

The Bell Beaker Culture in All its Forms

Proceedings of the
22nd Meeting of
'Archéologie et
Gobelets' 2021
(Geneva, Switzerland)

edited by

**Claudine Abegg, Delia Carloni,
Florian Cousseau, Eve Derenne
and Jessica Ryan-Despraz**

Foreword by **Marie Besse**



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Foreword

Marie Besse

Professor at the University of Geneva (Switzerland)

The 22nd meeting of the “Archéologie et Gobelets” Association took place on January 21 and 22, 2021 in Geneva Switzerland under the theme “The Bell Beaker Culture in All its Forms”. However, this conference did not transpire as originally intended because a few months into its organization, we found ourselves in the middle of the Covid-19 pandemic. While we had considered canceling the conference altogether, it felt important for us to maintain it and we therefore made the decision to continue its organization as an entirely virtual meeting. We believed that the links between friends and colleagues as well as the enriching scientific discussions were especially important during these difficult times.

The “Archéologie et Gobelets” meetings have always combined scientific presentations, informal discussions, visits to archaeological sites and expositions, the observation of archaeological objects, and shared moments of conviviality. For these two days, we tried our best to maintain this spirit despite the virtual format by organizing smaller “breakout” sessions, virtual coffee breaks, and two workshops aimed at discussing case studies in biological anthropology and other artifact studies.

The creation of the Association dates to April of 1996, also in Geneva, with many others joining the following year after a second successful meeting in Feldberg, Germany. Several colleagues and friends who were present during these first meetings also participated in this conference 25 years later. What commitment! And what a pleasure it is to see everybody again at each meeting. As a result, yesterday’s students are more experienced today, and young researchers participated in “Archéologie et Gobelets” for their first time in 2021. This includes the organization of this recent conference, which was primarily managed by young researchers from my laboratory, all of whom today have a PhD in prehistoric archaeology. This includes Claudine Abegg, Delia Carloni, Florian Cousseau, Eve Derenne, and Jessica Ryan-Despraz. I am delighted by their enthusiasm, their rigor, and their desire to organize this event of scientific exchange – and to have done so with such success. And now, less than 18 months after the conference, they are publishing its Proceedings. I would therefore like to take this moment to congratulate them for their hard work and dedication in this achievement. I wish them much success in their future pursuits.

The publication of these Proceedings is structured in three parts, following the three session themes of the conference. Nine articles comprise the section “Archaeological Material”, four in the section “Funerary Archaeology and Anthropology”, and seven in the final section “Reconstructing Bell Beaker Society”. These studies cover a vast geological region, including works from Czechia, France, Germany, Italy, Spain, and Switzerland. This additionally involves a diversity of research approaches that one will discover throughout this book. It contains articles discussing themes not often addressed in much modern Bell Beaker research, such as the cultural interactions at the edges of the Bell Beaker complex (Aurino and De Falco), “fire” rituals in the Alps (Pedrotti et al.), solar cult rituals and symbolism (Ripoche and Nicolas), and ceremonial landscapes (Turek and Krištuf). Some contributions present studies based on methods rarely applied to Bell Beaker contexts, such as paleopathological analyses (Abegg), network analyses (Caraglio et al.), and the combination of lithic and osteological analyses to assess social organization (Ryan-Despraz and Nicolas). Two major megalithic sites from the Alps also benefit from new approaches: Saint-Martin-de-Corléans in Aoste, Italy (Curdy et al.) and Sion ‘Petit-Chasseur’ in Valais, Switzerland (Derenne et al.). Likewise, it is a pleasure to see the publication of new field data essential to archaeological research (Boenzi and Mancusi; Perez-Romero et al.). To conclude, we also discover important advanced material studies (De Marco et al.; Favrel; Matera and Sarti; Matera et al.; Miranda et al.; Penco and Sarti; Puster; Rey and Treffort; Vitani and Bailly).

I would like to take a moment to remember two colleagues and founding members of the “Archéologie et Gobelets” Association: Alain Gallay, professor at the University of Geneva (Switzerland) and Daniela Kern of the University of Vienna (Austria). We remember them fondly and their families remain in our thoughts.

Lastly, I would like to extend my deepest thanks to one person who hid behind the “Host” panel throughout the two-day duration of our video conference. Mr. Thomas Mugnier (Fig. 01) took care of all the technical aspects of the meeting, which allowed us to concentrate on the science.

We recorded all consenting presentations from the conference and it is possible to access the complete video on the University of Geneva media server found at the following link:

<https://mediaserver.unige.ch/collection/VN4-2044-2020-2021>

Geneva, May 31, 2022

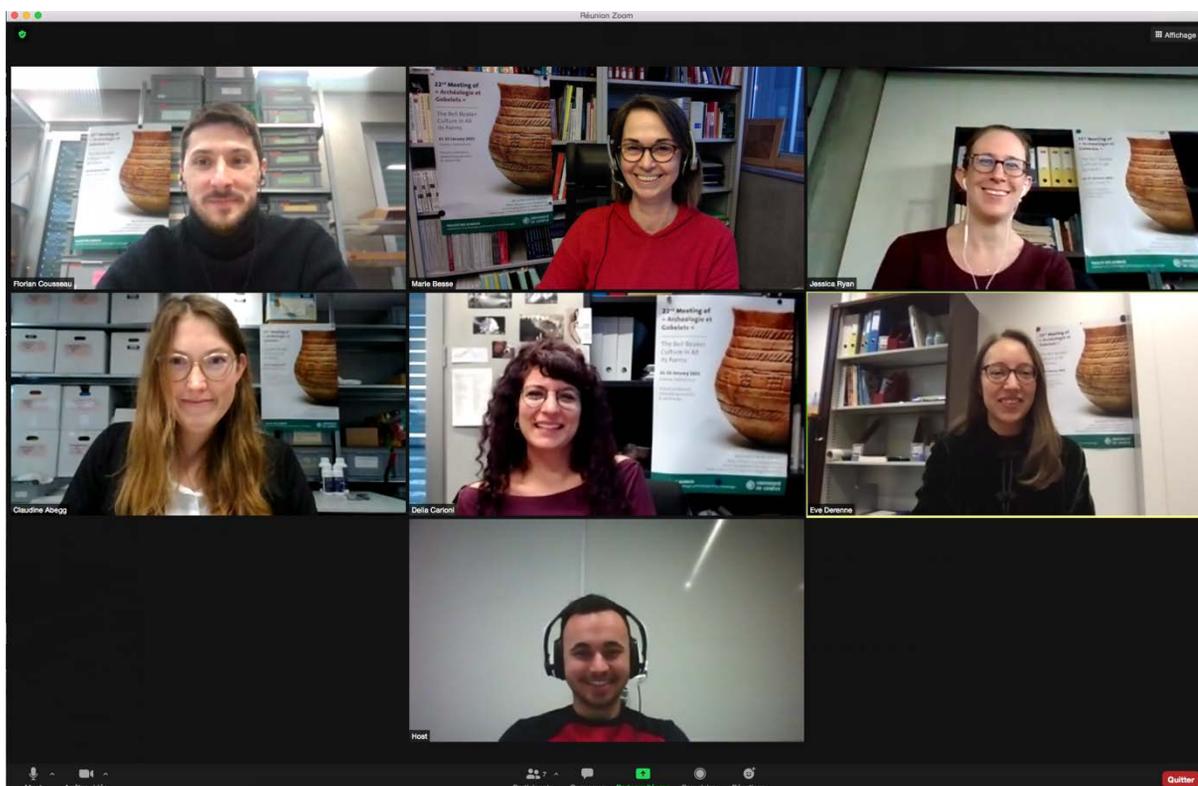


Fig. 01: The conference organizers, from left to right and top to bottom: Florian Cousseau, Marie Besse, Jessica Ryan-Despraz, Claudine Abegg, Delia Carloni, Eve Derenne and Thomas Mugnier, who has our deepest thanks as he ensured the technical success of the conference

In Memory of Daniela Kern



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Shortly before the conference in Geneva, our much-loved colleague Daniela Kern died suddenly and unexpectedly. Daniela's interests and publications spanned the Neolithic and Bronze Age and encompassed a range of topics; from isotopes and mobility, to experimental archaeology, and the archaeology of childhood. A creative and original thinker, much of this research stemmed from her important work on Corded Ware and Bell Beaker cemeteries in the Lower Traisen Valley. This work also led Daniela to explore the Bell Beaker Network in Austria at a national level and also its international connections, which she examined through the prism of the so-called bow shaped pendants. Daniela presented papers on these topics to Archéologie et Gobelets conferences and as the co-organiser of the Beaker Days on the Danube conference held in Bratislava and Vienna in 2014, she was happy and proud to welcome colleagues to Traisen Valley and Vienna, where she did so much work. A warm and welcoming hostess, Daniela embodied the friendship, collegiality and hospitality of Archéologie et Gobelets meetings. In dedicating this book, we remember Daniela with affection and respect.

Daniela Kern: Born Vienna 28.08.1960. Died Laa an der Thaya 05.10.2020.

Andrew Fitzpatrick

In Memory of Alain Gallay



Alain was a man of science and heart who passed away peacefully during the early morning hours of December 21, 2021. As an accomplished archaeologist, prehistorian, anthropologist, ethnologist, colleague, professor, and friend, Alain Gallay helped shape several generations of young scholars at the University of Geneva, all of whom still remember his scientific rigor and his desire to understand the complexities of past societies. His early research focused on the European Neolithic period in general and the Bell Beaker Culture in particular. The Bell Beaker archaeological excavations of Champ Vully-East (canton of Vaud, Switzerland) and the Petit-Chasseur megalithic necropolis (Sion, Switzerland) enabled him not only to reflect on exceptional artifacts, but also the role of the Bell Beaker Culture in Europe. His precise, demanding, and thoughtful work strongly influenced his theories of Bell Beaker networks. His succeeding research also contributed significantly to the development of archaeological theory and ethnoarchaeology, including several innovative projects in western Africa. Alain has left us with a vast human and scientific heritage that is precious to our understanding of the modern and ancient world. Lastly, I am particularly pleased to highlight the fact that Alain Gallay was also present for the very first meeting of the 'Archéologie et Gobelets' association in Geneva in 1996.

Alain Gallay: Born in Geneva, Switzerland on March 10, 1938 and died in Geneva, Switzerland on December 21, 2021.

Marie Besse

1. ARCHAEOLOGICAL MATERIAL

Bell Beaker and Epi-Bell Beaker in the Florentine Area: Metallurgical and Pottery Evidence from the Site of Fosso Di Lumino (Florence, Italy)

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Abstract: The aim of this contribution is to present the most recent results from the study of Fosso di Lumino (Sesto Fiorentino, Florence), a settlement characterised by a sequence of Bell Beaker and Epi-Bell Beaker levels along with evidence of metallurgical activities. The latter are tied into the secondary stages of copper-working and are attested by the presence of an elongated pit-like structure with crucible and tuyere fragments, slag, copper droplets and some finished metal objects. The first results of the archaeometric analyses carried out on these materials will also be illustrated in the present work. At the same time, a preliminary review of the ceramic assemblage from layers 8 and 9 has allowed to highlight the stylistic development, both for decorated ceramics and common ware, which took place between the last stages of the second phase of the evolved Bell Beaker and the first phases of the Early Bronze Age, referred to as Epi-Bell Beaker, in the Florentine area.

Keywords: Bell Beaker, Epi-Bell Beaker, Florentine area, Metallurgical production, Pottery.

The aim of this contribution is to provide a brief review of the still ongoing study of the material culture from Fosso di Lumino as well as set the grounds for a series of observations on the origin of the Early Bronze Age in the Florentine area. Its formation appears, in fact, to be connected to the events that took place in the last centuries of the 3rd millennium BC, corresponding to the final stages of the Bell Beaker culture and encompassing, as previously attested (Leonini, Sarti, 2008a; Leonini, Sarti and Volante, 2013; Sarti, 2015), a wide range of European regions in a complex series of connections.

The site of Fosso di Lumino is located in the western part of Sesto Fiorentino (Fig. 1), a short distance from the Settlement Unit (SU) of Querciola-Semitella-Campo del Sorgo and Neto-Spazzavento-Leopardi (Sarti, 2014). The recording at Lumino of an area where copper was worked from the horizon referable to the Early Bronze Age (layer 8) allows us to propose some observations on the development of metallurgical activities first attested in the Florentine area during the first half of the 4th millennium BC.

The discovery of the site took place in 2007 during rescue archaeology excavations carried out by the Prehistoric section of the Department of Archaeology and Art History of the University of Siena in collaboration with the Archaeological Superintendency for Tuscany, as a result of work on the water supply network by the Mugello river basin authority. These activities brought to light an occupation surface of about 1.000 square metres, set at 50 metres a.s.l. and not far from the palaeochannel of Fosso di Lumino.

1 - The environmental and cultural context

The settlement site of Fosso di Lumino is located in the Florentine Plain which is part of the Florence-Prato-Pistoia basin, crossed by the Arno River and bounded to the north by the slopes of the Calvana and Morello Mountains and to the south-east by the Albano Mountains and the hills of the Cerbaie. Moving south the territory opens onto the Val di Pesa, the Chianti Hills and the more southerly area of the Val di Chiana.

Bell Beaker and Epi-Bell Beaker settlements can be found on silty alluvial sand layers, the latter covering pebble deposits, the result of material originated from the Morello and Calvana mountains located further upstream and deposited in a silty sand matrix by the continually moving channels on the lower parts of the alluvial fans (Pizziolo, Sarti, 2011). The discovery of Fosso di Lumino has provided a stratigraphic sequence made-up of two settlement horizons, respectively referable to the Bell Beaker (25th-23rd centuries BC) (layer 9) and Early Bronze Age (23rd-22nd centuries BC) (layer 8).

The sequence confirms the chronological seriation that goes from the Copper Age to the initial Bronze Age – Epi-Bell Beaker, documented in other settlement units across the Florentine area such as Lastruccia (Fig. 1) (Sarti *et al.*, 2008), and presently offering some of the most detailed evidence of this cultural transition. Still valid for the Florentine area is the subdivision of the Bell Beaker into a number of steps, as proposed in 2008 (Leonini, Sarti, 2008a; Sarti, Martini, 2008), along with the evolutionary model characterised by a gradual passage from the

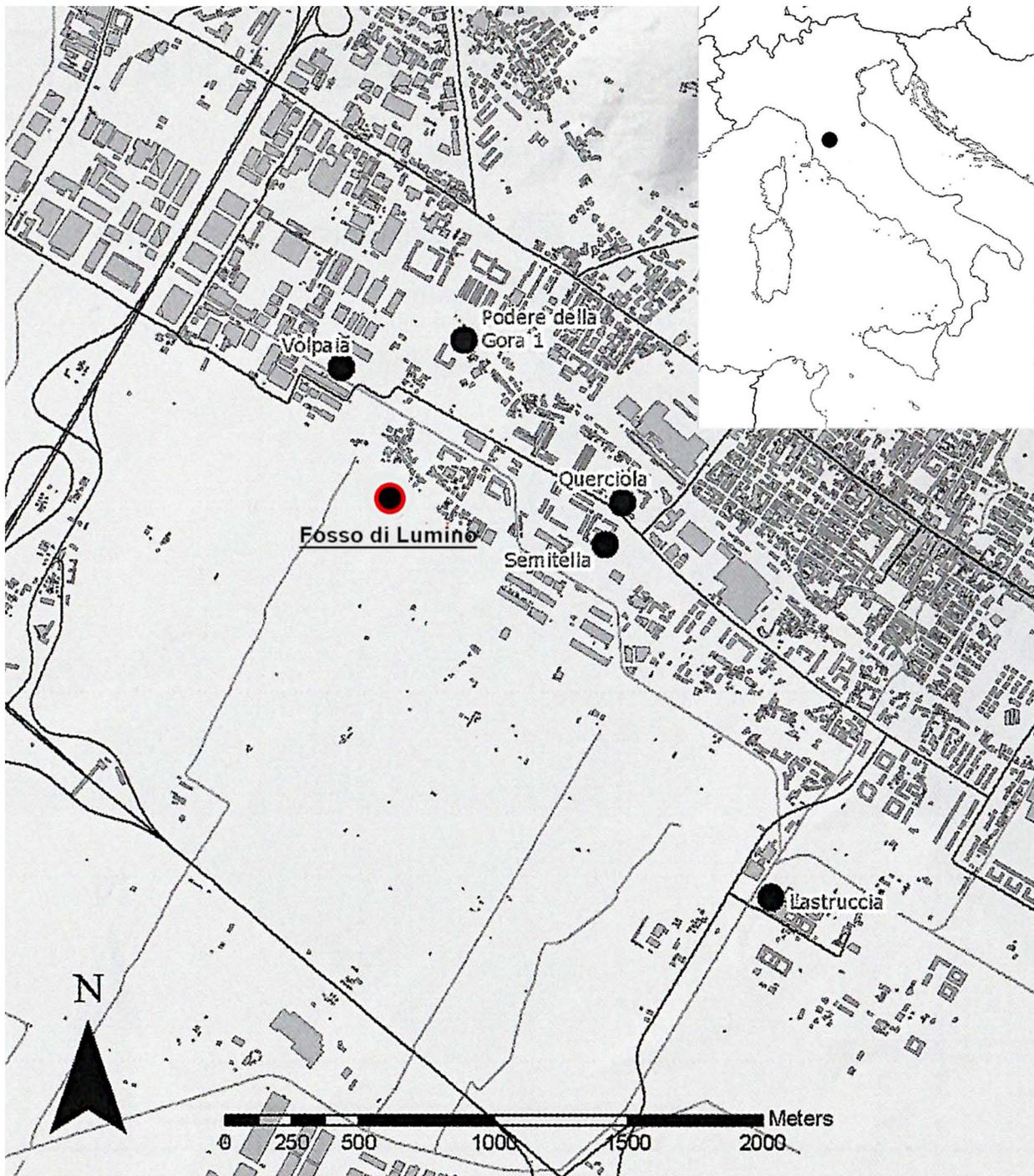


Figure 1: Location of sites in the present-day area of the municipality of Sesto Fiorentino, Florence (map elaboration from Pizziolo, 2018, fig. 3/7, p. 116).

evolved Bell Beaker to the Epi-Bell Beaker and later Early Bronze Age (Sarti, 2004; Sarti, Leonini, 2007). The stratigraphic sequence and typological seriation are supported by radiometric dating of the Bell Beaker levels (Leonini *et al.*, 2008), set in the second half of the 3rd millennium BC and within an uninterrupted Eneolithic timeframe (Leonini, Sarti and Volante, 2013). The radiometric dating of the Lastruccia sequence (Leonini *et al.*, 2008) provides a reference for the Epi-Bell Beaker

and Bronze Age up to the first half of the 2nd millennium BC. A program for a new series of radiometric analyses is currently underway with a special focus on the final stages of the Early Bronze Age. Demographic density and continuous settlement sites, along with the expansion during the Neolithic of areas featuring both functional and housing structures of a repeated seasonal nature, becoming more stable during the Copper and Bronze Ages (Sarti *et al.*, 2019), can be explained by the different

geographical aspects of a territory located at the center of communication routes and characterised by various types of resources. Likewise, the economic regimes seem to fully fit the known picture (Perusin *et al.*, 2008, see also in this volume Penco, Sarti).

2 - The stratigraphy and living surface

The stratigraphic sequence featured a deposit depth of about 2 metres:

- Layers 1 and 2: modern agricultural topsoil.
- Layers 3 and 4: loamy layers, at times with a more sandy matrix.
- Layers 5-7: Renaissance and Roman period levels featuring few water-borne finds in secondary deposit. Layer 7 is located above the two Prehistoric occupation surfaces and covers an area of about 200 square metres; distribution analysis of the finds and structures is still under way.
- Layer 8 (max. thickness of 30 cm): loamy grayish black layer with calcite inclusions in its upper portion, divided in three sub-horizons with a still preserved occupation surface characterised by stones alongside ceramic, lithic and bone finds (layer 8C) referable to a first moment of the local Early Bronze Age (Epi-Bell Beaker).
- Layer 9A (max. thickness 8 cm): archaeologically sterile yellowish-gray loam, partially eroded in its upper part.
- Layer 9 (max. thickness of 25 cm): a sandy yellowish gray loam filling a hollow feature. This level has been divided in three archaeological sub-horizons; at its base it featured a more structured surface with drainage pebbles, small stone structures as well as ceramic, lithic and bone finds (layer 9C). This level can be ascribed to the Bell Beaker.
- Layer 10 (excavated to a depth of over 1 metre): a clayey pseudogley soil with iron-manganese spreads, calcareous concretions and no traces of anthropic activities. The pseudogley and calcareous concretions constitute a stratigraphic marker found in the Florentine area at the base of anthropic sequences dating to the Prehistoric period.

The horizon referable to the Bell Beaker (layer 9), set in a palaeochannel adapted to the needs of a living area with fireplaces and pits, presented a structured drainage surface level characterised by gravels alongside ceramic and bone remains. The layout follows a well-known model in the Florentine area during the Bell Beaker, as documented at the sites of Querciola (Sarti, 1997) and Semitella (Sarti, 1998).

Likewise, the Epi-Bell Beaker layer (layer 8) also presents a pebbled drainage surface level containing

ceramic and bone remains. The functional structures of both levels 8 and 9 appear as simple with perishable material elevations and living surfaces organised in variously arranged sub-structures. Noteworthy is the presence in layer 8 of an elongated hollow pit with abundant charcoal remains containing evidence of metallurgical activities and finished objects (Fig. 2). The fire-reddened walls would seem to testify to a working area rather than a place for material discharge.

3 - The evidence of metallurgical activities

The pit-like structure (Fig. 2, no. 1) with numerous metal finds intermixed with charcoal, cannot be identified as a smelting structure, but rather appears to be related to processes linked to the manufacture of copper objects obtained from the melting of ingots. Finds include small-sized slags, crucible fragments, small ingots, isolated droplets and finished artefacts (Fig. 2, nos. 2-4).

The slag, which is mostly glassy with a siliceous component featuring traces of copper, can be traced back to melting residues of the metal mixed with crucible fragments. The numerous crucible fragments mostly consist of the thickest parts located near the handle (Fig. 3, nos. 1, 4-5) and therefore more resistant to mechanical and thermal stress. The petrographic analyses of some crucible thin sections show a ceramic paste characterised by the presence of inclusions of plagioclase and diallagio, material available near the site in an area known since the beginning of the Neolithic for its raw resources employed for the production of ceramic (Franchi, Pallecchi, 1986; Martini, Pallecchi, Sarti, 1996; for the Bell Beaker contexts see: Agostini *et al.*, 2008). The use of this raw material is directly related to its intrinsic properties, namely good heat resistance (Manganelli del Fa, Vannucci, 1976), a quality necessary for crucible durability at high temperatures. The external surfaces of the crucibles are partially vitrified while the internal ones are also vitrified and feature reddish-brown, sometimes black, encrustations which increase in thickness moving away from the crucible rim (Fig. 3, no. 4). The analysis of these incrustations revealed the main components to be O, Al, Si, Fe and Ca along with minor quantities of Cu, P, Mg and at times Sn. The presence of the latter is attributable to the deposit at the bottom of the crucible of impurities still present in the copper. Copper droplets, completely altered into basic carbonates, can be observed at the bottom of several crucibles, clearly embedded in the brownish deposits (Fig. 3, no. 4).

Among the finds recovered from the pit in layer 8 are also isolated copper droplets whose composition is constituted exclusively by copper with traces of silica. A different composition was recorded from a small discoidal shaped ingot (diameter of about 1.5 cm and height of 0.5 cm) (Fig. 3, no. 6) and an awl, showing a

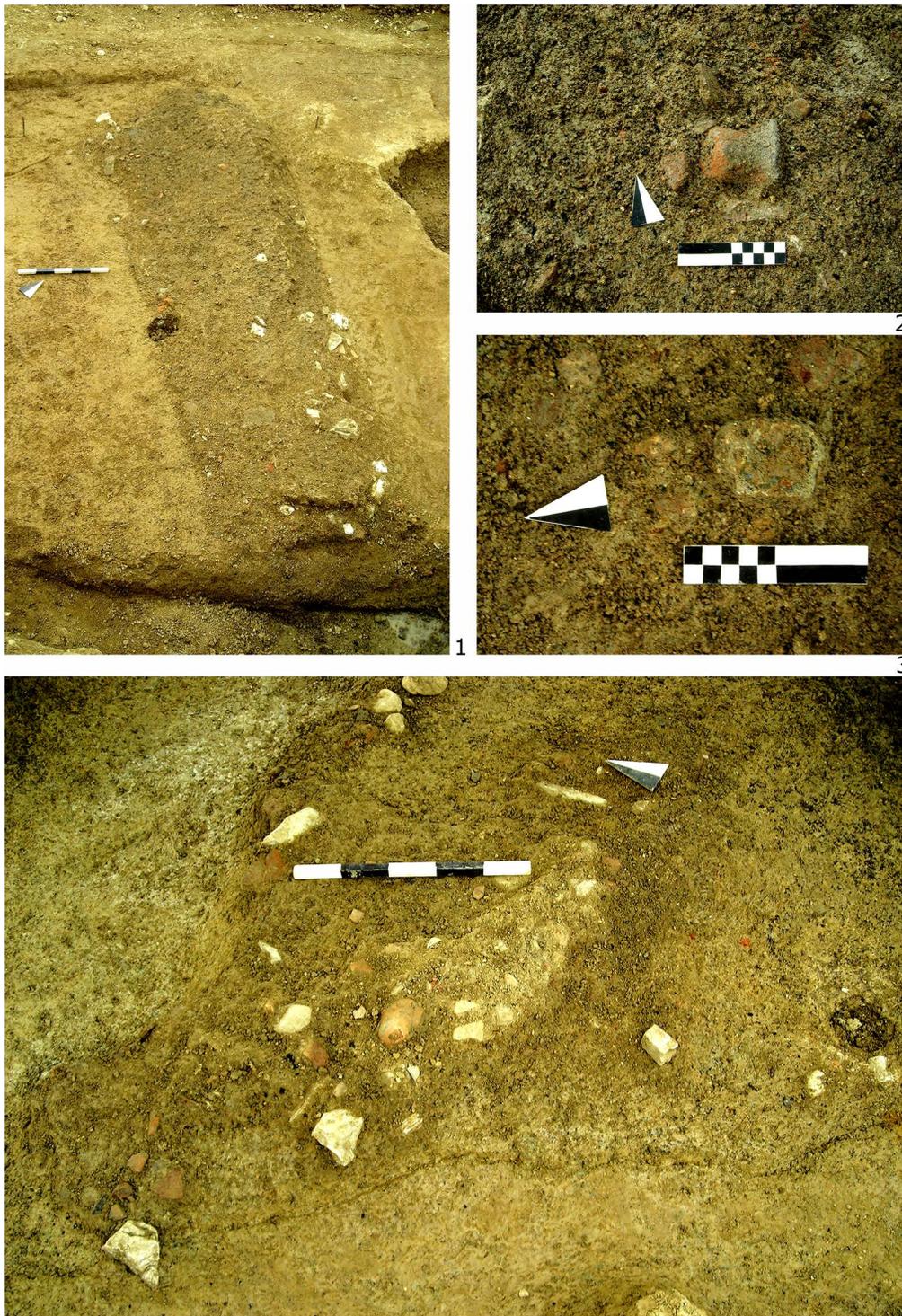


Figure 2: Layer 8 – detail of the elongated pit feature during excavation (nos. 1, 4); details of the crucible fragments and tuyeres from the pit (nos. 2-3) (photos from the DSSBC archive of the University of Siena).

composition with traces of Ag, Sn and Sb. The presence of these elements is compatible with the reduction of copper ores naturally bearing small quantities of antimony and silver minerals. Such a composition asset is compatible with the ore bodies found in southern Tuscany and upper Latium (Esposito *et al.*, 2019, Dolfini, Angelini and Artioli, 2020). Completion of the

analyses will provide more precise information on the provenance of the raw materials employed in the production of metal artefacts at Fosso di Lumino.

The shape of the numerous crucibles (Fig. 3, nos. 1, 4-5) and tuyeres (Fig. 3, nos. 2-3) can be set in the already known variability range, attested between the end of

the 3rd and mid-2nd millennium BC in a wider frame of toolsets and possible *chaîne opératoires* that appear to maintain similar characteristics even in later contexts.

The widely diffused medium-to-large sized spoon-shaped crucibles (Fig. 3, no. 5) are made of refractory materials from the surrounding territory; their appearance is different compared to the bowl-shaped ones present in the Florentine area at Neto via Verga dating to the beginning of the 4th millennium BC, or those from other sites where metallurgical activities are attested early on (in Emilia at Botteghino di Parma: Mazziere, Dal Santo, 2007) or in later dating Tuscan contexts such as the site of San Carlo-Cava Solvay in the second half of the 3rd millennium BC (Fedeli, Galiberti, 2016). The variously sized tuyeres present a truncated cone shape, with straight or convex walls (Fig. 3, nos. 2-3). Spoon crucibles and truncated cone tuyeres are known in various sites dating to the Copper Age, such as Millan in Trentino-Alto Adige, where a tuyere was recorded from a context dating to the end of the Copper Age, possibly of Bell Beaker culture (Dal Ri, Rizzi, Tecchiati, 2005), or in Corsica at Terrina (Camps, 1988); other examples are found among the first evidence of the Early Bronze Age in Trentino (Perini, 2000; Fasani, 1988). Referable to a widely diffused type throughout central Italy, in the area of Siena and Grosseto, is the short copper dagger characterised by a curved heel, pair of rivet holes, flat blade with slightly convex profile and rounded point (Bianco Peroni, 1994).

4 - The ceramic assemblage

The most significant results from the preliminary study of the pottery finds recorded in layers 9 and 8 at Fosso di Lumino will be presented, in view of the complete future publication of its full ceramic assemblage. While the study of the lithic industry documented from both levels is still under way it is nevertheless possible to confirm, following a preliminary review of the material, the presence of features that do not differ from those already known and published in the Florentine area (Martini, 2008).

The study of the ceramic assemblage has allowed to highlight in detail the stylistic development taking place between the last stages of the second phase of the evolved Bell Beaker (layer 9) and the first phase of the Early Bronze Age (layer 8), referred to as Epi-Bell Beaker.

Three main evolutionary trends are identified: the rarefaction of the Bell Beaker tradition, the emergence of shapes and decorative elements that also feature in Early Bronze Age contexts from the surrounding area, and the appearance of original elements within the Early Bronze Age panorama of central Italy (recent and still ongoing studies: the sites of Lazzerini 3, area C, Podere della Gora 4 – area C, Parri 2; Sarti, 2014).

The ceramic assemblage from layer 9 can be directly connected to the tradition of ceramic production pertaining to the second step of the Evolved Bell Beaker in the Florentine area. Pottery decorated according to the Bell Beaker style is for the most part produced using depurated clay whereas the surfaces appear as opaque or, in some cases, semi-polished. What is possible to observe from the scarce number of currently analyzed fragments is the clear prevalence of cups with sinuous profile and short rim, nearly always everted or with a slight neck (Fig. 4, nos. 2-3, 5, 7). These types of cups are widely attested in the Florentine territory in the second step of the Evolved Bell Beaker (Sarti, 1997, fig. 36, nos. 3, 6; Leonini, Sarti, 2008a, fig. 8, nos. 1-10).

The decoration of the cups from layer 9 is homogenous both in its technical execution and position on the vessel; the techniques employed are those of the comb and punch impression, often found together, while incisions are sporadically recorded (Fig. 4, nos. 1-7) (see Lipowicz, Travaglini, Volante, 2008). The execution is usually rough and poorly made. Although the finds are considerably fragmented, it is nonetheless possible to observe that the decorations are almost exclusively located in the upper part of the vessel, below the rim, arranged in horizontal bands of varying width, either contiguous or separated by plain unadorned areas (Fig. 4, nos. 1-7); the rim is never decorated. The decorative motifs do not reveal a wide range of patterns: horizontal margined bands filled by triangular punched impressions coupled with isosceles triangles and oblique hatchings (Fig. 4, nos. 2-3), motifs that are also found at Querciola (Sarti, 1997, fig. 30, no. 6; fig. 36, no. 3), or bands with oblique impressions (Fig. 4, nos. 1, 4, 7), also associated with bands featuring more complex impressed motifs (Fig. 4, no. 5) that recall specimens from layer S at Lastruccia (Sarti, 1995-96, fig. 1, no. 4).

Additional documented shapes are the medium-to-large sized open bowls with truncated-cone or domed profile and thickened flat rim usually decorated by incisions (Fig. 4, nos. 8, 10). This typology is well attested in the Florentine area during the second step of the Evolved Bell Beaker (Sarti, 1995-96, fig. 1, nos. 7-8). One of these still features the remains of a handle set on the rim, possibly identifiable as an asymmetric type with vertical elbow-like handles and traces of an incised metopal motif set on the vessel side (Fig. 4, no. 8). Also significant is the recording of a foot (Fig. 4, no. 11), already documented in this area at Querciola (Leonini, Sarti, 2008a, fig. 8, nos. 14-15).

The common ware is for the most part characterised by a semi-depurated clay with surfaces that appear as almost exclusively opaque. Preliminary work carried out on the material from layer 9 has allowed to highlight the presence of deep shapes such as vessels and cups, often with T-shaped or collared rims (Fig.

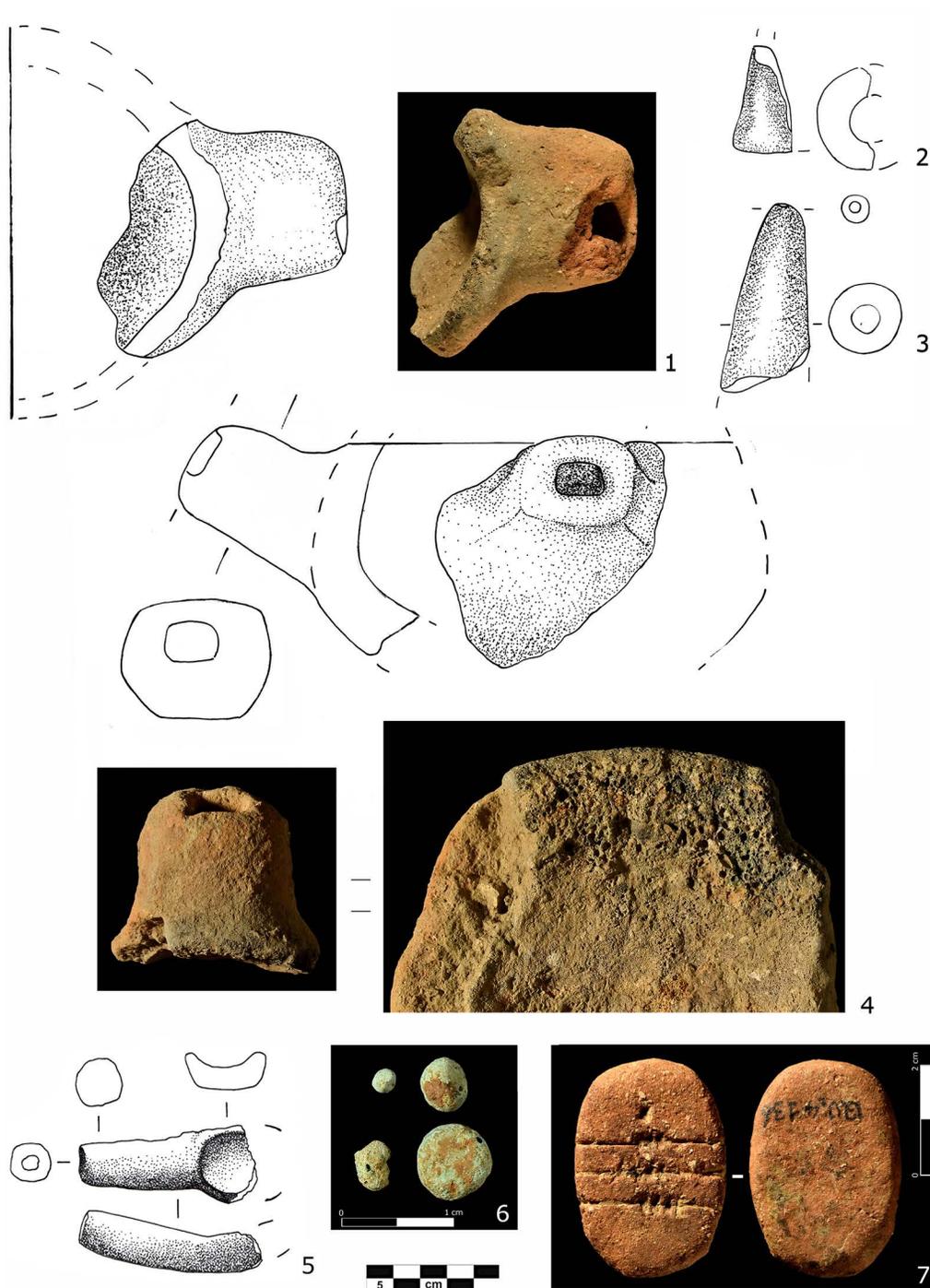


Figure 3: Evidence of metallurgical activities and enigmatic tablet from layer 8 – crucible fragments (nos. 1, 4); a close-up detail of copper incrustations from inside one of the crucibles (no. 4); spoon-shaped crucible (no. 5); tuyeres featuring a truncated cone shape with straight or convex walls (nos. 2-3); copper droplets and small discoidal-shaped ingot (no. 6); enigmatic tablet (no. 7) (drawings nos. 1-4 S. Poesini, no. 5 C. De Marco; photos L. Baglioni, from the DSSBC archive of the University of Siena).

