appearance of metalworking and cremation rites appears almost simultaneously and the transformative power of fire must have had some ideological potency (Kaliff 2022: 84). The fire of cremation allows the dead to transform from one state to the other; by destroying the body, it is thought that one may free the soul (Kaul 2004: 235ff). Also, fire is closely linked to cultivation and the fertility of fields and pastures (Kaliff 2022). In an NBA context, fire can thus be linked to the powers of the sun, which in turn embody the cyclical, regenerative, and fertile ideology of the north.

It is debated whether the transition towards cremation rites should be seen as a sign of religious and ideological change. Several early scholars argue that such a transition should be viewed without an altered religious- or world-view (Childe 1944: 85-88; Clark 1960: 232; Kaul 2004; Piggot 1965). Others have highlighted that changes in mortuary practices would likely have been based on philosophical and/or religious factors (Carr 1995). Burial rites are visible in the archaeological record as part of the actual burials themselves. These are very tangible remains that hint towards the intangible and are often interpreted as signs of beliefs about an afterlife (Ucko 1969: 264) and perhaps even religion (Kaul 2004). The practices of inhumation and cremation are both practical (but very different!) responses to the reality of a dead body (Rebay-Salisbury 2013: 15). It is clear that the transformative power of fire is very striking and seemingly a sign of change. Nevertheless, the overall iconographic imagery throughout the Nordic Bronze Age remains focused on the same cyclical narrative of the sun (Kaul 2004: 369). Therefore, it is perhaps not a changed ideology or religion we observe in the transition between the early and late NBA (*c.* 1100 BCE) but rather a different way to 'free the soul' from its bodily domain. The deliberate actions which transformed the body into cremated remains indicate a shift in beliefs about what form the body should have after death, yet still demonstrate continued care for bodily remains (Rebay-Salisbury 2013: 21).

Gender as Material Expression in the Nordic Bronze Age

> '[Metallurgy] altered the material platform that inspired social identification' (Vandkilde 2014b: 73).

With the major influx of metal beginning *c.* 1600 BCE, bronze quickly became a pillar in NBA society and, thus, played a crucial part in forming the gendered material expressions in life and in death. The most significant artefact that appeared was the sword – a male-gendered object which, for the first time, was clearly designed for combat and which, furthermore, holds ideological connotations to warriorhood (Treherne 1995: 109). NBA weaponry was part of a shared transcultural interest in warrior representation in which the sword was pivotal to creating strong ties between warfare, warriors, and religious beliefs (Vandkilde 2014a; Vandkilde 2014b). Studies of early NBA weapon combinations in graves suggests that the type of weapon points to status and specialised roles in warfare (Felding *et al.* 2020), an aspect that may have been mirrored in the contemporary Valsømagle hoard (Vandkilde 2018: 89). In the late NBA, the sword took a smaller symbolic form and was diminished in the inventory. The razor and tweezer instead became marks of masculinity in a grave goods assemblage. Paul Treherne (1995) has viewed this as a focus on a specific form of masculine beauty related to the warrior ethos, where the (well-kept) body was central for the ideology encompassing a lifestyle of luxury and excess and bodily grooming – instead of just risk and violence (Treherne 1995: 123). Razors were essential for this ideology, but it was not their only function. Susanne Thedéen (2003) also viewed them as ritual artefacts that should not only be seen as part of warrior ideology but also as objects that would have been in use during shifting phases of the individual life course, i.e. the cutting of the umbilical cord, shaving the first beard growth, skin removal as part of ritual purification (e.g. circumcision), and the cleaning and preparation of a dead body before burial rites (Thedéen 2003: 112).

The archaeological assemblages of grave goods from the Bronze Age are overall male dominated. Based on this evidence, we see a male-dominated society which is hardly in accordance with lived life in the Bronze Age. So, what can we say about the women? Women are visible (yet in lesser numbers) in the early NBA burial record. When studied, they were found to have held significant status. A more nuanced gendered understanding appears in more detailed studies on a smaller scale. One example of such study found that the percentage of primary burials in mounds in the early NBA was equal between women and men (Felding 2020). Also, it was found that 38% of NBA II women were buried with weapons (daggers), a fact which was interpreted as a sign of women with high social and political status. Such interpretations can only be achieved when analysing archaeological contexts beyond grave inventories (e.g. burial position in the mound (Felding 2020; Felding and Stott 2023)).

A study of late NBA cremation burials from Funen (Skogstrand 2016: 58-59) indicates a 3:2 ratio of men to women, though both sexes are buried with equal amounts of objects. The study also showed that toiletry equipment and amber were exclusive to men and that most dress accessories (especially pins) were found in female burials. Of interest is the fact that men were buried significantly more often in mounds than women – who were instead commonly laid to rest in flat graves (Skogstrand 2016: 60).

Unfortunately, late NBA women are otherwise mostly invisible in the burial record due to the fragmented nature of remains and the overarching lack of gender-significant grave goods. If we seek a more gendered balance, we must turn to the depositions and include them in our discussion of Bronze Age society. The depositional record reveals that the male inventory dominated in the early NBA while a female dominance in deposition inventory can be seen from NBA III (*c.* 1300-1100 BCE) onwards (Bodilsen 1987: 95).

This rise in the depositional practice with dominant female characteristics demonstrates a strong link between women and the religious sphere of Bronze Age life. In his work, Kristiansen has interpreted this evidence as an indicator of women being increasingly engaged in important rituals and their jewellery reflecting their high ritual standing as symbolic protectors and ritual leaders (Kristiansen 2014: 341). Kristiansen (2014), however, regards the ritual significance of women only as protectors of out-going, sea-faring men about to embark on dangerous journeys. This argument is based on the depictions of thousands of ship motifs known from Scandinavian rock carvings. He further argues that ship ornaments on female jewellery connects ritual actions with the real sea-faring activities depicted in the rock art. Although this makes for a compelling narrative, I would like to separate the power of women from exclusive service to men and instead give them full merit as ritual specialists. The material evidence from the Nordic Bronze Age demonstrates that women held strong positions in society (Ahlqvist 2024). From the early NBA, women were buried with weapons, indicating social and political power, and they may have held more visible roles, i.e. as leading ritualist specialists in the late NBA.

Concluding thoughts

There is much to be gained in analysing past material culture through a gendered lens. It is, however, difficult to avoid the pitfalls of binary thinking and circular argumentation. Nonetheless, it is held here that by combining different scales and aspects – by studying the finer details within normative gender categories and comparing broader gendered categories – we gain better insights into how Bronze Age society was gendered and structured.

A gendered approach to the material record has revealed a difference in expression between women and men, but also found artefacts shared by both genders (and well as with children). A male presence dominated overall in the burial record in the Bronze Age, though a gendered balance can be obtained by incorporating further contexts, i.e. depositions and figurines that show strong female dominance and connections between women and religion in the late NBA. This is important not only because it adds contours to past lived experiences but also because it continues to reveal social differences that remain to be explored![1]

Bibliography

Ahlqvist, L. 2023. The Social Role of Nordic Bronze Age Visual Art: Perspectives from ornamented personal objects. Unpublished doctoral thesis, Aarhus University.

Ahlqvist, L. 2024. Reshaping Gendered Narratives: Reinterpreting Female Art, Identity and Social Change in the Late Nordic Bronze Age. *Norwegian Archaeological Review* 57(1): 1-18.

Ahlqvist, L. and H. Vandkilde 2018. Hybrid beasts of the Nordic Bronze Age. *Danish Journal of Archaeology* 7(2): 180-194.

Aner, E. And K. Kersten 1973. Frederiksborg und København Amt, in K. Kersten and K.-H. Willroth (eds) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E. And K. Kersten 1976. Holbæk, Sorø und Præstø Amter, in K. Kersten and K.-H. Willroth, (eds) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E. and K. Kersten 1977. Bornholms, Maribo, Odense und Svendborg Amter, in K. Kersten and K.-H. Willroth (eds) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E. and K. Kersten 1978. Südschleswig-Ost, in K. Kersten and K.-H. Willroth (eds) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E. and K. Kersten 1979. Südschleswig-West, in K. Kersten and K.H. Willroth (eds) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E. and K. Kersten 1981. Nordschleswig-Süd: Tønder, Åbenrå u. Sønderborg Amter, in K. Kersten and K.-H. Willroth (eds) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E. and K. Kersten 1984. Nordschleswig-Nord: Haderslev Amt, in K. Kersten and K.-H. Willroth, (eds) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E. and K. Kersten 1986. Ribe Amt, in K. Kersten and K.-H. Willroth (eds) *Die Funde der* älteren *Bronzezeit*

[1] This last sentence mirrors the comments added during the review process and, as such, I would like to express my gratitude to the reviewer, thank you.

des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen. Neumünster: Wachholtz Verlag.

Aner, E. and K. Kersten 1990. Vejle Amt, in K.-H. Willroth (ed.) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E. and K. Kersten 1991. Dithmarschen, in K. Kersten and K.-H. Willroth (eds) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E. and K. Kersten 1993. Kreis Steinburg, in K.-H. Willroth (ed.) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E. and K. Kersten 1995. Ringkøbing Amt, in K. Kersten and K.-H. Willroth (eds) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E., K. Kersten and K.-H. Willroth 2001. Thisted Amt, in K.-H. Willroth (ed.) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E., K. Kersten and K.-H. Willroth 2005. Kreis Rendsburg-Eckernförde (südlich des Nord-Ostsee-Kanals) und die kreisfreien Städte Kiel und Neumünster, in K.-H. Willroth (ed.) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E., K. Kersten and K.-H. Willroth 2008. Viborg Amt, in K.-H. Willroth (ed.) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E., K. Kersten and K.-H. Willroth 2011. Kreis Segeberg, in K.-H. Willroth (ed.) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster: Wachholtz Verlag.

Aner, E., K. Kersten and K.-H. Willroth 2014. Skanderborg und Aarhus Amter, in K.-H. Willroth (ed.) *Die Funde der* älteren *Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*. Neumünster/ Hamburg: Wachholtz Verlag.

Ansigh, P. And M. Rassmussen 1984. Regional variation i ældre bronzealder udtrykt gennem gravfundne bronzer i Sydvestdanmark og Sydslesvig, in E. Mikkelsen, D.S. Hjelvik and S. Welinder (eds) *Varia Det 4. Nordiske Bronzealdersymposium på Isegran 1984*: 42-66. Oslo: Universitetets Oldsaksamling.

Austvoll, K.I., P.D. Frederiksen, A.L. Melheim, L. Prøsch-Danielsen and L. Skogstrand 2020. Time, Ritual, and Encounters in the Nordic World: An Introduction, in K.I. Austvoll, M.H. Eriksen, P.D. Frederiksen, A.L. Melheim, L. Prøsch-Danielsen and L. Skogstrand (eds) *Contrasts of the Nordic Bronze Age. Essays in Honour of Christopher Prescott*: 15-28. Turnhout: Brepols.

Baudou, E. 1960. *Die regionale und chronologische Einteilung der jüngeren Bronzezeit im Nordischen Kreis*. Stockholm: Acta Universitatis Stockholmiensis.

Bech, J.-H., M. Rasmussen, J. Olsen and M. Kanstrup 2018. Thy and the outside world in the Bronze Age. Regional variations in a North Sea perspective, in J.-H. Bech, B.V. Eriksen and K. Kristiansen (eds) *Bronze Age Settlements and Land-Use in Thy, Northwest Denmark, Vol I*: 25-106. Højbjerg: Jutland Archaeological Society.

Beck, M.R. 2018. Bronzealderens firstmovers – gravhøjen ved Kalvehavegård. *Cartha*: 27-41.

Bergerbrant, S. 2007. *Bronze Age Identities: Costume, Conflict and Contact in Northern Europe 1600-1300 BC*. Lindome: Bricoleur Press.

Bergerbrant, S. 2014. Ordinary or Extraordinary? Redressing the Problem of the Bronze Age Corded Skirt. *Current Swedish Archaeology* 22: 73-96.

Bergerbrant, S., L.B. Jørgensen and S.H. Fossøy 2013. Appearance in Bronze Age Scandinavia as Seen from the Nybøl burial. *European Journal of Archaeology* 16(2): 247-267.

Bodilsen, I. 1987. Enkeltfund – votivfund i dansk bronzealder. *Kuml* 35: 87-102.

Boye, V. 1986 (1896). *Fund af Egekister fra Bronzealderen i Danmark*. Aarhus: Aarhus Stiftsbogtrykkeri.

Broholm, H.C. 1949. *Danmarks Bronzealder. Danmarks kultur i den yngre bronzealder*. København: Nyt Nordisk Forlag (Arnold Busck).

Broholm, H.C. and M. Hald 1935. Danske Bronzealders Dragter. *Nordisk Fortidsminder* 2(5): 215-347.

Broholm, H.C. and M. Hald 1939. *Skrydstrupfundet en sønderjydsk kvindegrav fra den ældre bronzealder*. København: Nordisk Forlag.

Carr, C. 1995. Mortuary Practices: Their Social, Philosophical-Religious, Circumstantial, and Physical Determinants. *Journal of Archaeological Method and Theory* 2(2): 105-200 (available at: http://www.jstor.org/stable/20177326).

Childe, V.G. 1944. *Progress and Archaeology*. London: Watts.

Clark, G. 1960. *Archaeology and society; reconstructing the prehistoric past*. London: Methuen.

Felding, L. 2020. One Ring to Rule Them All? Appearance and Identity of Early Nordic Bronze Age Women. *Praehistorische Zeitschrift* 95: 422-446 (available at: https://doi.org/10.1515%2Fpz-2020-0029).

Felding, L. 2022. Relational Approaches to Gender, Identity and Mobility in the Southern Early Nordic Bronze Age. Unpublished doctoral thesis, Aarhus University.

Felding, L., S. Reiter, K.M. Frei and H. Vandkilde 2020. Male Social Roles and Mobility in the Early Nordic Bronze Age. A Perspective from SE Jutland. *Danish*

Journal of Archaeology 9(1): 1-167 (available at: https://doi.org/10.7146%2Fdja.v9i0.117955).

Felding, L. and D. Stott 2023. What a Mesh: Network Approaches to Nordic Bronze Age Identity and Regionality. *Offa* 78, 2021: 131-154.

Feveile, C. And P. Bennike 2002. Lustrupholm – Et brandgravsfelt fra ældre bronzealder under flad mark. *Kuml* 2002: 109-141.

Frei, K.M., U. Mannering, I.V. Berghe and K. Kristiansen 2017. Bronze age wool: provenance and dye investigations of Danish textiles. *Antiquity* 91(357): 640-654.

Frieman, C.J., A. Teather and C. Morgan 2019. Bodies in Motion: Narratives and Counter Narratives of Gendered Mobility in European Later Prehistory. *Norwegian Archaeological Review* 52(2): 148-169.

Goldhahn, J. 1999. *Sagaholm: hällristningar och gravritual*. Jönköping: Tryckeri AB Småland Quebecor.

Harvig, L. 2017. Land of the Cremated Dead, in J.I. Cerezo-Roman, A. Wessman and H. Williams (eds) *Cremation and the Archaeology of Death*: 231-249. Oxford: Oxford University Press.

Holst, M.K. and M. Rasmussen 2013. *Skelhøj and the Bronze Age Barrows of Southern Scandinavia: Vol. I. The Bronze Age barrow tradition and the exchange of Skelhøj*. Aarhus: Jutland Archaeological Society.

Horn, C. 2017. It's a mans world? Sex and gender in Scandinavian Bronze Age rock art, in S. Bergerbrant and A. Wessman (eds) *New Perspectives on The Bronze Age. Proceedings of the 13th Nordic Bronze Age Symposium held in Gothenburgh 9th to 13th June 2015*: 237-252. Oxford: Archaeopress.

Hornstrup, K.M. 1998. Overgangen fra ældre til yngre Bronzealder. Et eksempel fra Nordvestjylland, Danmark, in T. Løken (ed.) *Bronsealder i Norden - Regioner og interaksjon. Foredrag ved det 7. nordiske bronsealdersymposium i Rogaland 31. August - 3. September 1995*: 23-34. Stavanger: Arkeologisk museum i Stavanger.

Hornstrup, K.M. 1999. Brandgravene fra yngre bronzealder. Muligheder og perspektiver. *Kuml* 1999: 99-142 (available at: https://tidsskrift.dk/kuml/article/view/113609).

Jacomy, M., T. Venturini, S. Heymann and M. Bastian 2014. ForceAtlas2, a continuous graph layout algorithm for handy network visualization designed for the Gephi software. *PLoS One* 9(6): e98679 (available at: https://doi.org/10.1371/journal.pone.0098679).

Jensen, J. 1998. *Manden i kisten: hvad bronzealderens gravhøje gemte*. København: Gyldendal.

Kaliff, A. 2022. Cremation and Cultivation in the North, in A. Kaliff and T. Oestigaard (eds) *Indo-European Fire Rituals. Cattle and Cultivation, Cremation and Cosmogony*: 83-108. London: Routledge.

Kaul, F. 2004. *Bronzealderens religion. Studier af den nordiske bronzealders ikonografi*. Copenhagen: Det Kongelige Nordiske Oldskriftselskab.

Kristiansen, K. 1984. Krieger und Häuptlinge in der Bronzezeit Dänemarks. Ein Beitrag zur Geschichte des bronzezeitlichen Schwertes. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz* 31: 187-208.

Kristiansen, K. 2002. The tale of the sword - sword and swordfighters in Bronze Age Europe. *Oxford Journal of Archaeology* 21(4): 319-332.

Kristiansen, K. 2007. The Rules of the Game. Decentralised Complexity and Power Structures, in S. Kohring and S. Wynne-Jones (eds) *Socialising Complexity: Structure, Interaction and Power in Archaeological Discourse*: 60-76. Oxford: Oxbow Books.

Kristiansen, K. 2014. The dialectics of gender: Ritualizing gender relations in Late Bronze Age southern Scandinavia, in A. Andreeff, H. Alexandersson and A. Bünz (eds) *Med hjärta och hjärna: En vänbok till professor Elisabeth Arwill-Nordbladh*: 339-354. Göteborg: University of Gothenburg.

Kristiansen, K. 2018. Warfare and the Political Economy: Europe 1500-1100 BC, in C. Horn and K. Kristiansen (eds) *Warfare in Bronze Age Society*: 23-46. Cambridge: Cambridge University Press.

Kunwald, G. 1955. *De ældste vidnesbyrd om ligbrænding i Danmarks oldtid*. København: C. Hamburger.

Kveiborg, J. 2019. Traversing Sky and Earth. The Nordic Bronze Age horse in a long-term perspective. *Praehistorische Zeitschrift* 93(2): 225-264.

Ling, J., T.K. Earle and K. Kristiansen 2018. Maritime Mode of Production. Raiding and Trading in Seafaring Chiefdoms. *Current Anthropology* 59: 488-524 (available at: https://doi.org/10.1086/699613).

Madsen, O. And J. Davidson 1989. Grønlund. En høj med kammergrav og andre grave fra bronzealderen. *Kuml* 36: 97-118.

Mannering, U. 2017. Forhistorisk dragt, in U. Mannering (ed.) *Arkæologisk Tekstilforskning. Baggrund og Ny Viden*: 5-44. København: Nationalmuseet, Danmarks Grundforskningsfonds Center for Tekstilforskning.

Martin, S., W.M. Brown, R. Klavans and K.W. Boyack 2011. OpenOrd: an open-source toolbox for large graph layout, in P.C. Wong, J. Park, M.C. Hao, C. Chen, K. Börner, D. Kao and J.C. Roberts (eds) *Visualization and Data Analysis 2011. Proceedings Volume 7868*. Bellingham: Society of Photo-Optical Instrumentation Engineers (SPIE) (available at: https://www.spiedigitallibrary.org/).

Pape, E. and N. Ialongo 2023. Error or Minority? the Identification of Non-binary Gender in Prehistoric Burials in Central Europe. *Cambridge Archaeological Journal* 23(3): 43-63.

Piggot, S.P. 1965. *Ancient Europe from the Beginnings of Agriculture to Classical Antiquity. A Survey*. Edinburgh: Edinburgh University Press.

Rebay-Salisbury, K. 2013. Inhumation and cremation: how burial practices are linked to beliefs, in M.L.S. Sørensen and K. Rebay-Salisbury (eds) *Embodied Knowledge. Historical Perspectives on Belief and Technology*: 15-26. Oxford: Oxbow Books.

Reiter, S., N.A. Møller, B.H. Nielsen, J.-H. Bech, A.-L. H. Olsen, M.L. Jørkov, F. Kaul, U. Mannering, and K.M. Frei 2021. Into the fire: Investigating the introduction of cremation to Nordic Bronze Age Denmark: A comparative study between different regions applying strontium isotope analyses and archaeological methods. *PLoS One* 16(5): e0249476 (available at: https://doi.org/10.1371/journal.pone.0249476).

Rose, H.A. and J. Meadows 2024. Dividing time – An absolute chronological study of material culture from Early Iron Age urnfields in Denmark. *PLoS One* 19(5): 1-55 (available at: http://dx.doi.org/10.1371/journal.pone.0300649).

Sarauw, T., P.T. Hadsund and H. Lukesova 2023. The Hoard from Bækkedal in Northern Denmark and the Use of Two-Horse Teams in the Late Nordic Bronze Age. *Acta Archaeologica* 93(2): 339-402 (available at: https://doi.org/10.1163/16000390-09302041).

Skogstrand, L. 2016. *Warriors and other men: notions of masculinity from the late Bronze Age to the early Iron Age in Scandinavia*. Oxford: Archaeopress.

Sørensen, M.L.S. 1997. Reading Dress: The construction of social categories and identities in bronze age Europe. *Journal of European Archaeology* 5.1: 93-115.

Sørensen, M.L.S. 2010. Bronze Age bodiness – maps and coordinates, in K. Rebay-Salisbury, M.L.S. Sørensen and J. Hughes (eds) *Body Parts and Bodies Whole: Changing Relations and Meanings*: 54-63. Oxford: Oxbow Books.

Sørensen, M.L.S. and K. Rebay-Salisbury 2023. *Death and the Body in Bronze Age Europe: From Inhumation to Cremation*. Cambridge: Cambridge University Press (available at: https://doi.org/DOI: 10.1017/9781009247429).

Sørensen, T.F. and M. Bille 2008. Flames of Transformation: The Role of Fire in Cremation Practices. *World Archaeology* 40(2): 253-267.

Thedéen, S. 2003. Life Course Practices in Bronze Age Landscapes of East Central Sweden. Beyond Divine Chiefs and Neodiffusionism. *Current Swedish Archaeology* 11, 97-118.

Thomsen, T. 1929. Egekistefundet fra Egtved fra den ældre Bronzealder. *Nordisk Fortidsminder* II(4): 165-214.

Thrane, H. 1965. De første broncebidsler i Mellem- og Nordeuropa. *Aarbøger for Nordisk Oldkyndighed og Historie*: 50-92.

Thrane, H. 2019. Lusehøj at Voldtofte, South East Funen in its chorological setting-the best parallel for Seddin?, in S. Hansen and F. Schopper (eds) *Der Grabhügel von Seddin im norddeutschen und südskandinavischen Kontext: internationale Konferenz, 16. bis 20. Juni 2014, Brandenburg an der Havel : gemeinsame Veranstaltung des Excellence Clusters TOPOI, des Brandenburgischen Landesamtes* für *Denkmalpflege und Archäologischen Landesmuseums und der Eurasien-Abteilung des Deutschen Archäologischen Instituts*: 91-104. Wünsdorf: Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum.

Treherne, P. 1995. The Warrior's Beauty: The Masculine Body and Selv-identity in Bronze Age Europe. *Journal of European Archaeology* 3(1): 105-144.

Ucko, P.J. 1969. Ethnography and archaeological interpretation of funerary remains. *World Archaeology* 1(2): 262-280.

Vandkilde, H. 2006. Warfare and Gender according to Homer: An Archaeology of an Aristocratic Warrior Culture, in T. Otto, T. Henrik and H. Vandkilde (eds) *Warfare and Society. Archaeological and Social Anthropological Perspectives*: 515-528. Aarhus: Aarhus University Press.

Vandkilde, H. 2014a. Breakthrough of the Nordic Bronze Age: Transcultural Warriorhood and a Carpathian Crossroad in the Sixteenth Century BC. *European Journal of Archaeology* 14: 602-633.

Vandkilde, H. 2014b. Cultural Perspectives on the Beginnings of the Nordic Bronze Age. *Offa* 67/68: 51-77.

Vandkilde, H. 2016. Bronzization: The Bronze Age as Pre-Modern Globalization. *Praehistorische Zeitschrift* 91(1): 103-123.

Vandkilde, H. 2018. Violent Beauty in the Bronze Age, in S. Hansen and R. Krause (eds) *Bronze Age Hillforts Between the Taunus and Carpathian Mountains. Proceedings of the First International LOEWE Conference, 7-9 December 2016 in Frankfurt/M*: 83-101. Bonn: Verlag Rudolf Habelt: 83-101.

Varberg, J. 2005. Resenlund og Brøndumgård bronzedepoter–Kult og samfund i yngre bronzealder. *Kuml* 54: 75-119.

Verlaeckt, K. 2000. Hoarding and the circulation of metalwork in Late Bronze Age Denmark: quantification and beyond, in C.F.E. Pare (ed.) *Metals Make the World Go Round: the Supply and Circulation of Metals in Bronze Age Europe*: 194-208. Oxford: Oxbow Books.

Chapter 21

What bronze can't buy? The morality and ethics of metalwork destruction and deposition in Bronze Age Britain

Neil Wilkin

Department of Britain, Europe & Prehistory, The British Museum, London, UK
nwilkin@britishmuseum.org

Abstract

In the modern world, dominated as it increasingly is by the invasive and triumphant attitudes and reach of economic markets, it is easy to overlook the girding role of moral values. Some economists and political philosophers now claim that, for balance to be restored, 'market societies' must shift back towards being 'market economies', while conceding that social values and market forces are, ultimately, deeply intertwined. The growing appreciation of the overlapping spectra of economic, social and spiritual values mirrors recent developments in how prehistorians think about metalwork deposition in north-west Europe during the Bronze Age. Models involving simple binaries between utilitarian and spiritual explanations for destruction and deposition are long gone. Notably, David Fontijn forwarded the important concept of 'keeping while destroying' to help explain the rationale behind the sacrifice of material and economic valuables by recognising the creation of social and 'moral' meaning and value(s) that could be achieved in the process. This chapter uses the evidence for metalwork destruction and deposition during the British Bronze Age to define and develop the concepts of 'morality' and 'ethics' as important, archaeologically visible, motivations underpinning depositional behaviours. It makes a case for how morality can be related to the universal notion of 'rites of passage' and the idiom of 'rebounding violence' developed by the anthropologist Maurice Bloch. This concept offers prehistorians a way of connecting the role of rites of passage in the creation of power and authority and the acts of violence wrought upon so much Bronze Age metalwork during the mid to late second millennium BCE.

Introduction

The study of Bronze Age metalwork in Britain has reached a significant threshold. In England and Wales, the *Portable Antiquities Scheme* has overseen impressive increases in metalwork data that have contributed to a new wave of studies (cf. Griffiths 2023; Knight 2019; 2022; Murgia *et al.* 2014; Wiseman 2018). However, the growth in new datasets and analyses has served to highlight the weakness of existing explanatory frameworks for what the patterning evident in metalwork association and deposition 'meant' or 'did' in socio-political and religious terms during the Bronze Age (Bradley 2017: 1-7; Fontijn 2020; Griffiths 2023: 196-201). This contribution proposes some ways of approaching this problem anew.

Across Europe, the development of interpretative approaches to Bronze Age metalwork deposition have traditionally lagged behind discourse on the social, political and cosmological significance of burial rites and funerary monuments. The study of grave goods and mortuary practices broke new ground in the British post-processual zenith of the late 1980s and 1990s, stimulated by the exciting influences of anthropological, ethnographic and sociological thinking (cf. Chapman *et al.* 1981; Cooper *et al.* 2022: 33-7; Parker Pearson 1999). Early Bronze Age single burials and related barrow monuments came to be understood as arenas of (and for) transformation and reconstitution, where transcendental powers could have real-world influence on the course of socio-political life (e.g. Barrett 1994; Garwood 1991; Thomas 1991). Underpinning these approaches were close readings of anthropological work on the character and structure of ritual practice and process (e.g. Bloch and Parry 1982; Metcalf and Huntingdon 1991; Turner 1969).

By comparison, Bronze Age metalwork studies were slower to develop along theoretical lines, in part due to their strongly metallurgical, typological and 'economic' character (cf. Sørensen 2015; but with notable exceptions, e.g. Cowie 1988; Needham 1988; 2001). Explanations instead tended to follow relatively simplistic and binary oppositions in which ritual stood for esoteric and 'irrational' behaviour opposed to more functional, economic and 'rational' acts (cf. Bradley 2005; Brück 1999; Garwood 2011). Fontijn described the two resulting approaches thus: '[o]ne focuses on political economies and sees metalwork as prestigious valuables, the access to which was key to power. The alternative [approach] sees metal primarily as cultural valuables that were crucial in upholding an encompassing social, cultural and moral whole' (2020: 1). Fontijn noted that the result had been a 'confusing deadlock' (2020: 12).

In recent years researchers have begun to address this stalemate by charting the complex relationships

Table 1: David Fontijn's scheme showing the varying qualities of 'political' vs 'moral' economies (reproduced after Fontijn 2020: table 1.1).

'Political economies' tend to emphasize:	'Moral economies' tend to emphasize:
Value as quantifiable	Value as qualities
Value as price	Cultural values
Ends	Means
Action	The 'right'/appropriate action
Individual competition	Collectivity
Maximization of individual gain (power)	(Maintenance of) cultural/religious values, morality
Interaction between individuals	Society at large (including ancestors, supernatural entities)
Supra-regional scale	Regional/local scale

between economic/uneconomic exchanges and the inalienable/alienable qualities that resulted in the creation of 'value' and 'virtue' through metalwork deposition during the European Bronze Age (e.g. Fontijn 2002; 2020; Needham 1988; 2000; 2001; Vandkilde 2016; 2017). As in the development of funerary archaeology's theoretical maturity, anthropological and sociological studies have been brought centre-stage, especially those examining the relationships between economic and cultural spheres in the creation of 'value' (e.g. Godelier 1999; Graeber 2005; Lambek 2008; Mauss 1990). Instead of the ritually attuned reorientation applied to funerary studies, the new paradigm saw economic matters being balanced with broad cultural affairs to better explain metalwork deposition. Interestingly, despite foundational sociological contributions by the likes of Max Weber (1959 [1905]) and Émile Durkheim (2019 [1957]), which revealed the interleaving of explicitly religious, moral and ethical matters with economic life, contemporary social scientists (and by extension archaeologists) have generally shown a lack of interest in these matters. In prehistoric archaeology, decades of relatively abstract typological study on one hand and disconnected theoretical debate on the other, have arguably stripped the Bronze Age of much of its ethical and moral substance. Those dimensions of life must have existed four millennia ago – even if they are difficult to access today or were characterised by very different values, principles and logics to our own.

'Morality' and the challenges of archaeological interpretation

In *Economies of Destruction* (2020), David Fontijn drew on anthropological and sociological work (e.g. Bloch and Parry 1982; Graeber 2005; Lambek 2008) to fore-front the concept of 'moral economies' (MEs) which he perceived as existing in balanced or complementary opposition to 'political economies' (PEs) (Table 1). For Fontijn (2020: 1-17), the two economic models existed in tension along several important lines: individuality vs. collectivity, objective or quantifiable properties vs. subjective qualities; value as prices vs. cultural value. He argued that PEs led to the maxim of individual gains and accruement of power while MEs (despite their suggestive name) allowed for the maintenance of a wide range of cultural and religious values alongside aspects of morality (2020: 12-13). Among the oppositions and tensions that Fontijn perceived between PEs and MEs, a notable distinction occurred in their operative scale: PEs, he believed, worked at a 'supra-regional' scale, while MEs were best understood at a 'regional and local' scale (2020: 13). Fontijn argued that the resulting duality between the two kinds of economies was a (if not *the*) defining characteristic of Bronze Age social, cosmological and economic life. Drawing on Lambek (2008), he concluded that: '[t]o achieve something in society, something else must be given up. Value, in a way, is created by giving up that which is valuable' (Fontijn 2020: 172). The destruction and deposition of metalwork in acts of conspicuous consumption was therefore central to the creation of social power by certain individuals, notably leaders or chiefs but also (and equally importantly in this symmetrical view of the compulsion to deposit) to upholding social equality and a sense of social justice, fairness and morality. This double/balanced purpose is central to Fontijn's (2020) thesis in *Economies of Destruction* but the mechanism or processes by which it worked in social or ritual terms often remain just beyond the reader's grasp.

One repercussion of the dual-strand model between PEs and MEs is that Fontijn must keep the two rationales separate, highlighting their independence in certain ways and contexts, while exploring other (paradoxical) ways in which they existed in an interwoven and dialectical relationship. This causes some difficulties. Although Bronze Age political life is understood to be inextricably linked to access to transcendental powers (as a means of bestowing power on chiefs or leaders, for example), Fontijn undertook a more complex balancing of PE and ME to understand the exchange in the opposite direction. He rejected the usually assumed (relatively vague and simplistic) counter-gift of favours and fortune provided by transcendental powers on the grounds that this is open to socio-political interpretation and manipulation. Fontijn, drawing on Mauss (1990) and other social theories to define a more socially sophisticated approach, addressed the problem thus: '...with human-supernatural gift exchange, it remains unclear what the counter-gift from the supernatural [would be]. Giving to a "greater good" therefore may primarily have been conceived as a moral act: one gave up something because one thought one should.' (Fontijn 2020: 59). Here, offerings to transcendental powers are deemed a matter of exchange untainted by political or other selfish motivations ('...they were perceived as inalienable possessions of gods or spirits from the very beginning' (Fontijn 2020: 60)), a point that can, however, be contested using ethnographic parallels (Bradley 1998: 138; cf. Bloch 1992; Wengrow 2003: 305-306). As will be argued in the second half of this chapter, the 'counter-gift' on offer and the double/balanced (sometimes seemingly paradoxical) purpose of deposition can be more elegantly explained in terms of Bloch's (1992) idiom of 'rebounding violence', whereby sacrifices undertaken in the course of rites of passage can be understood as a means of creating socio-political power *and* transcendent 'vitality' without the need to constantly interpret and maintain the precarious PE/ME duality.

Defining and 'seeing' morality and ethics in prehistoric archaeology

The anthropologist Raymond Firth defined morality as a 'set of principles' on which 'judgement' about what was 'right and wrong' were based. Firth noted the socially specific character of these judgements and stated that 'for each society, such rules, the relevant conduct and the associated judgements, may be said to form a moral system' (cited in Cook 1999: 125). The terms 'morals' and 'ethics' are frequently used interchangeably. The concept of 'morals' can, however, serve to describe more personal, individualistic, notions of right and wrong, pitched against (e.g. an institution's) more widely accepted 'ethics' or ethical codes. It is likely that the individualism of the present-day Global North was less prominent during later prehistoric Europe, where there is good evidence for the more relational construction of identities (e.g. Brück 2004; Fowler 2013). However, it is important to allow for the agency of individuals (or communities) to express themselves through variations in depositional acts that may reveal 'moral' differences.

Despite the lack of attention given to the prospect of prehistoric morality and ethics, it seems fairly obvious that taking material possessions out of socio-cultural circulation through acts of alienation is at root an act that had moral and ethical consequences. It represents the moment a judgement was made, one that denied ownership or possession by others and the possibility of inheritance through kinship or other social ties, even if this judgement was only temporary, pending later recovery (cf. Needham 2001). As museum workers are only too aware, the 'acquisition', 'registration' and 'disposal' of objects is fraught with requirements for consent, approval and the correct 'rights' and procedures, and this concept is a key feature of legal and moral systems pertaining to property and ownership around the world and through time (cf. Durkheim 2019 [1957]: 142-154). The inheritance of metalwork is another area that has received relatively little attention. As Durkheim noted, citing John Stuart Mill, regarding rights to inherit wealth or property, 'limitation is needed, precisely because it is neither moral nor socially desirable for [people] to get richer in this way without any effort of their own' (2019 [1957]: 133). This simple but powerful observation appears to have been overlooked in much of the discussion around the rationale and meaning of Bronze Age metalwork destruction and deposition to date. It provides a way of rethinking some of the communal characteristics that have been highlighted in previous studies, a point further developed below.

Thus, the very nature of these hoards as disposed of and often damaged or destroyed artefacts has perhaps for too long been accepted as a neutral matter. In fact, it could be their central, key quality: a person or community had (or claimed) the socio-cultural right to dispose of these objects and in the process created ripples of consequence in terms of the potential to repossess them later, all of which are moral and ethical matters.

One of the most striking features of the metalwork data is the regularity with which hoards conform to a range of patterns that allow them to be described as coherent, predictable, 'traditions', 'assemblages' and 'horizons' (cf. Griffiths 2023; Needham 2017). Researchers have long charted the patterning, composition, layout and landscape settings of British Bronze Age metalwork deposits (e.g. Dunkin *et al.* 2020; Needham 1988; 2001; 2017; Wilkin 2017), and these patterns have the potential to reveal framework of a Bronze Age ethical behaviour, as it changed or varied through both space and time. Thus, the strong tendency for typological and compositional (pattern-oriented) approaches in metalwork studies may tend towards something valuable and intuitive: the material manifestation of clear moral or ethical concerns as opposed to opaque (or irrational) motivations for the behaviour that leads to archaeologically detectable patterning in the record. Indeed, the concept of an 'ethical code' is close to Fontijn's (2020: 12-13, 25-26) thinking on the 'right way' of 'acting' or 'doing' things with Bronze Age metalwork in terms of its treatment and deposition.

Unsurprisingly, detailed examples of moral or ethical behaviour expressed through Bronze Age metalwork deposition – as distinct from broader cultural and religious motivations bundled under Fontijn's MEs category (Table 1) – are rare. One example is, however, given by Fontijn (2020: 26): during the Dutch and Belgian Late Bronze Age (LBA) weapons were no longer deposited in graves but were, instead, placed in watery locations in the wider landscape. This, he argued, could be understood in terms of moral conventions or 'rules' about the separation of martial ideas and identities from the funerary sphere (cf. Cooper *et al.* 2022: 83-85; Vandkilde 2024: 351). The paucity of worked examples of how morality and ethics might have actually applied in the Bronze Age metalwork deposition (beyond the conceptual) creates the need for some basic groundwork. There are three broad scales at which questions can be posed:

1. *Hoards/deposits at intra-regional scales*: can the treatment, combination and composition at the level of single hoards or deposits be understood as morally or ethically charged acts, either as nuanced or particular statements (e.g. rejections of martial values or widely accepted moral concepts) or as building blocks of the principles and codes seen at regional scales?
2. *Typological/treatment at regional scales*: can patterning in treatment and typology at inter- and intra-regional scales relate to principles regarding what objects were 'right' and 'wrong' for deposition and reveal moral or ethical principles or codes accepted at a regional scale?
3. *Economic at supra-regional scales*: can the deposition of metalwork be understood in terms of the large-scale moral system or ethic code of communities in Bronze Age Britain and beyond, and how this varied through space and time – how might this draw forth the moral and ethical implications of nationwide fluctuations (including notions of 'boom' and 'bust') in bronze circulation and supply?

If a stronger case for revealing the ethical and moral component underlying the rationale for metalwork deposition is to be made, real-world examples are needed.

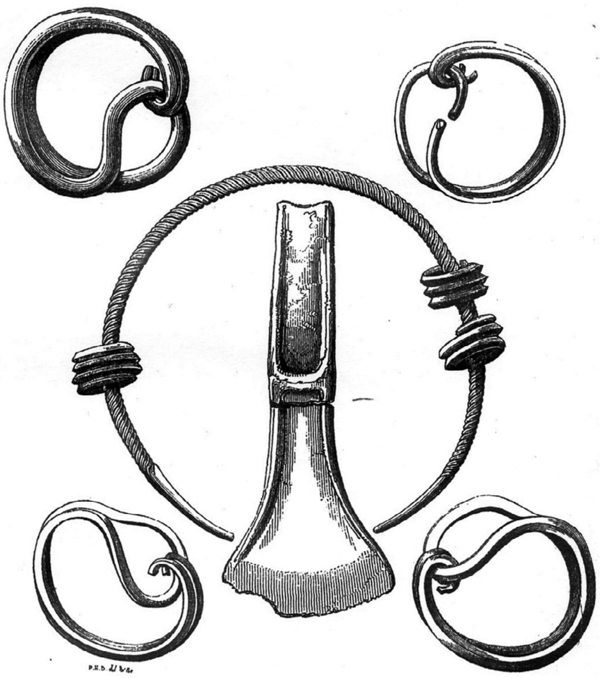


Figure 1: The Middle Bronze Age ornament hoard from Hollingbury, Sussex (image: *Archaeological Journal* 1848).

The 'harmony' of British Middle Bronze Age hoards

Stuart Needham (2001) recognised the potential for the 'right way to act' to be materially manifest through metalwork deposition when he observed the repeated and often balanced patterning and careful layout of many Middle Bronze Age (MBA) Taunton period hoards (*c.* 1400-1275 BCE) from southern England (Fig. 1). He suggested some hoards could mark social and ideological unions or marriages and speculated that hoard recovery may have been premeditated to occur, for example, upon the birth of a healthy child (Needham 2001: 292). Although this example was a thought experiment, intended to demonstrate the potential for the archaeological recovery of hoards to be predetermined by a range of complex socio-cultural factors, the scenario raises some important interpretative points. One is that both the deposition (and recovery) of hoards could have been interwoven with the perceived 'success' and 'failure' of a range of social enterprises and ventures that were based upon judgements about what was 'right' and 'wrong'. This point can be explored through case-studies of MBA hoards from southern England which frequently show evidence for careful composition patterning, object combination and spatial arrangement (cf. Needham 2001; Roberts 2007; Wilkin 2017).

Figure 2: The Middle Bronze Age tool, ornament and weapon hoard from Stalbridge, Dorset (image: PAS/Surrey County Council, CC BY-SA 2.0).

Local and foreign: The Stalbridge hoard, Dorset

The Stalbridge hoard consists of a rare solid-hilted rapier, bronze arm-ring/bracelet and palstave (Fig. 2) (Maslin 2020), found close to the River Stour, which drains into the English Channel, over 50 km to the south. The rapier is likely to be a French import, comparable to 'épées garde en crocs trilobée', such as Mon-Saint-Aignan (Dumont and Logel 2018; O'Connor 1980: fig. 24, 10). The thick decorated bracelet/armring belongs to a class of ornaments ('Liss type') that is well known from southern England (O'Connor *et al.* 2017; Needham and Stevenson 2021: 606-612; Roberts 2007), but the detailed typology of the Stalbridge bracelet is rare in southern England. It, too, may be a French import to England (Brendan O'Connor pers. comm.; cf. Nordez 2019). It is therefore a kind of hybrid object, exposing the complexity and need for negotiation and interpretation within the concept of local/foreign as understood during the Bronze Age (Fontijn and Roymans 2019). The palstave, on the other hand, is a distinctively local type. The combination of tool, weapon and ornament categories, present in balanced numbers is a convention now recognised in a range of Taunton period hoards (Wilkin 2017: 28-29, table 2.2).

The Stalbridge hoard therefore brings together objects with different degrees of foreign-ness: one (the rapier) novel on broad typological grounds, one (the thick, decorated bracelet/armring) is known as a general artefact class but is rarer in this particular typological form, and one (the palstave) of a type very familiar to communities in the south-west of England. Fontijn argued that the deposition of local and foreign blends within Bronze Age hoards was 'an important axis organising selective deposition' (2020: 36), one he thought became particularly important after the pan-European trade in bronze was underway (Vandkilde 2016). Plenty of attention has been given to the cosmological potential of 'foreign' or highly travelled objects in these local settings (e.g. Fontijn 2020; Needham 2000; Vandkilde 2017), it is also possible to consider this depositional convention in terms of what was 'right' and 'wrong' within the economic consumption and circulation of metal(-work). In contemporary politics, attitudes to outsiders are a touchstone of moral debate:

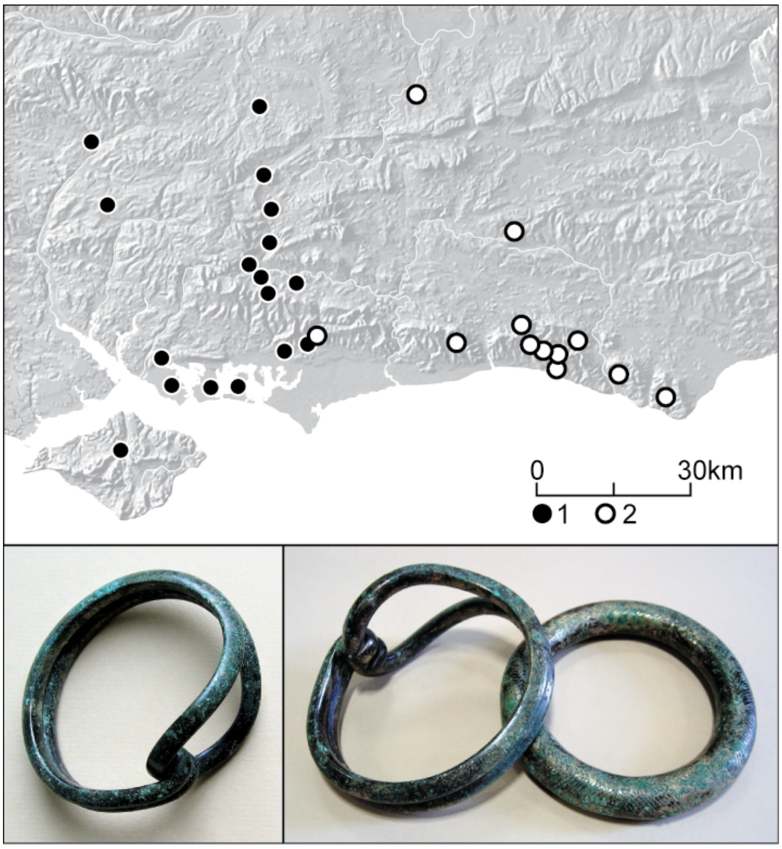


Figure 3: Map of relationship between Sussex Loops and Liss type bracelets (image: Craig Williams after Needham and Stevenson 2021: fig. 20.27) Key: 1) Liss-type bracelet/armring; 2) Sussex Loop; note that the bottom left image shows a Sussex Loop and the bottom right image shows the unusual combination of Liss-type and Sussex Loop bracelet at Chalkpit Lane.

immigration, gentrification and the socio-economic implications of 'Brexit' are just three examples of issues that preoccupy the news cycle and divide social opinion in the UK. These attitudes and debates can extend to material culture too. Boycotts and official sanctions on goods or services produced or associated with controversial nation states, corporations or even individuals (e.g. 'tech' billionaires) are increasingly common (e.g. Carney 2021; Sacks 2020; Sandel 2012).

What does this mean for hoards like Stalbridge? In bringing together 'local' and 'foreign' metalwork (and, indeed, gradings or hybrids within those categories) in balanced numbers for deposition, communities may have sought to find harmonious relationships between tensions brought into being by the economic currents of their lives. As argued in the second half of this contribution, this approach is connected to the role and purpose of ritual practice and process.

Boundary objects: Middle Bronze Age ornaments from Hampshire and Sussex

Developing from the idea that metalwork deposits could reflect acts or sites of socio-cultural negotiation, the mutual exclusivity seen in the distribution of certain object types provides an opportunity to consider how metalwork could have become bound up in acts of confrontation or confirmation, expressions that may socio-political have had a strong moral or ethical dimension.

A good example is the relationship between the Taunton period ornament class known as 'Sussex Loops' (Kaminski 2022; Roberts 2007; Rowlands 1976: 96) and Liss-type bar bracelets/armlets. Sussex Loops are a distinctive object type created from relatively thick bronze bars of square or round section, found, as their name suggests, in a small regional area, with a concentration on the coastal belt (mostly within 10 km of the English Channel) (Fig. 3). These unique objects recall the local/foreign tension, not least because they often occur with other objects with strong Continental connections (e.g. the 'Near Lewes' hoard, East Sussex: O'Connor *et al.* 2017: 272-275). They may be seen as expressions of local identity intended to rebalance or reframe the 'foreign' qualities and contents of Taunton period ornament hoards and may have reduced the perceived sense of a dependency on 'foreign' sources to replenish the local community's metalwork stock.

By comparison, Liss-type ornaments present a different perspective on local/foreign dualities. They are continentally connected or inspired objects that developed into local traditions, with seemingly different casting processes on either side of the English Channel (cf. Nordez 2019). This suggests that different communities approached the ethics of foreign/local duality in different but quite firmly guarded or bounded ways. What makes the situation more compelling is the pattern of mutual exclusivity noted between the two bracelet/armlet forms and the fact that in a single case (the most easterly location known to date), in a pit at the site of Chalkpit Lane, East Lavant in West Sussex (Needham and Stevenson 2021: 606-612), a Liss-type bracelet and a Sussex Loop were deposited together (one of each) (Fig. 3). The precise meaning of this act of unification is difficult to assess. It does, however, appear to have been confirming, confronting or challenging boundaries between styles, identities and rules of metalwork production and deposition. Whether it is taken as an act of social-political union, even a marriage to recall Needham's (2001: 292) experimental hypothesis, or as something more 'aggressive' in nature: the orphaned Sussex Loop as an expression of discord (looted or taken by force), it reveals the potential of such hoards to be interpreted in terms of moral and ethical concepts, rules and socio-political and geographical boundary marking. Thinking about metalwork in these terms helps to account for the stringent exclusivity and almost obsessive (and thus predictable) patterning seen among hoards of this period in southern regions of England (cf. Needham 2017; Wilkin 2017).

'Metals make the world go round'?

Standing back from the detail of Bronze Age studies, it is striking how much weight prehistorians have placed on metal(work) as the defining and driving force of European Bronze Age society. It has, over the last two centuries, come to serve as an important (and often only) proxy for political economy and social hierarchy during large periods of the Bronze Age in both popular and academic accounts and in museum displays across Britain. There are good reasons why bronze has come to occupy this pre-eminent role.

Firstly, although it occurs in regionally specific ways, Bronze Age metalwork occurs in impressive quantity, particularly when compared to grave goods, the other staple of narrative accounts and museum displays cf. (Cooper *et al.* 2022: 95). One recently discovered hoard from Boughton Malherbe in Kent contained more than 60 kg of bronze (Adams 2017). Secondly, the evidence for its circulation and the effort involved in mining, producing and transporting the raw materials and finished product suggest metal was an important commodity. Helle Vandkilde has played an instrumental role in restating and refining the socio-political, cultural and economic centrality of bronze as a long-distance commodity within Bronze Age society, bringing its significance and study into the 21st century by articulating the long-distance exchange and circulation networks during the early to mid 2nd millennium as pre-modern globalisation (Vandkilde 2016; 2017). Contemporary politics demonstrate how market forces, including the forces of globalisation, are far from morally neutral: they have consequences for communities and for people's everyday lives and the fate of the natural environment (e.g. Carney 2021; Sacks 2020; Sandel 2012).

Reconfirming that bronze *was* important in the Bronze Age is painfully obvious but it is necessary because this social 'reality' must have had moral and ethical dimensions and consequences. At the risk of setting up a circular logic, the exclusivity of bronze metalwork in hoards during this period may be telling us that, like capital today, its power and potential was understood to be at the heart of social life – one that posed problems that needed to be managed, worked through and resolved in a way that other material valuables, such as amber or high quality ceramic or textile products and exports, simply did or could not. Bronze clearly got 'under the skin' of Bronze Age people and this psychological dimension may have led to so much bronze being deposited so frequently in regions of Britain and north-west Europe. This poses the question: how can the 'booms' and 'busts' (so-called 'metal rushes': Vandkilde 2024) in metal circulation and possession be studied or understood in ways that might reveal their moral or ethical dimensions?

Hoards as communally sanctioned acts

As noted at the start of this contribution, the basic principles of how metalwork could be possessed, inherited during the Bronze Age are important but difficult to establish. The notion that British Bronze Age hoards could represent a community's wealth has been raised since at least Needham's (1988: 245-246) seminal study of Early Bronze Age metalwork. The strength of the argument varies by period but centres on the quantity of objects within hoards, which often exceed what we expect could feasibly be possessed by (or committed to the grave of) any individual (Needham 1988: 245-246). Another important aspect is the condition and character of objects, particularly those in fragmented condition from the LBA. These objects, which make up by far the largest percentage of objects by count, were stripped of any of the 'personal' qualities possessed by hafted or finished objects. They were reduced to their typological identities, itself a communal expression of tradition, or taken to a further degree of anonymity:

Figure 4: The Petters Sports Field hoard, Surrey, England, *c.* 1000-800 BCE (image: Trustees of the British Museum).

identifiable simply as pieces of a socketed axe, tool or weapon or casting waste. Although a 'communal' reading of hoard deposits in Britain has persisted (e.g. Griffiths 2023: 20), its fundamental significance has been obscured by the atomising effect of particular methodological and theoretical approaches. What may have been 'lost' in this process is the essential basis of the communal characteristic of Bronze Age hoard deposits: that it frequently forwarded 'the "we" within the "I"', to cite Sack's (2020: 12) useful short hand for the essence of morality 'that limits and directs our pursuit of private gain'.

Symbolism in 'metallurgical' hoards and a Bronze Age 'work ethic'?

Fragmented so-called 'scrap', 'founders' or 'metallurgical' hoards date principally to the Ewart Park phase of the LBA in Britain (*c.* 900-800 BCE) and are among the most prolific and difficult to interpret deposits from Britain during this period (Fig. 4) (Knight 2022; Needham 1990a; Turner 2010). The material deposited in these hoards often appears to have been produced and selected at 'random', drawn from assorted available metalwork passing through the recycling process (Wiseman 2018). However, the *intention* or 'ethics' behind the depositional act itself could certainly have been meaningful (Fontijn 2020: 118-119) and metallurgical hoards can certainly contain some remarkable, potentially symbolic things, including complete copper alloy moulds (Webley and Adams 2016). In recent efforts to illustrate the potential meaning of these hoards, attention has been paid to the fragmented character of the material through allusions to the ontological qualities of broken things and the relational character of identities during the Bronze Age (Brück 2004; Chapman 2000; Fontijn 2020; Knight 2019; 2022). While valuable, these perspectives tend to result in statements that risk being overly generic, vague or even circular. Thus fragmentation becomes yet another way of expressing identity or relationship formation, supported by the evidence of how life or identity was during the Bronze Age.

Max Weber's (1959 [1905]) theory of the 'Protestant work ethic' and its role in the development of modern capitalism illustrates how moral attitudes to (and perceptions of) hard work, thriftiness and drive towards higher productivity can be combined with the fundamental worldview, ethics or 'spirit' of particular religious community. Viewed through a Weberian lens, it may be possible to see 'scrap' hoards as conscious, symbolic representations of metalwork going through the process of recycling. This mid-process, industrious character, quality or 'spirit' may have held a cultural and moral value that prehistorians have interpreted both too literally (see, e.g., Evans 1881 for a British perspectove) and too metaphorically since the inception

Table 2: Paul Garwood's scheme showing the tripartite structure of rituals and their key attributes (reproduced after Garwood 2011: fig. 18.1).

Rites of separation	**Rites of liminality**	**Rites of reaggregation**
Departure and disengagement from the social world;expressions of breach, separation, journey and transition/transformation	Engagement with the transcendental; experience/expressions of otherness, order (cosmos), exaltation	Return to and re-engagement with the social world; expressions of return journey, sociality, vitality, fertility, profanity
Sacralization of social action; increasing formality, solemnity, deference, passivity and submission to sacred authority	Communication/revelation of sacra, esoteric knowledge, cosmology and prominent display of symbols of condensation (Turner 1967)	Domination/conquest of the social by the scared (expressions of transcendence and 'rebounding violence'; Bloch 1992)
Transition from linear time to cyclical time/atemporality	Timelessness, 'deep time' or cyclicity emphasized	Transition to and reassertion of linear time
Suspension of social hierarchy ('structure'; Turner 1969)	Communitas; egalitarian principles ('anti-structure'; Turner 1969)	Reassertion of social hierarchy ('structure'; Turner 1969)
Abandonment/symbolic negation of former social personal/state of being of the initiate	Transformation and sacralization of identity/personhood (initiates)	Celebration and reification of the social persona/state of being attained by the initiated

of Bronze Age studies. The sheer scale of some 'scrap' hoards (e.g. Adams 2017), and the patterning evident in the inclusion and exclusion of certain types of objects within these hoards at an inter-regional scale (Knight 2019; 2022), suggests they were not random acts of accumulation but meaningful deposits. The treatment of objects such as moulds also give good reason to assume that the act or practice of bronze casting itself was viewed as a symbolic, even sacred, subject (Budd and Taylor 1995; Webley and Adams 2016; Webley *et al.* 2020). Viewing fragmentation from a moral or ethical perspective rather than a practical, relational or ontological one also opens up important considerations for its potential ritual symbolism.

Metalwork, morality and the ritual process

In addressing the visibility of moral meanings in prehistory, anthropological and archaeological work on the importance of 'rites of passage' (RoP) provides a useful structuring concept. Paul Garwood (2011), drawing on anthropological work of Arnold van Gennep (1908 [1960]) and Victor Turner (1967; 1969), has highlighted the importance of paying close attention to each step of the tripartite process followed by all RoPs, and of seeing them as separate but inherently linked stages that are often conceived or experienced as a 'journey' involving 'rites of separation', 'rites of liminality', and rites of 're-aggregation' that ultimately navigate times or moments of crisis, breach or change (Table 2). The successful navigation of the three steps is essential for rites to have efficacy and practical effects in the 'real world', rejecting the simplistic dichotomy between ritual/esoteric and rational/practical actions (cf. Bradley 2005; Brück 1999) or, indeed, the traditional binary explanations of Bronze Age metalwork deposition. This point is important for two reasons. Firstly, it exposes the disconnect between traditional studies of metalwork deposition which treat ritual as an 'end' rather than a 'means', and thus overlook the potential of rites to have been decisive in social, political and, indeed, moral discourses. Garwood (2011, 267) notes that the successful navigation of the stages of RoP by participants leads to the obtainment of 'sacred knowledge' and qualities of the transcendental and thus participation in rites 'involves conscious commitment to a model of social and moral hierarchy in which certain people are superior to others' (Garwood 2011: 267). Secondly, it highlights the similarities between the staged character of rites and structured technological processes. In the case of metalworking, the bringing together of metallurgical or actively broken things is arguably comparable to the themes of 'rites of separation' with its focus in transition and its emphasis on the abandonment (and transition from) normal states of being, while the active molten (re) melting of these broken down fragments can be aligned with the 'liminal' stage of RoP, during which time 'anti-structure' and cyclicity are emphasised. Finally, the casting process, in which objects are reconstituted and take on new form is an apt metaphor for the social reaggregation that occurs as a result of funerary and initiation rites (Garwood 2011: 270-271; cf. Brück 2006: 306-307). It is tempting then to see the 'bronziness' of hoard deposition as being directly related to the strong structural and metaphorical similarities between RoPs and metalworking (cf. Webley and Adams 2016; Webley *et al.* 2020).

Given this relationship, it is notable that references to metalworking stages such as casting and pouring (e.g. casting jets, bun ingots, fragmented objects ready for the crucible and moulds) are common in LBA hoards, many of which have characteristics of the 'liminal' stages of RoP, when 'timelessness' and 'cyclicity' were emphasised and before the reassertion of 'social hierarchy' and 'linear time' (Fig. 4). Turner (1969), elaborated on the liminal stage of van Gennep's tripartite structure by developing the concept of 'communitas'. He noted that this stage is characterised by the breaking down of social hierarchies and experience of feelings of undifferentiated togetherness, solidarity and egalitarianism (Turner 1969; cf. Garwood 2011: 264-265). This concept, and the quality of social experience it enabled, is notable and apt given the apparent communal or community focus and make-up of Bronze Age hoards, discussed above. The fragmented, de-personalised nature of 'scrap' bronze in these hoards (in which single objects let alone personalised belongings can be extremely hard to detect) can be seen as comparable to the condition of participants undergoing RoP. As Garwood notes, RoP often have 'distinctive… material culture repertoires for their proper performance' (2011: 277). The very qualities of many LBA hoards from southern Britain may relate to the meaning and *purpose* of rites that ultimately created social and political action and power. How this process might have worked, and how it related to moral and ethical matters, can be further explored in terms of acts of 'sacrifice' and violence.

Bloch's theory of 'rebounding violence'

Building on both van Gennep and Turner's contributions, Maurice Bloch sought to explain the recurrent representation of violence in RoPs. Traditional anthropological explanations regarded it as expressive of innate human qualities or as a cathartic or purging release (e.g. Burkert 1983; Girard 1977). Bloch's more complex theory based around the idiom of 'rebounding violence' sought to account for it in terms of the creation of power and domination ('conquest'). As Bloch saw it, 'violence is an attempt to create the transcendental in religion and politics' (Bloch 1992: 6). Rites begin by bringing participants to an 'other' world by the inversion of normal life, this sometimes involves a symbolic act of 'killing'. However, in this new elevated state the participants have no bearing on the political 'here-and-now' and thus risk returning from the RoP having only glimpsed the sacred but without having brought it back in a way that would be effective in the world (Bloch 1992: 4-5). Bloch observed that a second act or representation of violence was therefore necessary, serving the purpose of replacing the ordinary vitality of participants with the consumed or conquered vitality obtained from *outwith* their own bodies, often from animals (e.g. sacrifices) consumed as 'the food of the transcendental subject', literally and metaphorically (Bloch 1992: 6).

Alongside the archaeological evidence for human and animal sacrifices, Garwood (2011: 267) suggested that the violence involved in the performative destruction of metal valuables during the Bronze Age could be interpreted as the residues of RoP. Whether all fragmentation can or should be considered in this way is a moot point but Garwood's suggestion provides a valuable basis for evaluating the evidence for the sequence of fragmentation and violent destruction evident on much metalwork during this period. It is notable that the quality and character of British metalwork deposition is so often 'other' worldly. This was noted in the materially eccentric 'bronziness' of hoards, the character of their composition, which contain a bespoke group of objects not found in 'everyday' settlements of the same period (Cooper *et al.* 2022: 75-110), and their often liminal, unaltered landscape settings (cf. Fontijn 2020: 147-149). These aspects of the evidence, often overlooked, may in fact reflect acts of separation on which further acts of violence were subsequently enacted to obtain ritually powerful 'vitality'.

A potential correlation can also be found between the growth of fragmentary and abused metalwork objects and the increasingly martial character of the objects within them, particularly from the Wilburton-Blackmoor phase of the LBA in Britain (*c.* 1150-900 BCE) (Mörtz 2018). Hoards of this date and type, such as the eponymous Blackmoor hoard, Hampshire, contain a large numbers of 'over-killed' weapons (subjected to acts of bending, hacking and burning), involving further damage and destruction wrought after participation in conflict and violence (Colquhoun 1979; Mörtz 2008: 175). This example may represent a case where the unruly and chaotic 'vitality' of warfare was, through RoP, 'conquered' by participants in a manner that fulfilled the logic and symbolism of Bloch's concept of 'rebounding violence'. Furthermore, the 'stuffing' of the mouths of socketed tools is a repeated feature (possibly a custom) of later Bronze Age deposits in Britain and beyond (Fig. 5). These sometimes contain other bronze objects but also goldwork, which have been inserted into the socket with considerable force following acts of fragmentation, without clear rationale (e.g. Dietrich and Mörtz 2019). This unusual but distinctive and repeated feature might be understood in terms of a metaphorical connection between sockets and mouths and thus for the eating and consumption of vitality offered by the destruction and deposition of Bronze Age metalwork.

While fragmentation during the LBA in Britain provides some of the clearest evidence for how 'rebounding

Figure 5: A broken Late Bronze Age (*c.* 1000-800 BCE) sword grip forced into a socketed axe, from the Sutton Area, Herefordshire (image: PAS/ Birmingham Museums Trust, CC BY-SA 4.0).

violence' may assist prehistorians in understanding the rationale, purpose and socio-political motivations underpinning metalworking deposition, the concept is also relevant to earlier metallurgical phases when 'destruction' through fragmentation was not such a prominent concern (cf. Knight 2022). For example, many Middle Bronze Age (Penard assemblage) ornaments have been subjected to manipulation prior to deposition, rendering them dramatically unusable. In southern England, gold flange-twisted bar torcs were frequently spiralled, distorted out of shape in a way that carefully inverted their functional use, placing their previously interlocking trumpet-shaped terminals at opposite ends of the now reshaped and 'use'-less object without breaking them (Wilkin 2017). This act gave these objects a clear liminal character (the performative inversion of their functional and rational or 'everyday' properties) that would befit RoP and ceremonies where the Blochian 'vitality' of such objects was being shown to have been conquered or converted into something else, namely social and political authority and power.

The moral or ethical dimension of 'rebounding violence' centres on the recognition of an agenda underpinning RoP. They were not 'neutral' affairs but rather acts of political ideology that asserted the idea that some people (superiors) had dominance and power over other people (inferiors). The apparently communal nature of 'scrap' or metallurgical hoards may therefore mask the more 'Machiavellian' motivations behind some metalwork deposits (cf. Wengrow 2003: 305-306). It may also explain the apparent regionality and sudden upswing in such deposits across southern England during the second half of the 2nd millennium BCE (cf. Griffiths 2023: figs 10-11), reflecting different approaches to the assertion of socio-political power or authority within different regional groups and of a competitive cycle of sacrifice and destruction in the quest for yet greater power and social and moral authority. There can be no doubt, for instance, that the frequency and size of deposits grew over the course of the 2nd millennium BCE, a point often explained in terms of bronze circulation and falling value (cf. Roberts *et al.* 2015). A ritual concept

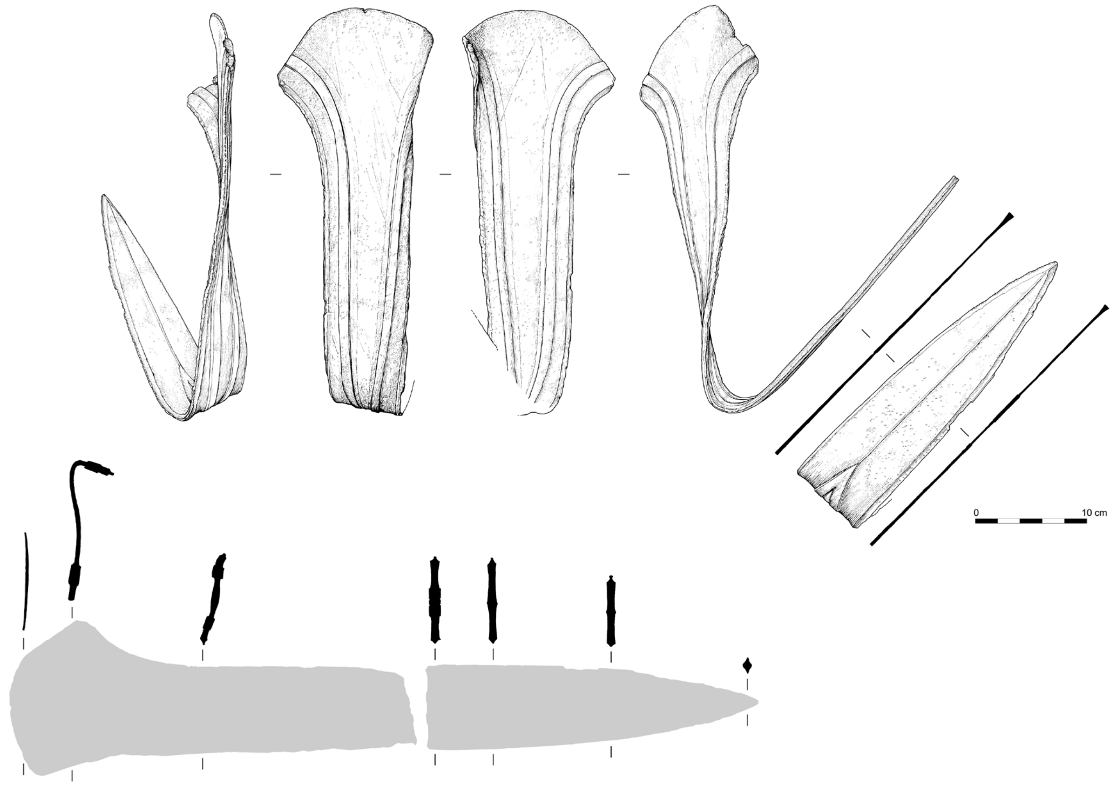


Figure 6: The East Rudham dirk, Norfolk (image: Craig Williams/ Trustees of the British Museum).

linked to the conquest of vitality and power as explored by Bloch (1992) offers an alternative way to analyse and interpret the socio-political rationale behind the intentional, often performative, destruction of Bronze Age metalwork: it provided a way of 'conquering' or capturing some of the valuable transcendent qualities or 'vitality' that the metalworking process, with all its liminal and transformative qualities, offered.

The East Rudham dirk

The spectacularly decommissioned East Rudham dirk from Norfolk (Fig. 6) of MBA (Taunton phase) date (*c.* 1400-1250 BCE) provides a case study for further exploring ideas of violence and morality. It is one of six known Plougrescant-Ommerschans (P-O) dirks found around the North Sea (two from Norfolk England, two from France, and two from the Netherlands), the blades are 'super-sized', unsharpened and were cast without rivet holes for attaching a usable haft. As a result, they have long been considered to be non-functional or 'ceremonial' objects (cf. Amkreutz and Fontijn 2024). Needham and Wilkin suggest that through the skilled and symbolically charged process of producing and then rendering the East Rudham dirk unusable (destroying its 'perfect symmetry' in the process) contemporary 'martial values and ideals were… being morally challenged and even rejected by embodying non-confrontational elements in the design and aggrandising the objects to an unusable state' (2024: 264). However, Amkreutz and Fontijn (2024) suggest an alternative reading of these objects, including East Rudham. They argue that the varied and antiquated typological features that are skillfully combined on the P-O blades (Needham and Wilkin 2024: 252-253) occur because these 'larger-than-life' blades were intended for use not by humans but by 'gods or mythical ancestors', they suggest that the typological references to earlier times were a 'potent symbol of power and legitimacy' during an era of 'social upheaval' at the cusp of the (continental European) LBA and the rise of a 'warrior elite' at a 'macro-regional scale' (Amkreutz and Fontijn 2024: 360).

Considered in the light of both ritual process and Bloch's concept of 'rebounding violence', an alternative reading can be offered that makes sense of ceremonial blades in terms of the social and political gains achieved by their deposition. Firstly, the very creation of extra-ordinary objects like the Plougrescant-Ommerschans blades represents the suspension of 'normal' life, hierarchy and the social world, as is befitting 'rites of separation'. The deposition of the blades shows evidence for the kind of destruction and fragmentation that, as noted, is closely associated with the liminal stage of RoP. The P-O dirk from Beaune, France was also probably broken, the Ommerschans dirk was buried with a hoard of partially broken objects and the East Rudham dirk was systematically and skillfully bent and broken along its key planes of symmetry. In this sense, Needham and Wilkin's moral statement hypothesis accords with the ethos of 'communitas' or solidarity achieved during the liminal stage of RoP. However, in the next phase, the so-called 'rite of reaggregation', the objects may have achieved the kind of 'power and legitimacy' proposed by Amkreutz and Fontijn through the principle of 'rebounding violence', where the vitality of sacrificed objects like the East Rudham dirk were taken over by participants in acts of symbolic violence and 'conquest'.

Bloch's approach also has the potential to shed light on an unresolved aspect of the P-O phenomenon: the existence of 'normal', practical and functional dirks with the same morphological properties as their ceremonial siblings, the so-called 'type Kimberley' dirks (Needham 1990b: 245, 247-248). In terms of the efficacy of RoP in acts of socio-political reconstitution and reaggregation involving ceremonial objects, the existence or presence of a closely related group of 'normal' objects may have been highly desirable.

Conclusions

This chapter began by revisiting the now exhausted explanatory duality between ritual and profane explanations for metalwork deposition during the Bronze Age. Drawing on contemporary anthropology on the issues of 'value', recent approaches have sought to break this impasse by demonstrating the circular, nested and balanced relationships between a range of 'short' term (essentially political) and 'long' term (essentially cultural but termed 'moral' by Fontijn (2020)) economic transactions or 'spheres of exchange' (Fontijn 2020). Intellectually, these approaches are ingenious but fall short of fully articulating the 'real world' character, consequence or experience of depositional practices. A case has been made for giving moral and ethical factors a more pervasive and unifying role in explanations of the destruction and deposition of metalwork during the Bronze Age. It has highlighted the ways deposition could have been used to negotiate morally charged tensions between 'right' and 'wrong', 'foreign' and 'local', 'us' and 'them', 'we' and 'I', and suggested that a better grasp of moral and ethical dimensions of depositional behaviour can yield valuable – and specific – interpretative insights into the construction of social and political life.

The second part of the contribution developed the argument in a different direction. The structured phenomena known as 'rites of passage' provide an invaluable framework for understanding metalwork deposition in several respects. Firstly, how moral justifications could be situated or evoked within a socio-politically sanctioned process intended to reconstitute society at times of crisis, breach or change. Secondly, how the egalitarian qualities of deposits may be a reflection of the particular, liminal phase of RoP (both in terms of the relevant position of deposition events within the ritual process and, correspondingly, their material qualities or properties) rather than being reflective of the full messaging of the rite as a whole. And finally, how the binary relationship between Fontijn's (2020) 'political' and 'moral' economies can be replaced by the study of a more structured and definable (tripartite) set of behavioural 'stages' that are widely found across space and time and that create social and political change borne of religiosity, morality and engagement with sacred and transcendent powers (cf. Garwood 2011).

Three different scales at which morality might be studied were proposed. The smallest (*Hoards/deposits at intra-regional*) and medium (*Typological/treatment at regional*) scales correspond with the liminal phase of RoP: being the occasion when objects drawn from 'normal' life (via rites of separation) are gathered up for the purpose of intermediating with transcendent powers (cf. Table 2). As in funerary practices, this stage of rites, characterised by overt symbolic communication and statement making, expressions of solidarity and egalitarianism, is over-represented in the archaeological record (Garwood 2011: 264). As a result, it is not surprising that themes of communality, negotiation and tension resolution feature prominently in accounts of hoard deposits, as they did in the first half of this chapter. It is, however, at the largest of the scales (*Economic at supra-regional*) that the potential for amoral (non-egalitarian) attitudes and outcomes may be most productively and usefully explored: the desire for access to or control of flows and 'rushes' of metal circulation for its intrinsic socio-political 'value' or gain. There is considerable potential to consider how the moral and ethical consequences of 'bronzization' (Vandkilde 2016) were experienced at regional, local and individual scales across Britain, Europe and beyond.

Finally, 'rites of re-aggregation' are notoriously difficult to 'see', archaeologically speaking. However, the benefit of the approach put forward here – invested in the universal, structuring role of RoP – is the recognition that, by the second half of the 2nd millennium BCE in Britain, acts of violent breakage were a regular, even standard, feature of metalwork treatment prior to deposition. Through Bloch's (1992; cf. Garwood 2011) idiom of 'rebounding violence', a potentially valuable insight can be gained into how the morally-charged qualities of Bronze Age metalwork enshrined in archaeologically visible, often fragmented, deposits were transformed into 'real-world' (re)assertions of political and social power and authority.

Acknowledgements

Stuart Needham, Duncan Garrow and an anonymous peer reviewer provided helpful comments on an earlier draft of this contribution. I am also grateful to Paul Garwood, Stuart Needham, and Sabine Stevenson for permission to reproduce images from their own work. Craig Williams assisted with the preparation of several images. All errors, naturally, remain my own.

Bibliography

Adams, S. 2017. The contents and context of the Boughton Malherbe Late Bronze Age hoard. *Archaeologia Cantiana*: 138: 37-64.

Amkreutz, L. and D. Fontijn 2024. Larger than Life: Interpreting the Ommerschans hoard, in L.W.S.W. Amkreutz and D. Fontijn (eds) *Larger than Life: The Ommerschans hoard and the role of giant swords in the European Bronze Age (1500-1100 BC)*: 355-376. Leiden: Sidestone.

Barrett, J. 1994. *Fragments from Antiquity: an archaeology of social life in Britain, 2900-1200 BC*. Oxford: Blackwell.

Bloch, M. 1992. *Prey into Hunter The Politics of Religious Experience*. Cambridge: Cambridge University Press.

Bloch, M. and J. Parry 1982. *Death and the Regeneration of Life*. Cambridge: Cambridge University Press.

Bradley, R. 1998. *The Passage of Arms. An Archaeological Analysis of Prehistoric Hoard and Votive Deposits*. Oxford: Oxbow Books.