4, no. 9). Noteworthy is the significant presence of vertical handles with elliptical-sectioned ribbon (Fig. 4, nos. 12-14), already documented in the second step of the Evolved Bell Beaker at Semitella and Querciola (Leonini, Sarti, 2008a, fig. 10, nos. 8-9); this would seemingly anticipate the elbow-like vertical handle

variant, often with apices or small flat or cone-like appendices, developing in a later phase with the Epi-Bell Beaker (Balducci *et al.*, 2000, fig. 26, nos. 1-2; Modeo and Sarti, Zanini, 2000, fig. 49, nos. 6-7, fig. 51). In order to better define the general characteristics of the evolved Bell Beaker in the Florentine area it is necessary

also to include the ceramic ware recorded in contexts such as Querciola, Semitella (probably two parts of a single settlement), Ambrosetti 2 and possibly Frilli W, Volpaia, Sassaiola and Lastruccia 1 (layer S) (Leonini, Sarti, 2008a; Sarti, 1995-96; 1997; 1998; Leonini, 2004a; 2004b), all of which have elements in common with the assemblage from layer 9 of Fosso di Lumino.

The ceramic production from layer 8 can be ascribed to initial phases of the Early Bronze Age, referred to in the local area as Epi-Bell Beaker, and characterised by a continuity of elements from the local Evolved Bell Beaker as well as the appearance of innovative forms and decorative motifs that anticipate the full development of the Early Bronze Age.

The decorated ceramics from layer 8 are for the most part shaped using a depurated clay and present surfaces that are for the most part opaque and only occasionally semi-polished. Several specimens feature a marked Bell Beaker influence, as documented by a fragment possibly interpretable as either a hemispherical bowl or cup with horizontal handle (Fig. 5, no. 1). This is decorated by a horizontal band formed by isosceles triangles crossed by oblique comb hatchings that recall examples attested in the Florentine area both during the first and second steps of the Evolved Bell Beaker (Leonini, Sarti, 2008a, fig. 8, no. 16; Sarti, Fenu, 1999, fig. 1, no. 1). Original decorative motifs are also present, such as the trellis (Fig. 5, no. 7), horizontal bands crossed by oblique hatchings or with zig-zag lines from which vertical bands depart (Fig. 5, nos. 2, 4). These are formed by a margined band made-up of an incised zig-zag decoration cross-hatched with vertical and parallel lines of which similar examples are also found in layer 8 at Lastruccia (Balducci *et al.*, 2000, fig. 25, no. 1). Decorative techniques include comb and punch impressions as well as incisions, at times used together, while the careless way in which the products are made becomes a leitmotif that eventually leads to a loss in the regularity and symmetry of the decorative element. A defining aspect that contributed towards the definition of the developing phase of the Epi-Bell Beaker is the carinated cup fragment with everted rim and incised decoration on its body featuring a complex band motif (Fig. 5, no. 8). This shape would appear comparable to deep carinated vessel types, attested in the first stages of the Early Bronze Age (Epi-Bell Beaker) from layer 8 at Lastruccia 3 (Balducci *et al.*, 2000, fig. 26, nos. 4, 8) and rarely documented during the Bell Beaker period. The profile of the specimen documented from layer 8 at Fosso di Lumino is lower when compared to the examples from layer 8 at Lastruccia 3. Likewise, the incised decoration with horizontal motifs constituted by a series of irregular zig-zag lines, executed with low accuracy, would seem indicative of a new fashion that anticipates the subsequent Early Bronze Age horizon, as documented at the site of Lastruccia 3 in layer

6 (Balducci *et al.*, 2000, fig. 30, nos. 1, 4) and layer 4 (Balducci *et al.*, 2000, fig. 36, no. 17).

The common ware from layer 8 is for the most part fashioned using a semi-depurated clay and presents almost exclusively opaque surfaces. The preliminary study has highlighted the presence of morphologies directly connected to the second phase of the evolved Bell Beaker, as evidenced by the presence of bowls with thickened and decorated flat rim (Fig. 5, no. 11). This shape is widely attested throughout the Florentine area in Epi-Bell Beaker contexts from the first stages of the Early Bronze Age, for example from layer 8 at Lastruccia 3 (Balducci *et al.*, 2000, fig. 27, no. 5). Other shapes are developed alongside these elements of clear Bell Beaker tradition that will see a wider distribution during the successive period, as in the case of the hemispherical bowl with slightly inverted rim and probable vertical ribbon handle set between two rounded appliques (Fig. 5, no. 9) that recall a specimen documented in layer C2-3 at Lastruccia 2A (Filippi, 2000, fig. 20, no. 4). Another example that foreshadows shapes that will develop in the succeeding phase of the Early Bronze Age is a fragment with possible high carination and vertical ribbon handle (Fig. 5, no. 10) that can be compared to examples documented in the second phase of the Early Bronze Age (Madonna del Piano, layer 7, Fenu, 2000, fig. 44, no. 4).

As previously stated, the influence of the evolved Bell Beaker is clearly attested in layer 8 of Fosso di Lumino, both in the decorated and common ware ceramics, and whose effects will contribute to determining a local aspect of the Epi-Bell Beaker during the first phases of the Early Bronze Age, as already documented at other sites across the Florentine area such as Lastruccia 1 horizon N (Sarti, Leonini, 2000); Lastruccia 2A layer C2-3, Lastruccia 2B layer B, Lastruccia 3 layer 8 (Filippi, 2000; Balducci *et al.*, 2000; Sarti, Martini, 2000); and Neruda layer G (Coradeschi *et al.*, 2012).

Four enigmatic tablets of elliptical morphology with engraved horizontal lines punctuated by small impressions have also been documented in layer 8 (Fig. 3, no. 7).

5 - Conclusions

The site of Fosso di Lumino can be set in the broader framework of the Bell Beaker and Early Bronze Age development. It confirms the distinctive aspects of ceramic and lithic productions of the end of the 3rd – early 2nd millennium BC in central Italy (Leonini, Sarti, 2008b; Leonini, Sarti and Volante, 2013). The pottery productions observed in the Florentine territory find analogies with other areas of the Peninsula such as southern coastal Tuscany, upper Latium and the area of Emilia-Romagna, albeit with different modes

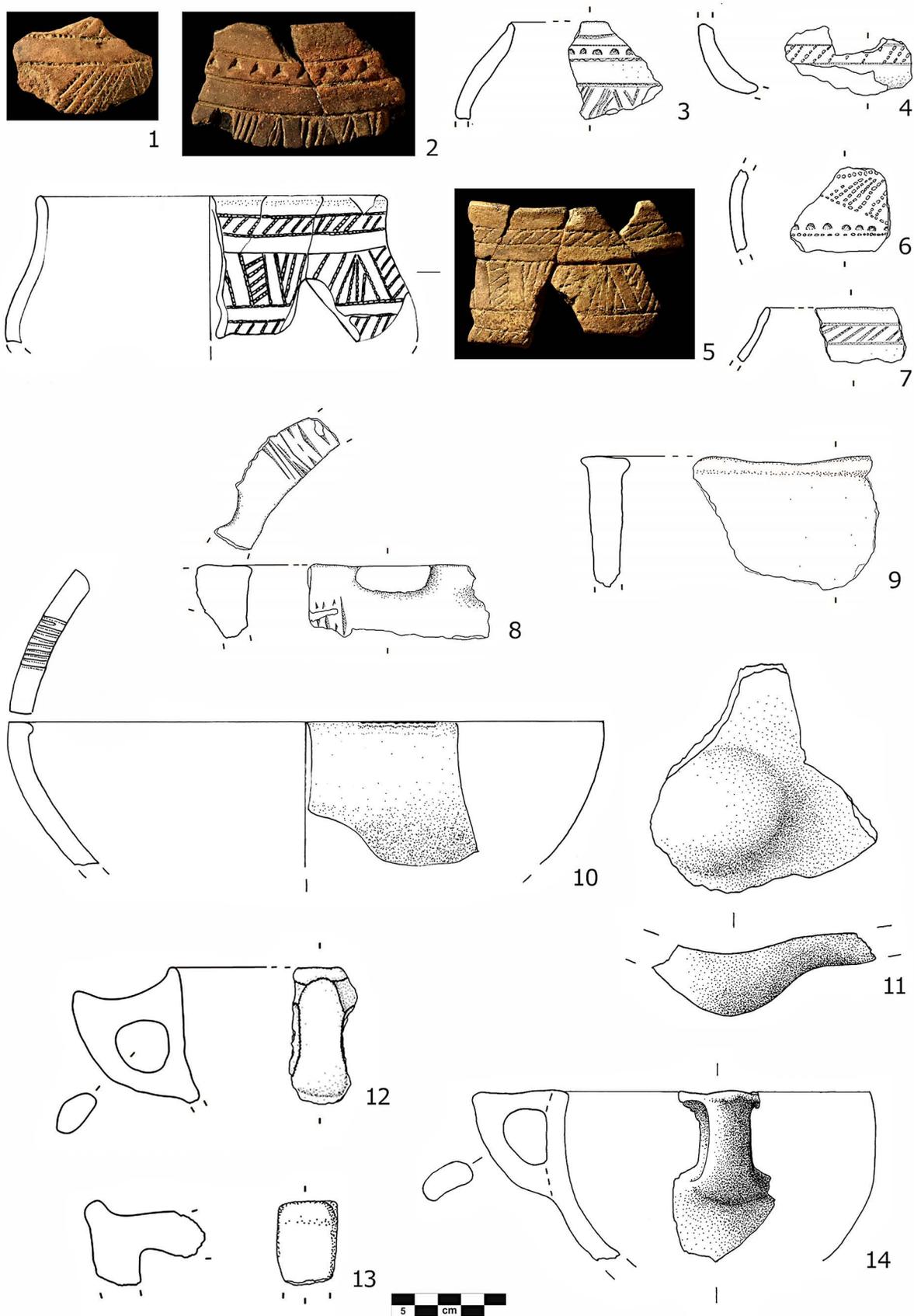


Figure 4: Pottery from layer 9 of Fosso di Lumino – Decorated pottery (nos. 1-8, 10, 11); Common ware (nos. 9, 12-14) (drawings nos. 3-10; 13-13 S. Poesini, nos. 11, 14 C. De Marco; photos L. Baglioni, from the DSSBC archive of the University of Siena).

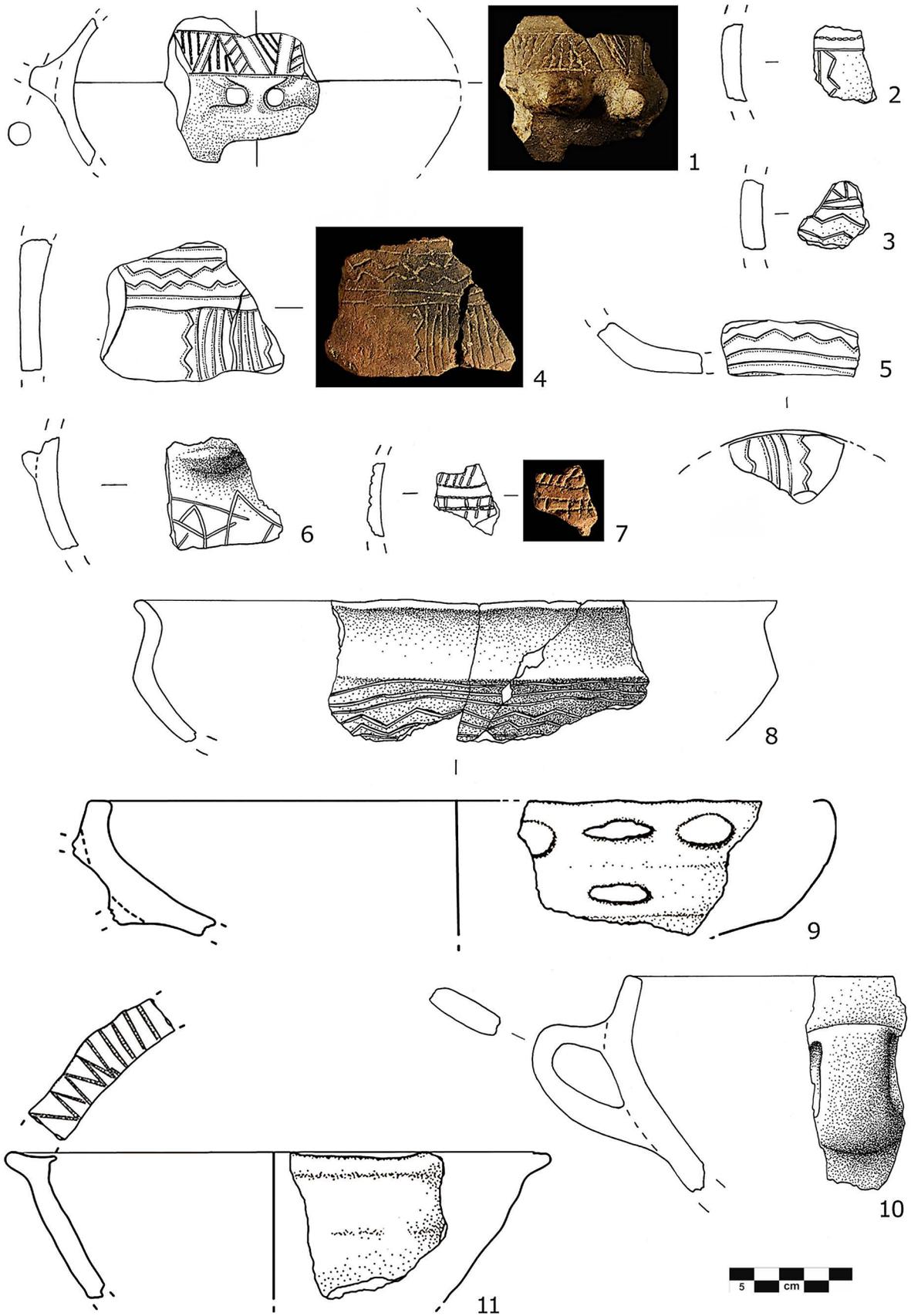


Figure 5: pottery from layer 8 of Fosso di Lumino – Decorated pottery (nos. 1-8); Common ware (nos. 9-11) (drawings nos. 1, 5, 9, 11 by S. Poesini, nos. 2-4, 6-8, 10 C. De Marco; photo L. Baglioni, from the DSSBC archive of the University of Siena).

and concentrations (Sarti, 1998; Sarti, Martini, 2000; Leonini, Sarti, 2008b).

Starting from the Bell Beaker period, the Florentine territory appears as part of a wider network that encompasses the Rhône and Rhine districts as well as Provence and parts of Central Europe, sharing original elements that can be reconnected to others from different western Mediterranean contexts (Leonini, Sarti, 2008b; *in primis* for Mediterranean analogies Sarti, 1997). The characteristics of the first local evidence of the Early Bronze Age, following the ceramic and lithic record, still point to a significant integration with local realities, as observed in the evolved phase of the Bell Beaker (Sarti, 2000). The same can be noted for settlement types and the exploitation of local resources, ultimately showing a continuity in economic strategies (Penco, Sarti in this volume).

For the first step of the Early Bronze Age (Epi-Bell Beaker) the existing hypothesis (Sarti, 2004; Sarti, Leonini 2007; Leonini, Sarti, 2008b) of the mid-Tyrrhenian boundaries of the Bell Beaker phenomenon still remains valid, albeit with caution, due to a disparity of evidence in the various areas and partially different characteristics that also include the territory of Emilia Romagna (Cattani, Miari, 2018; Bernabò Brea, Cardarelli and Cremaschi, 2018; Mazzieri, Dal Santo, 2007). In this wide-ranging area, in fact, the first moment of the Early Bronze Age is characterised by a strong Bell Beaker imprint. This same Bell Beaker influence is also documented in Romagna with the ‘stile della Tanaccia’ and in central Emilia with the ‘Tardocampaniforme’ (Ferrari, Steffè, 2008; Dal Santo *et al.*, 2014).

The presence of metallurgical activities at the site of Fosso di Lumino is also of key importance for the historical reconstruction of the Florentine area. The evidence seems to point to activities linked to secondary processes such as the refining and working of copper rather than direct ore smelting. Fosso di Lumino is set in a territory where metallurgical activities are attested with continuity during the 4th millennium BC, documented by working areas, slags and finished products (Podere Pietrino and Neto Via Verga - area 1: Sarti, Martini, 1993; Volante, 2003; 2005), as well as by slags and crucibles in the following periods (Via Leopardi, Podere della Gora, Querciola, Lastruccia: Sarti, 1997 and Sarti, unpublished data).

The analyses carried out on the slags and finished products show a variety of compositions that attest to the use of polymineral ore (sulfides and chalcopyrite) attributable to different areas of provenance. In addition to the area south of Florence (Monte Ferrato in the vicinity of Prato and Impruneta: Giachi, Pallecchi and Sarti, 2001) where, alongside native copper veins, modest secondary mineralisations are also

found (oxides, carbonates and sulfides), the area of Campigliese and the district of the Colline Metallifere in southern Tuscany, with its rich polymineral deposits, must also be taken into account. The copper and small quantities of antimony and silver composition of several Bell Beaker objects from the Florentine area, together with those recorded at Fosso di Lumino, refer more specifically to these southern Tuscan outcrops.

The data, currently being processed as part of a still ongoing research project, would seem to confirm the north-south regional trend already hypothesised from the ceramic finds, with the probable inclusion in this circuit of upper Latium as a possible mineral supplier. This unresolved issue must take into consideration, among other things, the evidence that supports the role of southern Tuscany in production activities across the Florentine area during the early metallurgical period. This includes: the site of San Carlo in the Campigliese, already active in the second half of the 4th millennium BC (Fedeli, Galiberti, 2016); crafted products such as axes, dating to the 4th millennium BC and documented from funerary contexts in Maremma (Dolfini, 2010); the excavations at Poggio Malinverno, Tolfa (Giardino, Steineger, 2011). It is also worth mentioning the well-known evidence provided by the composition of the axe of the Similaun Man, which can be ascribed to the Tuscan area (Artioli *et al.*, 2017), as can Early Bronze artefacts from the Valais (Cattin *et al.*, 2011) and in contexts from the Rhône Valley in Central France (Cattin *et al.* 2017). The study of these issues has seen more recent developments with the employment of lead isotopic analyses on a sufficiently wide number of specimens from the south-central parts of the Italian peninsula (Dolfini, Angelini and Artioli, 2020). The still preliminary data for the central Italian finds reveals a complex scenario characterised by both local and non-local primary resources, some of which already travelled significant distances (the Alpine area and southern France) during the 5th millennium BC (Sarti *et al.*, 2019; Sarti, 2015).

Furthermore, the small but important repertoire of ‘enigmatic tablets’ from Fosso di Lumino (Fig. 3, no. 7) – apparently indicating a connection with metallurgical activities as testified by other contexts (for a synthesis see: Piccoli, Zanini, 2015) – would document significant links between the Florentine area, Northern Italy and Central Europe. The specimens from Fosso di Lumino can be associated with those from Podere della Gora 4 and Lastruccia 3 – layer 8 (Sarti, Martini, 2000 fig. 28, no. 12; Sarti *et al.*, 2019), two Bell Beaker sites from the Florentine district, and the specimen from the first stages of the middle Bronze Age at Filettole (Sarti, Guidi, 1999, Fig. 6, no. 23). The adoption of commonly shared elements is documented in Latium (Caldera di Latera: Petitti, Rossi, 2012 although unfortunately not in primary deposit) and Umbria (Grotta dei Cocci: De

Angelis, 2008), in an area that actually still presents a sporadic presence of Bell Beaker and Epi-Bell Beaker elements. (Leonini, Sarti, 2008b). These shared elements, associated with the circulation of raw metal resources, document the existence of a possible network in central Tyrrhenian Italy and the possible intermediary role played by the Bell Beaker culture in the Florentine area, the latter showing, during its evolved phase, numerous contacts with the cultural environments of northern Italy as well as Central Europe.

There is therefore the need for a more in-depth reflection on the areas and modes of diffusion in these central Italian contexts. Among these modes of diffusion occurring between the mid-Tyrrhenian and central European areas, the issues related to the rare presence in the Florentine district of the *barbelè*, a technique (Leonini, Sarti, 2008a) documented in eastern Italy during the late Bell Beaker, connected to Slovenia (Leghissa, 2015) and reaching Mediterranean France during the Epi-Bell Beaker (Vital, Convertini and Lemercier, 2012), must be considered. Within this thematic and chronological framework one must also include the circular tablet with incisions found in layer 8 (Epi-Bell Beaker) at Lastruccia 3 (Balducci *et al.*, 2000, fig. 28, no. 12), a find that recalls the rondels known in Provence and the Lake Constance district (Vital, Convertini and Lemercier, 2012, fig. 33).

To complete this overview of possible multidirectional interrelationships it is necessary to assess the role provided by the decorative and morphological elements in the Evolved Bell Beaker and the Epi-Bell Beaker from the Florentine territory. These find analogies with ceramic products known in the southern Adriatic and Tyrrhenian areas (Cazzella, Silvestrini, 2005), recalling the trans-Adriatic elements of Çetina, a theme that is part of the issue related to the eastern boundaries of the Bell Beaker culture (Heyd, 2007).

In conclusion, Fosso di Lumino with its ceramic assemblage, metallurgical activities and presence of 'enigmatic tablets' can be set in the wider picture of long-distance connections that still require further investigation and definition, involving different markers of the Bell Beaker and Early Bronze Age in central Tyrrhenian Italy. The cultural dynamics of the Bell Beaker and Bronze Age Epi-Bell Beaker appear as inter-connected, even though they stem from a change in connection routes, nevertheless characterised by elements of reciprocity. With the Bell Beaker in central Italy contacts are established with the Rhône and Rhineland territories as well as the Provencal area; at a later stage (the third step of the Evolved Bell Beaker) an increase in contacts with north-eastern and central-eastern Italy can be noted. The production of the Evolved Bell Beaker is characterised by a contamination and hybridisation of various traditions, including the

local pre-Bell Beaker substrate. A significant amount of evidence as to the long-distance relations of the Florentine area is available between the Bell Beaker and the Early Bronze Age, whereas documentation from neighboring Italian contexts is still being defined.

Author contributions

Sections 1 and 2 by L.S; section 3 by P.P.; section 4 by C.D.M.; section 5 by all three authors. Translation by Alexander Agostini; photos by Lapo Baglioni.

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Bell Beaker Lithic Assemblages in the Florentine Area: Revisions, New Studies and Updates

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Abstract: The Florentine area (more specifically Sesto Fiorentino) appears as one of the regions with the highest number of Bell Beaker finds in the Italian peninsula. Archaeological investigations begun in the 1980s at Sesto Fiorentino and carried out by the Universities of Siena and Florence, brought to light a number of settlements with occupation phases attributable to the Bell Beaker and Epi-Bell Beaker, as well as to the local Pre-Bell Beaker Copper Age. Bell Beaker lithic assemblages from this area are well known thanks to previous research, the results of which were presented at the 2006 Proceedings of *Archéologie et Gobelets* and subsequently published in 2008. The present contribution constitutes a review of the lithic industries from the sites of Olmi 1 and Semitella, ascribable to two different steps of the local Evolved Bell Beaker. This revision, based mainly on a technological approach, seems to confirm the hypothesis of an evolution of the local Bell Beaker, already hypothesised for both lithic industries and ceramic products. Moreover, it provides key evidence for improving our knowledge of Bell Beaker lithic production in the Florentine area and, on a broader scale, of Central and Northern Italy.

Keywords: Florentine area, Bell Beaker lithic production, Lithic technology, Raw materials, Bell Beaker settlements

1. The Bell Beaker in the Florentine area

The human presence in the Florentine area during prehistory has in the Bell Beaker period a moment of great demographic development, from the final stage of the local Copper Age until the beginning of the Bronze Age (Sarti 2014). The study area consists of a plain located northwest of Florence (Tuscany, Italy) at the base of Mount Morello, part of the broader Firenze-Prato-Pistoia alluvial plain that originated from a lacustrine basin, developing along a tectonic depression since the Late Pleistocene (Ghinassi and Tangocci 2008).

In this micro-regional assessment of the area around Florence, the study of Bell Beaker settlements has been carried out through the analysis of their relationship with the past landscape and their interaction with other spaces; production activities have also been investigated via an interdisciplinary approach. Here, the relationship between man and the environment is defined by economic strategies, the ability to draw on local resources and the gaining of environmental skills that allow the development of appropriate solutions to a complex ecological context such as that of the Florentine area.

The proposal for a seriation of the Florentine Bell Beaker is based largely on the study of ceramic and lithic materials, confirmed by stratigraphic as well as radiometric data (Leonini *et al.* 2013).

The Sesto Fiorentino Bell Beaker can be set in a larger network of relationships comprising various

Italian and European regions (Leonini and Sarti 2008b). The cultural context involves Provençal and Central European areas although featuring distinct 'Mediterranean' characteristics (Sarti 1997) with effects on southern coastal Tuscany and upper Latium as well as Sardinia and the Emilia-Romagna in different ways and intensities.

2. Bell Beaker lithic industries from Olmi 1 and Semitella

The typological and stylistic features of Bell Beaker lithic assemblages from the Florentine area are well known thanks to several previous studies (Brilli, Fabrizio and Martini 2008 pp. 339-340; Brilli and Martini 2008 pp. 363-367; Leonini, Lo Cascio and Modesti 2008 pp. 345-347; Leonini, Martini and Salvadori 2008 p. 352; Lipowicz, Martini and Sarti 2008 p. 350; Martini 2008 pp. 103-118; Martini, Marton and Sarti 2008 p. 357). This paper focuses on the technological characteristics of lithic industries from two sites located in the municipality of Sesto Fiorentino, Olmi 1 and Semitella (Figure 1), both of which can be attributed to the local Evolved Bell Beaker, although to two different steps; Olmi 1 is ascribable to the first step of the Evolved Bell Beaker (step 2 of the local Bell Beaker), whereas Semitella is more recent (step 3) (Pizziolo and Sarti 2008 pp. 48-49).

Raw materials

Previous work carried out on the lithic resources exploited by Bell Beaker groups in the Florentine area

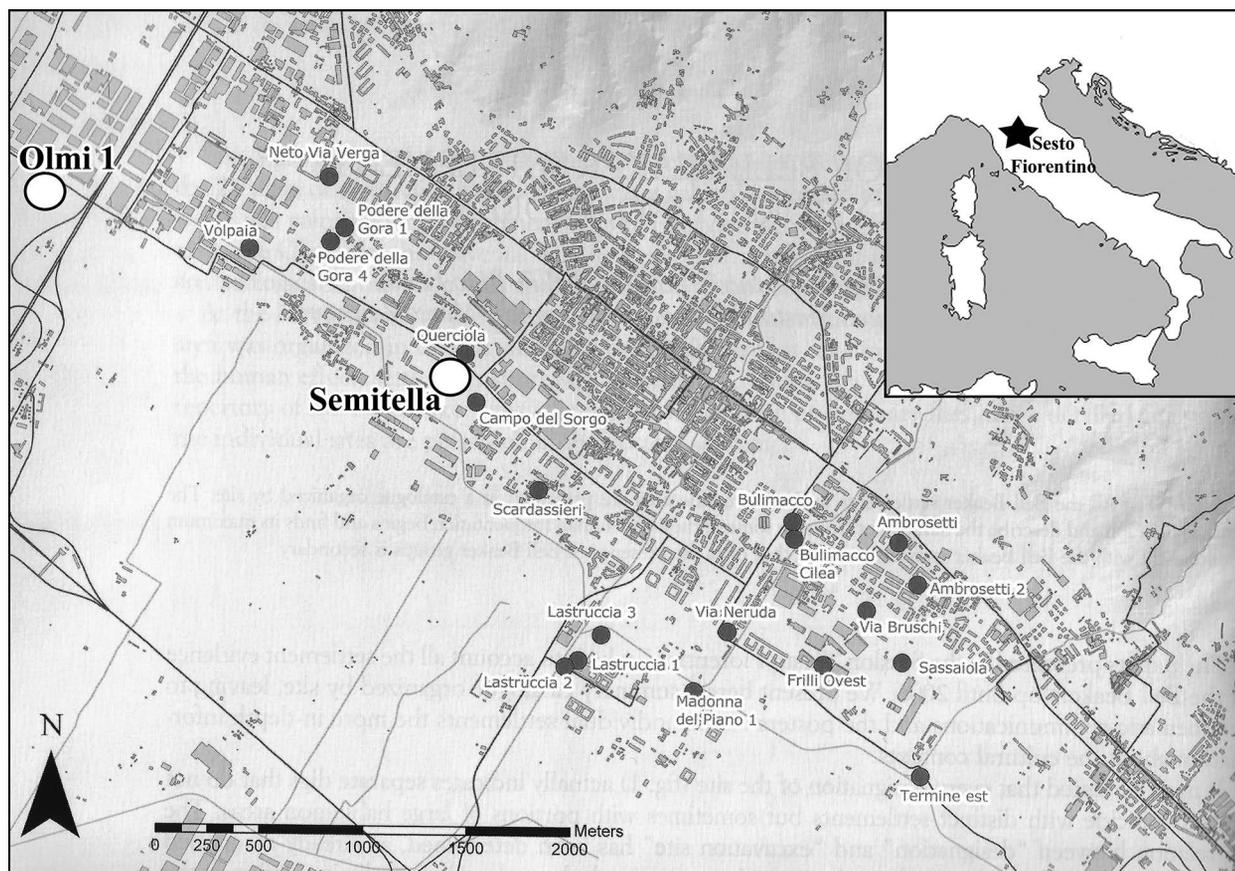


Figure 1: Map with locations of the sites of the Florentine area (Sarti *et al.* 2008 modified)

(Cipriani *et al.* 2001 pp. 356-377; Ghinassi, Martini and Moranduzzo 2008 pp. 75-79; Trenti *et al.* 2015 pp. 85-94), allows us to subdivide the raw materials into two main groups according to their provenance: local cherts, collected within a distance of 30 km from the site at most (probably not exceeding 20 km) (Figure 2), and cherts from more distant outcrops.

Local cherts are generally of poor quality, although better quality items are also present. Several lithotypes have been identified (Cipriani *et al.* 2001 pp. 360-372; Ghinassi, Martini and Moranduzzo 2008 p. 76; Trenti *et al.* 2015 pp. 86-87): flints of the Arenarie del Monte Falterona formation, of the Calcari e Brecciole del Monte Senario formation and of the Monte Morello formation; jaspers of Monte Alpe; quartzite; and limestone.

Arenarie del Monte Falterona, Monte Senario and Monte Morello cherts consist of dark-coloured flints, generally with a medium-fine texture. Given the similarity of many features (colour, texture, cortex...), the identification of each lithotype is often difficult. However, Arenarie del Monte Falterona flint appears to be the most commonly exploited local raw material during the Bell Beaker period (Ghinassi, Martini and Moranduzzo 2008 p. 76). Local flints and jaspers were picked up and brought on site in the form of small sized

pebbles. The occurrence of quartzite and limestone in these lithic assemblages is sporadic; however, in other Bell Beaker industries from the Florentine area, such as Querciola, the exploitation of limestone appears more frequent (Martini 1997 pp. 289-306).

The second group (Figure 3) consists of several types of high-quality flint and obsidian, possibly from Lipari (Sicily) (Martini 2008 p. 104; Martini 1997 p. 279), the latter attested only by two bladelets, one from Olmi 1 and the other from Semitella. High-quality flints consist of Scaglia rossa, Scaglia bianca, Maiolica, Scaglia variegata and Bedoulian flints.

Most of these seem attributable to the Umbro-Marche formations, although it cannot be excluded that some items, especially from the site of Olmi 1, come from the Lessini area (Trenti *et al.* 2015 p. 88). These consist generally of a few bladelets (often retouched ones) in Maiolica and Scaglia variegata; even though the area of Lessini is far from Sesto Fiorentino (it is located in the Venetian Prealps, in the north-eastern part of Italy), the occurrence of bladelet production in these raw materials is attested in some Bell Beaker sites of eastern Emilia, e.g. Cava Busani (Modena) and Sant'Ilario d'Enza (Reggio Emilia) (Barfield 2001 p. 510; Dal Santo *et al.* 2014 p. 220) (see *infra*).

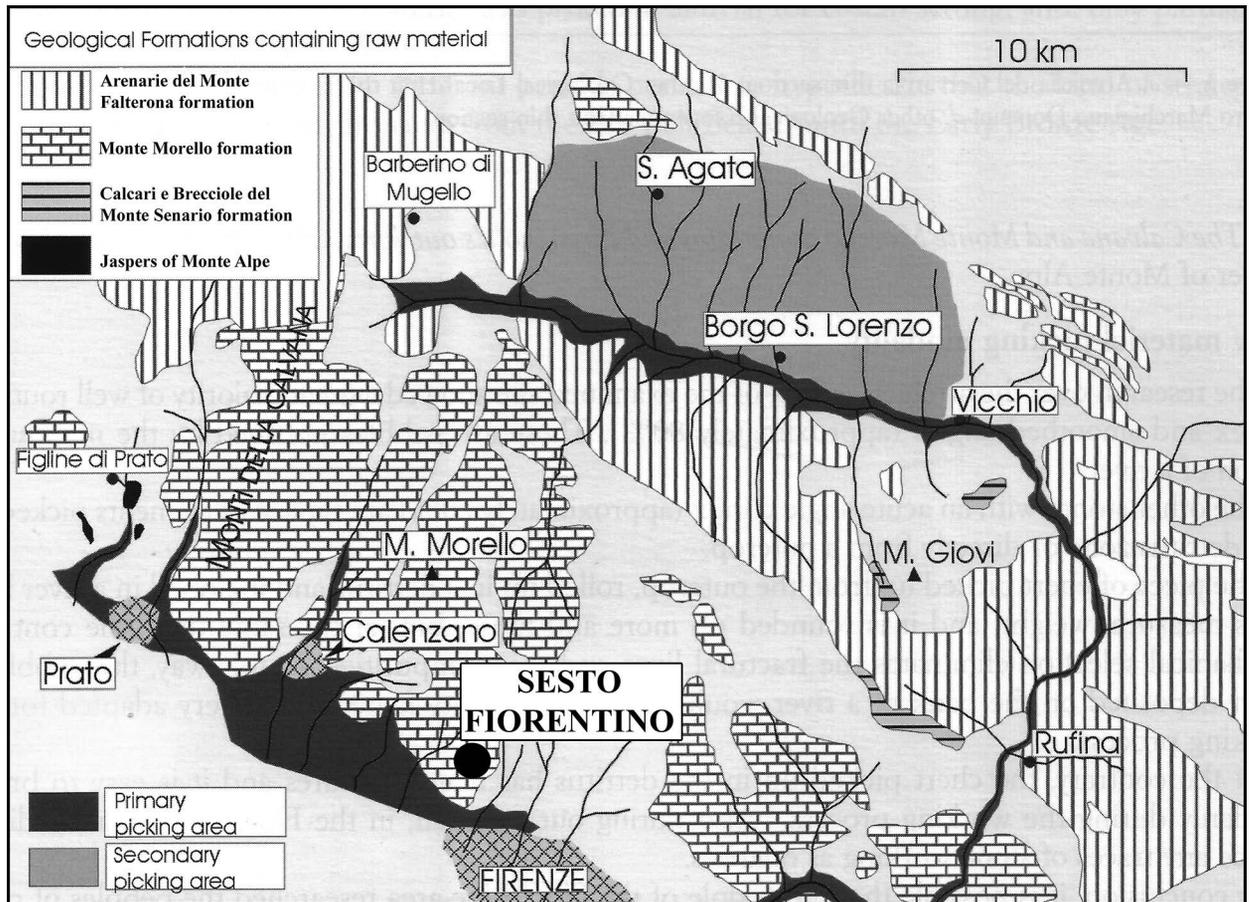


Figure 2 Bell Beaker in the Florentine area - Location of procurement areas of local raw materials (Ghinassi, Martini and Moranduzzo 2008 modified)

As for the Umbro-Marche lithotypes, the location of flint sources is still unclear. Pebbles attributable to these formations are found in 'Sabbie gialle' deposits, in the foothills of the Apennine Mountains of Emilia-Romagna (Trenti 2010 p. 14); however, cortex analysis shows that some items have been picked up in the form of nodules, thus indicating that these deposits are not the only procurement area. Outcrops of these flints are probably located in the Marche area (central-eastern part of the Italian peninsula), at a distance of 100-150 km at least from Sesto Fiorentino (Ghinassi, Martini and Moranduzzo p. 76; Trenti *et al.* 2015 p. 90). In any case, at both sites it is possible to observe the exploitation of high-quality flints whose outcrops are located at a distance of several tens of kilometres from the site. Far-reaching procurement is not only attested in the Florentine area, but has been noted at several Bell Beaker sites in Northern Italy (Barfield 2001 pp. 510-513; Dal Santo *et al.* 2014 pp. 220-221; Lo Vetro 2008 p. 183; Matera, Furestier and Lo Vetro in this volume; Salzani 2008 p. 74). The long-distance supply of Lessini flint is documented in Emilia since the Neolithic. It could be assumed that the same supply routes have been perhaps tested and reiterated over the millennia.

The presence of Bedoulian flint is sporadic and still uncertain (Trenti *et al.* 2015 p. 87); moreover, the two items from Olmi 1 that might be in this raw material (Trenti *et al.* 2015 p. 88) can be maybe interpreted as pieces found in older sites and picked up by Bell Beaker groups.

Olmi 1 lithic industry

A total of 501 chipped stone artefacts have been recorded from the site of Olmi 1. Lithic production is mainly based on the exploitation of high-quality flints distant several tens of kilometres from the site (which constitute more than 50% of the total lithic industry) (fig. 4), thus attesting to the existence of a supply strategy comparable to that observed at other sites in Northern Italy (via Crearo-Baldaria at Cologna Veneta, Brescia-San Polo, Cava Busani) (Dal Santo *et al.* 2014 p. 220; Matera, Furestier and Lo Vetro in this volume; Salzani 2008 p. 74). For the most part these flints belong to Umbro-Marche formations (Scaglia rossa and, to a lesser extent, Maiolica and Scaglia bianca) and are usually flaked on site, although some items were imported on site as finished products. Some elements would seem to be attributable to Lessini



Figure 3: Bell Beaker in the Florentine area - Location of provenance areas of non local raw materials: Sesto Fiorentino (1), Lessini area (2), "Sabbie gialle" deposits (3), primary outcrops of Umbro-Marche flints (4), Lipari (5)

cherts (Maiolica and more rarely Scaglia variegata) (Trenti *et al.* 2015 p. 88), consisting generally in retouched bladelets (often specialised tools, such as microlithic crescents and backed tools). These items, as with the obsidian bladelets, were not flaked on site, but rather imported at a later time. Elements for which an attribution as Bedoulian flint has been proposed (Trenti

et al. 2015 p. 88) consist of a tool fragment (a triangular or trapezoidal-shape geometric with transversal shear) characterised by a white patina, and a regular bladelet knapped by pressure technique.

Local raw materials account for less than 39%. The majority constitute Arenarie del Monte Falterona flints, but Calcari e Brecciole del Monte Senario cherts and jasper of Monte Alpe are also rather frequently exploited; Monte Morello flints are not attested. The exploitation of quartzite and limestone is sporadic.

High-quality flints from Umbro-Marche formations (and maybe also from the Lessini area, albeit very rarely) and local raw materials (except for quartzite and limestone) were knapped on site; the others were knapped elsewhere and thereafter brought to the site. As for local cherts, all stages of the *chaîne opératoire* are attested; conversely, with regard to the Umbro-Marche flints, the activities of cortex removal and shaping out of the cores were generally carried out elsewhere, perhaps at the outcrops. Knapping activities are aimed at the production of small flakes (mainly 1.5 to 3 cm long) usually made from local raw materials. In most cases, *débitage* is simple and not elaborated, and carried out by hard hammer percussion (also sometimes anvil percussion). Cores are generally with one striking platform and show short sequences of flaking. Multidirectional cores showing a longer sequences of *débitage* are also present. These cores represent the final phases of *débitage*: as a matter of fact, during the flaking, every platform showing a favourable flaking angle could be exploited, generally one after another. However, some flakes, mostly from high-quality flints, knapped by soft hammer percussion technique, demonstrate the existence of a more organised flaking.

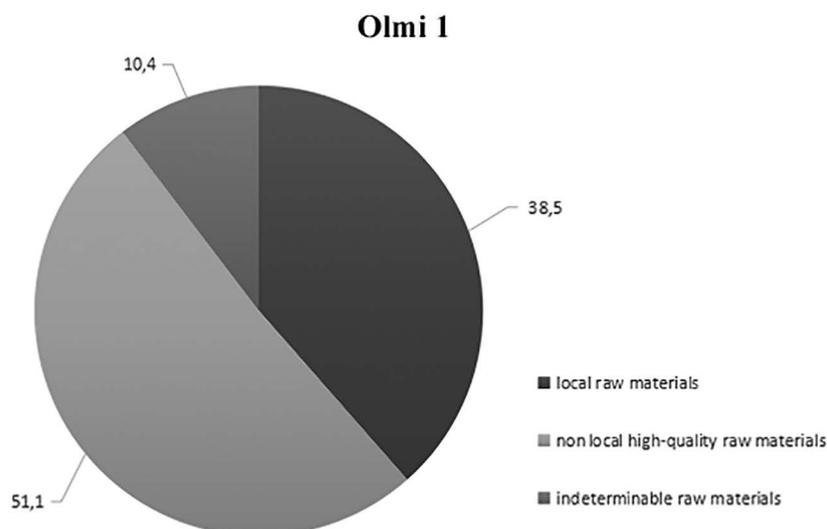


Figure 4: Olmi 1 - Provenance of raw materials

Production of bladelets is also attested. Bladelets represent 18% of the lithic industry from Olmi 1; even though some can be interpreted as pieces found in older sites and picked up by Bell Beaker groups, many items show the existence of bladelet production on site. Besides opportunist bladelets, generally in local raw materials and knapped by hard hammer percussion, bladelets can be divided into two categories: less regular and more regular. Less regular bladelets are generally knapped by soft hammer percussion, and are made both from local raw materials and from Umbro-Marche flints. More regular bladelets, almost exclusively from high-quality flints, show several features indicative of probable knapping by pressure technique (e.g. high regularity and parallel morphology of edges and arrises, straight profile, moderate thickness). This type of *débitage* is also testified by some cores, thus proving that it was carried out on site; shaping out of these cores was made through the removal of a crested blade or of a natural crest (Figure 6).

The toolkit consists of 214 items representing nearly 43% of the lithic industry from Olmi 1 (Figure 7). Most tools present discontinuous and inaccurate retouches; only some types, such as endscrapers, arrowheads, backed tools and geometrics, are made more accurately. Raw materials employed for the production of tools are both local cherts and high-quality flints. Tools are mainly produced on small flakes; however, the majority of bladelets, most of which are regular, are used as tool supports (more than 80% of the total number of bladelets).

Endscrapers represent less than 7% of tools and are generally made from local raw materials. Short endscrapers are prevalent; among them, items showing a sub-circular morphology obtained through an accurate and invasive retouch are present, albeit rarely. Only two arrowheads have been found; they are tanged arrowheads (one of which is fragmented), one in jasper, the other one in an unidentified chert. One item is comparable to an arrowhead found in the site of Brescia-San Polo, in Lombardy (Matera, Furestier and Lo Vetro in this volume, fig. 7 n. 7); however this type cannot be considered typical of Bell Beaker assemblages.

Microlithic crescents are frequent (11%). Raw materials are usually high-quality flint (in some cases possibly from the Lessini area), although the sporadic use of local cherts is also attested. Tool supports are almost exclusively bladelets, often regular. In most cases microlithic crescents are between 17 and 23 mm in length and slender-shaped, although wider items have also been recorded. One element with not retouched *piquant-trièdre* testifies to the use of the microburin blow technique for the manufacture of blanks for these tools. A few triangular and trapezoidal microlithic armatures are also present. Finally, it is worth mentioning that the backed tools represent 5.5% of tools; the occurrence of

truncations is rather frequent (9%), whereas borers are very rare, but present. Splintered pieces make up 11% of the total of the tools.

Semitella lithic industry

The lithic assemblage from Semitella is composed of 1,321 items. Supply strategy is based on the exploitation of local cherts, which constitute more than 70% of the industry (Figure 5). The most commonly exploited raw material is Arenarie del Monte Falterona flint (56%); other local raw materials (Monte Morello and Monte Senario flints, jasper of Monte Alpe and quartzite) are less frequent; the occurrence of quartzite is very sporadic. Exploitation of high-quality flints, mainly from Umbro-Marche formations (although we cannot exclude that some finished products are attributable to Lessini cherts) is attested, albeit more rarely than at Olmi 1 (15%). As for Umbro-Marche flints, most are Scaglia rossa, whereas Maiolica and Scaglia bianca are less frequent. Analysis of the cortex (present only in a few cases) shows that blocks were brought to the site in the form both of pebbles (perhaps picked up in 'Sabbie gialle' deposits) and, to a lesser extent, of nodules, thus testifying to the occurrence of a more far-reaching procurement, albeit more rare.

Knapping activities were carried out on site, both regarding local raw materials and Umbro-Marche formations; for the latter, however, it is probable that several items (generally regular bladelets) have been knapped elsewhere and imported as finished products. Small flakes (generally ranging in size from 1.5 to 3 cm long) were the main aim of the production and are usually made of local raw materials. In most cases flakes were knapped by hard hammer direct percussion (sometimes by anvil percussion) and show the existence of a simple and non-organised *chaîne opératoire* with short sequences of *débitage*; however, more elaborated flaking, carried out by soft hammer percussion, is also attested, although rarely. Flintknapping begins from cores with one striking platform and usually exploited through short sequences of *débitage*. Other platforms with a favourable flaking angle can be thereafter exploited, both one by one and alternated, without any clear organisation of *débitage*. Multidirectional cores generally represent the final flaking phase of cores with one striking platform.

Bladelets represent 12% of the lithic assemblage. They consist of opportunist and irregular bladelets knapped by hard direct percussion, but several items (e.g. crested blades, cores) proving the existence of more regular and organised bladelet production on site also occur (Figure 6); this more regular production was carried out not only by soft hammer direct percussion technique, but often also by pressure or indirect percussion. Local raw materials were employed more for the production

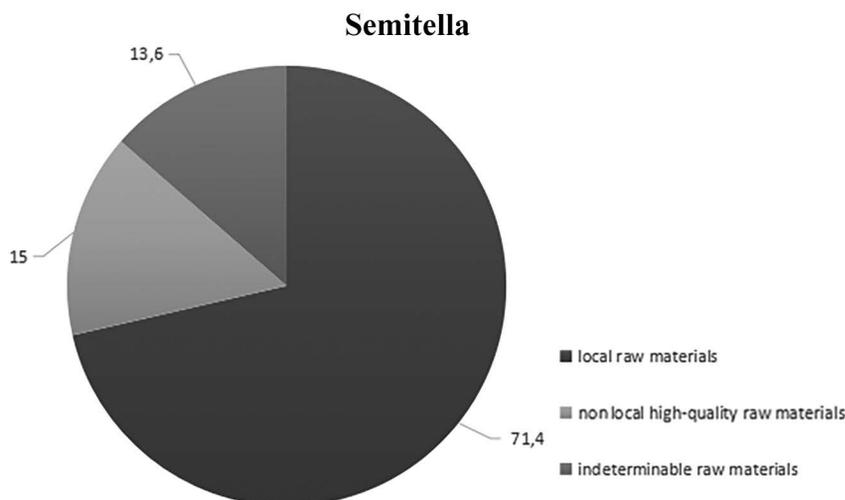


Figure 5: Semitella - Provenance of raw materials

of less regular bladelets, however better quality blocks of local chert could be used for making regular (also sometimes very regular) bladelets. Many very regular bladelets (characterised by parallel morphology of edges and arrises, and knapped by pressure and/or indirect percussion techniques) probably have not been knapped on site, but imported at a later time; moreover, it cannot be excluded that some of them were perhaps found in older sites and picked up by Bell Beaker groups. However, some items (such as cores, also in local raw materials) testify that a very regular bladelet production was carried out on site.

A total of 579 tools (Figure 7) were recorded from the site of Semitella and represent 44% of the lithic assemblage. A few tool types (endscrapers, arrowheads, backed tools, geometrics) show generally more accurate retouches; as a matter of facts, most of the tools are not accurately made and often present discontinuous retouches. The tools are made both of local raw materials and high-quality flints, and most of them are produced on small flakes; however, 70% of the bladelets have been used as tool supports. Some notes about toolkit of Semitella. Endscrapers (8% of the retouched items), most of which made from local raw materials, are generally short, and some show a sub-circular morphology (obtained through an accurate retouch). Arrowheads (3%) consist almost exclusively of tanged items (most of which are fragmented). Many of them are made from local raw materials, but items in high-quality flints occur frequently. Tanged arrowheads generally have long points and short and small tangs; the retouch is bifacial and with scale removals. It is worth mentioning the occurrence of one hollow base arrowhead made of jasper. Microlithic crescents are very rare (0.5%); the items made from high-quality flints show a very small size (that never exceeds 16 mm), while the only one in

local raw material (unfortunately fragmented) is longer. Among backed tools (which are less than 6%), the presence of one bilateral backed point is noteworthy, similar to those attested in other Bell Beaker industries of the Florentine area (Martini 2008 p. 107). Microlithic triangular and trapezoidal armatures are very sporadic; a single rhomboidal element was recorded. Finally, occurrence of truncations and borers is rather frequent (more than 5% and 3% respectively), burins occur, but very rarely, and splintered pieces represent 9% of the toolkit.

3. Bell Beaker lithic production in the Florentine area

The lack of data on the technological features related to most of the Bell Beaker lithic industries in the Florentine area does not allow us to fully grasp domestic Bell Beaker lithic production in the region; however, the evidence from the Olmi 1 and Semitella industries, although preliminary, seems to confirm the hypothesis of a local Bell Beaker evolution.

In terms of procurement strategies and raw materials exploitation, some significant differences between these two industries can be observed. The main one concerns the importance of high-quality flints, generally attributable to the Umbro-Marche formations, available at a distance of several tens of kilometres. At Olmi 1, lithic production is mainly based on the exploitation of these flints (which represent more than 50% of the industry), whereas in the Semitella lithic assemblage their exploitation is less important (15%). Despite these differences, in both industries a comparable procurement strategy can be seen, which has already been observed for several lithic industries in North-eastern Italy (Barfield 2001 pp. 510-513; Dal Santo *et al.*

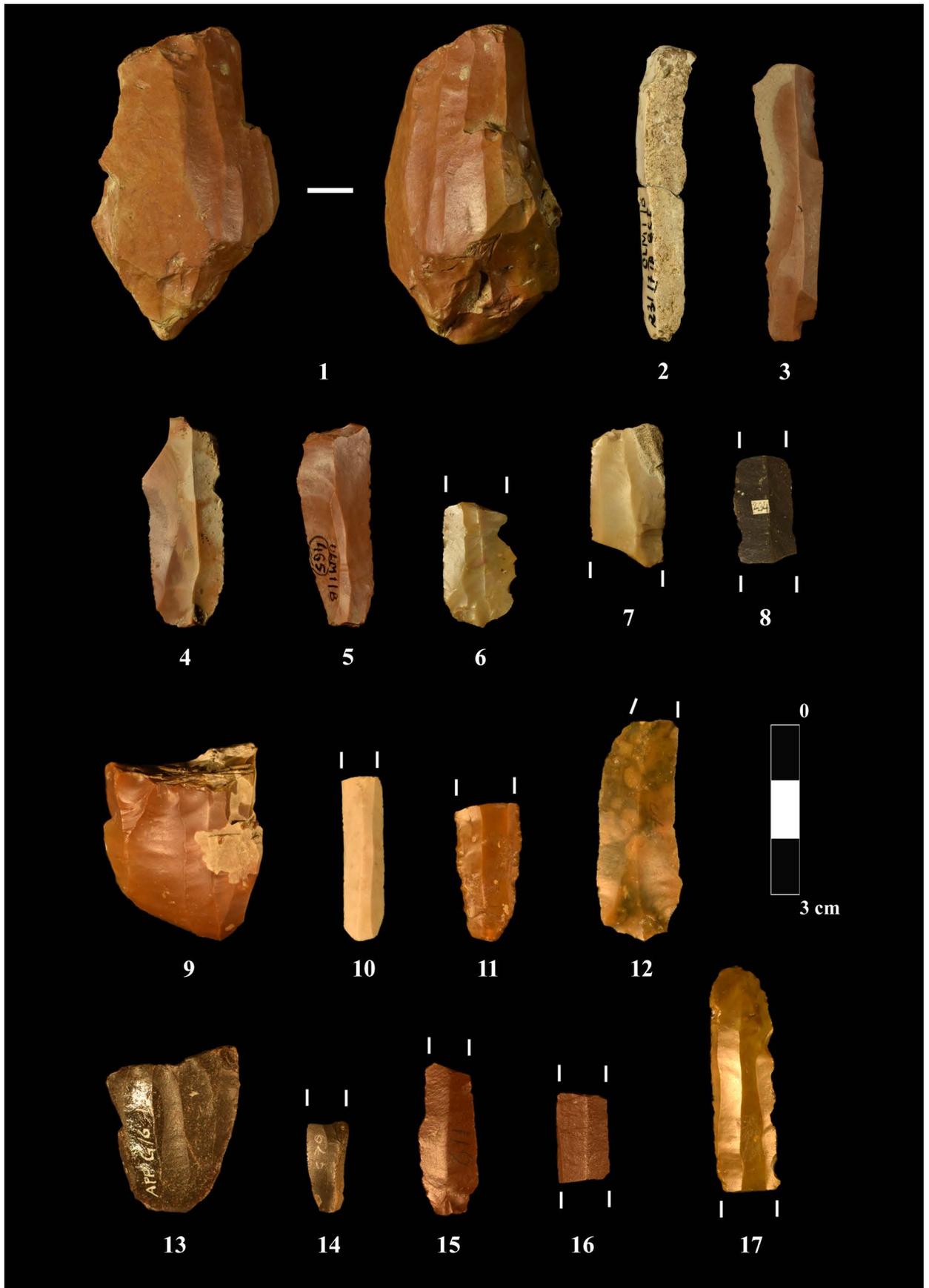


Figure 6: Bell Beaker lithic production. Olmi 1: bladelets core (1), natural crest (2), bladelets (3-8) (not local high-quality flints: 1-7, local raw materials: 8); Semitella: bladelets cores (9 and 13), bladelets (10-12, 14-17) (not local high-quality flints: 9-12 and 17, local raw materials: 13-16). Photos by I. Matera

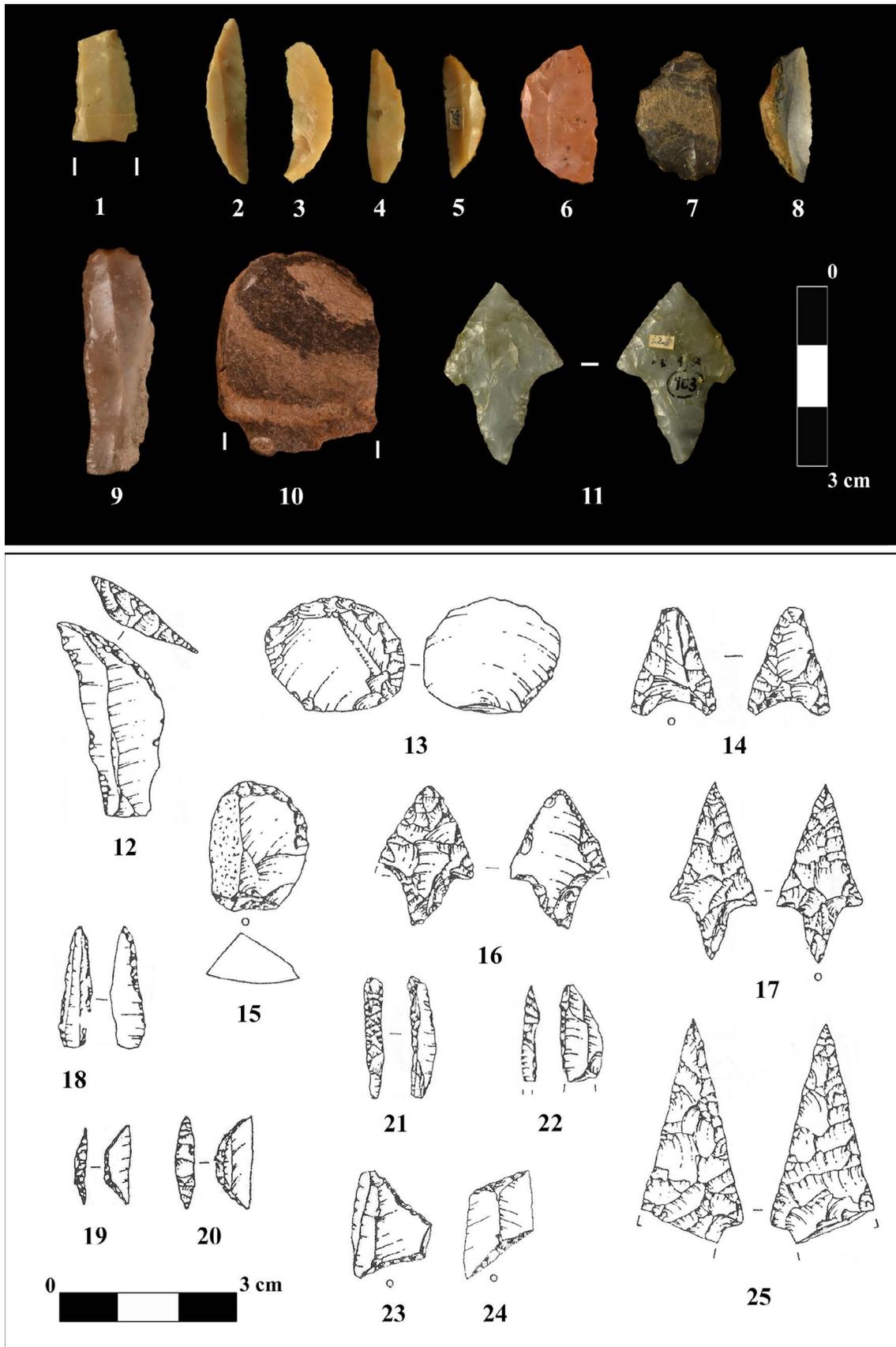


Figure 7: Bell Beaker toolkit. Olmi 1: backed tool (1), microlithic crescents (2-8), endscrapers (9-10), arrowhead (n.11); Semitella: truncation (12), endscrapers (13 and 15), hollow base arrowhead (14), arrowheads (16-17 and 25), backed tools (18 and 21-22), microlithic crescents (19-20), geometric armatures (23-24). Drawings: Martini 2008; photos by I. Matera

2014 pp. 220-221; Lo Vetro 2008 p. 183; Matera, Furestier and Lo Vetro in this volume; Salzani 2008 p. 74). As a matter of fact, exploitation of high-quality raw materials (often distant several tens of kilometres from the site) is frequent in Bell Beaker lithic production of Northern and Central Italy, and in some industries, ascribable both to the Early Bell Beaker and to more recent phases of this phenomenon (Cava Busani, Brescia-San Polo, via Crearo-Baldaria at Cologna Veneta), these flints represent the most commonly exploited raw material (Dal Santo *et al.* 2014 p. 220, Matera, Furestier and Lo Vetro in this volume; Salzani 2008 p. 74). The existence of a far reaching procurement strategy is also attested at other Bell Beaker sites in the Florentine area (Ghinassi, Martini and Moranduzzo p. 76). This could demonstrate the existence of contacts between Bell Beaker groups of this area and those both of the middle Adriatic area (for raw materials) and of Emilia. Contacts between the Florentine area and groups from Eastern Emilia have been noted in the pottery (Leonini and Sarti 2008a p. 127; Dal Santo *et al.* 2014 p. 225).

Regarding local raw materials exploitation, some slight differences can be noted between the lithic industries of Olmi 1 and Semitella. Indeed, it is interesting to note that at Olmi 1 the second most commonly exploited local raw material is Monte Senario chert, while no element in Monte Morello flint has been documented. On the contrary, in the lithic industry of Semitella Monte Morello flint is more frequent than that of Monte Senario, attested only sporadically. This could indicate a change in the management of the surrounding natural resources between step 2 and step 3 of the local Evolved Bell Beaker. Furthermore, the employment at Semitella of local raw materials for regular bladelet production might be further evidence of a change in the exploitation of the resources of the territory between these two steps.

The main aim of knapping activities was the production of small flakes, obtained as quickly and simply as possible; flaking is thus characterised by an optimisation concept, typical of systems based on expedient technology. This simplification of *chaînes opératoires*, aimed at the production of small flakes, is a feature shared by all lithic productions of the 3rd millennium BCE.

Regular and organised bladelet production on-site, often carried out by pressure or indirect percussion techniques, is attested in both industries. At Olmi 1 this production is more frequent than at Semitella (18% and 12% respectively) and is mainly based on the exploitation of high-quality flints; instead at Semitella regular bladelet production was also carried out using local raw materials of lower quality, albeit more rarely. Regular and elaborated bladelet production is attested in several Bell Beaker sites of Northern Italy (Barfield

2001 pp. 510-512; Dal Santo *et al.* 2014 p. 220; Lo Vetro 2008 p. 183; Matera, Furestier and Lo Vetro in this volume; Salzani 2008 p. 74).

Therefore, technological features would seem to show an evolution between lithic productions of step 2 and step 3 of the local Evolved Bell Beaker, which is clearer at a typological level (Martini 2008 pp. 107-118). From a technological point of view we can observe that in the industry of Olmi 1 the weight of high-quality raw materials from a distance of several tens of kilometres is considerably more important than at Semitella; moreover, at Olmi 1 a greater presence of bladelets has also been observed.

Characteristics of the Olmi 1 lithic industry are comparable to those of the Early Bell Beaker industry of Brescia-San Polo (Lombardy) (Matera, Furestier and Lo Vetro in this volume). Even though items that refer to the Florentine area have been detected in the pottery of Brescia-San Polo (Poggiani Keller *et al.* 2006 p. 134), the similarities in lithic industries might be due to factors other than contacts between these regions, difficult to grasp because of the scarcity of information on Early Bell Beaker and Pre-Bell Beaker lithic production, especially as regards the technological features.

Regarding the toolkit (Figure 8), the comparison between the lithic industry of Olmi 1 and that of the Pre-Bell Beaker of Volpaia layer 5 shows that Olmi 1 forms a sort of break, albeit weak, with the local Pre-Bell Beaker traditions (Martini 2008 p. 117). This break is mainly evidenced by the presence in the Olmi 1 industry of a high number of microlithic crescents (11%), which are absent in Pre-Bell Beaker toolkit and represent a local Bell Beaker innovation (*ibidem*), and of a low proportion of arrowheads (0.9%). The differences in the toolkit decrease in the later phases of the Evolved Bell Beaker: lithic assemblages of Querciola (step 3 of the local Bell Beaker) and especially of Semitella (attributable to a more recent phase of step 3) seem more related to Pre-Bell Beaker traditions (Martini 2008 pp. 117-118). As a matter of fact, as already observed by Fabio Martini (Martini 2008 p. 117), there are more connections between the lithic industries of Volpaia and Querciola than between Volpaia and Olmi 1. Therefore, after the break represented by Olmi 1, the weight of local Pre-Bell Beaker traditions seems to be more important in the Bell Beaker lithic production of the Florentine area (Martini 2008 pp. 117-118). As regards the Epi-Bell Beaker phase, typological features of lithic industries from Lastruccia 2A layers C2-C3 and Lastruccia 3 layer 8 show some connections with the local Evolved Bell Beaker as well as some differences (such as the rarity of microlithic crescents, not always present) (Martini 2008 p. 118).

Tools	Pre-BB	BB 2	BB 3		Epi-BB		
	VLP5	OLM1	QU	SEM	LST3 l. 8	LST3 str. 6	CdS
	%	%	%	%	%	%	%
Burins	–	–	0.7	1.2	3.7	1.4	–
Endscrapers	1.5	6.6	6.9	8.1	6.5	12.9	9.9
Truncations	5.2	8.9	4.0	5.4	6.5	2.0	12.6
Borers	1.5	0.9	1.2	3.3	3.7	1.4	2.0
Backed tools	3.0	5.5	3.2	5.7	1.9	1.4	1.3
Geometric armatures	2.2	1.4	0.8	0.5	–	0.6	–
Microlithic crescents	–	11.2	4.6	0.5	–	1.4	–
Hollow base arrowheads	0.7	–	–	0.2	–	–	–
Tanged arrowheads	11.9	0.9	9.4	2.9	0.9	0.7	4.6
Foliaceous pieces	19.3	1.9	18.1	5.0	0.9	2.0	8.6
Substratum	58.0	52.4	51.8	61.3	59.7	70.0	60.9
Splintered pieces	11.1	11.2	8.8	9.0	16.8	8.8	4.6
Total (n.)	135	214	725	579	107	147	151

Figure 8: Pre-Bell Beaker, Bell Beaker and Epi-Bell Beaker in the Florentine area: VLP5: Volpaia 5; OLM1: Olmi 1; QU: Querciola; SEM: Semitella; LST3 l. 8: Lastruccia 3 layer 8; LST3 l. 6: Lastruccia 3 layer 6; CdS: Campo del Sorgo (Martini 2008 p. 105 modified). Totals are indicated by number.

4. Conclusions

Preliminary study of the lithic assemblages from Olmi 1 and Semitella confirms the hypothesis of an evolution of the local Bell Beaker, already proposed for both lithic and pottery production (Leonini and Sarti 2008b pp. 100-101; Leonini *et al.* 2008 pp. 133-134; Martini 2008 pp. 107-118). Furthermore, this study would demonstrate the existence of some similarities between lithic productions of the Florentine area and those of North-eastern Italy (Matera, Furestier and Lo Vetro in this volume). Regarding the procurement strategies of lithic raw materials, local cherts and non-local high-quality flints are attested at both Olmi and Semitella, albeit with different levels of importance. The preference for local resources, an indication of a good territorial integration, is also documented in ceramic production. The minerals included in the pottery are in fact local, and their supply area can be located in the nearby ophiolitic outcrops, following a tradition that had begun in the Early Neolithic. This territorial rootedness is also attested by the importance of artisanal tradition, an example of which can be seen in the common ware of the second phase of the Evolved Bell Beaker, strongly influenced by previous local traditions.

The possible arrival in Tuscany of Lessini flints, if corroborated by other more diagnostic evidence and more detailed information, raises the question as to the methods of transmission of this lithic raw material. Not necessarily the result of direct contacts, non-local cherts might derive from mediations with

neighbouring areas, such as Emilia. In fact, the long-distance supply of Lessini flint is documented in Emilia since the Neolithic. It could be assumed that the same supply routes saw continuous use over the millennia. Theoretically, it cannot be excluded that elements of Lessini flints arrived where the Scaglia rossa of the Marche area was harvested.

The adoption of ceramic models and decorations over a wide geographic expanse, an indication of a shared taste, seems to link some Lombard, Emilian and Tuscan contexts (Bernabò Brea and Mazziari 2013 pp. 507-521; Dal Santo *et al.* 2014 pp. 221-225). This could indicate the ability to overcome considerable distances and establish relationships, both direct and mediated through a more or less extensive mobility, which finds proof in the Tuscan origin of materials related to metallurgy in Switzerland (Cattin *et al.* 2011 pp. 12-14). These elements are also shared with the Emilian area and with contexts in Central Italy to the south of Tuscany, which refer both to more generally widespread aspects and well-defined European areas. It should not be forgotten that relations with northern areas (Lombardy, Emilia-Romagna, primarily S. Ilario and Monte Covolo) are well documented, perhaps directed or mediated by the Emilian area, and mainly concern the decoration on ceramics (Sarti 1997, Sarti *et al.* 2012 pp. 233-238). It should also not be forgotten that in the Italian peninsula a network is also attested in southern Tuscany and upper Lazio, which chronologically spans the entire local Bell Beaker (Sarti 2014).

The presence in the Semitella lithic industry of a hollow base arrowhead, generally typical of Eastern Bell Beaker assemblages (see for example Bailly 2014 pp. 358-359, fig. 2), could perhaps be indicative of the existence of contacts, direct or mediated, with Central and Eastern Europe, already detected in the pottery, especially as regards step 3 of the Bell Beaker of the Florentine area (Leonini *et al.* 2008 p. 137; Sarti *et al.* 2012 pp. 235-238).

In conclusion, only through a study based on a technological approach to the Pre-Bell Beaker, Bell Beaker and Epi-Bell Beaker lithic productions from the Florentine area will it be possible to obtain a better understanding not only of the evolutionary dynamics of the Bell Beaker complexes of this area, but also of their relationships with other Italian and European Bell Beaker groups. In fact, in the ceramic production, some elements of the Evolved Bell Beaker present in the Florentine area show similarities with productions of North-eastern Italy that recall contexts of the eastern Adriatic area (Cetina).

A system of relations between Northern Italy and the central Tyrrhenian area seems to have already been outlined in the epoch preceding the Bell Beaker period; in this sense, the axe of the Similaun Man, whose chemical composition refers to the Tuscan area, should be evaluated (Artioli *et al.* 2017 p. 7).

The character of the Bell Beaker must be seen in the context of contacts, exchanges and relationships, even over long distances, between cultural contexts sensitive to knowledge sharing and the adoption of innovative stimuli. For the Tuscan context, represented by the numerous evidences of the Florentine area, which constitute an almost unique case in Italy, a cultural framework emerges in which the local tradition appears permeable to external contributions, ready to make possible transformations and re-elaborations of ways of life and knowledge that would eventually lead it to assume more cosmopolitan features.

Author contributions

Section 1 by L.S; section 2 by I.M.; sections 3 and 4 by all two authors.

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Bell Beaker Lithic Industry Between France and Italy: New Insights from Lombardy and Languedoc

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Abstract: The authors present the preliminary results of a techno-typological study of several Bell Beaker lithic industries from Lombardy (Calcinatè-Campo Musna and Brescia-San Polo) and eastern Languedoc (Maupas and Beaussement). This new data, integrated with the information available on lithic assemblages from both Northern Italy and the French Midi, contribute to improving knowledge on Bell Beaker lithic production. The comparison between Lombardy and Languedoc Bell Beaker lithic assemblages shows regional differences and similarities from both the technological and the typological point of view. In both these regions *chaînes opératoires* are aimed at the production of small and irregular flakes knapped by hard hammer percussion. However, important differences can be observed as regards bladelet production. Regarding the typological aspects, although certain similarities (e.g. endscrapers, microlithic crescents) are attested, some differences have been noted, in particular as regards the presence of specific types of arrowheads in the two areas: tanged arrowheads with squared barbs are more frequent in the French Midi than in Italy, whereas hollow base arrowheads, which are present in several Italian lithic industries, are absent in the whole of Southeastern France.

Keywords: Lithic production, Raw materials, Domestic contexts, Southeast France, Northern Italy

Introduction

During the 3rd millennium BCE, relationships between Southeast France and the western area of Central-Northern Italy developed as early as the Pre-Bell Beaker phases (see for example Chiarenza 2013b pp. 72-75; Pétrequin, Marguet and Rey 2013 p. 34; Saintot *et al.* 2014 p. 615). For the Bell Beaker period, the contacts between these regions seem to become closer in the final phases of this phenomenon, during the Early Bronze Age (Lemerrier 2004 pp. 466-468; Lemerrier *et al.* 2007 pp. 247-249). If French Midi is mainly linked to Western Europe, with only the Barbelé groups showing the occurrence of important influences from the east (especially from Northern Italy and North-western Balkans) (Lemerrier *et al.* 2007 p. 243), Italy reveals a more complex situation, due to links with both western and central-eastern regions, as well as with local traditions. Relationships with the western area are more evident in Central Italy, although influences from Central Europe are also attested (Leonini and Sarti 2008 p. 128). As regards pottery, certain similarities between some decorations and morphologies from western Mediterranean Europe and those from Florentine area (Tuscany) have been detected (Leonini *et al.* 2008 pp. 133-134). On the contrary, in Northern Italy (especially in the Northeast), western and Mediterranean influences are less evident, in this area decorated and common wares seem more related to Central and Eastern Europe (Barfield 1974 pp. 74-75; Bermond Montanari, Cremaschi, Sala 1982 pp. 87-88; Bernabò Brea and Mazziere 2013 pp. 519-521; Fasani and Nicolis 1990 pp. 325-326; Leonini 2006 pp. 39-40; Leonini 2008 p. 199). Influences from France are attested above all in

Ligurian sites (Chiarenza 2006 pp. 271-278 and p. 283; Chiarenza 2013a p. 63; Chiarenza 2013b p. 77; Fasani and Nicolis 1990 p. 325), but in other regions of Northern Italy some ceramic features which refer to western and Mediterranean canons also occur, albeit rarely, mainly in common ware (Leonini 2004 pp. 400-406; Poggiani Keller *et al.* 2006 p. 134).

Concerning stone tool assemblages, beyond some features shared by lithic productions of the 3rd millennium in Europe (production of small flakes, simplification of *chaînes opératoires*..), certain similarities between Italian industries and those of French Midi can be recognised on the typological ground, for example thumbnail and sub-circular endscrapers (attested in both regions) or microlithic crescents (Furestier 2007 pp. 146-148 and pp. 164-165; Furestier 2008 pp. 295-298).

The aim of this contribution is to offer new information and food for thought about Bell Beaker lithic production of Northern Italy and the relationships between this region and the French Midi. In these regions several sites with reliable stratigraphic contexts have been investigated, for which data for lithic industries are available (e.g. Barfield 2001; Dal Santo *et al.* 2014; Furestier 2005; Furestier 2008; Lo Vetro 2006; Lo Vetro 2008; Salzani 2008).

Technological and typological study of some Bell Beaker lithic industries from domestic contexts in eastern Languedoc (from the sites of Maupas and Beaussement) and Lombardy (from Brescia-San Polo and Calcinatè-Campo Musna), even though preliminary, shows that features of Languedoc lithic assemblages are very

similar to those of other Bell Beaker industries of French Midi already observed by one of the authors (Furestier 2004 pp. 81-92; Furestier 2007 pp. 137-159; Furestier 2008 pp. 291-295). By contrast, Bell Beaker lithic production of Lombardy (and, more generally, of Northern Italy) appears to be more intricate.

The sites

All the sites examined here are open-air sites, most of them located in the lowlands. Contrary to what generally found in these regions, where the majority of settlements shows more than one phase of occupation, two cases (Maupas and Brescia-San Polo), are 'pure' Bell Beaker settlements.

The settlements in eastern Languedoc are located in the Gard (the site of Maupas) and in the southern Ardèche (the site of Beaussement); both sites are related to the local Middle Bell Beaker phase (Rhodano-provençal group) (Roger, Ferrier and Valette 1988 p. 95; Lemerrier 2004 p. 83 and p. 199). The Bell Beaker sites in Lombardy are Brescia-San Polo (Brescia), a monophase site of the Early Bell Beaker (Poggiani Keller *et al.* 2006 pp. 122-123) and, further west, Calcinatè-Campo Musna (Bergamo), where levels with Bell Beaker pottery pertain to later phases of this phenomenon (Poggiani Keller 2016 pp. 72-74) (Figure 1).

Sites in eastern Languedoc

The site of Maupas is located in the municipality of Calvisson, less than 10 kilometres to the west of Nîmes, in the Vaunage area. This micro-region of about 70 km, situated at the edge of Garrigues plateau, is made up of a plain surrounded by small hills 200 m high and was densely populated during the Late Neolithic and the beginning of the Early Bronze Age (Roger 1988 p. 80). Emergency excavation of this site was carried out by Jean-Marc Roger in the mid-1980s (Roger, Ferrier and Valette 1988 p. 91-92). The archaeological dig brought to light an oblong structure 12 metres long and 4 metres wide, adjusted by a paving, similar to that found at the site of Bois Sacré (in the municipality of Saint-Côme-et-Maruéjols), also located in the Vaunage area, and, to a lesser degree, to the dwelling of Les Calades (Orgon, Bouches-du-Rhône) (Gilabert, Jallot 2018 p. 321; Roger 1988 pp. 98-99). The Bell Beaker occupation is the only attested for the site (Roger 1988 p. 80). Notwithstanding stratigraphic problems due to ploughing activities (Roger, Ferrier and Valette 1988 p. 92), the dig provided a homogeneous set of evidence attributable to the Rhodano-provençal Bell Beaker (Lemerrier 2004 p. 199; Roger, Ferrier and Valette 1988 p. 95).