Bradley, R. 2005. Ritual and Domestic Life in Prehistoric Europe. London: Routledge.

Bradley, R. 2017. *A Geography of Offerings. Deposits of Valuables in the Landscapes of Ancient Europe*. Oxbow Insights in Archaeology 3. Oxford: Oxbow Books.

Brück, J. 1999. Ritual and Rationality: Some Problems of Interpretation in European Archaeology. *European Journal of Archaeology* 2(3): 313-344.

Brück, J. 2004. Material metaphors: the relational construction of identity in Early Bronze Age burials in Ireland and Britain. *Journal of Social Archaeology* 4: 307-333.

Brück, J. 2006. Fragmentation, personhood and the social construction of technology in Middle and Late Bronze Age Britain. *Cambridge Archaeological Journal* 16(3): 297-315.

Budd, P. and T. Taylor 1995. The Faerie Smith Meets the Bronze Industry: Magic Versus Science in the Interpretation of Prehistoric Metal-Making. *World Archaeology* 27(1): 133-143.

Burkert, W. 1983. *Homo Necans: The Anthropology of Ancient Greek Sacrificial Ritual and Myth*. Berkeley: University of California Press.

Carney, M. 2021. *Values. An Economist's Guide to Everything That Matters*. London: HarperCollins.

Chapman, J. 2000. *Fragmentation in Archaeology. People, Places and Broken Objects in the Prehistory of South Eastern Europe*. London: Routledge.

Chapman, R., I. Kinnes and K. Randsborg (eds) 1981. *The archaeology of death*. Cambridge: Cambridge University Press.

Colquhoun, I. 1979. The Late Bronze Age hoard from Blackmoor, Selborne, in C. Burgess and D. Coombes (eds) *Bronze Age Hoards: Some Finds Old and New*: 99-115. British Archaeological Reports British Series 67. Oxford: British Archaeological Reports.

Cook, J.W. 1999. *Morality and cultural differences*. Oxford: Oxford University Press.

Cooper, A., D. Garrow, G. Gibson, M. Giles and N. Wilkin 2022. *Grave Goods Objects and Death in Later Prehistoric Britain*. Oxford: Oxbow Books.

Cowie, T. 1988. *Magic Metal: Early Metalworkers in the North-East*. Aberdeen: University of Aberdeen.

Dietrich, O. and T. Mörtz 2019. Learning from 'Scrap' about Late Bronze Age Hoarding Practices: A Biographical Approach to Individual Acts of Dedication in Large Metal Hoards of the Carpathian Basin. *European Journal of Archaeology* 17(3): 468-486.

Dumont, L. and T. Logel 2018. L'épée à Poignée Métallique de Niffer (Haut-Rhin) : Un Exemple de Production Occidentale Au Bronze Moyen. *BULLETIN* 2018: 154-165.

Dunkin, D., D. Yates and R. Bradley 2020. The Findspots of Bronze Age Metalwork in Lowland England: A New Field Study. *Oxford Journal of Archaeology* 39: 67-88.

Durkheim, E. 1957 [2019]. *Professional Ethics and Civic Morals*. London: Routledge.

Fontijn, D. 2002. *Sacrificial Landscapes. Cultural biographies of persons, objects and 'natural' places in the Bronze Age of the southern Netherlands, c. 2300-600 BC*. Leiden: Analecta Praehistorica Leidensia 33/4.

Fontijn, D. 2020. *Economies of Destruction. How the Systematic Destruction of Valuables Created Value in Bronze Age Europe, c. 2300-500 BC*. London: Routledge.

Fontijn, D. and J. Roymans, 2019. Branded Axes, Thrown into a Pool? The Hoogeloon Hoard and the Shape-Based Bronze Economy of the North-West European Bronze Age. *Oxford Journal of Archaeology* 38: 164-188.

Fowler, C. 2013. *The Emergent Past: a relational realist archaeology of Early Bronze Age mortuary practices*. Oxford: Oxford University Press.

Garwood, P. 1991. Ritual tradition and the reconstitution of society, in P. Garwood, D. Jennings, R. Skeates and J. Toms, (eds), *Sacred and Profane. Archaeology, ritual and religion*: 10-32. Oxford Committee for Archaeology Monograph 32. Oxford: Oxford Committee for Archaeology.

Garwood, P. 2011. Rites of Passage, in T. Insoll (ed.) *The Oxford Handbook of the Archaeology of Ritual and Religion*: 261-284. Oxford: Oxford University Press.

van Gennep, A. 1908 [1960]. *The Rites of Passage*. London: Routledge & Kegan Paul.

Girard, R, 1977. *Violence and the Sacred*. Baltimore: John Hopkins University Press.

Godelier, M. 1999. *The Enigma of the Gift*. Cambridge: Polity Press.

Graeber, D. 2005. Value: Anthropological Theories of Value, in J.G. Carrier (ed.) *A Handbook of Economic Anthropology*: 439-454. Cheltenham: Edward Elgar.

Griffiths, C J. 2023 Axes to Axes: the Chronology, Distribution and Composition of Recent Bronze Age Hoards from Britain and Northern Ireland. *Proceedings of the Prehistoric Society* 89: 179-205.

Kaminski, J. 2022.The Hollingbury Hoard. *Sussex Archaeological Journal* 160: 23-39.

Knight, M.G. 2019. Going to Pieces: Investigating the Deliberate Destruction of Late Bronze Age Swords and Spearheads. *Proceedings of the Prehistoric Society* 85: 251-272.

Knight, M.G. 2022. *Fragments of the Bronze age : the destruction and deposition of metalwork in south-west Britain and its wider context*. Prehistoric Society Research Papers 13. Oxford: Oxbow Books.

Lambek, M. 2008. Value and virtue. *Anthropological Theory* 8(2): 133-157.

Maslin, S. 2020. *Sur-68c46e: A Bronze Age Hoard* (available at: https://finds.org.uk/database/artefacts/record/id/993242 (accessed: 26 September 2024)).

Mauss, M. 1990. *The Gift* (trans. W.D. Halls). London: Routledge.

Metcalf, P. and R. Huntingdon 1991. *Celebrations of Death* (2nd edn). Cambridge: Cambridge University Press.

Mörtz, T. 2018. Violence and ritual in Late Bronze Age Britain: Weapon depositions and their interpretation, in C. Horn and K. Kristiansen (eds) *Warfare in Bronze Age Society*: 168-188. Cambridge: Cambridge University Press.

Murgia, A., B. Roberts and R. Wiseman 2014. What have metal-detectorists ever done for us? Discovering Bronze Age gold in England and Wales. *Archäologisches Korrespondenzblatt* 44(3): 353-367.

Needham, S. 1988. Selective deposition in the British Early Bronze Age. *World Archaeology* 20: 229-248.

Needham, S. 1990a. *The Petters Late Bronze Age Metalwork: An Analytical Study of Thames Valley Metalworking in Its Settlement Context*. British Museum Occasional Paper 70. London: British Museum.

Needham, S. 1990b. Middle Bronze Age ceremonial weapons: new finds from Oxborough, Norfolk, and Essex/Kent. *Antiquaries Journal* 70: 239-252.

Needham, S. 2000. Power pulses across a cultural divide: cosmologically driven acquisition between Armorica and Wessex. *Proceedings of the Prehistoric Society* 66: 151-207.

Needham, S. 2001. When expediency broaches ritual intention: the flow of metal between systemic and buried domains. *Journal of the Royal Anthropological Institute* 7: 275-298.

Needham, S. 2017. Assemblage, structure and meaning in bronze metalwork studies: an analysis of the British Penard assemblage. *Oxford Journal of Archaeology* 36(2): 111-156.

Needham, S. and S. Stevenson 2021. Neolithic and Bronze Age Occupation of the Rother Region, in S. Needham and G. Anelay (eds) *Barrows at the Core of Bronze Age Communities. Petersfield Heath Excavations 2014-18 in Their Regional Context*: 581-616. Leiden: Sidestone.

Needham, S. And Wilkin, N. 2024. British ceremonial weapons revisited: A new Plougrescant-Ommerschans dirk from East Rudham, Norfolk, and its typological, geochemical and landscape context, in L.W.S.W. Amkreutz and D. Fontijn (eds) *Larger than Life: The Ommerschans hoard and the role of giant swords in the European Bronze Age (1500-1100 BC)*: 236-269. Leiden: Sidestone.

Nordez, M. 2019. *La parure en métal de l'âge du Bronze moyen atlantique (XVe-XIVe siècles avant notre ère) = Metallic ornaments of the Atlantic Middle Bronze Age (XVth-XIVth centuries BC)*. Mémoires de la Société préhistorique française, 65. Paris: Société préhistorique française.

O'Connor, B. 1980. *Cross-Channel relations in the later Bronze Age*. British Archaeological Reports International Series 91 (2 vols). Oxford: British Archaeological Reports.

O'Connor, B., B.W. Roberts and N. Wilkin 2017. The Ornament Horizon revisited. New and old finds of Middle Bronze Age ornaments in southern England, in T. Lachenal, C. Mordant, T. Nicolas and C. Verber (eds) *Le Bronze moyen et l'origine du Bronze final en Europe occidentale, de la Mer du Nord à la Méditerranée (XVIIe–XIIIe siècle avant notre ère)*: 169-182. Strasbourg, Mémoires d'Archéologie du Grand-Est 1.

Parker Pearson, M. 1999. *The Archaeology of Death and Burial*. Stroud: Sutton.

Roberts, B. 2007. Adorning the living, but not the dead: understanding ornaments in Britain, c. 1400-1100 cal BC. *Proceedings of the Prehistoric Society* 73: 135-168.

Roberts, B.W., D. Boughton, M. Dinwiddy, N. Doshi, A.P. Fitzpatrick, D. Hook, N. Meeks, A. Mongiatti, A. Woodward and P.J. Woodard 2015. Collapsing Commodities or Lavish Offerings?. *Oxford Journal of Archaeology* 34: 365-395.

Rowlands, M. 1976. *The Production and Distribution of Metalwork in the Middle Bronze Age in Southern Britain*. British Archaeological Reports British Series 31 (2 vols). Oxford: British Archaeological Reports.

Sacks, J. 2020. *Morality: Restoring the Common Good in Divided*. London: Hodder & Stoughton.

Sandel, M.J. 2012. *What Money Can't Buy: The Moral Limits of Markets*. Harmondsworth: Penguin Books.

Sørensen, M.L. 2015. 'Paradigm lost' – On the state of typology within archaeological theory, in K. Kristiansen, L. Šmejda and J. Turek (eds) *Paradigm Found: Archaeological Theory Present, Past and Future*: 84-94. Oxford: Oxbow Books.

Thomas, J. 1991. Reading the body: Beaker funerary practice in Britain, in P. Garwood, D. Jennings, R. Skeates and J. Toms (eds) *Sacred and Profane. Archaeology, ritual and religion*: 33-42. Oxford Committee for Archaeology Monograph 32. Oxford: Oxford Committee for Archaeology.

Turner, L. 2010. *A Re-Interpretation of the Later Bronze Age Metalwork Hoards of Essex and Kent*. British Archaeological Reports British Series 507 (2 vols). Oxford: John and Erica Hedges Ltd.

Turner, V. 1967. *The Forest of Symbols: Aspects of Ndembu Ritual*. London: Cornell University Press.

Turner, V. 1969. *The Ritual Process. Structure and Anti-Structure*. Brunswick: Aldine Transaction.

Vandkilde, H. 2016. Bronzization: The Bronze Age as pre-Modern Globalization. *Praehistorische Zeitschrift* 91(1): 103-123.

Vandkilde, H. 2017. *The metal hoard from Pile in Scania, Sweden: place, things, time, metals, and worlds around 2000 BCE*. Aarhus: Aarhus University Press.

Vandkilde, H. 2024. Religion and metal rush: Deposition of valuables from the Neolithic to the Bronze Age in Scandinavia, in L.W.S.W. Amkreutz and D. Fontijn (eds) *Larger than Life: The Ommerschans hoard and the role of giant swords in the European Bronze Age (1500-1100 BC)*: 345-354. Leiden: Sidestone.

Weber, M. [1905] 2001. *The Protestant Ethic and the Spirit of Capitalism*. London: Routledge.

Webley, L., S. Adams and J. Brück 2020. *The Social Context of Technology: Non-ferrous Metalworking in Later Prehistoric Britain and Ireland*. Prehistoric Society Research Papers 11. Oxford: Oxbow Books.

Webley, L. and S. Adams 2016. Material Genealogies: Bronze Moulds and their Castings in Later Bronze Age Britain. *Proceedings of the Prehistoric Society* 82: 323-340.

Wengrow, D. 2003. Machiavellian Moments: a discussion with Maurice Bloch. *Journal of Social Archaeology* 3(3): 299-311.

Wilkin, N. 2017. Combination, composition and context. Readdressing British Middle Bronze Age ornament hoards (c. 1400-1100 cal. BC), in T.F. Martin and R. Weetch (eds) *Dress and Society: contributions from archaeology*: 14-47. Oxford: Oxbow Books.

Wiseman, R. 2018. Random Accumulation and Breaking: The Formation of Bronze Age Scrap Hoards in England and Wales. *Journal of Archaeological Science* 90: 39-49.

Chapter 22

Fragmenting metalwork in Late Bronze Age Europe – a secondary products revolution?

Anna Sörman

LARA /UMR 6566 CReAAH, Nantes University, Nantes, France and Department of Archaeology and Classical Studies, Stockholm University, Stockholm, Sweden

anna.sorman@ark.su.se

Abstract

The fragmentation of bronze objects was a widespread phenomenon in the European Bronze Age, especially in the later part of the period. Fragmented metalwork has primarily been linked to the practice of recycling; hoards dominated by fragments have long been seen as raw material caches, 'scrap' hoards or metalworkers' stocks. Breaking metalwork into smaller pieces can partly be explained by the inherent qualities of the material and the technology of casting with the possibility of re-melting. However, fragments were also employed beyond their immediate use in recycling as well as in various transactions, rituals and depositions. Lately, attention has been drawn to their potential function as a means of exchange in mercantile transactions, for example through adhering to specific weight standards. This contribution discusses fragments from different contexts in Middle and Late Bronze Age northern and western Europe, demonstrating the varied uses and values of fragmented metalwork. It is suggested that the concept of the 'secondary products revolution' can be useful for illustrating the diverse range of practices enabled by the increased fragmentation in the Late Bronze Age. The chapter concludes by pointing to some of the many interesting questions for future research.

Introduction

What do the Late Bronze Age hoards full of fragmented metalwork (Fig. 1) that appear in large numbers in most regions of Europe represent? Why were so many valuable objects broken, and what were the pieces used for? For a long time, the somewhat intuitive answer to these questions was that this was 'scrap', and that they represented raw material caches or founders' hoards, kept for later use in craft production or trade (e.g. Evans 1881; Worsaae 1866: 311, 315; Déchelette 1910: 165). In the late 20th century, studies began to draw attention to the various ways in which fragments in these hoards were selected, combined and sometimes mutilated. This raised awareness of structured behaviours, where the composition of the fragments in the hoards were seemingly following different 'codes' in different regions, to which the functionalistic scrap metal hypothesis was not a sufficient explanation (e.g. Gabillot 2004; Gabillot and Lagarde 2008; Rezi 2011; Brück 2016; Hansen 2016).

Over the past decade, the scrap metal hypothesis has come again to the forefront, as an increasing number of scholars are now arguing that 'defunctionalised' bronze objects were used as currency in a weight economy which encompassed large parts of Europe (e.g. Milcent 2017; Brandherm 2021; Ialongo and Lago 2021). Although it has often been emphasised that a mercantile function does not contradict the possibility of other simultaneous functions and meanings associated with fragments (e.g. Hansen 2016: 199; Milcent 2017; Brandherm 2021), and even though these statistically well-founded studies are far from the intuitive interpretations of 19th- and early 20th-century archaeology, it can nevertheless appear as if we have returned to an unproblematised, monolithic vision of these fragments and fragment hoards as mere utilitarian 'scrap metal' (e.g. Wiseman 2018; Ialongo and Lago 2021: 3). Despite case studies from previous decades showing that there were also other forms of use and that these fragment assemblages

Figure 1: Fragmented objects gathered inside an upside-down belt ornament, representing some of the objects from the large Nordic Late Bronze Age Period V hoard from Fangel Torp on Funen, Denmark (detail of photo: John Lee, Nationalmuseet Denmark, CC-BY-SA).

cannot be explained by the 'scrap hypothesis' alone, interpretations tend to be either economic or ritual. This urges us to consider; how can these different perspectives be united?

The need for an integrated perspective which acknowledges the multiple meanings of fragmented metalwork in the Bronze Age is the starting point of this contribution. How were fragments used in different contexts? When was 'scrap' a commodity? When and what type of fragments were employed for symbolic means? This text aims to demonstrate the variety in this phenomenon through some particularly illuminating finds. It proposes that we think of the increasing fragmentation of metalwork in the Middle and Late Bronze Age as a 'secondary products revolution', where the primary functions of bronze objects were complemented by the new, secondary uses enabled through fragments. With this approach we can develop a more pluralistic and accurate understanding of the making, use, circulation, hoarding, and deposition of incomplete bronze objects.

Background

Economic explanations for fragmented bronze from the Bronze Age have long dominated. Fragmented assemblages are interpreted as scrap stored or hidden away for later recycling and trade (e.g. Worsaae 1866: 315; Evans 1881; Oldeberg 1942: 171-176; Levy 1982; Weiler 1996). Three principal arguments can be seen in connection to such interpretations: 1) fragmenting into smaller pieces allows the material to fit in the melting crucible; 2) the presence of metalworking debris in some of these assemblages may indicate a link to bronze working; and 3) the accessibility of many such hoards deposited in dry contexts means they could have been revisited or retrieved, in contrast to irretrievable objects 'sacrificed' in wet contexts.

This view of 'scrap' hoards dominated at least up until the 1980s. As economic resources, such hoards were also drawn in as evidence in discussions of various 'workshop' traditions, trading ports, and socio-economic and ethnographically inspired readings of wealth distribution as signs of territories and chiefdoms (e.g. Rowlands 1976; Levy 1982; Larsson 1986).

From the 1990s and onwards, new perspectives developed where both the variation in the hoard phenomenon itself and categories such as 'scrap' were questioned (e.g. Bradley 1990; Hoffman 1999; Nebelsick 2000; Rezi 2011). Inspiration in part came from fragmentation theory, where the role of incomplete material culture in the construction of identity and the enchaining of social relations was highlighted, notably in the work of John Chapman (Chapman 2000; Chapman and Gaydarska 2007). Cases where a materialist explanation seemed insufficient were brought to the foreground. A much-cited example is a sword-find from Staffordshire, England, where the two halves of the sword – featuring differences in wear and patina – were found deposited at two different hills, 3 km apart (Bradley and Ford 2004).

Other peculiarities were noted, e.g. that Late Bronze Age hoards rarely contain more than one piece from each object (e.g. Hansen 2016; Milcent 2017), that fragments of bronze or gold objects were sometimes stuffed into the sockets of axe or spear heads (Dietrich and Mörtz 2019), and that some of the fragments and objects had been subjected to destructive or modifying treatments – crushing, bending, folding (Hoffman 1999; Nebelsick 2000; Gabillot and Lagarde 2008; Knight 2022) – gestures which do not seem motivated by simple decommission for recycling. The fact that objects are often represented by only one fragment was paralleled to the ancient Greek sacrificial custom of *pars pro toto*, where one votive piece was taken as a representation of the whole (Hansen 2016). Detailed studies of hoard content also raised awareness of the regional differences in the proportion of objects that had been completely broken, as well as how hoards were constituted (Maraszek 2006; Gabillot and Lagarde 2008). Fragmentation and hoarding became regarded as going far beyond our current framework of explanation, urging for the need to update the very definition of Bronze Age 'economy' (e.g. 'ritual economy' in Kristiansen 2012; 'moral economy' in Fontijn 2019).

Over the past few years, a new avenue of research about fragmented metal objects in the European Bronze Age has emerged. While it has revisited questions of fragments as potential raw material used in trade, more systematic statistical analysis has helped birth a renewed interest in how broken bronze (as well as gold) related to weight standards and fragments used in mercantile transactions (e.g. Milcent 2017; Wiseman 2018; Ramsdorf 2019; Ialongo and Lago 2021; Ialongo *et al.* 2021; for overview of the earlier research on this topic see Rezi 2011: 304-305; Pare 2013). Several important observations point in this direction. Pierre-Yves Milcent has argued for an increased monetary function of bronze 'scrap' in Atlantic France in the Late Bronze Age based on statistical observations of the increasing amounts of fragments in hoards as well as the fragments' decreasing size and the lack of matching fragments, which he suggests indicate increasing use and circulation before ending up in the ground (Milcent 2017). Nicola Ialongo and Giacomo Lago have performed statistical studies of large datasets of fragments in hoards from central Europe and Italy, demonstrating that their weights cluster around certain values (Ialongo and Lago 2021). They describe the increasing use of fragments as a form of money as a 'small change revolution'.

This research has gone hand in hand with new finds and studies identifying balance beams and weights from Late Bronze Age southern, western and central Europe, demonstrating the presence of weight systems (e.g. Rahmsdorf 2019; Mordant *et al.* 2021; Poigt 2022). However, many issues regarding Late Bronze Age weight systems are still under debate, e.g. if they were of regional or pan-European character, and whether the access to weighing technology was restricted or widespread in society (e.g. Pare 2013; Ialongo *et al.* 2021; Vandkilde 2021; Poigt 2022; Ialongo *et al.* 2023;).

Many questions also remain regarding the relationship between the use of fragments and their later composition and deposition in hoards – constituting two separate practices, and two separate but interrelated issues of archaeological interpretation. If 'scrap' hoards were meant as wealth storage (e.g. Wiseman 2018) or as safekeeping of 'hackbronze currency' in times of social unrest (Brandherm 2018: 50), why were so many fragment hoards left in the ground (Brück and Fontijn 2013: 211; Fontijn 2019: 163)? Were they revisited or not? What is the relation between what was deposited in a hoard and what was kept, and what is the relation between simultaneous or nearby depositions (e.g. Boulud and Fily 2009: 291)? What happened to all the 'missing pieces' from objects that were only partly deposited in hoards? Were they employed in recycling, were they curated, or did they end up in other forms of depositions (e.g. Brück 2006; 2016)? Despite almost 200 years of research on hoards, many of these questions remain unanswered and continue to intrigue the archaeological imagination.

Broken metalwork in Europe

Already from the advent of copper and copper-alloy metallurgy, objects were likely sometimes broken up into smaller parts for the sake of re-melting. We can imagine the need to remake a miscast object; certainly, the recycling of old objects was a known possibility. Signs of early deliberate fragmentation have been noted on some fragmented Late Neolithic copper flat axes from northern Germany and Denmark, seemingly broken via 'hot-shorting' (meaning that the object had been hit when heated, resulting in a clean and sharp break; Skorna 2022: 64-66). Occasional deliberately fragmented metalwork occurs in ritual depositions, e.g. the intricate arrangement of two axe halves and a necklace at the site 'La Vayssonnié' in southern France (Serville 2006). However, generally speaking, the fragmentation of early copper axes seems rare. There is an undeniable dominance of complete early metal axes in the archaeological record (Vandkilde 1996). The treatment of the early metal objects follows that of stone axes, suggesting that there was only a 'gradually increasing recognition, social acceptance and exploitation of metal's mutability' (Bray and Pollard 2012: 862, as quoted in Johnston 2020: 42-44).

The fragmentation rate of bronze metalwork in the archaeological record increased with time. Although it is difficult to generalise over this vast and culturally diverse area, the increasing presence of fragmented bronze objects in the Late Bronze Age is well attested throughout Europe (e.g. Gabillot 2004: 199; Pennors 2004; Rezi 2011; Hansen 2016: 201; Maraszek 2006; Milcent 2017; Vilaça and Bottaini 2019; Lago 2020; Knight 2022). Statistical studies of fragmentation patterns over time demonstrate a gradual increase which peaked in the Late Bronze Age (e.g. Pennors 2004; Milcent 2017; Lago 2020; Knight 2022; Bordas 2023). It should be noted that the fragmentation rate did not follow an exponentially increasing curve, e.g. in Atlantic France the second phase of the Middle Bronze Age shows almost no fragmented objects in hoards, in sharp contrast to the earlier and later periods (Gabillot 2004; Boulud-Gazo *et al.* 2017). Nevertheless, the general tendency is clear: less fragmentation in the beginning and more as the Bronze Age advanced. What if this could be seen as a veritable secondary products revolution?

'Secondary products' – what fragmentation facilitates

Pieces of bronze metalwork were increasingly omnipresent in the Late Bronze Age. The following section will explore the diversity in fragment use by looking at a range of archaeological find contexts. Here, I take inspiration from the concept of the 'secondary products revolution' first coined by Andrew Sherratt (1981) in his influential paper about transformations in the Eurasian Neolithic. Sherratt used this term to signify diversification in the utilisation of domesticated animals as resources for humans: instead of only being used as 'finite resources' for meat production, exploitation enlarged to include the use of animals to produce wool and milk in addition to the keeping of draught animals for ploughing and transport.[1] Sherratt dated this development to *c.* 4000 BCE in the 'Old World'. In the current study, 'secondary products' refer to the secondary uses of bronze objects in a fragmented form and should be contrasted with the primary function of the original (intact) object itself (i.e. cutting, shaving, inflicting violence, adorning, holding pieces of clothes together, etc.).

While Sherratt evoked the concept of a 'revolution' in a larger argument about the 'evolutionary benefits'

[1] Wool, milk, transportation, and ploughing are all secondary products according to Sherratt (1981).

Figure 2: Late Bronze Age hoard from Hellaz, Saint-Ygeux in Brittanny on the northwest coast of France. Among the objects and fragments deposited in the ceramic vessel excavated in situ (A), was a small linen bag (visible in the bottom-right corner of the pot) containing 13 small bronze fragments (B), interpreted by Fily and colleagues (2023) as a bag of fragments for weighing and trade (photos: Muriel Fily, Muriel Mélin, reproduced with permission).

of secondary products, and contrasting them to a lack of similar developments in sub-tropical zones and in the 'New World', I have no intention of applying this concept as an overall explanatory model. 'Secondary products revolution' is here used as a rhetorical figure to illuminate the range of practices in which Late Bronze Age metalwork fragments were involved.

Collecting and compiling: assembling fragments in pits, pots, and bags

The most visible testimony of fragment use in the archaeological record are the hoards. In these caches, fragments and complete objects were placed together, often in containers such as pots or bags, thereby compiled into tightly packed and sometimes carefully arranged bundles of bronze (Fig. 2). As pointed out by several scholars (e.g. Bordas 2023: 470), the so-called 'complete' objects found in these 'scrap hoards' might actually be incomplete (in the sense that hafts and other composite organic parts had been removed). Leaving aside the question of motifs behind the hoarding and deposition, I would like to stress here how fragmentation enabled metal to be kept in a tightly packed format. Fragmentation made bronze easier to stack, pile and to transport, but also to present or arrange/associate in new ways. Objects and fragments within the same assemblage could be more easily differentiated by separating them into various containers (e.g. Dietrich and Mörtz 2019; Fily *et al.* 2023; see Figs 1 and 2).

An example of this can be seen in the recently discovered hoard from Hellez, Saint-Ygeaux (Côte-d'Armor) in Brittany, France, dating to the Atlantic Late Bronze Age II (*c.* 1140-950 BCE) with a radiocarbon date of organic material from the find spanning 1056-917 cal BCE (Fily *et al.* 2023). It consisted of a variety of fragmented bronze objects, ingots and metal debris stacked together in a ceramic pot. In addition, the pot also contained a small linen bag sealed with an organic sprig, which, in turn, held 13 small bronze fragments (Fily *et al.* 2023; see Fig. 2). Muriel Fily and colleagues propose that these fragments might be seen as material for weighing and trading, in parallel with fragments found with weighing equipment in some western and central European burials from this period (see below). Such special sets of fragments could be kept apart, as they were small and light enough to fit in a small textile bag, creating a sort of 'bundle within the bundle'. Such tiny fragments have probably been overlooked in many earlier hoard finds.

Bits for barter: commodities and parts of individuals' purses

The suspicion that bronze fragments were used as money in a weight-based economy is a long-standing hypothesis in Bronze Age archaeology (e.g. Lomborg 1981: 79; Sommerfeldt 1994; Weiler 1996). Recently, new insights into weight systems and the use of delicate balance beams in several parts of Europe have improved our knowledge of the organisation and practical solutions for the exchange of valuable substances (e.g. Rahmsdorf 2019; Ialongo *et al.* 2021; Poigt 2022). Data supporting a monetary function of bronze 'scrap' in such systems have been advanced by scholars in various parts of Europe (e.g. Milcent 2017; Melheim 2018; Ialongo and Lago 2021). Besides arguments for regulated weights and increasing fragment circulation, the fragments of non-local objects found far from their original area of production also show the exchange of fragments over long distances (Milcent 2017: 726). Apart from trade, we might also consider the gifting or symbolic exchange of pieces to settle commitments, such as alliances or peace deals, as potential explanations for some such 'non-local' pieces.

Some of the most direct examples of fragments employed in barter are fragments serving as weights, or collections of 'scrap' found in connection with weighing equipment in personal purses or boxes of special individuals seen in the burial record (Pare 1999; Mordant *et al.* 2021). Certain Late Bronze Age (Bz D; Reinecke 1933) burials in southern Germany and eastern France contain rare examples of purses or boxes including (among other things) metalwork

Figure 3: An assemblage of 'scrap bronze' interpreted by Tomas Uhlig and colleagues (2019) as a personal toolbox with metal for weighing and trade lost by a passing traveller. It was found on the riverbed of the Tollense, at Weltzin 28, one of the battle sites (photo: Volker Minkus, reproduced with permission).

fragments, balance beams and weights (e.g. Pare 1999; Poigt 2022: 90-95; Mordant *et al.* 2021). One such find was identified in grave 298 at a Late Bronze Age burial site in Migennes, eastern-central France. A high-status male burial from the 13th century BCE included traces of two wooden boxes; one of these contained, among other items, several small bronze objects, bronze fragments, gold fragments and a balance beam (Roscio *et al.* 2011). This has been identified as a complete weighting set, probably used for weighing small quantities (Roscio *et al.* 2011, 182; Poigt 2022, 90-95). In the case of Migennes (as well as in some other cases; Pare 1999, 448; Mordant *et al.* 2021: 161, 164; Poigt 2022: 134) it is particularly interesting to note how the heads of dress pins were reused as weights (Poigt 2022: 147-148). Bronze fragments sometimes took on the function of being a personal possession. Individuals equipped in this way seem to have been linked to, or even in control of the exchange, treatment and refinement of precious substances, i.e. gold, pigments, spices, etc. (Pare 1999: 470).

From northern Europe we can also evoke the small 'scrap' metal assemblage of 31 object fragments, metallic casting debris and small tools from the famous site dated to the early 13th century BCE in the Tollense River in northeast Germany (Uhlig *et al.* 2019: 1211-1213). These objects, found tightly grouped on the river floor, are believed to have been kept in an organic container (hence disappeared), and are interpreted as the remains of a small personal toolbox similar to the collection from burial 298 in Migennes, France (Uhlig *et al.* 2019; see Fig. 3). Parallels with the box from Migennes are strengthened by the presence of similar cylindric bronze fittings, which made up part of the locking system on the French box (Uhlig *et al.* 2019: 1223-1224). The authors suggest that the metalwork collection was transported with the individuals (possibly originating from southern Germany) who were attacked and killed by rivalling groups when passing through the valley.

The power of pieces: symbolic partition, enchainment, and amulets

Certain pieces of bronze objects have been singled out for special treatments outside of the contexts of hoards. It is difficult to get an overview of such finds, as metalwork fragments from non-hoard contexts have not yet been systematically studied. Examples from the Middle and Late Bronze Age can nevertheless hint at various rituals and symbolic uses.

Intentionally broken pieces of metal objects occur in the Late Bronze Age burial record. Cremation graves in many regions include small, incomplete items. At the Late Bronze/Early Iron Age burial ground of Påljungshage in eastern Sweden, two neck ring fragments – apparently originating from the same object – were found deposited in two different graves (Eklund *et al.* 2012: 58-59; Röst 2016: 219-220, fig. 6.23, 6.33, 6.34; see Fig. 4). As discussed by Anna Röst, this creates a link or relation between these buried persons (one child and one adolescent/young adult) from roughly contemporary graves; a relation which was underlined, or 'enchained', in prehistory by the fragments broken off from this ring (Röst 2016: 220). Similarly, Karen Margrethe Hornstrup (2018) has noticed a case where two neck ring fragments, presumably originating from the same *Wendelring*, were found in two contemporary burials at the site Kildehuse II, Denmark (Hornstrup 2018: 104 with reference).

Hornstrup (2017) has also studied the unusual organic finds and potential amulets in the Late Bronze Age burial record from Denmark. Among these diverse objects she has noted items such as perforated teeth, eagle claws, and fragments of amber. She also highlights a potential amulet consisting of a bronze fragment inserted in a lump of pitch/resin found in a grave in Hellegård, Jutland (Hornstrup 2017: 85). Another context invoking use of certain bronze fragments as amulets is the famous Nordic Bronze Age Period III tumuli at Hvidegård on Zealand, Denmark. Among the objects found with the cremated remains of several individuals were a small leather belt purse which contained a mix of small items (a bronze razor and a knife, but also a peculiar range of animal bones and natural objects, i.e. the tail of a snake, various roots, and a piece of red ochre), as well as a collection interpreted as amulets in a magicians' bag or 'medicine bundle', perhaps serving in rituals (e.g. Kaul 1998: 18-20; Goldhahn 2009) or divination (Goldhahn 2019: 91). Bronze fragments occur in, and in connection to, several such purses, and interpretations range from money (Lomborg 1981: 79) to fragments of important objects for symbolic use, as heirlooms, or trophies kept for their 'mana' (Kaul 1998: 18-20; Goldhahn 2019: 89). It is also interesting to note that included in the grave was also a small bronze fragment from a larger decorated bronze object (Goldhahn 2009; 2019: 88-89).

Looking beyond the funerary arena, single fragments could also be intentionally deposited in the landscape. The much-cited sword from Staffordshire in England that was snapped in two pieces and buried at two nearby hilltops (Bradley and Ford 2004) has already been mentioned. Another example is the lower half of a Middle Bronze Age Atlantic Trèboul-type bronze sword, deliberately placed with the tip pointing upwards when deposited within a settlement in Maillé, Indre-et-Loire in western France (Chopin and Gomez de Soto 2014). These examples suggest the need for caution when assuming that individual fragments were lost or discarded as scrap, as they could evidently also be subjected to special forms of deposition.

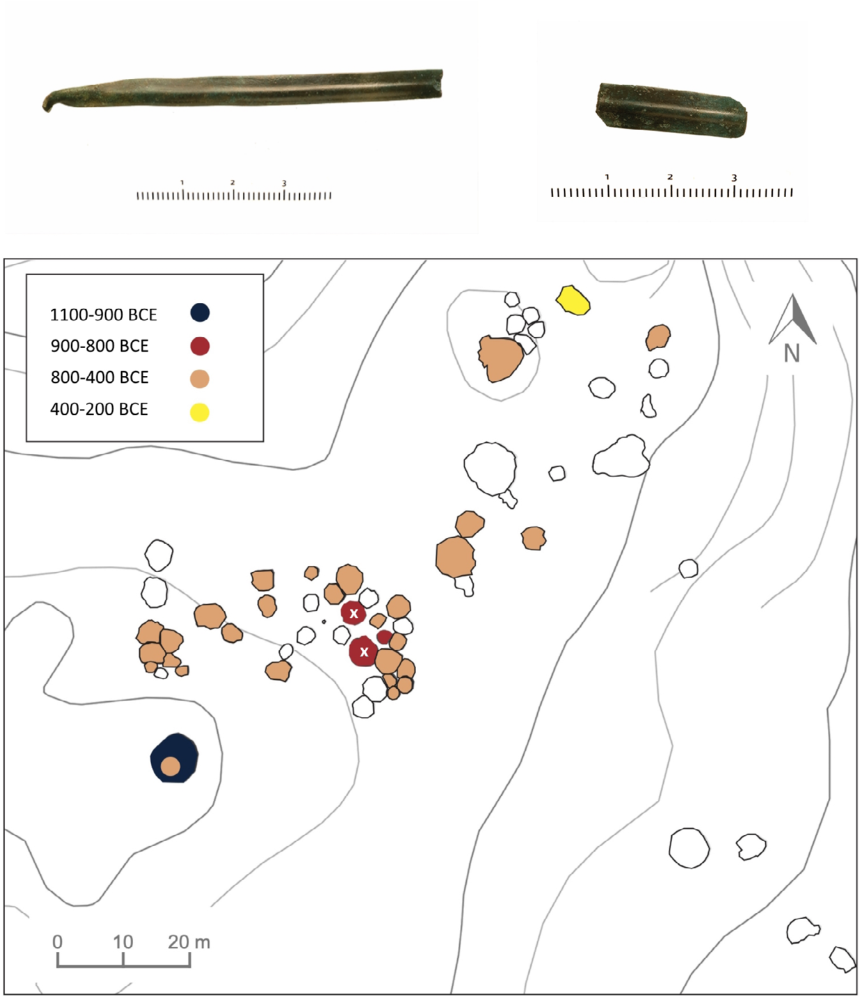


Figure 4: Two fragments appearing to be from the same neck ring. The fragments were found in two different, but roughly contemporary graves (the two equally sized and centrally located stone-settings dated to 900-800 BCE marked with white crosses on the site plan) at a burial ground at Påljungshage in eastern Sweden (photos: Societas Archaeologica Upsaliensis; site plan: Anna Röst, with minor edits by the author, reproduced with permission).

Recycling, reintegrating, and mixing: fragments in the making of new objects

A common (but archaeologically elusive) form of use of fragmented metalwork would have been recycling: integrating pieces of old bronzes into new objects. Although we can rarely prove, nor clearly observe it, the use of bronze fragments as raw material for casting is assumed to have been important in the Late Bronze Age.

'Scrap' hoards have often been seen as directly linked to and motivated by recycling practices (e.g. Wiseman 2018). However, the enigma remains: the fact that they were left in the ground means that such metals were clearly *retained* from recycling. However, some hoards with better contextual information found in recent years are reinvigorating the idea of 'scrap' hoards. One very recent example is the small collection of 11 bronze fragments found buried in a pit in a roundhouse at the Saint-Avé settlement in Brittany, France (Blanchet *et al.* in press). The roundhouse has been interpreted as a metalworker's hut due to finds of ceramic mould fragments, fragments of a tuyère and a structure interpreted as a bronze melting furnace. As Stéphane Blanchet and colleagues argue, the context does allow for the interpretation of the assemblage buried in this house as a founder's hoard (Blanchet *et al.* in press). Another case – also from a settlement – is that of the 15 bronze objects and fragments found in and around a wooden bucket at the well-preserved pile-dwelling settlement at Must Farm, Cambridgeshire, England (Uckelmann and Wiseman 2024). The collection was found in a small quadrangular building (Structure 4) and may possibly have been kept there awaiting remelting (Uckelmann and Wiseman 2024: 213). Unlike in Saint-Avé, however, there was no direct relation with

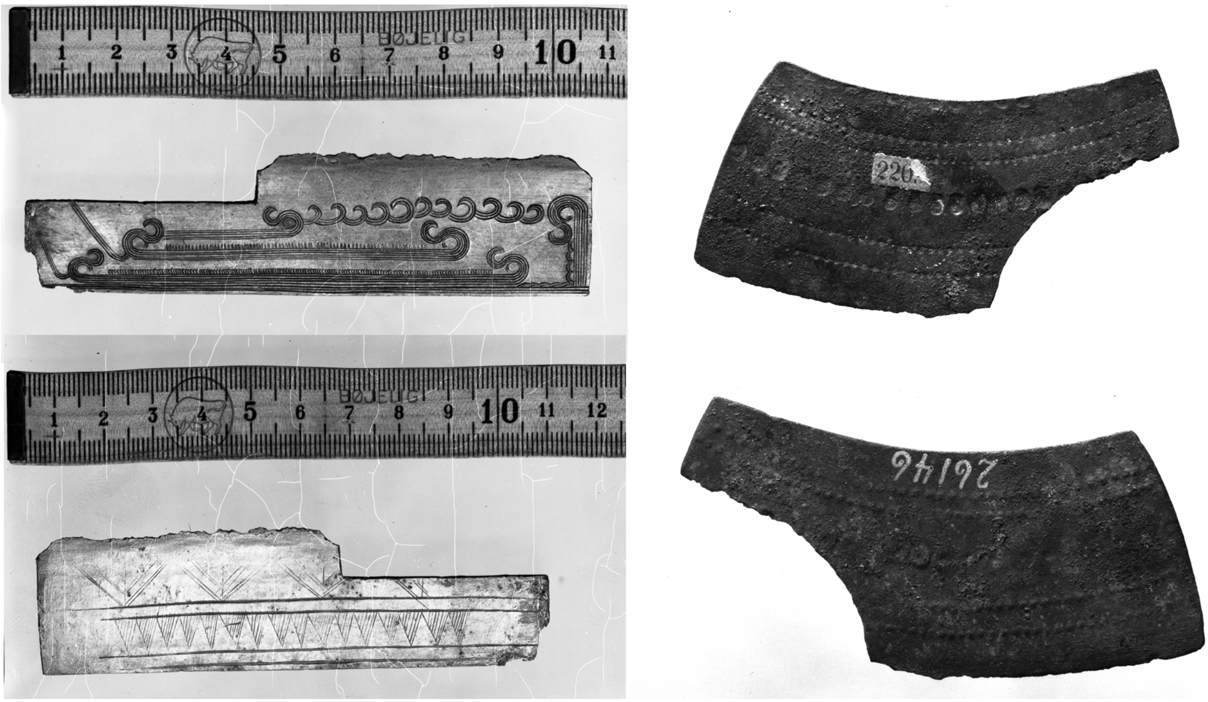


Figure 5: Nordic Late Bronze Age razors reworked from fragments of larger, decorated bronze objects. Inv. no. 26160 from Ebberup (left) and inv. no. 26146 from Bondehøj (right), both from Funen, Denmark (photos: Lennart Larsen, Nationalmuseet Denmark, CC-BY-SA).

metalworking remains in the case of the material from Must Farm.

Finally, some fragments were converted into new objects by being reworked, reshaped or re-combined (e.g. Thrane 2013; Jennings 2014; Hornstrup 2018; Vilaca and Bottaini 2019: 136; Ojala and Sörman 2024). For example, Nordic Late Bronze Age razors were sometimes created from fragments of larger bronze vessels, neck rings or hanging vessels (Kaul 1998; Thrane 2013; see Fig. 5). Older fragments which served new purposes in this 'metal ecosystem', either as raw material metal or as reused pieces in new creations, were probably not without symbolic or ancestral implications (e.g. Sörman 2024).

Discussion – breaking bronze as secondary products revolution

As demonstrated by these diverse examples, bronze metalwork fragments took on a range of new, secondary functions, compared to the original objects – representing a veritable secondary products revolution in Late Bronze Age metal use. Svend Hansen (2016: 200) has argued that the integration of fragments in the deposition of hoards (votive offerings, in Hansen's text) from the Middle Bronze Age onwards was a cultural innovation. As I hope to have shown with this brief exposé, fragmenting metalwork was a cultural innovation that also extended to many other spheres of society. This innovation, or revolution, 'brought with it a new way of thinking, whose social background and whose social consequences still need to be determined' (Hansen 2016: 200). I will now discuss some of the reasons behind, and consequences of, this fragmentation frenzy.

One important reason why fragments brought about new ways of thinking and acting was because of how their qualities differ from those of full artefacts, and how these qualities were harnessed. One obvious difference to complete metalwork is that broken pieces are smaller and lighter. When grouped, they can form a more compact mass, facilitating new ways of carrying, storing, and arranging metal. Fragments like those featuring in Late Bronze Age hoards could be compacted into bags and ceramic or bronze vessels more easily than the equivalent mass of complete items. Small pieces 'infiltrated' many contexts. They could be stuck in or folded into other substances, i.e. the bronze bit wrapped in resin recorded as the strange, and so far, unparallelled 'amulet' from the Hellegård burial ground (Hornstrup 2017). Alternately, they might be stuffed into the sockets of axes or spearheads (Dietrich and Mörtz 2019). Their 'secondary use' as amulets – presumably carried on a person (in a purse, for example) – or the small fragments occurring in the 'magician's bags', from Scandinavian Period III tumuli (e.g. Goldhahn 2009), also underlines this quality. Additionally, in some regions, small and carefully weighed fragments were kept and used as weights for measuring quantities of valuable goods (e.g. Mordant *et al.* 2021). Fragmented metal was stored in special toolkit boxes, which could also be brought when going on journeys or trading expeditions, as perhaps indicated by the Tollense box (Uhlig *et al.* 2019). The extent to which such toolkits may have been used by more 'ordinary' people beyond elites and ritual specialists still remains unclear. However, the storage of such fragments at 'normal' settlements like Saint Avé and Must Farm indicate a wide range of users in society.

The reduced size of most fragments also meant that they were easily traded in the form of 'fragment money', which may in some regions have even been acknowledged as a material category for weight-based trade (e.g. Milcent 2017; Ialongo and Lago 2021). The use of bronze fragments as means of exchange and standard of value probably partly overlapped with the function sometimes held by complete objects or ingots. In addition, trading with small bronze fragments might have facilitated the exchange of smaller values (Ialongo and Lago 2021). We should not underestimate how this medium of exchange facilitated barter and speeded up the connections in and between Bronze Age communities (e.g. Ialongo *et al.* 2023) – in a world which became more and more intertwined through 'bronzization' (*sensu* Vandkilde 2016).

However, fragments were not only seen as 'money', nor was this interpretation universally applicable. Indeed, the many uses of fragments point to other values associated with this material. One such value is that fragments carry the link to the original whole. This is one of its most particular qualities, charging it with potential capacity to 'enchain' (Chapman 2000). This was evidently used sometimes in the Late Bronze Age, for example when linking two buried persons by placing fragments of the same object in their respective graves, as shown in possible cases from Sweden and Denmark (Röst 2016: 220; Hornstrup 2018: 104). Pieces that were split up and used in various contexts could refer to a joint history (at least as long as it was remembered by the people involved) or a joint object, if the shape allowed onlookers to recognise the piece from which the fragments originally came. Whether this aspect was also important for pieces used for re-melting and creating new bronzes is, so far, difficult to study archaeologically. However, if we examine those fragments upcycled into new objects, i.e. the razors mentioned above (Thrane 2013), the 'previous life' of the fragment is visible to archaeologists familiar with Bronze Age metalwork typology, which probably means it was recognisable for Bronze Age persons as well.

Here, we approach one of the core questions asked about this material: did bronze lose its cultural value when fragmented? This question goes back to longstanding assumptions about commodification and 'scrap' as a sort of 'neutralised' bulk of raw material or trade goods (see discussion in Brück 2016). Here, again, we can illuminate the question by considering the particular material qualities of fragmented Bronze Age metalwork. On the one hand, these objects were 'defunctionalised' and disfigured through breaking. On the other, the origin of the fragments could still often be recognised by their shape or ornamentation. This key quality means that *the original whole was both eliminated and somewhat remained* following the fragmentation of Late Bronze Age metalwork. Fragments of Bronze Age metalwork were, thus, a fluid medium. As suggested in the literature, while scrap might have been popular for trade because of its less 'culturally recognizable form', it often remained recognisable, at least by the people familiar with the original forms and shapes. These associations could be latent and later re-evoked. Fragmentation does not destroy value; it creates another value (Brück 2016). Concepts like 'neutralised' and 'defunctionalised' should, therefore, be used cautiously.

On one level, fragmented bronze metalwork was a trans-cultural medium (so many groups produced bronze objects and broke them into pieces). At the same time, this medium was neither standardised, nor did it have a uniform shape; bits came from a wide range of various objects, creating non-identical fragments. Although fragments might have the same weight, they might not have the exact same look, and rarely the same history. The fragments' pluripotency and other qualities (packability, transportability, recyclability) added even more colours to the palette of bronze use in Late Bronze Age Europe.

Future perspectives

The archaeological thinking about fragmented Bronze Age metalwork has evolved rapidly over the last two decades, leading to a range of exciting questions. Many observations remain to be made about selective practices of what was fragmented and singled out for deposition, practices involving 'amulets' and enchainment, regional similarities and differences, their adherence to weight standards, mobility and cultural reach, and the importance of the act of breaking, to mention but a few.

To end, I want to take the opportunity to highlight some basic issues that remain to be dealt with in order to better understand this phenomenon. A fundamental step is *finding* fragments, notably by going through older materials. For many regions, we still lack reliable descriptions of fragmentation rate and incompleteness, as recording the detailed state of each item was often not considered important in earlier works. This hinders both quantitative approaches and selections for targeted qualitative studies. A second issue consists of tracing fragments in *non-hoard contexts*. As we have seen, pieces of metalwork appear in burials and built environments, but systematic studies of such finds are lacking. Such systematic studies open the way for important questions, e.g. the destiny of the 'missing fragments' and potential links between fragments of the same object ending up in different places. Thirdly, and finally, the application of *scientific methods*, such as use-wear analysis, provenancing, and composition studies might be able to provide new, basic information about circulation time, use patterns, and whether or not fragments come from the same object. The better our insights regarding the whereabouts and circulation of these little pieces, the better our understanding of the overarching motif of the greater Bronze Age puzzle.

Acknowledgements

I am grateful to the editors for the invitation to participate in this volume in honour of Helle Vandkilde – a truly inspiring scholar, one to whom I am acquainted via her work rather than in person. I also want to give my thanks to the colleagues who have generously provided me with images and permission to reproduce their material. Finally, I am grateful to the Wenner-Gren Foundations for funding my current research on Bronze Age fragmentation (WGF 2021-0006).

Bibliography

Blanchet, S., M. Mélin, C. Le Carlier De Veslud and T. Nicolas (in press, article to appear in edited volume). A Late Bronze Age settlement and its metallurgist's workshop at Saint-Avé (Brittany, France) – First results.

Bordas, F. 2023. Les dépôts métalliques du BFa 3 (950-800 av. J.-C.) en Gaule atlantique – Modalités de circulation, de manipulation et d'enfouissement du métal. Unpublished PhD Thesis, Université Toulouse 2, Jean Jaurès.

Boulud, S. & M. Fily 2009. Les dépôts métalliques de l'extrême fin du Bronze final en Bretagne : nouvelle évaluation des données à la lumière des découvertes récentes, in H. Gaillard de Sémainville (ed.) *De l'âge du Bronze à l'âge du Fer en France et en Europe occidentale (Xe - VIIe siècle av. J.-C.).* La moyenne vallée du Rhône aux âges du Fer: Actes du XXXe colloque international de l'A.F.E.A.F., co-organisé avec l'A.P.R.A.B. (Saint-Romain-en-Gal, 26 - 28 mai 2006): 283-298. Dijon: S.A.E., A.P.R.A.B. and A.F.E.A.F.

Boulud-Gazo, S., M. Mélin and M. Nordez 2017. De la fin du Bronze moyen au début du Bronze final : un état des lieux dans le Nord-Ouest à la lumière des dépôts volontaires, des productions métalliques et des contextes funéraires, in T. Lachenal, C. Mordant, T. Nicolas and C. Veber (eds) *Le Bronze moyen et l'origine du Bronze final en Europe occidentale, de la Mer du Nord à la Méditerranée (XVIIeXIIIe siècle avant notre* ère*)*: 851-870. Strasbourg: AVAGE.

Bradley, R. 1990. *The passage of arms: an archaeological analysis of prehistoric hoards and votive deposits.* Cambridge: Cambridge University Press.

Bradley, R. & Ford, D. 2004. A long-distance connection in the Bronze Age. Joining fragments of a Ewart Park sword from two sites in England, in H. Roche, E. Grogan, J. Bradley, B. Raftery and J. Coles (eds) *From Megaliths to Metals. Essays in Honour of George Eogan*: 174-177. Oxford: Oxbow Books.

Brandherm, D. 2018. Fragmentation patterns revisited: ritual and recycling in Bronze Age depositional practice, in D. Brandherm, E. Heymans and D. Hofmann (eds) *Gifts, Goods and Money: Comparing currency and circulation systems in past societies*: 45-65. Oxford: Archaeopress.

Brandherm, D. 2021. Valeur matérielle, valeur symbolique et fragmentation intentionnelle des objets dans les dépôts de l'âge du Bronze, in C. Marcigny and C. Mordant (eds) *Bronze 2019: 20 ans de recherches. Actes du colloque international anniversaire de l'APRAB, Bayeux (19-22 juin 2019)*: 573-582. Nonant: OREP.

Brück, J. 2006. Fragmentation, personhood and the social construction of technology in Middle and Late Bronze Age Britain. *Cambridge Archaeological Journal* 16(3): 297-315.

Brück, J. 2016. Hoards, Fragmentation and Exchange in the European Bronze Age, in S. Hansen, D. Neumann and T. Vachta (eds) *Raum, Gabe und Erinnerung: Weihgaben und Heiligtümer in prähistorischen und antiken Gesällschaften*: 75-92. Berlin: Edition Topoi.

Brück, J. and D. Fontijn 2013. The myth of the chief: prestige goods, power, and personhood in the European Bronze Age, in H. Fokkens and A. Harding (eds) *The Oxford Handbook of the European Bronze Age*: 197-215. Oxford: Oxford University Press.

Chapman, J. 2000. *Fragmentation in archaeology: people, places, and broken objects in the prehistory of south-eastern Europe*. London: Routledge.

Chapman, J. and B. Gaydarska 2007. *Parts and wholes: fragmentation in prehistoric context*. Oxford: Oxbow Books.

Chopin, J.-F. and J. Gomez De Soto 2014. Fragment de lame d'épée ou de poignard du type de Tréboul-Saint-Brandan du site du Perrou 2 à Maillé (Indre-et-Loire). *Bulletin de la Société préhistorique française* 111(3): 530-533.

Déchelette, J. 1910. *Manuel d'archéologie préhistorique, celtique et gallo-romaine. II, Archéologie celtique ou protohistorique*. Paris: Picard.

Dietrich, O. and T. Mörtz 2019. Sockets full of scrap? Remarks on deliberate fragmentation in Late

Bronze Age metal deposits in south-eastern and north-western Europe, in D. Brandherm (ed.) *Aspects of the Bronze Age in the Atlantic Archipelago and Beyond: Proceedings from the Belfast Bronze Age Forum, 9-10 November 2013*: 281-297. Hagen: curach bhán publications.

Eklund, S., A. Lindkvist and J. Wikborg 2012. *Påljungshage: kremerat, paketerat och respekterat: ett gravfält från yngre bronsåler-äldre förromersk järnålder: förundersökning och särskild undersökning: Helgona 220, Stenbro 1:8, Helgona socken, Nyköpings kommun, Södermanland*. Uppsala; Societas Archaeologica Upsaliensis.

Evans, J. 1881. *The Ancient Bronze Implements, Weapons, and Ornaments, of Great Britain and Ireland*. London: Longmans, Green and Co.

Fily, M., M. Mélin, V. Gendrot, A. Levillayer and V. Bardel 2023. L'affaire est dans le sac : un cas exceptionnel de contenant textile au sein du dépôt du Bronze final atlantique 2 de Hellez, Saint-Ygeaux (Côtes-d'Armor). *Gallia Préhistoire* 63 (online, 22 January 2024, available at: 10.4000/galliap.4186).

Fontijn, D. 2019. *Economies of destruction: how the systematic destruction of valuables created value in Bronze Age Europe, c. 2300-500 BC*. Abingdon: Routledge (e-book available at: 10.4324/9781315109879).

Gabillot, M. 2004. La fragmentation des objets : critère d'étude des dépôts de l'âge du Bronze, in P. Bodu and C. Constantin (eds) *Actes du 25ème Congrès Préhistorique de France : Approches fonctionnelles en Préhistoire, Nanterre, 24-26 novembre 2000*: 193-201. Paris: Société préhistorique française.

Gabillot, M. and C. Lagarde 2008. Voluntary destructions of objects in Middle and Late Bronze Age hoards in France, in C. Hamon and B. Quilliec (eds) *Hoards from the Neolithic to the Metal Ages: Technical and codified practices*: 59-65. Session of the XIth Annual Meeting of the European Association of Archaeologists. British Archaeological Reports International Series 1758. Oxford: Archaeopress.

Goldhahn, J. 2009. *Om krigens minnen och att minnas krig: Hvidegårdsgraven revisited #2*. Kalmar: Högskolan i Kalmar.

Goldhahn, J. 2019. *Birds in the Bronze Age: A North European Perspective*. Cambridge: University Press.

Hansen, S. 2016. A Short History of Fragments in Hoards of the Bronze Age, in H. Baitinger (ed.) *Materielle Kultur und Identität im Spannungsfeld zwischen mediterraner Welt und Mitteleuropa*: 185-208. Mainz: Verlag des Römisch-Germanischen Zentralmuseums.

Hoffman, C.R. 1999. Intentional damage as technological agency: breaking metals in late prehistoric Spain, in M.A. Dobres and C.R. Hoffman (eds) *The Social Dynamics of Technology: Practice, Politics, and World View*: 103-123. Washington, DC: Smithsonian Institution Press.

Hornstrup, M.K. 2017. From bird wings to fool's gold. Organic material and rock from the late Bronze Age and the early Iron Age, in S. Bergerbrant and A. Wessman (eds) *New Perspectives on the Bronze Age. Proceedings of the 13th Nordic Bronze Age Symposium held in Gothenburg 9th to 13th June 2015*: 84-95. Oxford: Archaeopress.

Hornstrup, M.K. 2018. Fragmenter, omdannede genstande og social status i yngre bronzealder, in S. Boddum and N. Terkildsen (eds) *Status og samfundsstruktur i yngre bronzealders kulturlandskab*: 101-113. Viborg: Viborg Museum.

Ialongo, N., R. Hermann and L. Rahmstorf 2021. Bronze Age weight systems as a measure of market integration in Western Eurasia. *PNAS* 118(27): e2105873118 (available at: 10.1073/pnas.2105873118).

Ialongo, N. and G. Lago 2021. A small change revolution. Weight systems and the emergence of the first Pan-European money. *Journal of Archaeological Science* 129: 105379 (available at: 10.1016/j.jas.2021.105379).

Jennings, B. 2014. Repair, Recycle or Re-use? Creating Mnemonic Devices Through the Modification of Object Biographies During the Late Bronze Age in Switzerland. *Cambridge Archaeological Journal* 24(1): 163-176.

Johnston, R. 2020. *Bronze Age Worlds: A Social Prehistory of Britain and Ireland*. London: Routledge.

Kaul, F. 1998. *Ships on bronzes: a study in Bronze Age religion and iconography*. Copenhagen: National Museum.

Knight, M.G. 2022. *Fragments of the Bronze Age: The Destruction and Deposition of Metalwork in South-West Britain and its Wider Context*. Oxford: Oxbow Books.

Kristiansen, K. 2012. Bronze Age Dialectics: Ritual Economies and the Consolidation of Social Divisions, in T.L. Kienlin and A. Zimmerman (eds) *Beyond Elites. Alternatives to Hierarchical Systems in Modelling Social Formations*: 381-392. Bonn: Rudolf Habelt.

Lago, G. 2020. Fragmentation of metal in Italian Bronze Age hoards. New Insights from a quantitative analysis. *ORIGINI* 44: 171-194.

Levy, J.E. 1982. *Social and religious organization in Bronze Age Denmark: an analysis of ritual hoard finds*. British Archaeological Reports International Series 124. Oxford, BAR Publishing.

Lomborg, 1981. Et tøjstykke fra Hvidegårdsfundet– En hilsen fra Christian Jürgensen Thomsen, in R. Egevang (ed.) *Det skabende menneske: Kulturhistoriske skitser tilegnet P.V. Glob*: 64-84. Copenhagen: Nationalmuseet.

Maraszek, R. 2006. *Spätbronzezeitliche Hortfundlandschaften in atlantischer und nordischer*

Metalltradition. Halle an der Saale: Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, Landesmuseum für Vorgeschichte.

Melheim, L. 2018. Weight units and the transformation of value: approaching premonetary currency systems in the Nordic Bronze Age, in D. Brandherm, E. Heymans and D. Hofmann (eds) *Gifts, Goods and Money: Comparing currency and circulation systems in past societies*: 67-83. Oxford: Archaeopress.

Milcent, P.-Y. 2017. Valeurs d'usage et d'échange. La dimension prémonétaire des dépôts en Gaule atlantique du XIIIe au Ve s. av. J.-C. *Bulletin de la Société préhistorique française* 114(4): 711-737.

Nebelsick, L.D. 2000. Rent Asunder, Ritual Violence in Late Bronze Age Hoards, in C. Pare (ed.) *Metals Make the World Go Round: The Supply and Circulation of Metals in Bronze Age Europe*: 160-175. Oxford: Oxbow Books.

Ojala, K. and A. Sörman 2024. Fusing fragments: Repaired objects, refitted parts and upcycled pieces in the Late Bronze Age metalwork of Southern Scandinavia, in A. Sörman, A.A. Noterman and M. Fjellström (eds) *Broken Bodies, Places and Objects: New Perspectives on Fragmentation in Archaeology*: 224-242. London: Routledge.

Oldeberg, A. 1942. *Metallteknik under förhistorisk tid*, Part 1. Lund: Håkan Ohlssons boktryckeri.

Pare, C.F.E. 1999. Weights and weighing in Bronze Age Europe, in I. Kilian-Dirlmeier and M. Egg (eds) *Eliten der Bronzezeit. Ergebnissezweier Kolloquien in Mainz und Athen*, Part 2: 421-514. Mainz – Bonn: Rudolf Habelt.

Pare, C. 2013. Weighing, Commodification and Money, in H. Fokkens and A. Harding (eds) *The Oxford Handbook of the European Bronze Age*: 508-527. Oxford: Oxford University Press.

Pennors, F. 2004. Analyse fonctionnelle et pondérale des dépôts et trouvailles isolées de l'âge du Bronze en France. Unpublished PhD Thesis, Université Panthéon-Sorbonne, Paris.

Poigt, T. 2022. *De Poids et de Mesure: Les instruments de pesée en Europe occidentale durant les âges des Métaux (XIVe-IIIe s. a.C.) : Conception, usages et utilisateurs*. Pessac: Ausonius éditions.

Reinecke, P. 1933. Zur Chronologie des frühen Bronzealters Mitteleuropas. *Germania* 17(1): 11-13.

Rezi, B. 2011. Voluntary destruction and fragmentation in Late Bronze Age hoards from central Transylvania, in S. Berecki, R.E. Németh and B. Rezi (eds) *Bronze Age rites and rituals in the Carpathian Basin*: 303-334. Târgu Mureş: Editura MEGA.

Roscio, M., J.-P. Delor and F. Muller 2011. Late Bronze Age graves with weighing equipment from eastern France: the example of Migennes 'Le Petit Moulin' (dép. Yonne), burial no. 298. *Archäologisches Korrespondenzblatt* 41: 173-187.

Röst, A. 2016. *Fragmenterade platser, ting och människor: Stenkonstruktioner och depositioner på två gravfältslokaler i Södermanland ca 1000–300 f Kr*. Stockholm: Stockholm University.

Rowlands, M.J. 1976. *The production and distribution of metalwork in the Middle Bronze Age in Southern Britain*. British Archaeological Reports British Series 31. Oxford: BAR Publishing.

Serville, C. 2006. La hache plate en cuivre, in Y. Tcheremissinoff (ed.) *"La Vayssonnié" et "La Salaberdié": deux occupations domestiques de l'âge du cuivre dans le Ségala (Tarn, France)*: 101-107. Castres: Centre archéologique départemental.

Sherratt, A. 1981. Plough and Pastoralism: Aspects of the Secondary Products Revolution, in I. Hodder, G. Isaac and N. Hammond (eds) *Pattern of the Past: Studies in the Honour of David Clarke*: 158-198. Cambridge: Cambridge University Press.

Skorna, H. 2022. *The Life and Journey of Neolithic Copper Objects. Transformations of the Neuenkirchen Hoard, North-East Germany (3800 BCE)*. Leiden: Sidestone Press.

Sommerfeld, C. 1994. *Gerätegeld Sichel: Studien zur monetären Struktur bronzezeitlicher Horte im nördlichen Mitteleuropa*. Berlin: Walter de Gruyter.

Sörman, A. 2024. Pieces of the past, fragments for the future - broken metalwork in Nordic Late Bronze Age hoards as memorabilia, in A. Sörman, A.A. Noterman and M. Fjellström (eds) *Broken bodies, places and objects – new perspectives on fragmentation in archaeology*: 259-273. London: Routledge.

Thrane, H. 2013. Scrap metal razors: Late Bronze Age razors made of scrap metal – another source for the study of imported bronze vessels, in I. Heske, H.J. Nüsse and J. Schneeweiss (eds) *Landschaft, Besiedlung und Siedlung: archäologische Studien im nordeuropäischen Kontext*: 445-453. Neumünster: Wachholtz Verlag.

Uckelmann, M. and R. Wiseman 2024. Inset: The bronze assemblage, in M. Knight, R. Ballantyne, M. Brudenell, A. Cooper, D. Gibson and I. Robinson Zeki (eds) *Must Farm pile-dwelling settlement: Volume 1. Landscape, architecture and occupation*: 213-215. Cambridge: McDonald Institute for Archaeological Research.

Uhlig, T., J. Krüger, G. Lidke, D. Jantzen, S. Lorenz, N. Ialongo and T. Terberger 2019. Lost in combat? A scrap metal find from the Bronze Age battlefield site at Tollense. *Antiquity* 93(371): 1211-1230 (available at: 10.15184/aqy.2019.137).

Vandkilde, H. 1996. *From Stone to Bronze. The Metalwork of the late Neolithic and earliest Bronze Age in Denmark*. Aarhus: Jutland Archaeological Society.

Vandkilde, H. 2016. Bronzization: The Bronze Age as pre-modern globalization. *Praehistorische Zeitschrift* 91: 103-123.

Vandkilde, H. 2021. Trading and weighing metals in Bronze Age Western Eurasia. [Commentary]

PNAS, 118(30): e2110552118 (available at: 10.1073/pnas.2110552118).

Vilaca, R. and C. Bottaini 2019. Breaking metals and handling ideas about Bronze Age hoards from Western Iberia. Material patterns, invisible behaviors and possible interpretations, in A.C. Valera (ed.) *Fragmentation and Depositions in Pre and Proto-Historic Portugal*: 125-139. Lisbon: Núcleo de Investigação Arqueológica (NIA).

Weiler, E. 1996. Metal standard during the Bronze Age. *Lund Archaeological Review* 2: 17-30.

Wiseman, R. 2018. Random accumulation and breaking: The formation of Bronze Age scrap hoards in England and Wales. *Journal of Archaeological Science* 90 (February): 39-49 (available at: 10.1016/j.jas.2017.12.007).

Worsaae, J.J.A. 1866. Om nogle mosefund fra Broncealderen. *Aarbøger for nordisk oldkyndighed og historie* 1866: 313-326.

Chapter 23

Images and numbers – Who are the anthropomorphic figures depicted in Nordic Bronze Age rock art?

Christian Horn

Department of Historical Studies, University of Gothenburg, Gothenburg, Sweden.
christian.horn@gu.se

Abstract

Nordic Bronze Age rock art (1700-500 BCE) has long had a wide array of different interpretations and was used as evidence for the reconstruction of social, religious, and economic aspects of past societies. Crucial in such studies are the over 6000 anthropomorphic, i.e. human-like figures, which have been interpreted as warriors, ancestors, gods, and other beings. Much of Bronze Age social life centred on achieving and increasing prestige and many of the objects depicted in rock art were connected with high-status individuals. Combining such objects with different body characteristics could indicate activities which may have been seen as important to attain status and prestige. This study investigates a large amount of anthropomorphic figures to understand which activities were considered appropriate including spatial differences. For clarity, social network analysis has been employed, because it offers different ways to discover subtle differences. The results suggest that rock art does indeed depict different pathways for elite individuals to gain status based on real-world activities. While there was a common pathway based on shared ideologies, prying apart the local differences shows that alternatives also existed.

Introduction

Long-standing research on the Nordic Bronze Age (NBA) has generated several social models, which demonstrate that certain individuals were able to maintain their grip on local power structures through the accumulation of status and prestige (Vandkilde 2013). The question which follows is how certain persons were able to gain such status. In this respect, two aspects are consistently highlighted: warrior ideology and maritime travels (Kristiansen and Larsson 2005; Vandkilde 2016; Ling *et al.* 2018). This is borne of very similar cultural heritage across the Nordic sphere, which is in turn mostly dominated by archaeological remains on Jutland, the Danish Isles, and Scania. There were constant back and forth relations with regards to trade, intermarriage, travels, and warfare which caused local communities to form tightly intertwined networks. These networks in turn may have created the outward uniformity of NBA material culture and social practices still visible today (Horn *et al.* in print). To identify regional variations, researchers have slowly started to pry apart the abundant cultural heritage of the NBA over the past decade (Anfinset and Wrigglesworth 2012; Austvoll 2021; Horn *et al.* in print).

Scandinavian rock art provides us with an outstandingly rich resource through which to explore potential differences between local societies. Figurative rock art in particular has clear local concentrations indicating that making figurative carvings was not common to all NBA societies (Nimura 2015). However, the carvings are one of the few direct self-expressions of prehistoric people of which we are aware. For this reason, the content and context of those carvings provide us with a unique chance to study local variations in ideas, ideologies, and reflections from the lives of ancient people. This content is clearly filtered (Bertilsson 1989: 315; Bevan 2015; Ling and Cornell 2010; Toreld 2012). For example, children, pottery, and houses were all very important components of daily live. However, none of those were depicted in rock art. Instead, the focus seems to have been on boats,[1] warriors, cosmology, etc. The chosen subject matters seem to suggest that the engravings were full of intentions, including the carvers' as well as those of later users and observers. There is no one single explanation for rock art; its purposes were likely manifold. It might, for example, have been used for self-aggrandisement, the illustration of social narratives, communication with ancestors or gods, or as a ritual act (Ling *et al.* 2018; Skoglund *et al.* 2022; Horn 2022; Kaul 2004; Bradley 2015). This is the reason why seemingly contradictory research results and interpretations may not in fact *be* contradictory, but complementary. Different research results may simply capture different aspects of this rich and complex material (Tilley 2021).

Among the plethora of rock art are more than 6000 anthropomorphic figures, many of which have associated attributes, e.g. swords, or, famously, horns similar to those on the helmets from Viksø which were recently conclusively dated by Helle Vandkilde and colleagues late in Period IV in the transition to Period V (Vandkilde *et al.* 2022). These anthropomorphic figures

[1] In the literature, both the terms 'boat' and 'canoe' can be found. Although not the same, I use them interchangeably here for variation, since this contribution does not seek to distinguish which vessels were depicted on the rocks.

Figure 1: Graphic explanation of how the database was established based on the example of Tanum (L1968:7550). The human has the following physical characteristics: a phallus (1), large hand (2), exaggerated calves (3), marked hips/thighs (4), and hoof-like feet (5). The outline of the body was carved deeper than the rest, so that it could be said that the figure has a frame-like body (6), but since the body was at least lightly carved it was not entered. All objects within a *c.* 10 cm-wide buffer around the figure were entered into the database, and thus, the analysis. This included a sword (A), boats (B), and feet/soles (C). Some indeterminate (D) objects were noted but not included within the analysis (graphic: Tanums Hällristningsmuseum; https://shfa.dh.gu.se/image/110128).

and their gear were also an excellent source material to study warfare and other violent conflict (Horn 2023; Ling and Cornell 2017; Frieman *et al.* 2017), a specialised field Vandkilde has defined over the past three decades (Vandkilde 1996; 2003; 2007; 2013; 2015; 2018).

Many of the objects in rock art were associated with high-profile burials and can, thus, be associated with high social status. Combining such high-status objects with body characteristics such as exaggerated calves, large hands and more was a purposeful decision by the carvers. This may have represented certain body images, perhaps associated to contemporary beauty ideals (Treherne 1995) or may have been linked to specific abilities. The objects depicted link these body characteristics (and perhaps the abilities therewith associated) to activities which may have been seen as important for the gain of status and prestige. In the context of this present chapter, a social network analysis (SNA) is employed to attempt to uncover how prestige and status were achieved, and especially to address variations through time and space (Scott 2013; Felding and Stott 2023; Horn 2023). By relying on a large dataset, the use of quantitative methods to investigate structure in the data, and interpreting the results by drawing on a wide array of theoretical perspectives, including archaeologies of practice, gender, and others, this contribution is situated within a processualism-plus framework (Hegmon 2003).

Anthropomorphic figures – The material

Continuous discoveries of new anthropomorphic figures by organisations like the Swedish Rock Art Research Archives (SHFA), *Stiftelsen för dokumentation av Bohusläns hällristningar*, Botark, and others, make it difficult to pinpoint their precise number. Another issue is the varying degree of the erosion of the rock surfaces throughout Scandinavia, which contributes to the difficulties in determining whether or not engravings were, in fact, anthropomorphs.[2]

[2] 'Anthropomorph' denotes a rock art figure in the shape of a human. The term is less interpretative than 'human', because the figures may be other beings than humans, especially since they may have features that would not naturally occur on humans, e.g. wings, double heads, horns, etc.

Boat images are often in association with short lines commonly interpreted as humans, i.e. the crew (Ling 2014). If these crew strokes would have been included in the total counts, then the number of human depictions in rock art would read into the tens of thousands. However, they have been excluded here, as these lines contribute little to an analysis of objects and body characteristics. Figures that were too heavily eroded were equally excluded. This leaves us with data from 4,849 anthropomorphic figures entered into a database – mainly from Sweden, but also from Norway, Denmark, and northern Germany (Fig. 1).

Every individual object some way linked to the human was collected within a database. Certain objects were not noted when they formed parts of a larger technical construction when they co-occurred in all cases, i.e. wagons always have wheels, which precluded these wheels from being entered. However, not every horseback rider or wagon driver was depicted with reins or ropes. In this way, we can assume that reins were considered important by some communities, but not all. Thus, their presence was noted in the database. An important observation is that most of the anthropomorphic figures were made without emphasised bodily characteristics or associated objects. That means that there are always more human figures without a specific bodily characteristic than with the same within a certain feature. This indicates that depicting certain objects and bodily characteristics depended greatly on local, temporal and/or contextually dependent customs.

Finally, as was previously shown, rock art is a highly fluid medium which had later additions, updates, and transformations (Bengtsson 2004b; Bertilsson 2015; Fredell 2003; Hauptmann and Wahlgren 2002; Horn and Potter 2018; Milstreu 2017). Nevertheless, all the figures discussed here emerged during the NBA in the form which we observe today. At one point in time, every attached or associated object and bodily characteristic was present and considered important by the carvers and their contemporary societies. Space here does not allow for the dating of all re-engagements for each individual figure, thus, the results presented should be seen as a general trend that forms a baseline for further investigations, but which also necessarily blurs the potential accuracy of the results and could challenge the interpretations put forward.