Southern Ardèche, as with the Vaunage area, is very rich in prehistoric sites; the many sites of the Late Neolithic and of Early Bronze Age are primarily funerary contexts

(dolmens and sepulchral caves) (Beeching 2013 pp. 33-34; Montjardin 1992 p. 227). The settlement of Beaussement (municipality of Chauzon), discovered in 1958, consists of an enclosure set up on the peaks jutting out over the Ardèche river; archaeological surveys were conducted by Raymond Montjardin in the 1960s (Montjardin 1962 p. 14). Most of the archaeological evidence come from surveys 3 and 4, located alongside each other and separated only by a rocky ridge (Montjardin 1962 pp. 15-50). The stratigraphic sequence shows the presence of several phases of frequentation of the site, beginning with the Late Neolithic (Ferrières, Fontbousse, Bell Beaker) until the Bronze and Iron Ages (Montjardin 1962 pp. 50-51; Montjardin 1965 pp. 25-28). Survey 3, made up of a trench 2.2 metres long and 0.6 metres wide, later expanded perpendicularly, is the only one which provided Bell Beaker evidence, ascribable to Rhodano-provençal group (layer 3) (Lemerrier 2004 p. 83; Montjardin 1962 p. 16; Montjardin 1965 p. 25).

Sites in Lombardy

The settlement of Brescia-San Polo is situated to the southwest of the city of Brescia (eastern Lombardy), at an altitude of 126 metres a.s.l., in the valley at the foot of the hills south of Monte Maddalena (Brescia Prealps) (Lo Vetro *et al.* in press; Poggiani Keller *et al.* 2006 p. 121). Rescue excavations, carried out by the Soprintendenza per i Beni Archeologici della Lombardia during the years 1994-2000, covered an area of about 1200 m (Poggiani Keller *et al.* 2006 pp. 122-123). Two neighbouring dwelling areas, which do not seem to be related have been recognised: the first one, installed on the northern side, is connected to the Bell Beaker occupation of the site; the other one, further south, is attributable to a final stage of the Early Bronze Age (Polada culture) (Poggiani Keller *et al.* 2006 p. 124). The Bell Beaker settlement consists of three sub elliptical structures, one of which (slightly further from the other ones) has been excavated only partially (Lo Vetro *et al.* in press; Poggiani Keller *et al.* 2006 p. 124). The site had only one phase of occupation, which, based on ceramic data, has been ascribed to the Early Bell Beaker (international style) (Poggiani Keller *et al.* 2006 pp. 122-123).

The site of Campo Musna (in the municipality of Calcinatè) is located in the plain, south of Bergamo. In the years 2006-2009, during the construction of an irrigation channel in the alluvial area of Serio river, preventive archaeological investigations were performed by the Soprintendenza per i Beni Archeologici della Lombardia; archaeological excavations led to the discovery of a settlement which refers to a period spanning from the Middle Neolithic to the Early Bronze Age (Poggiani Keller and De Stefani 2016 p. 35). Bell Beaker dwelling evidence was unearthed in a long strip within an irrigation channel, about 9 metres

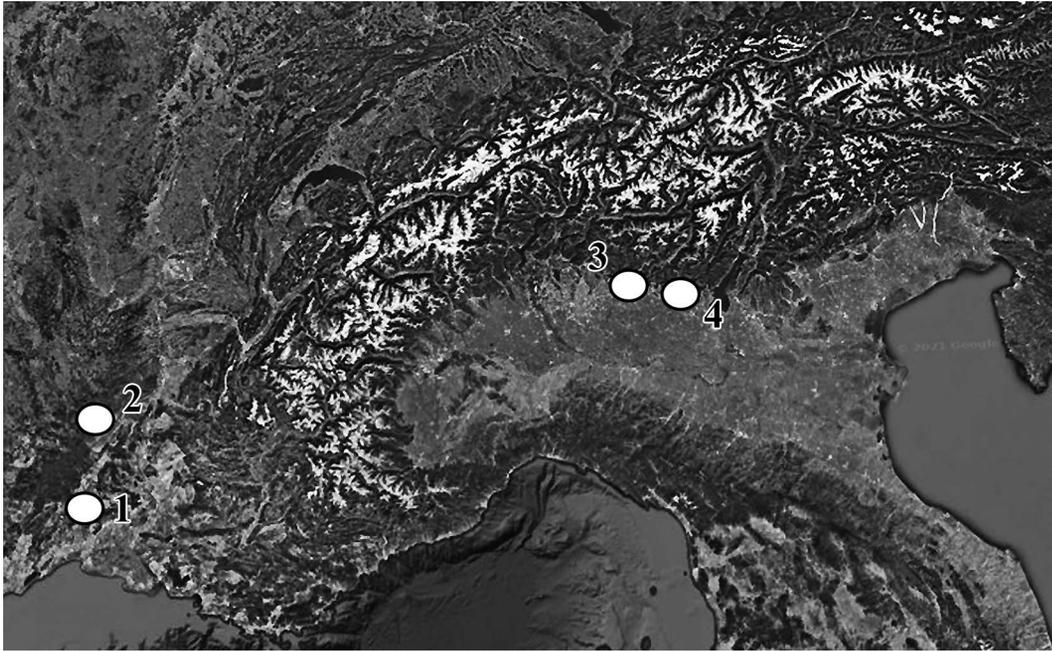


Figure 1: Map with the location of Eastern Languedoc and Lombardy sites: 1. Maupas (Calvisson, Gard); 2. Beaussement (Chauzon, Ardèche); 3. Calcinate-Campo Musna (Bergamo); 4. Brescia-San Polo (Brescia)

wide, covering an area of about 900 m (De Stefani 2016 p. 69). It consists of some large hollow structures, oval or circular in shape, from 3-4 metres up to at least 16 metres long, and often situated on paleochannels (De Stefani 2016 pp. 69-70). Bell Beaker findings examined here come from two different areas of the dig (sectors 1 and 2) and seem attributable to a later phase of the Bell Beaker, or perhaps even to Epi-Bell Beaker phase (Poggiani Keller 2016 pp. 72-74).

Lithic industries: techno-typological features

Eastern Languedoc stone tool assemblages

The lithic assemblages of Maupas and Beaussement are composed of 599 and 138 items respectively. These industries show similar technological and typological features to those observed in Bell Beaker lithic production of the French Midi (see for example Furestier 2007 pp. 137-159; Furestier 2008 pp. 291-295). The Bell Beaker lithic production of eastern Languedoc was based on the exploitation of local raw materials: the distance of supply areas never exceeds ten kilometres (Figure 2). At Maupas we can observe a certain variety of raw materials. The flint sourced at Mas de la Font d'Auroux, in the foothills of Serre de Peyre-Fioc (at a distance of about 7 km), was the most widely used; the flint of the basin of Salinelle, located at a distance less than 10 km from the site, was employed in lesser quantity (Fouéré and Roger 2002 p. 227). Other raw materials (such as the Ludian flint of the Tertiary basin of Collorgues) (*ibidem*) are rare and were not generally flaked on site. At Beaussement, on the other hand, only

one type of raw material was exploited. It consists of Barremian-Aptian flint from Lagorce, probably picked up at the outcrops localised at Le Charnier, less than 8 km from Beaussement (Beauvais and Kherdouche 2019 pp. 15-16). A few items made on high-quality Barremian-Bedoulian flint are also present, which were not flaked on site, but imported as finished products at a later time. Some of them (patinated ones and regular bladelets) can be interpreted as pieces found in older sites and collected (and maybe reused) by Bell Beakers, as already observed for lithic assemblages of the French Midi (Furestier 2007 p. 145).

Raw materials were imported on site in form of small-sized blocks (or small fragments of blocks); the employ of flakes as core supports is more uncommon. Flaking is almost always simple and not organised. Its aim was the production of small flakes (most of them 2 to 3 centimetres long) knapped by hard direct percussion (sometimes by anvil percussion). Flake production is characterised by an 'optimisation concept', as already observed for other lithic industries of the French Midi (Furestier 2005 pp. 195-196; Furestier 2008 p. 294). Knapping begins with cores with one striking platform. Every platform with a favourable flaking angle can be thereafter exploited, both one by one and, less frequently, alternated. Most cores have only one striking platform and show short and non-organised sequences of flaking. Some multidirectional cores, showing relatively longer sequences of *débitage*, are also present. However, this does not mean the existence of more elaborated flaking: these cores correspond to the last phase of *débitage*, they represent a final attempt

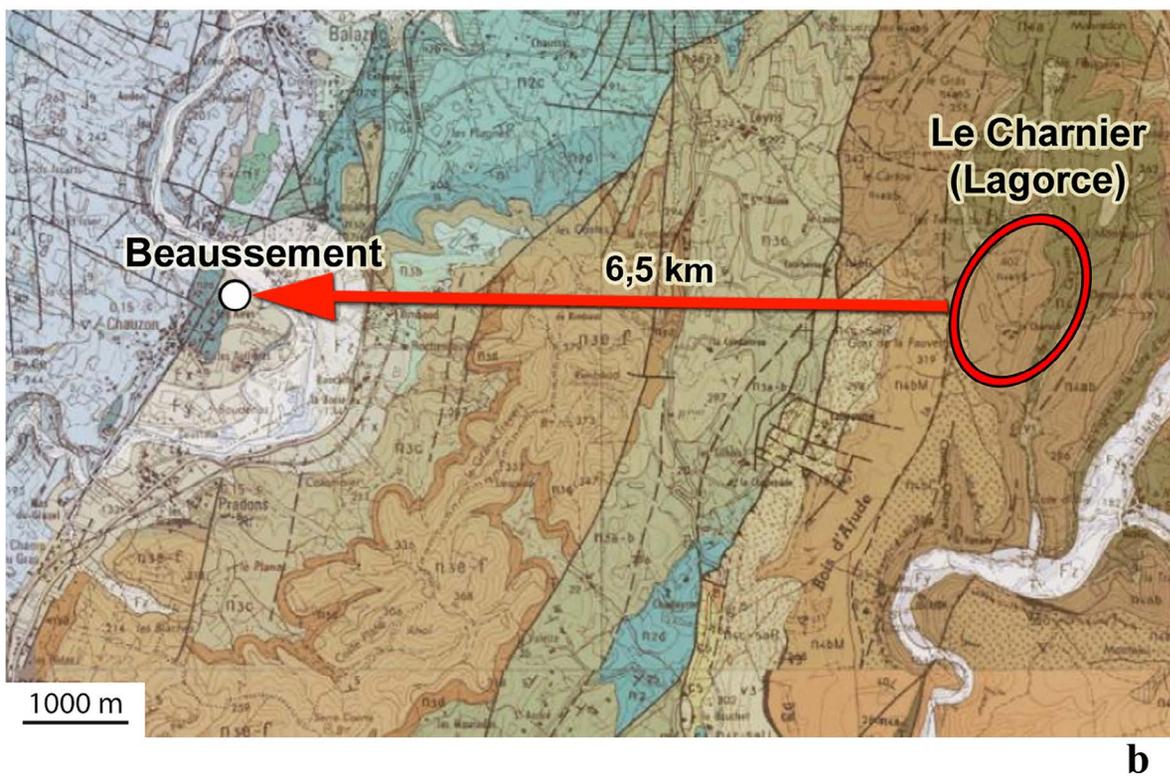
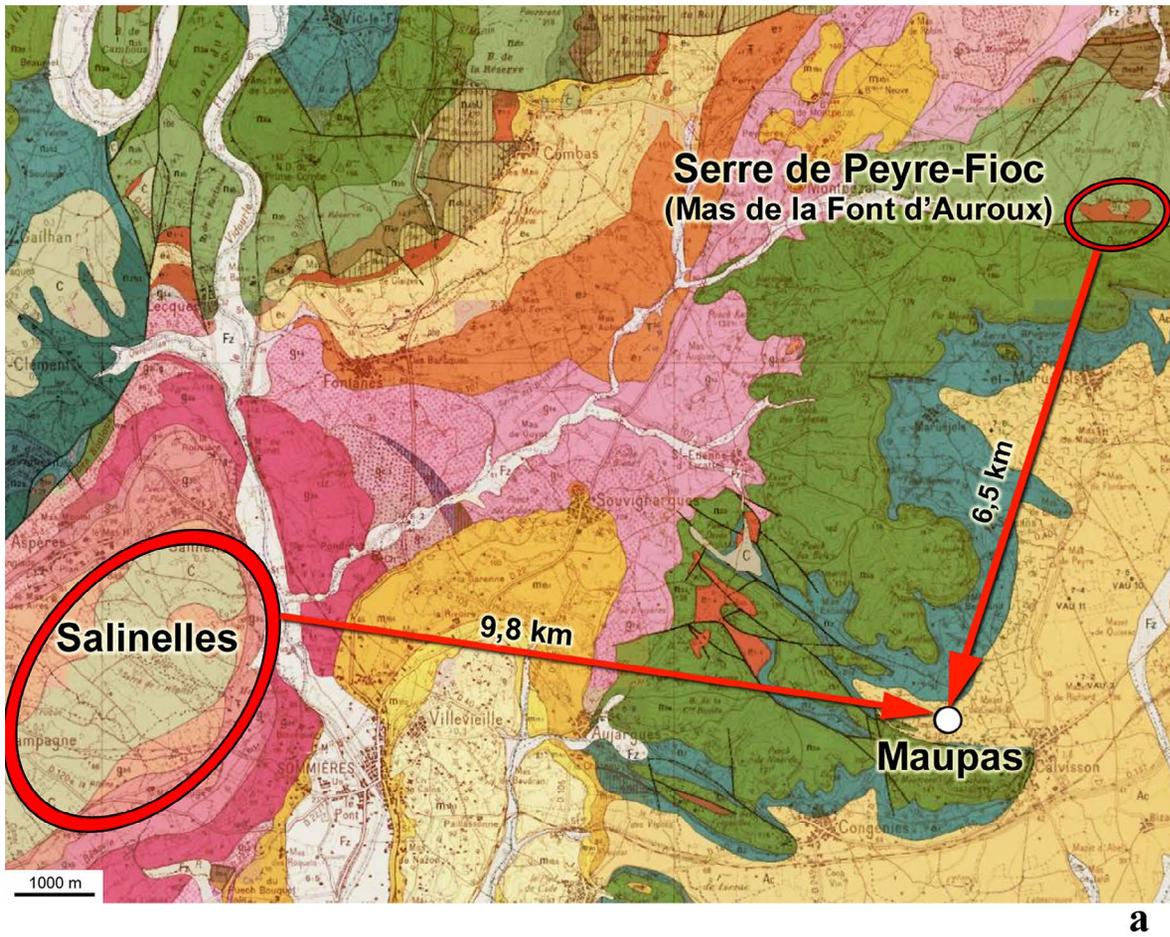


Figure 2: Eastern Languedoc sites - Procurement areas of raw materials exploited by Bell Beakers: Maupas (a); Beaussement (b)

to continue the flaking before deciding to abandon the core.

Flake production was the main aim of the knapping activities, but it was not the only one: bladelet production is attested both at Maupas and Beaussement. Although bladelets are very rare and in most cases can be interpreted as opportunist items or as pieces found in older sites (generally attributable to the Middle Neolithic), some items do reveal the existence of this type of production on site (crested bladelets, a *tablette*, a few bladelets and flakes with laminar negatives in local raw materials) (Figure 3 nos 1-2 and 6-7). However, specialised bladelet production on site is very rare; most bladelets are irregular or opportunist short ones, knapped by hard hammer percussion. The lithic industry from Maupas shows that despite its rarity (bladelets, more or less regular, are only 3% of the total), these were used frequently as supports for tools (almost 20% of tools are made on blades or bladelets).

At Maupas and notably at Beaussement only a small number of tools have been found, but several analogies with the French Midi toolkit are nevertheless recognisable (see for example Furestier 2004 pp. 83-88). Only a few of the tools, such as a foliaceous piece in Collorgues flint from Maupas (Figure 4 no. 1), are made accurately. The toolkit is generally characterised by a scarce typological variety, it is mainly composed of items with summary or discontinuous retouches, sometimes caused by usage. However, the lithic industry of Maupas shows a few differences compared to the toolkit of the French Midi, such as the occurrence of certain tools (borers, backed blades) (Figure 4 nos 2-3), which are rather uncommon in the other lithic series of Southeastern France. Regarding Maupas, worth mentioning is the presence of two microdenticulate blades (Figure 4 nos 4 and 6) similar to those found in the neighbouring site of Mas de Vignoles IV (Nîmes) (Furestier 2007 p. 153).

Lombardy stone tool assemblages

The Brescia-San Polo lithic industry consists of 351 chipped elements. Sectors 1 and 2 of the site of Calcinatè-Campo Musna has yielded 405 lithic artefacts. Concerning raw material supply strategies, Bell Beaker lithic industries from Lombardy reveal an articulated situation (Figure 5). At Brescia-San Polo, the most commonly exploited raw material is the high-quality Maiolica flint from the Baldo/Lessini area, c. 60 km as the crow flies from the site (Lo Vetro *et al.* in press). Local cherts (from Medolo, Concesio and Rosso ad Aptici formations), sourced at a distance of about 10 km, represent less than 27% of the total raw materials exploited (Lo Vetro *et al.* in press). A supply strategy based on the exploitation of high-quality raw

materials whose outcrops are located at a distance of several tens of kilometres from the site is not an *unicum* in Bell Beaker lithic production of Northern Italy. For example, we can observe a comparable supply strategy at the site of via Crearo-Baldaria at Cologna Veneta (Verona), in Northeastern Italy (Veneto), where Lessini chert (distant about 40 km from the site) is the most exploited (Salzani 2008 p. 74), or in the site of Cava Busani (Modena), in eastern Emilia (Dal Santo *et al.* 2014 p. 220). This strategy is also attested in Central Italy, in the site of Olmi 1, in the Florentine area (Matera and Sarti in this volume). On the contrary, the Calcinatè-Campo Musna lithic industry consists almost exclusively of local raw materials; however it must be taken into account that in the surroundings of the site outcrops of high-quality flints (from Sorisole and Maiolica formations) are available (Bertola *et al.* 2021). The occurrence of pieces in non-local raw materials is very sporadic; these items have not been knapped on site but introduced as finished products. Local raw materials were imported on site in the form of small-sized blocks, such as nodules, pebbles, block fragments and big flakes.

As for the lithic industry from Brescia-San Polo, items related to first stages of the *chaîne opératoire* are very rare; these activities were probably carried out somewhere else or in an area of the site that has not been investigated. Some items in Maiolica and Scaglia variegata from Baldo/Lessini area may have been introduced on site as a finished product.

Flaking activities were mainly aimed at the production of small flakes (generally ranging in size from 1.5 to 2.5 centimetres); this dimensional standard is the main feature of flake production, whereas no other standardisation has been observed. As a matter of fact, *débitage* is simple and not organised, it is mostly characterised by an 'optimisation concept'. Flintknapping begins from cores with one striking platform, which are usually exploited through short sequences of *débitage*. Other platforms with a favourable flaking angle can be exploited, generally one after another. Also in this case, as already observed for Languedoc industries, multidirectional cores do not prove the existence of more elaborated flaking but they refer to the final flaking phase of unidirectional cores. Hard hammer direct percussion (also sometimes carried out with anvil) is almost the only knapping technique. However, flakes knapped by soft hammer direct percussion are also present: at Brescia-San Polo this technique is very rare and attested only by some flakes in high-quality raw materials (Maiolica and Scaglia variegata from Baldo/Lessini area); at Calcinatè-Campo Musna, only waste products related to the shaping of foliaceous pieces are knapped by soft hammer percussion.



Figure 3: Eastern Languedoc sites - Bell Beaker lithic production. Maupas: *tablette* (1), crested bladelet (2), core (3); Beaussement: cores (4 and 5), crested bladelet (6), bladelet (7). Drawings: Fouéré and Roger 2002; photos by I. Matera

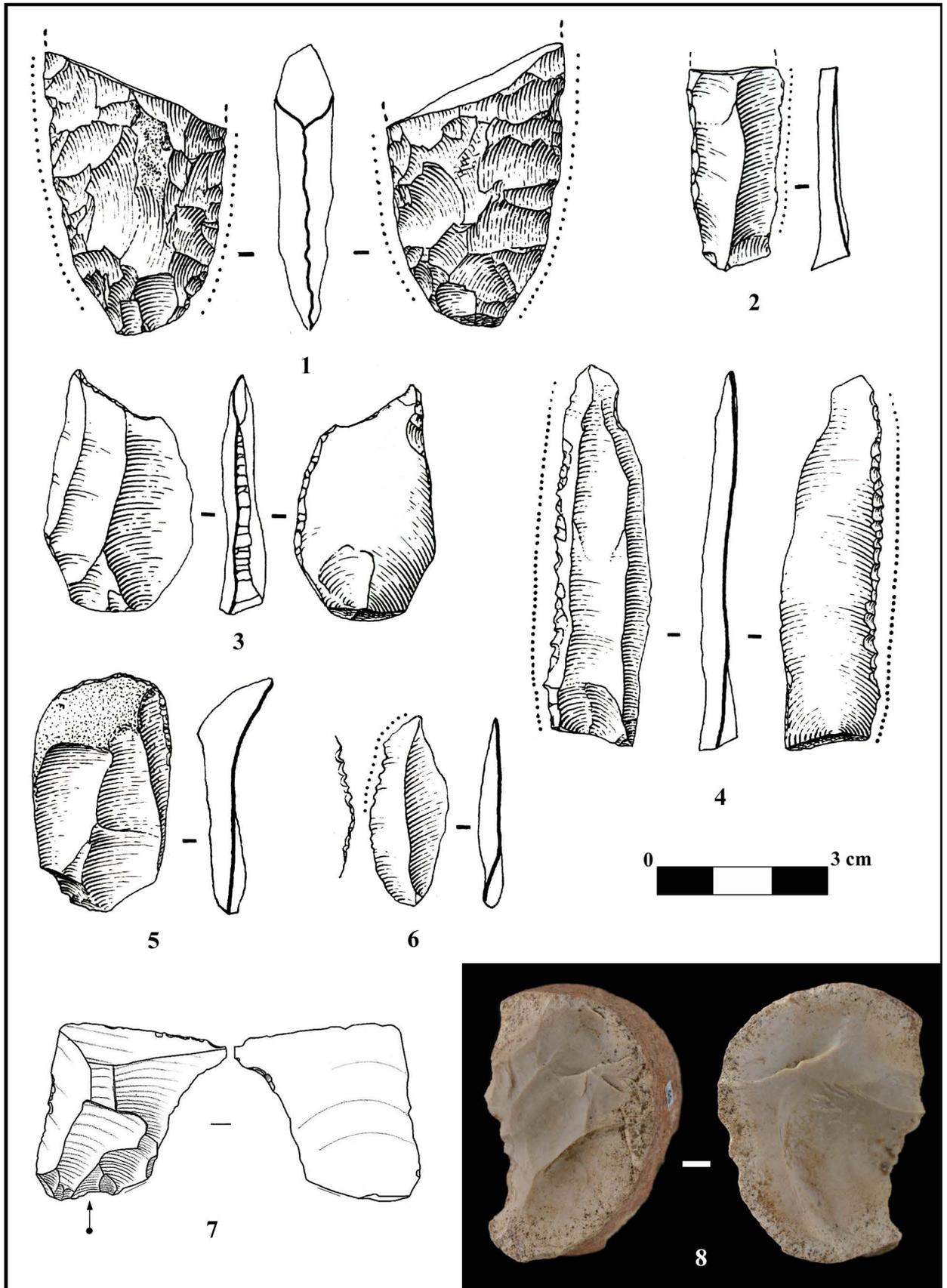


Figure 4: Eastern Languedoc sites - Bell Beaker toolkit. Maupas: foliaceous piece (1), backed bladelet (2), borer (3), microdenticulates (4 and 6), endscraper (5); Beaussement: retouched flake (7), splintered piece (8). Drawings: 1-6 Fouéré and Roger 2002, 8 by I. Matera; photo by I. Matera

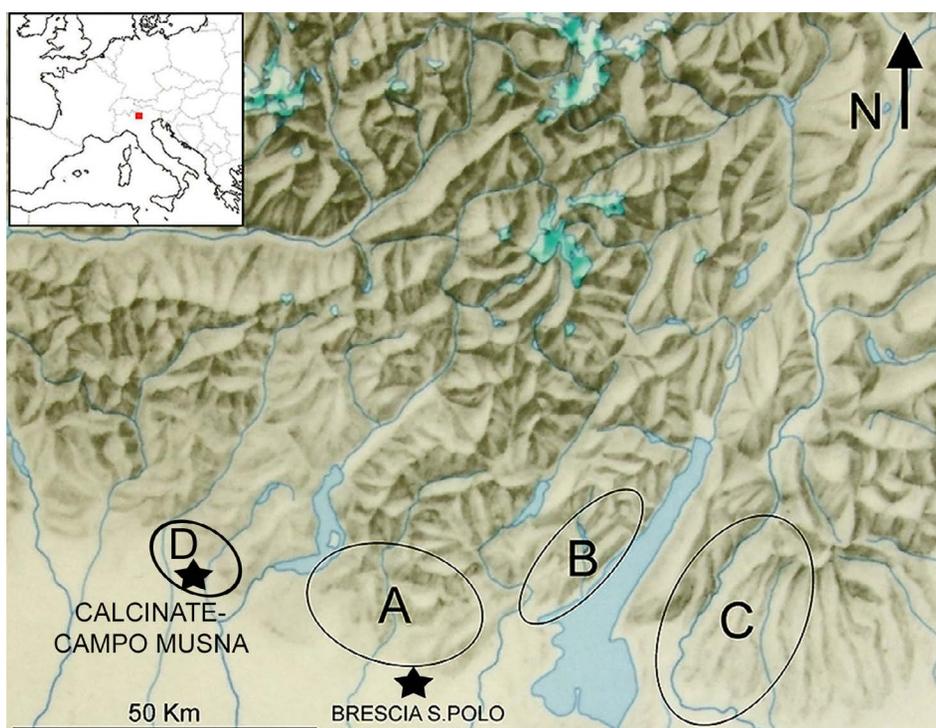


Figure 5: Lombardy sites - Procurement areas of raw materials exploited by Bell Beakers (Lo Vetro *et al.* in press, modified). A, B and C: procurement areas of Bell Beakers of Brescia-San Polo (A and B: Medolo, Concesio and Rosso ad Aptici formations, C: Baldo/Lessini area); D: procurement area of Bell Beakers of Calcinate-Campo Musna (Soriso and Maiolica formations)

Besides opportunist bladelets, in both sites specific bladelet production is attested (Figure 6 nos 5-13). At Brescia-San Polo, bladelets occur rather frequently (14% of knapping products), whereas at Calcinate-Campo Musna they are very rare (less than 2%). Blanks consists of both irregular bladelets knapped by hard direct percussion and items which can be referred to a standardised bladelet production. At Calcinate-Campo Musna this kind of production is very sporadic. Regular bladelets from Brescia-San Polo, made in high-quality cherts (Lessini flints), are thin, very symmetric, and often characterised by rectilinear and parallel edges and arrises; these features are compatible with pressure or indirect percussion techniques. Although it cannot be excluded that some of these regular bladelets were brought to site as finished products, items related to core shaping, maintenance and repair activities prove the existence of a regular bladelet production carried out on site.

As for the tools, retouch is generally not accurate. Only a few types of tools (endscrapers, arrowheads, microlithic crescents..) are carefully made. The toolkit mainly consists in used items with discontinuous retouches, splintered pieces and used flakes and bladelets. Among common tools, endscrapers are rather frequent in both sites; at Brescia-San Polo, burins (sometimes accurately made) (Figure 7 nos

1-2), truncations and borers are also present, although rarely, whereas at Calcinate-Campo Musna these tool types are almost absent. The rest of the common toolkit consists of scrapers and denticulated items. Among the arrowheads, worth mentioning is the presence of one hollow base item at Brescia-San Polo (Figure 7 no. 5); at this site, one microlithic backed point also occurs (Figure 7 no. 4). It is interesting to note the presence of microlithic crescents in the toolkit of both sites (Figure 7 nos 3 and 10).

Bell Beaker lithic production between Southern France and Northern Italy: more different than similar?

The data about the Languedoc and Lombardy lithic industries, even though preliminary, shows some analogies but also significant differences between Bell Beaker lithic production of the French Midi and Northern Italy.

Regarding raw materials procurement, in the French Midi production is exclusively based on the exploitation of local raw materials (Furestier 2007 pp. 137-138; Furestier 2008 p. 291). It is interesting to note that at Beaussement, although outcrops of high-quality Barremian-Bedoulian flint exist not too far from the site (20 or 30 km at most), the only raw material exploited is

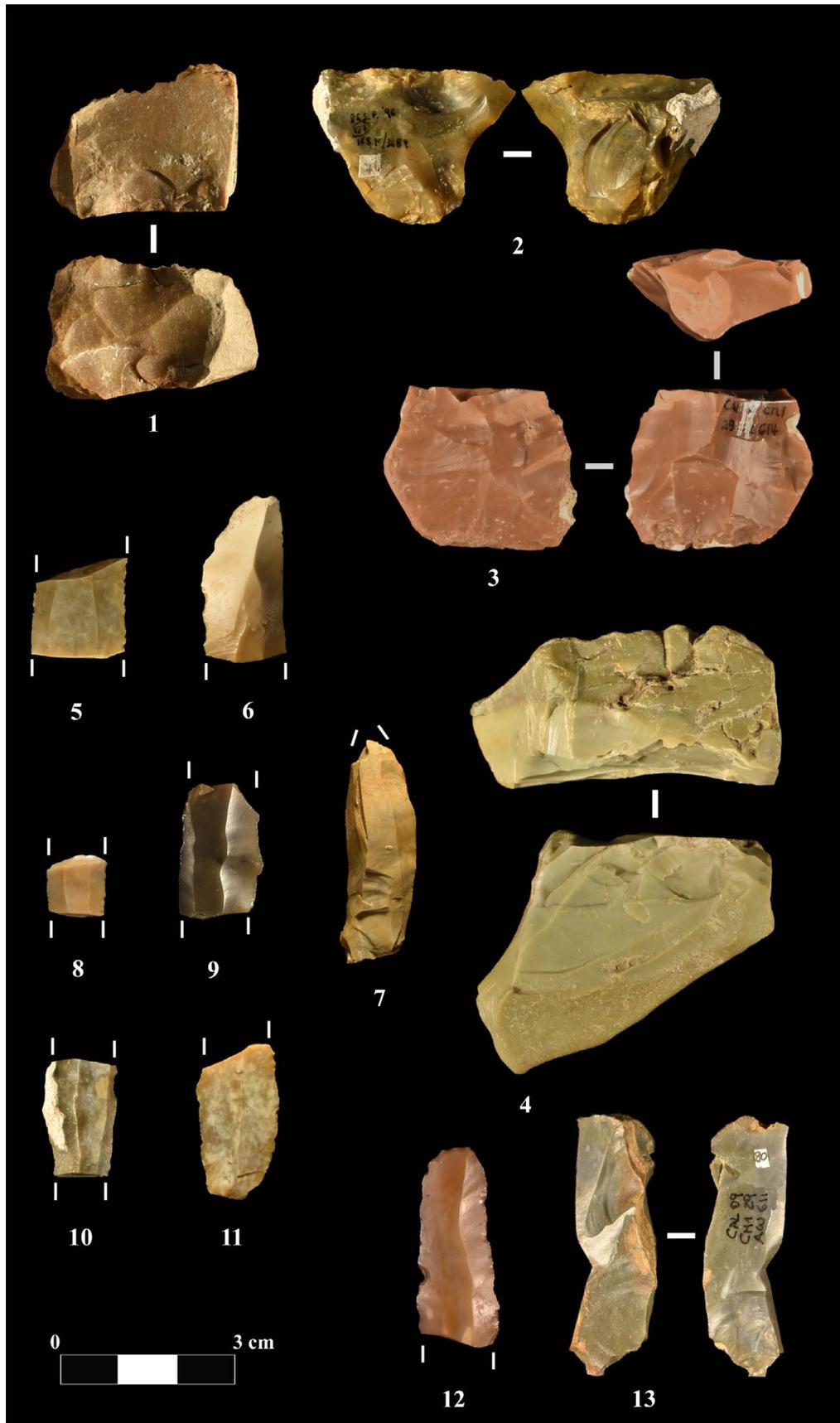


Figure 6: Lombardy sites - Bell Beaker lithic production. Brescia-San Polo: cores (1 and 2), blades and bladelets (5-11); Calcinate-Campo Musna: cores (3 and 4), bladelet (12), crested bladelet (13). Photos by I. Matera

Lagorce chert, of lower quality but with outcrops close to the site. If for French Midi sites it seems that proximity is the main criterion used in raw materials selection, Italian lithic industries show that the quality of raw materials is another important parameter. In Northern Italy far-reaching procurement is indeed attested frequently; exploitation of high-quality flints distant several tens of kilometres from the site (which sometimes represent one of the most commonly exploited raw materials) occurs in several sites, especially in North-eastern Italy (Barfield 2001 pp. 510-513; Dal Santo *et al.* 2014 pp. 220-221; Lo Vetro 2008 p. 183; Salzani 2008 p. 74). This strategy seems to recur throughout the Bell Beaker period. As a matter of fact, we can observe it in Early Bell Beaker assemblages (Brescia-San Polo, Monte Covolo-Phase 1) (Lo Vetro 2003 p. 189) as well as in Bell Beaker industries related to more recent phases, both from Lombardy (Monte Covolo-Phases 2 and 3, Rocca di Manerba) (Barfield 2001 p. 511; Lo Vetro 2003 p. 215 and p. 238) and from other regions: Veneto (via Crearo at Cologna Veneta, Gazzo Veronese) (Barfield 2001 p. 512; Salzani 2008 p. 74) and eastern Emilia (Cava Busani, Sant'Ilario d'Enza) (Barfield, Cremaschi and Castelletti 1975 p. 161; Barfield 2001 p. 510; Dal Santo *et al.* 2014 pp. 220-221). The Calcinatè-Campo Musna industry seems to show a different supply strategy, based exclusively on the exploitation of local cherts; however, we must not forget that outcrops of high-quality raw materials are located near the site (Bertola *et al.* 2021). In North-eastern Italian lithic assemblages a different management of both low- and high-quality raw materials can be observed; high-quality flints are often employed for the production of regular bladelets, knapped by pressure or indirect percussion technique, and for making specialised tools (e.g. arrowheads) (Barfield 2001 pp. 510-512; Dal Santo *et al.* 2014 p. 220; Lo Vetro 2008 p. 184; Salzani 2008 p. 74 and p. 77).

In both Italian and French Bell Beaker lithic industries raw materials were imported on site in the form of small-sized blocks or fragments of blocks. The main aim of knapping activity was the production of small flakes, which were obtained as quickly and simply as possible, according to a logic of optimisation typical of productions based on expedient technology. Flake production was generally carried out by hard hammer percussion, and is characterised by a basic and non-organised *chaîne opératoire* with short sequences of *débitage*. Except in the small size of blocks and of flakes, no standardisation can be observed (Furestier 2007 pp. 138-143).

Bladelet production on site is attested in both regions. However, features and frequency of bladelets represent one of the main differences between the lithic production of these regions (Figure 8). In the French Midi bladelets never exceed 3%; most of them are opportunist or, as regards regular bladelets, can be interpreted as older

items picked up from Middle Neolithic sites (Furestier 2007 p. 145). Lithic industries from Maupas and Beaussement show the existence of bladelet production on site, but occurrence of bladelets is very sporadic. By contrast, excepting the lithic industry from Calcinatè-Campo Musna, in other Bell Beaker assemblages from Northern Italy bladelets occur more frequently; several items (bladelets, cores..) could attest the existence of organised bladelet production on site, often carried out by pressure or indirect percussion (Barfield 2001 pp. 510-512; Dal Santo *et al.* 2014 p. 220; Lo Vetro 2008 p. 183; Salzani 2008 p. 74).

Bell Beaker toolkits of the French Midi and Northern Italy show both analogies and differences. Blanks are mainly small flakes (although bladelets are often used for tool production). In general, only some tool types are made accurately (e.g. arrowheads, microlithic crescents); most tools display inaccurate or discontinuous retouches, sometimes also caused by use. In lithic industries of Northern Italy (except for Calcinatè-Campo Musna) a greater variety of tool types is usually attested compared to those of Southeastern France; some tool types such as backed tools, truncations, borers or burins (sporadically present in French Midi assemblages) (Furestier 2004 pp. 83-88) are recurring, albeit generally rare (Barfield, Cremaschi and Castelletti 1975 pp. 161-162; Lo Vetro 2003 pp. 246-247; Lo Vetro 2008 pp. 184-189; Salzani 2008 pp. 74-75). Thumbnail endscrapers and, to a greater extent, microlithic crescents of the Italian tradition occur in toolkit of both regions and show strong similarities (Barfield, Cremaschi and Castelletti 1975 p. 161; Bermond Montanari, Cremaschi and Sala 1982 p. 82; Furestier 2007 pp. 146-148; Lo Vetro 2003 p. 247; Lo Vetro 2008 p. 185; Salzani 2008 pp. 75). As for thumbnail endscrapers, it is interesting to note that tools with similar morphology can also be found in lithic assemblages of Central Europe (more precisely in Moravia) (Kopacz, Přichystal and Šebela 2015 p. 44). Hollow base arrowheads, almost completely absent in France (Bailly 2014 p. 360 fig. 2), are attested in Lombardy (Brescia-San Polo, Monte Covolo) (Lo Vetro 2008 p. 185) and in other Bell Beaker sites of Northeastern Italy (Bailly 2014 pp. 359-360 fig. 2).

Lithic industry from Calcinatè-Campo Musna, ascribable to the later phase of Bell Beaker, or perhaps even to Epi-Bell Beaker phase, seem to be quite similar to Bell Beaker lithic production of French Midi; nevertheless these analogies might not be due to the existence of closer relationships between these regions in Bell Beaker final phases (already observed for the pottery) (Lemerrier 2004 pp. 466-468; Lemerrier *et al.* 2007 pp. 247-249), but perhaps to a local evolution of lithic production. Comparable features have been detected in lithic assemblages of Stellina and via Tosarelli, at Castenaso (Bologna, eastern Emilia) (Dal Santo *et al.*

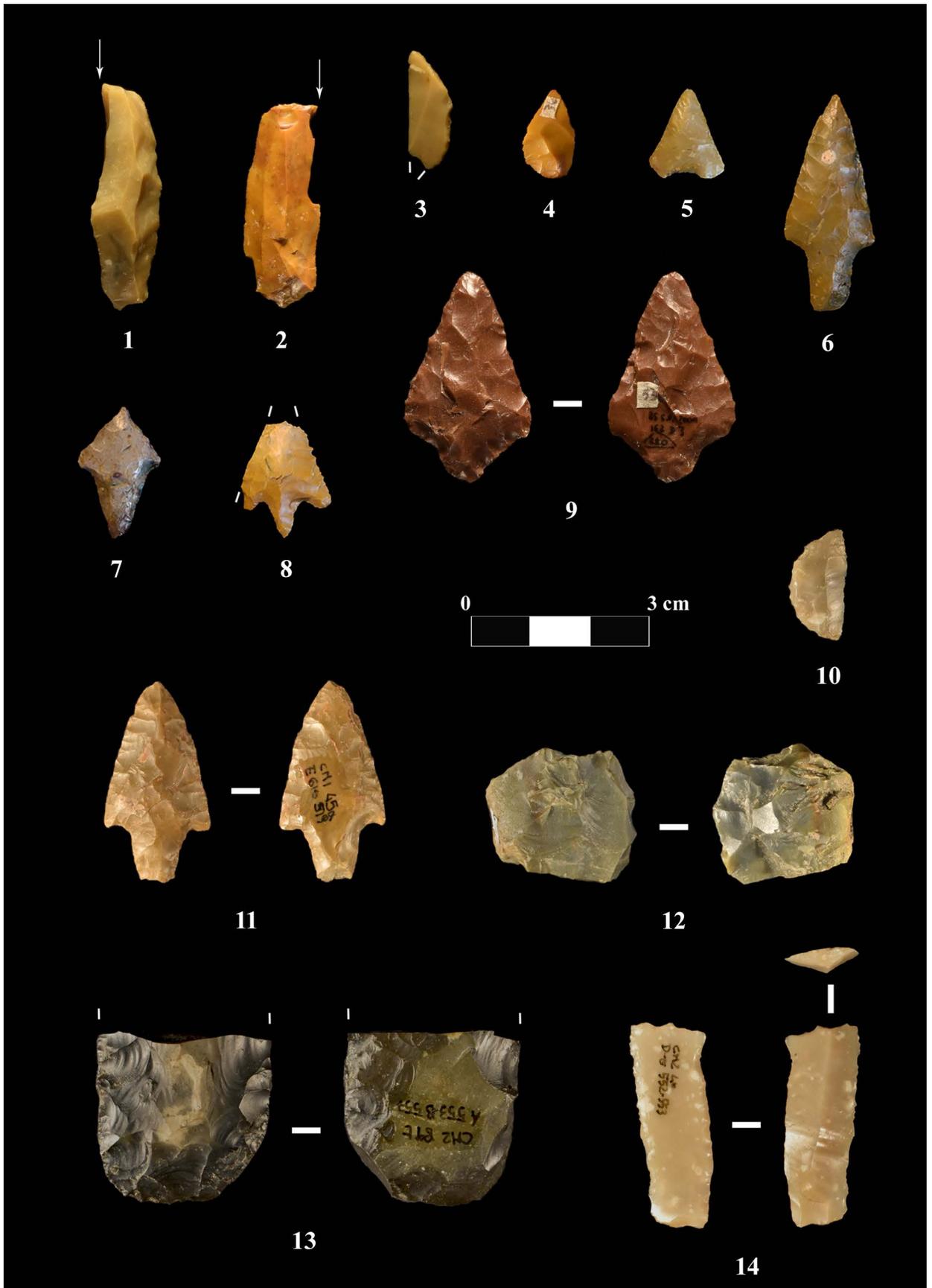


Figure 7: Lombardy sites - Bell Beaker toolkit. Brescia-San Polo: burins (1 and 2), microlithic crescent (3), backed point (4), hollow base arrowhead (5), arrowheads (6-9); Calcinate-Campo Musna: microlithic crescent (10), arrowhead (11), splintered piece (12), foliaceous piece (13), sickle element (14). Photos by I. Matera (1-4 and 9-14) and D. Lo Vetro (5-8)

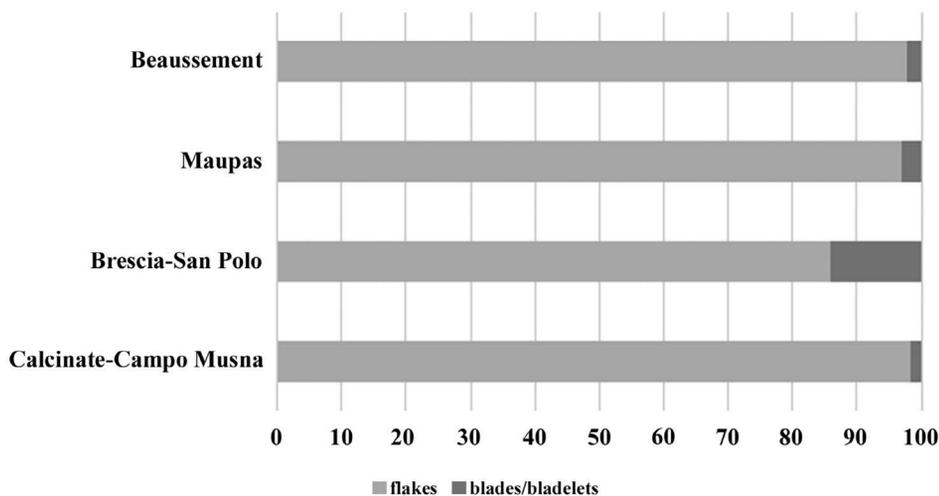


Figure 8: Proportion of flakes and blades and bladelets in lithic industries of Eastern Languedoc and Lombardy sites

2014 p. 225), but not in other industries of Northern Italy attributable to a final phase of Bell Beaker, such as Monte Covolo-Phase 3 (Lo Vetro 2008 p. 189). The scarcity of data available, especially on technological features, regarding Bell Beaker and Epi-Bell Beaker lithic assemblages impedes the proper evaluation of transformations in the lithic production.

Although this preliminary study is based on the comparison between industries attributable to different phases of Bell Beaker period, the differences observed between the lithic assemblages from Lombardy and French Midi would not seem to have a chronological meaning. As a matter of fact, the features of Early Bell Beaker industries of French Midi widely differ from those of Early Bell Beaker industry of Brescia-San Polo, whereas they do not show a significant break with French industries of the later phases (Furestier 2007 pp. 154-160). Furthermore, the similarities observed between Calcinate-Campo Musna and the lithic production of Southeastern France have not been detected in other Italian industries attributable to the same period, such as Monte Covolo phases 2 and 3.

Conclusions

Preliminary study of the Bell Beaker lithic industries of eastern Languedoc and Lombardy provides interesting information for improving our knowledge on the possible influences and contacts that might be developed between Bell Beaker groups of the French Midi and Northern Italy. Features of lithic productions of the French Midi and Northern Italy seem to suggest that relationships between these regions were not close and, above all, would seem to be non-reciprocal. As regards their lithic industries, if Italian influences in Southeastern France could be indicated by occurrence

of microlithic crescents, conversely items testifying to French influences in Italy seem not to be attested. This could suggest that relationships between French and North Italian Bell Beaker groups were not very deep, and we can see them only as regards pottery (which however generally shows more pronounced influences from other cultural areas, such as Central and Eastern Europe) (Barfield 1974 pp. 74-75; Bermond Montanari, Cremaschi and Sala 1982 pp. 87-88; Bernabò Brea and Mazzieri 2013 pp. 519-521; Fasani and Nicolis 1990 pp. 325-326; Leonini 2004 pp. 400-406).

Several authors suggest the existence of relationships with local Pre-Bell Beaker traditions for Bell Beaker lithic productions of Northern and Central Italy (Dal Santo *et al.* 2014 pp. 220-221; Lo Vetro 2008 p. 191; Martini 2008 pp. 107-118). These relationships are effectively undeniable; however, only a study based on a techno-economic approach of Pre-Bell Beaker lithic productions will allow a better understanding of the real importance of preceding traditions in the emergence and the development of Italian Bell Beaker lithic productions. Moreover, the question of possible influences from Central and Eastern Europe in Italy remains open. In fact, it cannot be excluded that differences observed between the Bell Beaker lithic industries of Northern Italy and the French Midi might be linked to this factor. Some analogies between Italian and Central European lithic assemblages, such as the occurrence of blade production (often carried out by pressure or indirect percussion technique) in a few sites of Moravia (Kopacz, Přichystal and Šebela 2008 p. 263; Kopacz, Přichystal and Šebela 2015 p. 38) can indeed be detected. The possible role of Central and Eastern European influences in the lithic production of Northern and Central Italy is still to be evaluated, and probably differs region by region.

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Pottery *Chaînes Opératoires* as a Tool to Approach the Integration of the Bell Beaker Phenomenon: The ‘Petit-Chasseur’ Necropolis as a Case Study

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Abstract: The aim of this paper is to explore the integration of the Bell Beaker phenomenon in a local context, in order to examine the mechanisms underlying its introduction and discuss possible factors related to it. As a case study, the authors use the Upper Rhône valley in southwestern Switzerland and focus specifically on the renowned Sion ‘Petit-Chasseur’ necropolis. Prehistoric populations repeatedly came to this megalithic site during the Final Neolithic (2900–2450 cal. BC), the Bell Beaker period (2450–2200 cal. BC), and the Early Bronze Age (2200–1600 cal. BC), offering ideal conditions to address the issues stated above. This multidisciplinary research focuses on pottery manufacturing processes through the *chaîne opératoire* approach, reconstructing each step from the raw material selection all the way to finishing treatments and firing. The analyses, both macro- and microscopic, carried out on the Bell Beaker pottery, led to the identification of an exogenous pottery tradition and of local raw material procurement sources. These results point towards a mobility of Bell Beaker potters, who exploited local raw materials but applied their own know-how. Probably specialised, these craftsmen/women were thus one of the factors active in the diffusion of the Bell Beaker phenomenon.

Keywords: Petit-Chasseur; pottery *chaînes opératoires*; technology; archaeometry; Western Switzerland; raw material procurement; local context; transmission processes

Introduction

Since 2013, research on the Bell Beaker phenomenon has joined the movement of broad aDNA studies, exploring their potentialities at large geographical and chronological scales. These studies focused on the issue of the origin(s), and discussed the role played by human mobility, in the diffusion of the Bell Beaker phenomenon across Europe (Brotherton *et al.*, 2013; Allentoft *et al.*, 2015; Haak *et al.*, 2015; Olalde *et al.*, 2018; Olalde *et al.*, 2019; Marcus *et al.*, 2019; Saube *et al.*, 2021). Scholars have abundantly discussed the results of such publications (e.g. Heyd, 2016, 2017; Kristiansen *et al.*, 2017; Guilaine, 2018), and often deemed them too general, particularly in their conclusions regarding migrations and population movements during the 3rd millennium BCE (Vander Linden, 2016; Furholt, 2018, 2021). Certainly, aDNA data collected by these studies impacted research on the Bell Beaker phenomenon and brought valuable knowledge to reinvigorate the discussions surrounding it. More data is however still needed to clarify and locate the phenomenon’s roots, as well as the factors responsible for its diffusion and resulting patterns. In agreement with other scholars (Lemercier, 2018, 2020; Furholt, 2021), we believe that this will only be achieved by combining genetic evidence to detailed information on archaeological material and contexts. Smaller scale aDNA studies were led on the Bell Beaker period (Massy *et al.*, 2017; Sjögren *et al.*, 2020), but they focused on questions related to

mobility, social organisation and kinship systems in Southern Germany, leaving aside reflections on the phenomenon’s emergence source.

Research led at a regional scale, and based on the relationship between the Bell Beaker and preceding local material culture, is still crucial to investigate the insertion or emergence mechanisms of the phenomenon and to determine whether it originated in an exo- or endogenous cultural movement (Convertini, 1998; Besse, 2003; Besse and Desideri, 2005; Vander Linden, 2006; Blaise, 2010; Lechterbeck *et al.*, 2014; Cauliez, 2015; Lemercier and Strahm, 2018). In that regard, the Upper Rhône valley, located in southwestern Switzerland at the crossroads of several transalpine routes (Curdy *et al.*, 2003; Besse, 2012; Hafner, 2015; Curdy and Nicod, 2019), offers a great opportunity for a regional case study (Figure 1A). At its heart lies the site of Sion ‘Petit-Chasseur’ (Figure 2), a megalithic necropolis used for over 1600 years, spanning the 3rd and 2nd millennia BCE (Bocksberger, 1976, 1978; Gallay and Chaix, 1984; Gallay, 1989; Favre and Mottet, 2011; Besse, 2014; Besse *et al.*, 2011). The site itself is surrounded by contemporaneous settlements with shorter occupation phases, distributed throughout the valley (Carloni *et al.*, 2020). This general situation thus brings an interesting association of long- vs. short-term occupations and of funerary vs. domestic contexts. Since the discovery of the ‘Petit-Chasseur’ necropolis in 1961, numerous studies have been led on the social, symbolic, and

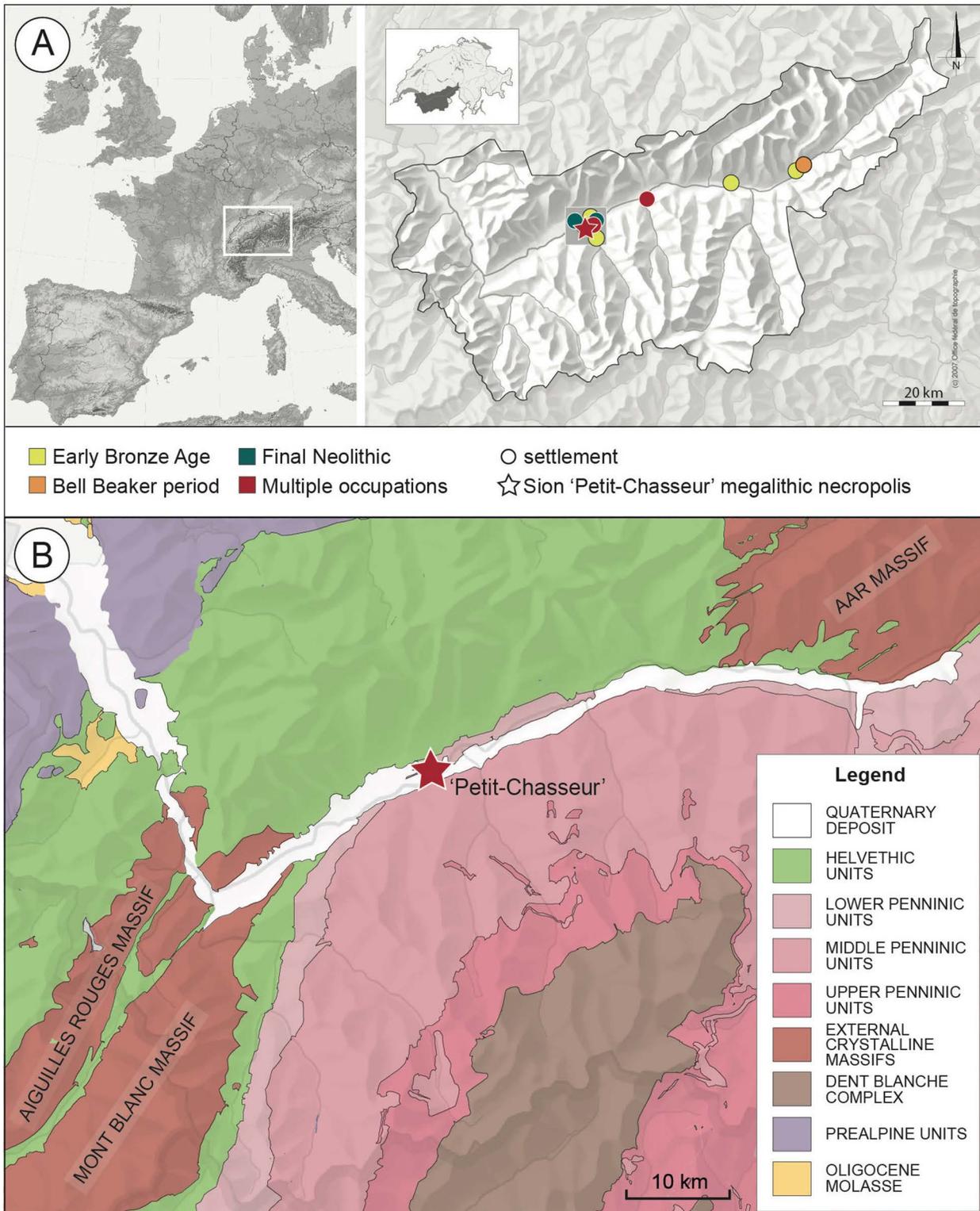


Figure 1: Research area for this study: A) location of the Upper Rhône valley in southwestern Switzerland and of the 'Petit-Chasseur' necropolis; B) geotectonic map (modified after the data provided by the Swiss Federal Office of Topography, <https://map.geo.admin.ch/>).

economic spheres of the megalith-erecting society of the Upper Rhône valley (Besse *et al.*, 2014; Gallay, 2014a). Notwithstanding the works that have been carried out so far, the necropolis' extensive documentation and

findings still allow for new analyses to be conducted. The ceramic assemblages uncovered in Sion 'Petit-Chasseur', which includes productions from the Final Neolithic (3100–2450 cal. BC), the Bell Beaker period

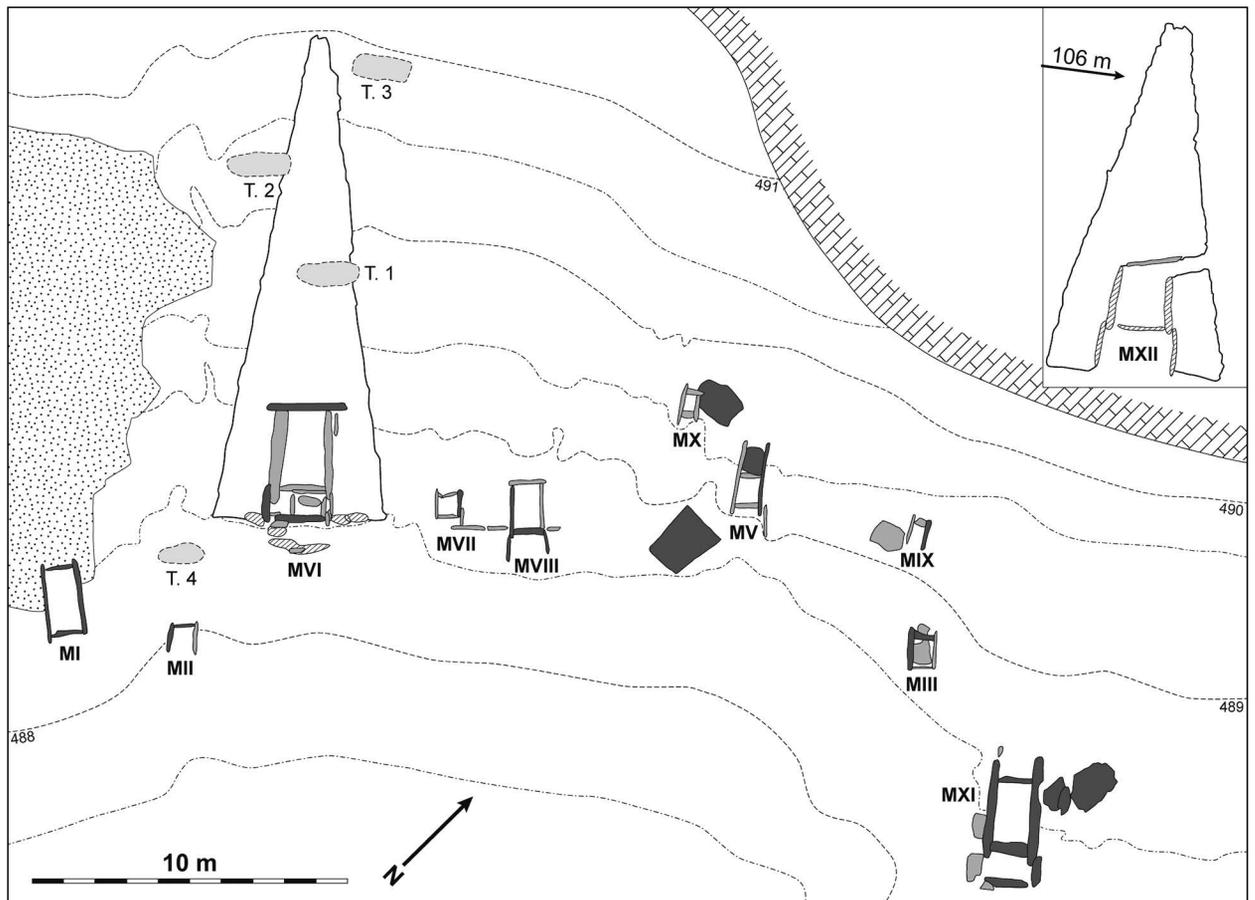


Figure 2: Map of the 'Petit-Chasseur' necropolis (adapted from Corboud and Curdy 2009, p. 20).

(2450–2200 cal. BC), and the Early Bronze Age (2200–1600 cal. BC), appear as a valuable medium to approach the issues mentioned earlier and particularly those related to the local integration of the phenomenon, as it offers a possibility to compare pre-Bell Beaker with Bell Beaker productions. From raw materials to finishing treatments, the ceramic assemblage from Sion 'Petit-Chasseur' provides great potential to trace back pottery *chaînes opératoires* and, ultimately, communities of practice and their evolution through time, whether in a continuous or disrupted manner. For this reason, the University of Geneva launched a vast research project on pottery traditions in the Upper Rhône valley (funded by the Swiss National Science Foundation, 2017–2021, PI M. Besse). The 'Petit-Chasseur' megalithic site's assemblages have been the focal point of this project. The research saw the collaboration of Swiss, European, and US institutions and involved three approaches: one on raw material procurement and paste preparation (PhD thesis of D. Carloni); another on fashioning, prehensions, decorating techniques, and surface treatments (PhD thesis of E. Derenne); and a last approach centered on typology.

This article specifically highlights the results related to the 'Petit-Chasseur' necropolis, which yielded the

largest Bell Beaker ceramic assemblage of the region. It presents a selection of seven Bell Beaker vessels for which detailed archaeometric and technical data could be produced and compares it to data collected on pottery attributed to the previous archaeological period from the same site. The research on the raw material choices and procurement strategies accounted for the particularly complex geology of this Alpine valley (Figure 1B) (Stampfli, 2001). Indeed, a variety of lithologies outcrop in the region given the presence of different structural domains (Schmid *et al.*, 2004). The Helvetic unit is composed of (meta)sedimentary and low-grade metamorphic rocks, while the Penninic unit comprises (meta)sedimentary, ophiolite, and low- to high-grade metamorphic rocks. Finally, the External Crystalline Massifs (Aiguilles Rouges, Mont Blanc, and Aar Massifs) are composed of granites, gneisses, amphibolites, and low-grade metamorphic rocks.

Materials and methods

The Bell Beaker ceramic assemblage of the 'Petit-Chasseur' necropolis comprises both undecorated and decorated beakers and cups, amounting to 28 pots and 120 sherds for a total weight of 4049.5 g. Out of the 148 elements, 61 bear decorations (41% of the pottery

corpus). The decoration generally covers the whole vessel's surface and consists of both cord impressions (All Over Corded style, AOC) and complex impressed patterns (All Over Ornamented style, AOO) (Harrison and Heyd, 2007; Besse *et al.*, 2011). Vases accompanied the dead as grave goods in megalithic monuments MI, MIII, MV, MVI, MVII, MVIII, MX, and MXI (see Figure 2). Harrison and Heyd (2007) proposed a four-step chrono-typological sequence for this pottery corpus, based on the observations made on Central European Bell Beaker contexts (Heyd, 2007): an Early Beaker phase A1, a Middle Beaker phase A2, a Late Beaker phase B1, and a Latest Beaker phase B2. This proposition was debated by Gallay (2014b), while Besse *et al.* (2011) accepted this overall relative chronology but disputed the presence of the Early Beaker phase A1 in the necropolis.

The methodology used for this study is based on a technological approach. It aims to reconstruct the *chaîne opératoire* (or operational chain), which was defined as the sequence of operations transforming raw material into a finished product (Leroi-Gourhan, 1964; Cresswell, 1976). Applied to the ceramic manufacturing process, this approach allows for the identification of pottery technical traditions and of the associated communities of practice, giving us insights on the social identity of the potters (Arnold, 1985; Stark, 1998; Wenger, 1998; Livingstone-Smith, 2001; Gosselain, 2008a; Roux, 2011, 2019; Roux *et al.*, 2017). This research, highly interdisciplinary, requires the application of different methods in the investigation of each individual step of this operational chain (Figure 3).

The raw material procurement, selection, and use were detailed by means of a range of spectroscopic and microscopic analytical techniques: optical microscopy (OM), crystallography (XRD), phase chemistry (QEMSCAN® and SEM-EDS), and whole-rock geochemistry (LA-ICP-MS). Sample selection for the archaeometric analyses accounted for the macroscopic features of the ceramic pastes as well as stratigraphic and topographic data. It also complied with the Valaisian History Museum's requirements, which did not allow for partial destruction of the material whose drawings figured in the publications of the 'Petit-

Chasseur's archaeological records. The complete details on the methodology and sample selection for analysis may be found in Carloni *et al.* (2021).

The analysis of the fashioning, prehension, and decoration techniques, together with finishing treatments, began with the macroscopic observation of the entire ceramic assemblage under low-angled light to detect diagnostic traces of these techniques. The use of repositories of photographed traces provided by actualist, experimental, and archaeological studies brought points of comparison for this identification. The study of surfaces focused on color, shine, granularity, striation, topography, and orientation of fracture networks (Roux, 2019). The examination of cross-sections centered on the colors of the margins and of the core, and on the general orientation of porosity, whenever it was visible. Following this, an interpretation was made concerning the possible techniques, tools, and gestures used by the potters. The observations made on surface treatments were then verified with a stereomicroscope (maximum magnification of 40x). Finally, two complementary analyses were led on a sample of sherds: the examination of mineralogical maps of thin sections analyzed with QEMSCAN®, and the scanning of two sherds using micro-computed tomography. The full methodology and sample selection are detailed in Derenne *et al.* (2020).

Finally, firing atmosphere was established based on the internal and the external surface colors, as well as the color combination in cross-section. Chromatic variations were first detected by macroscopic observations and then corroborated by means of OM.

It should be noted that the state of preservation of the ceramic assemblage, along with the restoration techniques applied to reconstruct the vessels, hampered the observation of many cross-sections, and affected the original aspects of the surfaces, limiting the macroscopic study of the ceramic pastes and the documentation of technical traces. The pottery material of 'Petit-Chasseur' was highly fragmented and sherd refitting involved plaster fillings. In some cases, the consolidation of sherds and vases was severe.

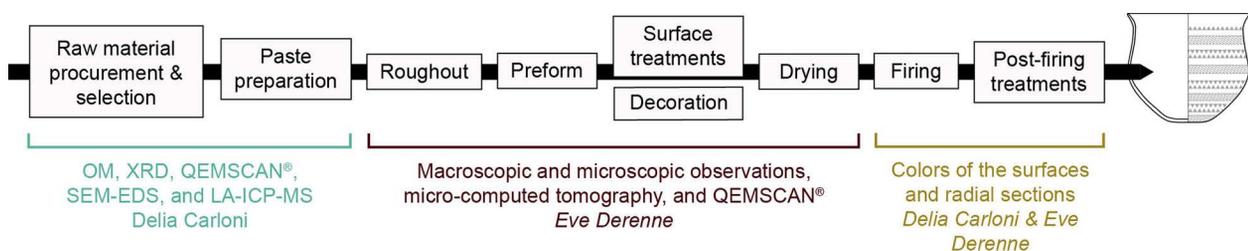


Figure 3: Analytical methods applied to investigate each step of the *chaîne opératoire*.

Results

We present here the most detailed *chaines opératoires* identified among the Bell Beaker ceramic assemblage of the ‘Petit-Chasseur’ necropolis. These results thus focus on seven specific vessels (out of the 28 identified in the site) uncovered in four different dolmens of the megalithic site (MV, MVI, MVII, and MXI; Figure 4). Comprehensive data on pottery raw materials from the necropolis can be found in Carloni *et al.* (2021), and details on fashioning, surface treatments, and decorating techniques are available in Derenne *et al.* (2020).

The first of these vases is an undecorated beaker found in dolmen MV (**PC1 MV Gob.2, sample PC72**). To prepare its paste, the potter blended a muscovitic clay and coarse sediment rich in granite particles, possibly a colluvial or till sediment. S/he then fashioned the beaker using the coiling technique and burnished its surfaces using a smooth, hard tool. The color of the vessel’s external and internal surface was very light pinkish brown, while the sections presented a dark core and light inner and outer margins.

The potter that produced the AOC beaker ‘number 4’ unearthed in dolmen MVII (**PC1 MVII Gob.4, sample PC74**) used similar raw materials to the ones from the previous vase: a muscovitic clay tempered with a coarse sediment rich in granite particles, probably stemming from a colluvial or till sediment. The technical macrotraces left on the beaker were unfortunately not diagnostic enough for us to determine the fashioning technique used by the artisan. However, s/he wrapped a Z-twisted cord around its outer walls, creating a linear impressed decoration, and burnished the vessel using a hard tool with a smooth surface. We observe the same color combination as the previous beaker, with light pinkish brown-colored surfaces and in section a dark core with light inner and outer margins.

The third vase presented here is an AOC beaker found in dolmen MVI (**PC1 MVI Gob.6, sample PC78**). To prepare the paste, the artisan blended an illitic clay and a coarse sediment rich in granite particles, possibly a colluvial or till sediment. The primary forming technique of the beaker remains unknown, but we strongly suspect its final shape was achieved through beating. Following this step, the potter created linear impressed decoration using an indented tool, either a comb or a shell, before burnishing the surfaces. In this case, the vessel’s surfaces are light reddish brown, while, as usual, the cross-section presented a dark core with light inner and outer margins.

The potter used the same type of clay, an illitic-based one, to make an AOC beaker later placed inside dolmen MXI (**PC1 MXI Gob.1, sample PC79**). S/he tempered

this clay with a granitic gruss or a coarse colluvial or till-like sediment rich in granite particles and probably used sieving during the paste preparation process, as the size of the aplastic inclusions appears particularly fine (<0.5 mm). The potter then used the coiling technique to create the roughout of the vase. The preforming technique used to give the beaker its final shape cannot be determined, but a circular stamp and indented tool were pressed onto the vessel’s walls to create the geometric patterns decorating it. As per usual, the artisan then went on to burnish the surfaces. The interior and exterior surfaces are characterised by a dark red color. The cross-section presents the exact same color combination as the three beakers detailed above, namely a dark core with light inner and outer margins.

The next two *chaines opératoires* presented here concern two cups. The first one (**PC1 MV Gob.4, sample PC71**) was made following a paste preparation recipe that involved tempering of an illitic clay with a coarse sediment rich in granite particles, probably stemming from a colluvial or till deposit. The vessel’s primary forming technique remains unknown, but we suspect that the potter used beating to preform it into its final shape. S/he then attached the strap handle with a tenon and mortise technique, before burnishing the undecorated surfaces. We observe a color combination comprising light pinkish brown surfaces and a section presenting a dark core coupled with light inner and outer margins.

The potter that fashioned the second cup (**PC1 MXI Gob.3, sample PC80**) used a muscovitic clay tempered with a coarse colluvial or till-like material rich in granite particles. Unfortunately, the technical macrotraces s/he left on the vase are insufficient for us to identify the primary and secondary forming techniques. But as for the above-described cup, a tenon and mortise secured the strap handle to the vessel’s wall. The artisan created an impressed geometric motif with an ovaloid stamp and finished the cup by burnishing its surfaces. The exterior surface is brown, whereas the interior one is dark brown. The core’s color is a darker shade from the one observed for the surfaces, with a dark inner margin and a light outer margin.

Finally, the last vase, an AOC beaker discovered in dolmen MVII (**PC1 MVII Gob.3, sample PC73**), presents singular features. Unlike any of the six other Bell Beaker beakers and cups detailed above, it was made with a stilpnomelane-based clay, a Fe-rich phyllosilicate. Aplastic inclusions, probably naturally present in the original sediment, consist of epidote-granite and Fe-rich particles. The technical macrotraces observed are too scarce to identify the fashioning methods and techniques used by the potter, but s/he used an indented tool and a triangular stamp to decorate the

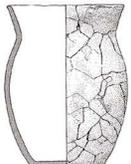
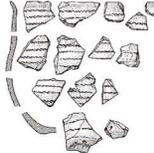
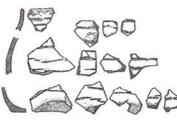
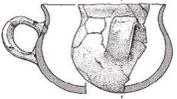
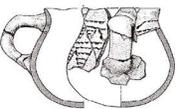
Inventory number	Clay material	Paste preparation	Fashioning (roughout and preform)	Decoration and surface treatments	Colors in cross-section (firing)
PC1 MV Gob.2 sample PC72 	Muscovitic clay	Tempering with granite-rich coarse sediments	Coiling Preforming technique undet.	No decoration Burnishing	Light/dark/light
PC1 MVII Gob.4 sample PC74 	Muscovitic clay	Tempering with granite-rich coarse sediments	Undetermined	Impressed Z-twisted cord Burnishing	Light/dark/light
PC1 MVI Gob.6 sample PC78 	Illitic clay	Tempering with granite-rich coarse sediments	Roughing-out technique undet. Suspected beating	Impressed indented tool (linear) Burnishing	Light/dark/light
PC1 MXI Gob.1 sample PC79 	Illitic clay	Possible sieving Tempering with granite-rich coarse sediments and/or granite cobbles	Coiling Preforming technique undet.	Impressed indented tool and circular stamp Burnishing	Light/dark/light
PC1 MV Gob.4 sample PC71 	Illitic clay	Tempering with granite-rich coarse sediments and/or granite cobbles	Roughing-out technique undet. Suspected beating Strap handle with tenon	No decoration Burnishing	Light/dark/light
PC1 MXI Gob.3 sample PC80 	Muscovitic clay	Tempering with granite-rich coarse sediments and/or granite cobbles	Roughing-out and preforming techniques undet. Strap handle with tenon	Impressed stamp (oblong) Burnishing	Dark/dark/light
PC1 MVII Gob.3 sample PC73 	Al-rich stilpnomelane	Likely no tempering	Undetermined	Impressed indented tool and triangular stamp Burnishing	Homogenous, light

Figure 4: Detailed *chaines opératoires* for the seven Bell Beaker vases selected for this study.

beaker's surfaces with geometric patterns. The artisan then finished the vessel by burnishing it. This beaker has bright red external and internal surfaces – a hue rarely observed in the rest of the sample set – and the section's color is fully dark red.

Discussion

The Bell Beaker chaînes opératoires of Sion 'Petit-Chasseur'

The reconstructed *chaînes opératoires* presented in this paper, along with additional data collected from the rest of the ceramic assemblage of the 'Petit-Chasseur' necropolis (Derenne *et al.*, 2020; Carloni *et al.*, 2021), allow us to make some inferences on the Bell Beaker ceramic production in the Upper Rhône valley (Figure 5). The different steps structuring the *chaînes opératoires* displayed some important similarities, which deserve to be put forth.

Concerning raw material procurement, the Bell Beaker potters sourced their clays mainly from sediments formed by physical weathering and moderate degree of hydrolysis under cold and arid climates (e.g. fluvioglacial, glaciolacustrine colluvial, and till sediments) (Meunier, 2005). This is the case for the muscovitic clays (Figure 5A), which can probably be found on the collinear belt of the Upper Rhône valley and at higher altitudes (Carloni *et al.*, 2021, and references therein). To a lesser extent, they used illitic clays (Figure 5B), which required higher degrees of hydrolysis to form and thus relatively high rates of chemical weathering (Velde and Meunier, 2008). Possible sources of illitic clays in the region are the horizons of pedogenised loess and the riverine deposits originating from the Rhône and its tributaries flows (Carloni *et al.*, 2021 and references therein). Concerning the temper material, the particles characteristics match the ones of the morainic deposits generated by the glacial expansion and contraction of the Rhône glacier (Figure 5D). The till sediments left by the latter once retreated, however, generally consist not only of granite particles, but of other gravel-sized sedimentary and metamorphic rocks as well (Bocksberger and Burri, 1963). Therefore, it is possible that the potters manipulated the original raw material by removing inclusions of undesired composition. It is also conceivable that the till sediment was procured closer to the Aar massif (see Figure 1B) – where granites effectively outcrops and where the Rhône glacier originates. The only other Bell Beaker archaeological site of the region was discovered right in this area, over 50 km away from the necropolis (Meyer *et al.*, 2012). Hence, geological and archaeological considerations point to a raw material provenance from the area of the Aar massif, even though it is not possible to undoubtedly affirm this at present. Regardless of the type of raw material and procurement area, the paste preparation

clearly followed a somewhat common recipe, which involved the tempering of the original muscovitic/illitic clay with a granite-rich sediment. It should be noted that this practice has also been observed in the Bell Beaker pottery from Rances 'Champ Vully Est' (Vaud, Switzerland; Besse *et al.*, 2019). Granite inclusions have similarly been reported in the Bell Beaker pottery of Alle 'Noir Bois' (Jura, Switzerland) but their presence in the ceramic paste has been interpreted as a characteristic feature of the original raw material (Convertini, 1997).