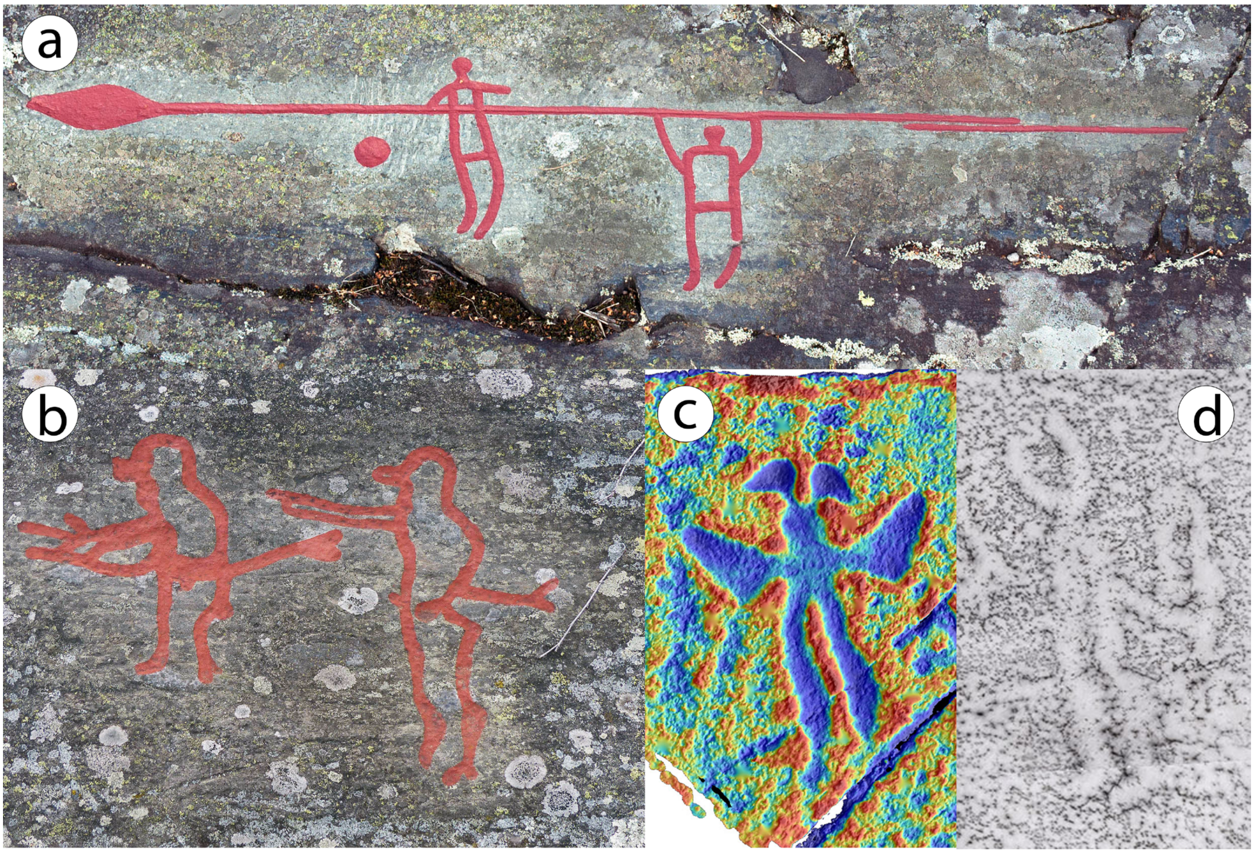


Figure 2: Figures with normal frame bodies (a) and with atypical, more rounded frame bodies (b) both located in Östra Eneby (L2009:5384) (photos: Catarina Bertilsson (a) and Anna Wessman (b)). Anthropomorph with two heads and wings (c) in addition to beaks/nose and exaggerated calves in Bottna (L1970:8166) (visualisation: Rich Potter from a laser scan by Ellen Meijer using https://tvt.dh.gu.se/). Horned warrior (d) in Mörk Hogdal (L1969:3521) (rubbing: Tommy Andersson and Andreas Toreld).

The eye of the beholder – Body characteristics

Let's talk about sex!

Much research has focussed on one particular body characteristic, i.e. male genitalia and their meaning (Bevan 2015; Fuglestvedt 2014; Horn 2017; Lindgren 1999; Nordbladh and Yates 1990; Skogstrand 2008; 2016; Yates 1993). This will be addressed briefly because of the importance of the subject in modern archaeology. A total of 977 cases of male genitalia have been recorded and most were engraved erect, as phalli (Vanggaard 1972). These have been discussed in connection with NBA warrior ideology (Horn 2019; 2023; Ling and Toreld 2018; Kristiansen 2002; Skogstrand 2016; Treherne 1995; Vandkilde 2018). On the other hand, only 23 figures were identified as female, of which only two had potential female genitalia indicated, e.g. in Hoghem (Tanum: 160:1) and on the famous Vitlycke panel (Tanum 1:1; see Horn 2017). In the other cases, the identification rests on secondary features and represents a mix of different body characteristics, i.e. combinations of birthing scenes, wide hips, enlarged breasts, and heterosexual intercourse (Hays-Gilpin 2004; Horn 2017; Kristiansen 2014). It has been suggested recently that long items of clothing (mantles, cloaks) can be used to identify female figures, such as can be seen aboard a boat in Leonardsberg (Östra Eneby 27:1; see Bergerbrant and Wessman 2018). While these could represent females, long clothing as sole identifier would not be sufficient, because the low temperatures, moisture, and wind out at sea would likely also cause men to wear warm clothing such as cloaks and mantles!

Beyond sex

With the strong research focus on sex and/or gender, it is perhaps surprising that such features were not most common. Exaggerated calves (see Fig. 1) occur on 1,144 figures in the database, and they appear on figures of either sex. Overall, 20 different body characteristics were recorded, with most being much less frequent than exaggerated calves and phalli (Fig. 1). Among these the most frequent are, e.g., enlarged noses or beaks (337), large hands (334), and bodies that form rectangular frames (242) (Fig. 2a-b). Among the most infrequent are a kind of halo-like indication (4), two heads (7) (Fig. 2c), and exaggerated breasts (8), which could either be particularly muscular male pectorals or female breasts.

The presence of horns has been interpreted as a merging of humans and bulls into hybrid beings with an important role in rituals (Ling and Rowlands 2015). Others interpret these as helmets similar to the helmets from Viksø which were also represented on the pairs of figurines from Grevensvænge (Sealand), Fogdarp (Scania), and Kallerup (Thy, Jutland) (with older literature Vandkilde *et al.* 2022). In addition, Vandkilde and colleagues (2022) counted *c.* 40 horned figures in the rock art of Bohuslän. However, a recalculation shows that there were at least 175 in Bohuslän and 210 throughout Scandinavia (Fig. 2d). Figures with wings (9) were recently considered to be of equal ritual importance (Fig. 2c). Kristian Kristiansen (2018; see also Goldhahn 2019) discussed their importance in Bronze Age religious beliefs by comparing archaeological data to Indo-European myth and observations from the Iron Age, i.e. their role in transporting the deceased to the afterlife.

As for other reconstructions of Bronze Age beliefs, ideologies, and cosmology, the observations in the examples discussed here are often taken to stand for the entire duration and the complete geographical extent of the NBA (Kristiansen 2012; Kaliff and Østigård 2022; Goldhahn 2019; Kaul 2004). However, it is important to remember that these interpretations were based on relatively rare occurrences, i.e. just 210 horns and only nine anthropomorphs with wings among thousands of anthropomorphs.

In the rock art of indigenous cultures of the North American southwest, human figures with animal characteristics were connected to shamanistic rituals in which people wore headdresses and masks which might represent, for example, the horns of a horned snake (Phillips Jr. *et al.* 2006). However, whether the Nordic rock art depicted hybrid beings or humans that use masks and costumes to pose as or transform themselves into such beings cannot be unravelled within the confines of the present text. Nevertheless, this serves as an excellent example of how beliefs and cosmologies could be of considerably *longue dureé*. At the same time, even in rock art traditions with extended chronologies, variations in space and across time have been observed that indicate changes in ideas and the way they were expressed (Grantham 2002; Lankford 2006), which can also be seen in the rock art of Australia (Frieman and May 2020). It is important to consider that carvings which appear to be similar may not have had the same meaning or origins (Moberg 1981). For example, a horned serpent occurs on the Iron Age Gundestrup cauldron without any connection to North America (Kaul 2011). Conversely, even if the cosmological base is similar within a given sphere, different observers may have had different interpretations or understandings of a particular depiction's meaning; carvers may have chosen to emphasise different aspects using subtly different symbols (Horn 2024).

What you do is who you are – Objects

Anthropomorphs were more frequently associated with different objects (3592) rather than with special

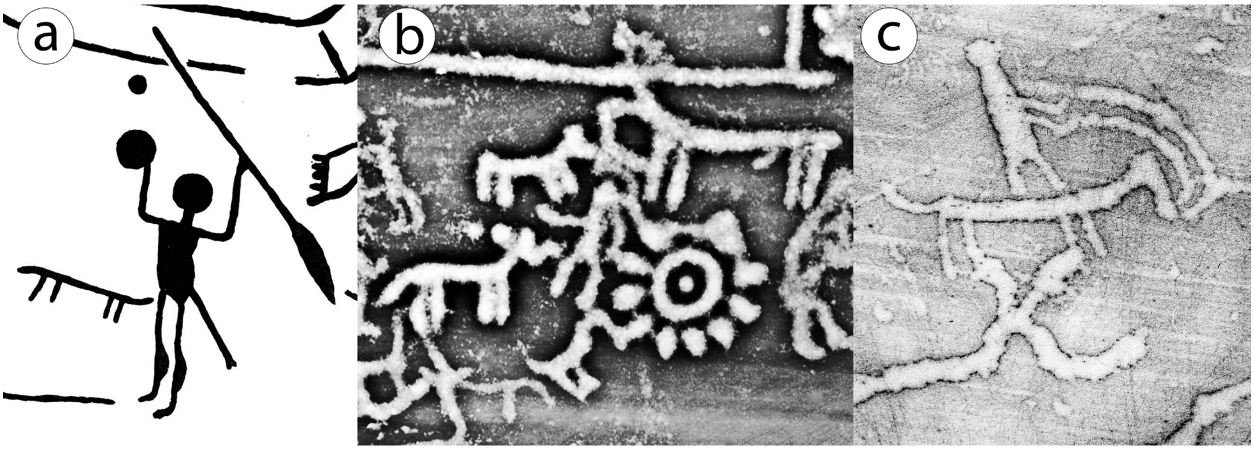


Figure 3: Warrior with a generic animal in Skindelsröd, Askum (L1970:4528) (tracing: Sven-Gunnar Broström and Kenneth Ihrestam). A sun depiction next to an anthropomorph surrounded by animals including a stag, a dog (?), a generic animal, and a bird on Massleberg in Lilla Skee (L1968:6295) (visualisation: Rich Potter from laser scan by Ellen Meijer using https://tvt.dh.gu.se/). Horseback rider including reins in Järrestad (L1990:608) (rubbing: Catarina Bertilsson).

body characteristics (1868). In some interpretations, it is implicitly assumed that all or most images on a panel were contemporary, including those things associated with humans (e.g. Melheim 2013). However, at the same time authors have long pointed to the great time depth associated with the carving of many of the panels (Bengtsson 2004b; Ling 2014). More recently, the long chronologies of even individual scenes and figures have been discussed (Bertilsson 2015; 2018; Milstreu 2017; Horn and Potter 2018; 2019). Due to an unfortunate lack of overarching studies on the chronology of human figures in rock art, the exact order of carving events is difficult to determine.

Unsurprisingly, the sheer number of canoe carvings (Goldhahn and Ling 2013) makes them the most common object (2389 cases) linked to anthropomorphs (Fig. 1). The second most frequently appearing motif was the sword (1256), more frequently than either exaggerated calves or phalli (Fig. 1). Other objects that appear relatively often were shields (514), spears (316), axes (297), and a kind of generic animal figure (277) that could represent either deer or horses (Fig. 3). Some very important objects in NBA cosmology were surprisingly infrequent. For example, the sun (Kaul 2004) only occurs next to humans in three cases (Fig. 3). This does not imply that the sun was not important, but it may lend support to the idea that the anthropomorphs in rock art actually depict humans – not gods or otherworldly beings (Earle 2013; Horn 2022).

Horses (196), which appear more frequently than suns, were also interpreted as part of the NBA sun cult, not least due to their presence on the sun-wagon from Trundholm and corresponding depictions in both rock art and on metalwork (Kaul 2002; Kristiansen 2010b). However, such horses are only rarely similar to those drawing the sun-wagon (Fig. 3) (see, e.g., in Arendal, Tanum 450:1). If anthropomorphs are on the same panels as sun-horses, they are usually widely separated (see Tanum 262:1). When horses and anthropomorphs occur directly linked, then they often appear as horseback riders, in chariot depictions, or with the horses led on leashes (Fig. 3). Superficially, such depictions seem to be more reflective of daily practices than representations of something particularly unique.

Objects were summarised into more abstract categories. Most can be associated with mobility (2809) and weapons (2546). Categories such as animals (721), tools (272), or plants (10) occur much less frequently (Fig. 4). Other groupings of objects are certainly possible. For example, ards, cattle, sickles, goats, and sheep could be summarised in the 'agriculture' category, which would then be represented in 329 cases. However, this and other possible categories would still be underrepresented when compared to mobility and weaponry. Such categorisations are, of course, dependent upon modern perceptions. However, patterns emerge, e.g., in the underrepresentation of plants, so that the defined categories can be considered significant to some extent (Fig. 4).

Social Network Analysis

So far, we have only addressed objects and body characteristics in individual groups numerically for the entire region. Since they also co-occur on individual figures, there may be a pattern in how these features were combined. Such patterns may vary locally and could, thus, reveal different ideas of what made a high-status individual. Social Network Analysis (SNA) is an excellent tool to visualise relational data (Scott 2013) and it has been employed to that end successfully by various Bronze Age researchers (Blake 2014; Felding *et al.* 2020; Felding and Stott 2023; Horn 2024). This

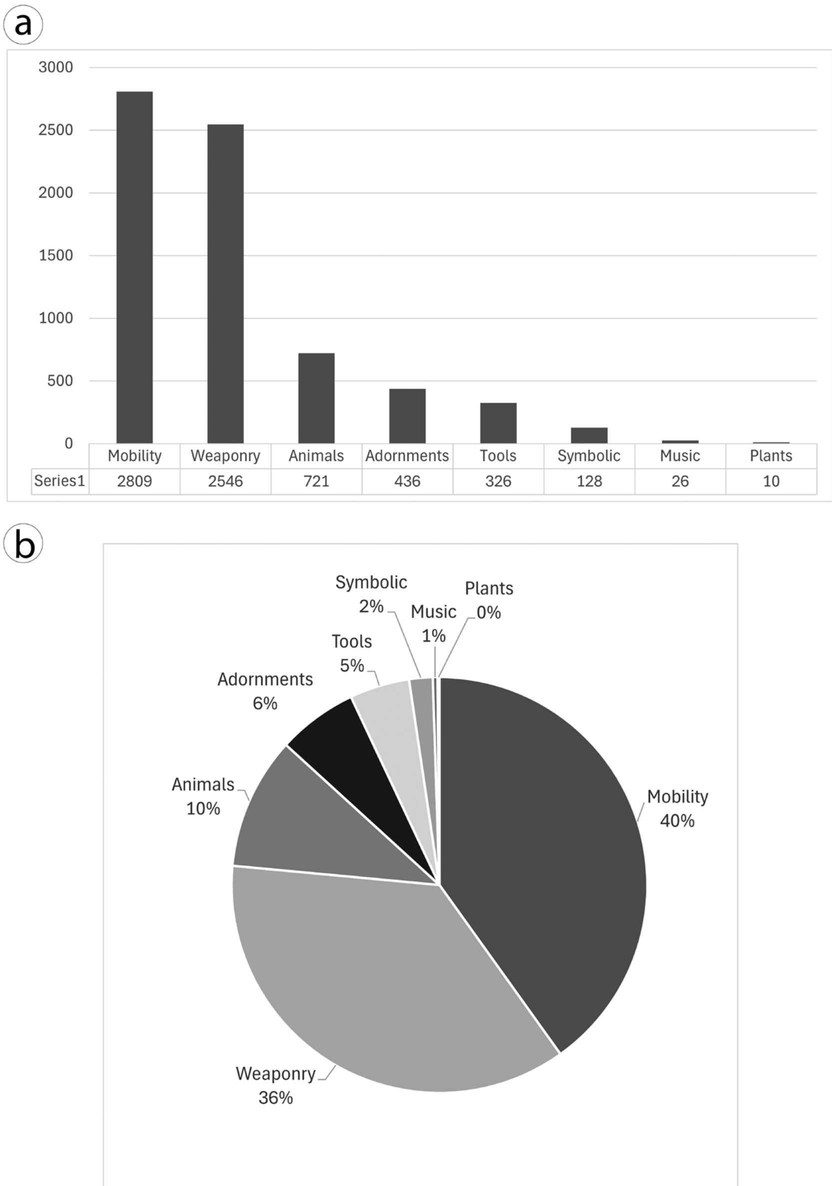


Figure 4: Objects associated with anthropomorphs summarised in categories in absolute (a) and relative (b) terms (graph: Christian Horn).

contribution follows the standard methods and theories established for SNA (see Scott 2023, with older literature). We will focus on three features for each region: degree centrality, strongest dyads, and specific clusters.

Social Networks are constructed from specific points (in our case, these include the associated objects and body characteristics, and their positive and negative connections). Positive connections mean that these features co-occur on an individual figure, and they are visualised by connecting the two points with a line (Scott 2013). In this study, all attributes and features were necessarily positively linked to humans and, thus, the network visualisations would have been centred around or stretched at these points. To get a clearer understanding of the relative connections of the attributes and features, the point human was left out of the analysis. The number of connections each point has establishes its degree of centrality, i.e. more connections mean higher centrality. This gives a relative view of features in each region and can overcome the dominance of the sheer number of carvings in Bohuslän. While this has many advantages in allowing us to compare regions to each other, one downside is that regions with less figures are more vulnerable to a change in interpretation with even a single new find. For example, finding a new figure associated with large hands in Bohuslän will not change the results substantially, while a similar find

Table 1: Degree ranking for each node in each of the study regions.

Degree rank	Overall	Bohuslän	Blekinge	Östergötland	Østfold	Scania	Southernmost	Stjørdal	Telemark	Uppland	Vänern	Västmanland	Kalmar	Kronoberg
Canoe	1	1	1	1	1	6	1	1	1	1	3	1	2	6
Exaggerated_calve	2	2		3	2	3		11	2	2	2	3	1	2
Sword	3	3		2	3	1	1	2	3	3	1	1	5	3
Other_animal	4	4		8	22		12	6	5	6	20	4	5	10
Large_hand	5	6	5	15	6	10	1		4	22	4			1
Hips	6	8	2	10	4	2	8	11	12	4	6		3	
Shield	6	4	7	6	9	11	4	6	5	15	16			
Beak	8	7		7	4	6	7	3		19	12		10	
Framebody	9	12		5	6		8			4	4		13	
Spear	9	9		4	19		12	5		25	8		3	
Circular	11	9		12	19		16	11		25	10			10
Axe	12	9		10	6	11				30	15			
Clothing	12	13		15	13	11	5	6		10	12			
Footsole	14	18	3	15	12	11		6	5	15	8			
Hoof	14	16		15	10			17		7	14			3
Horn	16	13	7	12	14				9	19	10			
Muscular	16	16		9	17	6	8			12	27	4	10	3
Belt	18	15		12	10					7	23	4	13	
Bird	19	19		20										
Wagon	19	19			22	6				25				
Cervidae	21	22		19	22		12							13
Long_hair	21	29		21	17	18	8	6	12	10	16			
Plough	21	21				11						8	5	
Helmet	24	24		29	31		5	11		22	20			
Horse	24	22	7	21	19	4		4		25	23		5	6
Rein_rope_whip	24	26		21	25	4		17		14	31		5	
Bow	27	29			15					22	20		10	6
Framehead	27	32						11		15	16		13	10
Bull	29	26		21	26	18		17		19		4		
Canidae	29	26								15				
Wheel	29	25		34	15			17			7			
elongated_feet	32	31		29	35	11	12	16		30	16			
Voltigeur	33	33			28						33			
Earrings	34	37							5		27			
Complex	35	34		29										
Hook_foot	35	34												6
Oars	35	34		34	35				9	25		8		
No_head	38	41		29	28					30	23			
Ornament	38	37												
Mace	40	43		21	31									

Degree rank	Overall	Bohuslän	Blekinge	Östergötland	Østfold	Scania	Southernmost	Stjørdal	Telemark	Uppland	Vänern	Västmanland	Kalmar	Kronoberg
Halberd	41	39												
Ibex	41	39												
Lurs	41	45			26			17			27			
Cattle	44	53		21						12				
Just_legs	44	41		27	33				12		31			
Pig	44	50				18				7				
Rudder	44	44	3		35				12					
Snake	44	45									23			
Breast	49	45	5		28					30				
Tree	49	45		29	39									
Mirror	51	49												
Wing	51	50			33									
Double_head	53	52							9					
Other_animal_feet	54	53									33			
Sun	54	53								30				
Goat	56	57												
Twig	56	57												
Fish	58					11		17						
Halo	58	63		34	39						27			
Sickle	58	53		34	35									
Hammer	61	59												
Other_weapon	61			27										
Drum	63	60												
Fishing_rod	63	60												
Sheep	63	60												

in Blekinge would mean a significant change of the ranks. Thus, it is possible that for some regions the results and interpretations could change rapidly with the discovery of new rock art. The link between two features is called a dyad. Dyads become stronger the more frequently their particular connection occurs (Scott 2013). That means the strongest dyads are the most frequent occurrences of two connected features in each region, and, for that reason, they are less impacted by individual new discoveries. Specific clusters of functionally or thematically related objects and body characteristics are very interesting. These can inform us about practices and/or beliefs considered important or meaningful in individual regions.

For our purposes, we stick with the modern administrative boundaries in Sweden and Norway, whereas Denmark and northern Germany were summarised as 'southernmost' due to their scarcity of human figures and rock art in general. While this may lead to some unnatural divisions, most of these contain one or more major rock art regions, with perhaps only the separation between Østfold and Bohuslän seeming out of place. However, we can use this as an opportunity to test whether variations exist even within the densest hotspot of Scandinavian rock art. The phallus has been excluded from the calculation, because sex and gender are well-discussed in NBA research and beyond, and it was the intention to draw attention to other, less established themes. At the same time, there seems little point in examining the node 'human', as they are the subject of the analysis. (All other points would connect to human, thereby distorting the network.) A clearer result of the relationship of the features on anthropomorphs is achieved when the point is subtracted from all local networks (Scott 2013).

Degree Centrality rank

While the analysis is summarised in Table 1 according to regions, and the discussion will focus on a cross-regional comparison, it is important that the totality of anthropomorphs is considered first to establish a baseline (Table 1). The most central and unifying features were canoes (1), exaggerated calves (2), and swords (3), which reflect the pervasive presence of a maritime warrior ideal throughout the NBA (Vandkilde 2014; Ling and Cornell 2017; Ling and Toreld 2018; Horn 2016). This is further emphasised by the shields (6), spears (9), and axes (12) taking up important positions in the network. However, other important features are not clearly linked to this, e.g. other animals (generic four-legged animals) (4), large hands (5), and hips or muscular thighs (6). Other features were only weakly interlinked, e.g. wings (51), the sun (54), fish (58), and sheep (63). This is important, because it means that their social importance in evidence in other data is not reflected in rock art generally.

To keep to the parameters of this contribution, we will discuss only selected local networks and compare them by focussing on deviations from the norm. Among all the networks, the Scanian-SNA stands out for a number of reasons. Perhaps most surprisingly, it is one of the regions that does not follow the baseline degree centrality ranking. In fact, in the Scanian-SNA, swords (1) replace canoes (6) as the most central feature (Table 1). However, canoes were probably nevertheless important as a means of travel. Certainly, the Scanian rock art demonstrates the same coastal distribution as do other Scandinavian regions (Skoglund 2016). In the Kalmar region, canoes (2) and exaggerated calves (1) switch ranks (Table 1). The two other regions in which we can observe variations in the importance of canoes are located inland, i.e. around Lake Vänern and in Kronoberg. In both cases, water transport would have still been crucial; perhaps more so around Lake Vänern, with only minor deviations in the ranking of swords (1), exaggerated calves (2), and canoes (3). In Kronoberg, canoes (6) were more clearly outranked by large hands (1), exaggerated calves (2), and swords (3) (Table 1).

In Stjørdal (Norway), exaggerated calves (11) were much less important than in any other region. Instead, beaks (3), be they masks, animal-human hybrids, or a form of helmet, were much more central (Table 1). However, this is one of the regions where new recordings (especially using 3D methods) could change the picture significantly, as older methods may not have been precise enough to record calves.

Swords were highly important in most regions. Nevertheless, it is conspicuous that they were not as significant in the Kalmar region (5), where hips (3) and spears (3) were more centrally connected (Table 1). Whereas Blekinge has only very few anthropomorphs in total, it is interesting that while canoes mirror the baseline, exaggerated calves and swords were absent – with hips (2), foot soles (3), and steering oars (3) of central importance instead (Table 1). Exaggerated calves were also absent in the southernmost regions, where canoes and swords share the prime centrality with large hands (1) (Table 1). In Östergötland (4) and Kalmar (3), spears take up a relatively important position, even if they do not replace canoes. Axes had a higher importance compared to the baseline in Østfold (6).

Among the various animal species depicted, horses (24) were very important in Scania and Stjørdal (both 4) compared to the baseline (Table 1). The point ‘other animal’ joins together animals that could be horses, deer, or some other species, but which is impossible to determine due to a lack of specific details. The similarity in depiction across several regions is striking, which makes the deviations in connectedness even more interesting. Their baseline rank (4) is clearly influenced by Bohuslän. It is intriguing that these animals were much less important in the nearby geographical areas of Østfold (22) and Lake Vänern (20), whereas horses and cervidae share similar ranks across the baseline and the three regions. Therefore, the differences seem to be related to Bronze Age perception and practices rather than modern misidentification of these various animals. In Uppland, the depiction of pigs (7) was important, which stands out because pigs were weakly interlinked in most regions and the baseline (44) (Table 1). It is interesting to observe that pigs have stronger ties to swords, shields, and hips rather than spears, because the latter would be the traditional prime weapon for pig hunting (Skoglund 2018). Thus, it may have been characteristics of the pigs themselves which were considered important rather than merely the act of hunting them. Aspects of hunting and animals such as pigs may even have been linked to warriors and warfare as other finds in Europe such as boar tusk helmets and the overlap of hunting and combat weapons attest (Georganas and Kvapil 2024; Vandkilde 2013).

Variation in strongest dyads

Despite swords being only the third-most central feature in the baseline, the most frequent dyad was canoe-sword, and only then followed canoe-exaggerated calves. While Bohuslän mirrors the baseline, the neighbouring regions of Vänern and Østfold distinguish themselves by linking canoes more

Table 2: Strongest dyad in each region.

	Bohuslän	Vänern	Östfold	Telemark	Stjørdal	Västmanland	Uppland	Östergötland	Kalmar	Scania	Southernmost
canoe-sword	X				X	X		X			X
canoe-exaggerated calve		X	X	X							
canoe-oar						X					
shield-no head							X				
sword-beak									X		
horse-rope/rein/whip										X	

frequently to exaggerated calves than to swords. Of the four regions that shared the same strongest dyad with Bohuslän, none is geographically close; in fact, Stjørdal is one of the most distant regions (Table 2).

Four regions have different dyads which appear as the strongest in their SNAs (Table 2). In Uppland, shields-no heads were the strongest interlinked features. This is mostly based on the documentations published by Einar Kjellén (1976) and John Coles (2000) of a panel in Biskoskulla (71:1). This has been described as a row of headless and armless humanoids (Coles 2000: Pl. 66). However, similar figures close by with necks and heads existed (Coles 2000: Pl. 65). Some heads were even indicated on Biskopskulla 71:1 by Kjellén in his chalking. Thus, this may be a case that could change significantly with new documentation using 3D methods.

The Kalmar region has sword-beak as its strongest dyad, which extends across three of the five sites that were entered into the database. While there were not as many individual figures as in the example from Biskopskulla, it seems to be a more solid case due to its wider geographical spread. Lastly, in Scania, horse-rope makes up the strongest dyad, because all instances of rope were also associated with horses at the same time. In connection with the centrality of horses in Scania, we may see evidence of special local concentration on activities involving these animals, perhaps leading to more naturalistic depictions (Table 2). This dyad is part of a larger cluster that will be discussed in the next section.

Specific clusters

Some clusters occur in the SNA that can be observed across several regions, meriting closer attention. One such cluster consisted of horses, ropes, and wagons. This cluster is very tightly defined in Scania. In Bohuslän – where most features were very tightly linked – this cluster forms and includes hooves (Fig. 5). This is interesting, because these were recorded on human figures rather than on horses. These clusters seem logical, and maybe even mundane at first glance, which is correct in the sense that the depicted features (horse, rope, wagon) were functionally connected for activities like driving carts or chariots, or without wheeled transport for horseback riding. This is supported by the cluster of bow, stag/deer, and bird in Bohuslän, which could be interpreted as a representation of hunting (Fig. 5). Thus, it is possible to call these functional clusters. However, we need to remember that the hooves in Bohuslän were depicted on humans, thereby transforming them into hybrids, like the other figures with horns or wings (Ahlqvist and Vandkilde 2018; Ling and Rowlands 2015; Goldhahn 2019; Kveiborg *et al.* 2020). This pulls the depictions of horseback riding and driving a wagon out of the purely functional sphere into the realm of ritual, belief, and myth.

Furthermore, while these scenes depict enough detail for activities to be recognised, they do not show all gear and body features required for the respective tasks. For example, while steering oars are functionally linked to the operation of canoes, they were only infrequently added in most regions. Belts were crucial for holding sword sheaths. However, they were often not indicated. Hunting requires more than just a bow (e.g. sets of knives, etc.). Nevertheless, the rock art makers seem to have concentrated on one weapon and specific prey items. Thus, a clear selection of features becomes visible to which special importance was attributed, and that was possibly considered meaningful functionally or which was infused by narratives, myths, and beliefs concerning the respective activities.

The chronological dimension

The numerical values of all features and the SNA analyses for the regions were used to investigate general trends and how they were reflected across local rock art traditions. The chronological dimension

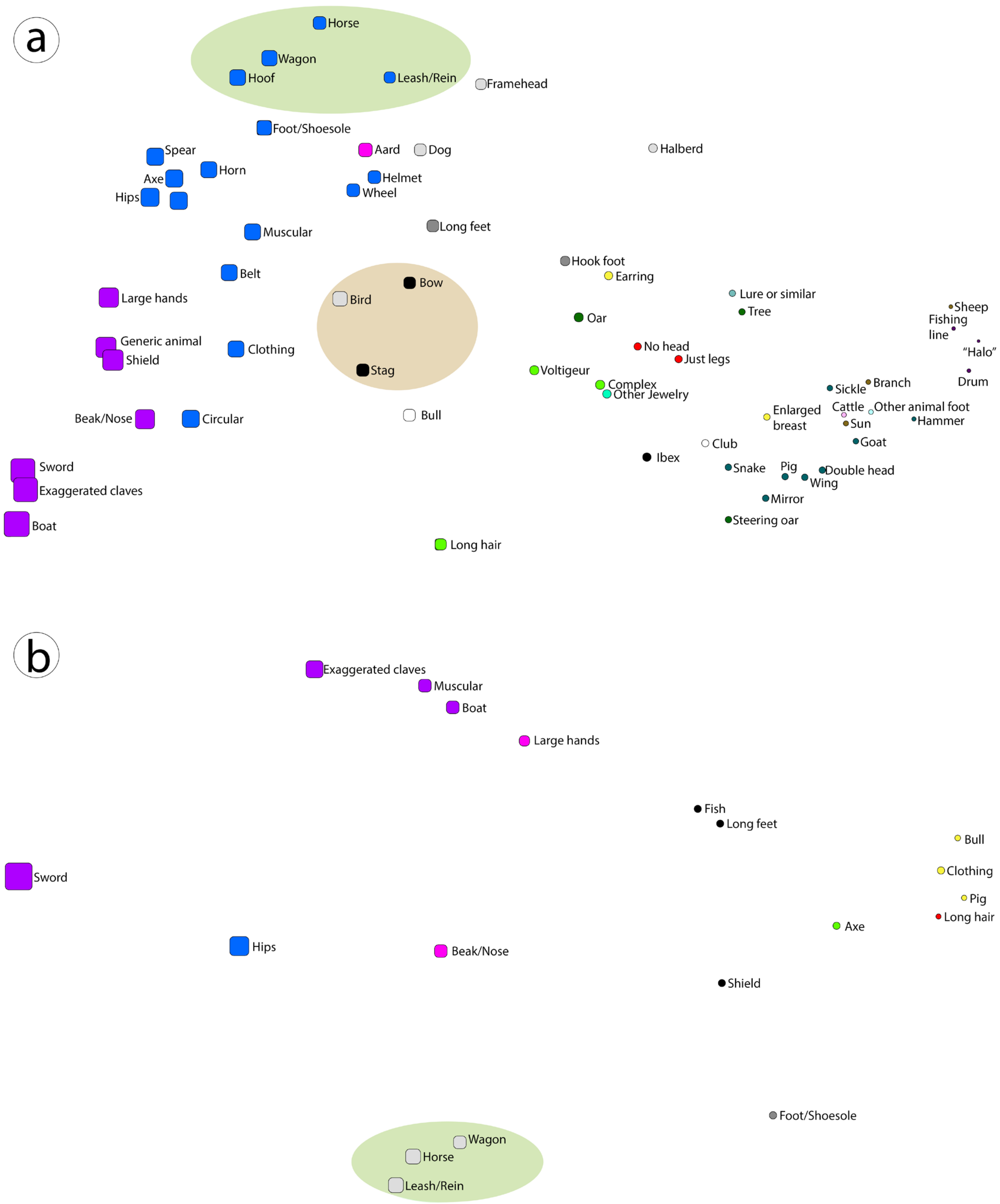


Figure 5: Social Network Analysis for Bohuslän (a) and Scania (b) with special clusters circled (horse related = green; hunting = orange). Node size by degree, node colour by hi-clus 10 for visual separation, no edges displayed for better visibility, but all nodes were connected at least with tie strength 1, layout force directed (compilation: Christian Horn with UCINet 6.769).

cannot be analysed quantitatively at this stage, because the dating of human figures is much less well-established than boat chronology (Fredell 2003). Based on the boat chronology and shore displacement, it has long been recognised that panels were palimpsests, collecting rock art through centuries and millennia (Bengtsson 2004b; Coles 2008; Ling 2014). In addition, specific lines on images were carved again and again, perhaps in an attempt not only to emphasise specific features and images, but also to reactivate them (Hauptman Wahlgren 2002). This means that many of the panel compositions as we see them today only emerged in their latest phase. This complicates modern interpretations, because they may only apply at the very end of a rock panel's life cycle (See, e.g., Melheim 2013). The brief discussion that follows is a (self-)critical note that the results and interpretations may lack an entire dimension and that the local variations observed so far may only be the tip of the iceberg of even more diverse ideas about humans depicted in rock art.

The recognised instances of re-engaging with older rock art by carvers in subsequent generations has in the past decade been escalated by an order of magnitude. Gerhard Milstreu (2017) detailed through careful observation that boat engravings were updated, e.g. with new prow endings, which transformed Early Bronze Age boats to look like Late Bronze Age vessels. For human figures, an even more complex process has been discussed. Ulf Bertilsson (2015) has discovered that the large human figure in Litsleby (Tanum 75:1) was a later addition to an Early Bronze Age spear originally carved individually. The current state of this spear warrior emerged over 2-3 carving events. However, there were even longer chronologies for anthropomorphs, incorporating a higher number of carving events. The large spearman in Finntorp (Tanum 89:1) emerged in its last form after 6-8 carving events (Horn and Potter 2018). Comparing the depicted item to real-world correlates suggests that at least 4-5 carvers of different generations were involved. Other examples confirmed that early individual depictions of spears were often subjected to the addition of human figures at a later date (Bertilsson 2018). However, this did not only affect spears. Other human figures were also changed after the original carving event (Horn and Potter 2018). Lastly, a process has been observed in which boats and human figures were overlaid in such a way that the boats replaced body parts in a phenomenon that has been termed 'pragmamorphism' (Horn 2018a). Along similar lines, one case of an animal replacing a body part has been observed (Horn 2018b). Unfortunately, in these instances, the timelines are not always clear.

Even entire scenes may have been transformed in outlook and meaning. The panel Tanum 184:1 in Finntorp hosts an Early Bronze Age boat next to a natural depression that, when filled with water after a rainstorm, mimicked a stream or fjord. This could simply be interpreted as a scene depicting waterborne travel. Perhaps during the Late Bronze Age a canoe with two spear-wielding warriors was added on the opposite side of the stream, giving the entire scene a much more adversarial outlook (Horn and Potter 2020; Horn *et al.* 2023).

The described processes do not only complicate the chronologies of boats, humans, and entire panels, but they also indicate that the images were a much more frequently engaged part of Bronze Age life than has previously been believed. The location at least of large sites must have been transmitted through generations, as must carving techniques, and the myth, stories and related ritual practices (Skoglund *et al.* 2022; Ranta *et al.* 2019; Ranta *et al.* 2020; Ranta 2016; Rédei *et al.* 2020; Horn 2022; Liebl *et al.* 2024). All these changes, updates and transformations demonstrate that the meaning of the images and the linked ideas about the depicted content were not stable, but varied and changed over time.

Interpretation and Conclusion

Rock art is often treated as a single tradition that was the same throughout the entire NBA and its local societies. However, carving was an activity that took place over a period of *c.* 1300 years and was created by multiple generations of carvers. As a result, the current interpretation of Nordic rock art is based on an amalgamation, or average, of all carvings over this time, and may therefore not be representative of any actual NBA community. The discussed evidence shows that local deviations from the NBA average were abundant, even though they might be difficult to identify due to the issues described above. Despite this, we can begin to ask what these local and temporal variations might mean.

Lasse Bengtsson (2004a) observed that large figurative sites formed clusters with adjacent and attached minor sites, which often only contain cup marks. According to his interpretation, the central sites were staging grounds for an elite. Comparing the depicted smaller objects (like swords) to the burial record indicates that their presence was linked to elite individuals, in particular male elite warriors (Felding *et al.* 2020). It has also long been established that rock art depicts actions that might have ritualistic significance, but that were likely carried out in real life, i.e. the use of boats (Ling and Cornell 2010; Horn 2018a). The objects engraved were deemed necessary to carry these actions out. Following this, the depicted body characteristics may have also been associated with the successful completion of the actions depicted. This could be straightforward, e.g. it might have been beneficial for a warrior to have strong calves for secure footing and a good stance to carry out deadly strikes in battle. At the same time, such features may have been experienced as beautiful, because looks were important during the NBA (Treherne 1995; Frieman *et al.* 2017). However, it may also have been less straightforward or more allegorical. For example, things and body characteristics may have linked humans to those desirable characteristics typically associated with objects, like the speed of a boat (Horn 2018a).

Whatever the ritual, religious and mythical dimensions were, they were informed by the real-life experiences of those who carved and their surrounding communities. This is supported by the special clusters which show a concern with a somewhat realistic representation of the depicted activities, e.g. horseback riding or driving a chariot. This is confirmed by the fighting scenes for which use-wear studies and other evidence has shown that they were informed by real-world fighting (Horn 2023; Vandkilde 2013; Kristiansen 2002; Jantzen *et al.* 2011). This is interesting, because the evidence also demonstrates that actual bloodshed was a means to gain or increase one's status (Vandkilde 2013; Horn 2019). This means rock art inadvertently depicted the pathways for elite individuals to gain status, although that was likely not the main purpose of the images.

Fighting was not the only means to gain status; conducting successful sea journeys, cattle raising, and more, might also have served similar ends (Ling *et al.* 2017; Kristiansen 2010a; Vandkilde 2019). Even if being a successful warrior was the main way to status and prestige, some alternative ways may have been depicted in rock art. Such pathways were unlikely exclusive, i.e. individuals could gain status by organising a sea voyage, acquiring copper, and proving themselves a worthy raider during their travels. To provide possible interpretations, it could be said that some communities in Scania at some point may have valued successful journeys over land by foot, on horseback, or wheeled transport, over being a sea voyager. This may have been even more prevalent in landlocked regions such as Kronoberg. Another example may be that certain individuals distinguished themselves as warriors by being capable spear fighters in some communities, e.g. Östergötland and Kalmar.

In summary, while there was a common pathway to accumulate prestige and status during the Bronze Age based on shared ideologies, prying apart the local differences shows that alternatives existed. This means that climbing social hierarchies was not set in stone. In some communities, alternative pathways may have been preferred over limited spans of time, and/or some individuals carved out their own ways to fame only for their stories to be memorialised on the rocks.

Bibliography

Ahlqvist, L. and H. Vandkilde 2018. Hybrid beasts of the Nordic Bronze Age. *Danish Journal of Archaeology* 7(2): 180-194 (available at: DOI: 10.1080/21662282.2018.1507704).

Anfinset, N. and M. Wrigglesworth (eds) 2012. *Local societies in Bronze Age Northern Europe*. New York: Routledge.

Austvoll, K.I. 2021. *Seaways to complexity. A study of sociopolitical organisation along the coast of northwestern Scandinavia in the Late Neolithic and Early Bronze Age*. Sheffield: Equinox.

Bengtsson, L. 2004a. Cup marks of the common people, images of the elite, in G. Milstreu and L. Bengtsson, (eds) *Prehistoric pictures as archaeological source*: 167-177. Tanumshede: Tanums Hällristningsmuseum.

Bengtsson, L. 2004b. *Bilder vid vatten*. Gothenburg, University of Gothenburg.

Bergerbrant, S. and A. Wessman (eds) 2017. *New perspectives on the Bronze Age: Proceedings of the 13th Nordic Bronze Age Symposium held in Gothenburg, 9th to 13th June 2015*. Oxford: Archaeopress.

Bergerbrant, S. and A. Wessman 2018. Women on the move in the Nordic Bronze Age: A case study based on rock art and costume, in J. Dodd and E. Meijer (eds) *Giving the past a future: Essays in archaeology and rock art studies in honour of Dr. Phil. h.c. Gerhard Milstreu*: 121-135. Oxford: Archaeopress.

Bertilsson, U. 1989. Space, economy and society. The rock carvings of northern Bohuslän, in T.B. Larsson and H. Lundmark (eds) *Approaches to Swedish Prehistory: A spectrum of problems and perspectives in contemporary research*: 287-321. British Archaeological Reports International Series 500. Oxford: Bar Publishing.

Bertilsson, U. 2015. Examples of application of modern digital techniques and methods: Structure for motion (SfM) and multi-view stereo (MvS) for three-dimensional documentation of rock carvings in Tanum creating new opportunities for interpretation and dating, in F. Troletti (ed.) *Prospects for prehistoric Rock Art research: XXVI Valcamonica Symposium*: 57-62. Capo di Ponte: Centro camuno di studi preistorici.

Bertilsson, U. 2018. In the Beginning There Was the Spear: Digital Documentation Sheds New Light on Early Bronze Age Spear Carvings from Sweden, in A. Dolfini, R.J. Crellin, C. Horn and M. Uckelmann (eds) *Prehistoric Warfare and Violence: Quantitative and Qualitative Approaches*: 129-148. Cham: Springer.

Bevan, L. 2015. Hyper-Masculinity and the Construction of Gender Identities in the Bronze Age Rock Carvings of Southern Sweden, in P. Skoglund, J. Ling and U. Bertilsson (eds) *Picturing the Bronze Age*: 21-26. Oxford: Oxbow Books.

Blake, E. 2014. *Social networks and regional identity in Bronze Age Italy*. Cambridge: Cambridge University Press.

Bradley, R. 2015. Mixed media, mixed messages: Religious transmission in Bronze Age Scandinavia, in P. Skoglund, J. Ling and U. Bertilsson (eds) *Picturing the Bronze Age*: 37-46. Oxford: Oxbow Books.

Coles, J. 2000. *Patterns in a rocky land. Rock carvings in South-West Uppland, Sweden*. Uppsala: University of Uppsala.

Coles, J. 2008. A Land Apart: Environments and Rock Art in Northernmost Bohuslän, Sweden. *The Antiquaries Journal* 88: 1-36.

Earle, T. 2013. The 3M: Materiality, materialism and materialization, in S. Sabatini and S. Bergerbrant (eds) *Counterpoint: Essays in archaeology and heritage studies in honour of Professor Kristian Kristiansen*: 353-360. British Archaeological Reports International Series 2508. Oxford: Archaeopress.

Felding, L., S.S. Reiter, K.M. Frei and H. Vandkilde 2020. Male Social Roles and Mobility in the Early Nordic Bronze Age. A Perspective from SE Jutland: A Perspective from SE Jutland. *Danish Journal of Archaeology* 9: 1-16 (available at: DOI: 10.7146/dja.v9i0.117955).

Felding, L. and D. Stott 2023. What a Mesh: Network Approaches to Nordic Bronze Age Identity and Regionality. *Offa* 78: 131-154 (available at: DOI: 10.26016/offa.2021.A3).

Fredell, Å. 2003. *Bildbroar. Figurativ bildkommunikation av ideologi och kosmologi under sydskandinavisk bronsålder och förromersk järnålder*. Gothenburg: University of Gothenburg.

Frieman, C. and S.K. May 2020. Navigating Contact: Tradition and Innovation in Australian Contact Rock Art. *International Journal of Historical Archaeology* 24(2): 342-366 (available at: DOI: 10.1007/s10761-019-00511-0).

Frieman, C. J., J. Brück, K. Rebay-Salisbury, S. Bergerbrant, S. Montón Subías, J. Sofaer, C.J. Knüsel, H. Vandkilde, M. Giles and P. Treherne 2017. Aging Well: Treherne's 'Warrior's Beauty' two decades later. *European Journal of Archaeology* 20(1): 36-73 (available at: DOI: 10.1017/eaa.2016.6).

Fuglestvedt, I. 2014. Declaration on Behalf of an Archaeology of Sexe. *Journal of Archaeological Method and Theory* 21(1): 46-75 (available at: DOI: 10.1007/s10816-012-9136-5).

Georganas, I. and L.A. Kvapil 2024. Weaponry, L. Kvapil and K. Shelton (eds) *Brill's Companion to Warfare in the Bronze Age Aegean*: 890115. Leiden: Brill.

Goldhahn, J. 2019. *Birds in the Bronze Age. A North European perspective*. Cambridge: Cambridge University Press.

Goldhahn, J. and J. Ling 2013. Bronze Age Rock Art in Northern Europe: Contexts and Interpretations, in H. Fokkens and A.F. Harding (eds) *The Oxford handbook of the European Bronze Age*: 270-290. Oxford: Oxford University Press.

Grantham, B. 2002. *Creation myths and legends of Creek Indians*. Gainesville: University of Florida Press.

Hauptman Wahlgren, K. 2002. *Bilder av betydelse. Hällristningar och bronsålderslandskap i nordöstra Östergötland*. Lindome: Bricoleur Press.

Hays-Gilpin, K. 2004. *Ambiguous Images. Gender and Rock Art*. Lanham: Rowman Altamira.

Horn, C. 2016. Nothing to lose: Waterborne raiding in southern Scandinavia, in H. Glørstad, A.Z. Tsigaridas Glørstad and A.L. Melheim (eds) *Comparative Perspectives on Past Colonisation, Maritime Interaction and Cultural Integration*: 109-127. Sheffield: Equinox.

Horn, C. 2017. 'It's a man's world'? Sex and gender in Scandinavian Bronze Age rock art, in S. Bergerbrant and A. Wessman (eds) *New perspectives on the Bronze Age: Proceedings of the 13th Nordic Bronze Age Symposium held in Gothenburg, 9th to 13th June 2015*: 237-252. Oxford: Archaeopress.

Horn, C. 2018a. Fast like a war canoe: Pragmamorphism in Scandinavian rock art, in A. Dolfini, R.J. Crellin, C. Horn and M. Uckelmann (eds) *Prehistoric Warfare and Violence: Quantitative and Qualitative Approaches*: 109-127. Cham: Springer.

Horn, C. 2018b. The cunning of the fox: A case of zoomorphism in Scandinavian rock art, in J. Dodd and E. Meijer (eds) *Giving the past a future: Essays in archaeology and rock art studies in honour of Dr. Phil. h.c. Gerhard Milstreu*: 143-152. Oxford: Archaeopress.

Horn, C. 2019. Showmen and Fighters: Bronze Age Rock Art and Weaponry in Scandinavia, in S. Hansen and R. Krause (eds) *Materialisierung von Konflikten/Materialisation of Conflicts: Beiträge der Dritten Internationalen LOEWE-Konferenz vom 24. bis 27. September 2018 in Fulda/Proceedings of the Third International LOEWE Conference, 24-27 September 2018 in Fulda*: 45-65. Bonn: Rudolf Habelt.

Horn, C. 2022. Most Deserve to Be Forgotten: Could the Southern Scandinavian Rock Art Memorialize Heroes?, in L.F. Zubieta (ed.) *Rock Art and Memory in the Transmission of Cultural Knowledge*: 125-146. Cham: Springer International Publishing.

Horn, C. 2023. Warriors as a Challenge: Violence, Rock Art, and the Preservation of Social Cohesion During the Nordic Bronze Age. *European Journal of Archaeology* 26(1): 57-80 (available at: DOI: 10.1017/eaa.2022.26).

Horn, C. 2024. Water and the Afterlife: Water-related Resources in the Burial Construction of the Nordic Bronze Age. *Proceedings of the Prehistoric Society* (published online): 1-21 (available at: DOI: 10.1017/ppr.2024.4).

Horn, C., K.I. Austvoll, J. Ling and M. Artursson (in print). *Nordic Bronze Age economies*. Cambridge: Cambridge University Press.

Horn, C. and R. Potter, R. 2018. Transforming the Rocks. Time and Rock Art in Bohuslän, Sweden: Time and Rock Art in Bohuslän, Sweden. *European Journal of Archaeology* 21(3): 361-384 (available at: DOI: 10.1017/eaa.2017.38).

Horn, C. and R. Potter 2019. A new documentation of Runohällen (Gerum, Tanum). *Fornvännen* 114(3): 129-141.

Horn, C. and R. Potter 2020. Set in Stone? Transformation and Memory in Scandinavian Rock Art, in C. Horn, G. Wollentz, G. Di Maida and A. Haug (eds) *Places* *of memory: Spatialised practices of remembrance from prehistory to today*: 97-107. Oxford: Archaeopress.

Horn, C., R. Potter and M. Peternell 2023. Water Flows and Water Accumulations on Bedrock as a Structuring Element of Rock Art. *Journal of Archaeological Method and Theory* 30: 828-854 (available at: DOI: 10.1007/s10816-022-09578-2).

Jantzen, D., U. Brinker, J. Orschiedt, J. Heinemeier, J. Piek, K. Hauenstein, J. Krüger, G. Lidke, H. Lübke, R. Lampe, S. Lorenz and T. Terberger 2011. A Bronze Age battlefield? Weapons and trauma in the Tollense Valley, north-eastern Germany. *Antiquity* 85(328): 417-433 (available at: DOI: 10.1017/S0003598X00067843).

Kaliff, A. and T. Østigård 2022. *Werewolves, warriors and winter sacrifices. Unmasking Kivik and Indo-European cosmology in Bronze Age Scandinavia*. Uppsala: Uppsala University.

Kaul, F. 2002. The horse, the ship, the sun and the wheel in the Nordic Bronze Age: Reality and abstraction, symbols and metaphors-conceiving figures of sacred images. *Sborník Národního muzea v Praze. Řada. A. Historie* 56(1-4): 143-154.

Kaul, F. 2004. *Bronzealderens religion. Studier af den nordiske bronzealders ikonografi*. Copenhagen: Det Kongelige Nordiske Oldskriftselskab.

Kaul, F. 2011. The Gundestrup Cauldron: Thracian Art, Celtic Motifs. *Études celtiques* 37: 81-110.

Kjellén, E. 1976. *Upplands hällristningar. The Rock carvings of Uppland, Sweden*. Stockholm: Almqvist and Wiksell.

Kristiansen, K. 2002. The tale of the sword: Swords and swordfighters in Bronze Age Europe. *Oxford Journal of Archaeology* 21(4): 319-332 (available at: DOI: 10.1111/1468-0092.00166).

Kristiansen, K. 2010a. Decentralized Complexity: The Case of Bronze Age Northern Europe, in T.D. Price and G.M. Feinman (eds) *Pathways to Power: New Perspectives on the Emergence of Social Inequality*: 169-192. New York: Springer.

Kristiansen, K. 2010b. Rock art and religion: The sun journey in Indo-European mythology and Bronze Age rock art, in Å. Fredell, K. Kristiansen and F. Criado Boado (eds) *Representations and Communications: Creating an Archaeological Matrix of Late Prehistoric Rock Art*: 92-115. Oxford: Oxbow Books.

Kristiansen, K. 2012. Rock art and religion: The sun journey in Indo-European mythology and Bronze Age rock art. *Adoranten* 2011: 69-86.

Kristiansen, K. 2014. The dialectics of gender: Ritualizing gender relations in Late Bronze Age Southern Scandinavia, in H. Alexandersson, A. Andreeff and A. Bünz (eds) *Med hjärta och hjärna: En vänbok till professor Elisabeth Arwill-Nordbladh*: 339-354. Gothenburg: University of Gothenburg.

Kristiansen, K. 2018. The winged triad in Bronze Age symbolism: Birds and their feet, in J. Dodd and E. Meijer (eds) *Giving the past a future: Essays in archaeology and rock art studies in honour of Dr. Phil. h.c. Gerhard Milstreu*: 70-74. Oxford: Archaeopress.

Kristiansen, K. and T.B. Larsson 2005. *The rise of Bronze Age society. Travels, transmissions and transformations*. Cambridge: Cambridge University Press.

Kveiborg, J., L. Ahlqvist and H. Vandkilde 2020. Horses, Fish and Humans: Interspecies Relationships in the Nordic Bronze Age. *Current Swedish Archaeology* 28: 75-98 (available at: DOI: 10.37718/CSA.2020.04).

Lankford, G.E. 2006. The Great Serpent in Eastern North America, in F.K. Reilly and J.F. Garber (eds) *Ancient Objects and Sacred Realms*: 107-135. Austin: University of Texas Press.

Liebl, C., M. Peternell, J. Ling, C. Lindhé, C. Horn, E. Meijer and J. Moyano 2024. Tracing the carvers on the rocks. *Adoranten* 2023: 113-125.

Lindgren, B. 1999. Rock art and gender-the case of the cup-marks, in J. Goldhahn (ed.) *Rock art as social representation*: 41-47. British Archaeological Reports International Series 794. Oxford: Archaeopress.

Ling, J. 2014. *Elevated rock art. Towards a maritime understanding of Bronze Age rock art in northern Bohuslan, Sweden*. Oxford: Oxbow Books.

Ling, J. and P. Cornell 2010. Rock art as secondary agent? Society and agency in Bronze Age Bohuslän. *Norwegian Archaeological Review* 43(1): 26-43 (available at: DOI: 10.1080/00293652.2010.489800).

Ling, J. and P. Cornell 2017. Violence, Warriors, and Rock Art in Bronze Age Scandinavia, in R.J. Chacon and R.G. Mendoza (eds) *Feast, Famine or Fighting?*: 15-33. Cham: Springer International Publishing.

Ling, J., P. Cornell and K. Kristiansen 2017. Bronze Economy and Mode of Production: The Role of Comparative Advantages in Temperate Europe during, in R.M. Rosenswig and J.J. Cunningham (eds) *Modes of production and archaeology*: 205-230. Gainesville: University Press of Florida.

Ling, J., T. Earle and K. Kristiansen 2018. Maritime Mode of Production: Raiding and Trading in Seafaring Chiefdoms. *Current Anthropology* 59(5): 488-524 (available at: DOI:10.1086/699613).

Ling, J. and M. Rowlands 2015. The 'Stranger King' (bull) and rock art, in J. Ling, P. Skoglund and U. Bertilsson (eds) *Picturing the Bronze Age*: 89-104. Oxford: Oxbow Books.

Ling, J. and A. Toreld 2018. Maritime warfare in Scandinavian rock art, in C. Horn and K. Kristiansen (eds) *Warfare in Bronze Age society*: 61-80. Cambridge: Cambridge University Press.

Melheim, A.L. 2013. An epos carved in stone: Three heroes, one giant twin, and a cosmic task, in S. Sabatini and S. Bergerbrant (eds) *Counterpoint: Essays in archaeology and heritage studies in honour of Professor Kristian Kristiansen*: 373-382. British Archaeological Reports International Series 2508. Oxford: Archaeopress.

Milstreu, G. 2017. Re-cut rock art images (with special emphasis on ship carvings), in S. Bergerbrant and A. Wessman (eds) *New perspectives on the Bronze Age: Proceedings of the 13th Nordic Bronze Age Symposium held in Gothenburg, 9th to 13th June 2015*: 281-287. Oxford: Archaeopress.

Moberg, C.-A. 1981. Similar finds? Similar Interpretations? A spectrum of approaches, in C.-A. Moberg (ed.) *Similar finds? Similar interpretations? Glastonbury – Gothenburg – Gotland; nine essays*. Gothenburg: University of Gothenburg.

Nimura, C. 2015. *Prehistoric rock art in Scandinavia. Agency and environmental change*. Oxford: Oxbow Books.

Nordbladh, J. and T. Yates 1990. This perfect body: this virgin text: Between sex and gender in archaeology, in I. Bapty and T. Yates (eds) *Archaeology after structuralism: post-structuralism and the practice of archaeology*: 222-237. New York: Routledge.

Phillips Jr., D.A., C.S. Vanpool and T.L. Vanpool 2006. The horned serpent tradition in the North American southwest, in C.S. Vanpool, T.L. Vanpool and D.A. Phillips (eds) *Religion in the prehispanic Southwest*: 17-30. Lanham: Altamira.

Ranta, M. 2016. Do Rock Carvings Tell Stories? Aspects of Narrativity in Scandinavian Bronze Age Petroglyphs, The Korean Society Of Aesthetics (ed.) *'Aesthetics and Mass Culture' – Proceedings of ICA 2016 – Seoul, Korea*: 523-531. Seoul: The Korean Society of Aesthetics.

Ranta, M., P. Skoglund, T. Persson and J.M. Gjerde 2020. Hunting stories in Scandinavian rock art: Aspects of 'tellability' in the north versus the south. *Oxford Journal of Archaeology* 39(3): 228-246 (available at: DOI:10.1111/ojoa.12197).

Ranta, M., P. Skoglund, A.C. Rédei and T. Persson 2019. Levels of Narrativity in Scandinavian Bronze Age Petroglyphs. *Cambridge Archaeological Journal* 29(3): 497-516 (available at: DOI:10.1017/S0959774319000118).

Rédei, A.C., P. Skoglund and T. Persson 2020. Seeing different motifs in one picture: Identifying ambiguous figures in South Scandinavian Bronze Age rock art. *Cogent Arts & Humanities* 7(1): 1802804 (available at: DOI:10.1080/23311983.2020.1802804).

Scott, J. 2013. *Social network analysis*. Los Angeles: Sage.

Skoglund, P. 2016. *Rock art through time. Scanian rock carvings in the Bronze Age and earliest Iron Age*. Oxford: Oxbow Books.

Skoglund, P. 2018. The Wild Boar in Scandinavian Rock Art, in J. Dodd and E. Meijer (eds) *Giving the past a future: Essays in archaeology and rock art studies in honour of Dr. Phil. h.c. Gerhard Milstreu*: 112-120. Oxford: Archaeopress.

Skoglund, P., M. Ranta, T. Persson and A.C. Rédei 2022. Narrative Aspects of Images of Spear Use in Scandinavian Rock Carvings. *European Journal of Archaeology* 25(2): 176-195 (available at: DOI:10.1017/eaa.2021.52).

Skogstrand, L. 2008. Hieros-Gamos, a Matter of Gender Disorder?, in J. Lund, C. Prescott and K. Chilidis (eds) *Facets of archeology: Essays in honour of Lotte Hedeager on her 60th birthday*: 567-575. Oslo: Universitetet i Oslo.

Skogstrand, L. 2016. *Warriors and other men. Notions of masculinity from the Late Bronze Age to the Early Iron Age*. Oxford: Archaeopress.

Tilley, C.Y. 2021. *Thinking through images. Narrative, rhythm, embodiment and landscape in the Nordic Bronze Age*. Oxford: Oxbow Books.

Toreld, A. 2012. Svärd och mord: Nyupptäckta hällristningsmotiv vid Medbo i Brastad socken, Bohuslän. *Fornvännen* 107: 241-252.

Treherne, P. 1995. The warrior's beauty: The masculine body and self-identity in Bronze-Age Europe. *Journal of European Archaeology* 3(1): 105-144 (available at: DOI:10.1179/096576695800688269).

Vandkilde, H. 1996. *From stone to bronze. the metalwork of the late Neolithic and earliest Bronze Age in Denmark*. Aarhus: Aarhus University Press.

Vandkilde, H. 2003. Commemorative tales: Archaeological responses to modern myth, politics, and war. *World Archaeology* 35(1): 126-144.

Vandkilde, H. 2007. *Archaeology and Anthropology: Inaugural Lectures of the Institute of Anthropology, Archaeology, and Linguistics at Aarhus University 1996-2004*. Aarhus: Aarhus University Press.

Vandkilde, H. 2013. Warfare in northern European Bronze Age societies: Twentieth-Century presentations and recent archaeological research inquiries, in S. Ralph (ed.) *The Archaeology of Violence. Interdisciplinary Approaches*: 37-62. Albany: SUNY Press.

Vandkilde, H. 2014. Archaeology, Theory, and War-related Violence: Theoretical Perspectives on the Archaeology of Warfare and Warriorhood, in A. Gardner, M. Lake and U. Sommer (eds) *The Oxford Handbook of Archaeological Theory*. Oxford: Oxford University Press (available at: DOI: 10.1093/oxfordhb/9780199567942.013.027).

Vandkilde, H. 2015. Conflict and War: Archaeology of Weapons and Artifacts, in J.D. Wright (ed.) *The International Encyclopedia of Social and Behavioral Sciences*: 607-613. Oxford: Elsevier.

Vandkilde, H. 2016. Bronzization: The Bronze Age as Pre-Modern Globalization. *Praehistorische Zeitschrift* 91(1): 103-123 (available at: DOI:10.1515/pz-2016-0005).

Vandkilde, H. 2018. Violent Beauty in the Bronze Age, in S. Hansen and R. Krause (eds) *Bronzezeitliche Burgen zwischen Taunus und Karpaten. Beiträge der ersten Internationalen LOEWE-Konferenz vom 7. bis 9. Dezember 2016 in Frankfurt/M. = Bronze Age hillforts between Taunus and Carpathian mountains. Proceedings of the* *first international LOEWE Conference, 7-9 December 2016 in Frankfurt/M.*: 83-102. Bonn: Rudolf Habelt.

Vandkilde, H. 2019. Bronze Age Beginnings. A Scalar View from the Global Outskirts. *Proceedings of the Prehistoric Society* 85: 1-27 (available at: DOI:10.1017/ppr.2019.7).

Vandkilde, H., V. Matta, L. Ahlqvist and H.W. Nørgaard 2022. Anthropomorphised warlike beings with horned helmets. Bronze Age Scandinavia, Sardinia, and Iberia compared. *Praehistorische Zeitschrift* 97(1): 130-158 (available at: DOI:10.1515/pz-2021-2012).

Vanggaard, T. 1972. *Phallos. A symbol and its history in the male world*. New York: International Universities Press.

Yates, T. 1993. Frameworks for an archaeology of the body, in C.Y. Tilley (ed.) *Interpretative archaeology*: 31-72. London: Bloomsbury.

Chapter 24

The prince and the myth of the serpent – Some new thoughts on the origin of Nordic Bronze Age mythology within the Nebra hoard

Harald Meller

State Office for Heritage Management and Archaeology Saxony-Anhalt – State Museum of Prehistory, 06114 Halle (Saale), Germany

sekretariat@lda.stk.sachsen-anhalt.de

Abstract

On one of the two swords from the Nebra hoard, Burgenlandkreis (Germany), both sides of the blade feature a copper inlay on the midrib. On one side, it has an undulating form and, towards the hilt, it branches into three ends that thicken partly; on the other side, it runs straight but likewise widens at the end. On closer inspection, these are probably snakes, one depicted as three-headed and undulating, the other as one-headed and at rest. Both for the Únětice culture (which generally did not favour images) and the European Early Bronze Age, this is a remarkable representation. Like the knowledge visually captured on the Sky Disc, the sword imagery was probably inspired by the Near East. Since the snakes on the Nebra sword face towards the bearer, they will also have furthered the legitimation of the prince (the sword bearer): the sword will have allowed him to present himself as a snake-conquering hero. However, the key to understanding the snakes on the Nebra sword lies in the imagery of the late Nordic Bronze Age, in which sun, ship, and snake are central elements of the myth of the sun's journey through day and night. In Nebra, these elements appear together for the first time and show that when the ship was attached to the Sky Disk towards the end of its period of use, a new mythological narrative had appeared. Though this narrative may possibly be derived from Egypt, it would nevertheless go on to characterise the late Nordic Bronze Age.

Introduction

Through her extensive and wide-ranging work, Helle Vandkilde has often returned to the subject of the sometimes puzzling and difficult to decipher visual imagery of the Nordic Bronze Age (NBA) (see, among other works, Ahlqvist and Vandkilde 2018; Vandkilde *et al.* 2022). This includes the small statuette from Fårdal, central Jutland (Denmark), a hybrid creature that is part coiled snake and part horse. The link between snake and horse is central to the Bronze Age myth of the sun's journey (see Kaul 1998) and was a further development of a narrative that has its beginning in the discovery of the hoard of Nebra, Burgenlandkreis (Germany).

The Nebra swords

Taking my cue from this, in the present chapter I will consider the representations of snakes on Sword 1 from Nebra, which have hitherto received little attention (Meller and Michel 2018: 354; Meller and Michel 2019: 367-368; Meller and Michel 2021: 206, 208). The Nebra swords were found in a deposit together with the famous Sky Disc, two axes, a chisel and two arm spirals (Meller 2010; Pernicka *et al.* 2020, see Fig. 1). The swords are two almost identical items of outstanding quality (Meller 2010: 48-56; Meller 2013: 503-515). They have damascened half-shell hilts with a grooved gold cuffband and highly polished blades that bear a lancet-shaped decoration and damascening. The organic part of the half-shell hilts is missing, except for remains of birch tar from the original attachment, which yielded several ^{14}C dates with a total date span of 1629-1431 cal BCE (see Meller 2010: 56 footnote 43; Schwarz 2021: 208). Typologically, too, they can be placed in phase Bz A2c after Walter Ruckdeschel (1625-1550 BCE; Ruckdeschel 1978). Since the swords were deposited in mint condition, this dating should also indicate the period in which the hoard was deposited. Although the swords were very probably produced in central Germany, they incorporate influences from the Apa type (Meller 2010: 52-56; Meller 2013: 503-505). However, the richly decorated hilts with gold cuffbands were probably an original creation.

The main distribution of Nebra-type swords ranges from central Germany across the North German Plain to Schleswig-Holstein (Meller 2013: 509, fig. 16). Late Early Bronze Age and early Middle Bronze Age sword hoards (chronologically comparable to NBA I B in Scandinavia) occur from Hungary across southern Germany to Scandinavia (Meller 2013: 513, tab. 1). Their distribution substantially matches that of the Apa swords, so not only the sword-type but evidently also the ideological background of deposition habits formed

Figure 1: The Nebra hoard, Burgenlandkreis (Germany). The hoard consists of the famous Sky Disc, two high-quality swords with damascened decorations, two axes, one chisel and two arm spirals (© State Office for Heritage Management and Archaeology Saxony-Anhalt – State Museum of Prehistory; photo: J. Lipták, Munich).

a continuous area of communication (Hansen 2010; Meller and Bunnefeld, in press). For the most part, only a single sword and several axes were deposited within any one hoard. However, in four cases pairs of swords were deposited (Meller 2013: 513, tab. 1). These include Nebra, Burgenlandkreis (Germany), Apa, județ Satu Mare (Romania; Bader 1991: 38-39, nos. 25-26), Rożnowo, województwo Zachodniopomorskie (Poland; Kersten 1958: 63, no. 607), and Rørby, Sjælland (Denmark; Aner/Kersten 1976: 6-7, no. 617), thus covering the entire distribution of the sword hoards. In these cases, the two swords may be different from each other (as in the Apa and Rożnowo deposits), or nearly identical (as in the Nebra and Rørby hoards). The similarity between the two swords in Nebra and Rørby is misleading, however. Although they match almost perfectly in form, quality and execution, they differ in decoration. In both cases, one of the two swords features a figurative depiction. In Rørby, the image is one of the earliest depictions of a ship (see Kaul 1998: 73-78) in the NBA (Fig. 2), while in Nebra snakes are represented, one with one head and one with three heads. In each case, the images bestow special significance to one of the otherwise almost identical swords. What exactly this significance was can no longer be established today beyond doubt archaeologically. However, the images may have been religious or mythological symbols associated with a solar journey, which has most recently been reconstructed by Flemming Kaul, above all for the late NBA (see, i.e., Kaul 1998; Kaul 2021). Further, within their respective cultural contexts, the swords themselves are the first of their kind. For that reason alone, they constitute a precious rarity. Since the dual principle that emerges here plays a role not only in these unusual hoard finds, but also in princely graves, e.g. at Leubingen, Landkreis Sömmerda (Germany), this cannot be mere chance (Hansen 2010; Meller 2010: 57-59). Whether principles such as the 'twin gods' brought into the discussion by Kristian Kristiansen lie behind this (e.g. Kristiansen and Larsson 2005) or whether, for example, worldly and spiritual power are indicated by the pair of swords cannot now be determined.

However, there is a crucial difference in the manner in which the decorations are applied. Whereas the Rørby ship is chiselled, the Nebra snakes are inlaid into the blade by damascening (Berger *et al.* 2010: esp. 759-760; Berger 2012: 34; Berger and Wunderlich 2019).

Damascening is extremely rare on swords in Early Bronze Age and early Middle Bronze Age contexts. In the Nebra case, it consists of linear copper inlays into bronze (Berger 2012: 254, nos. 2-4), in the case of Priziat, Dép. Morbihan (France; 20th-18th century BCE), it comprises gold inlays in the form of dots along the midrib of the blade of a dagger (Berger 2012: 268, no. 59). The sword from the 'Marais de Nantes', Dép. Loire-Atlantique (France) dates to the early Middle Bronze

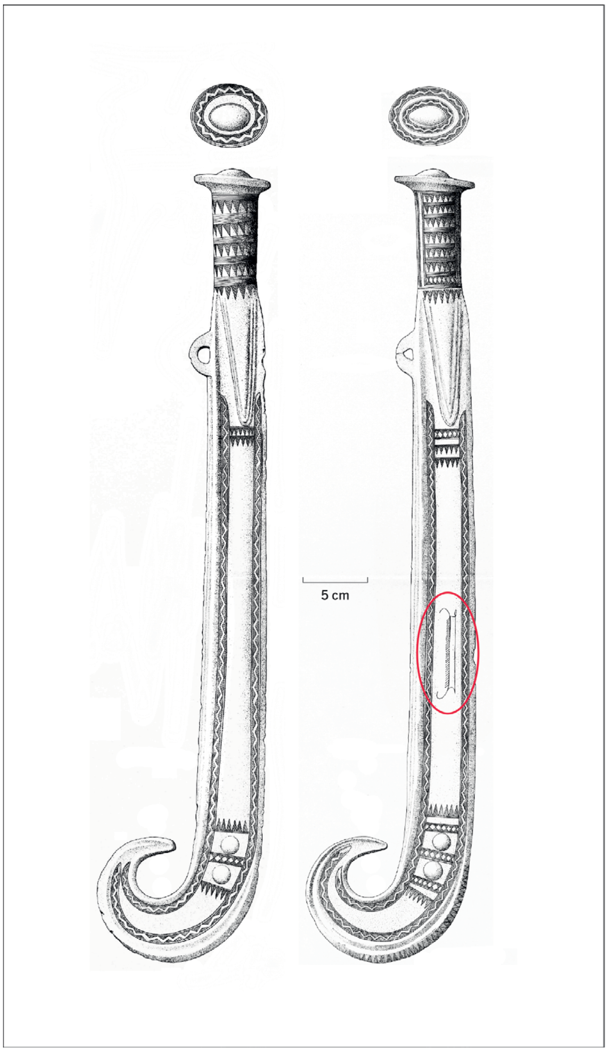


Figure 2: One of the two curved swords from Rørby, Sjælland (Denmark), bears one of the earliest depictions of a ship in the Nordic Bronze Age (highlighted in red), an important mythological symbol (drawing: after Aner and Kersten 1976: pl. 141).

Figure 3: The sword from Vreta kloster, Östergötland (Sweden), has copper inlays in the form of snaking lines on its tin-bronze blade. Where they are preserved, they hardly differ in colour from the sword blade in their corroded state (photo: J. Lipták, Munich, with kind permission of Statens Historiska Museum).

Age (16th/15th century BCE). It is excellently preserved and shows its original colouring: the blade appears almost golden, the various damascenings set into it are almost black and the zigzag bands within the lancet-shaped inlays are made of gold wire (Berger 2012: 254, no. 1). The hilt-plated sword from Vreta kloster, Östergötland (Sweden; 16th century BCE), too, exhibits copper inlays on its tin-bronze blade (Berger 2012: 255, no. 7; see Fig. 3). These copper inlays in the form of snaking lines have largely broken out and, where they are preserved, they hardly differ in colour from the tin-alloyed sword blade in their corroded state (Berger *et al.* 2010: 766-767, figs 22-23). The same is true of the Nebra swords. However, the original colouring – presumably achieved by artificial patination of the inlaid metal – must have been very different, as is shown by a colour reconstruction of Nebra Sword 1 (Fig. 4). The almost black copper inlays differ sharply from the golden background colour of the bronze blade and the hilt (Berger 2012; Wunderlich and Berger 2019: 48, fig. 21a). In my view, it should be assumed, furthermore, that between the golden cuffband and the grip at least two thin disks were placed (made for example of black wood or horn), which would have accentuated the difference in colour between the gold and the gold-coloured grip.

The snakes on Nebra Sword 1

At first glance, the damascening on the midrib of each side of the blade on Nebra Sword 1 seems to consist merely of decorative lines. A closer inspection of the copper inlay on the display side with the bronze grip reveals an undulating line on the central ridge from roughly the middle of the sword blade over *c.* 14 cm

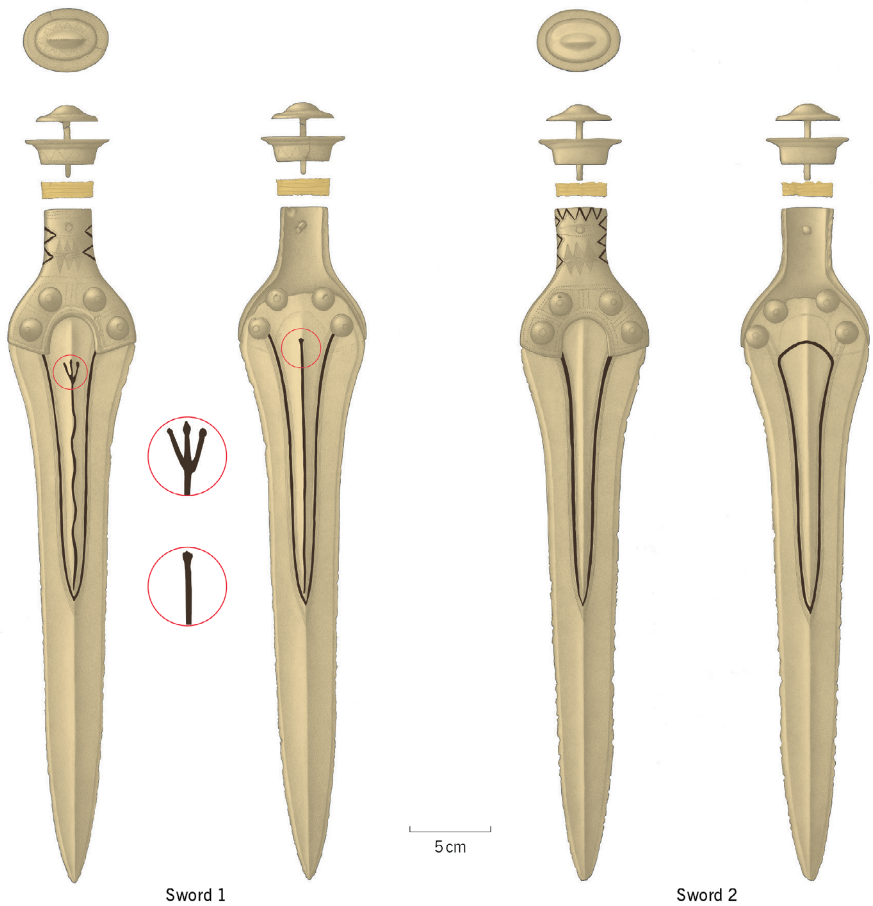


Figure 4: Colour reconstruction of the Nebra swords. It is probable that the copper inlays were originally patinated artificially and had an almost blackish colour that contrasted with the gold-coloured bronze. The colour contrast would otherwise be minimal, and the damascened elements would have been barely visible. On the midrib on one side of Sword 1, a three-headed undulating snake can be identified. On its opposite side, there is a one-headed snake at rest. The snake heads on the blade are shown enlarged in the red circles (© State Office for Heritage Management and Archaeology Saxony-Anhalt – State Museum of Prehistory; drawings: S. Belizki, Halle [Saale]; colouring: M. Wiegmann, State Office for Heritage Management and Archaeology Saxony-Anhalt – State Museum of Prehistory).

towards the hilt; it runs inside the lancet-shaped decorative grooves and the two strips of damascening within them. The undulating line ends before the hilt in three lines, which in part thicken slightly at the ends. This allows us to interpret the damascened line as a stylised, undulating three-headed snake. On the reverse of the blade, on the midrib, there is more damascene work which matches the undulating image on the front side in its length and breadth. However, in this case it runs in a straight line; it likewise ends in a thickening of the line – however, in this case in just a single line. When inspected in detail, this end forms a triangle with concave, drawn in sides; a shape which suggests here as well that an abstract snakehead (seen from above) might have been intended (see Fig. 4). Thus, both sides of the sword blade show snakes in different states: in one case, three-headed with an undulating motion and in the other one-headed, stretched out and at rest.