The primary and secondary forming techniques used by potters to reach a roughout and then a preform could rarely be observed due to several limiting factors. In addition to the ones described in the Materials and Methods section, another such factor is the fact that most of the vessels belonged to the fine ware category. Their walls are particularly thin (75 % of the assemblage are between 2 and 6 mm thick) and received an important technical investment, particularly regarding finishing treatments, which led to the removal of most traces produced by techniques applied earlier in the *chaîne opératoire*. Nonetheless, the use of coiling was identified in five instances with certainty, and in one case with the addition of a coil to the outer periphery of the base. Micro-computed tomography even revealed that the coils of beaker PC1 MVI Gob.5 were joined diagonally, from the inside to the outside of the wall (Figure 5E). Small, flat facets segmenting the outer surface of at least three beakers unveiled the use of beating as a secondary forming technique (Figure 5F). The dense fabrics and micro-porosities oriented parallel to the walls observed on QEMSCAN petrographic maps of Bell Beaker sherds corroborated this interpretation (Figure 5G). It should be noted that a lot of technical characteristics of the Bell Beaker assemblage of Sion 'Petit-Chasseur' were similar to the ones found in Alle, particularly regarding primary forming technique and finishing treatments (Convertini and Othenin-Girard 1997).

With reference to decoration, potters used a variety of tools, or a combination of them, to create the impressed patterns adorning the beakers. These included Z-twisted cords (Figure 5H), stamps (circular, triangular, or oblong), indented tools (e.g. Figure 5I) – most probably combs – with different dent sections (pyramidal, rectangular, square, oblong, or 'fish scale-like'), and a combination of a stamp and an indented tool (Figure 5J). No specific distribution of these tools could be identified inside the necropolis, and no preferential relationship emerged between the use of a tool and a deposit inside a particular dolmen (Derenne *et al.*, 2020).

Finishing treatments predominantly involved burnishing, with 89% of observable sherds – and all of the identified beakers and cups with observable



Figure 5: Synthesis of the Bell Beaker pottery tradition for the 'Petit-Chasseur' necropolis. QEMSCAN® mineralogical map of ceramic matrix: A) muscovitic groundmass; B) illitic groundmass; C) stilpnomelane groundmass. Temper material: D) granite particles in the ceramic paste. Forming techniques: E) coiling junctions visible through micro-computed tomography; F) small facets characteristic of the beating technique; G) dense fabric and extremely fine porosities (QEMSCAN® mineralogical map of PC1 MXI Gob.1). Decorating techniques: H) Z-twisted cord impression; I) indented tool impression; J) indented tool and stamp combination. Finishing treatments: K) and L) burnishing.

surfaces – presenting traits corresponding to this technique (Figure 5K-L).

Finally, the surface colors are all gradations of red, and all but one is accompanied by a dark core with light external and internal margins in cross-section (15 out of the 18 observable vases). No consensus currently exists regarding the exact relationship between colors in radial section and specific firing procedures or techniques (e.g. Roux, 2019; Gliozzo, 2020). Some authors, for example, argue that a dark core has more to do with a clay initially rich in organic matter and low firing temperatures than with a reducing atmosphere (e.g. Rice, 1987; Maritan *et al.*, 2006). The homogeneity of the observations made on the Bell Beaker assemblage from ‘Petit-Chasseur’, however, would suggest the implementation of consistent firing procedures by the potters, as well as a cooling phase conducted in an oxidizing atmosphere, as indicated by the surfaces (Rice, 1987; Velde and Druc, 1998; Roux, 2019). The sole exception is represented by cup PC1 MXI Gob.3, whose firing and/or cooling process may have been conducted in a slightly reducing atmosphere.

Our work also led to the discovery that one beaker, PC1 MVII Gob.3, had a special composition, as it was made using different raw material than the rest of the dataset: a stilpnomelane-based clay (Figure 5C). Furthermore, the compositional correspondence between the clay substrate and the lithology of aplastic inclusions (Carloni *et al.*, 2021) suggests that the original raw material underwent little or no manipulation. The raw material used for making this vessel, particularly Fe-rich, may have originated from the alteration of the granitic rocks present in the Mont Blanc External Massif (Figure 1B). In this case, the source area would therefore be located at the foot of the Mont-Blanc massif or along the Arve valley, more than 20 km west of the ‘Petit-Chasseur’ necropolis. It should be noted that no Bell Beaker archaeological site is known to this day in the western part of the Upper Rhône valley. The Fe-rich clay used to manufacture this vessel, coupled with a firing/cooling process in an oxidizing atmosphere resulted in the bright red color of the beaker’s surfaces. With regards to the fashioning and decoration techniques this beaker’s data is consistent with the rest of the assemblage.

Comparison of Final Neolithic and Bell Beaker period pottery traditions

The comparison between this Bell Beaker ceramic production and the pottery manufactured during the preceding period, i.e., the Valaisian Final Neolithic (3300–2450 cal. BC) – the raw material and technical data of which can be found in Derenne *et al.* (2020) and Carloni *et al.* (2021) –, brought the most instructive details on the emergence of the Bell Beaker phenomenon in the region.

These two assemblages of ‘Petit-Chasseur’ are different from many perspectives (Figure 6). The most self-evident were of course morphology and style, with a shift from larger, sparingly or un-decorated vessels, to small beakers and cups often covered with the phenomenon’s emblematic impressed patterns. Substantial changes occurred in the *chaîne opératoire* as well, affecting at least four of its steps. The first concerns paste preparation: the Final Neolithic potters tempered the raw clay with calcite (Figure 6A) or schist particles (Figure 6B), whereas the Bell Beaker potters added granite-rich material instead (see Figure 5D) (Carloni *et al.*, 2021). The second modification is found in fashioning, which during the Final Neolithic never involved the beating technique to shape the vessels into their final morphology. The coiling technique however was already in use (Figure 6C). Surface treatment is the third modification, with clear preference from the Final Neolithic potters for smoothing on a wet paste, with or without the addition of water and with a soft or hard tool (Figure 6D-E), which made way to a predilection for burnishing (Derenne *et al.*, 2020). As stated above, in contrast to the Bell Beaker pottery, the Final Neolithic vessels found in the necropolis bear no decoration.

Changes simultaneously affecting several aspects of the *chaîne opératoire* tend to reveal major upheavals, and such a sharp break in pottery traditions is usually interpreted as the arrival of a new community of practice in the area (e.g. Roux, 2011; Gomart *et al.*, 2020). This is undeniable in the case at the ‘Petit-Chasseur’ necropolis. The pottery learning process, deeply embedded in practice and linked to the observation of surrounding “teacher” potters, leads to a form of “impregnation” of the apprentice who will later find it difficult to change ways of doing that s/he has learned, as the use of specific methods, techniques, gestures, and tools is often strongly associated with social identity (Bril, 2002; Gosselain and Livingstone-Smith, 2005; Roux, 2011; Arnold, 2018). Style, in contrast, is less associated with inheritance and can be copied and diffused more easily (Gosselain, 2008a, 2008b; Roux *et al.*, 2017). Subsequently, it is thus less of a revealer of social and cultural shifts than pottery practices. However, modifications in both style and technical practices are a great indicator of major changes in ceramic traditions.

Transformations in the ‘Petit-Chasseur’ necropolis around the second half of the 3rd millennium BCE

The results presented above support many other observations made on the general material culture and history of the ‘Petit-Chasseur’ necropolis, which saw important shifts between the Final Neolithic and the Bell Beaker period. These included, to name but a few, the changes in megalithic monuments’ architecture and in the style of engraved stelae (Gallay, 1995; Corboud

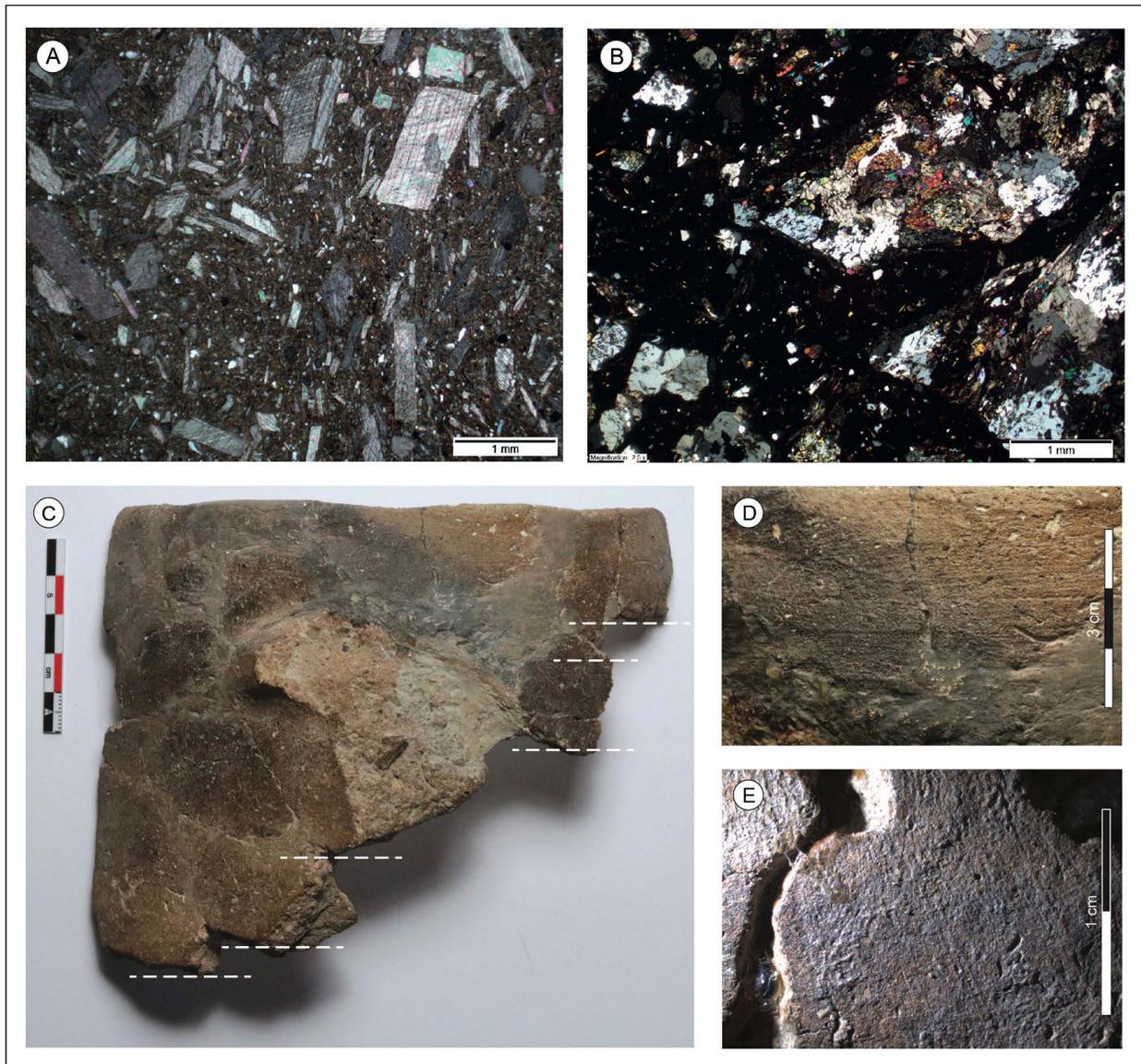


Figure 6: Final Neolithic pottery tradition at the Sion 'Petit-Chasseur' necropolis. Tempering: A) calcite; B) glaucophane schist. Fashioning: C) coiling. Finishing treatment: D) and E) smoothing.

and Curdy, 2009; Besse *et al.*, 2011), as well as in lithic raw material procurement networks (Affolter, 2014).

The probable arrival of a new pottery community of practice, revealed by this study on *chaînes opératoires*, revives questions related to exogenous cultural influences identified in the megalithic site's archaeological record. These were numerous, and of diverse geographical origins during the Bell Beaker period. The anthropomorphic stelae showed clear similarities with the ones discovered in Aosta 'Saint-Martin-de-Corléans' in Northern Italy (Gallay, 1995; Mezzena, 1998; Corboud and Curdy, 2009; Corboud, 2009). Then, the funerary practice of burying the dead in collective graves was more related to southwestern European traditions (Besse and Desideri, 2005). Finally, a silver ring discovered in dolmen MVI could

find comparisons with Eastern European artefacts (Bocksberger, 1976 vol. 2 pl. 33, 86; Besse, 1998).

These exogenous cultural influences along with the new pottery community of practice may suggest human mobility, for which bioanthropology and genetics can of course offer valuable information. With regard to the 'Petit-Chasseur' necropolis, a study based on dental nonmetric traits revealed a moderate exogenous biological input among Bell Beaker individuals (Desideri and Besse, 2010; Desideri *et al.*, 2012). Furthermore, strontium isotope analyses also showed that several adults were non-local (Desideri *et al.*, 2010). A small proportion of the individuals buried in the necropolis during the Bell Beaker period thus moved during their lifetime, a conclusion that is consistent with recent aDNA and strontium isotopes studies, which pointed

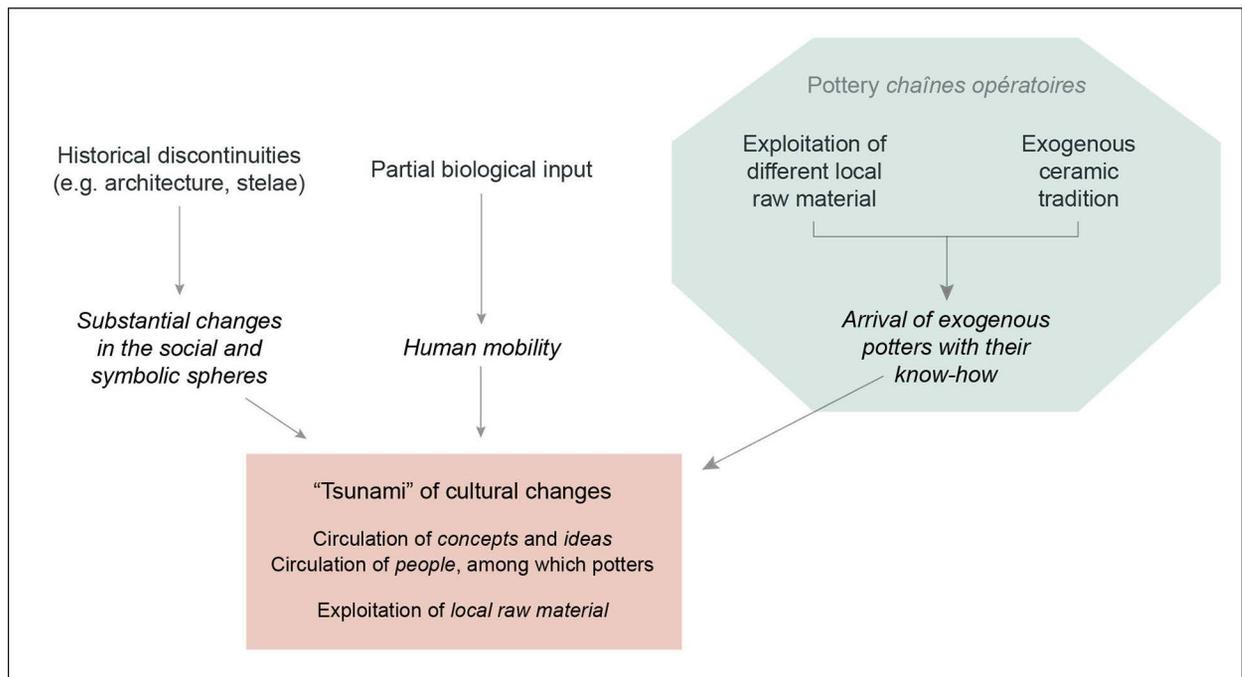


Figure 7: Diagram contextualizing interpretations regarding the Bell Beaker pottery traditions in 'Petit-Chasseur'.

out that the diffusion of the Bell Beaker phenomenon could be associated with human mobility (Fitzpatrick, 2011; Parker Pearson *et al.*, 2016; Olalde *et al.*, 2018). It should also be noted that the grave goods of the so-called 'Amesbury archer', who most probably grew up in the Alpine region before moving to Britain, included five bell beakers made with local raw material (Fitzpatrick, 2011). This is in line with other studies which concluded that the Bell Beaker pottery was made predominantly with local and regional raw material (distance radius from the site ~0-30 km) (Convertini, 1996; Convertini and Querré, 1998; Jorge, 2009; Salanova *et al.*, 2016; Dias *et al.*, 2017).

Bell Beakers in 'Petit-Chasseur': foreign potters and local raw materials

To summarise this discussion, the results of this multidisciplinary research centered on pottery *chaînes opératoires* are consistent with those made in former studies focusing on the emergence of the Bell Beaker phenomenon in the Upper Rhône valley in general, and at Sion 'Petit-Chasseur' in particular. Previous research had already identified: (1) substantial changes in the social and symbolic spheres, which were revealed by the history of the site, and (2) a partial biological input indicating mobility of some individuals, but not of an entire population (Figure 7).

The contribution of this study to the debate on the emergence of this cultural phenomenon in the Alps lies in the identification of an arrival of exogenous potters

who exploited local raw material, but applied their own know-how, bringing with them their own ceramic traditions. These potters, with a high level of expertise, were thus one of the factors contributing to the diffusion of this phenomenon and of its associated concepts and ideas, bringing with them the expertise necessary to manufacture one of its key elements: the decorated beaker.

Conclusion

This article began with the authors' plea for research on the Bell Beaker phenomenon to be led at a regional scale in order to examine its relationship with the previous cultural contexts, assessing the extent to which this relationship was characterised by continuity or rupture. It then offered a case study based on the renowned megalithic necropolis of Sion 'Petit-Chasseur' (Valais, Switzerland), used continuously between 2900 and 1600 cal. BC. Through this example, the authors presented the first in-depth study following the *chaîne opératoire* approach on the integration of the Bell Beaker phenomenon in an Alpine context. The research focused on identifying pottery traditions, using multidisciplinary analytical means to achieve its aims. The results revealed that the Bell Beaker traditions – both in raw material and manufacturing terms – were notably different from the preceding Final Neolithic ones, but that the craftsmen/women still procured their resources locally, in the Upper Rhône valley or in a neighboring region. Subsequently, the authors hypothesise that, in this area, the emergence of the Bell Beaker phenomenon coincided with the arrival of

a new pottery community of practice. The exogenous potters, who brought their own *savoir-faire*, thus possibly acted as one of the vectors for the diffusion of the phenomenon in the Alps.

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The Bell Beaker and Early Bronze Age Decorated Ware from the Preventive Excavations at 35 Auguste Isaac Street (Lyon 9e, Rhône, France)

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Abstract: Several recent preventive archaeological interventions at 35 Auguste Isaac Street in Lyon (9th, Rhône, France) have uncovered an important stratigraphic sequence often well preserved, ranging from the Epipaleolithic to the High Middle Ages. The aim of our paper will be to present the decorated ceramic findings related to the occupations from the mid-3rd to early 2nd millennium BCE.

With 159 elements, the corpus of decorated Bell Beaker vessels from 35 Auguste Isaac Street constitutes the second most important assemblage in number in the entire Auvergne-Rhône-Alpes region, after the site of Géovreissiat Derrière-le-Château. The analysis of the decoration shows that the majority of the decorated sherds belong to the recent Bell Beaker phase and belong to the southern Rhodano-Provençal group. Some very rare comb-decorated elements could either belong to an older phase (stylistic groups 1 or 2), or more probably to an influence of the Bourguignon-Jurassien group. Finally, a small group of elements belongs to the local Late Bell Beaker culture: the Vaise style.

During the Early Bronze Age, the ceramic material, relatively abundant, presents a diversity that goes well with a settlement. Frequent barbed and incised decorations (41 individuals) show the importance of southern influences in the first half of the Early Bronze Age. The stratigraphic data do not allow us to discuss the links between the Vaise style Bell Beaker vessels and the barbed or incised vases, but the distribution of the C dates in two clearly disjointed series seems to indicate two successive occupations.

Keywords: Bell Beaker, Rhodano-Provençal style, Vaise style, Bourguignon-Jurassien style, Early Bronze Age, barbed style, incised decoration, Middle Rhone Valley

Introduction

Real estate projects have recently led to three preventive archaeology interventions (phases 1, 2 and 3) at 35 Auguste Isaac Street in Lyon 9e (Rhône / Rhône; Figures 1-2). In 2009: diagnosis of phases 1 and 2 (Éric Bertrand and Jérémie Liagre / Savl; Bertrand, 2009); in 2010: excavation of phase 1 (Frédéric Jallet / Inrap; Jallet and Bouvier, 2012); in 2011: diagnosis of phase 3 (Jérémie Liagre / Savl; Liagre, 2011); and finally in 2012-2013: excavation of phase 3 (Jean-Michel Treffort / Inrap; Treffort, 2017).

Located north of the Saône alluvial plain, at the foot of the Duchère hill, on a slight slope, the site lies between the edge of a sandy cone from a small valley (Rochecardon creek), and the proximity of a Saône dead-arm, which gradually dried up during the Neolithic period. The stratigraphy, very dilated, presents an impressive succession of archaeological levels often well preserved, from the end of the Paleolithic to the Middle Ages.

The large number of occupation levels and the limited time frame for the survey imposed constraints and

choices, which affected the quality of the recorded data. During both excavation operations, the extensive study of the Epipaleolithic and Mesolithic levels was the priority objective defined by the SRA prescriptions. During the excavation of phase 3, the unexpected discovery of a Hallstatt necropolis of burial mounds further restricted the time available.

Finally, Bell Beaker / Early Bronze Age deposits were poorly individualised in the stratigraphic sections and were difficult to follow in planimetry. Almost all of the Neolithic layers were therefore treated with mechanical shovels; only a few obvious structures (stone blocks, isolated blocks, a few pits) were excavated manually. For the Early Bronze Age, the preserved occupation layer was largely sacrificed to quickly reach the clear surface of the underlying levels, in an attempt to draw a plan from the base of the sunken structures. In spite of these unsatisfactory search conditions, the various interventions revealed a large series of complex impressed and incised decorations attributable to the Bell Beaker and Early Bronze Age periods, forming a remarkable ensemble in terms of their number and diversity.

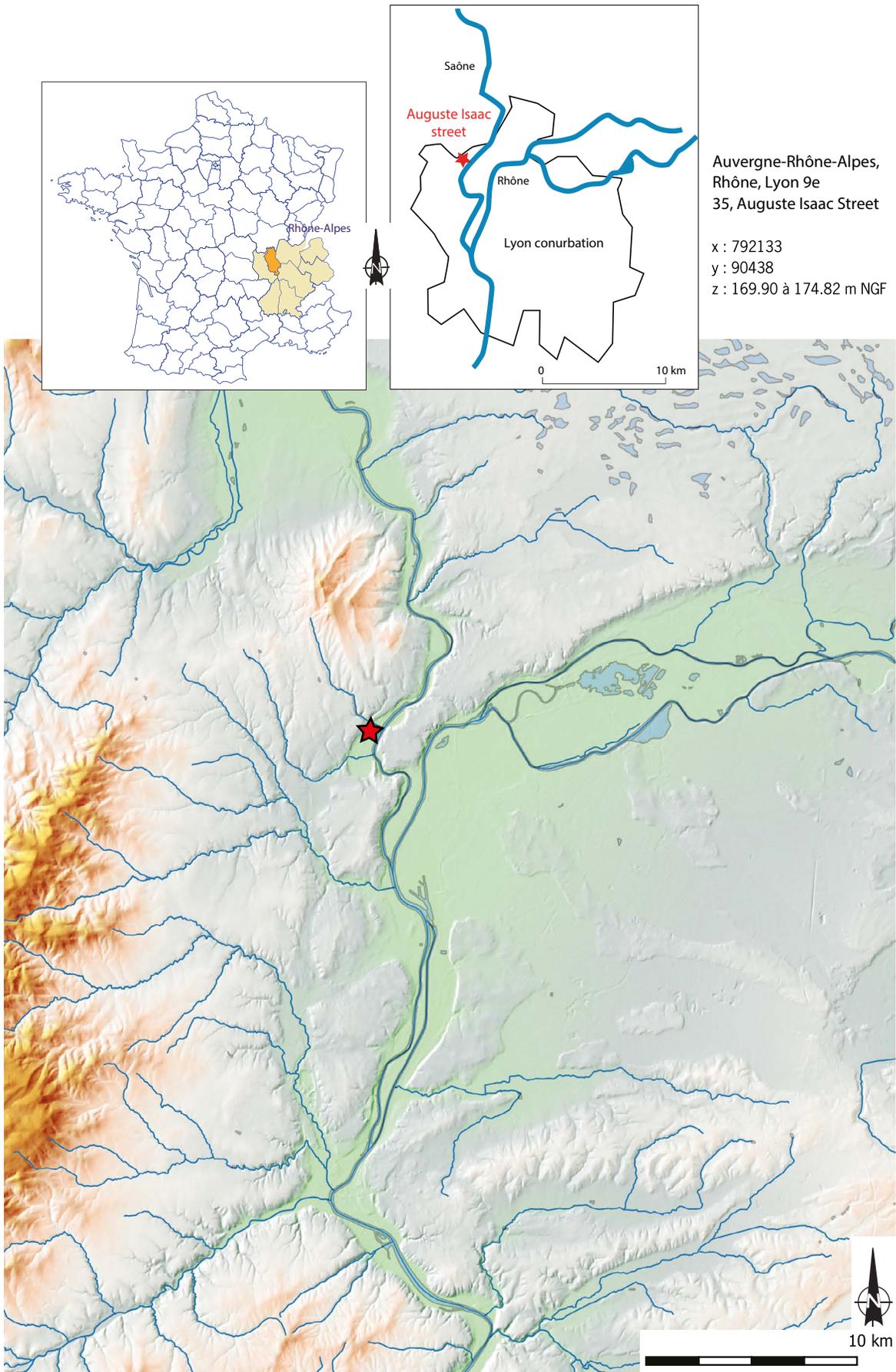


Figure 1: Site location in the Lyon area (France; DAO B. Rambault, Inrap).

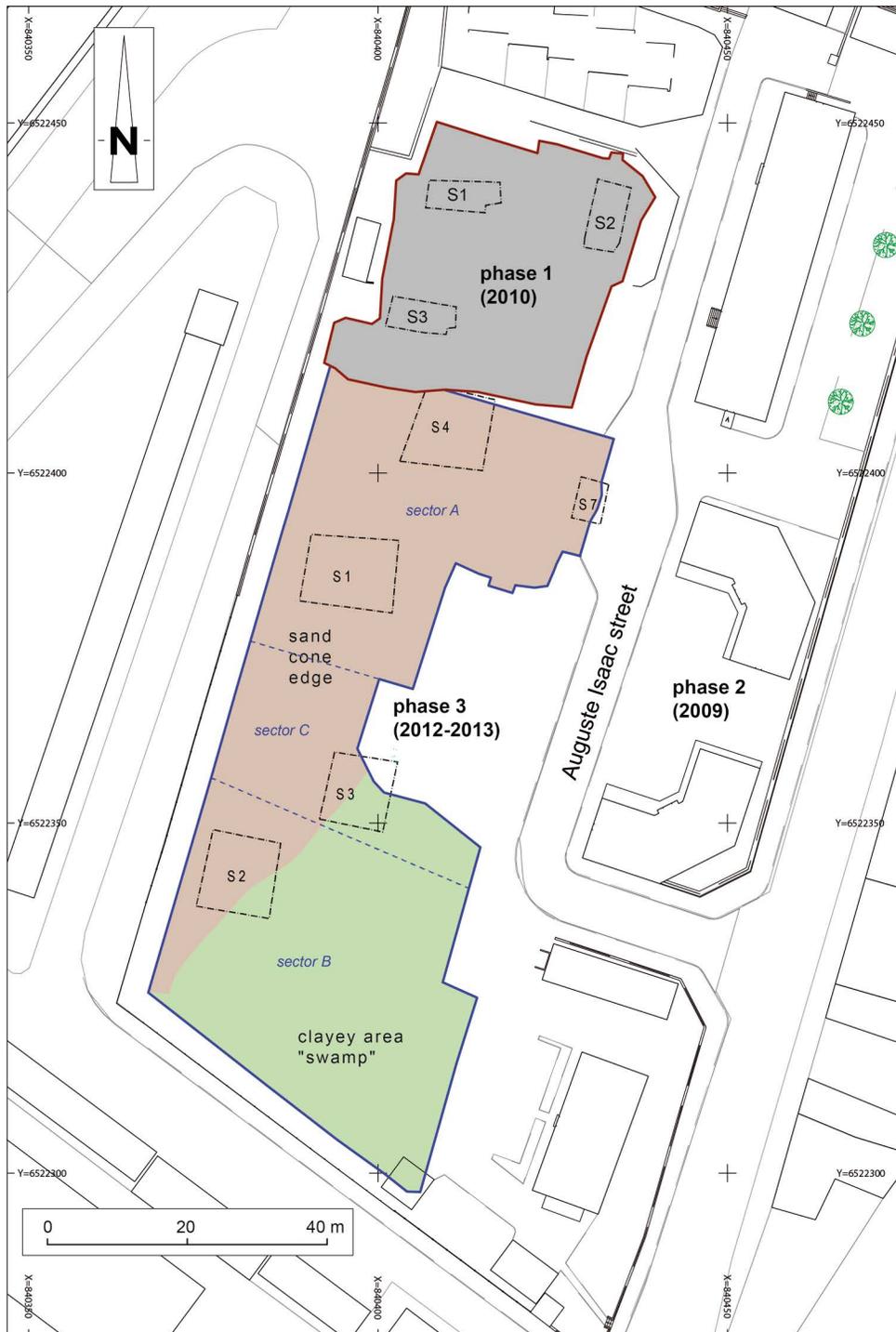


Figure 2: Plan of the various surveys and excavations carried out at 35 Auguste Isaac Street between 2009 and 2013.

1. Bell beaker decorated ware

1.1. Context

The Bell beaker occupation was particularly dense in the northern and especially north-central part of phase 3 (Figure 3). It was represented by a layer of fairly dark brown sandy loam (base of US58).

Three limited areas were established for surface manual excavation along the edge of the Epipaleolithic levels excavation. They were characterised by a 10 to 20 cm thickness of sediment (US272, US273 and US299). The archaeological material was predominantly from the Bell Beaker period, yet the rarity of ceramic refittings, the absence of structures and the presence of a few barbed-wire sherds indicated colluvial deposits containing some Early Bronze Age elements.



Figure 3: General plan of the structures from or attributed to the Bell Beaker occupation during phase 3 of the excavation, the richest in remains for this period (records by the excavation team, topography by S. Couteau, and synthesis by P.-J. Rey).

However, two sunken structures could be related to the Bell Beaker occupation. They suggest a better conservation of the deposits in the northeast corner of sector A (unfortunately largely unexcavated): F372 and F401.

1.2. Description of decoration

The various sites yielded about 180 decorated sherds related to the Bell Beaker period, 126 of which were from the phase 3 excavation alone (consisting of 95 isolated sherds or Ti and 17 pairing units or UA). An additional 17 isolated sherds came from the phase 3 excavation (inventory numbers starting with an 'M' in figures 4-6 and 8), 11 from the phase 1 excavation (inventory numbers starting with 'MC' in figures 4-6 and 8) and 11 from the phase 1 excavation (inventory numbers starting with 'Tr1' in figures 4-6 and 8).

Fragmentation, surface alteration and the presence of concretions sometimes made it very difficult to estimate the minimum number of individuals and

made it hard to lead a proper decoration analysis. After refitting and matching, the number of individuals was reduced to about 159.

Different techniques are in use for the decorations:

- The incision technique, used for both lines and motifs that fill in the bands, is present on 49.1% of the vases (78 individuals) and the fluted line on 5.7%.
- The punctual impression is present on 48.4% of the vases (76 individuals). These are mainly various types of punches. It is possible to identify 8 different impression "families", the shape of which depends on both the tool and the way it is held: triangular impressions (21 occurrences), round (14), foliated (13), fine pointed (13), rhombic (5), vertical arciform (5), rectangular (3) and tubular (4).
- Simple spatula impressions concern 33.3% of vases, mainly in the form of fillings or more rarely as single or multiple continuous lines.

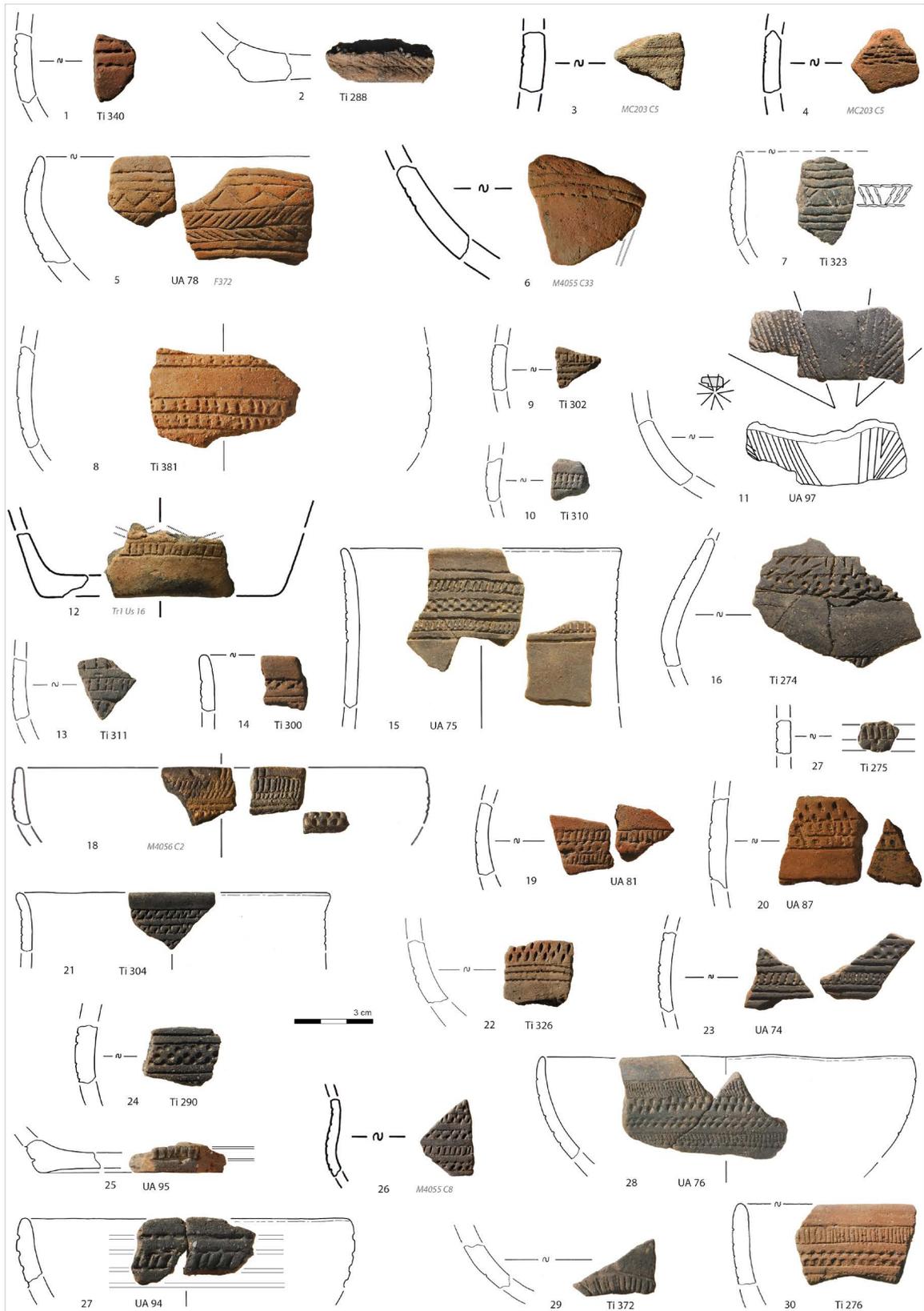


Figure 4: Decorated Bell Beaker ceramics from 35 Auguste Isaac Street. 1-6 and 11: decorations entirely made with a comb. 8-10, 12-13, and 20: decorations based on horizontal lines made with a comb and bands executed with a bifid or notched spatula, related to the bourguignon-jurassien style. 7: decoration made with a narrow spatula, imitating a small cord. 14-19 and 21-27: decorations related to the rhodano-provençal style based on horizontal lines made with a comb. 28-30: decorations based on horizontal lines made with a spatula. Probable match between 5 and 6, which were uncovered during two distinct interventions.

Some narrow spatulas are sometimes bifid (5.7%; Figure 4 nos. 8 and 14 or Figure 6 no. 15) or notched (4.4%; Figure 4 nos. 20 or 28).

- Comb impressions are seen on 17% of the vases (27 individuals), with a varied range of tools. The impression is generally fine, less than 1 mm wide. Two sherds show significantly wider impressions (Figure 4 nos. 1 and 27).

The four main techniques are never all represented on the same vase. The most frequent associations involve two of them, while associations of three techniques are more rarely encountered. Incisions and punctual impressions form the most frequent pairing.

Six main themes are present on more than 10% of the vases:

- The continuous horizontal line, either single (64.8% of decorated individuals) or multiple (25.8%) are present on a total of 144 individuals. They are made by comb stamped in 24 cases (Figure 4 nos. 1-27) or with spatula in 6 cases. They appear incised in 57 cases, fluted in 8 cases and both incised and fluted on the same vase in one case (Figure 6 no. 16).
- The narrow band of spatula impressions or short incisions, also called "ladder pattern" (37,1 %). It is generally bordered on both sides by a continuous line, but there are four unrestricted cases, either on one side or on both sides (Figure 6 nos. 4, 17 and 28, and also Ti 278 not illustrated).
- Shifted pairs of stamped horizontal lines (32.7%) also called "zipper" pattern, which are usually limited by continuous lines (with an exception: Figure 4 no. 28).
- Groups of continuous vertical lines (10,1 %).
- Simple horizontal stamped lines (10,7 %).
- Bands filled with more than two horizontal or oblique stamped lines (10,1 %).

Secondary themes include bands of obliquely hatched bands (8.2%), mostly incised or spatulated, and combed in 2 cases (UA 78 and Ti 288), vertical lines single (3.8%) or multiple (2.5%) or of unknown number (3, 1 %), nested chevrons (3.8 %) or single (1.3 %), continuous oblique lines (3.1 %), vertical (2.5 %) or oblique (1.9 %) single stamped lines, horizontal line over-stamped with punctual impressions to obtain a false barbed pattern (asynchronous barbed; 2.5%) and finally filled with incised or spatulated strip of crossbars (1.3%).