The snake depictions on the Nebra sword are thoroughly remarkable, since the central German Únětice culture does not generally favour images in their material culture. Central German Únětice pottery is smooth. Only in very rare exceptions does it exhibit small decorations in the tradition of Bell Beaker pottery (Schwarz 2021; Zich 1996). The few decorated bronze objects from this culture group exhibit ribbing and clustered lines and – above all – triangles formed from several lines, partly with hatching. These decorated objects include some daggers, halberds, and decorated discs (Coblenz 1986; Wüstemann 1995). The discs could be interpreted as stylised representations of the sun,

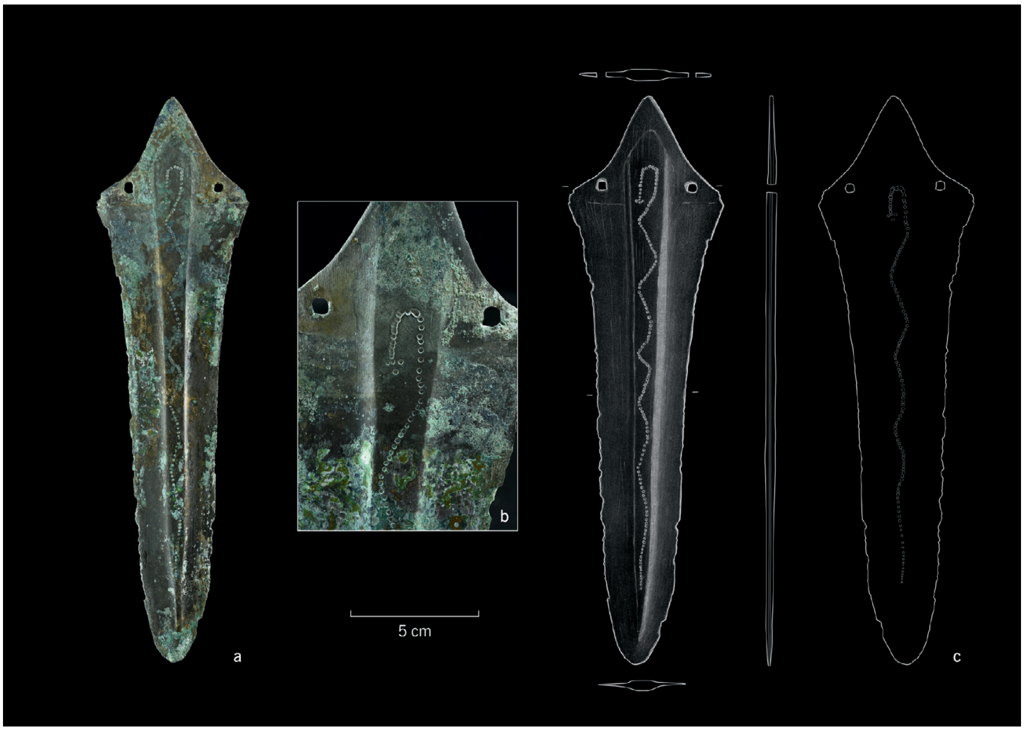


Figure 5: Other than Nebra Sword 1, a dagger (findspot unknown) is the only secure example of a depiction of a snake on bronze from the European Early Bronze Age. Typologically, it belongs among the British daggers. a) photo of side 1; b) detail photo of side 2; c) (schematic) drawings of both sides (© State Office for Heritage Management and Archaeology Saxony-Anhalt – State Museum of Prehistory; a-b: A. Hörentrup; c: M. Wiegmann, both State Office for Heritage Management and Archaeology Saxony-Anhalt – State Museum of Prehistory).

similar to the golden 'sun discs' of western Europe (Gerloff 2019).

Interpretation

If we search in the contact zones of the central European Bronze Age for comparable examples of snake depictions on Early Bronze Age blades, there are only two parallels. One includes the blade from Vreta kloster (and this only if we interpret snakes from the undulating lines along the edges of the blade) (see Fig. 3). The second example, unfortunately, comes from the antiquities market and is without provenance (Fig. 5).[1] It is 21.7 cm long, 5.8 cm wide and weighs 107 g. The smooth, blackish-brown-green patina is of complex composition. Analyses of the metal argue in favour of the dagger's authenticity.[2] On both sides over the broad midrib there runs a stylised depiction of a coiled snake formed out of single dots, cast along with the blade, which ends in a head turned towards the back composed of three dots. This typologically unusual piece combines formal elements of British daggers of Stuart Needham's series 1C and 4B (Needham 2015; Needham *et al.* 2017). While the hilt-plate, with its almost triangular tang, matches daggers of series 1C, and can be compared above all to a piece from Derrynamanagh, Co. Galway (Ireland), the midrib and the – by any standard – unusual pointed oval form of the hilt-mark (which argues against an interpretation as a halberd blade) point rather to Needham´s series 4(B). The dotted snake line recalls the *pointillé* decoration which normally covers the whole surface of many Wessex daggers, especially later ones (series 5D). However, the find should certainly be regarded as an early bronze dagger from the British Isles and dated between 1900-1700 BCE. It is the only comparable European item known to me from the relevant period that certainly depicts a snake.

A much more famous and very high-quality sword with a snake depiction comes from Royal Grave II at Byblos (Lebanon). It is a sickle sword of Egyptian origin with a dark copper band and gold inlays (Fig. 6). The hieroglyphic inscription 'Prince of Byblos, Ipshemuabi, Son of the deceased Prince Abishemu' dates to the first half of the 17th century BCE and is, thus, somewhat older than the Nebra sword (Ahrens 2024: 131-132; Meller and Schefzik 2020: 216, no. 131; Montet 1928-1929: 174-177, pl. 99). The high-quality workmanship of the sword exhibits a scaled serpentine body with the

[1] I wish here to warmly thank the owner, Dr Stefan Mäder, Riegel am Kaiserstuhl (Germany), for helpfully drawing attention to it and for permission to examine, document, and publish the object.

[2] The precise examination was kindly carried out by Dr Christian-Heinrich Wunderlich, State Office for Heritage Management and Archaeology Saxony-Anhalt – State Museum of Prehistory.

Figure 6: Egyptian sickle sword with high-quality damascene work from Royal Grave II in Byblos (Lebanon). As well as a hieroglyphic inscription, there is a cobra (probably the Uraeus snake) depicted on it, which protects the bearer of the sword (© Ministry of Culture/Directorate General of Antiquities, Lebanon).

hieroglyphic inscription just mentioned and, facing towards the point, an erect cobra with splayed hood. This is one of the many depictions of the Egyptian Uraeus snake, protector of the pharaoh.

That the snakes on the Nebra sword, and perhaps the blade from Vreta kloster and the British dagger, may have built on much older traditions is shown by wooden snake depictions from Zwenkau, Landkreis Leipzig (Germany), from the Linear Pottery culture of the late 6th millennium BCE, and from Järvensuo 1, Kanta-Häme region (Finland), of the late 3rd millennium BCE (Campen 2000: 38; Koivisto and Lahelma 2021).

From the Early Bronze Age onwards, the exchange of amber and other indications, e.g. scattered import finds, attest to connections between western, central and northern Europe and the Eastern Mediterranean (e.g. Bunnefeld *et al.* 2023; Gerloff 1993; Vandkilde *et al.* 2024). If we, therefore, take a look at the contact areas in the Near East and at Egypt, we find large numbers of depictions of serpents, including ones with multiple heads, from the 3rd millennium BCE (Theis 2019). In ancient Egypt in particular, snakes played a very prominent role, both in a positive sense, e.g. as protectors of the pharaoh, as on the death mask of Tutankhamun (reigned *c.* 1332-1323 BCE), as well as in a negative sense, e.g. the Apophis snake representing the evil principle that continually endangers the world during the nocturnal journey of the Sun God (Hornung 2005). The snake on the sword of Prince Ipshemuabi of Byblos likely represents the good cobra defending a king.

In Mycenaean Greece, there is no lack of splendidly damascened daggers and swords (Berger 2012: 30-32; Steinmann 2020). Yet here the inlay work mostly depicts scenes of battle or hunting. That snakes could indeed play a role also as images on weapons in early Greece can be seen from the description of the Shield of Heracles by Hesiod (Hes. *Aspis* 161-163). The later myths of the infant Heracles strangling snakes should also be mentioned here in passing (Pindar, *Nem.* 1.35-58, esp. 39-47; Theocritus, *Id.* 24, esp. 11-59).

However, the key to understanding the snakes on the Nebra sword lies in the visual world of the NBA. In its iconography, snakes appear in rock art as well as on razors. They are sometimes depicted as hybrid creatures, i.e. on the sculptural bronze figure from Fårdal (see Ahlqvist and Vandkilde 2018). Kaul has convincingly shown that, along with the horse and fish, snakes play an essential role as helpful animals in the pivotal NBA myth of the transport of the sun through day and night (Kaul 1998: 221-238). The snake, thus, becomes a key mythological element, since it guarantees the world's continuation and cyclical renewal (Kaul 2021). As the mobile figure of the Fårdal snake shows, it is also part of religious performances (Kaul 1998: 20-30). As well as the fish, horse, and snake as draught animals transporting the sun at different times of day, through air and water by day and by night, other central motifs along said mythical journey included the ship as a

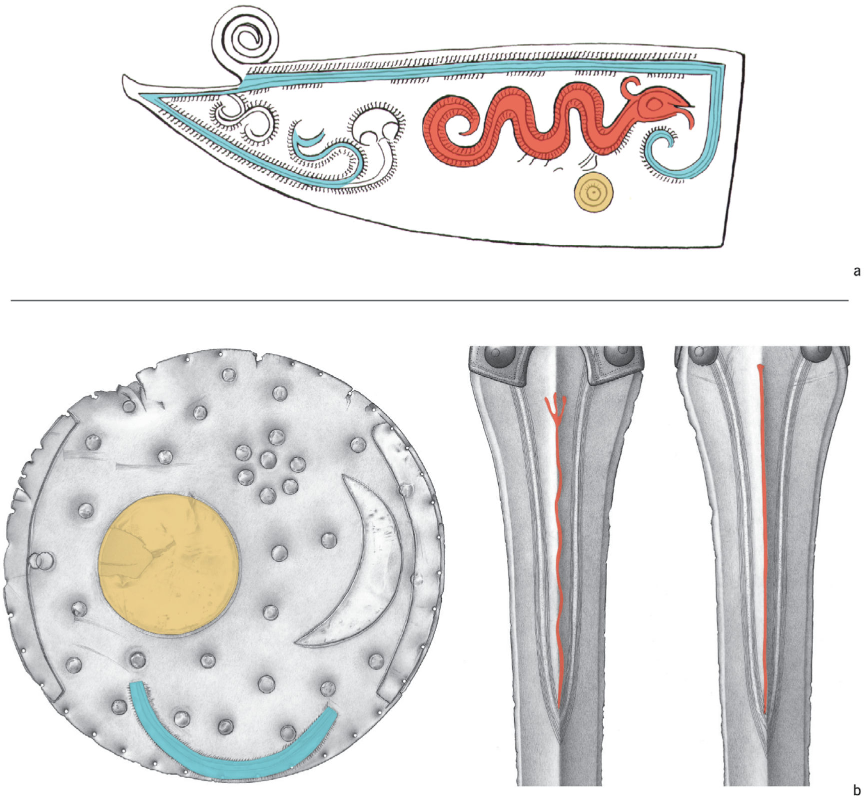


Figure 7: In the Nebra hoard (b), with the sun (yellow), ship (blue), and snake (red), for the first time the central elements of a new mythological tale appear. These elements played a central role in late Nordic Bronze Age mythology, referring to the journey of the sun through day and night, frequently depicted on razors (a) and rock art. Both the ship on the razor (findspot unknown, possibly Lolland) and the one ship on the Sky Disc are fringed, which probably symbolises the oars and crew (a: Kaul 1998: 225. fig. 150; b: © State Office for Heritage Management and Archaeology Saxony-Anhalt – State Museum of Prehistory; drawings: C. Liebing, S. Belizki, Halle [Saale]; graphics: M. Wiegmann, State Office for Heritage Management and Archaeology Saxony-Anhalt – State Museum of Prehistory).

means of transport and, of course, the sun itself. Three of these elements are found already centuries earlier in the Nebra hoard. On the Sky Disc, the sun (or full moon) is represented, as is a gold ship that was added later (Meller 2010). Further, the sword shows the serpent in two states: with three heads and undulating and with one head and immobile. Thus, essential components of the late NBA mythical journey of the sun have already been roughed out here (Fig. 7). This is true at least of the final use-phase of the Sky Disc, when the gold ship was already attached and the disc was deposited together with the swords (Meller 2010). This programme of imagery is all the more remarkable since the early Bronze Age Únětice culture was one that was notably image-averse, to the degree that even pottery decoration was reduced and ornamental decoration was found only on valuable bronze objects.

The Nebra hoard was deposited at the transition from the Early to Middle Bronze Age (Bz A2c in central Europe compared to NBA I B in Scandinavia); the inclusion of this programme of imagery points towards major religious change, which was transmitted more extensively in iconography only in later centuries a few hundred kilometres further north. Despite some early depictions of ships like in Rørby, just two other depictions – the small bird on a prong in the hoard from Ackenbach, Bodenseekreis (Germany), and the chiselled fish on the large spearhead from Hoard II from Valsømagle, Sjælland (Denmark) – likewise spotlight the existence of what would later become important religious or mythological elements already in the 16th and 15th centuries BCE (Aner-Kersten 1976: 130, no. 1098; Rittershofer 1983: 365, 373, no. 59). However, it is only in Nebra that the central motifs appear together. Thus, in the Nebra hoard we have a key to understanding the development of the iconography of the NBA.

How did this come about? There is no evidence of prior autochthonous models, except in the case of the sun.

The orientation of graves in the Corded Ware and Bell Beaker cultures, and especially the bowls decorated with suns in the Schönfeld culture, attest the importance of the sun for pre-Únětice people in the 3rd millennium BCE (Behm 1950; Schlosser 1979). The continuing importance of the sun in the Early Bronze Age is shown not only by the orientation of the graves but also by possible abstract sun depictions on decorative discs. Since the Sky Disc's complex programme of imagery, as well as the technique of damascening point towards the eastern Mediterranean and Egypt, a derivation of the journey of the sun from this region is at present the most probable explanation (Meller 2010; Meller 2021). Kaul, too, sees interesting similarities between the ideas about the sun in ancient Egypt and in the NBA and he does not rule out such influences (Kaul 1998: 287-289; Kaul 2021: 174).

The snake on the sickle sword from Byblos fits in here, too, though it should be interpreted not as the threatening Apophis snake as part of the sun's journey through the underworld, but as the protective Uraeus snake. However, it should be noted that the snakes on the blade from Nebra do not face towards the tip, but move towards the hand of the person holding the sword. This may have been intended to show – as with the myth of Heracles – that the hero/prince/sword-bearer could conquer even serpents, i.e. he is invincible.

These observations about the Nebra sword also contribute to our understanding of the ruling system of the princes in the Circumharz group of the Únětice culture in central Germany. As well as real power derived from the steep hierarchy of the society, together with economic and military resources, as can be seen from the princely graves of Leubingen, Helmsdorf, Landkreis Mansfeld-Südharz (Germany), and in the 'Bornhöck' near Dieskau, Saalekreis (Germany), their rule was based also on legitimation through the construction of an outstanding past. This can be seen most clearly from the construction of the princely graves and the presence of Neolithic stone axes as grave goods within them (summarised in Meller 2019). Furthermore, there was the knowledge of how to establish a lunisolar calendar, derived from the Near East and depicted in coded form on the Sky Disc, which made it possible to take control of time (Meller 2021). Towards the end of the Sky Disc's period of use, a revolutionary ideology was then adapted (or created) which further developed the solar religion that had existed for centuries – perhaps under decisive influence from the eastern Mediterranean – into a new mythological system of the journey of the sun. Ultimately, the Nebra hoard, with the sun, ship, and serpent, contains all the elements of a mythological narrative that was entirely new to central Europe but which would be depicted thousands of times centuries later in the visual world of the NBA, above all in rock art.

Bibliography

Ahlqvist, L. and H. Vandkilde 2018. Hybrid beasts of the Nordic Bronze Age. *Danish Journal of Archaeology* 7: 180-194.

Ahrens, A. 2024. Byblos: Egypt's gateway to the Levant and beyond during the Bronze Age, in National Museum of Antiquities (the Netherlands) and Ministry of Culture/Directorate General of Antiquities (Lebanon) (eds) *Byblos. A Legacy Unearthed*: 129-134. Leiden: Sidestone.

Aner, E. and K. Kersten 1976. *Die Funde der älteren Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen 2. Holbæk, Sorø und Præstø Amter*. Neumünster: Wachholtz.

Bader, T. 1991. *Die Schwerter in Rumänien*. Prähistorische Bronzefunde IV, 8. Stuttgart: Franz Steiner.

Behm, G. 1950. Die Schalenverzierungen der Schönfelder Gruppe. Ein Versuch ihrer Deutung. *Jahresschrift für mitteldeutsche Vorgeschichte* 34: 32-55.

Berger, D. 2012. *Bronzezeitliche Färbetechniken an Metallobjekten nördlich der Alpen. Eine archäometallurgische Studie zur prähistorischen Anwendung von Tauschierung und Patinierung anhand von Artefakten und Experimenten*. Forschungsberichte des Landesmuseums für Vorgeschichte Halle 2. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Berger, D., R. Schwab and C.-H. Wunderlich 2010. Technologische Untersuchungen zu bronzezeitlichen Metallziertechniken nördlich der Alpen vor dem Hintergrund des Hortfundes von Nebra, in H. Meller and F. Bertemes (eds) *Der Griff nach den Sternen. Wie Europas Eliten zu Macht und Reichtum kamen*: 751-777. Internationales Symposium in Halle (Saale) 16.-21. Februar 2005. Tagungen des Landesmuseums für Vorgeschichte Halle 5. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Berger, D. and C.-H. Wunderlich 2019. Oberfläche, Werkspuren, Tauschierung: Ästhetische Metallbearbeitungstechniken der frühen Bronzezeit im Zusammenhang mit dem Hortfund von Nebra. in H. Meller and F. Bertemes (eds) *Der Aufbruch zu neuen Horizonten. Neue Sichtweisen zur europäischen Frühbronzezeit*: 33-53. Abschlusstagung der Forschergruppe FOR550 vom 26. bis 29. November 2010 in Halle (Saale). Tagungen des Landesmuseums für Vorgeschichte Halle 19. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Bunnefeld, J.-H., J. Becker, L. Martin, R.-R. Pausewein, S. Simon and H. Meller 2021 (2023). Baltic Amber in Aššur. Forms and Significance of Amber Exchange between Europe and the Middle East, c. 2000-1300 BC. *Acta Archaeologica* 92(2): 228-243.

Campen, I. 2000. Älter als Babylon: Brunnen aus dem Leipziger Land, in J. Oexle (ed.) *Sachsen: archäologisch. 12.000 v. Chr. - 2.000 n. Chr.*: 37-38. Dresden: Landesamt für Archäologie mit Landesmuseum für Vorgeschichte.

Coblenz, W. 1986. Ein frühbronzezeitlicher Verwahrfund von Kyhna, Kr. Delitzsch. *Arbeits- und Forschungsberichte zur Sächsischen Bodendenkmalpflege* 30: 37-88.

Gerloff, S. 1993. Zu Fragen mittelmeerländischer Kontakte und absoluter Chronologie der Frühbronzezeit in Mittel- und Westeuropa. *Praehistorische Zeitschrift* 68: 58-102.

Gerloff, S. 2016. Die kupfer- und bronzezeitlichen „Sonnenscheiben“ aus dem atlantischen Europa. *Die Kunde N.F.* 67: 151-220.

Hansen, S. 2010. Der Hort von Nebra: seine Ausstattung, in H. Meller and F. Bertemes (eds) *Der Griff nach den Sternen. Wie Europas Eliten zu Macht und Reichtum kamen*: 77-89. Internationales Symposium in Halle (Saale) 16.-21. Februar 2005. Tagungen des Landesmuseums für Vorgeschichte Halle 5. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Hornung, E. 2005. “Söhne der Erde“ – Schlangen im Diesseits und Jenseits der Ägypter, in E. Hornung and A. Schweizer (eds) *Die Weisheit der Schlange*. Beiträge der Eranos Tagungen 2003 und 2004. Basel: Schwabe.

Kaul, F. 1998. *Ships on Bronzes. A Study in Bronze Age Religion and Iconography*. Copenhagen: National Museum.

Kaul, F. 2021. The eternal voyage of the Sun, the perpetual cyclical advance of time, seen from a Nordic Bronze Age position. Movement is time – time is movement, in H. Meller, A. Reichenberger and R. Risch (eds) *Zeit ist Macht. Wer macht Zeit? Time is power. Who makes time?*: 165-179. 13. Mitteldeutscher Archäologentag 2020. Tagungen des Landesmuseums für Vorgeschichte Halle 24. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Kersten, K. 1958. *Die Funde der älteren Bronzezeit in Pommern*. Atlas der Urgeschichte Beiheft 7. Hamburg: Hamburgisches Museum für Völkerkunde und Vorgeschichte.

Koivisto, S. and A. Lahelma 2021. Between earth and water: a wooden snake figurine from the Neolithic site of Järvensuo 1. *Antiquity* 95: e19 (available at: https://doi.org/10.15184/aqy.2021.79).

Kristiansen, K. and L. Larsson 2005. *The Rise of Bronze Age Society: Travels, Transmissions and Transformations* Cambridge: Cambridge University Press.

Meller, H. 2010. Vom Logos zum Mythos – Biographie eines Himmelsbildes, in H. Meller and F. Bertemes (eds) *Der Griff nach den Sternen. Wie Europas Eliten zu Macht und Reichtum kamen*: 23-73. Internationales Symposium in Halle (Saale) 16.-21. Februar 2005. Tagungen des Landesmuseums für Vorgeschichte Halle 5. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Meller, H. 2013. Der Hortfund von Nebra im Spiegel frühbronzezeitlicher Deponierungssitten, in H. Meller, F. Bertemes, H.-R. Bork and R. Risch (eds) *1600 – Kultureller Umbruch im Schatten des Thera-Ausbruchs? 1600 – Cultural Change in the Shadow of the Thera-Eruption?*: 493-526. 4. Mitteldeutscher Archäologentag vom 14. bis 16. Oktober 2011 in Halle (Saale). Tagungen des Landesmuseums für Vorgeschichte Halle 9. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Meller, H. 2019. Princes, Armies, Sanctuaries: The Emergence of Complex Authority in the Central German Únětice Culture. *Acta Archaeologica* 90(1): 39-79.

Meller, H. 2021. Die Himmelsscheibe von Nebra – Astronomie und Zeitbestimmung als Quelle der Macht, in H. Meller, A. Reichenberger and R. Risch (eds) *Zeit ist Macht. Wer macht Zeit? Time is power. Who makes time?*: 149-163. 13. Mitteldeutscher Archäologentag 2020. Tagungen des Landesmuseums für Vorgeschichte Halle 24. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Meller, H. and J.-H. Bunnefeld (in press). Vernetzte Eliten – Der Hortfund von Trassem und seine überregionalen Beziehungen. *Trierer Zeitschrift – Archäologie und Kunst des Trierer Landes und seiner Nachbargebiete*.

Meller, H. and K. Michel 2018. *Die Himmelsscheibe von Nebra. Der Schlüssel zu einer untergegangenen Kultur im Herzen Europas*. Berlin: Ullstein.

Meller, H. and K. Michel 2019. *Himmelskivan från Nebra: Nyckeln till en svunnen kultur i Europas hjärta*. Stockholm: Daidalos.

Meller, H. and K. Michel 2021. *Griff nach den Sternen. Nebra, Stonehenge, Babylon: Reise ins Universum der Himmelsscheibe* Berlin: Ullstein.

Meller, H. and M. Schefzik (eds) 2020. *Die Welt der Himmelsscheibe von Nebra – Neue Horizonte*, Begleitband zur Sonderausstellung im Landesmuseum für Vorgeschichte Halle (Saale), 4. Juni 2021 bis 9. Januar 2022. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Montet, P. 1928-1929. *Byblos et l’Égypte. Quatre campagnes de fouilles à Gebeil, 1921-1922-1923-1924*. Bibliothèque archéologique et historique 11. Paris: Geuthner.

Needham, S. 2015. Appendix I. A revised classification and chronology for daggers and knives, in J. Hunter and A. Woodward *Ritual in Early Bronze Age Grave Goods*. Oxford: Oxbow Books (CD-Rom).

Needham, S., J. Kenny, G. Cole, J. Montgomery, M. Jay, M. Davis and P. Marshall 2017. Death by combat at the dawn of the Bronze Age? Profiling the dagger-accompanied burial from Racton, West Sussex. *The Antiquaries Journal* 97: 1-53.

Pernicka, E., J. Adam, G. Borg, G. Brügmann, J.-H. Bunnefeld, W. Kainz, M. Klamm, T. Koiki, H. Meller, R. Schwarz, T. Stöllner, C.-H. Wunderlich and A. Reichenberger 2020. Why the Nebra Sky Disc dates to the Early Bronze Age. An Overview of the Interdisciplinary Results. *Archaeologia Austriaca* 104: 89-122.

Rittershofer, K.-F. 1983. Der Hortfund von Bühl und seine Beziehungen. *Bericht der Römisch-Germanischen Kommission* 64: 140-415.

Ruckdeschel, W. 1978. *Die frühbronzezeitlichen Gräber Südbayerns. Ein Beitrag zur Kenntnis der Straubinger Kultur*. Antiquitas 2(11). Bonn: Habelt.

Schlosser, W. 1979. *Astronomische Ausrichtungen im Neolithikum I. Ein Vergleich der böhmisch-mährischen Schnurkeramik und Glockenbecherkultur*. Bochum: Ruhr-Universität.

Schwarz, R. 2021. *Typentafeln zur Chronologie in Mitteldeutschland – Die Aunjetitzer Kultur auf Grundlage der Grab- und Siedlungskeramik*. Forschungsberichte des Landesmuseums für Vorgeschichte Halle 19. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Steinmann, B.F. 2020. Malen mit Metall – Die Technik der Tauschierung von der Levante bis ins Unstruttal, in H. Meller and M. Schefzik (eds) 2020. *Die Welt der Himmelsscheibe von Nebra – Neue Horizonte*: 178-181. Begleitband zur Sonderausstellung im Landesmuseum für Vorgeschichte Halle (Saale), 4. Juni 2021 bis 9. Januar 2022. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Theis, C. 2019. Die siebenköpfige Schlange im Vorderen Orient, in M. Brose, P. Dils, F. Naether, L. Popko and D. Raue (eds) *En détail – Philologie und Archäologie im Diskurs*: 1123-1136. Festschrift für Hans-Werner Fischer-Elfert. Zeitschrift für ägyptische Sprache und Altertumskunde Beihefte 7/1. Berlin: de Gruyter.

Vandkilde, H., V. Matta, L. Ahlqvist and H.W. Nørgaard 2022. Anthropomorphised warlike beings with horned helmets: Bronze Age Scandinavia, Sardinia, and Iberia compared. *Praehistorische Zeitschrift* 97: 130-158.

Vandkilde, H., C.F. Stephansen, P. Suchowska-Ducke, C.S. Andersen, L. Ahlqvist, L. Felding, M. Bjørnevad-Ahlqvist, J. Czebreszuk and H.W. Nørgaard 2024. Metal-for-Amber in the European Bronze Age. *Praehistorische Zeitschrift* 99(1): 280-338.

Wüstemann, H. 1995. *Die Dolche und Stabdolche in Ostdeutschland*. Prähistorische Bronzefunde VI, 8. Stuttgart: Franz Steiner.

Zich, B. 1996. *Studien zur regionalen und chronologischen Gliederung der nördlichen Aunjetitzer Kultur*. Vorgeschichtliche Forschungen 20. Berlin: de Gruyter.

Part 5

The Lived Bronze Age – of Settlements and Burials

"Fundamental openness with porous boundaries and overlapping spheres of interaction precondition the survival of each small world. Globalization in this manner transgresses territories, whether ethnic-language groups, economic modes, nations, towns or other hubs. The world at present is becoming more uniform because transcultural commodities are powerful transmitters of globalness ..."
(Vandkilde 2016: 113)

Chapter 25

Burial mounds and the social practices of the Central European Early Bronze Age

Johannes Müller[a] and Janusz Czebreszuk[b]

[a]Institute of Prehistoric and Protohistoric Archaeology, Kiel University, Kiel, Germany
[b]Faculty of Archaeology, Adam Mickiewicz University, Poznań, Poland
johannes.mueller@ufg.uni-kiel.de

Abstract

The Central European Early Bronze Age is described as a time of strong social differentiation. One of the main arguments supporting this concept concerns the large Early Bronze Age burial mounds known from central Germany, Silesia, and Greater Poland. A new study by Czebreszuk, Müller and colleagues shows that the practice of constructing large burial mounds first appeared with northeastern Únětice groups and was adopted only subsequently in central Germany. However, while this social practice of power representation was stable for centuries in Greater Poland, the large burial mounds of central Germany remain a rather temporary practice. Obviously, we recognise different social practices of varying temporal performance: permanent and non-permanent social monumental representation, each of which also plays a role in internal social transformation processes.

Introduction

The Early Bronze Age in Central Europe (*c.* 2200-1600 BCE) has long been the focus of archaeological research, especially as concerns the standardisation of societies for the formation of institutional power and social differentiation. At a regional level, for example, central German Únětice societies have been interpreted as highly differentiated societies which exhibited an institutionalised exercise of power in a dynastic sense (Meller 2019). At a supra-regional level, quantitative studies show different degrees of differentiation compared to earlier and later societies (Marzian *et al.* 2024).

A focus is placed here on large Únětice burial mounds. Whereas small burial mounds were still being constructed alongside flat graves in the Late Neolithic Corded Ware and Bell Beaker societies (2800-2100 BCE), in the Únětice groups, either no more burial mounds appear to have been constructed (Bohemia, Moravia, Lower Austria) or their construction was limited to very few examples of extraordinary size (central Germany, Silesia and Greater Poland). Apparently, in the northern Únětice zone, social 'elite' representation was monopolised in large burial mounds, while the rest of the population was buried in flat graves.

In the following, we will therefore take a closer look at the large burial mounds and the societies in which they were built. What is the association of social differentiation with the practice to construct large burial mounds? Are they institutionalised, i.e. long-lasting monumental phenomena, or rather non-permanent expressions of social representation? Are there other areas of society that enable the modelling of social development and its decline?

Large Únětice burial mounds

The large burial mounds (LBM) of Únětice societies are generally defined by their size, a particularly elaborate burial chamber and an abundance of grave goods (Steffen 2010: 19-21), which may be made of gold or may include other special grave goods rarely found in flat graves. For example, with regard to bronze grave goods, daggers, hatchets, axes and halberds play only a subordinate role in northern Únětice flat graves (Zich 1996). However, they are frequently found in the large burial mound graves. A gradation in grave construction and the variety of grave goods is recognisable within the central burials of the LBMs, which argumentatively also serves to differentiate social gradations in the 'ruling' group of Únětice societies (Meller 2019; Steffen 2010: 21).

29 large Early Bronze Age burial mounds are known from central Europe, 18 of which can only be reconstructed from older reports (Fig. 1). In central Germany, in addition to those with mostly ambiguous records, these include the burials of Helmsdorf, Leubingen, and Raßnitz-Bornhöck; in Silesia, Szcepankowice, and Kąty Wrocławskie; in Greater Poland, there are five generally known burial mounds and an additional nine burial mounds from Łęki Małe (Czebreszuk *et al.* 2024; Steffen 2010: 22, Fig. 22) and one from Krotoszyn Forest (Strożyk 2019). Raßnitz-Bornhöck, Leubingen, Helmsdorf, Dieskau Barrow II, Łęki Małe Barrow I/A and B, Łęki Małe Barrow II/B, as well as Szczepankowice belong to a group of rich LBMs, while Baalberge, Dieskau Hügel I, Königsaue, Nienstedt, Sömmerda, and

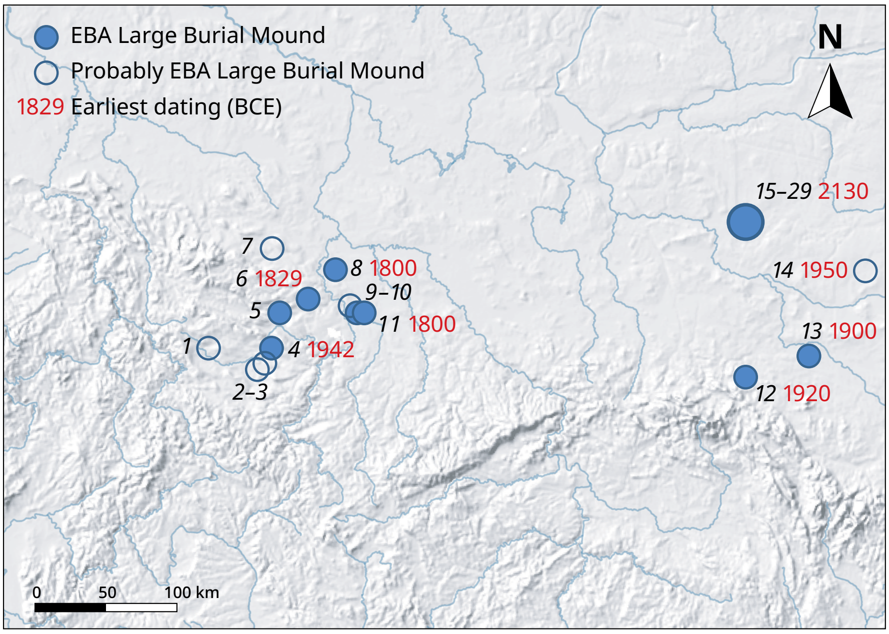


Figure 1: The distribution of large Únětice burial mounds and their earliest dating. Key: 1) Osterkörner; 2-3) Sömmerda; 4) Leubingen; 5) Nienstedt; 6) Helmsdorf; 7) Königsaue; 8) Baalberge-Schneiderberg; 9-10) Dieskau; 11) Raßnitz-Bornhöck; 12) Szczepankowice; 13) Kąty Wrocławskie; 14) Krotoszyn Forest, Barrow 35; 15-29) Łęki Małe (map: Karsten Reckweg, Institute UFG Kiel).

Österkörner belong to a second less rich group of LBMs (cf. Steffen 2010) (Fig. 1).

From the central German region, we are very well informed about the burial mounds from Leubingen (diameter 48 m, height 8.5 m), Helmsdorf (diameter 34 m, height 8.5 m) and Raßnitz-Bornhöck (diameter 65 m, reconstructed height 13 m). In the first two cases, the mounds include richly-furnished central burials erected over a Bernburg or Corded Ware burial mound, or which show a connection to predecessor societies via 'antique' grave goods (Zich 1996). Raßnitz-Bornhöck contained a central grave robbed or destroyed in later times, some of whose rich grave goods were apparently deposited in nearby Dieskau (Meller 2019).

In addition to these known large burial mounds, the Schneiderberg in Baalberge was identified in 2022 as an Early Bronze Age large burial mound built over a Baalberge core mound (diameter 40 m; height 5.75 m) (Fig. 2; Müller *et al.* 2024; Zolchow *et al.* 2024). Although the ancient grave contains a rich burial with two daggers, the grave good assemblage within it does not come close to the richness of the grave good assemblage within other central German burials in large burial mounds with gold (cf. also Steffen 2010).

Even though an additional 17 candidates for further large burial mounds are known (cf. Steffen 2010), it is possible to note a decisive characteristic of the central German region, i.e. there are always only individual mounds (at most two) rather than groups of mounds. These stand in contrast to the *c.* 3,381 Únětice flat graves recorded in the same region to date (Hubensack 2018; Zich 1996). The dating is also quite close: Helmsdorf-Galgenhügel (dendrodate 1829/28 BCE, cf. Meller 2020), Leubingen (dendrodate 1942 BCE, Becker et al. 1989; cf. Meller 2019), Raßnitz-Bornhöck (1850/1800 BCE ^{14}C, cf. Meller 2019) initially seem to date from the Middle Únětice period. Baalberge-Schneiderberg is also likely to fall within this period. At least the dating of samples from the Early Bronze Age burial mound revealed a period of *c.* 2275-1890 BCE, which suggests an initial construction *c.* 1890 BCE (Müller *et al.* in print, Zolchow *et al.* in print). Typochronologically, grave goods from burial mounds with older non-secure reports are assigned to subphase Zich 4 (Steffen 2010; cf. Zich 1996), which is dated *c.* 1950-1775 BCE (Schwarz 2021: 222).

Accordingly, the large Únětice burial mounds of central Germany are monumental social representations that were built *c.* 1950-1800 BCE (Fig. 3). It is therefore a Middle Únětice phenomenon (*c.* 1975-1775 BCE) which was unknown in Early (2275-1975 BCE) and Late Únětice (1775-1550 BCE).[1] In addition to this brief appearance of 'princely' burials, no lines of tradition can be identified on site, e.g. in the form of secondary Únětice burials in the mounds or further burial mounds. Possible exceptions are Österkörner, excavated in 1872 (Steffen 2010: 95), where other burials without grave goods are

[1] Chronology according to Schwarz 2021: 222 Tab.

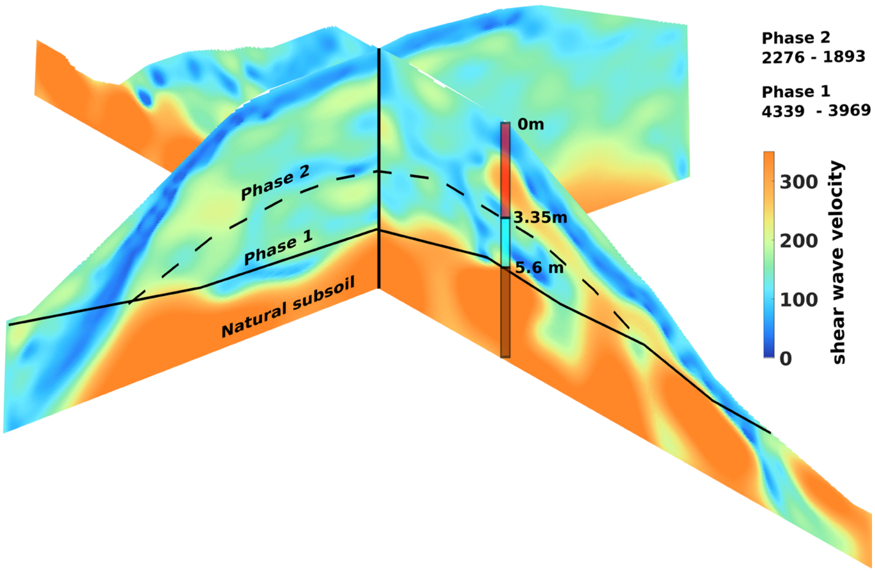


Figure 2: Baalberge-Schneiderberg (Saxony-Anhalt). With different geophysical methods, two phases of the mound have been detected. Phase 1 (height 1.80 m) is associated with the Baalberge cist; phase 2 (additional 3.35 m height) with the EBA burial. Based on ^{14}C-dating of material from drillings, used for phase 1 is dated to 4340-3970 BCE; used in phase 2 to 2275-1890 BCE (Müller *et al*, in print; drawing: Manuel Zolchow/Johannes Müller, Kiel University).

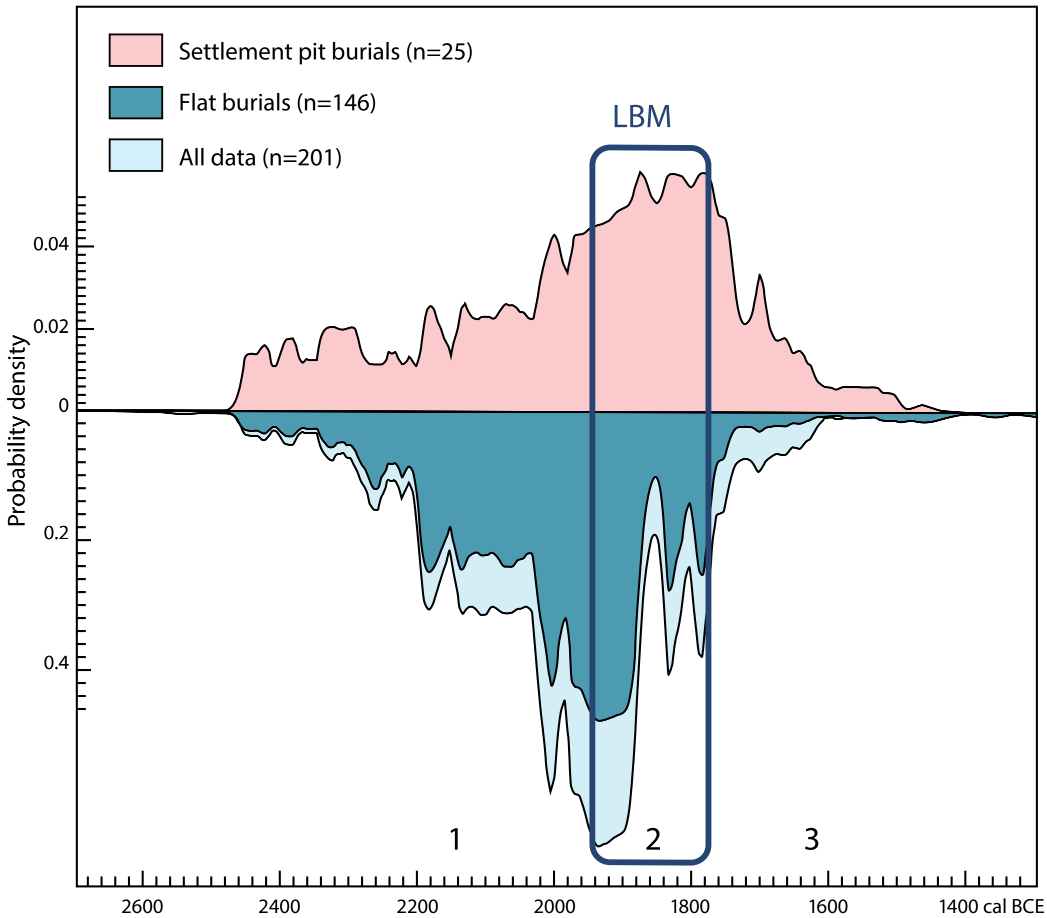


Figure 3: Sum calibration of the settlement pit burials in relation to the regular flat graves and the total number of Únětice data according to the Radon-B database (after Kneisel *et al.* 2013). The phase including large burial mounds is marked (see Hubensack 2018). Different phases of social formations are marked (1-3); n: number of ^{14}C dates (drawing: Karsten Reckweg, Institute UFG Kiel).

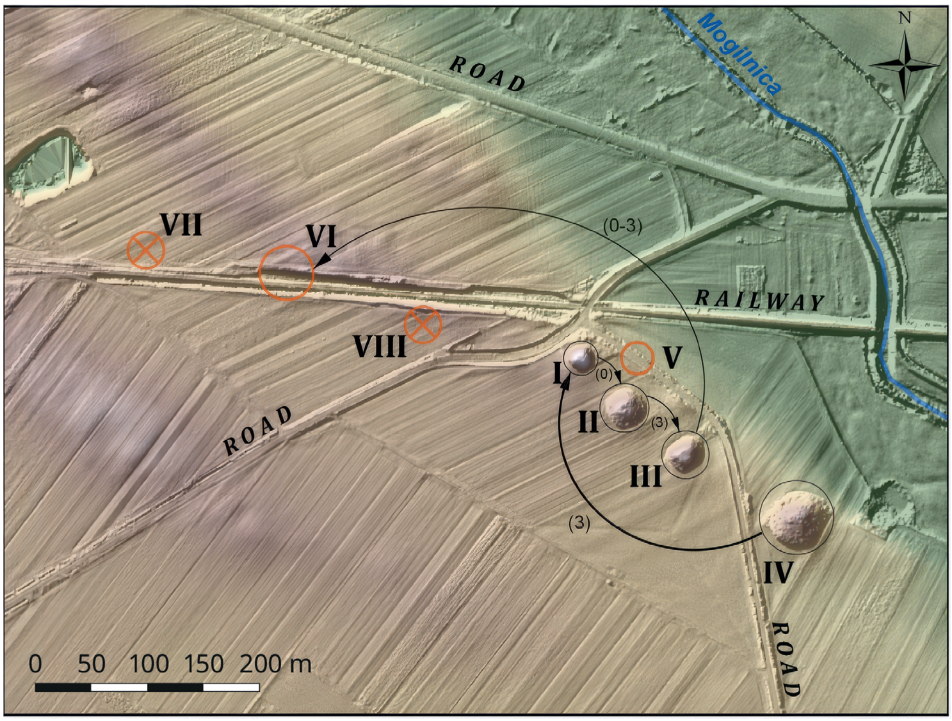


Figure 4: Łęki Małe (Greater Poland). Sequence of construction of barrows in the cemetery. Key: The excavated and reconstructed barrows are visible. The partially preserved barrows as well as those registered and documented in the mid 20th century are marked. Key: black circles = excavated and reconstructed; red circles = reported; arrows = chronological sequence (drawing: Janusz Czerbreszuk, UAM Poznan).

mentioned in addition to an Únětice secondary burial in a central burial (wall grave with floor pavement), which is described as a Kalbsrieth/Corded Ware. In Sömmerda-Randstätter Barrow II a burial chamber construction comparable to Leubingen is positioned above Early Únětice flat graves (Steffen 2010: 95).The rise of the LBMs, therefore, began after a period in which flat graves and burials in settlement pits were created (Early Únětice, Fig. 3.1) in parallel with a boom in flat graves and burials in settlement pits (Middle Únětice, Fig. 3.2) and before a phase in which there were hardly any flat graves and in which burials were mainly in settlement pits (Late Únětice Fig. 3.3) (Hubensack 2018: 150, fig. 83).

In Silesia, the situation is somewhat more difficult to assess due to preservation conditions and earlier excavations. Here, the Szczepankowice burial mound (diameter 25 m, height 5 m) with its central stone core and the hut-like burial chamber inside dates to *c.* 1940-1890 BCE (^{14}C, cf. Furmanek and Lasak 2013), and a smaller burial mound was excavated in Kąty Wrocławskie 1950-1765 BCE (^{14}C, cf. Pokutta 2013).

This situation is different in Greater Poland, *c.* 300 kilometres from central Germany.[2] In the Kościan region, there are reports of 14 large burial mounds at Łęki Małe, eight of which were excavated in the 1950s and which have now been subjected to new analyses (Czebreszuk *et al.* 2024; see Fig. 4). From Krotoszyn Forest in southern Greater Poland, there is also a hitherto little-studied burial group of which Barrow 35 dates to 1975-1915 BCE (^{14}C, see Strożyk 2019).

At Łęki Małe, the first burial mound was erected in 2130/2120 BCE (Łęki Małe IV, diameter 51 m, height 4 m). The last (Łęki Małe III, diameter 37 m, height 3.5 m) has been dated firmly *c.* 1900/1800 BCE (Czebreszuk *et al.* 2024). The diameters vary, as do the heights of the mounds (Fig. 4-5). Some of the burials were robbed, others were richly decorated. In total, a SE-NW alignment of 14 graves is established along the Mogilnica terrace over the course of the Early and Middle Únětice. Looting horizons mark the end of the Early Bronze Age occupation *c.* 1800/1775 BCE (especially in Mound IV). During this period, Únětice secondary burials also took place in the burial mounds, which was not usually the case in the Middle Elbe-Saale region.

The ritual practices, and probably the social lineages, are thus different from those in central Germany: large burial mounds were evidently erected along the Mogilnica in a continuous tradition which spanned 14

[2] Other large burial mounds from the Silesian region have unfortunately not yet been precisely dated, so that no concrete statements can yet be made for Silesia.

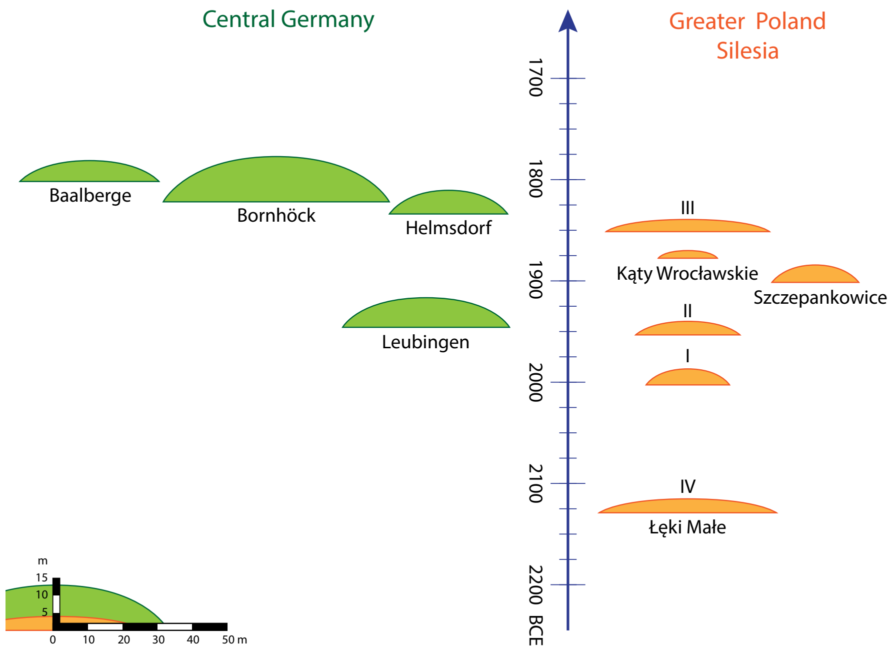


Figure 5: The Únětice Large Burial Mound development (drawing: Johannes Müller, Institute UFG Kiel, see also Tab. 1).

Table 1: Dating and size of EBA Únětice Large Burial Mounds.

Site	Region	Dating BCE; method	Diameter (m)	Height (m)	Reference
Łęki Małe, Barrow IV	Greater Poland	2130-2120 ^{14}C	51	4	Czebreszuk *et al.* 2024
Łęki Małe, Barrow I	Greater Poland	2000–1975 ^{14}C / dendro	24	4.6	Czebreszuk *et al.* 2024
Łęki Małe, Barrow II	Greater Poland	1975-1950 ^{14}C	30	3.9	Czebreszuk *et al.* 2024
Leubingen	Central Germany	1942 dendro	48	8.5	Meller 2019; Becker *et al.* 1989
Szczepankowice	Lower Silesia	1937-1889 ^{14}C	25	5	Furmanek and Lasak 2013
Kąty Wrocławskie	Lower Silesia	1951-1765 ^{14}C	17	2.2	Pokutta 2013
Łęki Małe Barrow III	Greater Poland	1900-1800 ^{14}C	37-47	3.5	Czebreszuk *et al.* 2024
Helmsdorf	Central Germany	1829-1828 dendro	34	8.5	Meller 2020
Raßnitz-Bornhöck	Central Germany	1850-1800 ^{14}C	65	13	Meller 2019
Baalberge-Schneiderberg	Central Germany	C. 1800 ^{14}C	40	5.75	Müller *et al. 2024;* Zolchow *et al.* 2024

generations, so that a long-term ‘dynastic’ succession could be reconstructed (Czebreszuk *et al.* 2024). In contrast to the other Únětice areas, there are far fewer flat graves in the Kościan region. However, human remains were found in the fortified settlement of Bruszczewo, which suggests further mortuary treatment. The dating of the different repair phases of the fortification at Bruszczewo overall prove a settlement occupation mostly contemporary with the mound sequence at Łęki Małe (Czebreszuk *et al.* 2015; Jaeger *et al.* 2016; Müller and Kneisel 2010).

Structural differences

The visible differences in burial mound practices in central Germany and Greater Poland make a structural comparison of the two regions especially important also in relation to other material and social practices of these societies. For example, numerous Únětice settlements with domestic features are known from central Germany, while from Greater Poland we only know of pit features or undefined cultural layers from non-enclosed settlements (Czebreszuk 2013; Müller and

Czebreszuk 2010). Large-scale excavations in central Germany point to individual farmsteads, on the one hand, but also to larger, unfortified settlements (e.g. Pömmelte; cf. Jurkenas and Spatzier 2019) on the other. Fortified or enclosed settlements have not yet been found in central Germany, while in Greater Poland, the fortified settlement of Bruszczewo is a known regional metalworking centre *c.* 14 km from Łęki Małe (Müller and Kneisel 2010). In Bruszczewo there is evidence of 400 years of constant settlement from *c.* 2150 BCE.

In terms of economic activity, there is evidence of intensive agriculture in both regions, as well as a high level of production and consumption of metal artefacts compared to earlier periods. Tin bronze technology developed in both regions from *c.* 2200 BCE (cf. Rassmann 2010), and tin mining is documented in the Saxon-Bohemian Ore Mountains from *c.* 2200 BCE (Hemker *et al.* 2020; Tolsdorf *et al.* 2019). In Greater Poland and the northern regions, the development of new casting technologies is recognisable very early on, as can be seen through the overlay casting of pins and the casting of a hollow-cored dagger (Müller and Kneisel 2010; Schwenzer 2004) which appeared in central Germany later on. Furthermore, both the metallurgical and the amber finds and contexts point to an intensive integration of both areas into Early Bronze Age large-scale networks.

The social structures and the question of political practices have already been intensively discussed for both Greater Poland and central Germany (cf. Bartelheim 2002; Czebreszuk *et al.* 2024; Dürr 2024; Müller 2002; Müller and Kneisel 2010; Meller 2019; Risch 2021; Steffen 2010). Among other things, the difference in diet between normal people in Únětice society and those who were singled out by burial mounds is obvious. This has been intensively documented in Helmsdorf (Knipper *et al.* 2015). However, while we recognise longer-term structures for the region of Greater Poland that indicate different access to resources, this is not yet the case in the central German region. The proof of ancestral lines that would suggest the heritability of these roles is still lacking.

Interpretation: secure and insecure elites

First of all, it should be noted that the proven period for burial mounds or large burial mounds in central Germany obviously only covers *c.* 150 years, with only one EBA burial event in each large burial mound. According to this, the large central German burial mounds are short-term phenomena associated with the extremely dynamic development of the EBA Circum-Hercynium Central German Únětice society. This pertains to the mining of tin in the Ore Mountains (Hemker *et al.* 2020), the establishment of tin bronze technology, and an apparently strong population growth (Grossmann *et al.* 2023). The phase of the few large burial mounds ends *c.* 1775 BCE at the latest. Thereafter, differences within the recognisable burial practices are expressed primarily between extramural flat graves, both with and without grave items, rather than in burial mounds.

While the construction of large burial mounds is more of a short-term phenomenon in central Germany, at Łęki Małe we detect the erection of the first burial mounds combined with the construction of the first fortified settlement, which represents a regional metal centre, including the processing of tin bronze and gold objects (Müller *et al.* 2023).

Consequently, we can assume that the first formation of Early Bronze Age hierarchies in Greater Poland was based on the continuation of Corded Ware burial mound traditions (cf. Czebreszuk 2022). The stable development from *c.* 2150 BCE of a fortified production and distribution centre for gold, bronze and amber, the participation in amber exchange routes from the north to the Carpathian region, and the renewed significance of agricultural activities formed the basis of a stable political system. Both the construction of new burial mounds and secondary burials in burial mounds illustrate the normality of this process. Even if there is certain variability in the size of burial mounds (*c.* 25-50 m diameter) over a period of *c.* 300 years, there remains a kind of standard.

This is in stark contrast to the Central German Únětice. While the sporadic large burial mounds with a fairly uniform diameter (34-40 m) were erected since *c.* 1950 BCE, a much larger burial mound (60 m in diameter) emerged *c.* 1850/1800 BCE, which was robbed later. Obviously, the political system was much less stable once the principle of building burial mounds had been adopted from the northeastern Únětice regions. The need for enlargement also testifies to a latent situation in which references to the past (e.g. Corded Ware burials or Neolithic axes) are emphasised in anticipation of something new (e.g. the stretched inhumation is consistently present in the MBA) in order to conceal the 'uncertainty'.

Consequence

The development of Únětice societies varies greatly in the different Únětice regions. This results from a structural comparison of EBA Greater Poland with central Germany. While in Greater Poland the emergence of a continuous power elite can be traced in large burial mounds (among other things) from a relatively early point in time – and seem to have continued to be practiced over *c.* 14 generations – so far only isolated large burial mounds have been found in the central German region, erected mainly *c.* 1850/1800 BCE (Fig.

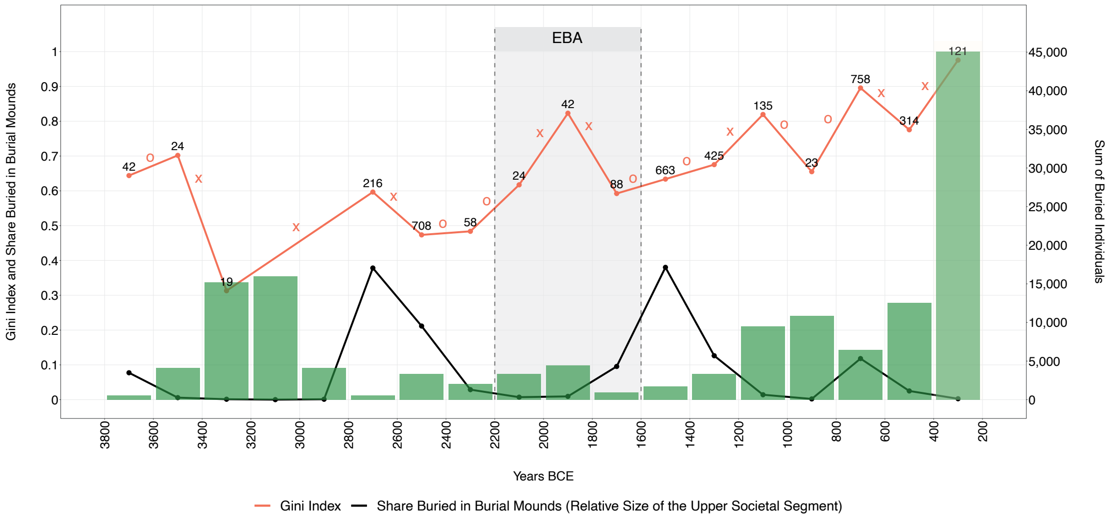


Figure 6: Development of inequality in relation to wealth between the members of the upper social segments over intervals of 200 years. The numbers on top of the inequality estimates show the sample size. The green bars represent the sum of excavated buried individuals (burial mounds, flat graves, and collective graves) in the respective time interval. The black line displays the share of individuals buried in burial mounds, which gives us an idea of the relative size of the population's upper social tier as well as social mobility and structures (cf. Marzian *et al.* 2024) (drawing: Johannes Marzian/Kartsen Reckweg, Kiel University).

5). Even if permanent and stable power structures are recognisable in one case, and rather unregulated and insecure power structures striving for 'greatness' in the other, overall, the Early Bronze Age in central Europe represents a peak of social differentiation in European prehistory (Fig. 6).

Bibliography

Bartelheim, M. 2002. Metallurgie und Gesellschaft in der Frühbronzezeit Mitteleuropas, in J. Müller (ed.) *Vom Endneolithikum zur Frühbronzezeit: Muster sozialen Wandels? Tagung Bamberg 14. - 16. Juni 2001*: 29-43. Bonn: Rudolf Habelt.

Becker, B., K.-D. Jäger, D. Kaufmann and T. Litt 1989. Dendrochronologische Datierung von Eichenhölzern aus den frühbronzezeitlichen Fürstengräbern bei Helmsdorf und Leubingen und an bronzezeitlichen Flußeichen bei Merseburg. *Jahresschrift für mitteldeutsche Vorgeschichte* 72: 299-312.

Czebreszuk, J. 2013. The Bronze Age in the Polish Lowlands, in H. Fokkens and A. Harding (eds) *The Oxford Handbook of the European Bronze Age*: 767-786. Oxford: Oxford University Press.

Czebreszuk, J. 2022. At the confluence of the Corded Ware and the Únětice cultures. The case of amber discs. *Studia Hercynia* 26: 32-48.

Czebreszuk, J., J. Müller, M. Jaeger and J. Kneisel 2015. *Bruszczewo IV. The settlement and fortification in the mineral zone of the site*. Bonn: Rudolf Habelt.

Czebreszuk, J., J. Müller, M. Szmyt, T. Goslar, M. Jaeger, I. Hildebrandt-Radke, J. Niebieszczański, B. Gmińska-Nowak, T. Ważny, J. Kneisel, B. Krause-Kyora, D. Makowiecki, A. Rewekant, N. Kotova and H. Raese 2024. Chronology and social significance of the 'princely' barrow cemetery in Łęki Małe and the Central European Early Bronze Age. *PLoS ONE* 19(5): e0300591 (available at: https://doi.org/10.1371/journal.pone.0300591).

Dürr, M. 2024. *Archäologisch-anthropologische Studien zur Aunjetitzer Kultur. Rekonstruktion sozialer Differenzierung anhand ausgewählter Gräberfelder in Böhmen und Mähren*. Bonn: Rudolf Habelt.

Furmanek, M. and I. Lasak 2013. Początki wczesnej epoki brązu na Śląsku w świetle aktualnych badań nad chronologią. Śląskie *Sprawozdania Archeologiczne* 55: 5-23.

Grossmann, R., M. Weinelt and J. Müller 2023. Demographic dynamics between 5500 and 3500 calBP (3550-1550 BCE) in selected study regions of Central Europe and the role of regional climate influences. *PLoS ONE* 18(10): e0291956 (available at: https://doi.org/10.1371/journal.pone.0291956).

Hemker, C., J.F. Tolksdorf and M. Schubert 2020. Neue Erkenntnisse zum bronzezeitlichen Zinnbergbau im Erzgebirge. *Arbeits- und Forschungsberichte zur Sächsischen Bodendenkmalpflege, Beiheft 34*: 150-162.

Hubensack, V. 2018. *Das Bestattungsverhalten in Gräberfeldern und Siedlungen der Aunjetitzer Kultur in Mitteldeutschland*. Halle: Landesmuseum für Vorgeschichte Halle.

Jaeger, M., J. Czebreszuk, J. Kneisel and J. Müller 2016. Human remains from the Early Bronze Age fortified settlement in Bruszczewo. Preliminay report, in F. Gogaltan and S.-C. Ailincai (eds) *Settlements of Life and Death. Studies from Prehistory to Middle Ages*: 52-70. Cluj-Napoca: Editura MEGA.

Jurkenas, D. and A. Spatzier 2019. Siedlungen des Endneolithikums und der Frühbronzezeit bei den Rondellen Pömmelte und Schönebeck, Salzlandkreis. Einblicke in die Besiedlung einer Sakrallandschaft des 3. und beginnenden 2. Jahrtausends v. Chr., in H. Meller, S. Friederich, M. Küssner, H. Stäuble and R. Risch (eds) *Siedlungsarchäologie des Endneolithikums und der frühen Bronzezeit*: 289-318. Halle: Landesmuseum für Vorgeschichte Halle.

Knipper, C., P. Held, M. Fecher, N. Nicklisch, C. Meyer, H. Schreiber, B. Zich, C. Metzner-Nebelsick, V. Hubensack, L. Hansen, E. Nieveler and K.W. Alt 2015. Superior in Life – Superior in Death: Dietary Distinction of Central European Prehistoric and Medieval Elites. *Current Anthropology* 56(4): 579-589.

Marzian, J., J. Laabs, J. Müller and T. Requate 2024. On the Mounds of Inequality: Prehistoric Burial Mounds in Northern Central Europe Reveal Increasing Inequality Through Four Millennia. *Nature Humanities and Social Sciences Communications* 11(557): 1-12 (available at: https://doi.org/10.1057/s41599-024-03053-x).

Meller, H. 2019. Princes, Armies, Sanctuaries: The Emergence of Complex Authority in the Central German Unětice Culture. *Acta Archaeologica* 90: 39-79.

Meller, H. 2020. Gold Weapons and Armies. Reflections on the Dieskau gold find and its possible origin from the Early Bronze Age Bornhöck barrow near Dieskau in the Saalekreis district. *Studia Hercynia* 23: 9-21.

Müller, J. 2002 (eds). *Vom Endneolithikum zur Frühbronzezeit: Muster sozialen Wandels? (Tagung Bamberg 14.-16. Juni 2001), Universitätsforschungen zur Prähistorischen Archäologie*. Bonn: Rudolf Habelt.

Müller, J. and J. Czebreszuk 2010. Bruszczewo und Łęki Małe - ein frühbronzezeitliches Machtzentrum in Großpolen, in H. Meller and F. Bertemes (eds) *Der Griff nach den Sternen. Wie Europas Eliten zu Macht und Reichtum kamen*: 381-396. Internationales Symposium in Halle (Saale) 16.-21. Februar 2005. Halle (Saale): Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt.

Müller, J., J.P. Brozio, W. Rabbel and M. Zolchow 2024. Metal, networks, and social change in Central Europe and Southern Scandinavia (c. 4100-1700 BCE), in H. Meller, E. Risch and E. Pernicka (eds) *Der soziale Wert von prähistorischen Beilen: neue archäologische und archäometrische Ansätze/The social value of prehistoric axes: new archaeological and archaeometric approaches: 343-354.* Halle: Landesmuseum Halle.

Müller, J., S. Delgado-Raack, N. Escanilla, L. Kienle, J. Kneisel, J. Czebreszuk, M. Jaeger, M. Szmyt and U. Schürmann 2023. First evidence for the forging of gold in an Early Bronze Age Site of Central Europe (2200-1800 BCE). *Journal of Archaeological Science: Reports* 47: 103748 (available at: https://doi.org/10.1016/j.jasrep.2022.103748).

Müller, J. and J. Kneisel 2010. Bruszczewo 5: Production, distribution, consumption, and the formation of social differences, in J. Müller, J. Czebreszcuk and J. Kneisel (eds) *Bruszczewo II. Ausgrabungen und Forschungen in einer prähistorischen Siedlungskammer Großpolens*: 756-783. Bonn: Rudolf Habelt.

Pokutta, D. A. 2013. *Population Dynamics, Diet and Migrations of the Unetice Culture in Poland.* Gotarc Series B. No. 60. Gothenburg: University of Gothenburg Press.

Rassmann, K. 2010. Neue chemische Analysen von Kupferartefakten aus der Siedlung Bruszczewo, in J. Müller, J. Czebreszcuk and J. Kneisel (eds) *Bruszczewo II. Ausgrabungen und Forschungen in einer prähistorischen Siedlungskammer Großpolens*: 703-714. Bonn: Rudolf Habelt.

Risch, R., H. Meller, S. Delgado-Raack and T. Schunke 2021. The Bornhöck Mound and the Political Economy of an Únětice Ruler, in S. Gimatzidis and R. Jung (eds) *The Critique of Archaeological Economy*: 85-116. Berlin: Springer (available at: https://doi.org/10.1007/978-3-030-72539-6_6).

Schwarz, R. 2021. *Typentafeln zur Chronologie in Mitteldeutschland - Die Aunjetitzer Kultur auf Grundlage der Grab- und Siedlungskeramik*. Halle: Landesmuseum für Vorgeschichte Halle.

Schwenzer, S. 2004. Przysieka Polska: Ein Grabfund in der Umgebung der frühbronzezeitlichen Siedlung von Brsuczewo?, in J. Czebreszuk and J. Müller (eds) *Ausgrabungen und Forschungen in einer prähistorischen Siedlungskammer Großpolens/Badania mikroregionu osadniczego z terenu Wielkopolski. Forschungsstand–Erste Ergebnisse–Das östliche Feuchtbodenareal/Stan badań –Pierwsze wyniki–Wschodnia, torfowa część stanowiska*: 317-342. Rahden/Westf.: Verlag Marie Leidorf.

Steffen, C. 2010. *Die Prunkgräber der Wessex- und Aunjetitz-Kultur*. British Archaeological Reports International Series 2160. Oxford: Archaeopress.

Strożyk, M. 2019. *Pejzaż z kurhanami. Krajobraz funeralny społeczności kręgu kultur mogiłowych na pograniczu* śląsko-wielkopolskim. Poznań: Muzeum Archeologiczne w Poznaniu.

Tolksdorf, J.F., C. Hemker and M. Schubert 2019. Bronzezeitlicher Zinnseifenbergbau bei Schellerhau im östlichen Erzgebirge, Sachsen. *Der Anschnitt* 71(5-6): 223-233.

Zich, B. 1996. *Studien zur regionalen und chronologischen Gliederung der nordischen Aunjetitzer Kultur*. Vorgeschichtliche Forschungen. Berlin: De Gruyter.

Zolchow, M., D. Köhn, D. Wilken, E. Erkul, S. Dreibrodt, N. Pickartz, E. Corradini, J. Müller and W. Rabbe 2024. Multi-method structural investigation of the Schneiderberg-Baalberge burial mound (Germany) including Seismic Full-Waveform Inversion (FWI). *Archaeological Prospection*. 1-26 https://doi.org/10.1002/arp.1961

Chapter 26

Mound durée: a manifestation of a timeless aristocratic ethos?

Casper Sørensen

Aarhus University, Aarhus & Viborg Museum, Viborg, Denmark
c7s@viborg.dk

Abstract

The aim of this contribution is to explore the newly proposed concept of *mound durée* encompassing the burial traditions in mounds of the Single Grave Culture, Late Neolithic, and Early Bronze Age of southern Scandinavia. It is structured around the question of whether the *mound durée* is a manifestation of a timeless aristocratic ethos. During these periods, a shared vision of burials and identities existed and there was also a prevailing symbolic warrior identity. Here I correlate the interpretation of material culture deriving from burials with new aDNA results. Across the three periods, symbolic objects (i.e. battle axes, flint daggers and bronze swords) were the preferred burial gifts in male graves. It is argued that they were symbolic expressions of similar identities and a means of envisioning comparative cultural norms throughout the 1600-year span of the *mound durée*.

Introduction

Prehistoric mounds provide a compelling glimpse into the minds of the people of the past. Who was buried? Who arranged the burial? What was the social reasoning for organising monumental burials and what were the cultural norms on which these were based? Between *c.* 1600 and 1200 BCE, the early and middle Nordic Bronze Age (EMNBA) saw the erection of a significant number of mounds; a conservative estimate suggests a minimum of 50,000 (Holst *et al.* 2013). Every mound preserves a history shaped by the cultural norms and questions above while also commemorating the esteemed roles of every individual buried inside. Such individuals were cared for after death via the arrangement of both elaborate bronze burial gear and the erection of monumental mounds and were themselves participants in the large cross-continental network which was a marked feature of 'bronzization'. The remarkable social journey of creating one of the densest mound landscapes in the world serves as a social manifestation of inclusion and integration into a broad network spanning across both regions and continents (Vandkilde 2016).

Some clues to unravelling the crux of these issues lie in the burials themselves, which contribute to the formation of narratives about and interpretations of prehistoric societies. Until the previous decade, stories of past cultures were mainly accessible through investigations of material culture, burials, and the contextual surroundings of the latter. Recent scientific advances in aDNA and other novel approaches have sparked an unprecedented level of detail by which we can gain insight into aspects of kinship, kinship organisation, and conjugal practices. The uncovering of kinship and lineage organisation, supplemented with patterns of mobility and conjugal systems, provides a seminal breakthrough in our understanding of social and cultural practices and opens up for a new epistemological setting into which these monuments can be reflected upon.

The EMNBA mounds and graves are not an isolated phenomenon. Their roots lie in the migrations of the Corded Ware Culture (CWC). Recent extensive analyses of aDNA provide convincing proof that the strong stylistic and material resemblance of the southern Scandinavian Single Grave Culture (SGC) was based on migrations and a change in genetic background from the first Neolithic farmers with Anatolian descent (Allentoft *et al.* 2015, Allentoft *et al.* 2024; Egfjord *et al.* 2021). The emergence of the SGC in southern Scandinavia led to a change in burial customs with a focus on individual interments in modest mounds (Hübner 2005). This was part of a collective vision for orchestrating burials within the CWC horizon across the continent (Bourgeois and Kroon 2017). This recently established burial practice endured, with a decrease in intensity through the Late Neolithic (LN) and a peak during the EMNBA (Holst 2013).

Due to its comparative nature, archaeology enables the investigation of long-term trends. The long stretch of time during which mounds were constructed in southern Scandinavia provides an excellent platform for putting a perspective on the roots of social organisation and hierarchies in the EMNBA. The people, burials, and settlements of the SGC, LN, and EMNBA cultures resided in the same landscape over the course of almost two millennia. As such, their social organisation was made manifest under similar subsistence conditions and laid claim to comparable resources. These basic similarities form the framework for the following analysis.

The concept has recently been presented as a *mound durée*; it refers to this long-term burial practice of southern Scandinavia and concomitantly also questions whether the tradition represented 'a timeless manifestation of an aristocratic ethos?' (Vandkilde *et al.* forthcoming).[1] The aim of this contribution is to explore and elaborate on this concept by scrutinising mounds and burials across the three periods through their material culture in relation to the key question of an aristocratic ethos. Material similarities across the *mound durée* are presented with inputs from novel research results from aDNA and stable isotopes. Due to regional variations in burial practices during the *mound durée*, this study concentrates on the central region of the Jutland peninsula, where the tradition remained strongest (Hübner 2005; Iversen 2016; Lomborg 1973).

Mound durée of southern Scandinavia

In essence, the mound-building tradition of southern Scandinavia began with the introduction of farming by the Funnel Beaker Culture (FBC), eventually leading to a higher degree of sedentism and ties to the land *c.* 4000 BCE. Earthen long barrows with wooden chambers were succeeded by megalithic structures. The erection of megalithic structures, such as dolmens and passage graves, ceased *c.* 3200 BCE, followed by a hiatus before the construction of a new grave type in which existing megalithic monuments were re-used for new burial rites (Ebbesen 2011; Hansen 2016; Midgley 1984). The construction of stone heap burials from *c.* 3100 BCE in the central and northern parts of Jutland form the real transition, where cattle burials probably also contained human individuals (Johannsen and Laursen 2010). These have been heavily linked with the Globular Amphora and Baden Cultures of central and eastern Europe and may have been the result of migration (Johannsen, N.N. 2023).

The SGC Culture emerged from the CWC migration *c.* 2800 BCE, and completely transformed the burial landscape of the Jutland peninsula. A burial tradition with small mounds (kurgans) over inhumation burials, typically placed in either lines or small clusters, became predominant (Hübner 2005). The region of the preceding stone heap graves from the late FBC saw a merging of traditions, and new CWC burial customs and cultural ties may have existed between the two groups (Nielsen and Johannsen 2024). The new form of burial in the SGC was inhumation graves. These graves distinguished strong individual identities through material culture. As the culture name implies, single inhumation burials constitute 90% of SGC burials, though wooden or stone chambers for successive burial sequences also exist (Hansen 1996; Hübner 2005; Ebbesen 1985). The SGC is concentrated on the Jutland peninsula mainly south of the Limfjord with fewer finds north of this natural border and with large concentrations around the Ribe and Viborg municipalities (Iversen 2016).

In the LN, the intensity of the erection of mounds and associated burials ceased dramatically in southern Scandinavia (Holst 2013). Previous burial chambers – particularly megalithic chambers from the FBC and even stone cists from the SGC were heavily re-used (Lomborg 1973). New LN stone cists built to be reused for new burials were also constructed (Ebbesen 2007). Burials in pits with no monumental structures were common, but predominant in eastern Denmark and northern Jutland (Bican 2012; Lomborg 1973). Mound burials in LN have a clear concentration around central Jutland (where mounds erected in the SGC were frequently reused) with no subsequent expansion of the mound as a monumental marker (e.g. Jørgensen 1977). However, new mound erections are not entirely uncommon (Ebbesen 2004; Jørgensen 1985). The regional differences may correlate with an influx of DNA from eastern or northeastern parts of Scandinavia (Allentoft *et al.* 2024).

In contrast to the LN, a new intensified expansion occurred in the EMNBA. This re-ignition coincided with the rise of the EMNBA Culture *c.* 1600 BCE and is especially remarkable with the arrival of the well-preserved oak-coffin burials from NBA II (Boye 1896). Cultural hegemony and a shared vision of the monumental erections of mounds in the EMNBA spread across southern Scandinavia. Mounds were generally larger than in the SGC (Fig. 1). They are often related with monumentality in the EMNBA and could be connected to both territorial markers and for honouring the ancestors (Jennbert 1993; Olausson 1993).

The landscape of a local *mound durée*

To better comprehend how the *mound durée* was formed in the landscape, a small case study from central Jutland will be presented. The Fjends district borders the southern part of the Limfjord and extends over 380 km^2 (Fig. 2). Topographical variations are present, with several larger streams and connected valleys running across the mainly sandy soil in both hilly

[1] This article celebrates Helles contribution to the scientific field of warrior and warriorhood within Bronze Age research. It puts the social status of the Bronze Age Warrior in a long-term perspective with the mounds as the point of reference of a persisting warrior symbolism over the course of almost two millennia. Novel perspectives on sex and gender contribute to understanding the deeper context of these mound-buried warriors. The concept of the *mound durée* featured as a small section in a forthcoming joint paper curated by Helle. The invitation to contribute to this festschrift came shortly after making this contribution, and it was the perfect opportunity to elaborate on this joint concept. It serves as a special greeting and celebration to Helle, whose ongoing inspiration led me to pursue the opportunity to work on a PhD, with the aim of scrutinising social hierarchies within the Nordic Bronze Age, and many thanks Helle for your encouragement during this process.

Figure 1: A glimpse into the *mound durée* showing the development in size and monumentality of four mounds in a row, starting with the lowest to the left and the highest to the right. The mounds have not been dated. However, reports of bronze objects which could have been found from any of them exist. These mounds are referred to as the Thinghøje, suggesting an important role in the historical political landscape. The Thinghøje are recorded as 180206-18, 19, 20, 21 in the Danish Finds and Monuments Database (photo: Astrid Toftdal Jensen, Holstebro Museum).

Figure 2: Map of present-day Denmark and the Fjends district (illustration: the author, created in Mapinfo).

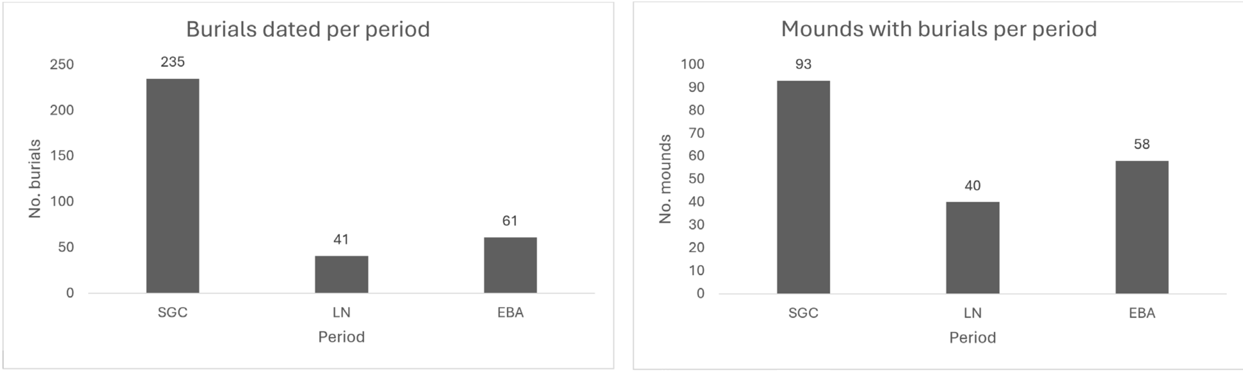


Figure 3: Overview of the number of burials dated to the SGC, LN and EBA (A) and the number of mounds from which burials have been dated (B). Note the numbers from the SGC is a little skewed due to the presence of a burial mound with many child burials (Simonsen 2006). In general, only a few burials have been located within the LN and EMNBA mounds (data from Aner *et al.* 2008; Hübner 2005; Lomborg 1973, and supported with data from the national Danish Finds and Monuments Database).

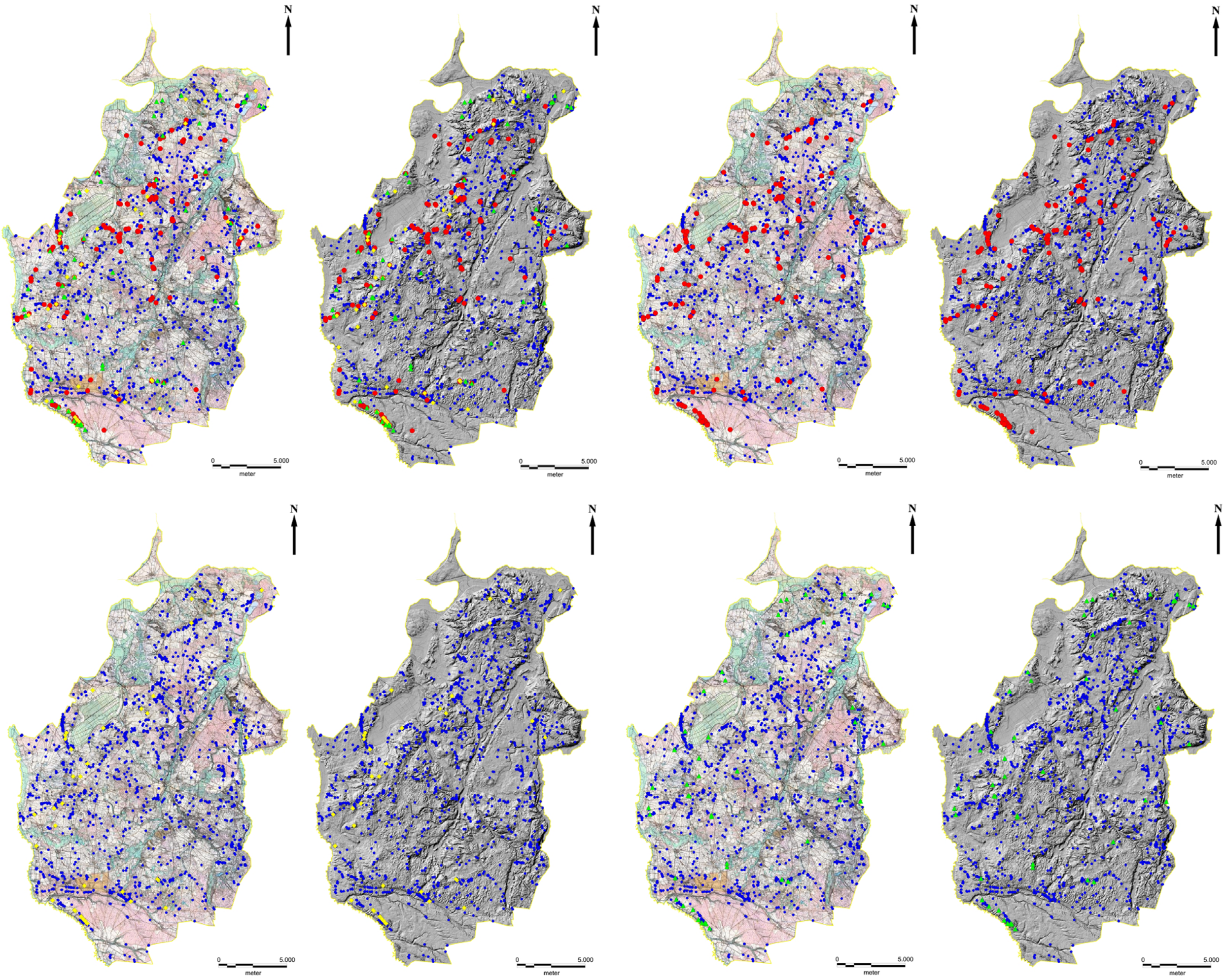


Figure 4: Distribution of mounds within the Fjends district. Burials dated to the SGC (red), LN (yellow) and EMNBA (green) and mounds with no specified date (blue) are mapped: A) Combination of burials from all three periods; B) Burials from the SGC; C) Burials from the LN; D) Burials from the ENMBA. Background maps: Høje Målebordsblade *c.* 1890, showing landscape types before drainage to support a better extent of original wetland areas and LiDAR map, 1.6 m. (background maps: the author with MapInfo, © Styrelsen for Dataforsyning og Effektivisering).

and flat areas. A coastal area with inland connections by means of streams formulates a landscape with maritime corridors. The sandy soils would have been easily arable by prehistoric tilling tools, while the many streams and valleys provided good pasturage. The presence of Hærvejen, an historically prominent corridor for north-south communication and travel along the Jutland peninsula further underscores the importance of this part of the region. 'The ancient road' is characterised by both long stretches and clusters of mounds, suggesting importance of the route stretching back into antiquity (Bang 2013; Müller 1904). Furthermore, this region was also one of the core areas for the first introduction of the SGC and the mound burial tradition remained strong in this area in the LN (Iversen 2016; Lomborg 1973).

The region contains a total of 1,608 mounds (excluding long barrows and identified megalithic chambers). This corresponds to an approximate density of 4.2 round barrows per square kilometre, which is common for the Jutland Peninsula (Sørensen 2016: 48). As expected, a minority of the mounds have yielded objects that can be associated with burials and date to the SGC, LN, or EMNBA (Fig. 3). Marinus Reffsgaard, a farmer with a special affinity for archaeology, accumulated and purchased numerous objects from farmers in the area and endorsed amateur excavations of multiple mounds in the region during the first half of the 20th century; in so doing, he amassed an enormous collection (Christensen 2018; Hübner 2005). The correlation between an object dated to one of the three epochs and representing a burial with a certain degree of certainty is adequate for this analysis and sufficient for interpretations of the landscape.

The majority of dated burials in the Fjends district are associated with the SGC (Fig. 3). In spite of the higher number of finds, the population density could be lower in the SGC due to different subsistence economies. Shifting from pastoralism to sedentary agricultural strategies can provide a higher fertility and lower morality rates, helping build an increase in population size, suggesting better support for higher population densities (Meir 1986). A long-term rise in population from 4000 BCE into the following millennia and into the Nordic Bronze Age (NBA) has also been argued by applying Summed Probability Distribution of Radiocarbon Dates (Shennan *et al.* 2013). The distribution of long-houses (which can be viewed as a proxy for sedentary agricultural societies) suggest a general rise in Scania going into the LN and EMNBA (Friman and Lagerås 2022: 172-173). A similar pattern appears from dates belonging to settlements of the Jutland Peninsula, seeing a rise into the LN (Torfing 2015: 195, fig. 2.). Although there has been debate regarding the applicability of the method (Crema *et al.* 2016; Timpson *et al.* 2015; Torfing 2015), an agricultural intensification and a population increase have been proposed in the LN (Johannsen, J.W. 2023). A mobile pastoral subsistence has been proposed for the SGC (Nielsen 2019), and thereby population densities in the more agriculturally focused subsistence of the LN and EMNBA was most plausibly higher than in the SGC. Conversely, this might indicate a more egalitarian structure within the SGC, where a greater number of individuals were entitled to burials in mounds than in the LN and EMNBA.

Natural transportation and communication routes in the landscape are intricately connected to burial mounds, particularly those found in the SGC, but also in the LN (Fig. 4). They are commonly found in close proximity to wetland regions and follow water streams and river valleys where natural fords might have been present. This last might lend further support to the idea that there was a certain dependence on good pastures in order to sustain the pastoral way of life. Additionally, it has been suggested that these characteristics correlate with the communication pathways established by the preceding lines of stone heap burials (Johannsen and Laursen 2010). Trackways and wheels dated to the beginning of the SGC period have also emerged and may perhaps best be understood in relation to this overall communication system (Olsen *et al.* 2024). Mounds with burials from the EMNBA are also found in more desolate areas further away from wetland zones than those of the SGC and LN. The ENBA also exhibited smaller concentrations of mounds. This could potentially be attributed to territorial expansion in the EMNBA into areas that were uninhabited, or of lesser importance, during the SGC and LN.

Identities of the *mound durée*

Sex and gender of the mound durée

Moving from the mounds to the burials requires a glimpse of the identity of the individuals interred. Inferring social aspects from burials is an established archaeological method which is essential for our inquiries into the lives of people in prehistoric societies. Since it is generally accepted that it was the living members of society who orchestrate the burial, we assume that the interment and arrangement of the deceased – including the grave, grave goods and (occasionally) monuments – reflect aspects of the social organisation and identity of the interred (Pearson 1999; Pearson 1993). The EMNBA features a long-standing research tradition of equating monumental mounds and rich graves with interpretations of chiefs (Earle 2002; Kristiansen 2015; 2011; 1987; Ling *et al.* 2018a; Randsborg 1974).

Aspects of sex and gender, and relations to the interpretation of material culture have become hot topics in archaeology in recent years (Matić 2024). This is especially relevant for the *mound durée*, as the main corpus of mound interpretation is related to the material culture from burials and, therefore, also to the identities of the individuals interred. Some of the famous oak-coffin burials are often referred to with a gendered connotation in their name: the 'Egtved girl', the 'Muldbjerg man' and the 'old man', 'young man' and 'older woman' from Borum Eshøj (e.g. Bergerbrant 2019; Frost *et al.* 2017). These connotations serve as a great example of the discourse by which mortuary interpretations are implicitly linked to gendered aspects, which (in these cases) is also partly connected with sex.

The question of sex and gender is complex and culturally influenced by the era to which a research paradigm belongs. Sex can be ascribed to the biology of the body, while gender is culturally defined and is, hence, more difficult to grasp through interpretations of material culture. Interpretations often rely on gender attributions given to a body based on specific objects (Matić 2024).

Skeletal material which can be ascribed to a sex and directly associated with burial goods from the SGC, LN and EMNBA is generally sparse. Thus, inferences on the sex and gender across the *mound durée* are difficult. The best-preserved examples are the notable oak coffin graves with an astonishing preservation of skeletons and organic objects such as clothing. Though few bone are present, osteological analyses support gendered dress associated with a specific sex. Examples of gendered grave goods (e.g. swords and axes for males, belt plates for females) correspond with estimates of biological sex (Bergerbrant 2007: 49-60; Boye 1896). Thus, gendered roles according to the biological sex existed and may have been the norm, though deviations from these could also be expected (Felding 2020; Felding *et al.* 2020). Correlations between gendered identities and biological sex are more problematic due to fewer single individual interments and a high rate of the re-use of shared burial cists and megalithic chambers. Flint daggers of the LN are associated with males and are related to a warrior identity, while the female identity remains more elusive (Sarauw 2007; Varberg 2015). A lack of skeletal material in general hinders insight into the correlation of identities from material culture and biological sex in the SGC. However, gendered roles are generally attributed by (especially) the presence of amber, as well as the position of the body (Bourgeois and Kroon 2017; Hübner 2005).

In sum, gendered-male and -female identities form a common theme spanning across the *mound durée*. The degree of preservation is best for the EMNBA, from which a division of male and female identities appear to have been the norm. A similar pattern is more difficult to validate in the SGC and LN, though male- and female-gendered identities are commonly referred to in the literature based on material culture and were likely also the norm in these periods.

Gendered males of the mound durée and an ode to the warrior

The identities of those buried within the *mound durée* exhibit remarkable similarity. The invading CWC migrants have been described as fearless warriors, mounted on horses, bearing battle axes, and who, upon encountering the population of the first Neolithic farmers with Anatolian descent on the Jutland Peninsula, subdued them (Glob 1969: 83-85). Recent research into the rapid spread of the CWC horizon across Europe has essentially reconfirmed this image (Kristiansen *et al.* 2017). However, new research has underscored that the migration was not that drastic and that FBC societies lived on for a few centuries. Exchange between the cultures did take place, though the two seemingly co-existed while retaining geographic separation: SGC societies were inland and FBC societies were oriented towards the coast (Madsen 2020). Axes and arrowheads firmly anchor the archaeological interpretation and accompanying narratives of warriors, with 90% of burials in the initial phase associated with male identities (Hübner 2005). In contrast to flint axes (which may have served utilitarian functions), battle axes are commonly associated with violence or symbolic connotations (e.g. Damm 1991).

Battle axes are a symbol of the SGC, and flint daggers are their equivalent for LN. A variety of dagger sizes are observed, of which at least a portion of the earliest and largest daggers likely held predominantly symbolic purposes (Vandkilde 1996; Varberg 2015). Flint mines dating to the LN and associated with dagger production indicate the existence of industry-like production and far-reaching exchange systems, supported by the extensive export of flint daggers from southern Scandinavia (Apel 2001). During the EMNBA daggers are frequently used or produced as strike-a-lights, suggesting that the meaning of the object had changed (Apel 2001: 259-260; Lomborg 1969; 1973: 27-29)

Following a short phase of consolidation in the early stages of the EMNBA, the onset of the period proper, *c.* 1600 BCE, saw the introduction of a boom in a new set of material culture. New weaponry was introduced to the Nordic zone with strong cultural links to the continent (Lomborg 1969; Vandkilde 2014a; 2014b). Male-gendered burials still predominate in material culture, with swords as the ultimate symbol of warriorhood

(Kristiansen 2002). Daggers and axes (palstaves) could also be symbols of a warrior culture, while heavy use-wear on spears and swords suggests use in battle (Horn 2013). Elaborate warrior identities were a well-established phenomenon during the European Bronze Age, showcasing transcultural integration into a pan-continental web of networks across regions and cultures (Vandkilde 2018a; 2018b; 2011). From NBA II, *c.* 1500 to 1200 BCE, the boom in the erection of mounds was followed by a massive amount of richly furnished burials (Felding 2022).

While the narrative of NBA warrior identity may appear today as an oft-repeated idiosyncratic chestnut, its importance is nevertheless confirmed by the shifting symbolic object types which played a pivotal part in the diachronic interplay between mounds and burials during the *mound durée*. The warrior appeared with a prominent symbolic role which persisted throughout this 1600-year span. Warrior narratives recur across the period: the in-migrating steppe warriors with battle axes (Kristiansen *et al.* 2017); the warriors with daggers and the archers of the LN (Sarauw 2007); and the famous 'warriors' beauty', which stretched across Bronze Age Europe (Treherne 1995; Vandkilde 2011). We should always question the validity of these long-standing and preeminent narratives which may overshadow research with a confirmation bias upon interpreting material culture. In spite of this, the warrior's identity persists across the *mound durée* with symbolic objects which in some instances held no utilitarian value, like swords and extraordinary long flint daggers, as well as exquisite battle axes. Correlating this with the frequent presence of warriorhood in pre-state societies (Otto *et al.* 2006), and the idealistic representation of warriors in the SGC, LN, and EMNBA seems valid.

Gendered females of the mound durée

Individuals identified as females appear in fewer numbers within the material culture of all three periods of the *mound durée*. During the SGC, variability is low amongst the grave goods, and 'female' objects mainly consist of amber, which is present in higher quantities than in 'male' burials. In most cases, amber beads in female-gendered burials were likely assembled as necklaces and deposited (Hübner 2005: 647-650). On a broader regional scale, female burials related to the CWC horizon show higher degrees of variability, suggesting that the cultural norms for burying females were constructed on a local scale (Bourgeois and Kroon 2017). Of the massive account of burials deriving from the SGC, only 13.4% have been ascribed to the female gender, while 27.2% remain undefined according to gender (Hübner 2006: 632, Abb. 454). Due to the lack of skeletal material, osteological analyses cannot provide insight into whether these were initially meant to be viewed as female, male, or even another unknown gender identity. However, osteological analyses from better-preserved burials could suggest a more even distribution according to biological sex (Sjögren *et al.* 2016), which may hint that a proportion of these unknowns may have been female.

With entry into the LN, amber went out of fashion in burials and was probably traded for metals. This meant that other organic objects were deposited in these burials and that female-gendered burials became even more elusive in terms of identification via amber quantity (Ebbesen 1995; Shennan 1982). Furthermore, as individual burials are often dated to a specific period by typology, the main object type from the LN is the flint dagger. Therefore, individual interments with no preserved grave goods could very well belong to gendered females of the LN, without either skeletal material or organic material preserved. The re-use of megalith burial sites and cists is well-known from eastern Denmark and Zealand, where skeletal material and objects are mixed. Scientific methods have revealed that a high proportion of these individuals can be classified as biological females; in some cases, the number of females even equals the number of males interred (e.g. Bennike 1985: 31-35; Blank *et al.* 2018).

Entering the EMNBA, gendered identities became more visible with both the preserved clothing from the oak coffin burials as well as the exquisite metal objects created through the import of foreign metal. Gendered male and female burials appear to have been quite strict, however there was some overlap within material culture. Weapons, e.g. especially swords and axes (palstaves) supplemented with spearheads, were associated with gendered males, while belt ornaments, neck rings and corded skirts are (among others) are associated with gendered females (Bergerbrant 2007; Felding *et al.* 2020; Felding 2020). Gendered-male burials appear in greater numbers than gendered females, although there still remains a large component of burials whose gender remains unidentified (Endrigkeit 2014: 29-31).

A new paradigm and a new toolbox

Since the dawn of archaeology, inferences regarding social issues from burials have almost entirely relied on material culture. Comparisons and analyses of monuments, burials, and burial goods have made up the formal analyses, with variable theoretical directions taken in terms of interpretation (Chapman 2013; Trigger 2007). However, archaeology's 'Third Science Revolution' has produced a completely new set of tools through which to gain insights into prehistoric cultures (Kristiansen 2014). One of the major scientific breakthroughs is the recognition of the CWC complex as having been related to steppe DNA and to a rapid turnover in haplogroups by migrations which took place at a quicker pace than those associated with the first Neolithic farmers (Racimo *et al.* 2020). Mass graves from groups with a higher influx of haplotypes belonging to the first Anatolian farmers have been related to the violent dispersion of the CWC (Schroeder *et al.* 2019).

In recent years, stable isotope and DNA analyses have also contributed to a new understanding of social practices associated with marriage and kinship patterns. A recurring number of studies present patrilocality and female exogamy as the main mode of kinship organisation for European prehistory (e.g. Fowler *et al.* 2022; Fürtwängler *et al.* 2020; Gnecchi-Ruscone *et al.* 2024; Mittnik *et al.* 2019; 2023, Sjögren *et al.* 2020). Studies of aDNA only provide insight into a small fragment of prehistoric individuals and skeletons with the best preservation. However, these would reflect the ancestry of only the most affluent members of society. Thus, studies of aDNA and isotopes may not provide insight into kinship practices for the full array of prehistoric populations, but mainly those concerning the elites of prehistoric European societies (Cummings *et al.* 2022). Critiques of the patrilocal model exist and highlight these interpretations as simple and not accommodating to the variability in archaeological record. Furthermore, social constructions of kinship without biological connections remain invisible in these studies (Brück 2021; Brück and Frieman 2021). Thus, the often proposed pattern of patrilocality may not feature the full array of kinship organisation (Ensor 2021; Melheim forthcoming).

The focus has been primarily on male burials of the *mound durée*. In the EMNBA richly furnished female burials (often with symbolic references to religious or ritual connotations) are widespread (Felding 2020; 2022). Debates regarding the origins of, especially, younger female burials have been ongoing these past few years (Andreasen and Thomsen 2021; Frei *et al.* 2019a, Frei *et al.* 2019b, Frei *et al.* 2017; Thomsen and Andreasen 2019; Thomsen *et al.* 2021). The resolution of the methodological issues concerning the latter will be resolved in the future. That being said, in-migration would nevertheless fit into the pattern of female exogamy and male patrilocality, which new research suggests was widespread across the continent (e.g. Mittnik *et al.* 2023; Sjögren *et al.* 2016).

Although the primary emphasis of these innovative DNA and stable isotope analyses is on new discoveries about ancestry, mobility, and migration patterns, they are fundamentally intertwined with archaeological interpretations of the prehistoric material culture. Combined, these create a new epistemology and framework for us to analyse the remains of the past. The documentation of migration as the driver of the SGC and, thus, the beginning of the *mound durée*, reduces doubts concerning the local origins vs. migration debate (Damm 1991; Kristiansen 1989). The prevailing warrior identity and predomination of burials associated with male warrior identities are supported by the ubiquitous patrilocality that has been identified. If patrilineality is the core concept of kinship organisation, the interment of leading and prominent male members of this lineage would most probably also be those most visible in the burial record, as is the case with the *mound durée*. Thus, the material culture from the *mound durée* is reinforced in terms of the interpretation of social aspects, aided by the new results from these recent aDNA and stable isotope analyses.

Discussion

Was the *mound durée* a manifestation of a timeless aristocratic ethos? This question was presented at the onset of the chapter. The following offers insight into aspects of the mounds, burials, identities, and landscapes of the *mound durée*. Scientific research regarding kinship practices and mobility patterns generally suggests that patrilocality was a widespread phenomenon throughout prehistoric European societies, while other perspectives highlight male mobility and the importance of females. The burials and identities created from the *mound durée* exhibit an overarching emphasis on male burials (Ensor 2021). Burials associated with gendered-male identities are markedly overrepresented within material culture during both the SGC and the EMNBA, and probably also the LN, where the picture is more blurred and more difficult to assess (Endrigkeit 2014: 25-43; Hübner 2005: 632). It is remarkable that osteological and scientific analyses of skeletal material suggest an otherwise more even picture. This requires a critical view of these 'ungendered' burials which can be ascribed to the periods by either absolute or relative dating. Was a large proportion of these indeed made up of some of the females who are otherwise invisible in the record? A few studies suggest more local practices of female burial traditions within both the CWC horizon as well as within the EMNBA (Bourgeois and Kroon 2017; Hansen 2014). Furthermore, the taphonomy processes in many sites may also hinder the later recognition of gendered females, as thin-plated objects (e.g. the belt-plates associated with females) may decay faster than, say, a robust sword (thought to represent a male). Indeed, this may also be true for the LN, if organic objects were associated with gendered females. This showcase the necessity of examining these graves (e.g. through peptide analysis) to determine whether they truly belong to biological females and should, thus, also be associated with gendered-female identities.

Figure 5: The three symbolic object types from each of the periods. Top: Battle Axe from the SGC (VSM 5575X5576). Middle: Flint dagger from the LN (VSM 04132X4137). Bottom: Full-hilted bronze sword from the EMNBA (VSM 05982) (photos: Viborg Museum).

Whether the recurring concept of patrilocality and female exogamy also prevailed within the *mound durée* must be the subject of future analyses. When making inferences based on the material culture from burials across the three focus periods, warrior identities among gendered-male burials endures. During the three periods, objects creating a symbolic representation of a warrior's identity are a common denominator and were deposited throughout the 1600-year span. Evidence of violence exists from the skeletal record, e.g. both fatal and healed traumas on skulls were relatively frequent in the Neolithic (Fibiger *et al.* 2013). While evidence of skeletal trauma from the mounds in the EMNBA in current-day Denmark is too few and far between for trauma analysis, mass graves from northern Europe and Bronze Age Norway show clear evidence of violence (Fyllingen 2005; 2006). Arrowheads situated in the chest region from several burials (here we need look no further than the well-known Gjerrild burial) also attest to violence in the SGC (Egfjord *et al.* 2021). Archer burials from the LN Bell Beaker horizon in northern Jutland show that this phenomenon continued into the LN, while several arrowheads were found and traumas identified from the Bronze Age battlefield at Tollense (Jantzen *et al.* 2011; Sarauw 2007). Moving towards the EMNBA, evidence of violence, warrior identity, and warfare becomes a prominent and a dominant characteristic. Use-wear on different groups of objects suggests that warfare occurred frequently (Horn 2013; Kristiansen 2002). It has also been suggested that the vast array of petroglyphs across Scandinavia may show myths of warfare, as scholars have identified figures of large warriors wielding votive axes on boats, as well as archers and chariots (Kristiansen 1999; Ling *et al.* 2018b).

Evidence for violence and warfare in the cultural epochs attached to the *mound durée* is vast, especially for the EMNBA. The implications reach beyond landscape, delving into aspects of social and societal organisation. Military, or the use of force or violence, is one of the principal organisational pillars in theories concerning the means by which individuals came to have powerful positions and changed the rules of society (Earle 1991; Kristiansen 2007; Mann 2012). The insertion of formalised violence into societal norms could yield social acceptance and advancement for certain individuals. Specialised warriors in the EMNBA could very well have been the extension of one such societal norm (e.g. Fyllingen 2003). This extends further into the presumed body image of the 'warrior's beauty', coined by Paul Treherne (1995), and was a component of the identity of EMNBA warriorhood. Population surplus resulting in young males embarking on maritime warfare and trade across European networks is a recent suggestion to our understanding of the social role of warriors, war, and warfare in the EMNBA (Ling *et al.* 2018a). The sword is pivotal in this sense as it is the prime symbol of warfare. Estimates suggest that as many as 5-10,000 swords were in contemporary circulation during NBA II-III EMNBA (Bunnefeld 2016: 197-200, tab. 26). The sheer number of these attests to the significance and integration of language into society, not only for leading members but on a rather broad scale (Bunnefeld 2016; Thrane 2006).

The monuments may also give evidence for a more hierarchical structure in the EMNBA than in the other periods. In the EMNBA the monuments had a different distribution pattern in the landscape; in the SGC there were concentrations around streams and river valleys; in the LN there was widespread re-use. However, in the ENBA there was a more dispersed pattern, which might be related to a different EMNBA settlement organisation. Records of sturdy, timber-built dwellings as symbols of sedentism remain absent on a broad scale for the SGC, though they showcase a drastic increase in numbers for the FBC, LN, and EMNBA following the last two decades' rise in the intensity of excavations. The absence has been correlated with a contrasting mobile and nomadic lifestyle for CWC cultures, including the SGC (Nielsen 2019). This contrasts with later patterns in which autonomous farmsteads consisting of 1 or 2 long houses dispersed across the landscape of the south Scandinavian LN and Nordic Bronze Age (Artursson 2009). The lack of settlements as focal points in the landscape can be an indication of a lack of territorial borders. The use of SGC burial mounds as territorial markers is not an uncommon reasoning for the erection of monumental mounds (e.g. Olausson 1993). Alternatively, one might consider whether these low mounds may have had a more symbolic nature connected to shared burial rites deriving from CWC ancestry. Farmsteads which endured in EBA landscapes for 20-50 years lend support to the idea that this time witnessed a more territorial lifestyle and may have also reflected an urge to mark territorial belonging through lineage with the erection of monuments (e.g. Løken 2020: 195-199). The erections of EMNBA mounds were very well-coordinated events, involving different parties, which probably originated in the nearby landscape (Holst and Rasmussen 2012). In these local community settings, ancestral ties and displays of wealth and power would have more likely supported investment in the monumental burials and larger mounds which occurred in the EMNBA (Marzian *et al.* 2024). Each settlement could have erected mounds, which both highlights and underscores the importance of this tradition in the EMNBA (Mikkelsen 2018). Thus, the strong identities displayed by richness in objects made of imported metals was a signifier of the wealth and power of a particular lineage, and tales of lavishly furnished burials and monumental mounds commemorated great ancestors for generations to come.

Conclusion

Was the *mound durée* a manifestation of a timeless aristocratic ethos? This was the question posed in the first section of the article, based on a forthcoming work (Vandkilde *et al.* forthcoming). To conclude the arguments presented here, it is necessary to break down the different elements of the initial question. The preferred objects of symbolic nature and little practical value other than warfare and violence discussed above were indeed a manifestation and a select choice to provide a warrior identity in the majority of burials across all three periods. This choice is based on a set of shared cultural norms across almost two millennia and is without doubt timeless, as this is enforced despite heavy changes in both material culture and raw material; the same symbolism is retained be it for stone battle axes, flint daggers, or bronze swords. Only a segment of the living population was entitled to warrior status, as they could amass the social capital to orchestrate both burial and mound, and could also procure the raw material and necessary expertise to produce the objects placed in burials, thus heavily implying an enduring aristocratic ethos.

Acknowledgments

I wish to express gratitude to Prof. Helle Vandkilde for inviting me to participate in a previous article in which the *mound durée* was proposed in relation to the south Scandinavian Early and Middle Nordic Bronze Age. Without this, the concept would never have been elaborated in this publication. Large parts of the article are founded on inspiring conversations about both mounds and burials in the EMNBA as well as social organisation in the Nordic Bronze Age with Dr Martin Mikkelsen (Viborg Museum). Both are engaging supervisors along the current journey of my PhD (and of which this article forms a part). Further thanks go to the peer reviewer and the editors of this volume, whose comments markedly improved this manuscript.

The PhD would not have been possible without my employment at Viborg Museum, to whom I am most grateful. Added to this, special thanks go to Brian Wiborg, who allowed me to pursue this chance, and to Lars Agersnap Larsen for his tireless efforts in helping secure the necessary funding. Finally, I express my sincere gratitude to the following for providing funding for the PhD: The Agency for Cultures and Palaces (FORM 2021-0019), the Aage og Johanne Louis-Hansens Fund, the Elisabeth Munksgaard Fund, and the William Demant Fund for supporting my research stay at Christian-Albrechts-Universität zu Kiel.

Bibliography

Allentoft, M.E., M. Sikora, K.-G. Sjögren, S. Rasmussen, M. Rasmussen, J. Stenderup, P.B. Damgaard, H. Schroeder, T. Ahlström, L. Vinner, A.-S. Malaspinas, A. Margaryan, T. Higham, D. Chivall, N. Lynnerup, L. Harvig, J. Baron, P.D. Casa, P. Dąbrowski, P.R. Duffy, A.V. Ebel, A. Epimakhov, K. Frei, M. Furmanek, T. Gralak, A. Gromov, S. Gronkiewicz, G. Grupe, T. Hajdu, R. Jarysz, V. Khartanovich, A. Khokhlov, V. Kiss, J. Kolář, A. Kriiska, I. Lasak, C. Longhi, G. Mcglynn, A. Merkevicius, I. Merkyte, M. Metspalu, R. Mkrtchyan, V. Moiseyev, L. Paja, G. Pálfi, D. Pokutta, Ł. Pospieszny, T.D. Price, L. Saag, M. Sablin, N. Shishlina, V. Smrčka, V.I. Soenov, V. Szeverényi, G. Tóth, S.V. Trifanova, L. Varul, M. Vicze, L. Yepiskoposyan, V. Zhitenev, L. Orlando, T. Sicheritz-Pontén, S. Brunak, R. Nielsen, K. Kristiansen and E. Willerslev 2015. Population genomics of Bronze Age Eurasia. *Nature* 522: 167-172 (available at: https://doi.org/10.1038/nature14507).

Allentoft, M.E., M. Sikora, A. Fischer, K.-G. Sjögren, A. Ingason, R. Macleod, A. Rosengren, B. Schulz Paulsson, M.L.S. Jørkov, M. Novosolov, J. Stenderup, T.D. Price, M. Fischer Mortensen, A.B. Nielsen, M. Ulfeldt Hede, L. Sørensen, P.O. Nielsen, P. Rasmussen, T.Z.T. Jensen, A. Refoyo-Martínez, E.K. Irving-Pease, W. Barrie, A. Pearson, B. Sousa Da Mota, F. Demeter, R.A. Henriksen, T. Vimala, H. McColl, A.B. Vaughn, L. Vinner, G. Renaud, A. Stern, N.N. Johannsen, A.D. Ramsøe, A.J. Schork, A. Ruter, A.B. Gotfredsen, B. Henning Nielsen, E. Brinch Petersen, E. Kannegaard, J. Hansen, K. Buck Pedersen, L. Pedersen, L. Klassen, M. Meldgaard, M. Johansen, O.C. Uldum, P. Lotz, P. Lysdahl, P. Bangsgaard, P.V. Petersen, R. Maring, R. Iversen, S. Wåhlin, S. Anker Sørensen, S.H. Andersen, T. Jørgensen, N. Lynnerup, D.J. Lawson, S. Rasmussen, T.S. Korneliussen, K.H. Kjær, R. Durbin, R. Nielsen, O. Delaneau, T. Werge, K. Kristiansen and E. Willerslev 2024. 100 ancient genomes show repeated population turnovers in Neolithic Denmark. *Nature* 625: 329-337 (available at: https://doi.org/10.1038/s41586-023-06862-3).

Andreasen, R. and E. Thomsen 2021. Strontium Is Released Rapidly From Agricultural Lime – Implications for Provenance and Migration Studies. *Frontiers in Ecology and Evolution* 8: 1-13 (available at: https://doi.org/10.3389/fevo.2020.588422).

Aner, E., K. Kersten and K.-H. Willroth 2009. *Die Funde der älteren Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*, Band XII: Viborg Amt. Neumünster: Wachholtz Verlag.

Apel, J. 2001. *Daggers, Knowledge and Power*. Coast to Coast Books 3. Uppsala: Department of Archaeology and Ancient History, Uppsala University.

Bang, J. 2013. The Route to a History of the Cultural Landscape: A Danish Record of the Prehistoric and Historic Roads, Tracks and Related Structures, in S. Sabatini and S. Bergerbrant (eds) *Counterpoint: Essays in Archaeology and Heritage Studies in Honour of Professor Kristian Kristiansen*: 703-715. British Archaeological Reports International Series 2508. Oxford: Archaeopress.

Bennike, P. 1985. *The Palaeopathology of Danish Skeletons. A Comparative study of Demography, Disease and Injury*. Copenhagen: Akademisk Forlag.

Bergerbrant, S. 2007. *Bronze Age Identities: Costume, Conflict and Contact in Northern Europe 1600-1300 BC*. Stockholm Studies in Archaeology 43. Lindome: Bricoleur Press.

Bergerbrant, S. 2019. Revisiting the Egtvedt Girl, in R. Berge and M.M. Henriksen (eds) *Arkeologi og kulturhistorie fra norskekysten til Østersjøen. Festskrift til professor Birgitta Berglund*: 18-39. Trondheim: NTNU Vitenskapsmuseet, Institutt for arkeologi og kulturhistorie og Museumsforlaget.

Bican, J.F. 2012. Bulkister og bådgrav ved Bulbrogård – en senneolitisk gravplads ved vestbredden af Tissø. *Aarbøger for Nordisk Oldkyndighed og Historie* 2010: 7-42.

Blank, M., A. Tornberg and C. Knipper 2018. New Perspectives on the Late Neolithic of South-Western Sweden. An Interdisciplinary Investigation of the Gallery Grave Falköping Stad 5. *Open Archaeology* 4: 1-35 (available at: https://doi.org/10.1515/opar-2018-0001).

Bourgeois, Q. and E. Kroon 2017. The impact of male burials on the construction of Corded Ware identity: Reconstructing networks of information in the 3rd millennium BC. *PLoS One* 12: e0185971 (available at: https://doi.org/10.1371/journal.phone.0185971).

Boye, V. 1896. *Fund af Egekister fra Bronzealderen i Danmark. Et Monografisk Bidrag til belysning af Bronzealderens Kultur*. København: Andr. Fred. Høst & Søns Forlag.

Brück, J. 2021. Ancient DNA, kinship and relational identities in Bronze Age Britain. *Antiquity* 95(379), 228-237 (available at: https://doi.org/10.15184/aqy.2020.216).

Brück, J. and C.J. Frieman 2021. Making kin. The archaeology and genetics of human relationships. *TA TuP* 30(2): 47-52 (available at https://doi.org/10.14512/tatup.30.2.47).

Bunnefeld, J -H. 2016. *Älterbronzezeitliche Vollgriffschwerter in Dänemark und Schleswig-Holstein: Studien zu Form, Verzierung, Technik und Funktion*. Studien zur nordeuropäischen Bronzezeit. Kiel: Wachholtz Verlag.

Chapman, R. 2013. Death, Burial and Social Representation, in S. Tarlow and L.N. Stutz (eds) *The Oxford Handbook of the Archaeology of Death and Burial*: 47-58. Oxford: Oxford University Press (available at: https://doi.org/10.1093/oxfordhb/9780199569069.013.0004).

Christensen, L.B. 2018. *Nationalmuseet og storstensgravene 1890-1950: Mennesker, fortidsminder og museale forhold*. Copenhagen: The Royal Society of Northern Antiquaries.

Crema, E.R., J. Habu, K. Kobayashi and M. Madella 2016. Summed Probability Distribution of ^{14}C Dates Suggests Regional Divergences in the Population Dynamics of the Jomon Period in Eastern Japan. *PLoS One* 11(4): e0154809 (available at: doi:10.1371/journal.phone.0154809).

Cummings, V., D. Hofmann, M. Bjørnevad-Ahlqvist and R. Iversen 2022. Muddying the Waters: reconsidering Migration in the Neolithic of Britain, Ireland and Denmark. *Danish Journal of Archaeology* 11: 1-25 (available at: https://doi.org/10.7146/dja.v11i.129698).

Damm, C. 1991. The Danish Single Grave Culture – Ethnic Migration or Social Construction? *Journal of Danish Archaeology* 10: 199-204 (available at: https://doi.org/10.1080/0108464X.1991.10590063).

Earle, T. 1991. The evolution of chiefdoms, in T. Earle (ed.) *Chiefdoms: Power, Economy and Ideology*: 1-15. Cambridge: Cambridge University Press.

Earle, T. 2002. *Bronze Age Economics: The Beginnings of Political Economies*. Cambridge: Westview Press (available at: https://doi.org/10.4324/9780429501999).

Ebbesen, K. 1985. Nordjyske gravkister med indgang. Bøstrup-kisterne. *Aarbøger for Nordisk Oldkyndighed og historie* 1983: 5-65.

Ebbesen, K. 1995. Spätneolitische Schmuckmode. *Acta Archaeologica 66*: 219-279.

Ebbesen, K. 2004. En højgruppe ved Kvindvad, Vestjylland: Studier over senneolitisk tid. *KUML* 2004: 79-127.

Ebbesen, K. 2007. Danske hellekister fra stenalderen. *Aarbøger for nordisk oldkyndighed og historie* 2004: 7-63.

Ebbesen, K. 2011. *Danmarks megalitgrave*. Copenhagen: Attika.

Egfjord, A.F.-H., A. Margaryan, A. Fischer, K.-G. Sjögren, T.D. Price, N.N. Johannsen, P.O. Nielsen, L. Sørensen, E. Willerslev, R. Iversen, M. Sikora, K. Kristiansen and M.E. Allentoft 2021. Genomic Steppe ancestry in skeletons from the Neolithic Single Grave Culture in Denmark. *PLoS ONE* 16: e0244872 (available at: https://doi.org/10.1371/journal.phone.0244872).

Endrigkeit, A. 2014. *Älter- und mittelbronzezeitliche Bestattungen zwischen Nordischem Kreis und süddeutscher Hügelgräberkultur, Frühe Monumentalität und soziale Differenzierung*. Bonn: Rudolf Habelt.

Ensor, B.E. 2021. *The Not Very Patrilocal European Neolithic. Strontium, aDNA, and Archaeological Kinship Analyses*. Oxford: Archaeopress.

Felding, L. 2020. One Ring to Rule Them All? Appearance and Identity of Early Nordic Bronze Age Women. *Praehistorische Zeitschrift* 95(2): 422-446 (available at: https://doi.org/10.1515/pz-2020-0029).

Felding, L., 2022. Relational Approaches to Gender, Identity and Mobility in the Southern Early Nordic Bronze Age. Unpublished PhD doctoral thesis, Aarhus University.

Felding, L., S.S. Reiter, K.M. Frei and H. Vandkilde 2020. Male Social Roles and Mobility in the Early Nordic Bronze Age. A Perspective from SE Jutland. *Danish Journal of Archaeology* 9: 1-167 (available at: https://doi.org/10.7146/dja.v9i0.117955).

Fibiger, L., T. Ahlström, P. Bennike and R.J. Schulting 2013. Patterns of violence-related skull trauma in neolithic southern Scandinavia. *American Journal of Physical Anthropology* 150: 190-202 (available at: https://doi.org/10.1002/ajpa.22192).

Fowler, C., I. Olalde, V. Cummings, I. Armit, L. Büster, S. Cuthbert, N. Rohland, O. Cheronet, R. Pinhasi and D. Reich 2022. A high-resolution picture of kinship practices in an Early Neolithic tomb. *Nature* 601: 584-590 (available at: https://doi.org/10.1038/s41586-021-04241-4).

Friman, B. and P. Lagerås 2023. From Neolithic Boom-and-Bust to Iron Age Peak and Decline: Population and Settlement Dynamics in Southern Sweden Inferred from Summed Radiocarbon Dates. *European Journal of Archaeology* 26(2): 168-188 (available at: https://doi.org/10.1017/eaa.2022.43).

Frost, L., M. Løvschal, M.R. Lindegaard and M.K. Holst 2017. Borum Eshøj Revisited – Bronze Age monumental burial traditions in eastern Jutland, Denmark. *Danish Journal of Archaeology* 6: 1-19 (available at: https://doi.org/10.1080/21662282.2017.1370835).

Fürtwängler, A., A.B. Rohrlach, T.C. Lamnidis, L. Papac, G.U. Neurmann, I. Siebke, E. Reiter, N. Steuri, J. Hald, A. Denaire, B. Schnitzler, J. Wahl, M. Ramstein, V.J. Scheunemann, P.W. Stockhammer, A. Hafner, S. Lösch, W. Haak, S. Schiffels and J. Krause 2000. Ancient genomes reveal social and genetic structure of Late Neolithic Switzerland. *Nature Communications* 11: 1-11 (available at: https://doi.org/10.1038/s41467-020-15560-x).

Fyllingen, H. 2003. Society and Violence in the Early Bronze Age: An Analysis of Human Skeletons from Nord-Trøndelag, Norway. *Norwegian Archaeological Review* 36: 27-43 (available at: https://doi.org/10.1080/00293650307297).

Fyllingen, H. 2005. Massegraver i Nord-Europa fra eldre bronsealder – osteologiske analyser og sosiale implikasjoner, in J. Goldhahn (ed.) *Mellan Sten Och Järn*: 627-636. Göteborg: Gotarc Serie C Skrifter.

Fyllingen, H. 2006. Society and the Structure of Violence: A Story Told by Middle Bronze Age Human Remains from Central Norway, in T. Otto, H. Thrane and H. Vandkilde (eds) *Warfare and Society. Archaeological and Social Anthropological Perspectives*: 319-330. Aarhus: Aarhus University Press.

Glob, P.V. 1969. *Danske Oldtidsminder*. Haslev: Nordisk Bogproduktion A.S.

Gnecchi-Ruscone, G.A., Z. Rásc, L. Samu, T. Szeniczey, N. Faragó, C. Knipper, R. Friedrich, D. Zlámalová, L. Traverso, S. Liccardo, S. Wabnitz, D. Popli, K. Wang, K. Radzeviciute, B. Gulyás, I. Koncz, C. Balogh, G.M. Lezsák, V. Mácsai, M.M.E. Bunbury, O. Spekker, P. Le Roux, A. Szécsenyi-Nagy, B.G. Mende, H. Colleran,

T. Hajdu, P. Geary, W. Pohl, T. Vida, J. Krause and Z. Hofmanová 2024. Network of large pedigrees reveals social practices of Avar communities. *Nature* 629: 376-383 (available at: https://doi.org/10.1038/s41586-024-07312-4).

Hansen, M. 1996. Træbyggede gravkister fra Enkeltgravskulturen og Senneolitikum. *KUML* 1993-1994: 87-146.

Hansen, M.R. 2014. Expressing identity through ritual in the Early Bronze Age, in N. Anfinset and M. Wrigglesworth (eds) *Local Societies in Bronze Age Northern Europe*: 56-70. London: Routledge.

Hansen, S.I. 2016. *Jættestuebyggerne*. Them: Kahrius.

Holst, M.K. 2013. Barrow Assemblies, in M.K. Holst and M. Rasmussen (eds) *Skelhøj and the Bronze Age Barrows of Southern Scandinavia, Vol. 1*: 11-128. Højbjerg: Jysk Arkæologisk Selskab & Nationalmuseet.

Holst, M.K. and M. Rasmussen 2012. Combined Efforts: The cooperation and coordination of barrow-building in the Brnonze Age, in N.N. Johannsen, M.D. Jessen and H.J. Jensen (eds) *Excavating the Mind: Cross-Sections through Culture, Cognition and Materiality*: 255-279. Aarhus: Aarhus University Press.

Holst, M.K., M. Rasmussen, K. Kristiansen and J.-H. Bech 2013. Bronze Age 'Herostrats': Rituals, Political and Domestic Economies in Early Bronze Age Denmark. *Proceedings of the Prehistoric Society* 79: 265-296 (available at: DOI: https://doi.org/10.1017/ppr.2013.14).

Horn, C. 2013. Weapons, fighters and combat: spears and swords in Early Bronze Age Scandinavia. *Danish Journal of Archaeology* 2: 20-44 (available at: https://doi.org/10.1080/21662282.2013.838832).

Hübner, E. 2005. *Jungneolithische Gräber auf der Jütischen Halbinsel: typologische und chronologische Studien zur Einzelgrabkultur*. Nordiske fortidsminder, Serie B. Copenhagen: Det Kongelige Nordiske Oldskriftselskab.

Iversen, R. 2016. Was There Ever a Single Grave Culture in East Denmark? Traditions and Transformations in the 3rd Millennium BC, in M. Furholt, R. Grossman and M. Szmyt (eds) *Transitional Landscapes? The 3rd Millenium BC in Europe, Universitätsforschungen Zur Prähistorischen Archäologie*: 159-170. Bonn: Rudolf Habelt.

Jantzen, D., U. Brinker, J. Orschiedt, J. Heinemeier, J. Piek, K. Hauenstein, J. Krüger, H. Lübke, R. Lampe, S. Lorenz, M. Schult, G. Lidke and T. Terberger 2011. A Bronze Age battlefield? Weapons and trauma in the Tollense Valley, north-eastern Germany. *Antiquity* 85: 417-433 (available at: https://doi.org/10.1017/S0003598X00067843).

Jennbert, K. 1993. Släkters Hågkomst. Om bruket av bronsålderhøgar, in L. Larsson (ed.) *Bronsålderns Gravhögar. Rapport Från Ett Symposium i Lund 15. XI-16. XI*: 69-78. Lund: Institute of Archaeology Report Series. University of Lund.

Johannsen, J.W. 2023. The Late Neolithic Expansion in Denmark. Ancient and new traditions 2350-1700 BC. *Danish Journal of Archaeology* 12: 1-22 (available at: https://doi.org/10.7146/dja.v12i1.132093).

Johannsen, N.N. 2023. Socioeconomic organisation in the Globular Amphora network during the earliest 3rd millennium BC, in H. Meller, J. Krause, W. Haak and R. Risch (eds) *Kinship, Sex, and Biological Relatedness. The Contribution of Archaeogenetics to the Understanding of Social and Biological Relations. Mitteldeutscher Archäologentag Vom 6. Bis 8. Oktober 2022 in Halle (Saale), Tagungen Des Landesmuseums Für Vorgeschichte Halle*: 161-169. Heidelberg: Propylaeum.

Johannsen, N.N. and S.T. Laursen 2010. Routes and Wheeled Transport in Late 4th-Early 3rd Millennium funerary Customs of the Jutland Peninsula: regional evidence and European context. *Praehistorische Zeitschrift* 85(1): 15-58 (available at: https://doi.org/10.1515/pz.2010.004).

Jørgensen, E. 1977. *Hagebrogård – Vroue – Koldkur*. Neolithische Gräberfelder aus Nordwest-Jütland, Arkæologiske Studier. Copenhagen: Institute of Prehistoric Archaeology, University of Copenhagen.

Jørgensen, E. 1985. To gravhøje ved Hjordkær i Sønderjylland. Om særprægede senneolitiske gravanlæg. *KUML* 1984: 155-189.

Kristiansen, K. 1987. From stone to bronze – the evolution of social complexity in Northern Europe, in E.M. Brumfield and T. Earle (eds) *New Directions in Archaeology: Specialization, Exchange and Complex Societies*: 30-51. Cambridge: Cambridge University Press.

Kristiansen, K. 1989. Prehistoric Migrations – The Case of the Single Grave and Corded Ware Cultures. *Journal of Danish archaeology* 8: 211-225 (available at: https://doi.org/10.1080/0108464X.1989.10590029).

Kristiansen, K. 1999. The emergence of warrior aristocracies in later European Prehistory and their long-term history, in J. Carman and A. Harding (eds) *Ancient Warfare. Archaeological Perspectives*: 175-190. Sutton: Sutton Publishing.

Kristiansen, K. 2002. The tale of the sword - swords and swordfighters in Bronze Age Europe. *Oxford Journal of Archaeology* 21: 319-333 (available at: https://doi.org/10.1111/1468-0092.00166).

Kristiansen, K. 2007. The Rules of the Game. Decentralised Complexity and Power Structures, in S. Kohring and S. Wynne-Jones (eds) *Socialising Complexity: Approaches to Power and Interaction in the Archaeological Record*: 60-75. Oxford: Oxbow Books.

Kristiansen, K. 2014. Towards a New Paradigm? The Third Science Revolution and its Possible Consequences in Archaeology. *Current Swedish Archaeology* 22: 11-34 (available at: https://doi.org/doi:10.37718/CSA.2014.01).

Kristiansen, K., M.E. Allentoft, K.M. Frei, R. Iversen, N.N. Johannsen, G. Kroonen, Ł. Pospieszny, T.D. Price, S.

Rasmussen, K.-G. Sjögren, M. Sikora and E. Willerslev 2017. Re-theorising mobility and the formation of culture and language among the Corded Ware Culture in Europe. *Antiquity* 91: 334-347 (available at: https://doi.org/10.15184/aqy.2017.17).

Ling, J., T. Earle and K. Kristiansen 2018a. Maritime Mode of Production: Raiding and Trading in Seafaring Chiefdoms. *Current Anthropology* 59: 488-524 (available at: https://doi.org/10.1086/699613).

Ling, J., R. Chacon and Y. Chacon 2018b. Rock art, Secret Societies, Long-distance Exchange, and warfare in Bronze Age Scandinavia, in A. Dolfini, R.J. Crellin, C. Horn and M. Uckelmann (eds) *Prehistoric Warfare and Violence. Quantitative and Qualitative Approaches*: 149-174. New York: Springer.

Lomborg, E. 1969. Den tidlige bronzealders kronologi. Et forsøg på at fastlægge grænsen mellem perioderne I og II. *Aarbøger for Nordisk Oldkyndighed og Historie* 1968: 91-152.

Lomborg, E. 1973. *Die Flintdolche Dänemarks: Studien über Chronologie und Kulturbeziehungen des südskandinavischen Spätneolithikums*. Copenhagen: Universitetsforlaget i København.

Madsen, T. 2020. Fra grænselandet mellem to kulturer. Tragtbægerkultur og enkeltgravskultur i det centrale Østjylland. *KUML* 2020: 9-84.

Mann, M. 2012. *The sources of social power. Volume 1: A history of power from the beginning to 1760* (2nd edn). Cambridge: Cambridge University Press.

Marzian, J., J. Laabs, J. Müller and T. Requate 2024. Inequality in relational wealth within the upper societal segment: evidence from prehistoric Central Europe. *Humanities and Social Sciences Communications* 11: 1-12 (available at: https://doi.org/10.1057/s41599-024-03053-x).

Matić, U. 2024. Gender and Queer Archaeology, in E. Nikita and T. Rehren (eds) *Encyclopedia of Archaeology*, Vol. 1 (2nd edn): 342-357. London: Academic Press.

Meir, A. 1986. Demographic transition theory: a neglected aspect of the nomadism-sedentism continuum. *Transactions, Institute of British Geographers* 11(2): 199-211.

Melheim, L. (forthcoming). Why patrilocal female exogamy? A critical view on kinship in the Nordic Bronze Age, in U. Pedersen, M. Moen and L. Skogstrand (eds) *Gendering the Nordic Past: Doalogues Between Perspectives*. Turnhout: Brepols.

Midgley, M.S. 1984. The origin and function of the Earthen Long Barrows of Northern Europe. Unpublished PhD dissertation, University of Edinburgh, Edinburgh.

Mikkelsen, M. 2018. Bronze Age Settlement and Land-Use in Thy, Northwest Denmark. in J.H. Bech, B.V. Eriksen and K. Kristiansen (eds) *Bronze Age Settlement and Land-Use in Thy, Northwest Denmark*: 477-503. Aarhus: Jutland Archaeological Society.

Mittnik, A., K. Massy, C. Knipper, F. Wittenborn, R. Friedrich, S. Pfrengle, M. Burri, N. Carlichi-Witjes, H. Deeg, A. Furtwängler, M. Harbeck, K. Von Heyking, C. Kocioumaka, I. Kucukkalipci, S. Lindauer, S. Metz, A. Saskiewicz, A. Thiel, J. Wahl, W. Haak, E. Pernicka, S. Schiffels, P.W. Stockhammer and J. Krause 2019. Kinship-based social inequality in Bronze Age Europe. *Science* 366: 731-734 (available at: https://doi.org/10.1126/science.aax6219).

Mittnik, A., K. Massy, C. Knipper, R. Friedrich, J. Krause and P.W. Stockhammer, 2023. Kinship, status and mobility in the Bronze Age Lech Valley, in H. Meller, J. Krause, W. Haak and R. Risch (eds) *Kinship, Sex, and Biological Relatedness. The Contribution of Archaeogenetics to the Understanding of Social and Biological Relations. 15. Mitteldeutscher Archäologentag Vom 6. Bis 8. Oktober 2022 in Halle (Saale)*: 195-217. Tagungen Des Landesmuseums Für Vorgeschichte Halle. Heidelberg: Propylaeum.

Müller, S. 1904. Vei og Bygd i Sten- og Bronzealderen. *Aarbøger for nordisk oldkyndighed og historie* 1904: 1-64.

Nielsen, P.O. 2019. The development of the two-aisled longhouse in the Neolithic and Early Bronze Age, in L.R. Sparrevohn, O.T. Kastholm and P.O. Nielsen (eds) *Houses for the Living: Two-Aisled Houses From the Neolithic and Early Bronze Age in Denmark*: 9-50. Copenhagen: Nationalmuseet.

Nielsen, S.K. and N.N. Johannsen 2024. Mortuary palisades, single graves and cultural admixture: The establishment of Corded Ware culture on the Jutland peninsula. *Praehistorische Zeitschrift* 99(2): 529-590 (available at: https://doi.org/10.1515/pz-2023-2022).

Olausson, D. 1993. The Bronze Age Barrow as Symbol, in L. Larsson (ed.) *Bronsålderns Gravhögar. Rapport Från Ett Symposium i Lund 15. XI-16. XI*: 91-113. Lund: University of Lund.

Olsen, J., B. Madsen, M. Kanstrup, C. Korthauer and L. Klassen 2024. Middle Neolithic trackway A20 at Kastbjerg Å. High-precision dating and archaeological context. *Danish Journal of Archaeology* 13: 1-16 (available at: https://doi.org/10.7146/dja.v13i1.137091).

Otto, T., H. Thrane and H. Vandkilde 2006. *Warfare and society*. Aarhus: Aarhus University Press.

Pearson, M.P. 1993. The Powerful Dead: Archaeological Relationships between the Living and the Dead. *Cambridge Archaeological Journal* 3: 203-229 (available at: https://doi.org/10.1017/S0959774300000846).

Pearson, M.P. 1999. *The archaeology of death and burial*. Sutton: Stroud.

Racimo, F., J. Woodbridge, R.M. Fyfe, M. Sikora, K.-G. Sjögren, K. Kristiansen and M. Vander Linden 2020. The spatiotemporal spread of human migrations during the European Holocene. *PNAS* 117: 8989-9000 (available at: https://doi.org/10.1073/pnas.1920051117).

Randsborg, K. 1974. Social Stratification in Early Bronze Age Denmark: a Study in the Regulation of Cultural Systems. *Praehistorische Zeitschrift* 49: 38-61.

Sarauw, T. 2007. Male symbols or warrior identities? The 'archery burials' of the Danish Bell Beaker Culture. *Journal of Anthropological Archaeology* 26: 65-87 (available at: https://doi.org/10.1016/j.jaa.2006.05.001).

Schroeder, H., A. Margaryan, M. Szmyt, B. Theulot, P. Wlodarczak, S. Rasmussen, S. Gopalakrishnan, A. Szczepanek, T. Konopka, T.Z.T. Jensen, B. Witkowska, S. Wilk, M.M. Przybyla, Ł. Pospieszny, K.-G. Sjögren, Z. Belka, J. Olsen, K. Kristiansen, E. Willerslev, K.M. Frei, M. Sikora, N.N. Johannsen and M.E. Allentoft 2019. Unraveling ancestry, kinship, and violence in a Late Neolithic mass grave. *PNAS* 116: 10705-10710 (available at: https://doi.org/10.1073/pnas.1820210116).

Shennan, S. 1982. Exchange and ranking: the role of amber in the earlier bronze age of Europe, in C. Renfrew and S. Shennan (eds) *Ranking, Resource and Exchange. Aspects of the Archaeology of Early European Society*: 33-45. Cambridge: Cambridge University Press.

Shennan, S., S.S. Downey, A. Timpson, K. Edinborough, S. Colledge, T. Kerig, K. Manning and M.G. Thomas 2013. Regional population collapse followed initial agriculture booms in mid-Holocene Europe. *Nature Communications* 4: 2486 (available at: doi:10.1038/ncomms3486).

Simonsen, J. 2006. Strandet Hovedgaard. Children's graves of the late Single Grave Culture in North Jutland, and some social and cultural considerations. *Journal of Danish Archaeology* 14: 45-85.

Sjögren, K.-G., T.D. Price and K. Kristiansen 2016. Diet and Mobility in the Corded Ware of Central Europe. *PLoS ONE* 11(5): e0155083 (available at: doi:10.1371/journal.phone.0155083).

Sjögren, K.-G., I. Olalde, S. Carver, M.E. Allentoft, T. Knowles, G. Kroonen, A.W.G. Pike, P. Schröter, K.A. Brown, K.R. Brown, R.J. Harrison, F. Bertemes, D. Reich, K. Kristiansen and V. Heyd 2020. Kinship and social organization in Copper Age Europe. A cross-disciplinary analysis of archaeology, DNA, isotopes, and anthropology from two Bell Beaker cemeteries. *PLoS ONE* 15: 1-28 (available at: https://doi.org/10.1371/journal.phone.0241278).

Sørensen, C. 2016. Samfundsorganisation i ældre bronzealder. Et spatialt og kvantitativt case study af ældre bronzealders sociale struktur og samfundsorganisation med udgangspunkt i det Nordvestlige Jylland. Unpublished Master's thesis, Højbjerg, Aarhus University.

Thomsen, E. and R. Andreasen 2019. Agricultural lime disturbs natural strontium isotope variations: Implications for provenance and migration studies. *Sci Adv* 5: eaav8083 (available at: https://doi.org/10.1126/sciadv.aav8083).

Thomsen, E., R. Andreasen and T.L. Rasmussen 2021. Homogeneous Glacial Landscapes Can Have High Local Variability of Strontium Isotope Signatures: Implications for Prehistoric Migration Studies. *Frontiers in Ecology and Evolution* 8: 1-18 (available at: https://doi.org/10.3389/fevo.2020.588318).

Thrane, H. 2006. Swords and Other Weapons in the Nordic Bronze Age: Technology, Treatment and Context, in T. Otto, H. Thrane and H. Vandkilde (eds) *Warfare and Society: Archaeological and Social Anthropological Perspectives*: 491-504. Aarhus: Aarhus University Press.

Timpson, A., K. Manning and S. Shennan 2015. Inferential mistakes in population proxies: A response to Torfing's 'Neolithic population and summed probability distribution of ^{14}C-dates'. *Journal of Archaeological Science* 63: 199-202 (available at: http://dx.doi.org/10.1016/j.jas.2015.08.018).

Torfing, T. 2015. Neolithic population and summed probability distributions of ^{14}C-dates. *Journal of Archaeological Science* 63: 193-198 (available at: https://doi.org/10.1016/j.jas.2015.06.004).

Treherne, P. 1995. The Warrior's Beauty: The Masculine body and Self-Identity in Bronze Age Europe. *Journal of European Archaeology* 3: 105-144 (available at: https://doi.org/10.1179/096576695800688269).

Trigger, B.G. 2007. *A History of Archaeological Thought* (2nd edn). Cambridge: Cambridge University Press.

Vandkilde, H. 1996. *From stone to bronze: the metalwork of the Late Neolithic and earliest Bronze Age in Denmark*. Højbjerg: Jysk Arkæologisk Selskab.

Vandkilde, H. 2011. Bronze Age Warfare in Temperate Europe, in S. Hansen and J. Müller (eds) *Sozialarchäologische Perspektiven: Gesellschaftlicher Wandel 5000-1500 v. Chr. Zwischen Atlantik Ud Kaukasus*: 365-380. Deutsches Archäeologisches Institut Eurasien-Abteilung. Darmstadt: P. von Zaber.

Vandkilde, H. 2014a. Cultural Perspectives on the Beginnings of the Nordic Bronze Age. *Offa* 67/68: 51-77.

Vandkilde, H. 2014b. Breakthrough of the Nordic Bronze Age: Transcultural Warriorhood and a Carpathian Crossroad in the Sixteenth Century. *European Journal of Archaeology* 17: 602-633 (available at: https://doi.org/10.1179/1461957114Y.0000000064).

Vandkilde, H. 2016. Bronzization: The Bronze Age as Pre-Modern Globalization. *Praehistorische Zeitschrift* 91: 103-123 (available at: https://doi.org/doi:10.1515/pz-2016-0005).

Vandkilde, H. 2018a. Violent Beauty in the Bronze Age, in S. Hansen and R. Krause (eds) *Bronze Age Hillforts between Taunus and Carpathian Mountains, Universitätsforschungen Zur Prähistorischen Archäologie*: 83-102. Bonn: Rudolf Habelt.

Vandkilde, H. 2018b. Body Aesthetics, Fraternity and Warfare in the long European Bronze Age – postscriptum, in C. Horn and K. Kristiansen (eds) *Warfare in Bronze Age Society*: 229-243. Cambridge: Cambridge University Press.

Vandkilde, H., H. Nørgaard, C. Sørensen, J.W. Johannsen and A. Tornberg (forthcoming). From Stone to Bronze in Scandinavia – Tradition and Transformation, in J. Kneisel, Furholt M., Hofmann R., Kirleis W., Mischka D., Wunderlich M. (eds) *A haunting spectre - archaeological studies of social organisation, economic practice and inequality*. Leiden: Sidestone Press.

Varberg, J. 2015. Bloody Daggers: A Discussion of the Function of Late Neolithic Flint Daggers from a South Scandinavian Perspective, in C. Frieman and B.V. Eriksen (eds) *Flint Daggers in Prehistoric Europe*: 92-102. Oxford: Oxbow Books.

Chapter 27

Burning flames – more than barrow building

Jutta Kneisel

Kiel University
jutta.kneisel@ufg.uni-kiel.de

Abstract

Fire played an important role in the burial ritual of the Late Bronze Age. However, the use of fire in burials was already documented in the Early Bronze Age, as the recently excavated example from Bornhöved, Segeberg, shows. There, the burning of a circular structure around the burial mound could be observed. The question arises as to when fire began to play a role in burial rituals, since fire can already be observed in the Neolithic period not only in cremations, but also in the construction of burial monuments. A focus lies on the use of fire in burial rituals in the period before cremation became the common form of burial custom. Chronological and chorological comparisons are made between early cremations in the Neolithic and the Bronze Age in northern Europe, as well as the deliberate burning of mortuary chambers and grave constructions. A comparison with strontium isotope data can give insights into the possible origin of this custom. But it looks like fire also played a role outside of funerals. The introduction of cremation in the north also seems to coincide with the beginning of the use of cooking pits.

Introduction

Fire and flames are an integral part of rituals and feasts. Even today, the shared campfire experience and the flaring of flames in the dark still fascinates us. Birthday cakes are topped with candles, and, according to superstition, a wish is granted when the flames are blown out.[1]

Fire is documented many times in the Bronze Age, even beyond its use as a source of warmth and processed food and in crafts, be it in house construction or in the production of ceramics and bronze artefacts. Fire plays a particularly important role in burial rituals, and not only since the introduction of widespread cremation and urn burials in the Late Bronze Age. This contribution will therefore focus on the utilisation and use of fire in the late Neolithic and the Bronze Age in northern Europe. The way in which fire is used in burial rituals varies greatly and can be found in very different contexts until the widespread introduction of cremation and urn burials in the Late Bronze Age. In recent years, improved excavation methods and the expansion of the excavation areas have yielded a great deal of new information to enable a better understanding of the use of burial mounds in southern Scandinavia. The barrow is no longer seen as merely the covering of a grave and, thus, as a one-off construction, but rather as a constant process of change and a place for a wide variety of rituals, in which fire also plays a role. The 'Galgenberg' near Itzehoe (Struve 1979: 33, fig. 3) and the recently excavated mound LA117 near Bornhöved (Kneisel *et al.* 2020) are impressive examples of the constant changes and remodelling of a barrow. Evidence for changes and renewals of the barrows is also known from the later Bronze Age, e.g. the burial mound at Lusehøj on Fyn was built over four older and smaller mounds (Thrane and Madsen 2004); and the burial mound at Seddin, Brandenburg, was repeatedly raised over several intervals (Brunke *et al.* 2016: 171). In contrast, the extensive excavations at Skelhøj were only able to prove a very short period of use, in which the mound was not further altered after the end of the complex construction phase (Holst and Rasmussen 2013). In addition to the extensive earthworks, stone and timber constructions, the use of fire in the context of ritual activities, especially in a funerary context, can be proven at some sites. The burning of a pyre is certainly an impressive experience – the smoke, the crackling and cracking of the wood, the flames and the smell, as Marie Sørensen and Katharina Rebay-Salisbury describe in their book (2023: 126). However, fire not only plays a role in the cremation of the deceased, the burning of grave constructions or houses for the dead also conveys this experience (Hübner 2005: 473-474, 502-503).

Let us therefore take a look at the various uses of fire in a ritual context.

1. The cremation of the deceased is certainly the most commonly documented use of fire and has not only been known since the Late Bronze Age (Bech and Rasmussen 2018: 68; Bo Henriksen 2016).
2. Fire clearing or burning of the base of the burial mound leaves traces that can occasionally be

[1] With this written birthday cake and the lit candles on it, I wish the jubilarian all the best and the continuation of her exciting research into 'Bronzization'.

found in Neolithic and older Bronze Age contexts (Hübner 2005: 473).

3. The burning of installations and constructions in connection with burials has been repeatedly observed. They range from early evidence from the Corded Ware to the Late Bronze Age.
4. Another ritualistic use of fire can be observed in the cooking pits of the Late Bronze Age. Although they are not apparently directly connected with burial rituals, they do not belong to settlement contexts either. Their linear arrangement and the simultaneous burning of fires in a row (which has been documented several times, e.g. Ledreborg, Zealand (Christensen 2018) also places this activity in the ritual sphere and should, therefore, be mentioned here.

Fireplaces, which sometimes occur under the barrows or next to the mounds, are not considered here, since it is unclear whether they have a direct connection to ritual (Hübner 2005: 474).

In recent years, new research and methods have made it possible to analyse more precisely the origins of cremation as a burial custom in the north. Radiocarbon dating on cremated remains is more accurate than dating on charcoal, which often harbours the risk of an old wood effect. Although analyses from Brandenburg indicate that often only small branches and short-lived wood, e.g. pine, were used for burning the deceased (Tiedke 2015: 81-82), this cannot be generalised. By now, ^{14}C dating is available for early cremations from Schleswig-Holstein (Schaefer-Di Maida 2023) and Denmark (Olsen and Bech 1994; Heinemeyer and Rud 2000; Olsen *et al.* 2008), northern Lower Saxony (Geschwinde 2000) and Sweden (Feldt 2005; Blank 2021; Arcini and Svanberg 2005). Large-scale studies exist for Belgium and the Netherlands, which have led to a large number of dated cremations (e.g. De Mulder *et al.* 2013; De Reu *et al.* 2012; Lanting and van der Plicht 1999; 2000), and more recent studies are also available from Poland (Makarowicz *et al.* 2021; Chochorowski 2007). Data from the Kiel Radon B database, which has been compiled from the literature and by colleagues in recent years, was added (Kneisel *et al.* 2013). In addition to the absolute dating, typo-chronologically dated cremations were available for Schleswig-Holstein, Denmark and the northwestern part of Lower Saxony (Hübner 2005; Endrigkeit 2014; Schaefer-Di Maida 2023; Strahl 1990; Hofmann 2008; Bo Henriksen 2016). Apart from the absolute chronology of early cremations, new studies have made it possible to investigate the origin of the burial custom. Even if the sample numbers are still relatively small, strontium isotope analyses allow new insights into the origin of cremation burials in the north. An initial attempt has already been made with data from Denmark (Reiter *et al.* 2021; Frei *et al.* 2017). Further analyses originate from Schleswig-Holstein (Schaefer-Di Maida, in prep.). The available data make it possible to trace the spread of early cremations in northern Europe and to formulate new approaches for interpretation.

Evidence of fire clearance and traces of burning in burial contexts has been described for the Younger Neolithic in Denmark by Eva Hübner (Hübner 2005: 474) and has also been sporadically documented in the Nordic Bronze Age (Aner and Kersten 1979: 111; Holst 2013: 72). Burning the surface of the burial mound before it is erected has a practical aspect, as the ground is levelled for construction by burning heather and small bushes. However, the limitation of the fire to the grave area immediately before the construction of the burial pit (Single Grave culture) or the first stone construction (Bronze Age) can certainly not have been carried out by a single person. It is likely that several people were responsible for limiting the fire as part of the collective burial ritual.

One aspect that is usually overlooked is the burning of grave structures, wooden constructions and mortuary houses, which can occasionally be observed. On the one hand, the surface level of small barrows or shallow graves are rarely preserved in heavily agricultural regions. Secondly, there is a lack of detailed observations from old excavations. Nevertheless, there are some sites from the Neolithic and Bronze Age where these features have been found (Holst and Rasmussen 2013; Hübner 2005; Strahl 1990), including the Bornhöved burial mound described below (Kneisel *et al.* 2022a).

Cooking pits are a generally seen as a phenomenon of the Late Bronze Age but appear at about the same time as the older Bronze Age cremation burials in southern northern Europe. Their interpretation ranges from shipyards to saunas and salt production sites and no single explanation applies to all. In recent years, the interpretation as assembly and feasting sites has prevailed, with the pits being interpreted as cooking pits (e.g. Kruse and Matthes 2019; Honeck 2018; Ling *et al.* 2024; Gustavsen *et al.* 2018; Kneisel *et al.* 2024). Their location outside the settlements and in the immediate vicinity of the older burial mounds indicates regular gatherings of larger groups and the communal preparation of food using fires in stone-filled pits.

Research Question

The following focuses on the aspect of fire primarily in burial ritual and possible parallels of the custom, which is only rarely observed in northern Germany and Denmark in the Older Bronze Age and Neolithic. The introduction of cremation or urn burial is often ascribed to southern influences with the beginning of

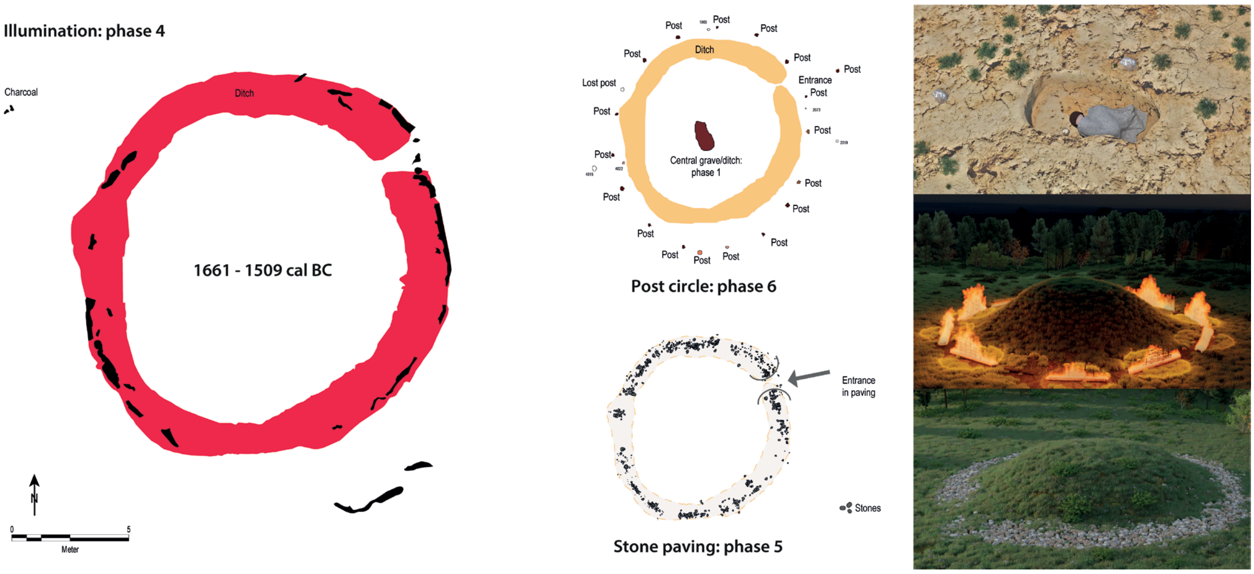


Figure 1: Charcoal structure of wooden beams and other phases of construction at Bornhöved LA 117, district of Segeberg (3D-graphic: C. Reckweg).