Some vases have particular motif organizations. Three sherds have very spaced or discontinuous ladder patterns (for example: Figure 5 no. 33). Five pots carry a band organised in metopes (Figure 6 nos. 12 and 18-20) and 3 other recipients present an alternation of decorated oblique bands and empty areas (Figure 6 nos. 15-17).

A minimum of nine vertical stripes or radiating panels are installed on the base of pots with rounded bottoms.

The execution of the decorations is very often neat and regular, but three individuals stand out for their clumsy quality (Figure 5 no. 34). Most of the time the decoration is the last step of the shaping process, but UA 96 was burnished after the application of the stamped patterns, which partially obliterated them (Figure 5 no. 1).

Finally, two sherds belonging to large-diameter, coarse-paste vases bear widely spaced impressions, probably made with plant stems (Figure 6 nos. 9-10). The disordered decorations with nail or small spatula constitute a major type of Bell Beaker common ware (type 9; Besse, 2003, fig. 66 and 78). They are particularly well represented in Northern Italy. Good examples can be found in Derrière-le-Château, Géovreissiat (Ain; Besse, 2003, pl. 12), in Le Châtelard, Bourg-Saint-Maurice (Savoie; Rey *et al.*, 2012, fig. 14), in the cave of the Margot, Montrond (Jura; Besse, 1996, pl. 23) and in Noir Bois, Alle (JU; Othenin-Girard, 1997, pl. 9 nos. 8-10).

1.3. Shapes

The high fragmentation does not allow for a very detailed analysis nor a representative overview of the shapes decorated vases. Carinated pots are well represented (13 individuals) as are bowls and cups (11 cases). High shapes with sinuous profiles are only perceptible in 5 cases and the presence of a narrowed opening is noticed on 4 fragments. Rounded bottoms appear to be present or potentially present in 15 cases, three of which show a clear umbilicus. The flat bottom is known on 7 individuals, three of which are associated with a slight concavity. These characters are classic in the corpus belonging to stylistic group 3 of Southeast France Bell Beaker (Lemerrier, 2004, p. 349-351).

1.4. Stylistic groups and comparisons

Presence of organised incised and stamped decorations, horizontal lines limiting the decorated bands and radiating decorations on the rounded bottoms characterise the incised and stamped style which constitutes the main component of the stylistic group 3 of the Bell Beaker culture from southeastern France (Lemerrier, 2004, p. 339; Lemerrier and Furestier, 2009).

The main decorative themes of Isaac Street are all very common in the rhodano-provençal style. Among the secondary themes, the single, double or multiple lines of punctual impressions, as well as the lines of tubular impressions, are also well represented in the rhodano-provençal style sets (Lemerrier, 2004, p. 331-334). The wide stamped bands are known in level B3 from Balme Rousse, Choranche (Isère; Vital and Bintz, 1991, fig.

THE BELL BEAKER AND EARLY BRONZE AGE DECORATED WARE

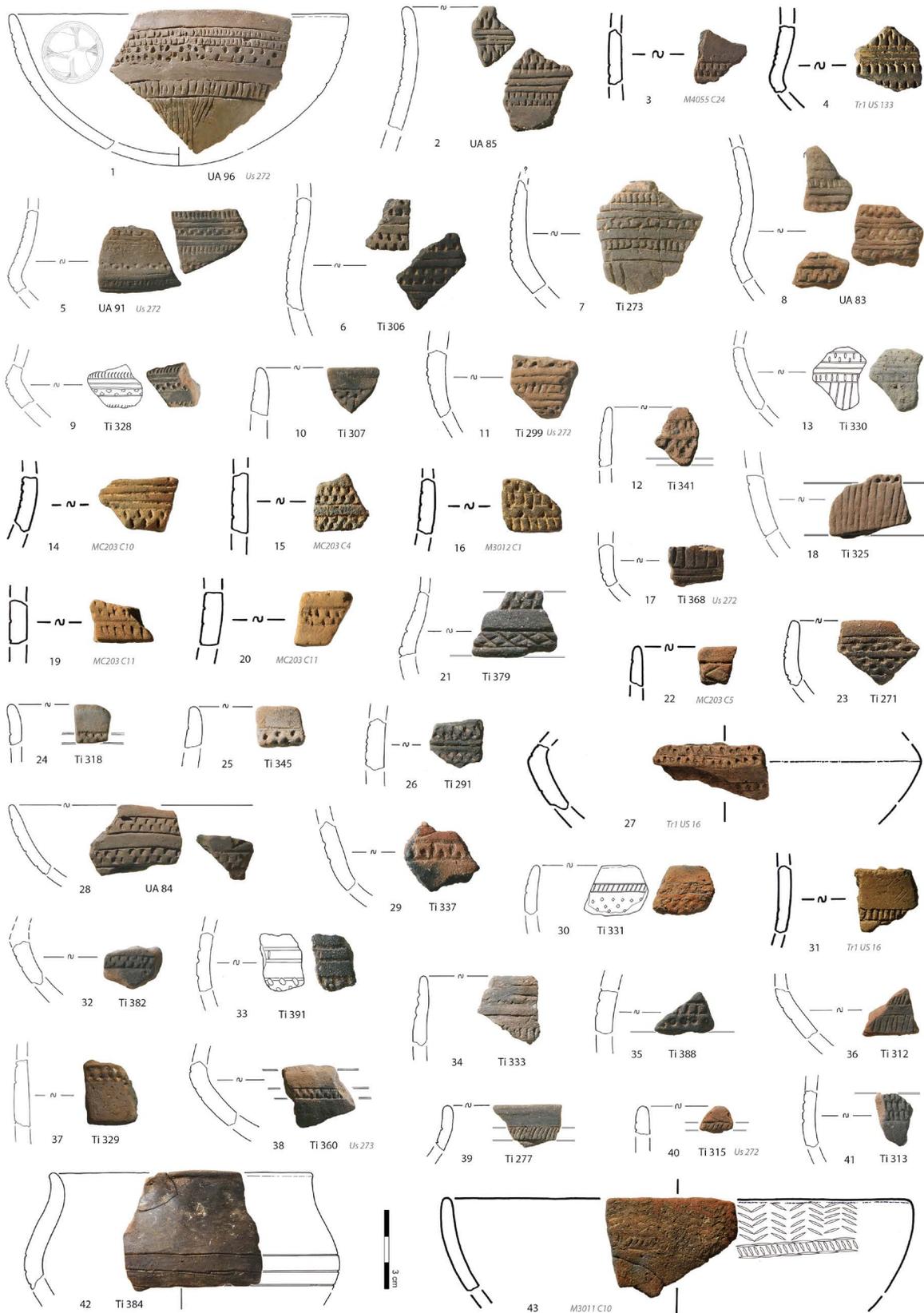


Figure 5: Decorated Bell Beaker ceramics from 35 Auguste Isaac Street. 1-41: decorations related to the rhodano-provençal style based on incised or likely incised horizontal lines and more rarely fluted horizontal lines. 42: atypical decoration exclusively made of incised lines. 43: vase which seems to be entirely decorated with a spatula. Probable match between n° 2 and 3, which were uncovered during two distinct interventions.

21) or in the cave of Reychas, Saint-Nazaire-le-Désert (Drôme; Lemerrier 2004, fig. 140). The line of hollow stem impressions is present for example on 3 recipients in Géovreissiat (Ain; Salanova, 1997).

The double vertical lines of punctual impressions are rarer in the South-East of France, but they appear punctually in rhodano-provençal contexts, for example on the site from Maupas, Calvisson (Gard; Lemerrier, 2004, fig. 160), in the shelter no. 2 from Fraischamp, La Roque-sur-Pernes (Vaucluse; *ibid.*, fig. 242) and on the Vignarets site, Upie (Drôme; *ibid.*, fig. 149). They are also known in the burial of Comboire, Claix (Isère; *ibid.*, fig. 193).

The multiple continuous vertical lines (Figure 5 nos. 13, 17-18) could belong to wide incised scales, a rare decoration, but present on a rhodano-provençal beaker from the Chauve-Souris cave in Donzère (Drôme; Vital, 2006, Figure 13 no. 13). On this deposit, the presence of this theme is interpreted as an indication of interactions with the Fontbousse culture.

Simple incised or stamped chevrons are rare in southeastern France, whereas multiple nested chevrons are better represented and quite widely distributed (Lemerrier, 2004, p. 335). Several examples are known in the Grande Baume cave, Gémenos (Bouches-du-Rhône; *ibid.*, fig. 93), in Maupas, Calvisson (*ibid.*, fig. 159), in Font de Figes, Montpézat (Gard; *ibid.*, fig. 167), in Derrière-le-Château, Géovreissiat (Salanova, 1997) and in the Baume de Gigny cave (Pétrequin *et al.*, 1988, fig. 12). The simple chevrons' origin is sometimes attributed to influences from the Fontbousse culture.

The incised or stamped scale with interruptions is an infrequent theme with a very southern distribution (Lemerrier, 2004, p. 337). It was found for example in the shelter of Pendimoun, Castellar (Alpes-Maritimes; *ibid.*, fig. 41), in the Grande Baume cave, Gémenos (*ibid.*, fig. 93) and on the site from La Capelle, La Capelle-Masmolène (Gard; *ibid.*, fig. 166).

Horizontal lines over-stamped to obtain a false barbed pattern (asynchronous barbed wire) and bands of stamped motifs not limited by horizontal lines are not common in rhodano-provençal contexts. They can be observed for example at the Sainte-Anne Pass, Simiane-Collongue (Bouches-du-Rhône; Lemerrier, 2004 p. 164; Vital *et al.*, 2012, p. 442), in La Chatière, Conjux (Savoie; Bocquet *et al.*, 1987, fig. 2A) or in level B3 from Balme Rousse, Choranche (Vital and Bintz, 1991, fig. 21 no. 11) for the over-stamped lines, and on the site from Maupas, Calvisson (Lemerrier, 2004, fig. 158 to 161), in the Baume Sourde, Francillon (Drôme; *ibid.*, fig. 143), in the Reychas cave, Saint-Nazaire-le-Désert (*ibid.*, fig. 140), on the site from Vignarets, Upie (*ibid.*, fig. 149), and in Lyon, 79/81 Gorge de Loup Street (Rhône;

Hénon, 2007, fig. 41) for the not limited bands. These are also known in late Bell Beaker Vaise style, in Lyon, BPNL (Rhône; Vital *et al.*, 2007) or in the material of Bourbonnais Street / ZAC des Blanchisseries (Rhône; Rahatsöz, 1996), which could suggest a rather late dating for the few elements of this type from Isaac Street.

The strips of crossbars are a motif that seems to be absent in Bell Beaker groups from southeastern France (Lemerrier, 2004, p. 339). It is known, however, in the Gorge de Loup site (Lyon), in a late Vaise-style assemblage (Vital *et al.*, 2012, pl. 98 no. 2), and then appears more frequently among the themes of Early Bronze Age barbed ware (*ibid.*, figs. 51 and 52). It is known regionally on a sherd with incised decoration attributed to the Early Bronze Age from the Batteries-Basses cave, Virignin (Ain; *ibid.*, pl. 97 no. 16). If the association of themes observable on the Ti 379 sherd links it without problem to the Bell Beaker productions (Figure 5 no. 21), the presence of strips of crossbars could therefore constitute a late feature.

While radiating decorations on the bottom are well represented in the rhodano-provençal style, the number of radiating bands is usually an even number greater than two (Lemerrier, 2004, fig. 277). The thematic and organization of the two best-preserved individuals from Auguste Isaac Street do not find comparisons (only two opposite triangles for UA 96, which is a special case; potential quintuple combed triangles for UA 97, which would be more related to the bourguignon-jurassien style).

The metopes decorations are not very frequent but are widely distributed. They appear in the rhodano-provençal as in the bourguignon-jurassien styles or in central Italy (Lemerrier, 2004, p. 337; Vital *et al.*, 2007, p. 37)

The punctual impressions present rather classic types in the rhodano-provençal style. Only the presence of several cases of horizontal lines of arciform patterns is out of the ordinary and constitutes indeed a particularly rare theme in the South-East of France (Lemerrier, 2004, p. 331-332).

One sherd has a stamped decoration consisting of groups of 4 horizontal lines framing a band filled with alternating oblique lines 3 by 3 (Figure 4 no. 7), which imitate the trace of a small cord and could be interpreted as an indication of an earlier phase. This element does not find direct comparisons.

Most of the sherds with horizontal comb lines are also stamped with punches, and bear decorative themes characteristic of the rhodano-provençal style. Decorations of this type have already been discovered

in Rochette Chevrier Street in Lyon (Chastel *et al.*, 2003 p. 44). A small group distinguishes itself by the exclusive use of comb and bifid or notched spatula (Figure 5 nos. 5-6, 8-13 and 20). The use of these tools and themes dominated by horizontal lines and scales refers to the bourguignon-jurassien style (Salanova and Ducreux, 2005). However, we note the presence on UA 87 of two shifted stamped lines that constitute a very common theme of the rhodano-provençal style and which we find, with the same technique, on a vase from the Baume de Gigny cave (Pétrequin *et al.*, 1988, fig. 11).

Rare sherds decorated exclusively with a comb cannot be linked to the rhodano-provençal style. Very fragmentary elements bearing horizontal lines or a hatched band (Figure 4 nos. 1-4) could be related to stylistic groups 1 and 2 of the Bell Beaker culture from southeastern France (Lemerrier, 2004, p. 341), even if the alternative hypothesis of an attachment to the bourguignon-burassien style cannot be completely ruled out. A small bowl shows a comb decoration of horizontal lines, simple chevron and hatching (UA 78, Figure 4 no. 5), which belongs more definitely to the geometric stipple style of the Bell Beaker style group 2 (Lemerrier, 2004, p. 341).

Finally, a small group of sherds bearing a series of vertical or oblique motifs inscribed between two lines and potentially two horizontal bands, as well as a checkerboard background (Figure 6 nos. 12 and 14-19) can be related to the late Bell Beaker Vaise style (Vital *et al.*, 2007). Other more atypical or highly fragmented elements (Figure 6 nos. 11, 13 and 20-25) could also belong to the Vaise style, but they are too small to be certain.

1.5. Stylistic assessment and regional context

With a minimum of 118 certain individuals and a maximum of 159 possible vases, the Bell Beaker corpus from Auguste Isaac Street is by far the second largest in number in the entire Auvergne-Rhône-Alpes region, after the settlement of Géovreissiat, Derrière-le-Château, which yielded a maximum of 292 vases, undoubtedly overestimated (Salanova, 1997).

The majority of the decorated Bell Beaker sherds are thus related to the southern rhodano-provençal style (93 individuals). A few rare elements could either belong to an earlier phase (linear and cross-hatched comb decorations and one imitation of small cord decoration: 5 individuals) or be influenced by the bourguignon-jurassien group (7 individuals). A small batch and a few ambiguous sherds refer to a late local evolution: the Vaise style (from 6 to 13 individuals). Finally, about 25% of all sherds cannot be precisely attributed, either because of a lack of comparisons or due to their small size.

Represented throughout the southeastern quarter of France, the rhodano-provençal Bell Beaker style constitutes the third stylistic in the classification of Bell Beaker styles, and corresponds to a recent phase in the evolution of decorated ware. In the Rhone Valley, the density of sites attributable to this style decreases significantly beyond the confluence of Isère and Rhone rivers (Lemerrier, 2004, p. 181; Lemerrier, 2014 fig. 8). The Beaume site in Châteauneuf-sur-Isère (Drôme) marks the northern limit of the high-density zone. Beyond that, the rhodano-provençal style appears in a more punctual way in level B3 from Balme Rousse, Choranche (Vital and Bintz, 1991), in the Grande Rivoire shelter, Sassenage (Isère; Lemerrier 2004, fig. 194), in level 36a from the Gardon cave, Ambérieu-en-Bugey (Ain; Besse, 2013, fig. 229), in La Chatière, Conjux (Bocquet *et al.*, 1987, fig. 2A) and in the Sur Les Barmes shelter, Marlens (Haute-Savoie; Serralongue and Rey, 2005), and also in the Baume de Gigny cave (Pétrequin *et al.*, 1988, fig. 11) and in the Font de l'Or site, Cleppé (Loire; Patouret and Charvet, 2014, fig. 195 and 225). In Lyon, several elements were already known at the 41-43 Bourbonnais Street (Plassot and Frascione, 1999, pl. 14; Le Nézet-Célestin *et al.*, 1999, pl. 35; Le Nézet-Célestin and Franc, 2000 pl. 20), and at 79/81 Gorge de Loup Street (Hénon, 2007, fig. 40-41).

The bourguignon-jurassien style develops north of Lyon (Lemerrier, 2014, fig. 8). It is characterised by comb-stamped decorations and by themes of horizontal lines, ladder motifs and chevrons. Its chronological insertion is not yet certain, but it is considered to be close to that of the rhodano-provençal style. It is well represented in Saône-et-Loire, at the sites of La Noue, Saint-Marcel (Salanova and Ducreux, 2005) and La Pérrouze, Lux (Ducreux, 2013). The site of Derrière-le-Château, Géovreissiat (Ain), which is located on the southern edge of the bourguignon-jurassien style's extension area, still contains 89% of sherds with comb, geometric and linear dotted decoration, and only 7% of incised and stamped decoration (Salanova, 1997).

The rhodano-provençal corpus of Auguste Isaac Street is rich and very homogeneous and confirms the presence in Lyon of an occupation directly influenced by this southern style. Only a few vases with combed decoration refer to the bourguignon-jurassien style. This situation contrasts completely with that observed at Géovreissiat. One can deduce a chronological discrepancy or the existence of a border effect between Lyon and Géovreissiat. The Isaac Street corpus also stands out from the few elements from the Savoyard Alpine valleys: the Vieille Eglise shelter, La Balme-de-Thuy, Haute-Savoie and Les Vignettes, Bellentre, Savoie (Ginestet *et al.*, 1984; Rey and Moulin, 2019, fig. 8) where the use of the comb also dominates.

Placed between 2200 and 2050 cal. BC by Joël Vital (Vital *et al.* 2007), the late Bell Beaker Vaise style could

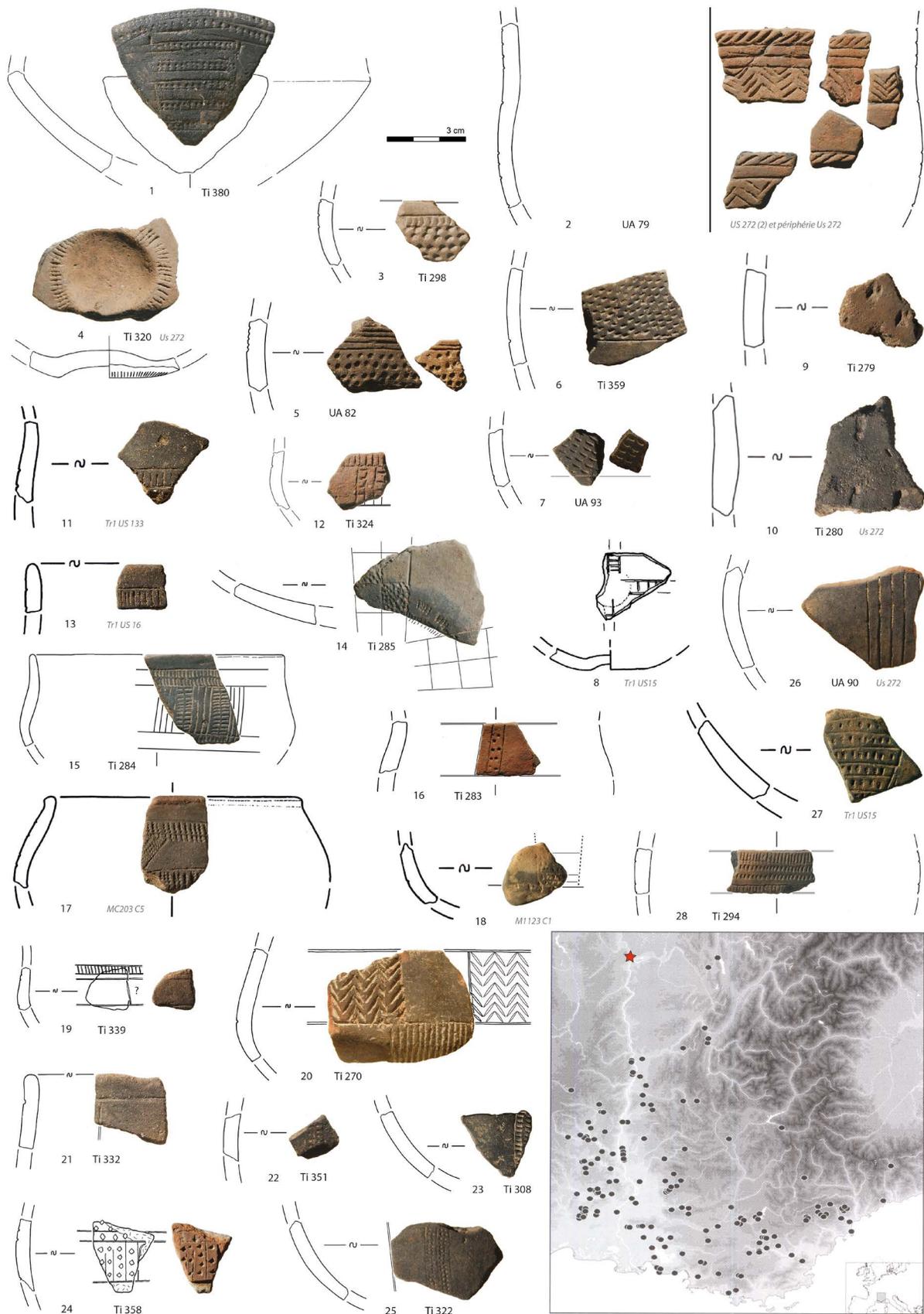


Figure 6: Decorated Bell Beaker ceramics from 35 Auguste Isaac Street. 1-8 and 26-28: uncommon patterns. 9-10: impressions made with a vegetable stem on fragments of coarse vessels. 11-25: elements related in a more or less convincing way to the late Vaise style. Bottom right: map of the sites where the rhodano-provençal style was observed and location of the site at 35 Auguste Isaac Street (according to Lemerrier and Furestier 2009).

be partially contemporary with the very first phase of the Early Bronze Age. It is characterised by double band decorations with incised fillings, stamped with comb or more rarely with punch, often framing a metope pattern of scales and vertical lines. The lower part of the recipients bears radiating bands sometimes accompanied by triangles. A checkerboard filling is known (*ibid.*, fig. 17 and p. 37). The Vaise style has already been encountered in Lyon, in BPNL, in Gorge de Loup (Martin and Gesler, 1989, fig. 1; Vital *et al.*, 2012, pl. 98), and in the material of Bourbonnais Street / ZAC des Blanchisseries (Rahatsöz, 1996, fig. 14-15), and also further in Grange Rouge, Quincieux (Rhône; Ramponi, 2018) and perhaps in Font de l'Or, Cleppé (Loire; Patouret and Charvet, 2014, fig. 225).

The presence on Auguste Isaac Street of a few Vaise style sherds is consistent with the series of 4 radiocarbon dates centered on the 22nd century cal. BC obtained on the site. The small number of sherds attributable to this stage indicates an occupation of small scale or one that is much more poorly preserved than that of the rhodano-provençal phase. The Isaac Street site therefore hardly adds to the corpus of this late local style, which is still poorly known.

2. Early Bronze Age decorated ware

2.1. Context

This occupation can be related to an Early Bronze Age phase (21st / 22nd century cal. BC). The settlement remains consist of two large elongated houses of northeastern tradition (Figure 7), which are known from two other regional sites: "PIPA Lima", Saint-Vulbas, and La Cotette (Ain; Lemaître and Argant, 2018; Treffort, 2020). They are surrounded by additional structures and facilities: secondary built structures, buried vases, various pits, and posts, some of which seem to belong to fences that could incorporate elevated markers (milestones) to the north. Between the two houses is a poorly documented silage area. The general organization of these remains suggests a possible contemporaneity: the distribution of C dates in two groups, "old" and "recent", can be explained by charcoal inherited from previous occupations and/or by old wood effects (F487 (post hole house B): Poz-71770 = 3725±35 BP, F535 (pit): Poz-71773 = 3740±35 BP and F462 (filling of buried vase): Poz-71769 = 3725±35 BP for the oldest group; F534 (pit): Poz-71772 = 3590±35 BP, F428 (post hole house A): Poz-71767 = 3620±35 BP, F397 (post hole house A): Poz-71766 = 3590±35 BP and bone no.5324 (upper part Mesolithic excavation): Poz-71641 = 3555±35 BP for the for the newest group). The Early Bronze Age inornate ceramic material refers to characteristic facies of the rhodanian domain, attributable to the first phase of this period. It is therefore compatible with the barbed and incised decorations.

2.2. Decorations description

There are 57 sherds (including 49 from the excavation of Trench 3) representing a minimum of 41 distinct individuals. Most of them have barbed decoration, but 8 of them have complex, deeply incised decoration and one sherd has a pattern of vertical lines of half-moon impressions (not illustrated).

The majority of these elements come from sector A of phase 3. Only two recipients with incised decoration have a significant context: US464 (a flake of soil excavated at the opening level of a large buried jar, undoubtedly directly linked to House 1) and F535 (a small pit located in House 1, and theoretically associated with this structure).

Two sherds with barbed decoration and two sherds with incised decoration bear what appears to be residual inlays of a light to white coloring material (Figure 8 nos. 14 and 31; and also Ti 344 and 386 not illustrated).

The barbed decorations (Figure 8 no. 1-26) are made with a single tool (synchronous barbed). The majority of barbed sherds bear groups of horizontal lines, separated most often by empty bands, or sometimes by groups of 3 parallel lines (or perhaps more in some cases), vertical organised in metopes, or oblique in nested chevrons. Only one case of simple chevron is known (Figure 8 no. 16).

Towards the lower part of the vases, we find hanging motifs consisting of groups of 3 to 4 short vertical lines (Figure 8 nos. 16 and 21). On one recipient, the decoration is extended downwards by groups of 4 parallel lines arranged in a chevrons pattern (Figure 8 no. 15). Finally, a handle installed above a low inflection probably belonging to a cup (Figure 8 no. 26) is decorated with a vertical scale, perhaps incised, but unfortunately very badly preserved. Apart from this poorly readable sherd, there are only two cases of relatively secure association between horizontal barbed lines and a band of more complex incised motifs (Figure 8 nos. 12 and 23).

The incised decorations (Figure 8 nos. 23 and 26-32) often present an organization rather close to that of the barbed decorations. The regional corpus of incised motifs is enriched by strips of crossbars, ladders, and more occasionally, horizontal arches or V-shaped motifs. One sherd has groups of parallel incisions that are superimposed in a rather anarchic manner (Figure 8 no. 29).

2.3. Shapes

The fragmentation hinders the perception of decorated ware shapes. Nevertheless, we notice that they have various diameters, from the very small beaker (Figure 8

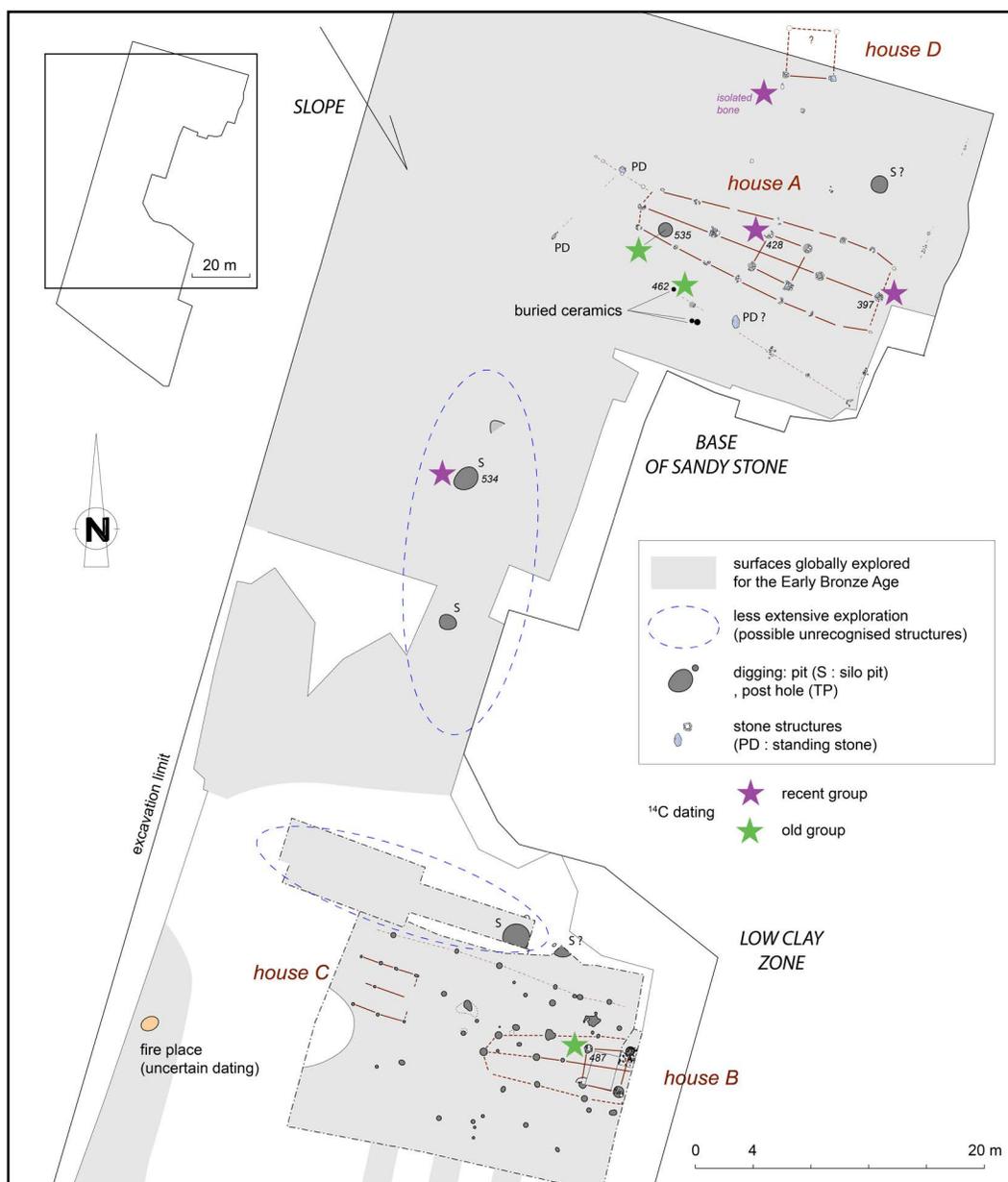


Figure 7: General plan of the structures from or attributed to the Early Bronze Age occupation (records by the excavation team, topography by S. Couteau, synthesis by J.-M. Treffort / Inrap).

nos. 17-18) to the rather voluminous pot (Figure 8 nos. 11, 14, 24, 29 and 31). Narrowed openings dominate. The sinuosity of the ceramic walls is variable. Only three handle departures are preserved and only four sherds show segmentation: two low inflections (Figure 8 nos. 4 and 26; the second probably belongs to a low cup with a handle), a rather low carina (Figure 8 no. 32) and a very pronounced carina (Figure 8 no. 7). Finally, a flattened bottom probably belongs to a large bitronconic recipient (not illustrated).

2.4. Comparisons

The elements with barbed and incised decoration from Auguste Isaac Street currently constitute the largest

series of this type in the north of the Auvergne-Rhône-Alpes region. These discoveries partially rebalance the distribution map (Vital *et al.*, 2012, fig. 40) with respect to the Clermont-Ferrand region and confirm the role of the Rhone axis in the northward diffusion of meridional influences.

The represented shapes are in agreement with the state of knowledge. The great pots and truncated cone jars with narrowed openings evoke productions from peninsular or insular Italy (Vital *et al.*, 2012, p. 91). The small sinuous beakers could constitute original southern productions according to the same author. The presence of a highly carinated vase reflects a legacy of rhodano-provençal productions.

THE BELL BEAKER AND EARLY BRONZE AGE DECORATED WARE

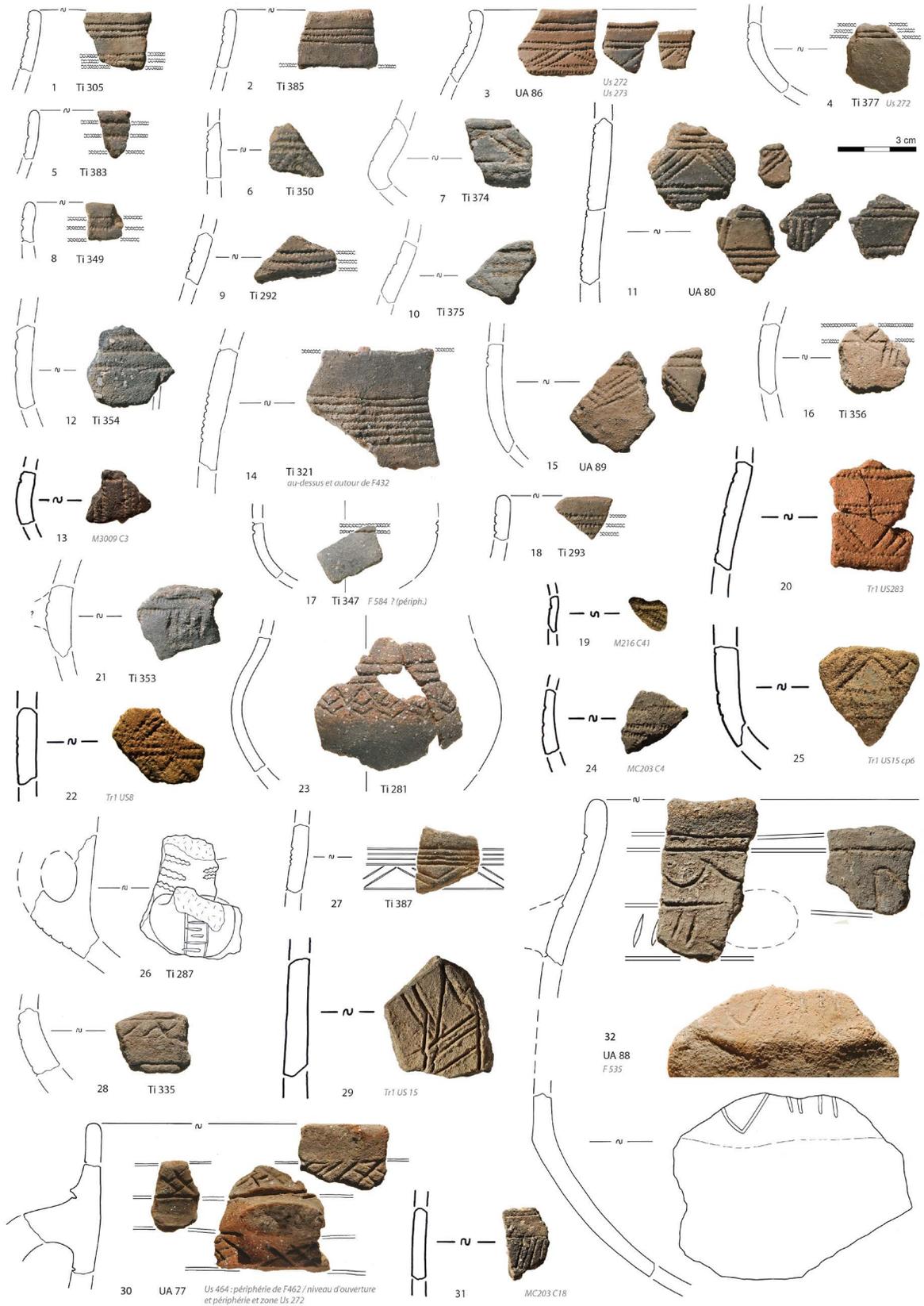


Figure 8: Decorated ceramics from 35 Auguste Isaac Street attributed to the Early Bronze Age. 1-25: barbed wire patterns. 26-31: incised patterns.

The strong representation of the barbed technique over the incised technique or the combination of the two is consistent with the general picture in the Auvergne-Rhône-Alpes region (Vital *et al.*, 2012, fig. 49).

Concerning decorations organization: bands of horizontal lines such as chevrons are frequent and widespread motifs (*idem*, fig. 52). Metopes are a rare but widely distributed theme (*ibid.*, 2012, fig. 55A) and are known locally at Derrière-le-Château, Géovreissiat and in the La Bressane cave, Injoux-Génissiat (Ain; *ibid.*, pl. 113 and 115). Hanging patterns are slightly more frequent, but until now have been distributed exclusively in the south of France (*ibid.*, fig. 55B).

The incised decoration is well known around Lyon in Derrière-le-Château, in the La Bressane cave, in the Batteries-Basses cave (Ain), in the site of Chaninats, Andrézieux-Bouthéon (Loire), in the Tune de la Varaine cave, Boulc-en-Diois (Drôme), as well as in Lyon, 59 Docks Street / Laborde School (Roscio, 2012, fig. 18). The sherd from the Batteries-Basses cave is the only one to have a crisscross band (Ain; Vital *et al.*, 2012, pl. 97 no. 16). Finally, we note the rarity of stamped lines on Isaac Street, which are known in the south of France and in Auvergne.

3. Conclusion

Although largely devoid of stratigraphic context, the decorated ware from 35 Auguste Isaac Street allowed us to clarify the cultural geography of the middle Rhone Valley between the end of the 3rd and the beginning of the 2nd millennium BC. An important series of Bell Beaker decorations attributable to the recent phase mostly belong to the rhodano-provençal style, with a very minor presence of the bourguignon-jurassien style. The Lyon region can thus be clearly integrated into the distribution area of the rhodano-provençal group (Figure 6, bottom right). A small batch of complex decorations, unfortunately very fragmented, seemed to belong to the late Bell Beaker Vaise style. Regrettably, these were too small to significantly increase our knowledge of these local productions, which remain poorly known. Finally, a relatively large series of barbed and incised decorations reduced a gap in the distribution maps (Vital *et al.*, 2012, fig. 40) and confirmed that the Lyon region belonged to the diffusion zone of this style from southern origin.