Urnfield cultures (Falkenstein 2017; Fokkens 1997; Bech and Rasmussen 2018; Sørensen and Rebay-Salisbury 2023; Schaefer-Di Maida *et al.* 2023). However, the availability of radiocarbon-dated cremated remains opens up completely new possibilities for analysis. In addition, fire seems to have played an important role in the funerary ritual even before the cremation of the body. The illumination of a burial mound, the burning of the surface or of so-called 'houses of the dead' or layers of charcoal under oak log coffins is evidence of the early use of fire in the burial ritual. Are there any spatial links between the early use of fire in funerary rituals and the introduction of cremation in northern Europe? Can the use of fire be documented in other ritual contexts?

Case Study Bornhöved LA 117, near Segeberg

An apparently unique use of fire (thus far) as the illumination of a burial mound could be proven at Bornhöved, Segeberg. The burial mound was excavated in 2018 and showed numerous changes over a long period of time (Kneisel *et al.* 2022a; Kneisel *et al.* 2020). The actual mound fill was only 10 cm high and covered a central grave of the Late Neolithic (19th-18th century BCE). The burial pit was dug deep into the subsoil and contained an inhumation, of which the shadow of the body in a crouched position could still be vaguely recognised. The pit had presumably organic structures around the rim and large pieces of charcoal were found scattered throughout the grave fill. The burial mound itself was surrounded by a ditch, with a small gap to the northeast (Fig. 1). Different ditch depths and shapes prove that it was excavated and backfilled several times (Kneisel *et al.* submitted). At the end of Per. I (17th-16th century BCE), oak beams were laid in a ring on the (at the time) almost backfilled ditch and set alight in situ. The charred remains of moss and hazel indicate further constructions (possibly a wattle fence) which also went up in flames. The mound was evidently illuminated by the fire one night,[2] possibly in connection with another burial. The ditch was then covered with a pavement of cobble stones, while the gap in the northeast was retained. The most recent modification took place during the 14th century BCE, when a ring of posts was erected around the burial mound. The posts were fixed with stones in deep post holes. The last structural alteration in the Bronze Age was the subsequent burial of seven urns on the southeastern edge of the burial mound, which probably took place in the course of Per. V. Some cooking pits indicate further activity on the site in the Late Bronze Age (Kneisel *et al.*, in press).

The use of fire can therefore be detected in the first burial in the 19th-18th century BCE, followed by the illumination at the end of NBA I (1660-1510 cal BCE), in which the burial mound was surrounded by a ring of fire. In the later Bronze Age, fire plays a role both in the urn burials and in the cooking pits, although it is unclear whether the cremations took place on site.

Discussion

Early cremation in northern Europe

The cremation burials for Denmark and Schleswig-Holstein compiled by Stefanie Schaefer-Di Maida, Anja Endrigkeit, Kerstin Hofmann, Erwin Strahl, Jan Piet Brozio, Mogens Bo Henriksen, and Eva Hübner show

[2] See online exhibition: https://allesbleibtanders.com/en/modules/illumination/ [last access: 5th November 2024].

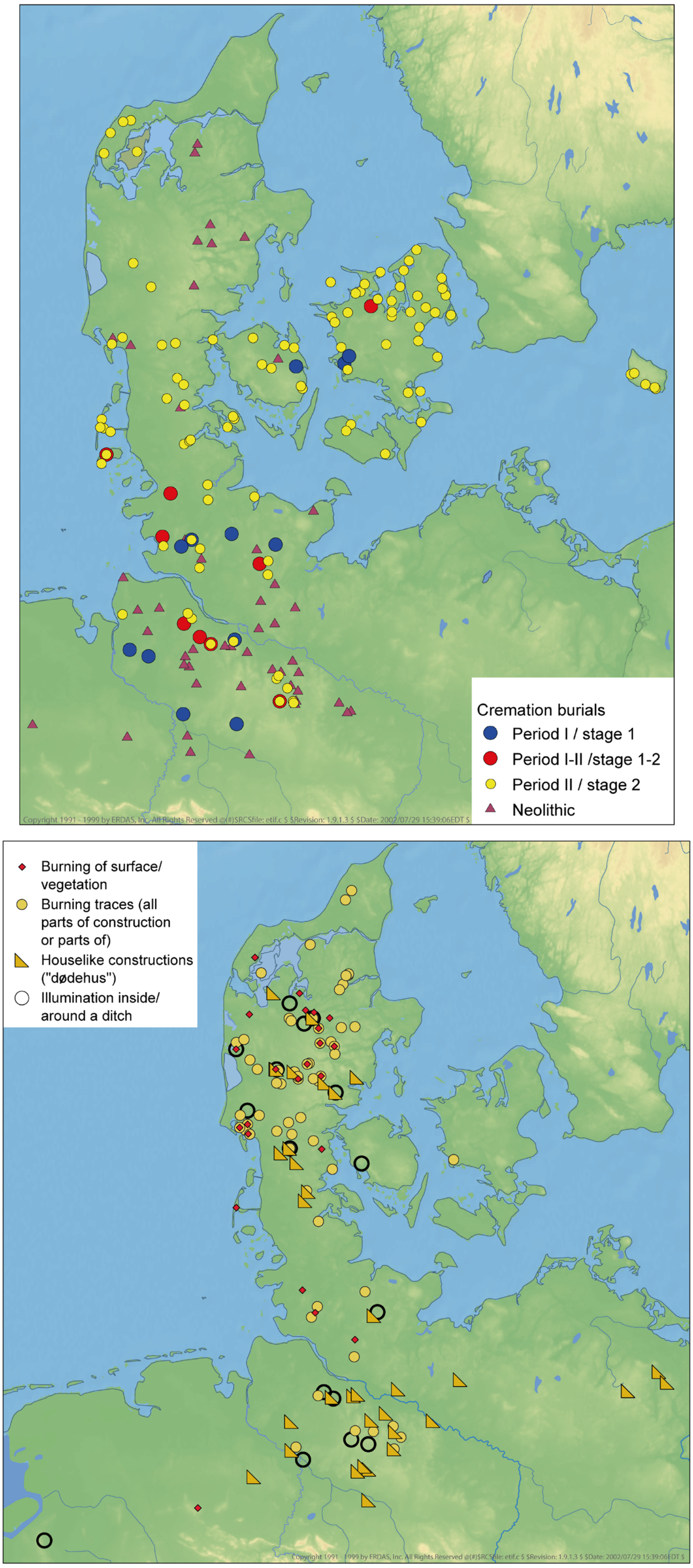


Figure 2: A) Distribution of early cremations in Denmark and northern Germany (based on Strahl 1990; Hübner 2005; Hofmann 2008; Brozio 2012; Endrigkeit 2014; Schaefer-Di Maida 2023). B) Distribution of burning events in grave context. For the Neolithic mainly, Jutland and northern Germany are mapped.

Table 1: Chronological table for southern Scandinavia and northern Germany (according to Vandkilde and Müller 2020, with additions for the Neolithic (in grey) according to Hübner 2005).

Neolithic	Earlier Neolithic		3600-2800 BCE
	Younger Neolithic	YN	2800-2350 BCE
	Late Younger Neolithic	YN 1/Phase 1 a-c	2850-2600 BCE
	Middle Younger Neolithic	YN 2/Phase 2 a -b	2600-2450 BCE
	Young Younger Neolithic	YN 3/Phase 3 a-b	2450-2250 BCE
	Late Neolithic I	LN I	2350-2000 BCE
	Late Neolithic II	LN II	2000-1700 BCE
	Nordic Bronze Age (NBA)	Period IA	1700-1600 BCE
Bronze Age	Nordic Bronze Age (NBA)	Period IB	1600-1500 BCE
	Nordic older Bronze Age (NBA)	Period II	1500-1300 BCE
	Nordic older Bronze Age (NBA)	Period III	1300-1100 BCE
	Nordic younger Bronze Age (NBA)	Period IV-VI	1100-500 BCE

that cremation burials already occurred in the younger Neolithic and Older Bronze Age and are by no means a phenomenon unique to the Late Bronze Age (Schaefer-Di Maida 2023; Endrigkeit 2014; Brozio 2012; Hofmann 2008; Hübner 2005; Strahl 1990). According to Hübner, sporadic cremations already happened in her Phase 3a of the Young Neolithic (Tab. 1); these were urn burials which occur exclusively in Schleswig-Holstein. The shallow-grave cemetery of Hamburg-Lohbrügge/Sande also dates to the late Young Neolithic (Hübner 2005: 395). Hübner presents almost 30 Neolithic finds from 17 sites, of which it is unclear in at least four cases whether the burnt bones were human or not (three of which were from the region of central Jutland (not mapped). According to Hübner, cremations increased on the Jutland Peninsula[3] in the early Late Neolithic (Hübner 2005: 597). For the Neolithic and early Bronze Age of northeast Lower Saxony, however, there is much debate as to which cremations can be dated with certainty and which cannot (see Strahl 1990: 279-280; Hofmann 2008: 166-169; Brozio 2012: 76). In the following, I rely mainly on Hofmann's catalogue (Hofmann 2008: 168, Fig. 50 catalogue A and list 17). In the Bronze Age, Period I or Level 1 according to Endrigkeit and Hofmann, there are a total of 13 cremations (Fig. 2A). They are documented in Lower Saxony (Bramstedt, Cuxhaven; Wardböhmen, Celle; Vahrendorf, Harburg; Vollersode, Osterholz; Weitzenmühlen, Verden: Geschwinde 2000; Hofmann 2008; Laux 1971), and Schleswig-Holstein (Tensfeld, Plön; Schülp and Hademarschen, Rendsburg-Eckernförde; Schafstedt, Dithmarschen; Aner *et al.* 1991: cat. no. 9226; Aner *et al.* 2017: cat. no. 9998; Kersten *et al.* 2005: cat. nos. 9644, 9707). There are also two burials with cremated bones from Zealand (Hemmeshøj and Slots Bjergby, Aner and Kersten 1976: cat. nos. 1130, 1152) and one from Fyn (Vindinge, Bo Henriksen 2016: cat. no. B1:12). There are five further examples from NBA I-II or Level 1-2 according to Endrigkeit (2014) in Schleswig-Holstein and on Zealand, and five more from Lower Saxony according to Hofmann (2008). The early cremation burials are mainly found on the west coast of Jutland. In NBA II, or Stage 2, according to Endrigkeit, there is a significant increase in the number of cremation burials (over 100) in Schleswig-Holstein, southern Denmark and on the Danish islands. In the region of central Jutland, on the other hand, cremations are missing, but for a few exceptions. For the Elbe-Weser-triangle and Luneburg Group, only six sites with NBA II cremations are reported (Hage 2012; Hofmann 2008). In north Jutland, there is a small group of cremation burials as well as on Bornholm. In NBA III, the number of cremations in the north increases further and densifies the picture. In Mecklenburg-Western Pomerania, early cremations are missing as well (even from the single grave period (Brozio 2012: 76, fig. 49) and are only documented there from NBA III onwards. (Endrigkeit 2014: 89). For Sweden, no systematic survey of cremations was undertaken for this present contribution. However, Lennart Lundborg assumes that cremations in Halland, southwest Sweden, did not begin until NBA III (Lundborg 1972: 120). In contrast, two early cremations are documented from eastern Skåne. One dated to NBA I-II from Fjälkinge and one dated to NBA II from Nymölla (Jennbert 1993:

[3] Hübner only collected material for Jutland, the Danish islands were not covered.

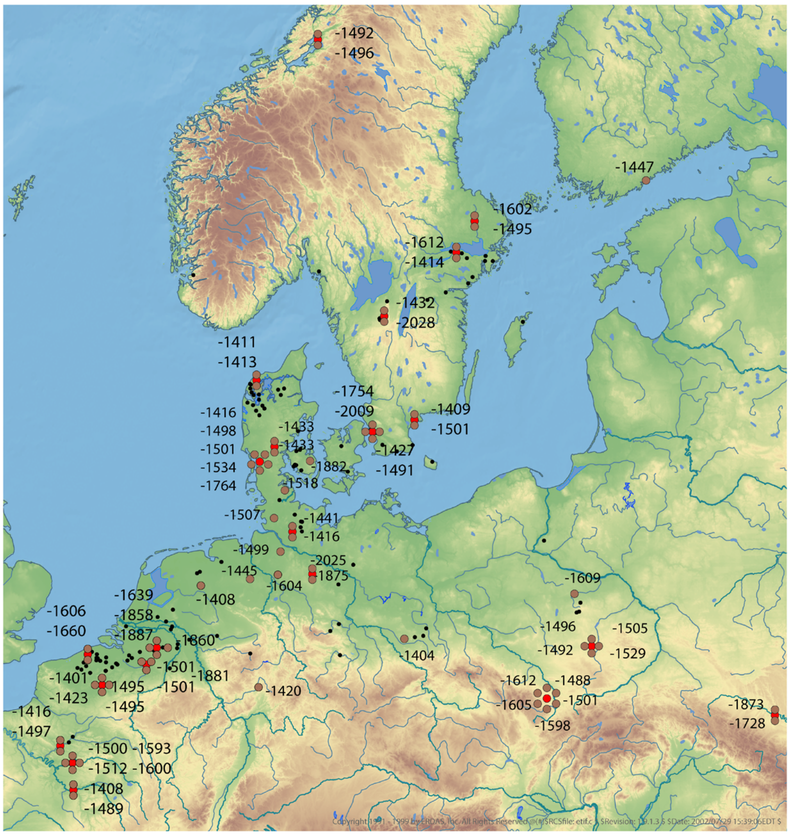


Figure 3: Red dots denote sites with [14]C-dated cremated bones within the range of 1 sigma 2010-1400 cal BCE (the given date indicates the beginning of the range); black dots denote other [14]C-dated cremations (map design: J. Kneisel, using QGIS and Oxcal software).

76, tab. V; Stjernqist 1993: 121). Here, too, however, the majority of cremation burials date to NBA III.

In general, an early group can be identified in northern Germany which used cremation from the late Young Neolithic to NBA II. In Denmark, on the other hand, the picture is more mixed. Neolithic cremations in Jutland are mainly found in the central part, while Bronze Age cremation burials only occur from NBA II onwards in the regions of northern Jutland and southern Denmark. This uneven distribution indicates different phenomena that influenced the selection of this type of burial.

The distribution of the typo-chronologically dated cremations can be supplemented by [14]C-dated cremation burials (Fig. 3). In addition to the data from the working area, Swedish and Polish data, as well as from Belgium and the Netherlands, are considered (De Reu *et al.* 2012; Kneisel *et al.* 2013). All sites with a start date in the 1 sigma range between 2010-1400 cal BCE are mapped. If we look at the early-dated cremation burials of northern Europe, the picture of the previous typo-chronological distribution is confirmed. Early data are available from Schleswig-Holstein and the west coast of Denmark. The shallow-grave cemetery at Lustrupholm is a rare find in a burial landscape otherwise dominated by barrows (Feveile and Bennike 2002; Heinemeyer and Rud 2000) and raises the question whether this type of burial is not found far too rarely. The early data from Sweden from Häljarps Mölla, Skåne, also come from a shallow-burial ground (Runcis 2005; Arcini and Svanberg 2005: 315) and show that early cremation burials can also be recorded when systematic dating is applied. From Fallbygden, a few posthumous burials were found in megalithic graves; further reburials from megalithic tombs come from Torbjörntorp (Blank 2021) and Dragby (Engstrand and Östlund 1962). However, an early cremation from the Late Bronze Age cemetery of Torshälla in Södermanland (Feldt 2005) comes from a conventional charcoal date and must therefore be viewed with caution. This also applies to the sample from Dragby, deriving from a layer below the grave (Engstrand and Östlund 1962: 130). The date from Vindinge, Fyn, belongs to a pit grave, and also here the charcoal (*Quercus*) seems to indicate an old wood effect and thus a date that might be too old (Bo Henriksen 2016: cat. no. B1:12). Two dates from the end of the 16th century BCE are available from Schleswig-Holstein: a cremation burial from Albersdorf and one from under a mound at Sörup (Schaefer-Di Maida 2023). From Lower Saxony there are three early dates from Ripdorf and Oldenstadt, both Uelzen and Weitzmühlen, Verden,

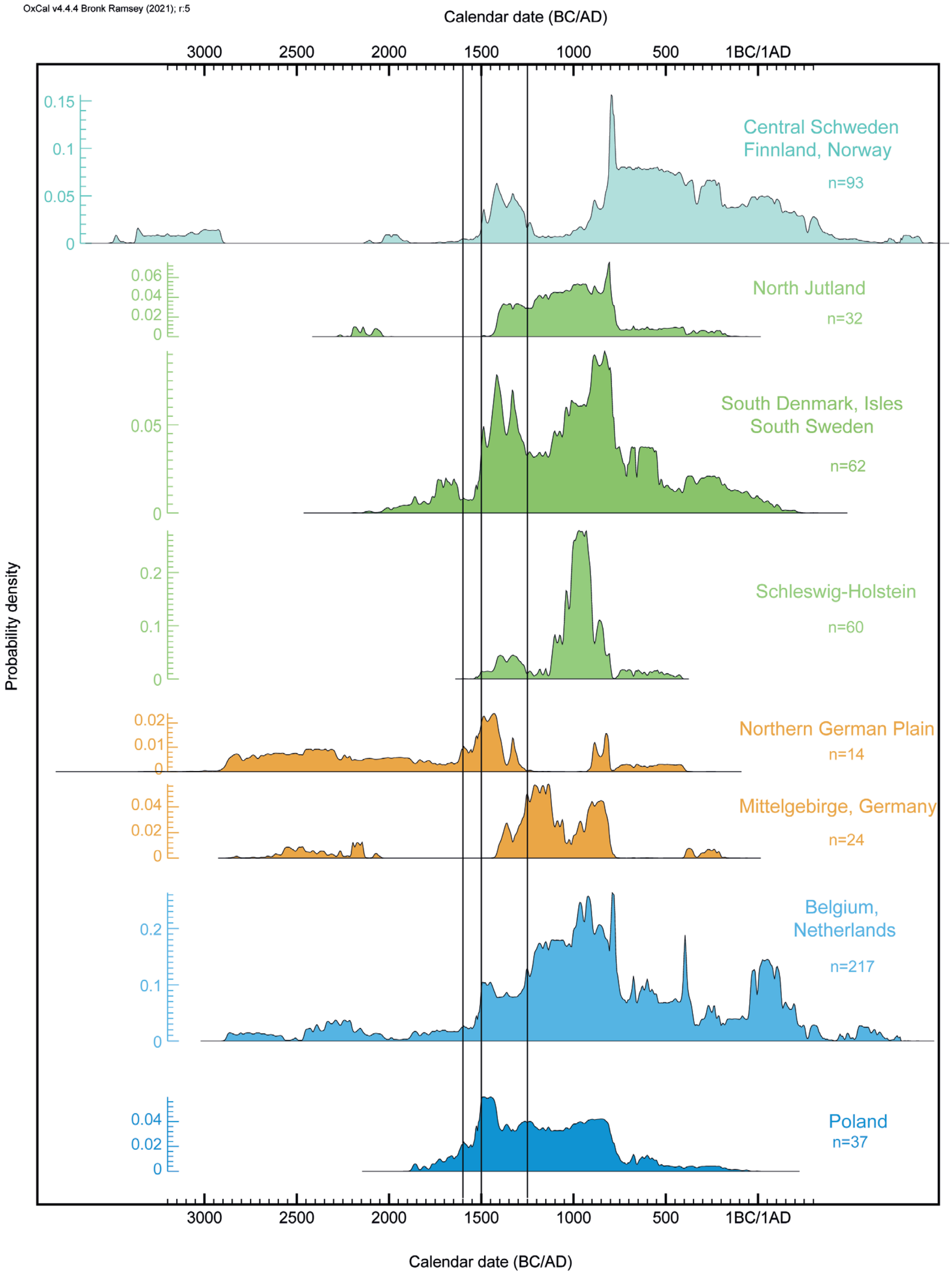


Figure 4: Sum-calibration of cremation in different regions of Europe (plot: J. Kneisel, using Oxcal software).

which are still counted as part of the Single Grave culture (Geschwinde 2000; Hofmann 2008: cat. no. A55). All other dates start in the 15th century BCE and, thus, lie in the middle of NBA II. They are distributed from the Netherlands to Norway and Finland.

The examples show that early cremation burials are recorded from time to time in regular data series. As the dating of cremations has long been a research desideratum, it can be assumed that further data from NBA II will be added in the future. Nevertheless, in these regions, inhumation burials remained dominant until NBA III. The ^{14}C dates extend the distribution pattern of early cremations and are consistent with the typo-chronological distribution for Denmark and northern Germany. The north Jutland dates are younger than in the Luneburg Group or the graves of southern Denmark. The regions to the west and southeast, on the other hand, show an earlier beginning of cremations (with the exception of Mecklenburg-Western Pomerania).

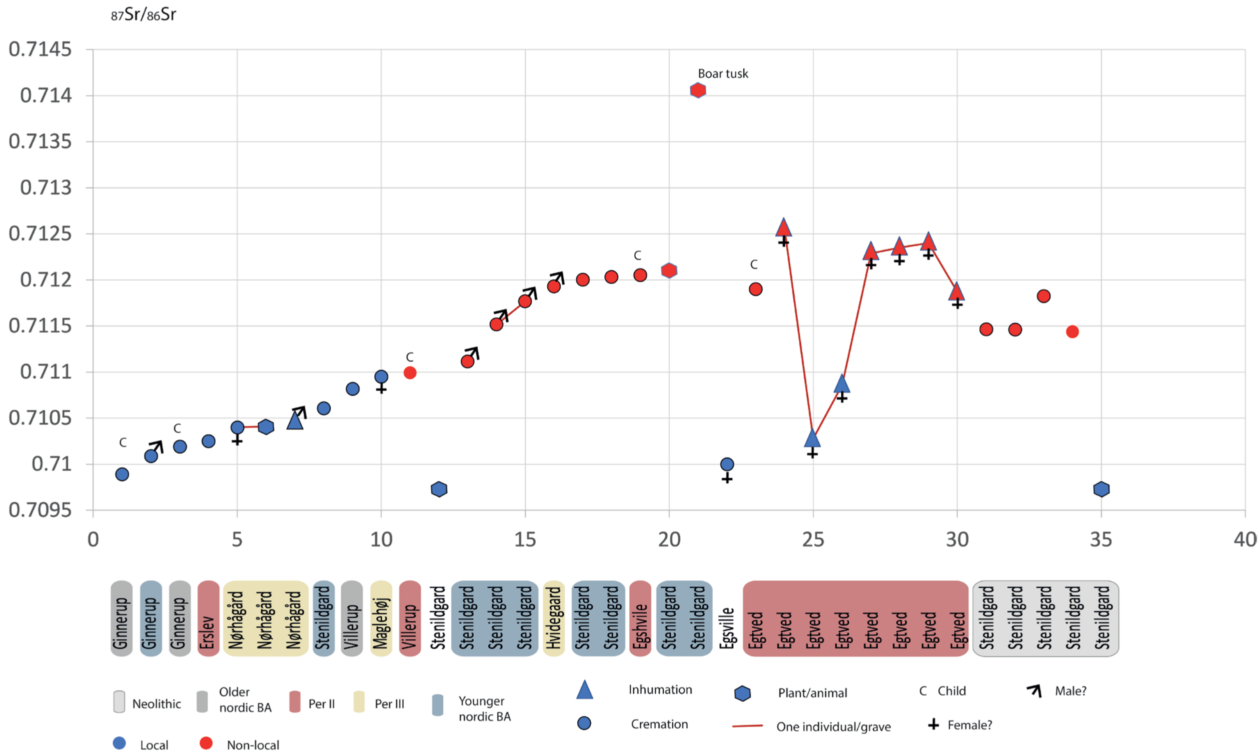


Figure 5: Strontium isotope analysis of cremation burials in Denmark (after Reiter *et al.* 2021; Nielsen *et al.* 2020; Frei *et al.* 2015).

In Belgium, data are already available from the 19th century BCE, but the majority are from the 17th-16th centuries BCE; the same applies to Poland.

Unfortunately, there is a lack of sufficient data material for cremations from central Germany, but the question arises as to whether the influence of Urnfield cultures really played such a strong role in the adoption of cremation burials, as we can already observe this in the north on a regular basis from the 15th century BCE. If we compare the percentage increase in cremations in the north from NBA II up to the Late Bronze Age with data from southern Germany, the introduction of cremation follows almost the same course as in southern Germany, where we can observe a continuous increase in cremations from the Bz C stage (1500-1300 BCE) up to the Ha A stage (1200-1050 BCE). Whether the same mechanisms are behind these changes cannot be answered with certainty (Falkenstein 2017: 84, fig.7).

There may also have been a fundamental western influence, as the early data from Belgium show. In Great Britain, cremation is also a Neolithic phenomenon (Willis 2019) that ends in the Bronze Age with the beginning of inhumation burials. It can be assumed that the early data from Belgium can be traced back to influences north of the English Channel. It is not only cremation in northern Europe that suggests a western connection, but also grave constructions, such as ditches and post circles, which are documented in both the Netherlands and Britain, and which are also found in our case study from Bornhöved, although not all of them are burnt (e.g. Harding and Healy 2007: 211; Needham and Anelay 2021; Freudenberg 2012: 631, fig. 9; De Reu 2012; Strahl 1990: 295, map 77).

The difference in the start of cremation is more apparent in the sum-calibration (Fig. 4). However, the data should be interpreted with caution as there is no comprehensive dating of cremations in all regions. Especially for the later Bronze Age, the sum-calibration loses its significance, as only occasional dating of cremations was carried out in this period. Nevertheless, the beginnings of the cremation process can be depicted quite well here. Individual cremations have existed since the Neolithic. In Belgium and Poland, we see an increase from 1500 BCE; in northern Germany, southern Denmark and Sweden the increase appeared shortly after 1500 BCE. In contrast, cremations in the German *Mittelgebirge* and northern Jutland only began later. While perhaps only due to the small selection of graves sampled, it is interesting to note the slight decline *c.* 1300 BCE and the gap until *c.* 1100 BCE (except for the *Mittelgebirge*, north Jutland, and Belgium). Only then does the classic Late Bronze Age with urn burials prevail. Are we possibly dealing with two different phases here, or does this pattern represent a trial-and-error process, as suggested by Sørensen and Rebay-Salisbury (2023)? As mentioned above, it is possible that we see two different spheres of influence here. On the one hand, there was the more recent adaptation of the urn burial custom and almost universal cremation custom; on the other there was an early phase of more intensive exchange, especially at the beginning of the Bronze Age and, thus, individual adaptations of a different burial rite. This may have come from England in the west, where we already have the predominant cremation burial custom in the Neolithic (e.g. Willis 2019). This would fit with the early data we know from Belgium and the Netherlands.

The strontium isotope analyses mentioned at the beginning allow us to look more closely at the spatial origin of the cremations. Of the 35 published dates from Denmark, five are Neolithic, 11 date to NBA II, two to NBA III, three generally to the Older Nordic Bronze Age, and nine to the Later Nordic Bronze Age (Fig. 5). Two more Late Bronze Age examples come from Sweden, although they were not included in the figure as the values from the Mälar region are much higher. However, the strontium isotope values from Sweden indicate a local origin of the cremated individuals (Zachrisson *et al.* 2022: 13). For Denmark, only a small number of analyses are available for the early cremations (Reiter *et al.* 2021; Nielsen *et al.* 2020; Frei *et al.* 2015). One non-local child burial from Egshvile stands in contrast to two local individuals. NBA III also contains one non-local, presumably male, burial from Hvidegård and four local individuals. From the Neolithic, on the other hand, although only from one site (Stenildgård), all four cremated individuals are non-local (Nielsen *et al.* 2020). The data from Schleswig-Holstein, which will be presented soon, also include early non-local cremations of children (Schaefer-Di Maida, in prep.). The total number of observed cases is very small, yet raises interesting questions. Are Neolithic cremation burials graves of non-local populations? And are the early cremations (the first peak before the final shift to urn burials) linked to possibly non-local children?

In summary, three results can be identified for the cremations. First, the possible adaptation of early cremation burial from the west; second, the almost simultaneous slow introduction of cremation from 1500 BCE, as can also be seen in southern Germany; and third, the possible separation of the use or introduction of cremation in two separate phases: the first at the beginning of the Early Bronze Age, the latter in the course of NBA II-III, possibly linked to different social groups and adoption processes.

Burning Constructions

Fire clearing, burning of the base

Fire clearing or burning of the base of the burial mound leaves traces that can occasionally be found in Neolithic and Older Bronze Age contexts (Hübner 2005: 473; Holst 2013: 72; Endrigkeit 2014: 105). There exists also evidence from the Tumulus culture further south (Görner 2002: 93). For the Younger Neolithic, Hübner lists 23 sites in Jutland where there is evidence of vegetation burning. The distribution is mainly in the region of central and northern Jutland, with a few finds from southwestern Schleswig-Holstein (Fig. 2B). The ^{14}C data from the Lustrup Huse mound, from the red-burnt layer below the mound fill (K-3003 4180±85 BP, Hübner 2005: cat. no. 973-3), dates from 2887-2635 cal BCE and thus to the oldest phase of the Young Neolithic. No data collections are available for the Bronze Age, but burning is also mentioned there (Holst 2013: 72; Endrigkeit 2014: 105). This custom can also be observed in southern Sweden (Lundborg 1972). Depending on the vegetation, however, it will not be a blazing fire, as small flames and swelling fires with larger smoke development are more likely for the targeted burning, which should take place in a controlled manner.

Houses of the dead and constructions in fire

In contrast, the burning of wooden structures and buildings must have been much more visually impressive. A whole series of different examples can be found here.

Mortuary chambers (so called *dødehus* or *Totenhütte*) are documented from various periods and have also been found in northern Europe from the Younger Neolithic to the Bronze Age (Fig. 2B). They vary in design and construction and are occasionally burnt down and covered by a barrow (Hübner 2005: 552-556). For the Younger Neolithic, submerged and above-ground structures are known, containing either cremations or inhumations. There is only occasional evidence of deliberate burning: clear evidence can be found in Skarrild Mose (Hübner 2005: cat. no. 982-1) and Torp, Håsum sogn (Hübner 2005: cat. no. 480). At Skarrild, traces of long wooden planks (2.0 m in length) and of a fence or roof structure were excavated, which had been partially burnt down before the mound was erected. In Torp, on the other hand, there were clear charcoal layers above the grave. Together with a chain of kerbstones and two post pits, they may be evidence of a burnt house-like construction. Although mortuary structures are also known from the later Young Neolithic and the Dagger Period in the working area, there are no traces of burning found (e.g. Ethelberg 1982; Jørgensen 1984). In the Bronze Age, too, we occasionally find such mortuary structures or cult buildings (Nielsen and Bech 2004), but fire plays no role here either. In Hüsby, Schleswig-Flensburg, the burning of a house on the edge of a mound was observed, although this was not directly related to the burial (Freudenberg 2012). In the southern peripheral zone of the Nordic Circle, mortuary houses are also found in the Bronze Age and they are also rather an exception to the regular burial custom. They are found in the Luneburg Group (Busch 1996; Hage 2012) and Mecklenburg-Western Pomerania (Schmidt 2007; Christmann and Selent 2014). In the Luneburg Group, the burning of the wooden structure under which cremation burials are located can be observed throughout, while in Mecklenburg-Western Pomerania and Jutland, both unburnt and burnt structures exist side by side. But it is not always easy to distinguish between a burnt construction and the burning of the post for better preservation, as in the case of Warsow, Ludwigslust-Parchim district (Christmann and Selent 2014). The northern German mortuary chambers differ from the northern structures to the extent that they are always associated with a cremation, even if the structure itself was not burnt to the ground. In the Luneburg Area, this custom can already be observed from NBA I onwards and several times in Period II, with one (or possibly two) exceptions, the burials are associated with children or women (Busch 1996: 420; Christmann and Selent 2014: 144).

The burning of the so-called mortuary houses or wooden chambers and protrusions above the grave is certainly an essential part of the burial ritual. After the cremation, which was sometimes only carried out when the house or the rising structure burned down, the mound was erected. The deceased was then no longer visible as a person. The transformation of the body by fire involved not only the body itself, but also the entire space or room in which the deceased lay. Ralf Busch's analyses (1996) also show that we are probably dealing with a specific social group that was buried in these structures.

Illumination of the grave

Another aspect of the fire in the burial ritual is the illumination of the mound. The Bornhöved case study mentioned above clearly shows a charred layer of beams lying on the almost backfilled ditch, which was set on fire on site, as shown by some red colourations of the underlying soil layers. Smaller branches and moss indicate further constructions, possibly a fence (Kneisel *et al.* 2022a).

In the Younger Neolithic, charcoal layers can often be observed around the grave. At two sites, burnt layers were ascribed to the burning of fences or wooden constructions (Hübner 2005: 494). Eva Hübner cites further parallels from phase 1b of the Single Grave period (2800-2700 BCE), i.e. the primary grave of Trehuse, amt Viborg. Charcoal from branches and twigs were found in a charred area measuring 3.5 m x 0.3 m. A circle 20 m in diameter with lots of charcoal was found at Tinghøj in Ribe. Burnt wattle or brushwood fences were documented from the Late Neolithic site of Heber, Soltau-Fallingbostel, Lower Saxony. Burnt post settings and traces of burning in circular ditches have also been documented (Hübner 2005: 494). The evidence of charcoal filling in circular ditches also points to a fire event that engulfed the burial mound in flames, as has been documented for Skarrild Mose, Ringkøbing and Tastum, Viborg (Hübner 2005: cat. no. 998, 1500-2). At the Late Neolithic site of Große Heide near Ripdorf, Lower Saxony, all but one of the mounds with circular ditches show signs of burning, in some cases extensive layers of burning (Geschwinde 2000: 76). In the Bronze Age, however, such evidence is rare. From the Late Bronze Age, the example from Lusehøj, Fyn, shows that here too the wattle enclosure around the grave was burnt down on site (Thrane 1984).

However, this phenomenon is not limited to northern Europe. Burnt horizons are also documented for the Late Neolithic and Early Bronze Age in Hesse. This is also the case at the mound of Großenhausen, Gelnhausen, which also has a circular ditch (Gebers 1984: 76 cat. no. 270). The frequently occurring fire remains in the area of the burial mound consist of ash, charcoal, and charred branches above the skeleton or fire layers in the grave filling (Gebers 1984: 85). Burnt layers in the mounds are likewise documented from Corded Ware contexts (Bach *et al.* 1975: 54; Feustel *et al.* 1966: 73).

Charred beams are also known from cremation burials in the Netherlands. In the Apeldoorn-Wieselseweg cemetery, two of the mounds each contained a grave with charred beams placed on top (barrow 2, grave 8; barrow 3, grave 12), with the cremated remains lying separately in a pit below. The excavators interpreted this as pyre remains, which were added to the burial as a kind of grave good (Louwen and Fontijn 2019; 117, 141, figs. 8.18, 9.18), just as similar findings in Great Britain have been interpreted (Harding and Healy 2007: 162). In connection with the above examples, however, an interpretation as the burning of a grave construction is also possible. The two graves from the Netherlands date to the transition to NBA II and are thus contemporaneous with the fire event in Bornhöved LA 117. In general, such fire horizons are rarely observed. The Late Neolithic mound at Heber, or the sites in northern Hesse, offer a further parallel to the burnt beams (Gebers 1984; Hübner 2005: 494).

It is often difficult to distinguish between individual burnt horizons in the barrow excavation reports. These horizons indicate the burning of vegetation, the burning of pit interiors or chambers, the construction of mortuary chambers, and/or the illumination of the ditch. Some features are unambiguous, others can be assigned to different groups. Usually, there is also a lack of chronological information on the interval between

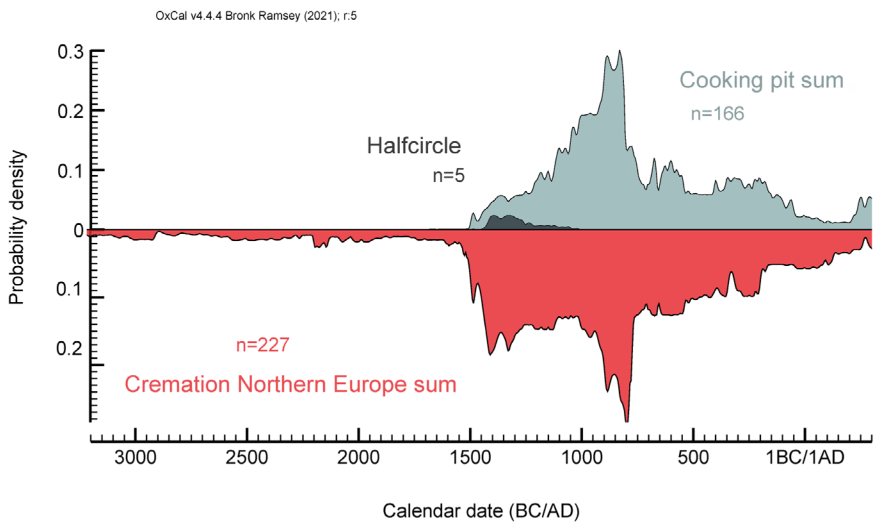


Figure 6: Sum-calibration of northern European cremation burials and cooking pits (graph/calculation: J. Kneisel, with Oxcal software).

the burial, the final burning and the construction of a mound over the burnt remains. At Bornhöved, there were almost 200 years between the first burial and the illumination, including several ditch excavations and backfill layers. Hübner's catalogue for Jutland documents several examples of this in the Younger Neolithic, whereas they seem rather rare in the Bronze Age (Hübner 2005: 487). The distribution map (Fig. 2B), therefore, summarises the different types of evidence of fires in graves. While the Jutland evidence dates mainly to the Younger Neolithic, with a few more recent examples from southern Jutland, the circular graves and mortuary houses in Lower Saxony and Mecklenburg-Western Pomerania are more likely to be Bronze Age. It can be assumed that the Bornhöved barrow with its illumination is part of a Neolithic tradition, in which fire generally played an active role in burial rites, but in a Bronze Age context, and also in connection with the circular ditches and post enclosures (without fire), it is more likely to be seen in a western tradition (Kneisel *et al.*, submitted; De Reu 2012; Strahl 295: map 77).

The examples show that fire is used in burial rituals in very different ways – not only to burn corpses. The burning of the mortuary chamber involves a similar transformation process to the burning of a corpse on a funeral pyre. In both cases, the corpse is consigned to the fire. The former is structurally more complex than a funeral pyre, but forms a certain conclusion which is only followed by the erection of the mound (in most cases). The latter, on the other hand, involves further treatment of the deceased, such as collecting the remains and depositing them, digging the grave, etc., which represent many further steps within the ritual act of a funeral. Only then can the burial, the grave goods and the construction of the mound begin. The fire, thus, marks more the beginning than the end of the funeral. When examining the often very different uses of fire in the Neolithic context, it becomes clear that there is no obvious standardisation of the use of fire. It takes place in the burial pits or in the ditches or on the mound itself. There are isolated traces of fire in parts of the ditch or directly outside it. In contrast to the later Bronze Age, however, there appears to be a clear temporal difference within the *chaîne opératoire* of the funeral.

Cooking stone pits

Let us leave the burials behind and turn to another aspect of the use of fire in the Bronze Age: the cooking stone pits. They probably have little to do with burial customs, even though they are often found in the vicinity of burial mounds (Kneisel *et al.* 2022b, c). The phenomenon of cooking stone pits occurs during NBA II and extends into the Late Iron Age in northern Europe. They are roughly contemporaneous with the burnt offering sites of the Alpine region (e.g. Steiner 2010; Töchterle *et al.* 2018) and are not a purely northern European phenomenon, as evidenced by sites from France, Poland and southern Germany (Honeck 2018). In the context of this present contribution, the beginning of the cooking stone pits is of particular interest.

If one compares the beginning of cremation burials in northern Europe with the onset of the early cooking stone pits, it is noticeable that both begin at about the same time, even if the actual peak of the cooking stone pits lies after 1000 BCE (Fig. 6). Within the general phenomenon of cooking stone pits, various types can be distinguished, from unregulated distribution of the pits to rows and rectangular structures. The semi-circular shape is documented particularly early in Schleswig-Holstein (Schaefer-Di Maida 2023), while the creation of several parallel rows – so-called 'belts' – is a more recent development, with a peak after 500 BCE (Kneisel *et al.* 2022c). Nevertheless, early sites, e.g. Mang de Bargen, are documented from southern Schleswig-Holstein. Is this a coincidence and can the two different phenomena of cooking stone pits and fire in the grave context be compared at all? On the one hand is the treatment and transformation of the deceased by fire; on the other, we counterbalance with the preparation of food in places of communal gathering and celebration. Both practices can be located in the ritual sphere, take place outside the settlements, and both characterise the Bronze Age landscape (as mounds, as rows, or as short-term fire activity away from the settlement area).

Conclusion

This chapter has been an attempt to shed light on the use of fire in the ritual sphere between the Younger Neolithic and the Bronze Age. Early cremations, the burning of grave constructions, mortuary chambers, the illumination of burial mounds, and cooking stone pits have been considered. Despite all the differences, fire seems to have played an important role in ritual events as early as the Neolithic, not only in cremations, but also in burial rituals in general, the burning of constructions and their subsequent covering with mounds. However, neither the distribution nor the chronology can be directly linked to the widespread introduction of cremation burial in the Late Bronze Age. Rather, there are some indications that we are dealing with different traditions. Especially the early peak *c.* 1500 BCE points most probably to a different provenance than the Urnfield tradition. Either we are dealing with an experimental phase that stands in the context of western tradition and is possibly limited to a specific social group, which also includes non-local individuals and children or, alternatively, local Neolithic traditions were adopted or followed. The second increase after 1100 BCE – when cremation burial finally becomes established – can be observed throughout Europe and marks the beginning of the widespread urn grave custom. In addition to this two-stage introduction of cremation burial, western connections are particularly evident, which can be seen not only in the early cremation burials of Belgium and the Netherlands, but also in the unusual grave constructions, i.e. the post circles and ditches documented in the Bornhöved case study. At Bornhöved, despite constant changes over 600 years, the entrance area in the NE was retained until the most recent construction phase; this possibly indicates an adoption of local traditions from the end of the Neolithic to NBA III.

With the introduction of cremation burial from 1500 BCE in northern Europe, we suddenly also encounter cooking stone pits. These are placed near older barrows (at least in Jutland and Schleswig-Holstein, not so in Mecklenburg-Western Pomerania) which regularly combine fire and outdoor gatherings outside the actual settlements. Fire was, therefore, used in a variety of rituals in the Nordic Older Bronze Age, and not only there, as burnt offering sites can be traced in southern Germany and the Alpine region at the same time. There, too, fire served as a visible sign, the glow of which shone from hilltops at night and the smoke of which could also be seen from afar during the day.

In conclusion, it can be stated that the changes in the burial system at the beginning of the Nordic Bronze Age were preceded by an experimental phase, which in part shows similarities to the Neolithic burial custom and in part points to western influences. Fire played an important role in this. Furthermore, the introduction of cremation and urn burial, which is prevalent in the later Bronze Age, does not appear to start much later than in the south, which argues against a slow spread of the idea of the Urnfield culture to the north.

Only limited conclusions can be drawn in terms of the introduction of cremation burials and the use of fire in burial rituals on the basis of old excavations and a few new ones. In the near future, computer-supported analyses will make it possible to process the mass of data hidden in the excavation reports and catalogues in order to make large-scale comparisons. With the new possibilities for analysing cremated bones, it will certainly be easier in future to pursue the theories put forward here and to find explanatory patterns for the different spread of burial types.

Acknowledgements

This article is based on a collaboration between the sub-cluster D3 of the CRC 1266, funded by the German Research Foundation (DFG – project number 2901391021-SFB 1266) and the German Excellence Strategy ROOTS sub-cluster 3 'Knowledge' (EXC-2150 – 390870439).

Bibliography

Aner, E. and K. Kersten 1976. *Holbaek, Sorø und Praestø Amter*. København/Neumünster: Verlag Nationalmuseum København.

Aner, E. and K. Kersten 1979. *Südschleswig-West. Nordfriesland*. København/Neumünster: Verlag Nationalmuseum København.

Aner, E., K. Kersten and K.-H. Willroth 2017. *Kreise Plön und Ostholstein und die kreisfreie Hansestadt Lübeck*. Neumünster: Wachholtz.

Aner, E., K. Kersten, K.-H. Willroth and H.-H. Steen 1991. *Dithmarschen*. Neumünster: Wachholtz.

Arcini, C. and F. Svanberg 2005. Den yngre bronsålderns brandgravsmiljöer, in P. Lagerås and B. Strömberg, (eds) *Bronsåldersbygd 2300-500 f Kr.*

Skånska spår – arkeologi längs Västkustbanan. Lund: Riksantikvarieämbetet.

Bach, A., H. Bach, W. Gall, R. Feustel and M. Teichert 1975. Beiträge zur Kultur und Anthropologie der mitteldeutschen Schnurkeramiker II. *Alt-Thüringen* 13: 43-107.

Bech, J.-H. and M. Rasmussen 2018. Thy and the outside world in the Bronze Age. Regional variations in a North Sea perspective, in J.H. Bech, B.V. Eriksen and K. Kristiansen (eds) *Bronze Age Settlement and Land-Use in Thy, Northwest Denmark*. Højbjerg: Jutland Archaeological Society.

Blank, M. 2021. Burning the dead: Human bones subjected to fire in southwestern Swedish megalithic grave. *Journal of Neolithic Archaeology* 23: 29-60 (available at: https://doi.org/10.12766/jna.2021.2).

Bo Henriksen, M. 2016. Bålets betydning. Ligbrænding i Danmarks oldtid belyst ved arkæologiske fund og ligbrændingseksperimenter. Unpublished PhD dissertation, University of Copenhagen.

Brozio, J.P. 2012. Bestattungen der Einzelgrabkultur an der Ilmenau (Nordostniedersachsen), in J.P. Brozio and F. Hage, (eds) *Zwei Studien zu den neolithischen und bronzezeitlichen Grabanlagen der Lüneburger Heide*. Rahden/Westf.: Leidorf.

Brunke, H., E. Bukowiecki, E. Cancik-Kirschbaum, R. Eichmann, M.V. Van Ess, A. Gass, M. Gussone, S. Hageneuer, S. Hansen, W. Kogge, J. May, H. Parzinger, O. Pedersén, D. Sack, F. Schopper, U. Wulf-Rheidt and H. Ziemssen 2016. Thinking Big. Research in Monumental Constructions in Antiquity, in G. Graßhoff and M. Meyer (eds) *Space and Knowledge*. Topoi Research Group Articles. Berlin: Exzellenzcluster 264 Topoi (available at: https://edition-topoi.org/publications/details/942).

Busch, R. 1996. Häuser für die Toten. Die Rekonstruktion des Totenhauses der älteren Bronzezeit von Sottdorf, Gde. Rosengarten, Lkr. Harburg, in G. Wegner (ed.) *Leben, Glauben, Sterben vor 3000 Jahren: Bronzezeit in Niedersachsen*. Ausstellung zur Bronzezeit-Kampagne des Europarates. Hannover, Niedersächs. Landesmuseum, 13. Dez. 1996 bis 31. März 1997, u.s.w. Hannover: Isensee.

Chochorowski, J. 2007. Metodyczne i metodologiczne problemy datowania radiowęglowego pozostałości kremacji z grobów ciałopalnych kultury łużyckiej (na przykładzie materiałów z czmentarzyska w Kietrzu), in J. Chochorowski (ed.) *Studia nad epoką brązu I wczesną epoką żelaza w Europie. Festschrift Marek Gedl*. Kraków: Uniwersytetu Jagielloński.

Christensen, T. 2018. *Arkæologisk undersøgelse ved Ledreborg Golfbane*. ROMU 2290 (available at https://romu.dk/wp-content/uploads/sites/21/2018/07/Ledreborg-Golfbane.pdf).

Christmann, E. and A. Selent 2014. Das Haus für die Toten – Ein außergewöhnlicher Bestattungsplatz der älteren Bronzezeit bei Warsow, Lkr. Ludwigslust-Parchim, in D. Jantzen, L. Saalow and J.P. Schmidt (eds) *Pipeline Archäologie. Ausgrabungen auf den großen Ferngastrassen in Mecklenburg-Vorpommern*: 141-144. Schwerin: Landesamt für Kultur und Denkmalpflege Mecklenburg-Vorpommern.

De Mulder, G., M. Van Strydonck and W. De Clercq 2013. 14c dating of 'Brandgrubengräber' from the Bronze Age to the Roman Period in Western Flanders (Belgium). *Radiocarbon* 55: 1233-1245.

De Reu, J. 2012. *Land of the Dead. A comprehensive study of the Bronze Age burial landscape in north-western Belgium*. Gent: Universiteit Gent (available at: http://hdl.handle.net/1854/LU-4337096).

De Reu, J., G. De Mulder, M. Van Strydonck, M. Boudin and J. Bourgeois 2012. 14C Dates and Spatial Statistics: Modeling Intrasite Spatial Dynamics of Urnfield Cemeteries in Belgium Using Case Study of Destelbergen Cemetery. *Radiocarbon* 54: 635-648.

Endrigkeit, A. 2014. *Älter- und mittelbronzezeitliche Bestattungen zwischen Nordischem Kreis und süddeutscher Hügelgräberkultur. Gesellschaftsstrukturen und kulturhistorische Beziehungen*. Bonn: Rudolf Habelt GmbH (available at: https://www.monument.ufg.uni-kiel.de/fileadmin/projekte/common/fmsd6/FMSD_06.pdf).

Engstrand, L. and H.G. Östlund 1962. Stockholm Natural Radiocarbon Measurements IV. *Radiocarbon* 4: 115-136.

Ethelberg, P. 1982. Gravens traditioner. *Skalk* 1982/6: 10-15.

Falkenstein, F. 2017. Zum Wandel der Bestattungssitten von der Hügelgräber- zur Urnenfelderkultur in Süddeutschland, in D. Brandherm and B. Nessel (eds) *Phasenübergänge und Umbrüche im bronzezeitlichen Europa Beiträge zur Sitzung der Arbeitsgemeinschaft Bronzezeit auf der 80. Jahrestagung des Nordwestdeutschen Verbandes für Altertumsforschung*. Bonn: Rudolf Habelt.

Feldt, B. 2005. *Synligy och osynliga Gränser. Förändringar i gravritualen under yngre bronsålder i Södermanland*. Stockholm: Stockholm Universitet.

Feustel, R., H. Bach, W. Gall and M. Teichert 1966. Beiträge zur Kultur und Anthropologie der mitteldeutschen Schnurkeramiker. *Alt-Thüringen* 8: 20-170.

Feveile, C. and P. Bennike 2002. Lundstrupholm. Et brandgravfelt fra ældre bronzealder under flad mark. *Kuml* 51: 109-141.

Fokkens, H. 1997. The genesis of urnfields. Economic crisis or ideological change? *Antiquity* 71: 360-372.

Frei, K.M., U. Mannering, K. Kristiansen, M.E. Allentoft, A.S. Wilson, I. Skals, S. Tridico, M.-L. Nosch, M.-L. Willerslev, L. Clarke and P. Frei 2015. Tracing the dynamic life story of a Bronze Age Female. *Nature* 5, 10431: 1-4 (available at: https://www.nature.com/articles/srep10431).

Frei, K.M., C. Villa, M.L. Jørkov, M. Allentoft, F. Kaul, P. Ethelberg, S.S. Reiter, A.S. Wilson, M. Taube, J. Olsen,

N. Lynnerup, E. Willerslev, K. Kristiansen and R. Frei 2017. A Matter of Months. High Precision Migration Chronology of a Bronze Age Female. *PLoS ONE* 12: 1-20 (available at: https://doi.org/10.1371/journal.pone.0178834).

Freudenberg, M. 2012. Grab und Kultanlage der älteren Bronzezeit von Hüsby, Kreis Schleswig-Flensburg – rituelle Landschaft oder eine Demonstration der Macht am Verbindungsweg zwischen Jütischer Halbinsel und Norddeutschland?, in D. Bérenger, J. Bourgeois, M. Talon and S. Wirth (eds) *Gräberlandschaften der Bronzezeit. Internationales Kolloquium zur Bronzezeit. 15.-18. Okt. 2008 in Herne*: 619-639. Darmstadt: Verlag Philipp von Zabern.

Gebers, W. 1984. *Endneolithikum und Frühbronzezeit im Mittelrheingebiet*. Bonn: Rudolf Habelt.

Geschwinde, M. 2000. *Die Hügelgräber auf der großen Heide bei Ripdorf im Landkreis Uelzen. Archäologische Beobachtungen zu den Bestattungssitten des Spätneolithikums und der Bronzezeit in der Lüneburger Heide*. Neumünster: Wachholtz.

Görner, I. 2002. *Bestattungssitten der Hügelgräberbronzezeit in Nord- und Osthessen*. Rahden/Westf.: Verlag Marie Leidorf GmbH.

Gustavsen, L., R.J.S. Cannell, E. Nau, C. Tonning, I. Trinks, M. Kristiansen, M. Gabler, K. Paasche, T. Gansum, A. Hinterleitner, V. Poscetti and W. Neubauer 2018. Archaeological prospection of a specialized cooking-pit site at Lunde in Vestfold, Norway. *Archaeological Prospection* 25: 17-31 (available at: https://doi.org/10.1002/arp.1589).

Hage, F. 2012. Exkurs zu den Totenhäusern der älteren und mittleren Bronzezeit und die Einordnung des Befundes Wittenwater, in J.P. Brozio and F. Hage (eds) *Zwei Studien zu den neolithischen und bronzezeitlichen Grabanlagen der Lüneburger Heide*. Rahden/Westf.: Verlag Marie Leidorf GmbH.

Harding, J. and F.M. Healy 2007. *A Neolithic and Bronze Age Landscape in Northamptonshire*: Volume 1 – The Raunds Area Project. Oxford: English Heritage.

Heinemeyer, J. and N. Rud 2000. AMS 14C dateringer Köbenhavn 2000. *Arkæologiske udgravninger i Danmark* (2000): 313-328.

Hofmann, K.P. 2008. *Der rituelle Umgang mit dem Tod. Untersuchungen zu bronze- und früheisenzeitlichen Brandbestattungen im Elbe-Weser-Dreieck*. Oldenburg: Stade.

Holst, M.K. 2013. South Scandinavian Early Bronze Age barrows – a survey, in M.K. Holst and M. Rasmussen (eds) *Skelhøj and the Bronze Age Barrows of Southern Scandinavia*: *Vol. I. The Bronze Age barrow tradition and the excavation of Skelhøj. Højbjerg*: 27-128. Jutland Archaeological Society/Aarhus University Press.

Holst, M.K. and M. Rasmussen 2013. *Skelhøj and the Bronze Age Barrows of Southern Scandinavia.: Vol. I. The Bronze Age barrow tradition and the excavation of Skelhøj*. Højbjerg: Jutland Archaeological Society/Aarhus University Press.

Honeck, M. 2018. Gargruben, Götter und Gelage. Zur Deutung und Kontextualisierung bronze- und eisenzeitlicher Brenngruben, in K.-H. Willroth (ed.) *Elemente bronzezeitlicher Siedlungslandschaften. Beiträge des Workshops vom 9.-10. November 2018 in Rendsburg*. Neumünster: Wachholtz.

Hübner, E. 2005. *Jungneolithische Gräber auf der Jütischen Halbinsel. Typologische und chronologische Studien zur Einzelgrabkultur*. København: Det Kongelige Nordiske Oldskriftselskab.

Jennbert, K. 1993. Släkters hågkomst. Om bruket av bronsåldershögar, in L. Larsson (ed.) *Bronsålderns gravhögar. Rapport från ett symposium i Lund 15.11-16.11.1991*. Lund: Arkeologiska Institutionen och Historika Museet.

Jørgensen, E. 1984. To gravhøje fra Hjordkær i Sønderjylland. Om særprægede senneolitiske gravanlæg. *Kuml* (1984): 155-190.

Kersten, K., K.-H. Willroth and E. Aner 2005. *Kreis Rendsburg-Eckernförde (südlich des Nord-Ostsee-Kanals) und die kreisfreien Städte Kiel und Neumünster*. Neumünster: Wachholtz.

Kneisel, J. 2022. Illuminiertes Bornhöved – eine außergewöhnliche Hügelkonstruktion der Bronzezeit. *Archäologie in Schleswig* 19 (2022a): 223-239.

Kneisel, J., C. Damm, B.V. Eriksen, A. Schwab and G. Schwedler (eds) (in press). *Lost Knowledge. Studies in transmission, translation and discontinuities from prehistory until the renaissance*. Leiden: Sidestone.

Kneisel, J., M. Hinz and C. Rinne 2013. *Radon-B* (available at: http://radon-b.ufg.uni-kiel.de/).

Kneisel, J., A. Loy, O. Nakoinz and S. Schaefer-Di Maida 2024. Konfliktvermeidung und Konfliktbeilegung in der Südzone des nordischen Kreises und Polen, in M. Jung, M. (ed.) *Konfliktvermeidung und Konfliktbeilegung in Gesellschaften ohne Zentralgewalt*. Würzburg: Würzburg University Press (available at: https://doi.org/10.25972/WUP-978-3-95826-241-6-443).

Kneisel, J., O. Nakoinz and I. Beilke-Voigt 2022b. Interpreting Bronze and Iron Age enclosed spaces, fortifications and boundaries in the western Baltic, in F. Nikulka, D. Hofmann and R. Schumann (eds) *The Baltic in the Bronze Age. Regional patterns, interactions and boundaries*. Leiden: Sidestone (available at: https://www.sidestone.com/books/the-baltic-in-the-bronze-age).

Kneisel, J., L. Rose and S. Schaefer-Di Maida 2022c. Den Boden durchleuchtet – Magnetische Untersuchungen von Feuergruben in Norddeutschland. *Archäologie in Deutschland* 4: 28-31.

Kneisel, J., S. Schaefer-Di Maida, S. Dreibrodt, I. Feeser and D. Filipović 2020. Mang de Bargen – Bornhöved. Bronzezeitliche Gräberlandschaft und eine ungewöhnliche Hügelkonstruktion. *Archäologische Nachrichten aus Schleswig-Holstein* (2020): 92-93.

Kneisel, J., S. Schaefer-Di Maida, I. Feeser, S. Dreibrodt and D. Filipović (submitted). Leben und Ansichten von LA 117 und LA 57, Grabhügel. Vorbericht über die Ausgrabungen bronzezeitlicher Grabhügel bei Bornhöved, Kr. Segeberg. *Offa*.

Kruse, P. and L. Matthes 2019. Vieh, Laub und Versammlungsplatz. Soziale Organisation in der Bronzezeit, Beispiel Brunde/Egelund. *Acta Archaeologica* 90(2): 204-251 (available at: https://doi.org/10.1111/j.1600-0390.2019.12220.x).

Lanting, J.N. and H. Van Der Plicht 1999/2000. De 14C-chronologie van de Nederlandse pre- en protohistorie, III Neolithicum. *Palaeohistoria* 41/42: 1-110.

Laux, F. 1971. *Die Bronzezeit in der Lüneburger Heide*. Hildesheim: Verlagsbuchhandlung August Lax.

Ling, J., M. Fauvelle, K.I. Austvoll, B. Bengtsson, L. Nordvall and C. Horn 2024. Where are the missing boatyards? Steaming pits as boat building sites in the Nordic Bronze Age. *Praehistorische Zeitschrift*, advance online publication: 1-26 (available at: https://doi.org/10.1515/pz-2024-2005).

Louwen, A. and D. Fontijn (eds) 2019. *Death revisited. The excavation of three Bronze Age barrows and surrounding landscape at Apeldoorn-Wieselseweg*. Leiden: Sidestone (available at: https://www.sidestone.com/books/death-revisited).

Lundborg, L. 1972. *Undersökningar av bronsåldershögar och bronsåldersgravar i södra Halland. Höks, Tönnersjö och Halmstads härader under åren 1854-1970*. Halmstad: Hallands Museum.

Makarowicz, P., T. Goslar, J. Górski, H. Taras, A. Szczepanek, Ł. Pospieszny, M.O. Jagodinska, V. Ilchyshyn, P. Włodarczak, A. Juras, M. Chyleński, P. Muzolf, A. Lasota-Kuś, I. Wójcik, A. Matoga, M. Nowak, M.M. Przybyła, M. Marcinkowska-Swojak, M. Figlerowicz, R. Grygiel, J. Czebreszuk and I.T. Kochkin 2021. The absolute chronology of collective burials from the 2nd millennium BC in east central Europe. *Radiocarbon* 63: 669-692 (available at: https://doi.org/10.1017/RDC.2020.139).

Needham, S.P. and G. Anelay 2021. *Barrows at the core of Bronze Age Communities. Petersfield Heath excavation 2014-2018 in their regional context*. Leiden: Sidestone (available at: https://www.sidestone.com/books/barrows-at-the-core-of-bronze-age-communities).

Nielsen, B.H., T.E. Christensen, A. Moltsen, K.M. Frei, S. Reiter, M.F. Mortensen, P.S. Henriksen, M.C. Christensen and K. Gyldenløve 2020. Late Neolithic Stenildgård Grave: Re-Excavated, Re-Analysed and Re-Interpreted. *Acta Archaeologica* 91: 121-146.

Nielsen, H.B. and J.-H. Bech 2004. Bronzealderens kulthuse i Thy. Anlæg med relation til gravkulten. *Kuml* 53: 129-159.

Olsen, A.L.H. and J.-H. Bech 1994. Damsgård. En overpløjet høj fra ældre bronzealder per. III med stenkiste og ligbrændingsgrube. *Kuml* 39: 158-198.

Olsen, J., J. Heinemeier, P. Bennike, C. Krause, K. Margrethe Hornstrup and H. Thrane 2008. Characterisation and blind testing of radiocarbon dating of cremated bone. *Journal of Archaeological Science* 35: 791-800 (available at: https://doi.org/10.1016/j.jas.2007.06.011).

Reiter, S.S., N.A. Møller, B.H. Nielsen, J.-H. Bech, A.-L. Haack Olsen, M.L.S. Jørkov, F. Kaul, U. Mannering and K.M. Frei 2021. Into the fire: Investigating the introduction of cremation to Nordic Bronze Age Denmark. A comparative study between different regions applying strontium isotope analyses and archaeological methods. *PLoS One* 16(5): e0249476 (available at: https://doi.org/10.1371/journal.pone.0249476).

Runcis, J. 2005. Västskånska jordgravar från tidig metalltid, in P. Lagerås and B. Strömberg (eds) *Bronsåldersbygd 2300-500 f Kr. Skånska spår – arkeologi längs Västkustbanan*: 253-283. Lund: Riksantikvarieämbetet.

Schaefer-Di Maida, S. 2023. *Unter Hügeln. Bronzezeitliche Transformationsprozesse in Schleswig-Holstein am Beispiel des Fundplatzes von Mang de Bargen, Bornhöved (Kr. Segeberg)*. Leiden: Sidestone (available at: https://www.sidestone.com/books/unter-huegeln-band-1).

Schaefer-Di Maida, S. and J. Kneisel 2023. The urnfield phenomenon in Schleswig-Holstein: New insights into the chronology and hypotheses, in A.R. Rose, L. Christensen and A.J. Louwen (eds) *Beyond Urnfields. New Perspectives on Late Bronze Age – Age Funerary Practices in Northwest Europe*: Kiel: Verlag Ludwig.

Schmidt, J.-P. 2007. Neue Ergebnisse zur Datierung der Totenhäuser von Stolzenburg, Lkr. Uecker-Randow. *Bodendenkmalpflege in Mecklenburg-Vorpommern* 55: 119-131.

Sørensen, M.L.S. and K. Rebay-Salisbury 2023. *Death and the body in bronze age Europe from inhumation to cremation*. Cambridge: Cambridge University Press (available at: https://doi.org/10.1017/9781009247429).

Steiner, H. 2010. *Alpine Brandopferplätze. Archäologische und naturwissenschaftliche Untersuchungen*. Trento: Ed. Temi.

Strahl, E. 1990. *Das Endneolithikum im Elb-Weser-Dreieck*. Hildesheim: Lax.

Struve, K.W. 1979. Die Bronzezeit, Periode I-III, in O. Klose (ed.) *Geschichte Schleswig-Holsteins 2*. Neumünster: Wachholtz.

Thrane, H. 1984. *Lusehøj ved Voldtofte - en sydvestfynsk storhøj fra yngre broncealder*. Odense: Odense Bys Museer.

Thrane, H. and C. Madsen 2004. *Fyns yngre broncealdergrave*. Odense: Odense Bys Museer.

Tiedtke, V. 2015. Grave, Pig and Pine – Animals and Plants at the Lusatian Urn Field of Müllrose, East Brandenburg, in J. Kneisel, W. Kirleis, M. Dal Corso, H. Scholz, N. Taylor and V. Tiedtke (eds) *The Third Food Revolution? Setting the Bronze Age Table: Common Trends in Economic and Subsistence Strategies in Bronze*

Age Europe. Proceedings of the International Workshop 'Socio-Environmental Dynamics over the Last 12,000 Years: The Creation of Landscapes III' (15th-18th April 2011) in Kiel. Bonn: Rudolf Habelt.

Töchterle, U., M. Staudt and G. Tomedi 2018. Alpine Brandopferplätze der Bronzezeit, unter besonderer Berücksichtigung der Nordtiroler Fundstellen, in L. Kreiner (ed.) *Symposium 27.02.-01.03.2014, Opfer- oder Festplätze von der Bronze- zur Latènezeit*: 234-257. Dingolfing: Verlag Marie Leidorf GmbH.

Willis, C.C. 2019. Stonehenge and Middle to Late Neolithic cremation rites in mainland Britain (c. 3500-2500 BC). Unpublished PhD dissertation, University College, London.

Zachrisson, T., I. Ullèn and M. Olaus (eds) 2022. *Håga. Gravhögen och bygden från bronsålder till nutid*. Uppsala: Upplandsmuseet (available at: https://www.upplandsmuseet.se/contentassets/d48dfb1356824f25a19deda5ed008516/hagaboken-original---uppslag.pdf).

Chapter 28

Sampling at Lista, Norway: Inconspicuous fragments of large-scale agrarian history

Christopher Prescott

Department of Archaeology, Conservation and History, Oslo, Norway
christopher.prescott@iakh.uio.no

Abstract

This contribution adopts a three-tiered scale in its study of the southwestern region of Lista – a polity that is an integral part of the Nordic Bronze Age and a pivotal point and bottleneck in maritime communication from north to south. A study of one community (Vanse) demonstrates that most elements of a Bronze Age complex farm society are potentially present: the farm and farmhouse, mortuary structures, wetland deposits, places of power and potential military control, and a harbour. The final tier is the field at Penne. Though best known for the Late Bronze Age rock art and Early Iron Age farm complexes, fragments of evidence suggest a chronologically deep and extensive use of the landscape including agriculture, mortuary practices, production (metallurgy), and ritual.

Background

Though perhaps out of vogue today, the mid 1970s to mid 1980s in Scandinavian archaeology accelerated the appreciation of research into local and regional human relations with the environment, societal parameters and locally available resources. I started studying bifacial lithics in Norway (which date from the Late Neolithic into the Pre-Roman Iron Age) 45 years ago. At that time, the reigning approaches to the Bronze Age were bound up with a mix of culture historical ideas from the 1920s and elements from processually oriented schools in Scandinavia. The first suggested that the forms of the Stone Age (in terms of long-term continuity, lithics, production, and social structure) lasted far into the Iron Age (indeed, even the Viking Age). The latter created chronologies based on radiocarbon dates where the divisions between periods spanning Middle Neolithic B to the Pre-Roman Iron Age were blended into a rather amorphous period in which nothing much happened apart from slow environmental adaptations and dabbling in agro-pastoralism. The theoretical factors were local evolution, environmental determination, and social drivers. In this frame of thought, the monuments and metal objects belonged to one world, the rock shelters and sites with bifacial lithics another, and the study of rock art was a nearly separate subdiscipline (Prescott 1994). Interpreting these phenomena as expressions of a whole society, adding explicit historical dimensions and recognising the links between variable scales and analytical categories (artefacts, eco-facts, sites and landscapes) when studying material as expressions of multi-dimensional societies has since become more pronounced. Studies of the role of communication in western Scandinavia, not the least studies of the Late Neolithic and Bronze Age in Jutland (e.g. Vandkilde 2019; in press) and concepts of 'bronzization' (Vandkilde 2016) are important premises for recognising Lista as an integral part of the Nordic Late Neolithic and Bronze Age, which was closely networked with northern Jutland and Jæren. The present study emphasises Lista, by Norwegian standards a region relatively rich in metal finds and a landscape imprinted with Bronze Age monuments, as a geographically bounded polity which encompassed local communities and farms, i.e. as a regional and local expression within a globalised Bronze Age world.

Lista in Vest-Agder, Norway

Northern Jutland and southwestern Norway (i.e. Lista and Jæren) face each other on either side of the Skagerrak Strait and are not separate worlds divided by the sea (Fig. 1). Instead, as of the mid 3rd millennium, they were regions bound together by the sea. These areas are cores in the transformation and evolution of the western Scandinavian Peninsula from southern Scandinavia to north of the arctic circle as of the second half of the 3rd and into the second half of the 2nd millennium BCE (Prescott 2012). Though linked in networks, the landscapes, distribution of finds and monuments of western Scandinavia suggest that there are numerous discreet political entities in the Late Neolithic and Bronze Age of which Lista is one (e.g. Austvoll 2021).

'Lista' means ledge or brim, an accurate description of the peninsula stretching out from southernmost Norway, completed by the low-lying stretch of land at its southern end. Between the rocky uplands and the sea, the 25 x 5 km ledge of 'Flat Lista' is comprised glacial moraines (Fig. 2). With a mild climate, contemporary Lista is characterised by intensive agriculture, and was a potential candidate for agricultural experimentation

Figure 1: Scandinavia (areas influenced by the Nordic Bronze Age are shaded). Note how the Skagerrak Strait can serve as a connection between Jutland if the maritime technology and the social networks are present. Lista is a western Scandinavian node and potential bottleneck for sea travel north, northeast, and south (map: K.I. Austvoll).

in Norway already before the Late Neolithic (Prøsch-Danielsen 1996). Today's landscape is the result of the draining of shallow lakes and wetlands, the modification of water courses, the clearing of stones and boulders, of levelling, soil improvement, deforestation, pasturing, and construction (e.g. an airstrip and fortifications built during the German occupation of Norway in World War II). Before the 1900s, the landscape was a patchwork of fields, wetlands, streams and lakes – ideal for the traditional mix of cultivation and stockkeeping, supplemented with fishing, hunting and foraging. Immediately inland to the north are rocky and forested uplands suitable for logging, hunting, grazing stock, and exploiting outfield resource. In all other directions, the open North Sea prevails; harbours are scarce, and the seabed outside of the Lista Peninsula is littered with shipwrecks (Kvalø 2000).

Elements of the sea: sea lanes, harbours and boundaries

Settlement throughout Scandinavia's prehistory has been associated with a range of landscapes, environments and resources, though the sea has remained a common denominator. As of the mid 3rd millennium BCE, there were strong indications that the sea and seafaring become two of the elements that constituted and defined the Nordic Bronze Age in western Scandinavia (Glørstad 2011: 90-95; Ling *et al.* 2018; Østmo 2011; Prescott *et al.* 2018).

Lista is the pivot for three routes along the Scandinavian Peninsula and across the Skagerrak. The perhaps least

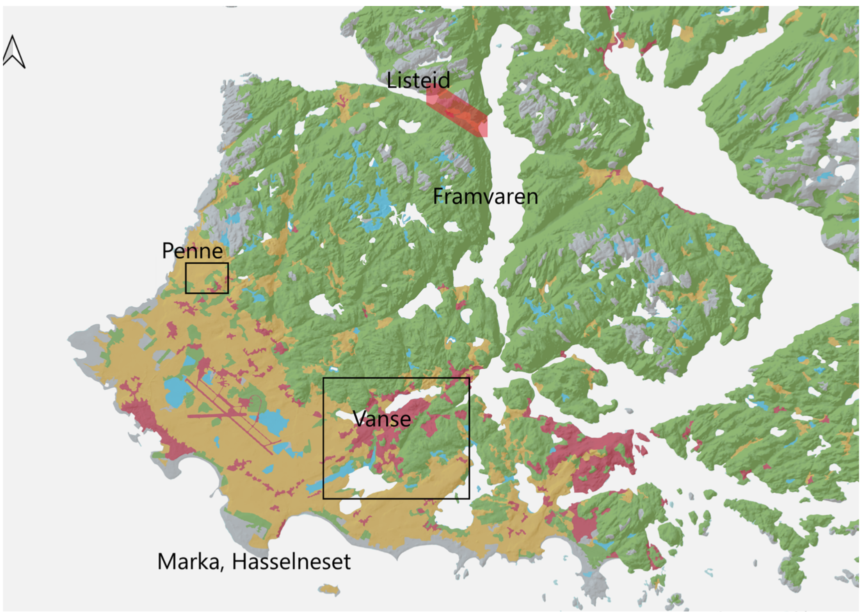


Figure 2: Map of the Lista Peninsula. The lighter areas reflect the low-lying rim between the sea and the uplands that gives the peninsula its name. The portage over Listeid, at the foot of the peninsula, the Vanse village, Penne and the Hasselneset Peninsula – discussed in the text – are marked (map: K.I. Austvoll).

Figure 3: Reconstructed distribution of large gravemounds at Hasselneset, an example of the line of prehistoric graves that encircle Lista, as well as demarcate the boundary between the sea and land (from Stylegar 2010).

important of these leads from the west to the northeast (i.e. to Oslo Fjord). More important in a prehistoric context was the route that stretches 2200 km along the Norwegian coast. For this route, Lista represents the final destination before, and staging point for, the third important route: the 86- nautical mile crossing to Jutland in Denmark (Johansen 1986; Kvalø 2000). In this regard, Lista may have been a bottleneck for maritime transportation (especially north-south) in western Scandinavia, as traffic had to go past the coast. The bottleneck role was enhanced if vessels sought to avoid the open sea outside Lista in stormy seasons, and instead chose a protected route through the Eidsfjorden, over the narrow stretch of land portage called Listeid into Lake Framvaren, and then sailed through a narrow outlet into the archipelago to the east (Fig. 2). Even today, smaller boats are still hauled over Listeid and sail the above route (Stylegar 2010). With the sea level 3 m higher in the Bronze Age (Prøsch-Danielsen 1997: 98), the portage would have been shorter than today's 1.2 km. The portage, lake and outlet would have afforded control of movements and provided a source of power and wealth.

The lower-lying settlement area of Lista is delimited (especially between the sea and land) by grave mounds, cairns, and cemeteries whose construction and use started in the Late Neolithic and continued into the Viking Age. The border between the terrestrial settlement and the mobility of seafaring is marked by a string of cemeteries and monumental gravemounds and cairns (based on Austvoll 2019; Hauge 2007; Rudjord 1992: 94-97; Stylegar 2005). These constructions offer a vantage point from land and would have been highly visible from boats sailing along the coast. Numerous grave monuments have been removed in the historical epoch; however, some reconstruction is possible, e.g. at Hasselneset (Stylegar 2005), Penne, and nearby Jølle (Prescott 2009). As one of the most remarkable expressions of this relationship between settled farming and stockholding communities and the sea and seafaring, the distribution of mounds and cairns can be reconstructed through historical documents and preserved mounds and cairns at Hasselneset (Fig. 3), the peninsular stretch that runs through Vest-Hassel. Frans-Arne Stylegar (2005) points out that the this set of monuments should be compared to Reheia on Avaldsnes, further northwest. Dated to the Early and Late Bronze Age and partially the Viking Age, these coastal monuments were located in a deforested landscape on a terrace 9-10 masl. Today, 13 large mounds and cairns and a field of five or so smaller cairns are known to have been distributed along a 1.7-km stretch and on Rauna Island in the open bay. The most impressive monuments include the cairn that dominates the island of Rauna and the Engelshaugen mound on the mainland, with a diameter of 40 m and a height of 4 m (though originally this was probably 8-10 m and, thus, may potentially be the largest Bronze Age mound in Norway; Stylegar 2005). Funerary rites and burial monuments, social power and cultural identity are immediate associations for this assemblage. However, perhaps the most dramatic aspect is a line of monuments communicating the scale and power of the associated polity to seafarers arriving from outside. The mounds in the sea- and landscape mark the borders between the institutional foundations that constitute Nordic Bronze Age society, world views, and politics: seafaring, trade and war, the sedentary farm, and outfields, with seasonal pastoralism, hunting and gathering.

Vanse: elements of a harbour community

Harbours directly facing the sea are virtually absent in the central part of Lista, though the archipelago to the east and the Listafjord to the west offer harbours connected by the above-mentioned Listeid-Framvaren portage. In both the ancient and recent past, harbours for smaller vessels in the central part of the peninsula at Vanse (Fig. 4) were conceivably offered through Lake Nesheim. Today, Nesheim drains into the sea through an artificial canal 1 km in length. Originally it drained through a 2 km-long river that broke through the 250 m-wide storm embankments and beach that divide the lake and the sea. Today Nesheim Lake lies at 2 masl, but it was lowered by 2-3 m in conjunction with draining of Nesheim, Prestvann, and Brastad lakes in 1915. In the Bronze Age, sea levels would also have been 2-3 m

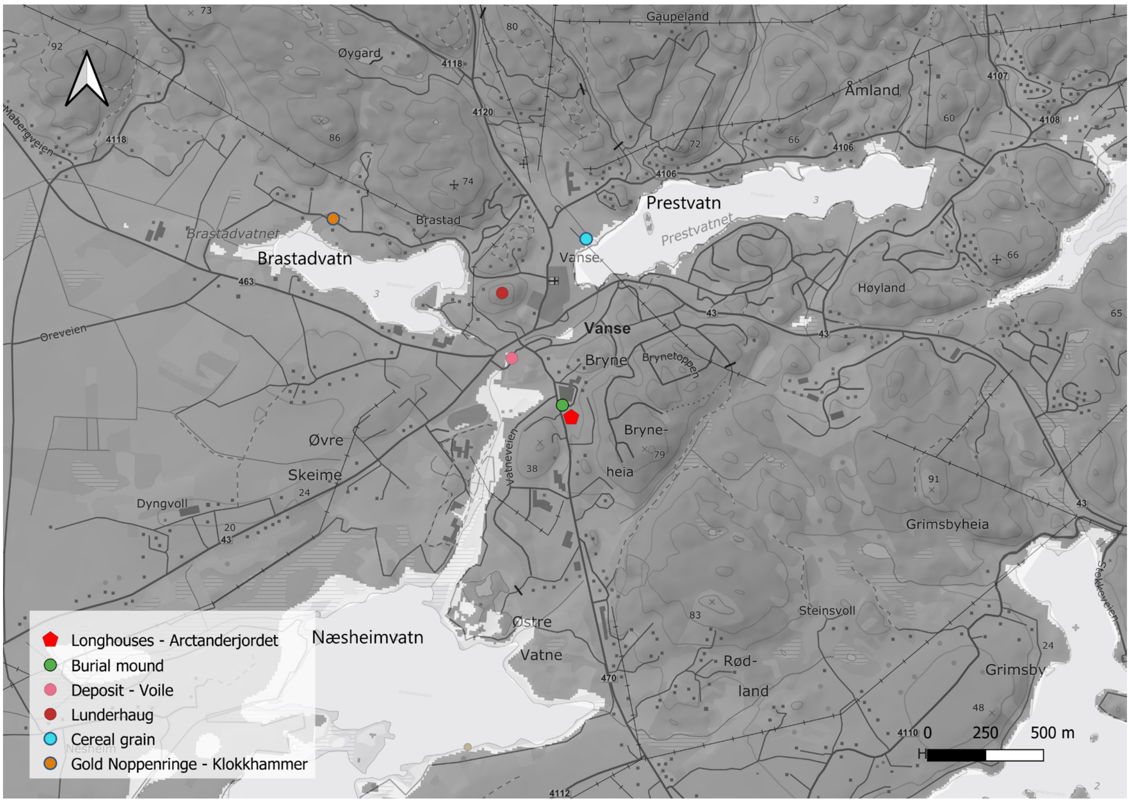


Figure 4: Map of the Vanse area with sites marked. The level of lakes has been raised by 3 m to pre-1915 drainage levels. The southernmost lake is Næsheim, and with the original water levels Bryne at Vanse would have been a natural harbour for smaller vessels (map: K.I. Austvoll).

higher (Prøsch-Danielsen 1997: 98) and the elevation difference between the lake and the sea would have been negligible; therefore, moving boats along the river or portage over the narrow isthmus would have been practical. Lake Nesheim would have extended 1.2 km further inland from today's northern shore (Rudjord 1992: 104). Today, locals still recall relatives speaking of boats sailed over the lake north to the interior of Lista. The natural lake would have provided safe passage that could have been monitored by the surrounding polity. Passing through a landscape of rich Late Neolithic and Bronze Age sites, i.e. the Kviljo rock art site, the northern destination would have been Vanse and Vatne.

Until the beginning of the 20th century, the northern end of Nesheim Lake was the confluence with southwestern and eastern Prestvatnet and Brastadvatnet lakes. The three lakes were separated by a 200-300 m-wide low-lying isthmus, cut by shallow wetland streams. The Vanse and Vatne area is, thus, not only a potential protected terminal port for seafaring vessels, but also a pivotal point that provided boat access through inland waterways to much of the Flat Lista part of the peninsula and the more than 18 farm communities located there during the Late Neolithic and Bronze Age (based on Johansen 1986).

Although graves, depots, artefacts, and rock art are found throughout the peninsula, the Vanse and Vatne area provides elements that in their totality describe a Bronze Age community. Besides the harbours and pivotal contact zones, there are LN to EBA dual-aisled longhouses and fragmentary evidence of a Late Bronze Age V/VI house at Arctanderjordet (Grimsrud 1999; Spitalen 2009), fields (Prøsch-Danielsen 1996), grave monuments at Arctanderjordet and Klokkhammer (with a gold *Noppenring*, Hauge 2007: 46; Melheim 2015), wetland depositions and a footbridge at Voile[1] (Hauge 2007), and rock art sites overlooking the lake (most notably at Kviljo).

In addition to the above, there is an enigmatic monumental structure on top of the 'Lunderhaug' hilltop at Vanse overlooking the intersection of lakes, inland water passages and farm communities. Originally described by Nicolai Nicolaysen in 1859, there are visible remnants of structures comprised of a cairn encircled by a wall of stones and earth 150 m

[1] Discovered in Vanse in 1915 in connection with the drainage of the lakes. The context was a wetland traversed by a natural (?) gravel ridge and remains of a wooden bridge. In the sediments a complete soapstone mould for a per. II palstave, a shaft-hole axe, three flint daggers, ceramic sherds, and a Late Iron Age soapstone vessel have been found.

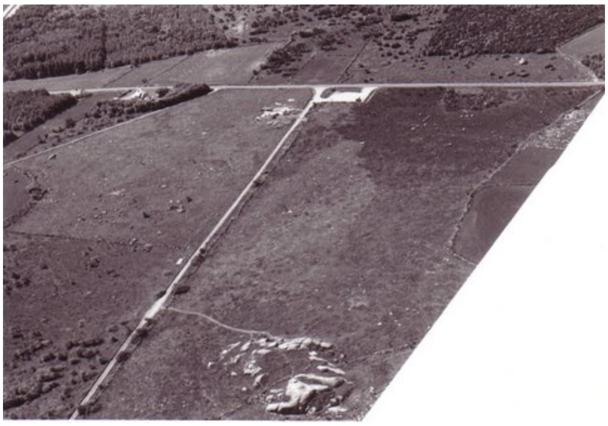


Figure 5: Old aerial photograph of Penne and Jærberg. The Jærberg outcrop is seen to the lower right. The Late Bronze Age rock carving panels are found on the upper end of the outcrop, about where the path meets the rock. The uneven surface of the field can be discerned in the picture, and is the result of prehistoric house remains, grave mounds and cairns, clearance cairns, and stone fences (photo: Vest-Agder Museet, Lista. Lokalhistoriske samling).

in diameter (today 35 cm wide and up to 45 cm high). The age of the Lunderhaug cairn and walls is not documented, but a Late Neolithic or Early Bronze Age date is plausible (The Directorate of Cultural Heritage n.d.).

The above regional and community scale observations illustrate the spatial elements of the Bronze Age polity of Lista, with perhaps more than 18 farms. A central community at Vanse and Vatne allows an appreciation of the landscape that combines the maritime, agricultural, ritual, and (conceivably) military aspects of Bronze Age settlement as well.

Penne

Moving west from Vanse to the northwestern edge of Flat Lista (Fig. 2), we turn to a farm area at Penne. Penne is a set of two adjacent fields, Penne/Jærbergsletta and Penne Utmarka, owned by the University of Oslo. These 200,000 m^2 fields are important, primarily because they have been protected from modern agricultural practices: they were not drained, levelled, or deep-ploughed. The uneven surface topography (which is the result in no small measure of manually built structures) is preserved. The grass/heather cover has been maintained until the present through traditional means (i.e. sheep grazing and fire clearance). This ensures that ancient structures such as grave mounds and cairns, clearance cairns, fences, house remains and pits are both preserved and visible on the surface (Mydland 1991).

Penne is known in archaeology for two main reasons. The first involves the Early Iron Age farm complexes at Penne and Penne Utmarka investigated by Helge Gjessing from 1917 to 1922 (Gjessing 1918; 1925) and Sigurd Grieg (1934; 1938), and which were later part of a detailed study of Iron Age farming practices (Myhre 2002: 120-121). House remains, fences, graves and clearance cairns have been mapped and partially excavated. The second reason behind the fame involves the Late Bronze Age rock art on the Jærberg stone outcrop found by Otto Penne in 1918. There seems to be some variance in observations about what is present on the rock, perhaps partially due to wear – associated with the fact that the rock knoll was used for traditional midsummer bonfires in more modern times (Fett and Fett 1934), as well as spring celebrations (Rudjord 1992: 141). According to Eva and Per Fett (1934), there are four clusters that contain 23 boats, two sets of foot soles, and 41 cup marks on the outcrop. One of the boats seems to be transporting a sun on a pole. Two new boats were uncovered in conjunction with a student field course in 2007 (see below). Further occurrences of cup-marks are found on boulders in the area.

Although the Late Bronze Age rock art at Jærberg and the Early Iron Age farm complexes have received most of the attention, some finds in conjunction with Gjessing's house excavations of the farm complexes indicate a deeper history than is visible today from the surface structures. In addition to numerous pieces of flint debitage and finds from the nearby farm at Kjølleberg (e.g. a shaft-hole axe fragment – Museum of Cultural History number (KHM no. C22287)), particular mention can be made of three bifacial Late Neolithic and Early Bronze Age points (KHM nos. C22304, C22161/b/c), a fragmentary LN/EBA shaft-hole axe (KHM no. C22304/e in house remains 2), and a fragmentary Bronze Age crucible (KHM no. C25289) (in the cover soil of Grieg's mound 5) found in conjunction with the excavations of Gjessing and Grieg.

The 2007-2009 project at Penne and the time-depth of farm settlements

The 2007-2009 Lista-project was designed as a series of short student-training excavations. The premise was that later phases had, in all probability, disturbed but also protectively covered earlier deposits, and fragments of older deposits would be recoverable. As only minimally invasive exploration was permissible, nine trench sites, with a width of 1m and lengths of up to 6 m, were dug through eight features (mounds, walls, cairns, and back-fill) identified through the previous excavations by Gjessing and Grieg, and one structure identified during pre-excavation surveys. The aim was to detect evidence of older phases (structures, soil features, artefacts, eco-facts) in or under those structure features visible on the surface. Though shovels were used to remove turf, deposits were primarily dug

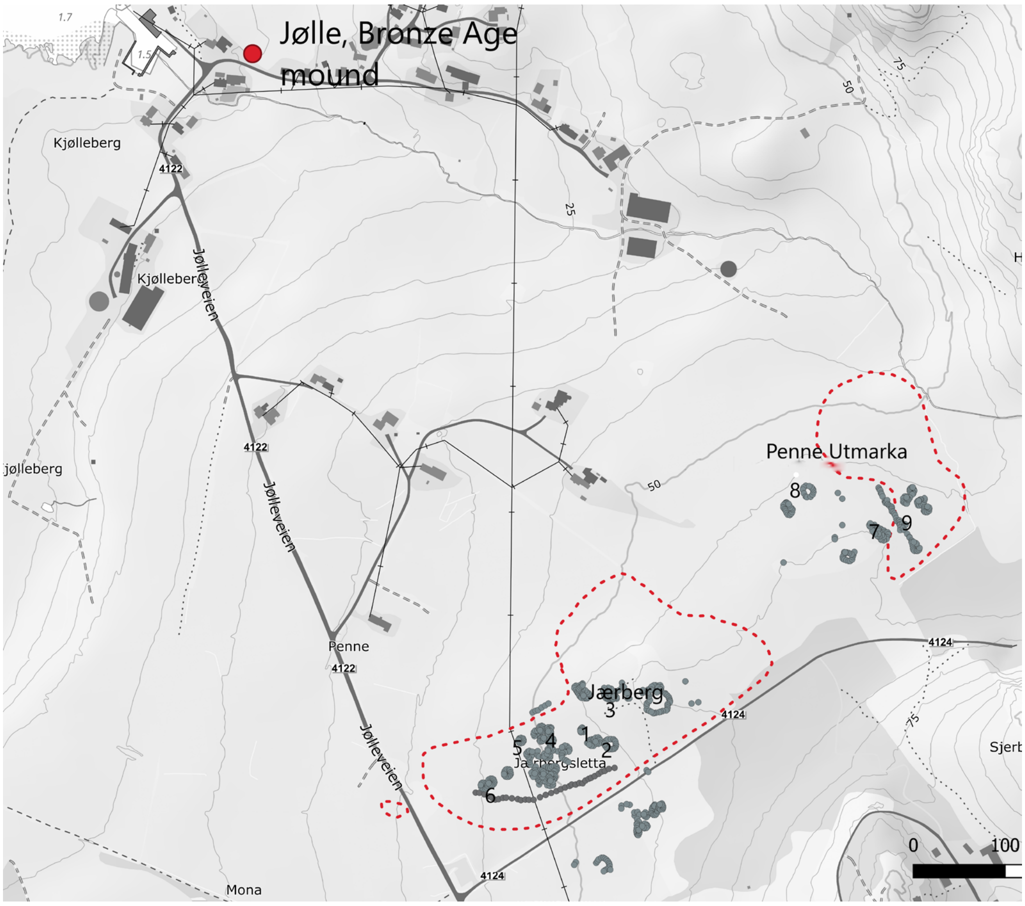


Figure 6: Penne, Jærberg, and Penne Utmarka. The trenches excavated in 2007-2008 at Penne (1-6) and 2009 at Penne Utmark (7-9) are marked with their trench numbers. The previously unmapped mound at Jølle is marked near the upper edge of the map (map: S. Kristensen, K.I. Austvoll, C. Prescott).

with trowels and all soil below the surface turf was dry sieved through 4 mm mesh.

The trenches (Fig. 6) were placed at the sites of the three houses (Penne I, II, III) described by Grieg (1934: 52-63, trenches 1, 4a-b, 7); Gjessing's long mound 5 (trench 2); Grieg's round mound 5 (trench 5); two clearance cairns with older grave cairns (trench 6); a previously undefined and unreported structure consisting of a 13 x 14 m oval; a slightly raised section of ground encompassed by 10-30 cm-high embankment consisting of stones and earth (trench 8); trenches through a prehistoric cattle fence (trenches 9a-b); and a trench and squares placed adjacent to the Jærberg outcrop with the rock art (trench 3). Each site has been presented in detail in excavation reports (Prescott 2007a-c; 2008a-d; 2009a-c).

The 2007-2009 trenches produced *c.* 508 lithic flakes, fragments, cores, and retouched pieces. The raw material is primarily flint, but there are a few quartz, red calcedony, and jasper flakes. A few of the flint pieces are from modern flintlocks. A few are catalogued as morphological blade fragments (though usually associated with pressure surface flaking). Most of the fragments are not diagnostic, but a majority of those with clear characteristics are indicative of surface retouching (i.e. Late Neolithic to mid-Pre-Roman bifaces). Some of the lithics were conceivably redeposited in conjunction with locally sourced turves used in the construction of grave mounds and walls. As a whole, the Penne assemblages are dominated by Late Roman and Migration Period structures and artefacts, but settlements and activity areas predating the Roman Iron Age are found throughout the area.

This is to an extent corroborated by the 1013 potsherds, the majority of which are from the Early Iron Age house and grave contexts. However, both the sherds and the find contexts indicate that older phases are represented (beyond the Jærberg rock art). There are also other elements that support a deeper settlement chronology. These are summarised in Table 1.

The brief summary in Table 1 can be elaborated by more descriptions of some selected contexts. 3 m^2 (trench 3) excavated immediately in front of the virtually vertical rock art panel uncovered a stratigraphic sequence of

Table 1: Indications of chronological phases at Penne.

Trench + site (after Gjessing 1918; Grieg 1934)	Object	Context	Age	Surface structure/ context age
2007, trench 1, house 'Penne I'	Sherd of thin-walled soapstone vessel	Layer potentially pre-dates house structure	Late Bronze Age/ Pre-Roman	Late Roman Iron Age to Early Migration Period
2007, trench 2, Gjessing's long mound 5	Tip of parallel retouched bifacial point, possible scratch-plough marks	Back-fill from mound excavation, under mound	Late Neolithic/ Early Bronze Age, plough marks pre-date mound	Early Iron Age
2007, trench 3, in front of Jærberg rock art panel	Tip of flint sickle blade, tip of flint bifacial point with fine surface retouch, piece of copper	In deposit in front of rock art, below deposit that covers two ships	Late Neolithic/ Early Bronze Age	Late Bronze Age rock art
2007, trench 3, in front of Jærberg rock art	Deposit with ceramic use-ware sherds	Deposit covers two ships	Post-Late Bronze Age Period 5	
2007, trench 3, in front of Jærberg rock art	Two ships that complete composition of previously discovered ship figures	Covered by later Iron Age to modern deposits	Late Bronze Age	
2008, trench 4, house 'Penne III'	A single sintered brown and red-green slag	Layer under Roman Iron Age house structure	Late Roman or older	Roman Iron Age
2008, trench 5, Grieg's mound 5[2]	21 pieces of slag and vitrified clay	In mound	Associated with previously recovered Bronze Age crucible?	Early Iron Age mound
2008, trench 6, trench between two cairns	Butt end of pecked grooved granite axe with a curved neck of a Late Bronze type two circular foot chains	In material constituting two dual-phased cairns: a) grave cairns; b) clearance stones added later	a) Late Bronze Age; b) Late Bronze Age or later	Iron Age to modern
2009, trench 7, Penne Utmarka, house 'Penne II'	Scratch plough furrows and associated barley kernel dated to 245-170 BCE	Under structures associated with Late Roman Iron Age house	Mid- to Late Pre-Roman Iron Age	Late Roman Iron Age
Trench 8, previously undescribed structure	Foot chain, pit-chamber with cremation traces and Late Roman Iron Age ceramics	Surface structure, later interpreted as base of earthen mound	Late Roman Iron Age cremation and base of burial mound (14 m diam.)	Late Iron Age
Trench 9, cattle fences associated with house 'Penne II'	Blade scraper/sickle	Under stone fence	Late Bronze Age?	Roman Iron Age

up to 60 cm. The top peat and sand layers (15-25 cm) covered dark clay and humus containing charcoal and sand (up to 35 cm). This layer contained a stone packing that resulted from human activities perhaps associated with the Late Bronze Age petroglyph carving. The finds in the upper level are modern earthenware, brass, lead, iron, glass, etc. These were probably deposited in conjunction with midsummer bonfires on the outcrop (at least into the 1950s), as well as dances, races and target practice. A sequence of undecorated ceramics probably represents Early Iron Age cooking, table and storage ceramics (probably associated with the house structures), though there could also potentially be some Bronze Age shards. Flint was found throughout the deposit but was concentrated in the layers below the modern top level. Where identifiable, the flint remains represent debitage and fragments linked to bifacial retouch. Quartz flakes were found in the lower layers, as were three hammerstones. Bifacial flint artefacts were represented by a probable sickle tip and the tip-end of a point. The surfaces of the latter were continuously flaked in a systematic technique indicative of a Late Neolithic to Early Bronze Age date. A small piece of metal

[2] The designation of this mound is confusing: Gjessing numbered it 1, Grieg renumbered it 5.

was found at the bottom of a square in front of the rock carvings – XRF-analysis (Hutchings 2007) indicated that it was made of pure copper; the stratigraphic position and the metal composition circumstantially point to a Late Neolithic date. Higher up in the deposit were a few sintered and vitrified clay fragments indicative of metal processing in the Late Bronze Age or later. The deposit in front of the rock art, from about the level of the stone packing, covered two boat figures that are integral to the final composition, indicating continued prehistoric activity after the figures were carved. In sum, carving rock art seems but one activity associated with the Jærberg outcrop between the Late Neolithic and the historical era.

Trench 5 (Grieg's mound 5) produced some (Migration Period) potsherds that possibly reflect the burial phase. Two flint flakes, a hammer or quern stone, and, importantly, 21 small pieces of potential slag and a sintered and vitrified clay fragment with a green-grey and black glazing may possibly have been related to a Bronze Age casting context linked to the crucible fragment. Apart from expanding the metallurgic aspect associated with the Jærberg rock art outcrop, the situation echoes the variable associations between settlement sites, burial contexts, and metallurgy in Scandinavia, particularly during the Late Bronze Age (Melheim 2015; Melheim *et al.* 2016; Sörman 2018).

Before 2007, mortuary contexts predating the Roman Iron Age were lacking at Penne, as were large mounds. Trench 6 (located between and cutting into two clearance cairns) demonstrated that these cairns covered older foot chains and cairns, which, in all probability, were part of a Late Bronze Age or Pre-Roman Age cemetery. This interpretation and age are supported by the D2 granite curved neck and grooved axe of a Late Bronze Age type that was found there (Indreko 1956). In western Norway as far north as to Sunnmøre, the handful of such axes found in an original deposition context have been associated with graves (Solberg 1988). The two clearance cairns investigated in 2008 were arbitrarily chosen among at least 128 cairns at the Penne site. If only a fraction of the cairns were also mortuary structures, Penne would represent an extensive cemetery, with a mix of stone settings, low cairns and small and large mounds spanning at the very least the Late Bronze Age through to the Migration Period. As such, Penne reflects broader diachronic trends in Scandinavian mortuary practices (Melheim 2015; Melheim *et al.* 2016; Wangen 2009). The monumental element of the cemetery is indicated by the large (14 m in diameter) Late Roman mound structures defined by trench 8. On the outskirts of Penne, at today's Jølle, a large mound was removed (for soil improvement, according to the landowner) two generations ago. It contained a slab with cup-marks (now outside Lista Museum, Nordberg) indicative of a Bronze Age date. These two monuments complement the series of mounds demarcating the land-sea interface discussed above.

The common location of the Late Neolithic to historical finds indicates that agriculture and stockkeeping were common denominators and determinants. The landscape suggests mixed practices with cultivated fields and stockholding. This is clearly seen in the Early Iron Age farm-site phase, with the house remains and their finds and stone fences leading through the infields out to nearby wetland-pastures. In all probability, in the older phases (the Late Neolithic) the environment was suitable for pre-industrial farm settlements, cultivation, and stockkeeping, and was exploited in comparable ways. Without significantly more extensive topsoil removal detailed proof eludes us. However, beyond the environment and the selection of artefacts recovered, there are some direct indicators that pre-date the Late Roman and Migration Periods. The scratch plough (ard) furrows and the dated barley kernel found under 'House 1' at Penne Utmarka (trench 7) demonstrate Pre-Roman cereal cultivation. Likewise, the potential scratch plough furrows under mound 5 (trench 2) predate the Early Iron Age mound.

The context associated with the Late Bronze Age rock art (trench 3), the adjacent deposits, the artefacts, and the possible cobble platform seems, in sum, to span from the Late Neolithic to the contemporary era, with the clearest traces from the Late Neolithic/Early Bronze Age, the Late Bronze Age, the Migration Period, and recent historical epoch. The situation echoes observations from other sites made by Lasse Bengtsson (2004: 116 ff) and Joakim Goldhahn (2006: 92). It would seem, thus, that Jærberg attracted human activity since the advent of farming in the area, for practical, ritual and/or social reasons. Whether this happened regularly or intermittently cannot be determined. However, the boat figures would have been moderately visible through much of prehistory. It is interesting that the lower figures were covered during the Iron Age, and perhaps even during the later part of the Late Bronze Age, whether as a conscious act or out of indifference. The rock art readily attracts modern attention; however, it seems the Jærberg outcrop was and remains the essential element: attracting depositions, rituals, gatherings and the production of figures. Interpretative variants of Jærberg's prehistory range from a continuity in worldviews and activities spanning 2500 years, elements generated out of an agro-pastoral mode of production or structural forces generated through the topography of the landscape. The first entails an initial phase, probably in the Late Neolithic, that generated narratives and historically anchored actions to Jærberg. The latter two entailing otherwise unrelated uses that drew people to the spot on multiple occasions.

Lines of interpretation

Landscape, activity, and scale

The primary aim of the work at Lista is the study of an agro-pastoral, maritime-oriented, Bronze Age society in southern Norway, based on available sources and contemporary ideas concerning the Nordic Bronze Age. As such, the broad geographical, ecological, and archaeological observations point to a political unit based in the Lista flatlands, bounded by the sea and the rocky uplands. The expression of this entity is partially expressed through the monumental gravemounds along the water-land interface. Lista represents a maritime bottleneck in western Scandinavia. These elements are the likely foundations of the political economy: maritime travel and trade, control of maritime movements, agro-pastoral production, and outfield resources (hunting, fishing, foraging). Within the polity, and indeed within the communities and individual farms, the fragmentary data describe the infrastructure of a complex society: farms, outfields, ritual sites, harbours, portages, exercising of power, technology (especially metallurgy), communication, and monumental expressions of the polities' boundaries.

In terms of scale, Lista is part of the Nordic networks and played a pivotal role in the networks of interaction in northwestern Scandinavia during the Bronze Age. It is an example of the 'continental' scale of ideology, social practices, technologies, and economy which was conceivably driven by 'bronzization'. It also indicates that broad world views and recipes of practices were applied and adapted locally on a community and farm level. As such, the study illustrates the dialectics of scale inherent to Bronze Age research since its inception.

Diachronic patterns, continuity, and historical structuration?

The 'expanded Bronze Age' from the Late Neolithic to the Pre-Roman Iron Age is the primary focus for the current chapter. Within this timeframe, there are elements with varying degrees of certainty that can be dated more accurately, e.g. the Jærberg rock art site, the potential Late Bronze Age stone settings and graves under clearance cairns, the scratch plough marks and dated barley, the monumental mounds along the coast, the longhouses at Actanderjordet, and the wetland depositions at Voile in Vanse. A survey of all finds, tracing flint depots, Late Neolithic and Early Bronze Age graves and settlement remains led Silje Hauge (2007: 75) to define NBA II/III and V/VI as the most intensive. The fragmentary nature of the material leaves detailed elucidation of diachronic comparisons ambiguous.

Beyond the Bronze Age, there are diachronic elements which extended into the Viking Age. Stylegar (2005) dates the monumental graves at Vest-Hassel to the Bronze Age and Viking era, while the Roman Iron Age mound at Penne (trench 8) adds a new chronological component. If the above periods are the time of primary construction, there is a pattern of secondary use – whether for mortuary purposes or as late as the construction of German artillery positions in World War II (Stylegar 2005). There was also a Late Iron Age component in the wetland deposit at Voile at Vanse. At Penne, the Roman and Migration Periods were most pronounced in the materials, though there was also Pre-Roman cultivation as well as modern artefacts. Though most archaeological periods are represented, the degree to which the material represents continuous usage remains open for discussion.

The landscape and similarities in the societies across time conceivably structured recurring expressions in the same landscapes. In some cases (e.g. the construction and use of monumental mounds) it is highly likely that older monuments structured later construction. Whether this was the result of common traditions, an institutionalisation of the landscape for monuments, or that later inhabitants were inspired by what they observed from the past, is open for debate. The patterns in the use of agro-pastoral land through the millennia can likewise be explained in multiple ways, on a scale from continuity via social structures to environmental determinism? The material from Penne, though fragmentary, demonstrates that the remains of Roman Iron Age and Migration Period farms form but part of a long pastro-agrarian history.

The use of the Jærberg area, whether over long stretches of time, or multiple, discrete events, may likewise be seen as something that was structured by the interplay of environment and human behaviour – i.e. that the outcrop was and is a suitable spot for get-togethers, or the edge of a field at an outcrop was a suitable place for depositing waste. It is nevertheless interesting that test-pitting and trial trenches indicated that the cultural deposits around Jærberg were only concentrated in front of the rock-face that also contained rock carvings. As the deposits seem to contain elements that both pre- and postdated the Late Bronze Age figures, a reasonable interpretation is that the outcrop was an institutionalised and probably mythicised place. In this perspective, the rock art was but one activity and feature in the history of the place – not *the* defining feature.

Bibliography

Austvoll, K.I. 2019. *Constructing identities. Structure and practice in the Early Bronze Age – Southwest Norway*. AmS-Varia 60. Stavanger: Museum of Archaeology, University of Stavanger.

Austvoll, K.I. 2021. *Seaways to complexity. A Study of Sociopolitical Organisation Along the Coast of Northwestern Scandinavia in the Late Neolithic and Early Bronze Age*. Sheffield: Equinox Publishing.

Bengtsson, L. 2004. *Bilder ved vatten*. Uppsats för licentiatexamen, Arkeologiska institutionen, Göteborgs Universitet.

Directorate Of Cultural Heritage n.d. *Kulturminnesøk*, «Lundehaugen el. Vanseborg, gravminne» (available at: https://www.kulturminnesok.no/kart/?q=vanseborg&am-county=&lokenk=location&am-lok=&am-lokdating=&am-lokconservation=&am-enk=&am-enkdating=&am-enkconservation=&bm-county=&bm-municipality=&cp=1&bounds=58.10062076437147,6.689236164093018,58.09910699454838,6.691381931304932&zoom=18&id=4a2a5f2a-63ce-11eb-9df2-005056bf3d73 (accessed 5 November 2024)).

Fett, E. and P. Fett 1941. *Sydvestnorske helleristninger. Rogaland og Lista*. Stavanger: Stavanger Museum.

Gjessing, H. 1918. *Innberetning om arkeologiske undersøkelser i Pennemarken. Graver og hustuft. Penne, 14, Vanse, Farsund, Vest-Agder* (available at: http://urn.nb.no/URN:NBN:no-80299: UiO DUO vitenarkiv).

Glørstad, H. 2011. Historical ideal types and the transition to the Late Neolithic in South Norway, in C. Prescott and H. Glørstad (eds) *Becoming European: The transformation of third millennium Northern and Western Europe*: 82-99. Oxford: Oxbow Books.

Goldhahn, J. 2006. *Hällbildsstudier i norra Europa – trender och tradition under det nye mellenniet*. Gotarc serie C. Arkeologiska skrifter No 64. Göteborg: Göteborgs Universitet.

Grieg, S. 1934. *Jernaldershus på Lista*. Instituttet for sammenlignende Kulturforskning. Ser. B: Skrifter. Oslo: H. Aschehoug & Co.

Grieg, S. 1938. *Listas jernalder. Bidrag til Vest-Agders eldste kulturhistorie*. Universitetets oldsaksamlings skrifter I. Oslo: A.W. Brøggers Boktrykkeri A/S.

Grimsrud, O. 1999. *Rapport fra utgraving av boplasspor på Arctanderjordet*. Oslo: Universitetets Oldsaksamling.

Hauge, S. 2007. Symbolsk alkymisme. Maktrelasjoner i bronsealderen i Farsund og Lyngdal. Unpublished Master's thesis, University of Oslo.

Hutchings, J. 2007. Analysis report. Konserveringsstudiet IAKH. Oslo: UIO.

Indreko, R. 1956. *Steingeräte mit Rille*. Stockholm: Almqvist & Wiksell.

Kvalø, F. 2000. Oversjøiske reiser fra Sørvest-Norge til Nordvest-Jylland i eldre bronsealder: - en drøfting om maritim realisering og rituell mobilisering, in L. Hedeager (ed.) *Sjøreiser og stedsidentitet: Jæren/Lista i bronsealder og eldre jernalder*: 11-134. Oslo: Unipub.

Ling, J., T.K. Earle and K. Kristiansen 2018. Maritime Mode of Production. Raiding and Trading in Seafaring Chiefdoms. *Current Anthropology* 59: 488-524.

Melheim, L. 2015. *Recycling Ideas: Bronze Age Metal Production in Southern Norway*. British Archaeological Reports International Series 2715. Oxford: BAR Publishing.

Melheim, L., C. Prescott and N. Anfinset 2016. Bronze Age casting and cultural connections: Bronze Age workshops at Hunn, Norway. *Praehistorische Zeitschrift* 91(1): 42-67.

Mydland, L. 1991. *Listaprosjektet. Arkeologiske undersøkelser 1991. Del I – III*. Kristiansand: Fylkeskonservator i Vest-Agder.

Myhre, B. 2002. Del I. Landbruk, Landskap og Samfunn, in B. Myhre and I. Øye (eds) *Norges Landbrukshistorie I*: 11-213. Oslo: Det Norske Samlaget.

Østmo, E. 2011. Late Neolithic Expansion to Norway. The beginning of a 4000 year-old shipbuilding tradition, in C. Prescott and H. Glørstad (eds) *Becoming European: The transformation of third millennium Northern and Western Europe*: 63-69. Oxford: Oxbow Books (available at: doi: 10.2307/j.ctvh1dq3m.10).

Prescott, C. 1994. Paradigm gained - paradigm lost? 150 years of Norwegian Bronze Age research. *Norwegian Archaeological Review* 27(2): 87-109 (available at: https://doi.org/10.1080/00293652.1994.9965578).

Prescott, C. 2007a. *Rapport arkeologisk utgravning. Hustuft «Penne 1», Penne, 44/12 Farsund kommune, Vest-Agder*. Oslo: Kulturhistorisk Museum, Universitetet i Oslo.

Prescott, C. 2007b. *Rapport arkeologisk utgravning. Mulig langhaug, Penne, 44/12 Farsund kommune, Vest-Agder*. Oslo: Kulturhistorisk Museum, Universitetet i Oslo.

Prescott, C. 2007c. *Rapport arkeologisk utgravning. Kulturlag foran helleristningsfeltet, Jærberget Penne, 44/12 Farsund kommune, Vest-Agder*. Oslo: Kulturhistorisk Museum, Universitetet i Oslo.

Prescott, C. 2008a. *Rapport arkeologisk utgravning. Tuft III, nordre veggvoll (felt 4a-2008) Penne, 44/12 Farsund, Vest-ASgder*. Oslo: Kulturhistorisk Museum, Universitetet i Oslo.

Prescott, C. 2008b. *Rapport arkeologisk utgravning. Tuft III, nordre veggvoll (felt 4a-2008) Penne, 44/12 Farsund, Vest-Agder*. Oslo: Kulturhistorisk Museum, Universitetet i Oslo.

Prescott, C. 2008c. *Rapport arkeologisk utgravning. Sørsørøstre veggvoll i hustuft III. Penne, gnr 44 bnr 12 Farsund kommune, Vest-Agder fylke*. Oslo: Kulturhistorisk Museum, Universitetet i Oslo.

Prescott, C. 2008d. *Rapport arkeologisk utgravning. Haug 5. Penne, gnr 44 bnr 12 Farsund kommune, Vest-Agder fylke*. Oslo: Kulturhistorisk Museum, Universitetet i Oslo.

Prescott, C. 2009a. *Sørlige veggvoll i hustuft Penne II. Penne, grn 44 brn 13 Farsund kommune, Vest-Agder fylke*. Oslo: Kulturhistorisk Museum, Universitetet i Oslo.

Prescott, C. 2009b. *Sjakt(er) i vollformet parti. Penne, gnr 44 bnr. 13, Farsund Kommune, Vest-Agder fylke*. Oslo: Kulturhistorisk Museum, Universitetet i Oslo.

Prescott, C. 2009c. *Steingjerde/gardfar. Penne 44/13, Farsund, Vest-Agder fylke*. Oslo: Kulturhistorisk Museum, Universitetet i Oslo.

Prescott, C.2012. Third millennium transformations in Norway: modeling an interpretative platform, in C. Prescott and H. Glørstad (eds) *Becoming European. The transformation of third millennium Northern and Western Europe*: 115-127. Oxford: Oxbow Books.

Prescott, C., A. Sand-Eriksen and K.I. Austvoll 2018. The Sea and Bronze Age Transformations, in E. Holt (ed.) *Water and Power in Past Societies. Proceedings of the IEMA Postdoctoral Visiting Scholar Conference on Theories and Methods in Archaeology*, Vol. 6: 177-197. Albany: SUNY Press.

Prøsch-Danielsen, L. 1995. *Lista i støpeskjeen – landskapsendringer gjennom 15.000 år*. Kristiansand: Fylkeskonservatoren i Vest-Agder.

Prøsch-Danielsen, L. 1996. Vegetation history and human impact during the last 11500 years at Lista, the southernmost part of Norway. Based primarily on Professor Ulf Hafsten's material and diary from 1955-1957. *Norsk Geografisk Tidsskrift* 50(2): 85-99.

Prøsch-Danielsen, L. 1997. New light on the Holocene shore displacement curve on Lista, the southernmost part of Norway. *Norsk Geografisk Tidsskrift* 51(2): 83-101.

Rudjord, K. 1992. *Listaboka III*. Farsund: Farsund Kommune.

Solberg, B. 1988. Steinøkser med skaftfure fra Syd-Norge, in S. Indrelid, S.H. Kaland and B. Solberg (eds) *Festskrift til Anders Hagen*: 277-291. Arkeologiske Skrifter fra Historisk Museum 5. Bergen: Universitetet i Bergen.

Sörman, A. 2018. Gjutningens arenor: Metallhantverkets rumsliga, sociala och politiska organisation i södra Skandinavien under bronsåldern. Unpublished Doctoral thesis, Stockholm University.

Spitalen, M.V. 2009. Hellig eller profan? Hus og husoffer som kilde til kosmologi i senneolitikum og bronsealder på Lista i Vest-Agder fylke. Unpublished Master's thesis, IAKH, University of Oslo.

Stylegar, F.-A.H. 2005. Et makeløst gravfelt – Hasselneset på Lista (available at https://arkeologi.blogspot.com/search?q=hasselneset, accessed 2014-10-01).

Stylegar, F.-A.H. 2005. Listeid. Arkeologi i Nord (available at https://arkeologi.blogspot.com/2010/07/listeid.html, accessed 2014-10-01).

Vandkilde, H. 2016. Bronzization: The Bronze Age as Pre-Modern Globalization. *Praehistorische Zeitschrift* 9(1): 103-123 (available at: https://doi.org/10.1515/pz-2016-0005).

Vandkilde, H. 2019. Bronze Age Beginnings – A Scalar View from the Global Outskirts. *Proceedings of the Prehistoric Society* 85: 1-27 (available at: doi:10.1017/ppr.2019.7).

Vandkilde, H. (in press). From Stone to Bronze – Formation of the Nordic Bronze Age in Southern Scandinavia, in L. Hedeager, C. Prescott and K. Kristiansen (eds) *Oxford University Press Handbook of Scandinavian Archaeology*. Oxford: Oxford University Press.

Wangen, V. 2009. *Gravfeltet på Gunnarstorp i Sarpsborg, Østfold. Et monument over dødsriter og kultutøvelse i yngre bronsealder og eldste jernalder*. Norske Oldfunn 27. Oslo: Kulturhistorisk Museum, University of Oslo.

Chapter 29

From architectural experiments to timber-consuming monuments: The changing building traditions at the dawn of the Nordic Bronze Age

Silja Arnfridardottir Christensen and Martin Egelund Poulsen

Museum Sønderskov, Brørup, Denmark
sac@sonderskov.dk; mep@sonderskov.dk

Abstract

The building tradition in southern Scandinavia underwent a dramatic change in the centuries from the middle of the Late Neolithic (LN) to the end of the Early Nordic Bronze Age (NBA). This development is particularly evident in the archaeological record from Jutland, Denmark, that offers interesting insights into, among other things, the transition from the two-aisled to the three-aisled building tradition (from LN II-NBA III, 1950-1100 BCE). Currently, there are multiple examples of excavated houses dating to LN II and NBA I that demonstrate experimentation with the three-aisled architectural style while the two-aisled tradition was still dominant. There are several examples of houses that combine both architectural styles, a form of hybrid house style, as well as houses built in a fully developed three-aisled style from this transitional period, which spans from LN II (*c.* 1950 BCE) until the start of NBA II (*c.* 1500 BCE). After this date, almost all longhouses were built in the three-aisled style. The three-aisled longhouses from NBA II and the beginning of NBA III (1500-1200 BCE) tend to be monumental in size. In Jutland, most of these are built in the timber-intensive bole-walled technique. Whereas the large two-aisled longhouses from LN and NBA I seem to be concentrated in the central and eastern parts of southern Scandinavia, the monumentalisation of house construction moved westwards to Jutland in NBA II. Central and south Jutland in particular stand out with their concentration of large three-aisled bole-walled houses that were contemporary with a network of barrow lines that represented important prehistoric routeways. There is thus a clear link between monuments and political influence.

Introduction

In the 1950s, the first definite traces of houses in Denmark dated to the Late Neolithic and Bronze Age saw the light of day (Brøndsted 1957: 311-312; Draiby 1985: 127). Since then, the number of houses dated to these periods has steadily increased, especially after developer-led archaeology was fully established at the turn of the 21st century (e.g. Bech and Rasmussen 2018: 25). New Danish museum legislation that came into force in 2002 resulted in a new archaeological tradition with large-scale excavations, often involving soil-stripping of several hectares at each location (Mikkelsen 2012). This has resulted in a more complex picture and a better understanding of prehistoric settlements, how these were structured, and architectural variation exhibited by houses. That variation is important where different building traditions existed simultaneously, as it shows that it was not necessarily representative of chronological differences. These observations are not least relevant for the Late Neolithic and Early Bronze Age, where a lot of architectural changes took place. The main change occurred when, after at least 2000 years of use, the old tradition of having one row of roof-bearing posts running down the middle of the lengths of the houses was abandoned (Nielsen 1998; Artursson 2009: 72). The single row of roof-bearing posts created two aisles running down through the house, hence the name 'two-aisled longhouse' (Rasmussen and Adamsen 1993: 136). In its place, a three-aisled tradition was introduced in which two rows of roof-bearing posts ran down the length of the houses (Tesch 1993: 162; Nielsen 1998: 9). The three-aisled tradition then moved on as the dominant way of building houses for the next 2500 years in southern Scandinavia (Artursson 2009: 48, 72-73).

The last of the two-aisled houses and the transitional period (LN II-NBA I)

The transition between the two- and three-aisled longhouses should not be viewed as a sudden change, but more as a transition which took place over a longer period during which two-aisled, three-aisled and hybrid houses were all being utilised simultaneously.

The last of the two-aisled longhouses often seem to contain elements which seem to suggest that people were trying to expand the maximum possible size of the houses' interior spaces. In Jutland, this is seen in the sunken floors, where parts of the floor were being dug into the subsoil (whereas normally it was only the wall- and roof-bearing posts that were dug this deeply down), thus expanding the sizes of the space downwards, instead of up- or outwards. In the central and eastern parts of southern Scandinavia, there are multiple examples of very long two-aisled houses

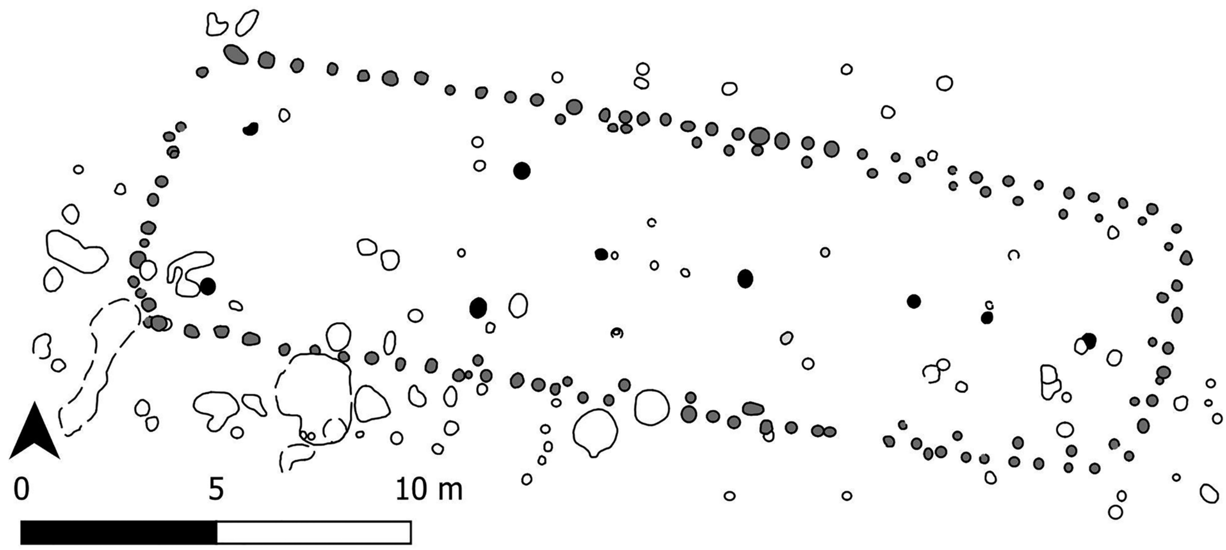


Figure 1: The large hybrid house from the site at Verdens Ende on the island of Fur in northern Jutland (graphics: Silja Christensen and John Bertelsen).

(Nielsen 1998: 20). These elements seem to represent perfect precursors for the introduction of three-aisled longhouses, which offer new possibilities in terms of building comparatively larger house structures.

Here we should not forget a well-known architectural element in many two-aisled Late Neolithic houses: rows of posts along the insides of the long walls (Björhem and Säfvestad 1989; Boas 1993; Nielsen and Nielsen 2022: 160 ff.; Sarauw 2006). They are relevant to the development from the two-aisled to the three-aisled building tradition, as these posts enable the wall to bear the roof and would later move further inside. They become in a three-aisled construction roof-bearing pairs of posts that took over the main part of the weight of the roof. In some large two-aisled longhouses, the inner wall posts were only present along the western part of the house (Johannsen 2017: 14), reminiscent of hybrid houses, where the three-aisled part was situated in the western end.

The hybrid houses

The hybrid houses contain elements of both the two-aisled and three-aisled building tradition. They can, therefore, be seen as being stuck in an in-between state, with one foot in the old traditions and another in the new. It is important not to view these houses as a specific type, but more as a phenomenon which appears in different shapes and sizes. Sometimes a house's appearance is more difficult to categorise, while other times it is more clear-cut. Some are mainly two-aisled, where it seems that some three-aisled roof-bearing posts have been added to support the structure. Others have one part of the house that is completely three-aisled and another that is completely two-aisled. It is interesting to note that the three-aisled elements almost always tend to be placed in the western parts of the houses. This is in contrast to how the sunken floors of the Late Neolithic houses most often were placed in the eastern part. When they appear in hybrid houses, the sunken floors always seem to be associated with the two-aisled context in the eastern part of the houses. Furthermore, there are examples of hybrid houses with close similarities which sometimes appear to group regionally (Christensen and Bertelsen 2024).

For an overview of these hybrid houses, the current body of data can be roughly divided into three main categories. The first of these includes larger houses with sets of three-aisled roof-bearing posts in the western part (Fig. 1; see also Bech and Olsen 2013: 15; Bech and Rasmussen 2018: 33-35; Christensen and Mehlsen 2023: 23; Kristensen 2019: 200; Mikkelsen 2019: 228); the second category includes smaller houses for which the three-aisled design makes up approximately half of the house (Fig. 2; see also Fyllingen and Armstrong 2012: 36-38; Borup 2018: 107; Mikkelsen 2019: 227); whereas for the last category the houses are mainly two-aisled, yet nevertheless exhibit a combined two- and three-aisled construction in some part, mostly in the west (Fig. 3; see Jensen and Bagge 2019: 284; Poulsen 2023: 86; Poulsen and Grundvad 2015).

Some of the large two-aisled longhouses found in Djursland showed both elements in the full length or the main part of the longhouse: smaller supporting posts were placed in between the walls and the roof-bearing posts, making the house look almost like a four-aisled construction (Boas 2019: 252). The line between

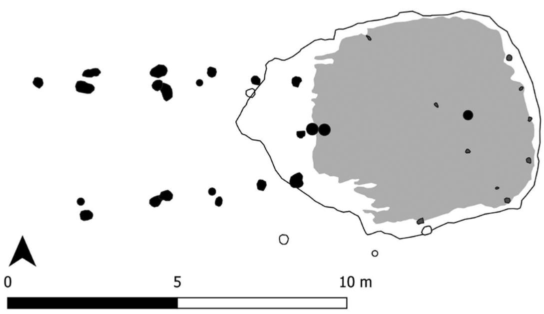


Figure 2: A hybrid house from the site Revsinggård II in southern Jutland. The house contains a sunken floor and two-aisled elements in the eastern part and three-aisled elements in the western part. This particular multi-phased house shows evidence of experimentation with the many postholes in the western part (graphics: Silja Christensen).

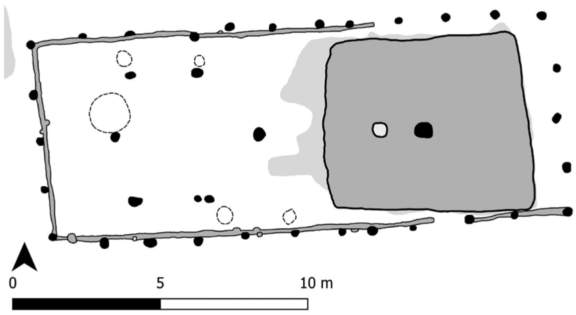


Figure 3: One of the two hybrid houses from the sites at Vestervang in southern Jutland. This house is mainly two-aisled, with supporting three-aisled posts in the western part and a sunken floor in the eastern (graphics: Silja Christensen after Steffen Laursen).

these houses and the previously mentioned two-aisled longhouses with the wall-supporting posts can at times be very fine. It should also be mentioned that some of these examples may represent two phases of construction, insofar as a three-aisled house replaced a previous two-aisled building. Even more rare are the cases of three-aisled houses with sunken floors (Nissen 2018: 45-46). These different variations were all likely to have been more or less cautious experiments involving the new three-aisled elements into previous or extant two-aisled traditions.

The earliest three-aisled houses

The earliest three-aisled houses known currently include a few small constructions ^{14}C-dated to earlier parts of the Neolithic (Mikkelsen 2019: 230-231). These kinds of small constructions are often not prioritised for dating via the ^{14}C-dating method within the relatively small budgets in development-led excavations. However, a growing number of larger three-aisled houses have been ^{14}C dated to the LN II-NBA I (Ethelberg 2000: 174; Poulsen *et al.* 2019: 11-12). These early three-aisled houses should be seen in the same context as hybrid houses, as they belong to the same phase of architectural experimentation. Three-aisled houses dating to the centuries right before 1500 BCE have a southern distribution in Denmark, where they concentrate in southern Jutland and Funen (Poulsen *et al.* 2019: 17; Runge and Lundø 2019: 144). However, this preliminary distribution can potentially be revised when more similar houses have been scientifically dated. Interestingly, a three-aisled longhouse at Kvåle, Rogaland, in the southwestern part of Norway, has been ^{14}C-dated to the transitional period between LN II and NBA I (1750-1665 BCE) (Soltvedt *et al.* 2007: 49; Bech and Rasmussen 2018: 33). This only supports the notion that there might be a lot more three-aisled longhouses from this early period which are still waiting to be excavated and/or scientifically dated.

Often it is only the roof-bearing postholes that are preserved from many such houses (Fig. 4, top), which indicates that the walls were not nearly as deeply grounded and robust as the roof-bearing posts. Therefore, they seem to differ from the bole-walled construction that became typical for the three-aisled longhouses in Jutland in NBA II-III. This is likely as these houses often exhibit walls dug in at a similar depth to that of their roof-bearing posts. The earliest bole-walled, three-aisled houses have been mainly ^{14}C-dated to the NBA I (Fig. 4, bottom) and do not tend to be older than that (Poulsen 2023: 92; Rasmussen 2015).

It seems, therefore, that the three-aisled construction was far from unknown in the LN II-NBA I. In fact, the house type was used particularly in Jutland, along with two-aisled houses and hybrid houses. It seems that there must have been some advantages to the three-aisled construction when compared to the two-aisled format (e.g. Nielsen 1998: 25); it was more stable and robust, which gave better opportunities to construct wider and taller houses. At the start of NBA II, a new level of monumentalisation of the landscapes took place in a way never before seen. When this need for building large longhouses and round barrows appeared, the three-aisled construction took over completely.

The three-aisled revolution

After 1500 BCE, the two-aisled building tradition was abandoned, along with the that of sunken floor houses. The three-aisled architecture was fully integrated and the overall picture seemed more homogenous than before, as there was clearly less architectural variation – at least in the *inner* parts of the houses. Nevertheless, wall construction varied significantly across southern Scandinavia during the NBA II-III. The most remarkable

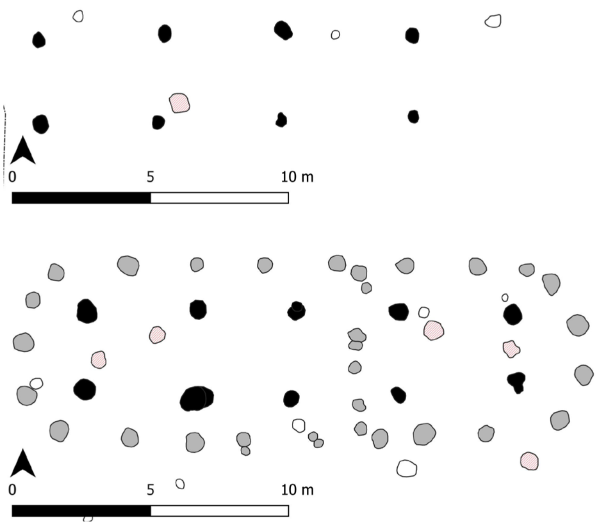


Figure 4: Two examples of early three-aisled longhouses from Kongehøj III at Vejen in south Jutland. Above: K12, ^{14}C-dated to the transition LN II-NBA I (*c.* 1750-1650 BCE). Below: K10, ^{14}C-dated to NBA Ib (1600-1500 BCE). The red features are cooking pits (graphics: Silja Christensen and Martin Poulsen).

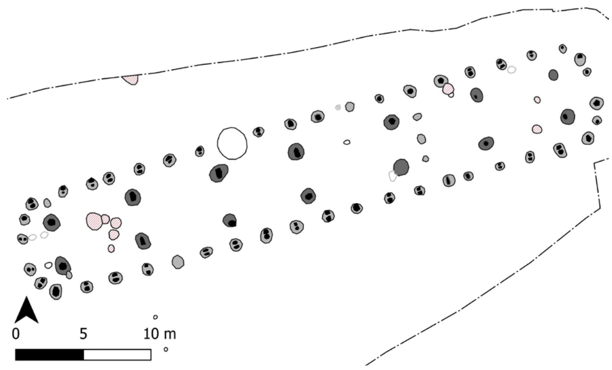


Figure 5: The monumental three-aisled longhouse K13 from Kongeengen in south Jutland (356 m^2: 44.5 m x 8 m). Traces of double-posts in the postholes of the long-walls and the gable-ends show that horizontal planks were fixed in between the vertical posts; the red features are cooking pits (graphics: Silja Christensen and Martin Poulsen).

difference was between the western versus the central and eastern parts. The westernmost area (the old glacial landscapes of Jutland) was dominated by the timber-consuming, bole-walled architecture (an example is shown in Fig. 5). However, other regions in Scandinavia and northern Germany had three-aisled houses with lighter wall constructions that made use of wall types which demanded less timber, i.e. wattle-and-daub, stakes, and tiny staves.

These regional variations were noticed decades ago by Ethelberg, when he pointed out that the bole-walled houses were built on the sandy soils in the western parts of southern Jutland (Ethelberg 2000: 186). In recent years, this distribution has been confirmed on a larger scale, where the bole-walled houses clearly seem to be concentrated on the sandy soils and hilltops in the western part of southern and central Jutland. Further north, the timber-consuming house type was also present, though in that area there was greater variation of wall constructions. Further east on the young moraine landscapes of Jutland, the bole-walled house was rarely seen. Further in this direction (on the Danish Isles and in southern Sweden), the house type was apparently absent, or at least very rarely represented at NBA settlements (Poulsen 2022: 61). However, the distribution is somehow too irregular, as the numbers of NBA houses in the young moraine landscapes of central and eastern Denmark are remarkably few in contrast to the western parts of Jutland. Furthermore, the numbers of houses would be expectedly much larger when comparing the distribution of the NBA barrows. Intense cultivation in modern times on Funen and Zealand could be a possible explanation for the missing houses. However, *if* the sturdy bole-walled longhouses were originally well distributed in these regions, many more NBA houses would be expected in this area, as both the wall posts and roof-bearing sets were often dug deep into the subsoil. Here it is worth mentioning that some of the large two-aisled longhouses from the LN II-NBA I in central and eastern southern Scandinavia were clearly built using the bole-walled technique as well (Boas 1993: 125; Johannsen 2017: 16-17).

The process of monumentalisation from late LN I to NBA III

The first wave of monumental house construction started in the later part of LN I (*c.* 2200-1950 BCE) in southern Scandinavia and continued more intensively during the LN II and NBA I (*c.* 1950-1500 BCE). These large two-aisled longhouses (30-45 m x 6-8 m) are predominantly found in the central and eastern regions of southern Scandinavia. The main distribution of monumental graves (large stone cists, cairns and barrows) was in the eastern parts as well (Ebbesen 2007: 13; Schiellerup 1992: 47). Despite this eastern concentration of monumentality, the large two-aisled longhouses were not totally absent in Jutland outside the young moraine landscapes. Here, they just appeared with a wider spread and smaller numbers. When comparing the distribution of large two-aisled longhouses and metal objects from the LN II-NBA I, it seems most likely that the main area of political influence were the central and eastern portions of southern Scandinavia (Brink 2013; Poulsen 2009: 163; Vandkilde 1996: 209). This eastern orientation corresponds with the late Únetice centre in eastern middle Germany, from whence a great deal of the imported metal objects recovered in southern Scandinavia originated

(Vandkilde 2017: 147). The large two-aisled longhouses in southern Scandinavia and eastern central Europe had some similarities as well (Nielsen 1999: 159-160). During the LN, western Denmark was still more or less under the influence of Bell Beakers that was dominated by small and middle-sized two-aisled houses, often with sunken floors (Borup 2018; Christensen *et al.* 2023; Eisenschmidt 2015; Jensen 1973; Sarauw 2006; Simonsen 2017). The largest two-aisled longhouses in this area have often been ^{14}C dated to the NBA I (Grundvad *et al.* 2015; Poulsen 2014: 45). However, an exception is seen in the area around Esbjerg in southwestern Jutland, where the large two-aisled longhouses are dated to the middle of the LN, having more in common with eastern Scandinavian house finds than the two-aisled houses from Jutland (Torfing 2021). Nevertheless, we see a gradual movement of political influence from the east towards the west during the NBA I (Poulsen and Grundvad 2019: 17). When this is considered together with the distribution of hybrid houses and early three-aisled constructions where the majority belongs to the NBA I as well, this picture gains traction. Furthermore, the movement towards the west during NBA I is not least confirmed by the distribution of metal objects (Vandkilde 1996: 249).

That the centuries from 1500-1200 BCE represented one of the most intense periods of monumental construction ever seen in southern Scandinavian prehistory has been a well-known fact for a long time, even considering only the large round barrows. However, knowledge of large houses from the NBA did not exist before the late 1980s, when 'Late Bronze Age halls' found in the 1960s in western Jutland were redated to the Early Bronze Age (Ethelberg 1987: 164). After this, the number of large houses known increased considerably during the 1990s. But it was the new Danish museum legislation in the early 2000s that made the number of known prehistoric houses increase dramatically, as mentioned above. Within this context, the number of Bronze Age houses has been multiplied several times, which of course has improved our general understanding of Bronze Age society. This has changed our view on Bronze Age farming – from a livestock-based community to a more agriculturally-based society – due to the great number of finds associated with agriculture from NBA settlements (e.g. charred grains, quern stones, etc). With the new larger numbers of NBA houses, it is possible to look at variations in architecture, function, economy, location, and regional variation at different levels.

The notion that the variety of different house types became greatly reduced, thus creating more homogeneity in the architecture of the houses after 1500 BCE, may be most noticeable when focusing on the roof-bearing construction and different elements of internal division. The rounded gable-ends, the inner roof-bearing sets of posts, and the division in three equally sized main rooms with cooking pits in the western end make NBA houses look quite uniform. However, one gets a different and more varied impression if the houses are examined from the outside. The wall constructions represented different building traditions, both regionally and sometimes locally as well. Longhouses built with wall posts and planks of oak timber, or the bole-walled construction completely dominated NBA II-III settlements in western and central Jutland, and (especially) the northern part of southern Jutland (Poulsen 2022: 61). By contrast, such houses were rarer in the northern part of Jutland, where they were often found on sites alongside other three-aisled houses without bole-walls. Archaeologically, these houses are identified by closely spaced stake-holes, narrow trenches, or no preserved traces of the walls, which indirectly indicate flimsy and shallow wall constructions. These house types were even more predominant in the young moraine landscapes along the eastern fjord and coastal zones of Jutland. On the eastern Danish Isles and in southern Sweden, the bole-walled house seems to be either absent or very rare in NBA II-III.

Despite the fact that the timber-consuming houses clearly had a western distribution in southern Scandinavia, wherever they were constructed, three-aisled houses were large and most often raised on high and visible spots in the landscape (Björhem and Staaf 2006: 152-153; Grundvad *et al.* 2015: 63; Nielsen 1998: 26). In other words, intense monumentalisation of the landscape was happening all over southern Scandinavia, including the regions without bole-walled houses. This trend becomes even more clear when looking at the great number of barrows from the NBA II-III. They tend to be raised on elevated and prominent locations in the landscapes as well, often in close vicinity to their contemporary houses. In the eastern and central southern parts of Scandinavia, the locations of both houses and barrows were concentrated along the fjord and coastal zones, while in Jutland they were placed more frequently in inland regions (Holst 2013: 32; Poulsen 2022: 61). In Jutland barrows often formed clusters and lines in the landscapes. Since the beginning of the 20th century these lines have been interpreted as prehistoric routeways (Müller 1904), as the barrows tend to follow the natural ridges, avoiding the low-lying and impassable wetlands (Johansen *et al.* 2004). The southern part of Jutland was covered by a network of these potential routeways along with numerous streams. Therefore, this area has been described as the *delta* of the Ancient Road or *Hærvejen* (Becker-Christensen 1981: 81). Here, we find some of the largest barrows and a concentration of barrows with iron pans (Holst *et al.* 2015: 260), along with an accumulation of prestige metal objects, many of these found in graves, or which presumably originated from barrows. Hence, it is not surprising that NBA houses concentrated in this area as well, where the bole-walled type is predominant. But to what extent does the house type represent a form of architecture connected with political influence?

Architecture of prestige

The resource-demanding character of the large amounts of timber required for each individual house would be reason enough to interpret such constructions as very expensive projects. More than 150 logs of high-quality oak timber were used in the construction of a standard-sized longhouse (*c.* 33 m x 8 m; Holst *et al.* 2013: 16). The building process was complex, involving many people and careful and well-structured organisation, similar to that behind the construction of barrows (Holst *et al.* 2004: 15-18). What made such houses even more expensive was that at many sites suitable timber needed to be transported long distances, as building timber did not seem to have been locally available in sufficient quantities. This is evident when looking at regional and local pollen analyses from the old glacial landscapes in Jutland, as they show evidence for open grass and heath landscapes in the NBA (e.g. Karg 2008; Odgaard 1994; Odgaard 1985). Furthermore, the dense concentration of barrows constructed with pieces of turf indicate vast deforested areas dominated by grass- and heathlands in these regions (e.g. Haughton and Løvschal 2023). Possibly large quantities of suitable timber were imported from the sparsely settled and more forested young moraine regions further east (Holst 2013: 32; Holst *et al.* 2013: 7; Poulsen 2022: 62). In northern Jutland, bole-walled constructions seem to have been used only for the largest longhouses at some sites; they also sometimes accommodated high-status objects, e.g. bronze artefacts, hoards of bronze, and the remains of bronze casting activities that were found in postholes and other features in the houses (Kristensen 2015: 115; Nilsson 1996).

In our view, these factors indicate that the bole-walled house type represented an architecture of prestige. The NBA elites did not only use long-distance exchange, including prestige objects of bronze, gold and glass. they were also dependent on imports of objects from shorter distances, e.g. suitable building materials for longhouses from eastern Jutland, or amber from the Jutlandic west coast for further export (Earle *et al.* 1998: 19). Here, it is worth mentioning that Thy in north-western Jutland may have imported timber for boats and longhouses from Rogaland in south-west Norway (Ling *et al.* 2018: 8-10).

It would indeed seem more rational if the Bronze Age farmers in the old glacial landscapes of Jutland adhered to an architecture that was less timber-consuming. However, elite building projects tended to involve great amounts of resources that were not easily available and sometimes needed transport over longer distances of more than 50, or even 100 km (e.g. Pearson *et al.* 2015 1347-1350).

The southern part of Jutland seemed to represent a communicative junction in the NBA, with its many extraordinary routeways and streams. This would explain the concentration of barrow and longhouse monuments, and why we find the largest houses built in the most resource-demanding architecture in this region. Geographically, this part of the Jutland peninsula represents a physical threshold between Scandinavia and continental Europe – a perfect place for the elites to control long- and shorter-distance exchanges (i.e. metal objects, building materials, and more local products).

Conclusion

Centuries before the turning point of 1500 BCE, people were aware of other architectural forms than the common two-aisled building tradition. Being familiar with the three-aisled construction type they knew about its advantages and disadvantages in the LN and NBA I. This is evident with the presence of both the hybrid houses, which combine elements of two- and three-aisled constructions, and early three-aisled longhouses. The inner roof-bearing posts may have been a room-disturbing element in the smaller houses, which could explain why the alternative roof-bearing construction were not embraced generally before the middle of the NBA. The transition from two- to three-aisled longhouses is therefore not a linear chronological evolution but should be seen more as a longer period with experimentation with different forms of construction. The adoption of three-aisled house architecture may reflect a need for larger byres for cattle-stalling, as pointed out by earlier studies (e.g. Ethelberg 2000: 192; Kristiansen 1998). Stall-partition walls would fit well to the roof-bearing posts, as clearly seen in well-preserved longhouses from the Late Bronze Age in the marshlands of northwestern Germany (Strahl 2004). However, traces of byres and animals kept inside houses have been recorded for two-aisled houses as well (Kirk 2020: 16; Schwartz 1996,: 32). The main reason for the three-aisled revolution should be connected to the need for *monumental* architecture, as the culmination of building large longhouses coincides with the culmination of erecting large round barrows. A three-aisled construction is more solid compared to the two-aisled architecture, which does not allow wider and taller longhouses in the same robust way. Some of the largest three-aisled longhouses contain rooms with cooking- and fire-pits that were larger than the other internal divisions in the houses. With sizes of 50 m^2 - 100 m^2, these rooms may have served social activities of a larger group of people (e.g. Ethelberg 2000: 177-178; Poulsen and Dollar 2015: 11) and therefore may have represented a kind of hall-function. With the general great number of agriculture-related objects found in these longhouses (charred grains, quern stones, etc.), along with traces of cattle stalling (although this is more rarely seen, but also more difficult to document), it can hardly be doubted that they represented large farms. In other words, these units represented large farms with potential hall-functions. The largest examples played an important social, economic, and political role taking part in the complex exchange-system network. These powers would have influenced the building traditions of the entire society, including the people building smaller houses, and spreading the use of three-aisled construction through all the different tiers of the community. The concentration of monumentality and prestige in the southern part of Jutland would be a result of the communicative character of the landscapes, with its many routeways, along with the geographical position as the threshold between Scandinavia and the continent. However, it is still unclear why the large and robust NBA houses are so sparsely represented in central and eastern southern Scandinavia. This problem needs further attention.

Bibliography

Artursson, M. 2009. *Bebyggelse och Samhällsstruktur: Södra och mellersta Skandinavien under senneolitikum och bronsålder 2300-500 f.Kr*. Stockholm: Riksantikvarieämbetet.

Bech, J.-H. and A.-L. H. Olsen 2013. Early Bronze Age houses from Thy, Northwest Denmark, in K.-H. Willroth (ed.) *Siedlungen der* älteren *Bronzezeit. Beiträge zur Siedlungsarchäologie und Paläo-ökologie des zweiten vorchristlichen Jahrtausends in Südskandinavien, Nord-deutschland und den Niederlanden*: 9-32. Studien zur nordeuropäischen Bronzezeit, Band 1. Neumünster: Wachholtz.

Bech, J.-H. and M. Rasmussen 2018. Thy and the outside world in the Bronze Age: Regional variations in a North Sea perspective, in J.-H. Bech, B.V. Eriksen and K. Kristiansen (eds) *Bronze Age Settlement and Land-use in Thy, Northwest Denmark, Vol. I*: 25-106. Højbjerg: Jutland Archaeological Society, Museum Thy.

Becker-Christensen, H. 1981. *Hærvejen i Sønderjylland – et vejhistorisk studie. Fra Kongeåen til Danevirke*. Aabenraa: Institut for Grænseregionsforskning.

Björhem, N. and B.M. Staaf 2006. *Långhuslandskapet. En studie av bebyggelse och samhälle från stenålder till järnålder*. Malmöfynd 8. Malmö: Malmö kulturmiljö.

Björhem, N. and U. Säfvestad 1989. *Fosie IV. Byggnadstradition och bosättningsmönster under senneolitikum*. Malmöfynd 5. Malmö: Malmö kulturmiljö.

Boas, N.A. 1993. Late Neolithic and Bronze Age Settlements at Hemmed Church and Hemmed Plantation, East Jutland. *Journal of Danish Archaeology* 10: 119-135.

Boas, N.A. 2019. The House in the Neolithic and Early Bronze Age in Djursland, East Jutland, in L.R. Sparrevohn, O.T. Kastholm and P.O. Nielsen (eds) *Houses for the Living. Two-aisled houses from the Neolithic and Early Bronze Age in Denmark. Volume 1 – Text*: 237-261. Nordiske Fortidsminder Volume 31:1. Odense: Syddansk Universitetsforlag.

Borup, P. 2018. Østbirk – a strategic settlement at the end of the Neolithic. *Journal of Neolithic Archaeology* 20: 83-130.

Brink, K. 2013. Houses and Hierarchies: Economic and Social Relations in the Late Neolithic and Early Bronze Age of Southernmost Scandinavia. *European Journal of Archaeology* 16(3): 433-458.

Brøndsted, J. 1957. *Danmarks Oldtid I. Stenalderen*. Anden udgave, København: Gyldendal.

Christensen, S.A. and J.B. Bertelsen 2024. Huset ved Verdens Ende. Mellem to- og treskibet byggeskik. *Tings Tale. Tidsskrift for materiel kultur* 6: 52-67.

Christensen, S.A. and S.N. Mehlsen 2023. Korn og arkitektur. Overgangen mellem sten- og bronzealderen ved Revsinggård II. *Arkæologi i Slesvig/Archäologie in Schleswig* 19: 19-42.

Christensen, S.A., M.E. Poulsen and L. Grundvad 2023. Forsænkede hustomter og deres aktivitetsspor efter boligfasens ophør – stenansamlinger, deponeringer og ardspor på forsænkede gulve fra senneolitikum og ældre bronzealder. *By, marsk og geest* 35: 4-20.

Draiby, B. 1985. Fragtrup - en boplads fra yngre bronzealder i Vesthimmerland. *Aarbøger for Nordisk Oldkyndighed og Historie* 1984: 127-216.

Earle, T., J.-H. Bech, K. Kristiansen, P. Aperlo, K. Kalertas and J. Steinberg 1998. The Political Economy of Late Neolithic and Early Bronze Age Society: the Thy Archaeological Project. *Norwegian Archaeological Review* 31(1): 1-27.

Ebbesen, K. 2007. Danske hellekister fra stenalderen. *Aarbøger for Nordisk Oldkyndighed og Historie* 2004: 7-62.

Eisenschmidt, S. 2015. Vom Spätneolithikum in die vorrömische Eisenzeit – Grabhügel und Siedlung in Møsvrå bei Kolding. *Arkæologi i Slesvig/Archäologie in Schleswig* 15: 87-103.

Ethelberg, P. 1987. Early Bronze Age Houses at Højgård, Southern Jutland. *Journal of Danish Archaeology* 5: 152-167.

Ethelberg, P. 2000. Bronzealderen, in L.S. Madsen and O. Madsen (eds) *Det Sønderjyske Landbrugs Historie. Sten- og Bronzealder*: 135-280. Skrifter fra Historisk Samfund for Sønderjylland 81. Haderslev: Historisk Samfund for Sønderjylland.

Fyllingen, H. and N.J.O. Armstrong 2012. *Arkeologisk utgravning på Tjora, gnr. 10 bnr. 5,17, og 19. Sola kommune, Rogaland. Sesong 2009 – id. 114908.* Oppdragsrapport

B 2012/23B. Stavanger: Arkeologisk museum i Stavanger.

Grundvad, L., M.E. Poulsen and M.H. Andreasen 2015. Et monumentalt midtsulehus ved Nørre Holsted i Sydjylland. Analyse af et langhus fra ældre bronzealder periode I. *Kuml* 2015: 49-75.

Haughton, M. and M. Løvschal 2023. Ancestral commons: the deep-time emergence of Bronze Age pastoral mobility. *Antiquity* 97(396): 1470-1487.

Holst, M.K. 2013. South Scandinavian Early Bronze Age barrows – a survey, in M.K. Holst and M. Rasmussen (eds) *Skelhøj and the Bronze Age Barrows of Southern Scandinavia Vol. I. The Bronze Age barrow tradition and the excavation of Skelhøj*: 27-128. Jutland Archaeological Society Publications 78. Højbjerg: Jutland Archaeological Society.

Holst, M.K., H. Breuning-Madsen and M. Rasmussen 2015. The iron pans and the barrow construction, in M. K. Holst and M. Rasmussen (eds) *Skelhøj and the Bronze Age Barrows of Southern Scandinavia Vol. 2. Barrow building and barrow assemblies*: 249-285. Jutland Archaeological Society Publications 89. Højbjerg: Jutland Archaeological Society.

Holst, M.K., M. Rasmussen and H. Breuning-Madsen 2004. Skelhøj. Et bygningsværk fra den ældre bronzealder. *Nationalmuseets Arbejdsmark* 2004: 11-23.

Holst, M.K., M. Rasmussen, K. Kristiansen and J.-H. Bech 2013. Bronze Age 'Herostrats': Ritual, Political and Domestic Economies in Early Bronze Age Denmark. *Proceedings of the Prehistoric Society* 79: 1-32.

Jensen, A.V. and M.S. Bagge 2019. Two-aisled houses in the Skanderborg area from the Late Neolithic and Early Bronze Age, in L.R. Sparrevohn and O.T. Kastholm (eds) *Houses for the Living. Two-aisled houses from the Neolithic and Early Bronze Age in Denmark. Volume 1 – Text*: 279-286. Nordiske Fortidsminder Volume 31: 1. Odense: Syddansk Universitetsforlag.

Jensen, J.A. 1973. Bopladsen Myrhøj. 3 hustomter med klokkebægerkeramik. *Kuml* 1972: 61-122.

Johannsen, J.W. 2017. Mansion on the Hill – A Monumental Late Neolithic House at Vinge, Zealand, Denmark. *Journal of Neolithic Archaeology* 19: 1-28.

Johansen, K.L., S.T. Laursen and M.K. Holst 2004. Spatial patterns of social organization in the Early Bronze Age of South Scandinavia. *Journal of Anthropological Archaeology* 23: 33-55.

Karg, S. 2008. Direct evidence of heathland management in the Early Bronze Age (14th century BC) from the gravemound at Skelhøj in western Denmark. *Vegetation History and Archaeobotany* 17(1): 41-49.

Kirk, L.O.H. 2020. *VHM 00803 Vester Hedegaard*. Hjørring: Beretning Vendsyssel Historiske Museum.

Kristensen, I.K. 2015. Spor efter bronzehåndværk i Salling og Fjends, in S. Boddum, M. Mikkelsen and N. Terkildsen (eds) *Bronzestøbning i yngre bronzealders lokale kulturlandskab*: 107-119. YBK 5. Tarm: Viborg & Holstebro Museum.

Kristensen, I.K. 2019. Two-aisled house sites without sunken floors from Salling, Fur and Fjends, in L.R. Sparrevohn, O.T. Kastholm and P.O. Nielsen (eds) *Houses for the Living. Two-aisled houses from the Neolithic and Early Bronze Age in Denmark. Volume 1 – Text*: 189-202. Nordiske Fortidsminder Volume 31: 1. Odense: Syddansk Universitetsforlag.

Kristiansen, K. 1998. The Construction of a Bronze Age Landscape. Cosmology, Economy and Social Organisation in Thy, Northwestern Jutland, in B. Hänsel (ed.) *Mensch und Umwelt in der Bronzezeit Europas*: 281-291. Kiel: Oetker-Voges.

Ling, J., T. Earle and K. Kristiansen 2018. Maritime Mode of Production. Raiding and Trading in Seafaring Chiefdoms. *Current Anthropology* 59(5): 1-37.

Mikkelsen, M. 2012. Development-led archaeology in Denmark, in L. Webley, M.V. Linden, C. Haselgrove, and R. Bradley (eds) *Development-led Archaeology in Northwest Europe. Proceedings of a Round Table at the University of Leicester 19th-21st November 2009*: 117-127. Oxford: Oxbow Books.

Mikkelsen, M. 2019. Two-aisled houses from the areas around Viborg and Holstebro, in L.R. Sparrevohn, O.T. Kastholm and P.O. Nielsen (eds) *Houses for the Living. Two-aisled houses from the Neolithic and Early Bronze Age in Denmark. Volume 1 – Text*: 215-236. Nordiske Fortidsminder Volume 31:1. Odense: Syddansk Universitetsforlag.

Müller, S. 1904. Vei og Bygd i Sten- og Bronzealderen. *Aarbøger for Nordisk Oldkyndighed og Historie* 1904: 1-64.

Nielsen, F.O.S. and P.O. Nielsen 2022. *Limensgård. Houses from the Early, Middle and Late Neolithic on Bornholm*. Nordiske Fortidsminder 34. København: Syddansk Universitetsforlag.

Nielsen, P.O. 1998. De ældste langhuse. Fra toskibede til treskibede huse i Norden. *Bebyggelsehistorisk tidskrift* 33: 9-29.

Nielsen, P.O. 1999. Limensgård and Grødbygård. Settlements with house remains from the Early, Middle and Late Neolithic on Bornholm, in C. Fabech and J. Ringtved (eds) *Settlement and Landscape. Proceedings of a conference in Århus, Denmark, May 4-7 1998*: 149-165. Højbjerg: Jysk Arkæologisk Selskab.

Nilsson, T. 1996. Store Tyrrestrup. En vendsysselsk storgård med bronzedepot fra ældre bronzealder. *Kuml* 1993-94: 147-154.

Nissen, M. 2018. *HAM 5792, Almindgård I, Hjordkær sogn, Rise herred, Aabenraa amt, stednr. 220202, sb. 151*. Arkæologisk rapport. Haderslev: Museum Sønderjylland.

Odgaard, B. 1985. Kulturlandskabets historie i Vestjylland. Foreløbige resultater af nye pollenanalytiske undersøgelser. *Fortidsminder. Antikvariske studier* 7: 48-59.

Odgaard, B. 1994. The Holocene vegetation history of northern west Jutland, Denmark. *Opera Botanica* 123: 1-171.

Pearson, M.P., R. Bevins, R. Ixer, J. Pollard, C. Richards, K. Welham, B. Chan, K. Edinborough, D. Hamilton, R. Macphail, D. Schlee, J.-L. Schwenninger, E. Simmons and M. Smith 2015. Craig Rhos-y-felin: A Welsh bluestone megalith quarry for Stonehenge. *Antiquity* 89(348): 1331-1352.

Poulsen, M.E. 2009. De monumentale midtsulehuse fra senneolitikum og tidligste bronzealder i Sydskandinavien, in T. Brattli (ed.) *Det 10. Nordiske bronsealdersymposium. Trondheim 5.-8. Okt. 2006*: 156-168. Vitark 6. Trondheim: Tapir.

Poulsen, M.E. 2014. *Beretning for arkæologisk systematisk undersøgelse af HBV j.nr. 1456 Kongehøj etape III Askov by matr.nr. 9iy, Malt sogn, Malt herred Vejen kommune, gl. Ribe amt, Region Syddanmark*. Brørup: Museet på Sønderskov.

Poulsen, M.E. 2022. Robust longhouses in the west. Bole-walled houses from the Early Bronze Age Periods II-III and their western distribution, in A. Tornberg, A. Svensson and J. Apel (eds) *Life and afterlife in the Nordic Bronze Age. Proceedings of the 15th Nordic Bronze Age Symposium held in Lund, Sweden, June 11-15, 2019*: 57-70. Acta Archaeologica Lundensia Series Prima in 4⁰, No. 37. Lund: Department of Archaeology and Ancient History, Lund University.

Poulsen, M.E. 2023. Halvvejgård og Kongeengen – to nyundersøgte lokaliteter med hustomter fra senneolitikum og ældre bronzealder ved Vejen i Sydjylland. Foreløbige betragtninger. *Arkæologi i Slesvig/Archäologie in Schleswig* 19: 75-96.

Poulsen, M.E. and S.D. Dollar 2015. Bronzealderbønder i det sydjyske indland – treskibede langhuse fra ældre bronzealder på Kongehøj II. *By, marsk og geest* 27: 5-19.

Poulsen, M.E. and L. Grundvad 2015. Vestervang ved Vejen – væggrøftshuse fra overgangen mellem yngre stenalder og ældre bronzealder. *By, marsk og geest* 27: 20-36.

Poulsen, M.E. and L. Grundvad 2019. Bronzeøkserne fra Bækbølling og det 16. århundrede f.Kr. i en sydjysk indlandsegn. *By, marsk og geest* 31: 5-20.

Poulsen, M.E., P. Borup and L. Grundvad 2019. Anvendelsen af den treskibede konstruktion før 1500 f.Kr. i Danmark. *Gefjon* 4: 8-23.

Rasmussen, M. 2015. The house structure and associated activities, in M.K. Holst and M. Rasmussen (eds) *Skelhøj and the Bronze Age Barrows of Southern Scandinavia, Vol. 2. Barrow building and barrow assemblies*: 141-156. Jutland Archaeological Society Publications vol. 89. Højbjerg: Jutland Archaeological Society.

Rasmussen, M. and C. Adamsen 1993. Bebyggelsen, in S. Hvass and B. Storgaard (eds) *Da klinger i muld. 25 års arkæologi i Danmark*: 136-141. Allingåbro: Jysk Arkæologisk Selskab.

Runge, M. and M.B. Lundø 2019. Two-aisled houses from the Neolithic and Early Bronze Age in the area of responsibility of Odense City Museums, in L.R. Sparrevohn, O.T. Kastholm and P.O. Nielsen (eds) *Houses for the Living. Two-aisled houses from the Neolithic and Early Bronze Age in Denmark. Volume 1 – Text*: 135-151. Nordiske Fortidsminder Volume 31: 1. Odense: Syddansk Universitetsforlag.

Sarauw, T. 2006. *Bejsebakken. Late Neolithic Houses and Settlement Structure.* Nordiske Fortidsminder Serie C, Vol. 4. København: Det Kongelige Nordiske Oldskriftselskab.

Schiellerup, P. 1992. St. Valbyvej – et senneolitisk højkompleks ved Himmelev, nord for Roskilde. *Aarbøger for Nordisk Oldkyndighed og Historie* 1991: 21-57.

Schwartz, W. 1996. Bronzezeitliche Hausgrundrisse von Hesel im Landkreis Leer. *Die Kunde* NF 47: 21-50.

Simonsen, J. 2017. *Daily Life at the Turn of the Neolithic. A comparative study of longhouses with sunken floors at Resengaard and nine other settlements in the Limfjord region, South Scandinavia*. Jutland Archaeological Society Publications 98. Højbjerg: Jutland Archaeological Society.

Soltvedt, E.-C., T. Løken, L. Prøsch-Danielsen, R.L. Børsheim and K. Oma 2007. *Bøndene på Kvålehodlene. Boplass-, jordbruks- og landskapsutvikling gjennom 6000 år på Jæren, SV Norge*. AmS-Varia 47. Stavanger: Arkeologisk museum i Stavanger.

Strahl, E. 2004. Ein Haus für Mensch und Tier. *Archäologie in Deutschland* 2: 26-27.

Tesch, S. 1993. Houses, Farmsteads, and Long-term Change. Unpublished doctoral thesis, Uppsala University.

Torfing, T.D. 2021. Senneolitiske huse i Sydvestjylland – hustyper, kronologi og landskab. *By, marsk og geest* 33: 4-31.

Vandkilde, H. 1996. *From Stone to Bronze. The Metalwork of the Late Neolithic and Earliest Bronze Age in Denmark.* Jutland Archaeological Society Publications XXXII. Højbjerg: Jutland Archaeological Society.

Vandkilde, H. 2017. *The Metal Hoard from Pile in Scania, Sweden. Place, Things, Time, Metals and Worlds around 2000 BCE*. Swedish History Museum Studies 29. Aarhus: Aarhus University Press.

Chapter 30

The end of an era: a village from the end of the Bronze Age

Tobias Torfing,[a*] Anna Thusgaard Kristensen[a] and Jesper Olsen[b]

[a] Vejle Musserne, Vejle, Denmark
[b] Physics and Astronomy, Aarhus University, Denmark
*torfing@live.dk

Abstract

At Veldbæk in southwestern Jutland, a recent excavation undertaken by the Museum of Southwest Jutland revealed the remains of hundreds of structures, e.g. houses, pit and activity areas, which date all the way from the Early Neolithic to the Medieval period. In this contribution, we will discuss the Late Bronze Age settlement and related structures at Veldbæk and their impact on Danish archaeological material. The preliminary analysis of the data totally changes our understanding of the Late Bronze Age settlement structure in the region. We argue that it is during period VI of the Nordic Bronze Age (NBA) that we see the first large villages appear. Furthermore, we will suggest that this was accompanied by important changes in agricultural practice.

Introduction

At Veldbæk, near Esbjerg in southwestern Jutland, an excavation from 2021-2024 revealed a large Late Bronze Age (LBA) settlement. The excavation also included interesting finds from the Early Neolithic and every major period until World War II. Within this chapter, we focus on presenting the material from the LBA settlement area.

In general, LBA settlements have been described as single farmsteads (Nielsen 2012: 146; Runge 2012: 130-131) or as double farmsteads, including a 'free' family and a subservient 'unfree' worker, although some houses might instead have featured two families in one house (Bech 2012: 17-19 with references; Mikkelsen 2012; 2020). Although Bjarne Henning Nielsen (2012: 143) does suggest a small village of three houses at Borregård, he puts forward that they are exceptions. More general publications (Jensen 2002: 339-352) also describe the LBA as a period with small settlements of one or two houses. Often it is assumed that it was *c.* the 2nd or 3rd century CE that we saw the first villages, i.e. fenced villages such as Hodde (Hvass 1985), or villages with individually fenced farms (i.e. Vendehøj) in the latter half of the pre-Roman Iron Age (Ejstrud og Jensen 2000).

Here we will argue that during the LBA settlement structures became so dense in some areas that we must consider them proper villages. This marks a substantial change from the Early Bronze Age (EBA) and the Late Neolithic (LN), where houses were scattered around the landscape as single farms. As mentioned, this same model of single or dual farms has also generally been suggested for the LBA (and might indeed be applicable for some areas during that time). At Veldbæk, however, and likely many other sites, we argue that the settlement density and the clearly structured appearance are characteristics of a village.

The archaeological material

The LBA settlement at Veldbæk consists of *c.* 90 structures interpreted as houses, although a few houses might date to the first decades of the subsequent pre-Roman Iron Age (^{14}C-datings are still in progress and these will identify the numbers of Iron Age houses). As well as the houses, the site also has cooking pits, refuse pits, ovens, and other structures that can be dated to the Bronze Age.

The dating of settlement structures is based on ceramic typology and the typological traits of the houses. Additionally, 44 radiocarbon dates on charred material directly linked to either houses or features consisting of Bronze Age ceramics allow us to also date these structures scientifically. Of the 44 radiocarbon dates, most were made on cereals, although a few were made on charcoal from short-lived trees or branches with a negligible age. Two of the 44 dates (AAR36116 and AAR36177) had to be removed as outliers, as other dates from the same structures confirmed a LBA date.

Of the 90 houses, 16 were dated through radiocarbon dating (see Table 1), as well as nine other features. The dated houses resemble the dataset in general. The sampling strategy for the radiocarbon dating focused on a balance between small and large houses, as well as houses from different parts of the site. However, most of the dates are from the northern and central parts of the site; the dating of the southernmost houses is still in progress.

In addition, a series of other features, i.e. pits and ovens, have been radiocarbon dated. These features are not directly related to a specific house, but are considered

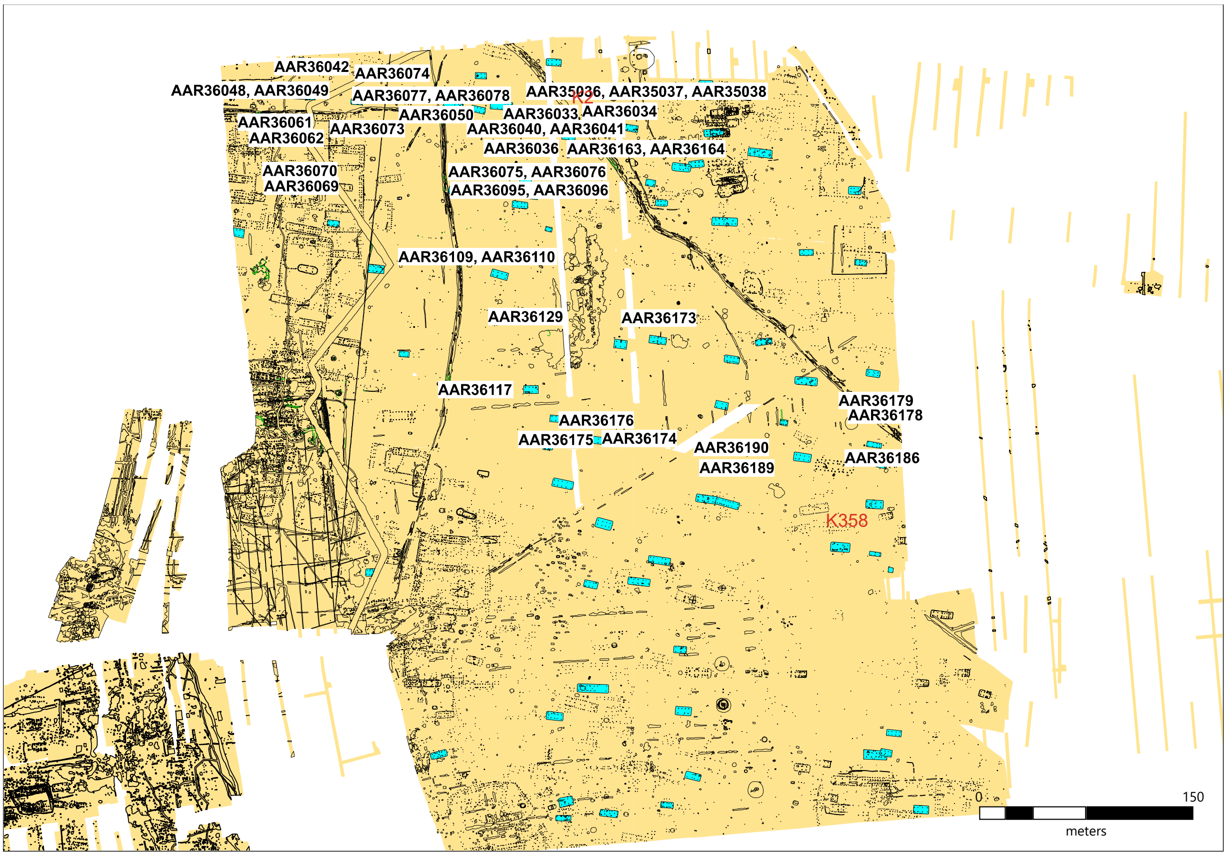


Figure 1: Overview plan of the settlement structures at Veldbæk, near Esbjerg in southwest Jutland. Houses from LBA are marked in blue (graphics: the authors using MapInfo 21).

part of the LBA settlement. These were selected so as to reveal any biases resulting from our selection of houses (Fig. 1).

The houses

Most of houses were only preserved as two rows of roof-bearing postholes: the last remains of three-aisled longhouses. The postholes were often very small in both diameter and depth, and were filled with light and brownish soil which made it easy to separate these postholes from those of the pre-Roman Iron Age houses at the site. Only a few houses had signs of walls and/or doors. Here, the walls consisted of a single row of small posts which likely supported wattle-and-daub walls.

The houses from Veldbæk in general resemble LBA houses from other parts of Denmark (see Bech 2012; Brinch Bertelsen 1996; Christiansen 2012; Mikkelsen 2012; 1996; Runge 2012). The lack of structural details in the houses could theoretically be a problem for dating the LBA houses. Recurring archaeological features in houses of the subsequent construction phase of the pre-Roman Iron Age, however, helped the typological dating process. Iron Age houses almost always had traces of a wall trench in the eastern half of the house end and (sometimes) also signs of animal stalls. The Bronze Age houses had no wall trenches and, as already mentioned, only occasionally had the remainder of wattle-and-daub walls. Another feature that should be named as characteristic of LBA houses is the very wide central aisle (distance between a pair of posts), which often measured above 3 m, and sometimes up to 3.4 m (though some were smaller). By contrast, the pre-Roman Iron-Age houses had central aisles of 2.3 m - 2.8 m.

As changes in house-types do not always follow our modern chronological system (they do not respect the end of the Bronze Age and the start of the Iron Age in the same way), we need to assume a potential overlap of the two types of houses. For this study, we assumed that both types could exist in parallel during 1-2 generations (50+ years).

The pottery

Even if not analysed in detail, the pottery assemblage at the site displays a majority of LBA traits as well as a few occasional traits from the pre-Roman Iron Age. Both are present in the same houses and the same pits. The Bronze Age ceramics are characterised by band-shaped handles which start at the rim and have a slight vertical depression along the back (Fig. 2). Many rim sherds are

Table 1: ^{14}C dates taken from Bronze age house constructions or related features at Veldbæk.

House /feature number	Sample	Material	UncalBCE	Uncertainty	Type
K002	AAR35036	charred seeds	2391	29	house
K002	AAR35037	grain	2491	28	house
K002	AAR35038	grain	2459	30	house
K002	AAR36033	grain	2465	25	house
K002	AAR36034	grain	2428	29	house
K003	AAR36036	grain	2453	27	house
K006	AAR36040	grain	2437	30	house
K006	AAR36041	grain	2444	29	house
K018	AAR36050	grain	2503	26	house
K032	AAR36061	grain	2370	26	house
K032	AAR36062	grain	2419	31	house
K042	AAR36069	grain	2477	32	house
K042	AAR36070	grain	2446	27	house
K047	AAR36073	grain	2377	30	house
K067	AAR36095	grain	2490	33	house
K067	AAR36096	grain	2475	36	house
K087	AAR36116	grain	388	29	house
K087	AAR36117	grain	2450	31	house
K099	AAR36129	grain	2397	28	house
K132	AAR36163	grain	2428	26	house
K132	AAR36164	grain	2475	23	house
K139	AAR36173	grain	2433	24	house
K141	AAR36174	grain	2467	23	house
K141	AAR36175	grain	2463	27	house
K141	AAR36176	grain	2502	25	house
K143	AAR36177	charcoal	3246	25	house
K143	AAR36178	charcoal	2525	25	house
K143	AAR36179	charcoal	2411	26	house
K147	AAR36186	grain	2469	27	house
K149	AAR36189	grain	2485	26	house
K149	AAR36190	grain	2456	27	house
Pit/grave A4433	AAR36035	grain	2429	28	other
Pit A4800	AAR36048	grain	2457	28	other
Pit A4800	AAR36049	grain	2434	29	other
Pit A4749	AAR36042	grain	2455	43	other
Pit/oven A6001	AAR36111	grain	2417	30	other
Pit/oven A6001	AAR36112	grain	2454	27	other
Pit A5253	AAR36077	grain	2438	28	other
Pit A5253	AAR36078	grain	2379	41	other
Pit A15121	AAR36109	grain	2433	30	other
Pit A15121	AAR36110	grain	2407	28	other
Pit/oven A4889	AAR36075	grain	2423	32	other
Pit/oven A4889	AAR36076	grain	2413	23	other
Pit A5223	AAR36074	grain	2392	33	other

Figure 2: Examples of LBA pottery from Veldbæk (x 015 and x 150) (photo: the excavation team at SJM 979 Veldbæk, Museum of Southwest Jutland).

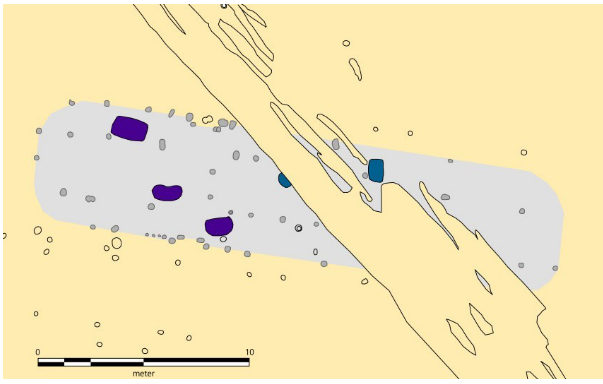


Figure 3: K2 with storage pits shown in purple and cooking pits shown in blue (graphics: the excavation team at SJM 979 Veldbæk, Museum of Southwest Jutland (using MapInfo 21)).

thin, but some had a small, round and outward-turned ‘lip’, while the Iron Age ceramics were slightly flatter. The larger vessels had either continuous or short, horizontally moulded lines with finger impressions (for comparison, see Jensen 1997: 98-143; Nielsen 1996).

LBA grain storage

When looking at the Bronze Age houses from Veldbæk, two houses stand out from the rest (K2 and K358). House K2 was an unusually large house for the LBA. It measured over 20 m in length (Fig. 3) and lies in the centre of the northern part of the excavation (dated to period VI, based on pottery typology and radiocarbon dates). The house had well-preserved walls and doors but was cut in half by a prehistoric road.

One of the more interesting features was the discovery of three storage pits inside the house that have been interpreted as having been contemporary. Two of these were filled with large amounts of stones and ceramics. Some of the stones could be identified as hammer stones and one as an ‘anvil stone’. Furthermore, a fragment of a clay mould (Fig. 4) for bronze casting was found in storage pit A4428.

In the third storage pit, even more fascinating finds came to light. The top of the pit was covered in stones, one of which turned out to be a mould for a celt (Fig. 5). Underneath this layer of stones, a thick layer of burned cereals and charcoal was recovered. In some areas of the pit, the cereal accumulation was so ‘clean’ that there was almost no soil around the single grains In between and around the cereals were many uniformly thin pieces of bark. Lumps of small seeds were stuck to the sides of several of these bark pieces, suggesting that they were the remnants of bark containers containing seeds.

The second house (K358, Fig. 6) was of ‘standard’ size for LBA VI at the site and measured c. 13 m in length. This house also had three storage pits, of which two were round and one was more rectangular. The rectangular pit contained large amounts of charcoal, burned animal bones and antlers, together with a huge quantity of

Figure 4: Clay mould from storage pit A4428, house K2 (photo: the excavation team at SJM 979 Veldbæk, Museum of Southwest Jutland).

Figure 5: Stone mould for a celt from storage pit A4488, house K2 (photo: the excavation team at SJM 979 Veldbæk, Museum of Southwest Jutland).

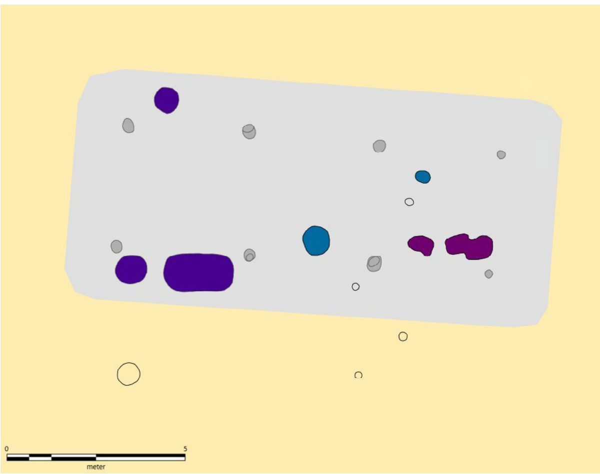


Figure 6: K358 storage pits shown in purple, cooking pits shown in blue and the cultural layer shown in magenta (graphics: the graphics the excavation team at SJM 979 Veldbæk, Museum of Southwest Jutland (using MapInfo 21)).

Figure 7: Cereal pits from K2 (top) and K358 (middle) and the burned lump of seeds from A4488 (bottom). In both houses, the cereal pits were emptied into sample bags and water-sifted. Approximately 50 litres of clean cereals and seeds were found in K2 alone.

ceramics. Similar to the feature described above, the other two pits were filled with cereals and seeds and were packed with ceramics from top to bottom (Fig. 7).

The crops in the pits from K2 consisted partly of cereals in the form of oats, barley, and wheat and partly of the oleaginous plants flax (*Linum usitatissimum*) and gold-of-pleasure (*Camelia sativa*).

It was observed that some samples from the main pit mainly consisted of one of the two species, indicating that the species had been kept separate.

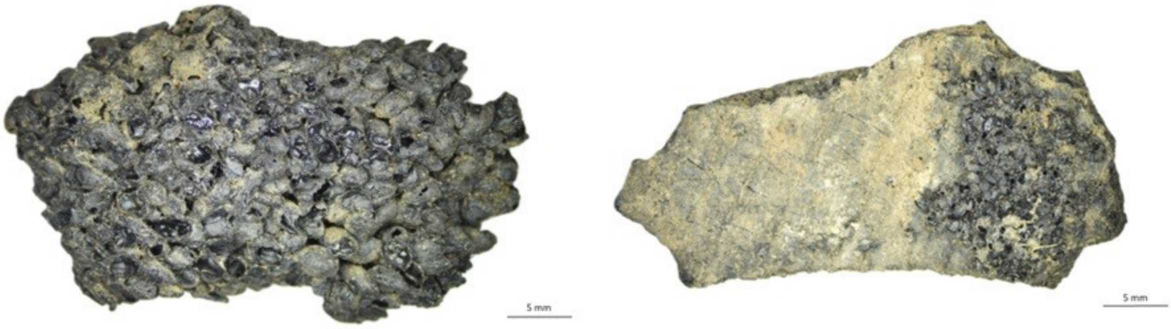


Figure 8: On the right: burned clump of seeds; on the left: bark piece with seeds on (graphics: the authors).

This is supported by the evidence that the bark pieces had several lumps of pure *Camelia sativa* and *Linum usitatissimum* burned onto them, thereby indicating that the two species were probably stored separately in bark containers (Fig. 8).

An analysis of the variety of species between the storage pits in K2 and K358 revealed that the pit-filling in K358 was significantly less varied. The primary species present in K358 is naked barley (*Hordeum vulgare var. nudum*) and hulled barley (*H. vulgare var. vulgare*), while small quantities of goosefoot (*Chenopodium sp.*) and knotgrass (*Polygonum aviculare*) were also detected.

In high-status LBA houses, one sometimes sees many different types of cereal and seeds present (Sørensen *et al.* 2023), i.e. flax seeds as well as barley, wheat, and oats. These are the same types we see in the pits from K2, whereas K358 has fewer (and more common) types of cereal and seeds, e.g. barley and knotgrass. This could indicate that the residents of K2 had a much higher social status than those of K358 (Sørensen *et al.* 2023: 13-14). Additional support for this theory comes insofar as that one can also observe differences in the other artefacts found in the houses. In K2, several signs indicate bronze casting. When we assume that bronze casting in settlements was associated with the elite (based on Larsen *et al.* 2015), an accumulation of casting debris in K2 throws further support behind the assumption that K2 represents a high-status building. The fact that copper and tin sources were not exploited in southern Scandinavia during the Bronze Age (see Ling *et al.* 2014) would, of course, mean that the metal used at Veldbæk would have been imported (see here Nørgaard *et al.* in this volume). It follows, therefore, that the presence of bronze casting in K2 could indicate that the settlement shared in an active metal network, with the probability that the residents of Veldbæk had contacts with foreign regions.

In contrast, the artefacts found in K358 point to more common kinds of craft activities. One of the storage pits contained bones and antlers with signs of cutmarks. Such remains indicate handicraft activities, i.e. the production of bone combs or other bone/antler tools in or near the house. Also, the reworking of pottery sherds indicates everyday craft activities; some of the pieces had secondarily added perforations and were probably used as spindle whorls (Lerke and Hjort-Jørgensen 2020). As K358 was smaller than K2, in addition to the craft activity traces as described, these might be indications that K358 was the dwelling of persons from a lower social class.

It is important to highlight that such an accumulation of cereals is unique compared to other examples from the same period. These cereal deposits from both houses are some of the largest in Scandinavia from this period and have close parallels to EBA Hestehaven (Jensen *et al.* 2020), Arnbjerg N (Sørensen *et al.* 2023), LBA Bjerre 7 (Earle *et al.* 2022), and Early Iron Age (EIA) Overbygaard (Lund 1980). The cereal finds from Veldbæk are, however, particularly special, as they enable us to now compare the grain repertoire of two houses of different social ranges, which makes a tremendous contribution to our understanding of Bronze Age society and structure.

The chronology of the LBA settlement

Method

To investigate how long the settlement phase was, we have chosen to use a simple Bayesian model of radiocarbon dates (Bronk Ramsey 2009a; OxCal 4.4.4. modelling). We applied a single phase, with the assumption that the settlement started and ended at some point, and placed our 42 radiocarbon dates of presumed LBA origin within this phase. We also made a query towards the span of the length of the phase. This estimates the length of the settlement. All the radiocarbon dates (see Table 1) are AMS dates from Aarhus University. ^{14}C ages are reported in conventional radiocarbon years BP (before present = 1950) in

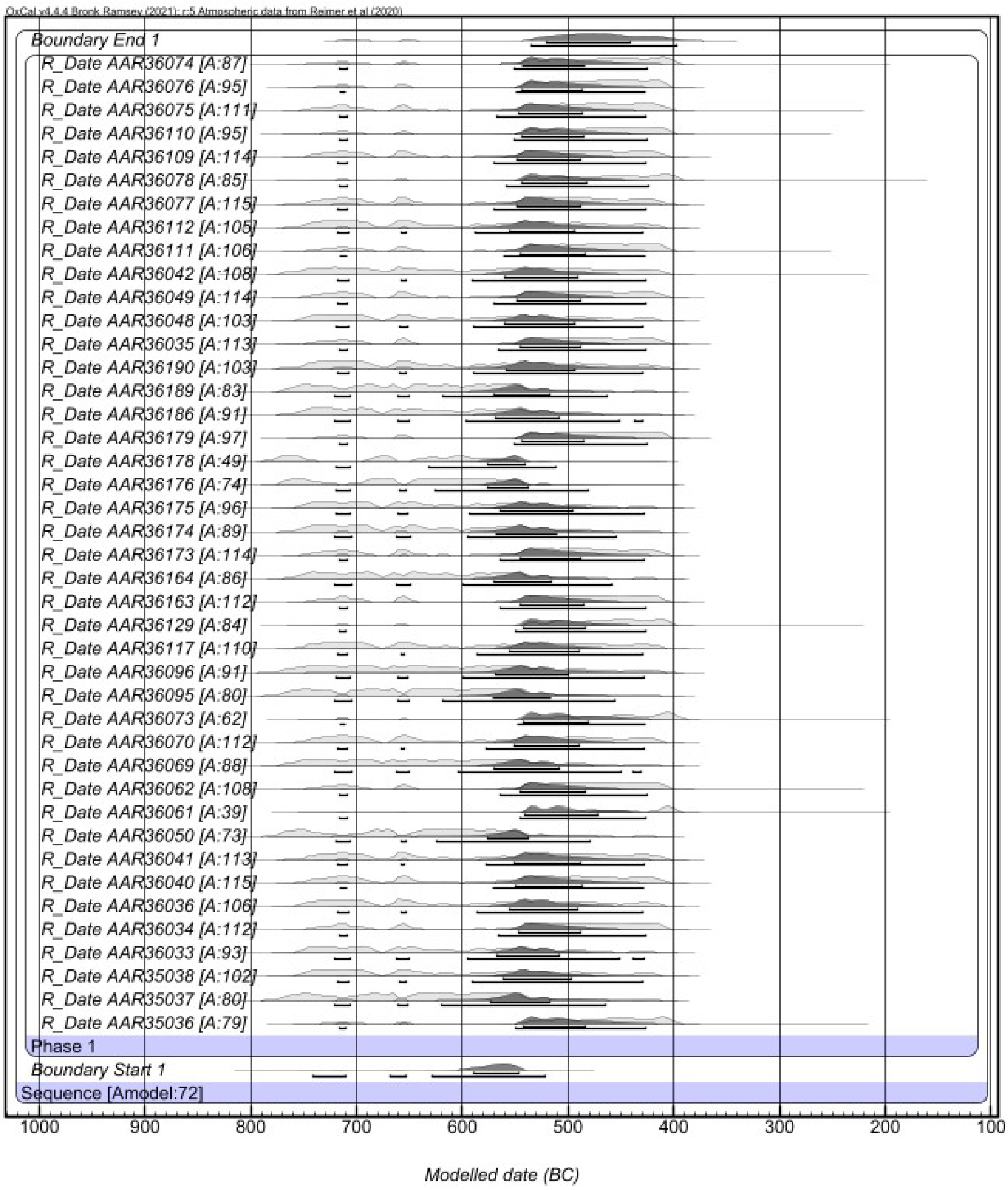


Figure 9: Phase model of the 42 dates (OxCal 4.4.4 and the authors).

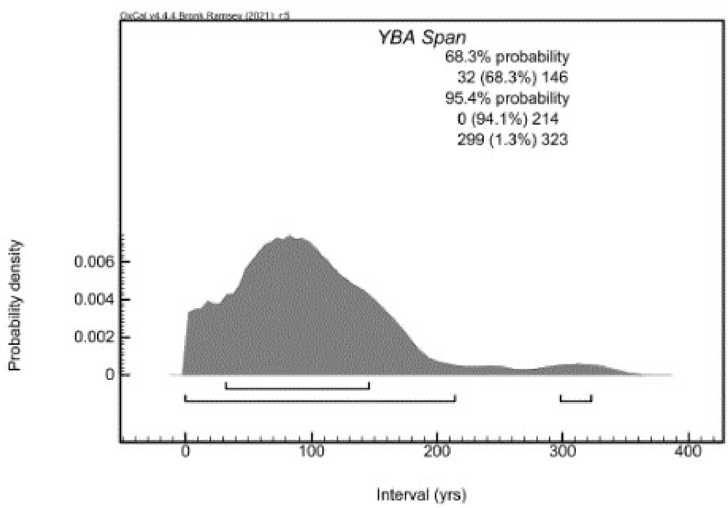


Figure 10: The span query of the phase (OxCal 4.4.4 and the authors).

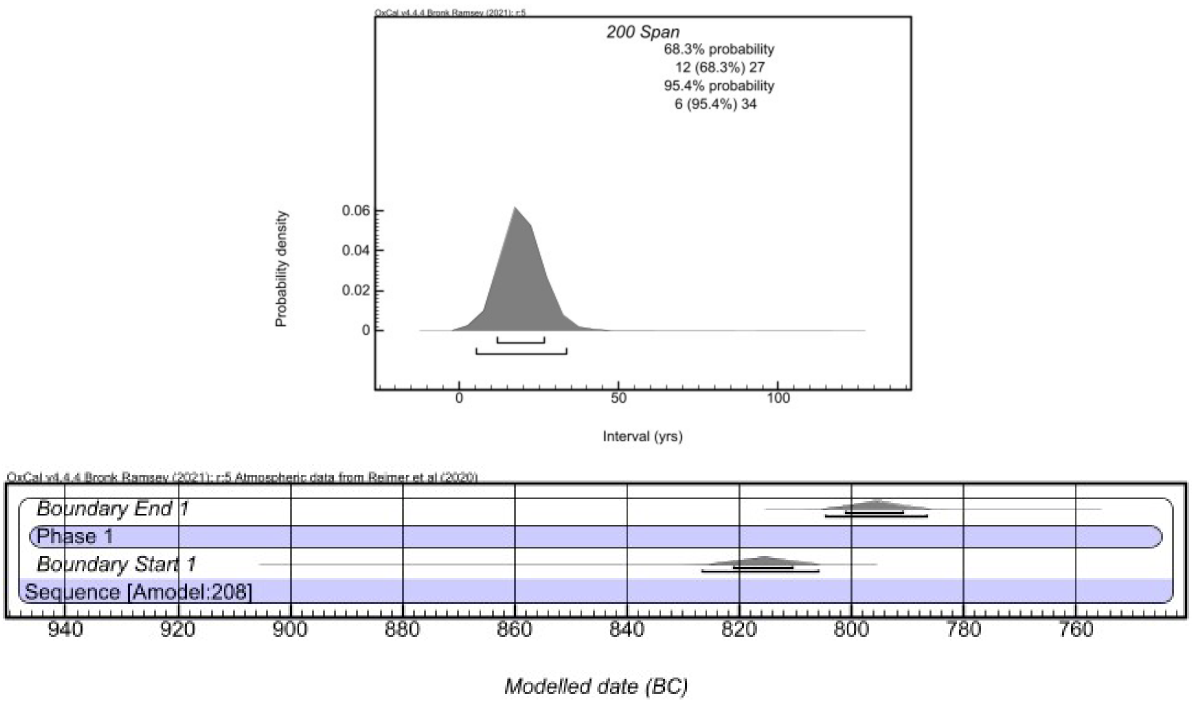


Figure 11: Start, end, and span of the dates once moved 200 years backwards in time (OxCal 4.4.4 and the authors).

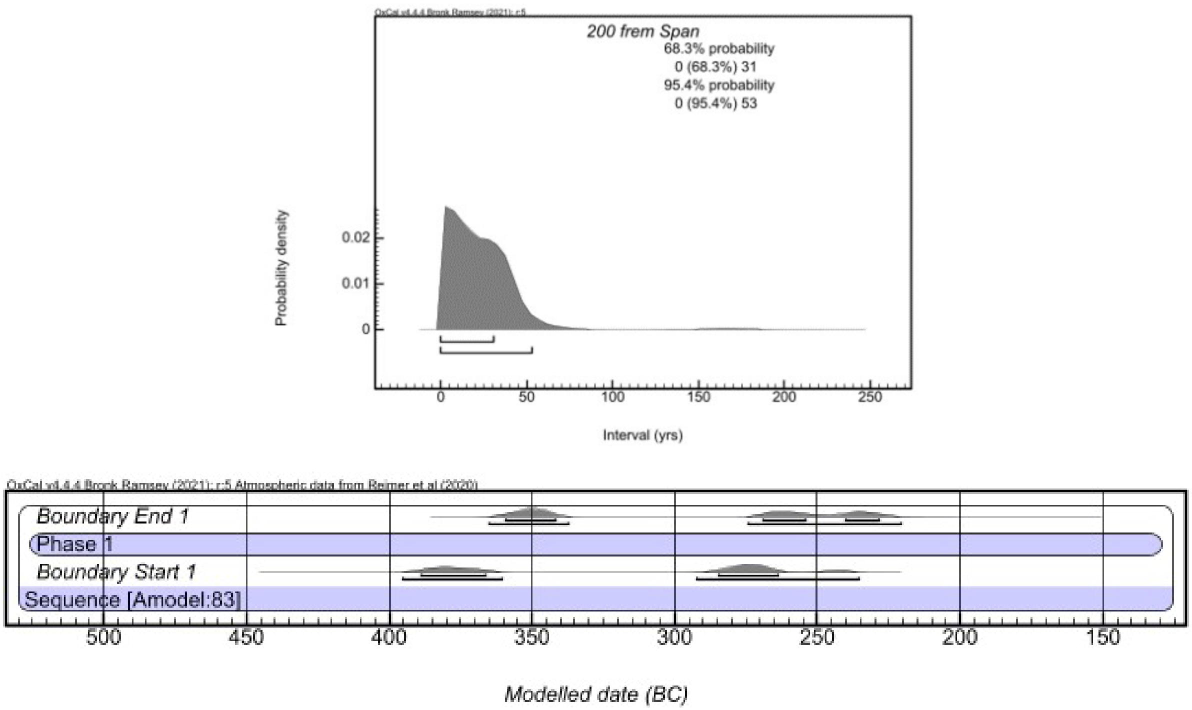


Figure 12: Start, end, and span of the dates moved 200 years forwards in time (OxCal 4.4.4 and the authors).

accordance with international convention (Stuiver and Polach 1977).

As the transition between the LBA and the pre-Roman Iron Age lies on the Halstatt Plateau in the calibration curve, precise dating is often difficult (Rose and Meadows 2024). We have thus tested sensitivity to the effect of the calibration curve (see Meadows 2020: 1275-1276 for a similar test on a different dataset). We have used real and simulated radiocarbon dates to test

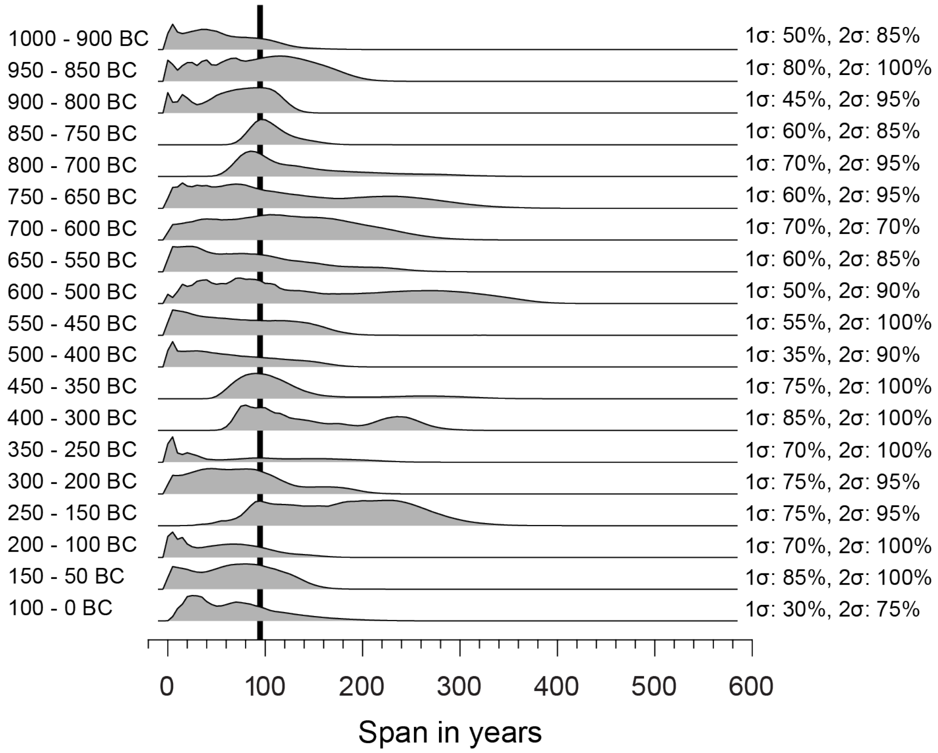


Figure 13: Shown is the summed probability distribution of simulated durations for 100-year intervals between 900 - 0 BCE (see Appendix 1 for further details). Each interval is simulated 20 times using 42 randomised sample ages. The vertical line shows the expected duration).

whether the results of our preferred model are a result of the calibration curve or whether they instead might reflect ancient reality.

The Bayesian model of the LBA radiocarbon dates

The phase model of the 42 dates gave a very narrow phase (Fig. 9). The agreement indexes are Amodel at 72 and Aoverall at 62, thus both above the level accepted as significant (Bronk Ramsey 2009b). The model estimates that the settlement started (boundary start) somewhere between 630-520 calBCE (at 90.8%), and between 590-550 calBCE (at 68.3%). The end (boundary end) is estimated to have been *c.* 540-400 calBCE (95.4 %), and likely between 520-440 calBCE (68.4). The span analysis (Fig. 10) shows that the settlement had a duration between 30-150 years (at 68.4%).

In summary, the LBA settlement phase at Veldbæk existed for *c.* 100 years (30-130) according to the span, and started *c.* 630-520 and ended 540-400 calBCE. If the 16 houses and nine other features can be considered representative of the settlement as a whole, this settlement can also be said to have been rather short lived. The narrow dating fits the typological dating of the pottery to NBA VI, with some sherds pointing to early pre-Roman Iron Age (period 1, after Jensen 2005).

Testing the results

As mentioned above, carbon dating at the Halstatt Plateau is difficult. To ensure that modelled dates are correct we have tested them in various ways. The first test was moving the dates back in time by 200 uncalibrated years. Moving all dates back 200 years and placing them in a single phase gives a very short phase (see Fig. 11 a-b). The Amodel is 208 and Aoverall 171, and both are well above what is required (Bronk Ramsey 2009b). The suggested length of the phase is between 6-34 years (at 95.4 %). The curve is very steep at this time and the dates make a very uniform group.

The second test is moving the dates 200 forward in time (Fig. 12). Here the Amodel is 83 and the Aoverall is 34. This should mean that the model as such is ok, although too many individual dates fail. If we look at the modelled phase, it shows a dual top distribution of both start and end date. The model either points to a phase in the early 300s BCE or to the mid 200s BCE. The result is affected by the curve, which, for this period, is first very steep and then has a wiggle. This wiggle gives the modelled phase two possible ranges. However, the span again suggests a very short phase, here 0-53 years.

The two tests together indicate that the model calculated using the real data does not produce an artificially narrow phase. Instead, this model might overestimate the length of the settlement phase.

Test three – simulated dates

As the base model suggests a settlement phase of *c.* 100 years, lasting from 630-520 and ending 540-400 calBCE, we have used a similar phase-length for the test. OxCal's R simulate function was used to simulate the uncertainty of each date. It also makes them interact with the curve as if they were actual dates. As this gives a great deal of randomness in the modelling, the result will vary each time the model is run.

Radiocarbon calibration has been simulated for calibrated dates between 900 and 0 BCE, using 100 year intervals. A step of 50 years was used, resulting in a total of 19 simulations (900 - 800 BCE, 850 - 750 BCE, ... , 100 - 0 BCE). Each simulation contains a total number of 42 simulated radiocarbon dates, all with an uncertainty of ±25 ^{14}C years. Furthermore, each of the 100-year intervals was repeated 20 times to achieve statistics on the modelled onset, termination, and duration. Thus, in total, 380 OxCal models were run.

The purpose of the simulations was to investigate the influence of the shape of the IntCal20 calibration on simple phase models for the period between 900 - 0 BCE, encompassing the Danish Bronze Age.

Final results

In general, there is a good resemblance between the phase made with the real dates and the simulated phases. However, there is a tendency for models on simulated dates to result in phases that are slightly shorter. Comparing the real dates with the simulated ones could suggest that the actual settlement phase is slightly shorter than the simulated ones, or that it does not have the simulated phases' uniform distribution of dates. This could be further tested with more simulations of different scenarios. However, as the phase of the real dates do fall within the simulated phases, and it still only represents a sample from a larger village, we do not want to over-emphasise this before we can get more data and also date the following Early Iron Age settlement.

As both the modelled phase of the actual dates and the subsequent testing of the results show that these 42 dates form a short phase of *c.* 100 years, we are confident that the 16 dated houses were contemporary or were erected within two to three generations. Regarding the rest of the 90 houses, the sampling does give some uncertainty, but it is highly unlikely that many of them should produce vastly different results.

At the current state-of-research, we can conclude that the evidence points towards a LBA settlement phase that lasted *c.* 100, or perhaps 150 years.

Discussion

One question still remains: how large was the LBA settlement at Veldbæk? If we take a cautious approach and estimate that each house/generation existed for just 20 years on average and that the LBA phase discussed above lasts *c.*100 years, this would mean that each family has five generations and, thus, would use five houses during the 100-year phase. If the houses were in use for longer, there would have been more contemporary houses (see discussion in Beck 2012: 19-20). If we again carefully assume that only 80 of the 90 similar houses actually were from this phase (we assume here that there are also houses from the early pre-Roman Iron Age), this would result in 16 houses per generation. In another scenario, we assume that all 90 houses are from the LBA phase, and that each house was in use for 30 years, in which case we end up with 27 contemporary houses.[1]

In the western part of the excavated area, no LBA houses were documented. This area was heavily used in the Iron Age and the Medieval period. Here, smaller sherds of the LBA/IA l, as well as a few pits and scattered postholes of prehistoric appearance, were detected. Additionally, in this area we found a Word War II bunker and anti-tank ditch. It is likely that the poor preservation explains the lack of prehistoric settlement evidence in this area of the site. The scientific dates show that there were at least 16-27 contemporary house at Veldbæk SJM 979. Smaller excavations from the 1990s east and west of Veldbæk SJM 979 have shown similar houses, but so far without secured dates and further detailed excavations. We cannot estimate if/how many houses might be located here, although we do know that the settlement continued in both directions.

Having presented the evidence from Veldbæk above, we argue here that a settlement of 16-27 contemporary houses should be considered a village in terms of prehistoric Scandinavia. Even if each farm consists of two buildings and the number of economic units are, thus, halved, the settlement will still consist of 8-13 contemporary farms. Martin Mikkelsen, for instance, has provided arguments for the existence of double farmsteads in the Bronze Age, with the main family in one house and what he terms 'unfree labor' in another (smaller) building, thought to have been subservient to the main family (Mikkelsen 2012; 2020). Whether or not this model of two classes existed at Veldbæk remains unclear, as variation in the house sizes could also have

[1] 90 houses/phase 100 years/30 years per house.

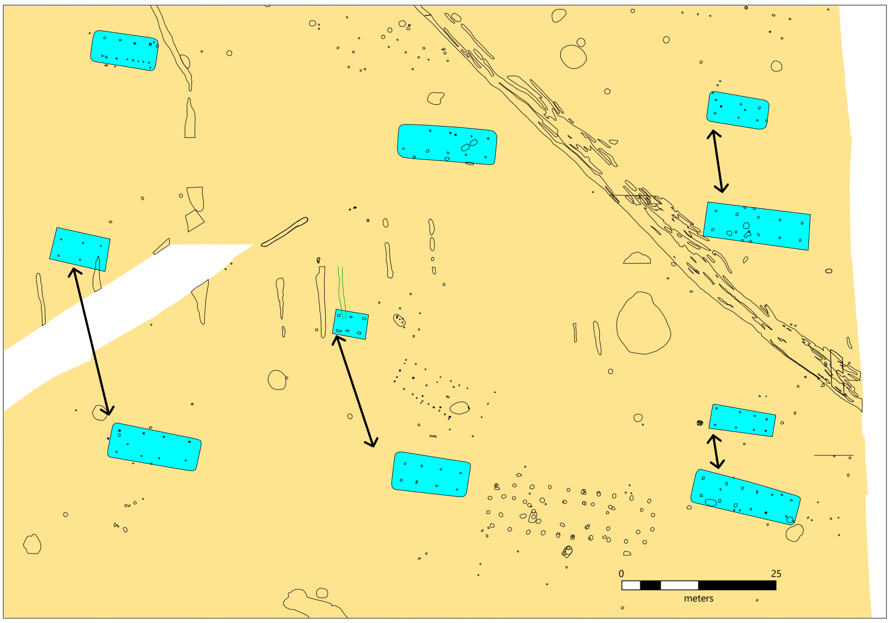


Figure 14: The two rows of pairs of houses (graphics: the authors using MapInfo 21).

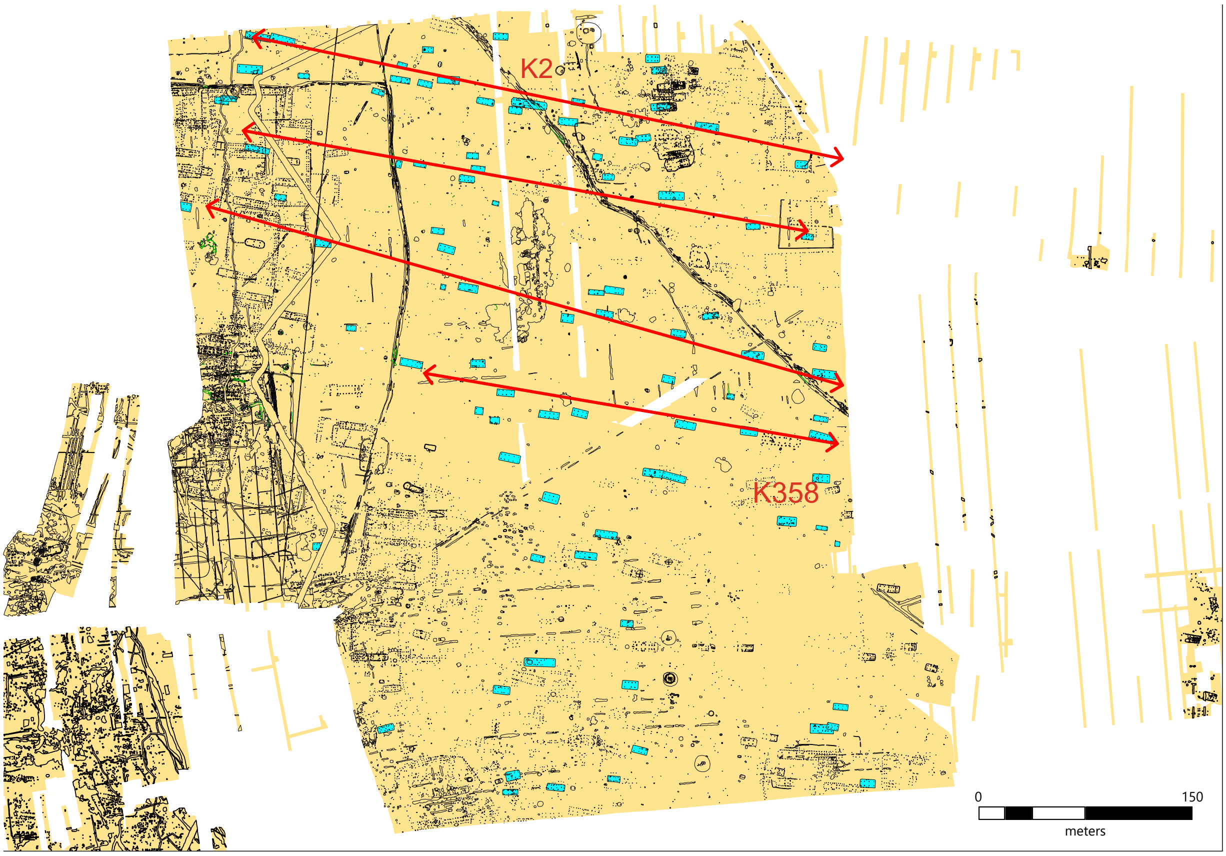


Figure 15: The two rows from Figure 14 are extended as far as the two lower lines in Figure 15 (graphics: the authors using MapInfo 21).

other explanations. The material will allow for future identification of whether the smaller houses could hold other functions (e.g. smaller workshops or workspaces, storage facilities, etc.).

The actual house sizes at Veldbæk are hard to estimate as the walls were not preserved. Many of the smallest houses have only three pairs of postholes and measure only 5 - 8 m from the first to last roof-bearing post.

These houses might have been only 7 - 10 m long when the few meters to the walls and gables were added. The larger houses typically have 4-6 pairs of posts with a distance from the first to last pair of 8 - 15 m and, thus, a possible length of 10 - 17 m.

In some instances, a small and a large house could form a unit (for an example, see Fig. 14). Taking this evidence into account, we can observe four pairs of houses in the northern part of the site (Fig. 15). Three of the pairs lie in a row to the south, while a last pair lies a little further to the north. The large house in the north also forms a row with two other larger houses, although no small houses were found in relation to these (see Fig. 15). The lines each include *c.* 10-20 constructions in close proximity. At the northernmost line, a few houses overlap or lie so close that they cannot be contemporaneous. Here, we might see evidence of two phases. In the other areas of the site, the structure is less clear, but the houses do seem to cluster in east-west rows.

The suggested lines of houses could represent either one house moving east-west, or a whole row of houses moving north-south. In this way, each line could be a phase in the village. So far, we do not have enough dates to separate sub-phases out from the settlement. However, 10-20 houses lie in the vicinity of each line and we propose 16-27 contemporary houses per phase. On this basis, we argue that the red lines are roughly equal to a phase in the village.

One objection we should address regarding the term 'village' could be the dispersed pattern with no evidence for fences. However, as argued above, a least some of the houses were located in a linear fashion and with a roughly equal distance between the farms, each including a large house and at least some farms having an additional smaller house. The lack of fences is not surprising and might be due to the poor preservation conditions, as the houses are lightly built, and wall postholes rarely preserved. Furthermore, it was during the LBA that the phenomenon of Celtic fields was first detected (Nielsen *et al.* 2017). These field systems have only survived in heaths, plantations, and other landscapes where modern agriculture has not destroyed them. In conclusion, we could assume that the surrounding area at Veldbæk consisted of Celtic fields (low dike delimited enclosures). These often rectangular enclosures, of which many are oriented east-west (see Helt Nielsen *et al.* 2017), could be the reason for the linear structure of the village. As the landscape was organised by the field-system it might follow that the empty area had been used as an enclosure for the village. When the village moved, it moved to the next empty field.

Conclusion and future plans

In this contribution we have presented the settlement site of Veldbæk, consisting of *c.* 90 houses from the NBA VI and pre-Roman Iron Age period 1. We argue that there were somewhere between 16-27 contemporary houses, possibly organised in farms, each consisting of two houses. We suggest that the farms could be structured in east-west rows, following the agricultural scheme of the Celtic fields. All the above presented evidence allows us to use the term 'village' for this specific settlement as early as NBA VI.

The future research at Veldbæk will expand the model presented above, including the houses from the south part of the area as well as the typologically dated pre-Roman Iron Age houses. Furthermore, it is important to note that the crops (from the LBA houses) at Veldbæk are not yet fully investigated, both in regard to the agricultural processes and social stratification. The cereals discovered at Velbæk were found in houses that were scientifically dated to the LBA, in houses of different size, and with signs of bronze casting and other craft activities. This evidence will allow for the investigation of agricultural practices in light of social stratification.

Appendix

Radiocarbon calibration has been simulated for calibrated dates between 900 and 0 BCE using 100-year intervals. A step size of 50 years is used resulting in a total of 19 simulations (900 - 800 BCE, 850 - 750 BCE, ... , 100 - 0 BCE). Each simulation contains a total of 42 simulated radiocarbon dates, all with an uncertainty of ±25 ^{14}C years. Furthermore, each of the 100 year intervals was repeated 20 times to achieve statistics on the modelled onset, termination and duration. Thus, in total 380 OxCal models were run.

The purpose of the simulation was to investigate the influence of the shape of the IntCal20 (Reimer *et al.* 2020) calibration on simple phase models for the period between 900 and 0 BCE, encompassing the Danish Bronze Age.

Running Simulations

All simulations were carried out using a locally installed Oxcal program version 4.4 with the IntCal20 calibration curve (Bronk Ramsey *et al.* 2010; Reimer *et al.* 2020). Looping the 100 year intervals, writing OxCal input files, running OxCal, collecting data from OxCal output files, and data analysis have all been done using Matlab 2020 (version 9.8.0.1396136). A schematic of the Matlab script responsible for running the simulations is illustrated here:

1. For each 100-year interval calibrated age are randomised from a uniform probability distribution ranging between the minimum to maximum calibrated age for each interval.
2. An OxCal input file (.oxcal) is written as:

```
Sequence() {
   Boundary(“S”);
   Phase(){
      R_Simulate(“sample1”,
randomized calibrated age, 25);
      R_Simulate(“sample1”,
randomized calibrated age, 25);
      ⋮
      R_Simulate(“sample42”,
randomized calibrated age, 25);
     };
   Boundary(“E”);
};
Difference(“D”,”E”,”S”);
```

3. Running OxCal using the OxCal input file from 2.
4. Reading OxCal output files (.js) and collect data for analysis. For each simulation the probability distributions of onset (“S”), termination (“E”) and duration (calculated as the difference between “E” and “S”) are saved to a file for later analysis.

Data analysis

One of the aims with conducted simulations was to investigate the influence of the calibration curve on the onset and termination estimated from simple phase models. The success rate of the simulated data is calculated as a success if one of the possibly multiple confidence intervals encompasses the expected value. For simplicity the 68.3% and the 95.4% confidence intervals are denoted as 1σ and 2σ respectively.

The lengths of the 68.3% and 95% confidence intervals for the duration have been calculated and are shown in Figure A3. If a confidence interval is given as 1 - 19 years (53.1%) and 24 - 55 years (15.1%) as an OxCal outcome, then length is here defined as 19 - 1 = 18 years, and 55 - 24 = 31 years respectively. Thus, the length of the confidence interval provides a measure of the ‘precision’ of the duration of each simulated age interval. A low number would indicate a narrow probability distribution in contrast to a higher number, which would indicate a broad probability distribution. The boxplot in Figure A3 also visualises the range in the confidence interval length for each of the 20 simulations that were performed on each on the age interval simulations. A broad range suggests that the duration is dependent on the ages of the randomised sample ages. In contrast, a narrow range would imply that the ages of the randomised sample ages are less important for the outcome and hence that the duration is more robustly defined for that particular age interval.

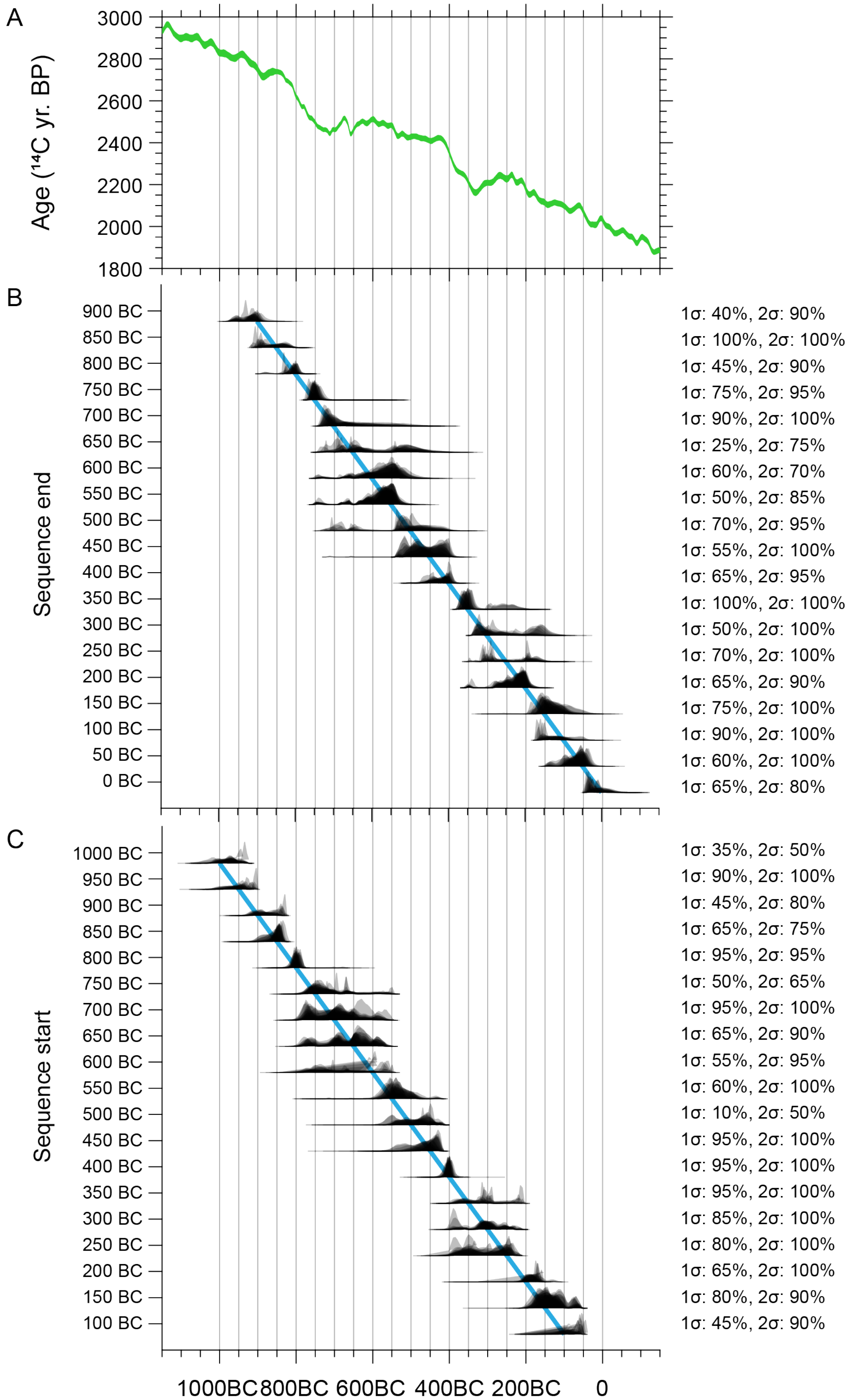


Figure A1: A) The IntCal20 calibration curve. B) Shown are the 20 probability distributions for the phase model end ("E") for each of the simulated intervals. The straight line (blue) indicates the expected outcome. C) Shown are the 20 probability distributions for the phase model end ("S") for each of the simulated intervals. The straight line (blue) indicates the expected outcome. For both B) and C) statistic are shown on the right indicating success rate as a percentage for both the 68.3% (1σ) and 95.4% (2σ).

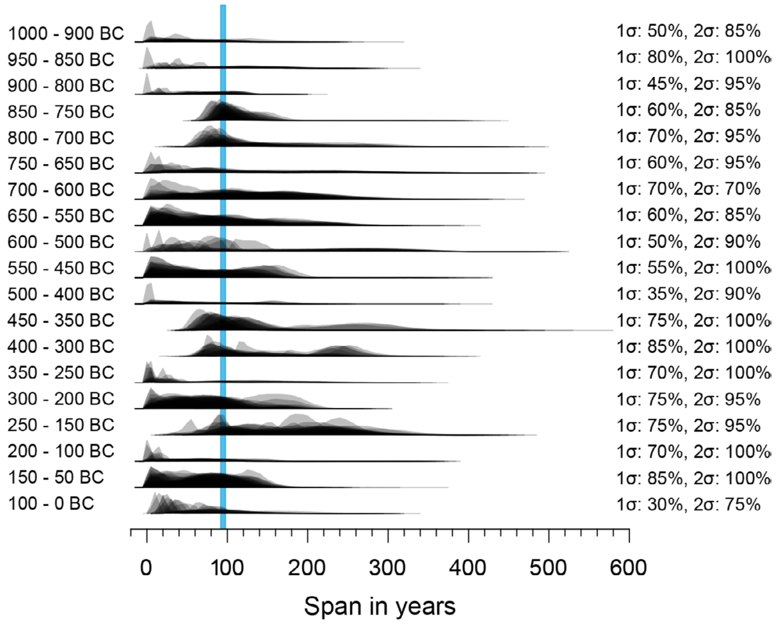


Figure A2: Shown are the 20 probability distributions for estimated duration of each of the simulated phase models for each of the simulated intervals. The vertical straight line (blue) indicates the expected outcome. Statistics are shown on the right indicating success rate as a percentage for both the 68.3% (1σ) and 95.4% (2σ).

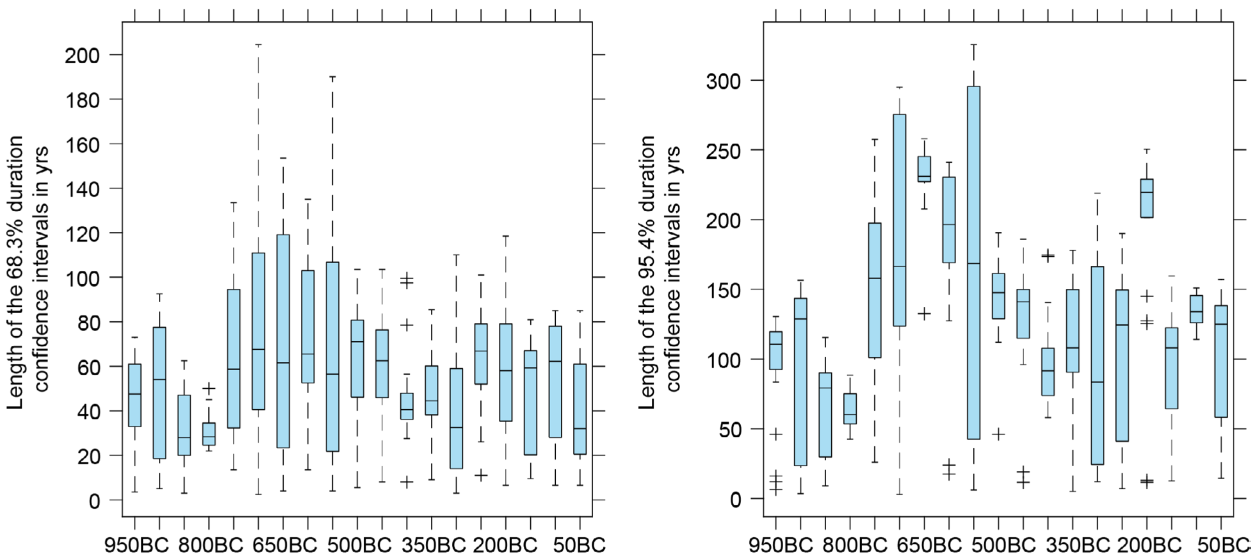


Figure A3: Shown is the length of the 68.3% and 95% confidence intervals for the duration (see text for details of the calculation).

Bibliography

Bech, J.-H. 2012. Bronzealderbebyggelsen i Thy på grænsen mellem ældre og yngre bronzealder, in S. Boddum, M. Mikkelsen and N. Terkildsen (eds) *Bebyggelsen i yngre bronzealders lokale kulturlandskab.* : 9-24. Viborg/Holstebro: Viborg Museum/Holstebro Museum.

Brinch Bertelsen, J. (ed.) 1996. *Bronzealderens bopladser i Midt- og Nordvestjylland.* Skive: Arkeologiske Museer i Viborg Amt.

Bronk Ramsey, C. 2009a. Bayesian Analysis of Radiocarbon Dates. *Radiocarbon* 51(1): 337-360.

Bronk Ramsey, C. 2009b. Dealing with outliers and offsets in radiocarbon dating. *Radiocarbon* 51(3): 1023-1045.

Bronk Ramsey, C., M. Dee, S. Lee, T. Nakagawa and R. Staff 2010. Developments in the calibration and modelling of radiocarbon dates. *Radiocarbon* 52(3): 953-961.

Christiansen, T.T. 2012. Yngre Bronzealder i Østhimmerland – bebyggelsen, in S. Boddum, M. Mikkelsen and N. Terkildsen (eds) *Bebyggelsen i yngre bronzealders lokale kulturlandskab*: 73-84. Viborg/ Holstebro: Viborg Museum/Holstebro Museum.

Ejstrud, B. and C.K. Jensen 2000. *Vendehøj – Landsby og gravplads.* Højbjerg: Jysk Arkæologiske skrifter.

Hvass, S. *Hodde – et vestyjysk landsbysamfund fra ældre jernalder.* Arkæologiske studier 7. København: Akademisk forlag Universitetsforlaget i København.

Jensen, C.K. 2005. *Kontekstuel kronologi: en revision af det kronologiske grundlag for førromersk jernalder i Sydskandinavien.* Højbjerg: Kulturlaget.

Jensen, J. 1997. *Fra bronze- til jern: en kronologisk undersøgelse.* København: Det Kongelige Nordiske Oldskriftselskab.

Jensen, J. 2002. *Danmarks Oldtid. Bornzealder 2000-500 f.kr.* København: Gyldendal.

Larsen, L.A., M. Kieldsen and M. Mikkelsen 2015. Løgstrup SØ – bronzestøbning på en lokalitet med gårdsanlæg og samlingsplads, in S. Boddum, M. Mikkelsen and N. Terkildsen (eds) *Bronzestøbning i yngre bronzealders lokale kulturlandskab*: 41-60. Seminarrapport fra seminaret "Bronzestøbning i yngre bronzealders lokale kulturlandskab" afholdt i Viborg, 6. marts 2014. Viborg/Holstebro: Viborg Museum/Holstebro Museum.

Lerke, L. and C.S. Hjorth-Jørgensen 2021. Fragmenter af et håndværk: Ten- og vævevægte i førromersk og ældre romersk jernalder i Jylland. *Arkæologi i Slesvig/ Archäologie in Schleswig* 18(2020): 221-238.

Ling, J., Z. Stos-Gale, L. Grandin, K. Billström, E. Hjärthner-Holdar and P.-O. Persson 2014. Moving metals II: provenancing Scandinavian Bronze Age artefacts by lead isotopes and elemental analyses. *Journal of Archaeological Science* 41: 106-132 (available at: https://doi.org/10.1016/j.jas.2013.07.018).

Lund, J. 1980. Tre førromerske jordkældre fra Overbygård. *Kuml* 1979: 109-139.

Nielsen, N.H., M.K. Holst, A.C. Gadd and K.K. Holst 2017. The Layout and Internal Development of Celtic Fields: Structural and Relative Chronological Analyses of Three Danish Field Systems. *European Journal of Archaeology* 21: 385-410.

Nielsen, B.J. 2012. Bebyggelsen og Bosættelse i Vesthimmerland i yngre bronzealder og ældre førromersk jernalder, in *Bebyggelsen i yngre bronzealders lokale kulturlandskab*: 141. Viborg/ Holstebro: Viborg Museum/Holstebro Museum.

Nielsen, J. 1996. Keramikken på bronzealderbopladserne, in J. Brinch Bertelsen (ed.) *Bronzealderens bopladser i Midt- og Nordvestjylland*: 60-63. Skive: Arkeologiske Museer i Viborg Amt.

Mikkelsen, M. 1996. Bronzealderbosættelserne på Ås-højderyggen i Thy, in J. Brinch Bertelsen (ed.) *Bronzealderens bopladser i Midt- og Nordvestjylland*: 110-123. Skive: Arkeologiske Museer i Viborg Amt.

Mikkelsen, M. 2012. Dobbeltgårde i yngre bronzealder, in S. Boddum, M. Mikkelsen and N. Terkildsen (eds) *Bebyggelsen i yngre bronzealders lokale kulturlandskab*: 41-66. Viborg/Holstebro: Viborg Museum/ Holstebro Museum.

Mikkelsen, M. 2020. Slaves in bronze age Scandinavia? *Acta Archaeologica* 91(1): 47-90.

Reimer, P.J., W.E.N. Austin, E. Bard, A. Bayliss, P.G. Blackwell, C. Bronk Ramsey, M. Butzin, H. Cheng, R.L. Edwards, M. Friedrich, P.M. Grootes, T.P. Guilderson, I. Hajdas, T.J. Heaton, A.G. Hogg, K.A. Hughen, B. Kromer, S.W. Manning, R. Muscheler, J.G. Palmer, C. Pearson, J. Van Der Plicht, R.W. Reimer, D.A. Richards, E.M. Scott, J.R. Southon, C.S.M. Turney, L. Wacker, F. Adolphi, U. Büntgen, M. Capano, S.M. Fahrni, A. Fogtmann-Schulz, R. Friedrich, P. Köhler, S. Kudsk, F. Miyake, J. Olsen, F. Reinig, M. Sakamoto, A. Sookdeo and S. Talamo 2020. The IntCal20 Northern Hemisphere Radiocarbon Age Calibration Curve (0–55 cal kBP). *Radiocarbon* 62: 725-757.

Rose, H.A. and J. Meadows 2024. Dividing time – An absolute chronological study of material culture from Early Iron Age urnfields in Denmark. *PLoS ONE* 19(5): e0300649 (available at: https://doi.org/10.1371/journal.phone.0300649).

Runge, M. 2012. Yngre bronzealders bebyggelse indenfor et 350 hektar stort undersøgelsesområde, in S. Boddum, M. Mikkelsen and N. Terkildsen (eds) *Bebyggelsen i yngre bronzealders lokale kulturlandskab*: 113-140. Viborg/Holstebro: Viborg Museum/ Holstebro Museum.

Stuiver, M and H.A. Polach 1977. Discussion of reporting 14C data. *Radiocarbon* 19(3): 355.

Sørensen, C., P.M. Jensen, S.N. Mehlsen and M. Kanstrup 2024. Late Bronze Age millet farmers at Arnbjerg N: an archaeobotanical analysis and a review of Late Bronze Age millet in Denmark. *Vegetation History and Archaeobotany* 33: 425-440.