Barbed decorations appear early in the South of France, e.g., in Camp de Laure in Le Rove (Bouches-du-Rhône), but are not represented in Le Serre I, Roynac (Drôme), the earliest Early Bronze Age ensemble in the mid-rhodanian area. For Joël Vital, there seems to be a shift in the diffusion of barbed decoration towards the North, perhaps linked to the presence of the Vaise style, the chronology of which would partially overlap the

interval of the first Early Bronze Age phase. The various excavations on Isaac Street have not made it possible to establish stratigraphic relationships between the barbed and incised decorations and the rare finds of the Vaise style. During the excavation of phase 3, the radiocarbon dates obtained for the transition between the Neolithic and the Early Bronze Age were organised into two poles. The first covered the interval attributed to the Vaise style, while the second series focused on the 20th century cal. BC and corresponded to the interval proposed by Joël Vital (Vital *et al.*, 2012) for the diffusion of barbed and incised decoration in the Lyon area.

In the absence of a solid stratigraphic context, the ceramic and radiocarbon data from Isaac Street do not contradict the evolutionary scheme proposed by Joël Vital, but unfortunately do not allow us to consolidate his argument.

Acknowledgements

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Degrees of Investment in Bell Beaker Ceramics from North-West France

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Abstract: This work aims to discuss the notion of investment in Bell Beaker ceramic production. It is trivial to point out that traditional typological models imperfectly reflect the whole complexity of a ceramic assemblage. We assume that vessels of the same shape, decoration and decoration technique belong to the same style, but sometimes sharp differences in colour, firing technology, surface treatment, type of fabric or even building technique occur. Conversely, some vessels diverge only in decoration motif, all other criteria for comparison being absolutely identical. Yet in the end they still belong to different styles. Copies, or vessels made by apprentices, could help to explain these differences, but one can also question the validity of traditional typological schemes: can one place a 'standard' Bell Beaker and its copy(s) in the same group just because the shape or decoration is similar? Therefore, another grid of analysis is needed to account for these similarities, since they are often hidden by the shallowest typological parameters.

Our methodology relies on comparative studies based upon ceramics related to the Bell Beaker phenomenon in northwestern France. All vessels are examined under different parameters related to each stage of the *chaîne opératoire*, such as surface treatment or decoration technique. For each parameter we gave a grade corresponding to the aptitude or the investment shown by the potters. In the end comparisons rely on the overall grade of the vessels as well as a specific parameter under scrutiny. We will then discuss the difference of investment observed within and between the pre-existing styles to see what kind of information this approach provides.

Keywords: Ceramic Technology, Chaîne Opératoire, Know-how, Investment, Quality, Maritime Beaker, AOC Beaker, Common ware.

1.a Context: the Bell Beaker phenomenon in northwestern France¹

Recent research on Bell Beaker ceramics from northwestern France has enabled us to define several ceramic styles, build a typo-chronology based on local data and highlight spatial differences in order to distinguish different cultural groups amongst the Bell Beakers of western France (Favrel, 2015, 2020). This work has been partially published as part of a wider review of the Bell Beaker phenomenon and the Early Bronze Age in several regions of western France (Blanchet *et al.*, 2019; Nicolas *et al.*, 2019). The proposition to divide the Bell Beaker phenomenon in three stages is completely compatible with the chronology of north-west France (Lemerrier, 2018):

- Stage 1, 2550 to 2350 BC, the 'phenomenon';
- Stage 2 2350 to 2150 BC, regional Bell Beaker groups;
- Stage 3 2150 to 1950 BC, late phase, corresponding to the traditional Early Bronze Age and the first stage of the Armorican Barrow Culture.

There are four different geographical groups, based on the decorated ceramics (Figure 1):

- The Normandy and the English Channel coastal group, with a majority of comb decorated beakers. Horizontal lines or groups of horizontal lines are the most frequent decoration, followed by chevron decoration and then hatched bands. Currently no true Maritime beakers have been identified, but there are Linear, LBR or AOC beakers;
- The Channel Islands group, not under study;
- The Lower-Brittany group, with a majority of shell decorated beaker. Hatched bands and horizontal line dominate. Maritime, Linear, LBR, AOC/AOO beakers are attested;
- The West-Central group, between the Loire and Garonne rivers, with a majority of comb decorated beakers. Hatched bands and hatched triangles dominate, but overall Maritime, Linear, LBR and AOC/AOO beaker are present.

1.b Ceramic production in the second half of the third millennium in northwestern France

It can be estimated that there are around 4200 vessels related to the Bell Beaker phenomenon in northwestern France. The proportion of common

¹ This work is currently being carried out as part of an ongoing PhD thesis at the University of Paris 1 Panthéon-Sorbonne, titled « Analyse technologique des productions céramique du Néolithique final dans le nord-ouest de la France : l'impact du Campaniforme sur les cultures locales au troisième millénaire avant notre ère ».

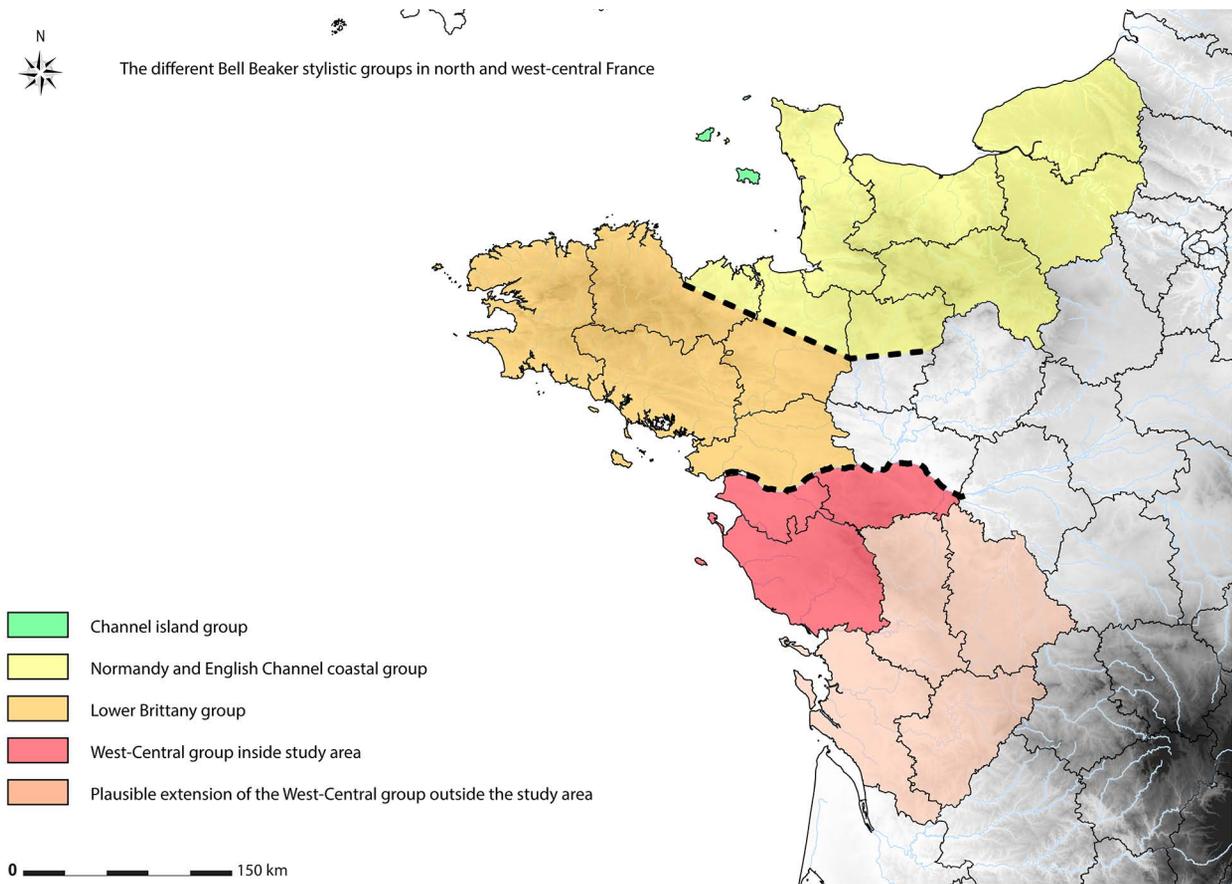


Figure 1: Map of the four different Bell Beaker groups in north-western France.

ware is equivalent to Bell Beakers. Some sites are noteworthy for their very numerous finds, skewing the data. In the case of the dry-stone building at Beg-ar-Loued on the shore of Molène Island, where all the sediment was wet-sieved (Pailler and Nicolas, 2019) des recherches archéologiques sont menées dans l'archipel de Molène. Ce secteur s'avère particulièrement riche en vestiges du Néolithique et de l'Age du Bronze. Une concentration exceptionnelle de monuments mégalithiques y a été mise en évidence. Plusieurs habitats sont attestés par la présence de dépotoirs domestiques. A la pointe de Beg ar Loued (île Molène, the minimal number of individual (MNI) is (over)estimated at 620 vessels based on the number of rims. The site of Le Collédic at Saint-Nicolas du Pelem has been fieldwalked for more than forty years, and here at least 580 vessels have been associated with the Bell Beaker phenomenon (Briard *et al.*, 1997; Le Provost *et al.*, 1972; Ripoche, 2013). For these two sites, considering the fragmentation of the sherds, the MNI numbers should be taken with great caution. In our work we used the MNI to estimate the proportions of the different decorative styles, but excluded these two sites, where bias was too obvious. However, we cannot rule out unknown problems on other sites. The remaining ceramics (around 2900 vessels) can

be attributed either to Bell Beakers (1150 vessels), common ware (800 vessels), undetermined coarse ware (800 vessels) and undetermined fine ware (300 vessels).

2.a Current issues: the limit of current typological models

When dealing with Bell Beaker typology several issues should be addressed. Several Bell Beakers found mainly in megalithic contexts have a coarse fabric. Two vessels from Men-ar-Rompét at Kerbors, Brittany, have even been compared to the former 'flowerpots' belonging to what used to be called the 'secondary Neolithic', now the Late Neolithic period (Giot *et al.*, 1958, 1957). With our current knowledge of the situation, they can be considered as beaker shaped common ware, rather than classic Bell Beaker (Figure 2a). On the other hand, some vessels with a horizontal cordon under the rim do not fit in the category of common ware (Favrel, 2020). They have the shape, fabric, surface treatment and sometimes the impressed decoration of Bell Beaker, with the addition of the cordon, usually found on local common ware through the Late Neolithic traditions. Therefore, we consider them as Bell Beakers influenced by local tradition (Figure 2b).

DEGREES OF INVESTMENT IN BELL BEAKER CERAMICS FROM NORTH-WEST FRANCE

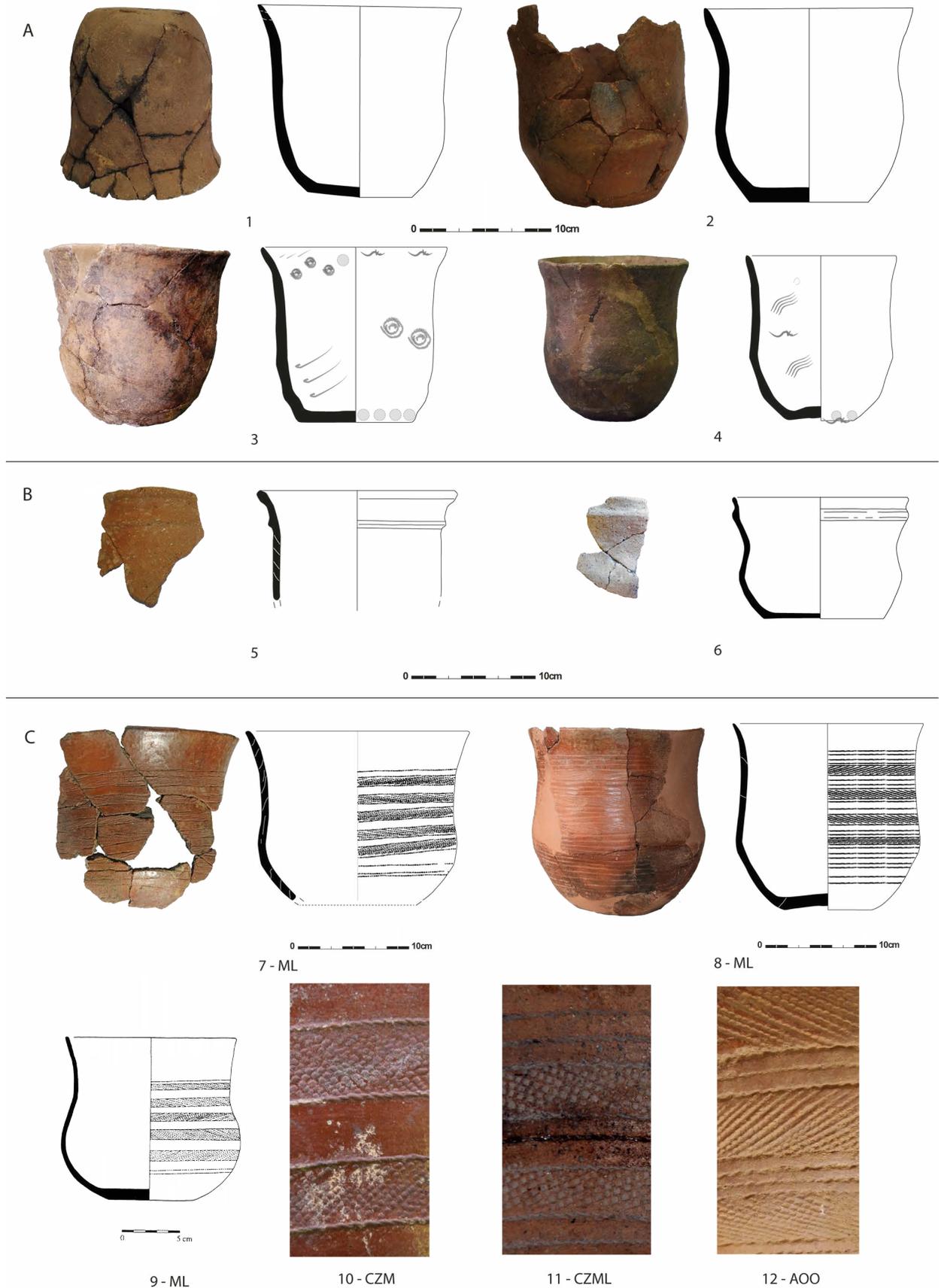


Figure 2: Current typological issues for the Bell Beakers ceramics from north-western France. A: Beaker shaped Common ware, B: Bell beaker with plastic decoration, C: the variations around Maritime beakers. 1 & 2: Men-ar-Rompét, Kerbors; 3 & 4: Butten-er-Harh, Groix; 5: Le Coin des Petits Clos, Trémuson; 6: Lost-er-Lenn, Grandchamp; 7: Kergazec, Plouharnel; 8: Le Net, Er-Bé; 9: Petit-Rosmeur, Penmarc'h; 10: Crugou, Plovan; 11: Kergazec, Plouharnel; 12: L'Île Verte, Ancenis.

Those examples provide evidence for the exchange of ideas between communities producing local common ware and Bell Beaker communities in north-western France.

Another issue should be mentioned for the standard, as several vessels do not fit the three existing categories known as Maritime, Linear and Linear with groups of lines (Salanova, 2000, p. 171). They are decorated with both horizontal lines and hatched bands, but without geometric decoration (Figure 2c). For this reason they cannot belong to the Dotted-geometric style. In the Spanish Meseta, R. Garrido-Pena called these vessels ILM (Intermedial Lined Maritime) or ILV (Intermedial Lined Variety), since the alternation of horizontal line and hatched band was regular (Garrido Pena, 2000, p. 198). As we saw symmetrical and asymmetrical organisation in the decoration of some of these vessels in north-west France, we considered in the first place that we had different degrees of variation around vessels belonging to the standard (Favrel 2015). In some cases there are Maritime beakers with an additional horizontal line under the rim or above the base, sometimes both. In the middle we find the so-called ILV/ILM Beakers with an intermediate line between each hatched band (Favrel 2020, cap. 4, n°5). At the other end of the spectrum, we have a particular shape with asymmetrical decoration made of hatched bands and horizontal lines (*ibid*, fig. 5 n°7). We decided to call these vessels Maritime-Linear (ML), and the ILV/ILM is then a variant within the Maritime-Linear. The situation becomes even more complex when thin cord impression is used for the horizontal lines (Favrel 2020, fig. 5). Several terms like 'Corded-Zoned-Maritime Beaker' or 'All-Over-Ornamented' Beaker are used in the literature to describe these vessels. But there is a difference between the vessels with horizontal lines and hatched bands decorated with cord and combs or shell. The main difference is the presence of true reserved bands, half-reserved bands or their complete absence. We propose to settle the problem by restricting the term AOO only to the vessels without reserved bands, thus closely respecting the definition. The term Corded-Zoned Maritime Beaker on the other hand describes well the classic Maritime beaker, with true reserved bands, horizontal cord impressed lines, without supplementary horizontal lines. Between these vessels we acknowledge the existence of a cord-impressed production with an intermediate horizontal line between hatched bands, dividing the reserved band in half. In other words it is a cord-decorated variant of the Maritime-Linear vessels that we decided to name Corded Zoned Maritime-Linear (CZML). If the decoration is perfectly symmetrical, with a systematic intermediate horizontal line between the hatched bands, vessels could therefore be named more accurately Corded Zoned Intermediate Lined Variety (CZILV) or Corded Zoned International Lined Maritime (CZILM).

Another issue arises when the decoration is not restricted to impression with comb or shell but has unusual associations of techniques. This situation was observed by F. Giligny on Bell Beakers from central-eastern France (Giligny, 1993), where some beakers are decorated with incision and comb impression, or with stamped as well as comb impression. They do not belong to the Dotted-geometric style or the Incised-stamped style of south-eastern France, and were therefore named 'intermediate production'. We recognised these rare associations of decoration techniques in northwestern France, as well as incised-stamped decoration. With the increase in discoveries since the start of development-led archaeology, sufficient material is now available to define new styles based on previously unknown associations of decoration techniques. An overview of all the different decoration techniques is given below.

2.b Current issues: evidence of technological transfer

In west-central France the Artenac culture covers the late Neolithic, before and during the Bell Beaker phenomenon (Burnez and Fouéré, 1999). This contemporaneity with Bell Beakers led to the recognition of Bell Beaker decorative patterns (circular decoration in horizontal bands) and motifs (hatched bands, groups of lines or geometric design) on Artenac cups (Cormenier, 2005, 2009; Pautreau, 1979; Roussot-Larroque, 1984). A hybrid vessel with beaker shape and Fontbousse decoration has been found in the Grotte de la Chauve Souris at Donzère, Drôme (Bill, 1973). As the Artenac and Fontbousse culture are amongst the most dynamic in the first half of the third millennium in France, their interaction with Bell Beaker communities is not surprising. On a deeper level of analysis, petrographic studies conducted on Bell Beaker sites of southern France showed uses of local temper like crushed calcite, as well as of non-local temper like grog in Bell Beaker vessels (Convertini, 2017). The various clay 'recipes' reflect the different influences received by potters making Bell Beakers. Several explanations are possible, such as movement of potters from other regions or acculturation of local potters.

Influences found on Bell Beakers are not restricted to fine and decorated ware from neighbouring Late Neolithic cultures. This comes as no surprise: the Artenac and Fontbousse are considered recalcitrant to the phenomenon during the first stage, although there is good evidence of contact with Bell Beaker people. In this situation we wonder what we might expect in areas where Bell Beakers occur in large numbers? Stronger ties between Bell Beaker communities and local Late Neolithic cultures have been known since the discoveries of Beaker shaped common ware in several megalithic monuments. We already mentioned the two 'Bell Beaker shaped' common ware vessels from Men-

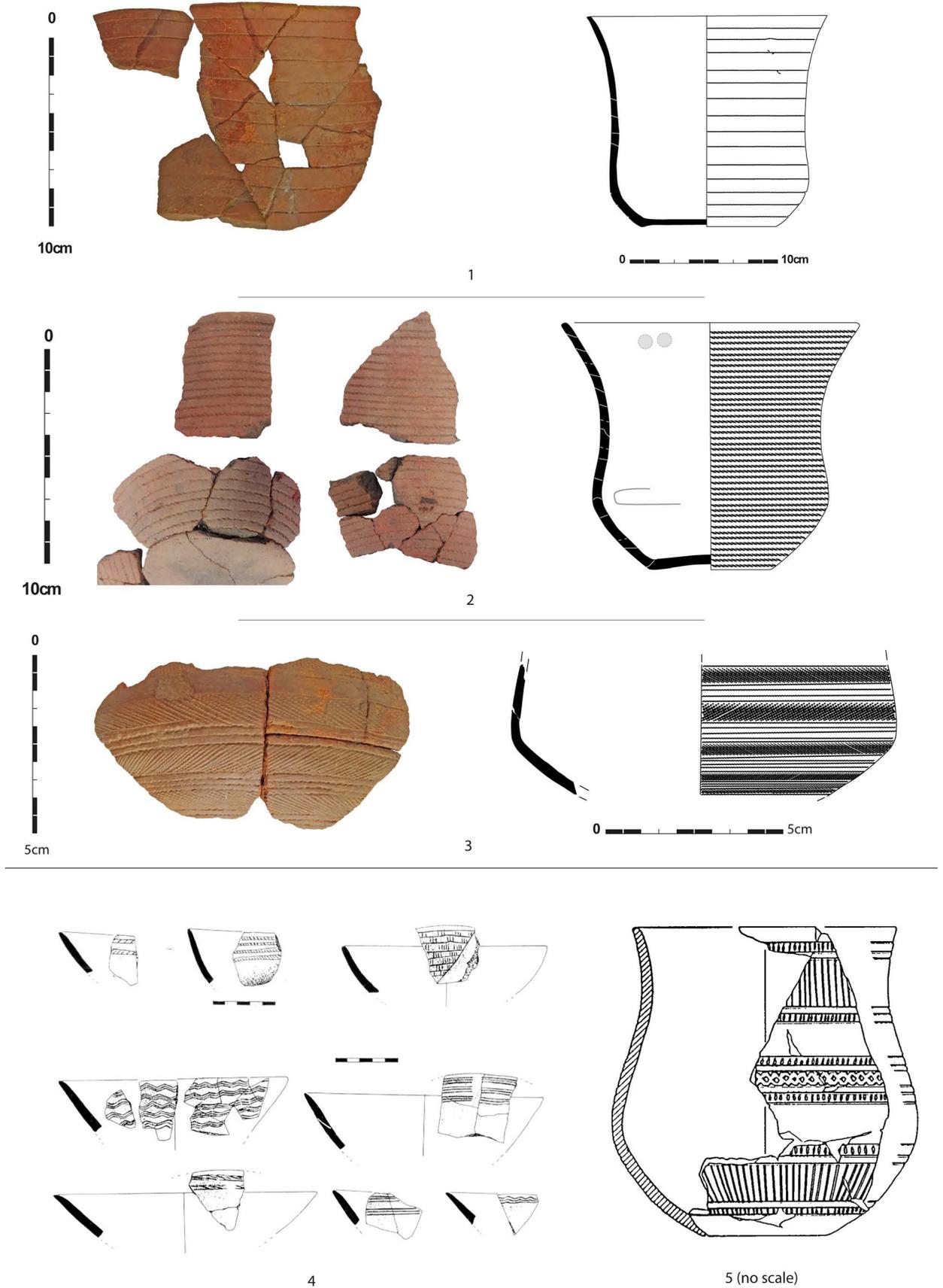


Figure 3: State of the art about relationship between Bell Beaker networks and fine decorated ware from neighbouring Late Neolithic culture. 1 & 3: false-AOC, Men-ar-Rompel, Kerbors; 2: false AOC: Le Goërem, Gâvres; 4: Artenac cups with BellBeaker decorative motive, Le Camp, CHallignac (Burnez *et al.* 1995); 5: Bell Beaker with Fontbouisse decoration, Grotte de la Chauve-Souris, Donzère (Bill, 1973).

ar-Rompét, but there are other examples in Brittany, as La Pie-Le Moustoir at Paule, La Lande-La Bouille at Saint-Caradec, Buiten-er-Harh at Groix, Tuchen-er-Hroëck at Ploemeur or Crugou at Plovan. Their shapes are simpler, the neck is absent or showing a slight curvature, and the base is sometimes protruding or demarcated.

Last but not least, influences within the Bell Beaker phenomenon are recorded. The more obvious are the Bell Beakers with a Maritime shape and fabric but decoration technique and motif from the Rhine area. Bell Beakers from Le Goërem at Gâvres or Men-ar-Rompét at Kerbors are wide with a balanced shape, unlike tall and narrow beakers from the Netherlands. They also have the classic red/orange highly burnished fabric. The decoration technique is a thin S-twisted cord, quite similar but not identical to the cord used in Corded ware (Guilaine *et al.*, 2004). The vessels are not true AOC beakers like vessels from the Netherlands, or the vessel from Le Haut du Château at Jablines, in the Paris basin (Laporte *et al.*, 1992), and we have no evidence of imports, unlike Maritime beakers (Convertini and Querré, 1998; Querré and Salanova, 1994; Salanova, 2004; Salanova *et al.*, 2016). Therefore they must be distinguished from the AOC vessels. As far as we know the Rhine influence did not involve movement of potters, but rather contacts resulting in technical transfer (cord impression). Copy of the tall Beakers from the Netherlands probably involved the same process, like the Linear Bell-Beaker from Crugou at Plovan with line printed with a shell in spiral. To conclude we have evidence of ‘false-AOC’ or ‘false AOO’ (L’Helgouach, 2001, p. 297), defined as partial copies of AOC beakers in northwestern France (Figure 3a). Other vessels might be considered as complete copies or display at least stronger influence from the Rhine area such as the vessels from Kerallant at Saint-Jean-Brevelay (Cussé (de), 1886). But there is no evidence for true AOC traditions, whether imported or made locally by potters moving in from elsewhere.

To sum up, decoration motifs and even decoration techniques initially associated with the Bell Beaker phenomenon are found in contemporary Late Neolithic cultures, and the opposite is true as well (Figure 3b). As with choices of temper, those stages of the *chaîne opératoire* are highly unstable. They are not defining the ‘core’ of a tradition, but rather showing individual preference of potters in fields where changes might deliberately be made after discussion with other potters, as observed by O. Gosselain in south Niger (Gosselain, 2010). Borrowing or copying likely concern these stages more than others, because they are not a challenge to the know-how already acquired by the potters, and changes on ceramics remain slight. Crafting a whole new shape, trying a new type of surface treatment or a different firing process is much

more complicated for potters, because it requires a more significant change or an adaptation in know-how, corresponding more to a change in tradition. Following this idea, unstable stages in the *chaîne opératoire* rather define variants within a tradition, rather than the tradition itself.

3.a Methodology: stylistic attributions

We distinguished five major parameters in our ongoing analysis on Bell Beaker ceramic technology: shape, fabric, building technique, decoration technique and decoration motif.

Ultimately, our goal is to compare the investment in ceramic production for each of these parameters, by performing a Component Analysis. At the current stage of research, however, we will focus in this paper on decoration technique and decoration motif as well as proposing a revision of the terminology of styles.

We distinguished 21 decorative styles, based on 1152 vessels related directly to Bell Beakers and with reference to our previous observation on the boundaries between styles (Favrel 2020). We defined decorative style as a mix between specific decoration techniques and decoration motifs. Many of the styles have already been defined, like the Maritime, the AOC, the AOO, but as we showed, a maritime decoration is not enough to attribute a vessel to the standard, otherwise an Artenac cup with a hatched band would be considered as Bell Beaker. The case of the false-AOC is another example of the different parameters related to ceramics manufacture; a vessel might have a Maritime shape and fabric, with AOC decoration and decoration technique. Although we identified five major parameters in our technological analysis, we decided to restrict use of the canonical terms to decoration style, rather than integrating building technique, shape and fabrics, as these remain largely unknown or poorly documented.

The Maritime and Dotted-geometric styles are generally the most frequent (Figure 4). Undecorated, Linear and Linear with Reserved Bands (LBR) styles are well represented, with more than a hundred vessels each. Yet half of the styles distinguished include less than ten vessels: the stamped-incised style, extremely frequent in the south-east of France is only identified on seven vessels in our study area. More than 44% of Bell Beakers are only decorated with hatched bands or horizontal lines, a proportion reaching exactly 50% if cord impression is included. As 14% of beakers are undecorated, nearly two-thirds of all Bell Beaker ceramics in northwestern France have no geometric decoration. The main styles left are Dotted-geometric (16.7%), incised-geometrical (4.6%) and nail-decoration (4.4%).

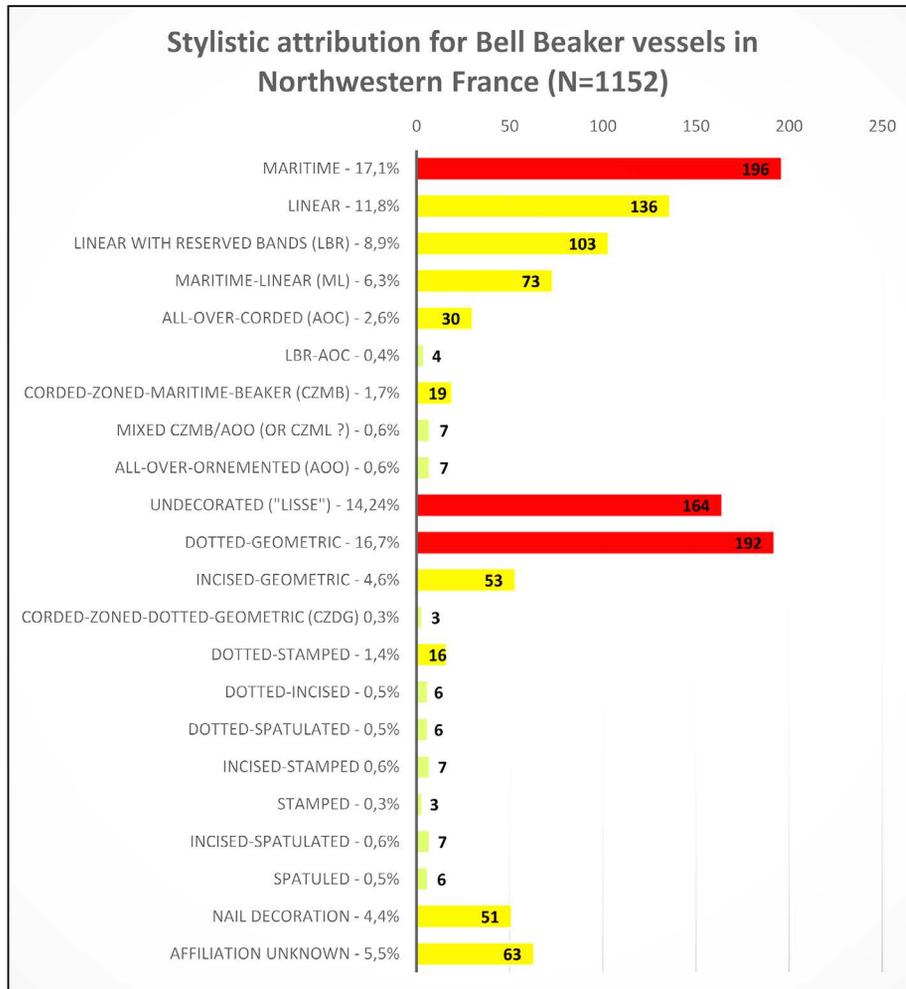


Figure 4: Board of the 21 Bell Beaker styles depending of their absolute number and relative frequency.

3.b Methodology: historical perspective

It seems necessary to reconcile the typological and technological aspects of ceramics studies, as they provide different information that increases our knowledge of ceramics and our overall understanding of the Bell Beaker phenomenon. However, we must determine how to proceed. Should several separate frameworks (typological and technological) be merged or superimposed? In other words, does one tradition always equal one style or can different traditions share decoration motifs or techniques? If the definition of a tradition encompasses all aspects of the *chaîne opératoire*, the number of traditions will likely explode, following the wide diversity of the combinations known for making Bell Beakers (Salanova 2000). On the other hand, if only some parts of the *chaîne opératoire* are used to define a tradition, there will be less possible combinations and less traditions.

We propose a protocol comprising a traditional technological approach coupled with a study of the

degree of investment observed in the manufacture of the vessel. This work is inspired by similar research undertaken on the degree of skill involved in a variety of materials: Early Bronze Age metalworking (Kjuipers 2017, 2018), Bell Beaker and Early Bronze Age arrowheads in Brittany, Denmark and Wessex (Nicolas, 2016); Late Prehispanic ceramics in Peru (Costin 1995); Middle Bronze Age ceramics in Hungary (Budden, 2008); the aptitude of potters from France, Prajapati and Multani Khumar in India (Gandon, 2011). One must also mention the notion of 'quality' in Bell Beaker ceramic production (Salanova, 2012) and work on Copper Age potters' skill in central Italy (Forte, 2019).

We decided to use the term investment rather than quality, because the aesthetic aspects are irrelevant when we consider some common ware vessels were used for cooking. Furthermore, some fine-walled, decorated vessels are brittle, but should we consider this a lack of quality? In other words, quality assumes those vessels fulfil their initial function, but it is not necessarily related to skills if it is independent of aesthetic aspects.

Stage	n°	Grade	4	3	2	1	0
Building	1	Global symmetry	Symmetric	slightly distorted	One strong distortion or several slight distortions	Strong distortions	Unknown
	2	Profile complexity	Complex (strong curvature)	Complex (soft curvature)	Bipartite	Simple	Unknown
	3	Thickness	Very thin (3/4mm)	thin (5/6mm)	Average (7/8mm)	Thick (9mm ou +)	Unknown
	4	Surface topography	No stigmas	Rare stigmas	Frequent stigmas	Numerous stigmas	Unknown
	5	Thickness regularity	Regular	Increasing or decreasing	one-time excess thickness	irregular	Unknown
Surface treatment	6	Treatment intensity	"Mirror"-burnished	Burnished	Smoothed	Poorly smoothed	Unknown
	7	Temper visibility	Invisible	rare grain of temper piercing the surface	Visible in some places	Visible everywhere	Unknown
Decoration technique	8	Lines thickness (tool used)	Very thin shell	Thin comb Thin shell Thin cord	Shell Cord Average comb	Thick comb Scallop Thick cord	Unknown
Appliance of decoration	9	Lines regularity (lisibility/overlaps)	No default	Rare overlaps	Frequent overlaps or discontinuities	Discontinuity Curved or doubled lines	Unknown
Decoration settings	10	Symmetry/decoration organisation	Perfect symmetry	almost symmetric	Mostly symmetric + other organisation	strong asymmetry	Unknown
Firing process	11	Firing process knowledge	Monochrome	"Coup de feu" (Black spot)	Different colors inside and outside/ Slightly polychrome	Polychrome	Unknown

Figure 5: The rating scale with its eleven parameters and their four different states.

A strong investment in ceramics is evidence for skilled potters, but the opposite situation is not just only explained by lack of know-how, and economic reasons might be advanced. Indeed, knowledge is not linear in form and depends on various parameters, like the number of different shapes crafted by a potter. It is easier to master one shape rather than five, but it also requires less knowledge. Until we know more about the relationship between the time and skill spent during ceramic manufacture, we will retain the more neutral term of investment.

This protocol enables us to justify how a vessel is interpreted, whether it belongs to the ‘standard’ (Salanova 2000), a more or less successful copy, or the work of an apprentice. It also enable us to comment on the development of ceramics in time and space, or according to the context. Thus one can see further, and explore in detail the most appropriate grouping techniques for ceramic production. The final objective is the construction of an equivocal typo-technological model that is as close as possible to archaeological reality.

We will compare the degrees of investment in ceramics by rating them. We distinguished 11 parameters for the vessels (Figure 5), and each parameter was graded from 1 (clear lack of investment) to 4 (perfect execution). The maximum score per vessel is therefore 44. In order to work with only the most reliable data, we sampled the ceramics. For undecorated ceramics we retained vessels with at least 7 or 8 parameters documented out of the 8 possible, and for decorated ceramics we retained vessels with at least 8 parameters out of 11. Then we applied a ratio to compare them. Our sample contains 107 vessels, attributed to 4 different classes corresponding to their final grade: A (from 1 to 0.9), B (<0.9 to 0.8), C (<0.8 to 0.7) or D (<0.7).

4.a Result: case study

All parameters considered, the CZM from Men-ar-Rompert at Kerbors, Côtes-d’Armor scores at 0.93. It has three minor flaws involving three different parameters: a black spot on the base from the firing process, a horizontal line breaking the symmetry of the decoration and an average thickness. The small Maritime beaker from Mané-Beg-Portivy at Saint-Pierre-Quiberon, Morbihan only scored at 0.68. Only two parameters are fully mastered, the regularity of the thickness and the regularity of the lines, meaning the decoration is perfectly executed, without overlapping or discontinuity. The nine remaining parameters bear minor or major flaws, especially the overall symmetry of the vessel: the mouth and the base are oval-shaped but in different ways and the rim is higher on one side than the other.

This comparison shows the high variability of investment in Bell Beaker production. There are many flaws on the small Maritime vessel from Mané-Beg-Portivy, possibly related to a stage of apprenticeship or an attempt to copy a classic Maritime beaker. The latter generally show a high degree of investment (Salanova 2000).

4.b Result: overall comparison

We summarised the result of the study on degrees of investment by counting the vessels of each class by style (Figure 6). The numbers are too low to be meaningful for three categories: brown/red undecorated beakers, Dotted-stamped beakers and ‘others’ vessels. They are low as well for CZDG, AOO, and AOC beakers, all styles that could have been merged with CZM into one larger group related to cord and comb or shell impression. As this merging would have produced the same result anyway, we kept them apart for more visibility.

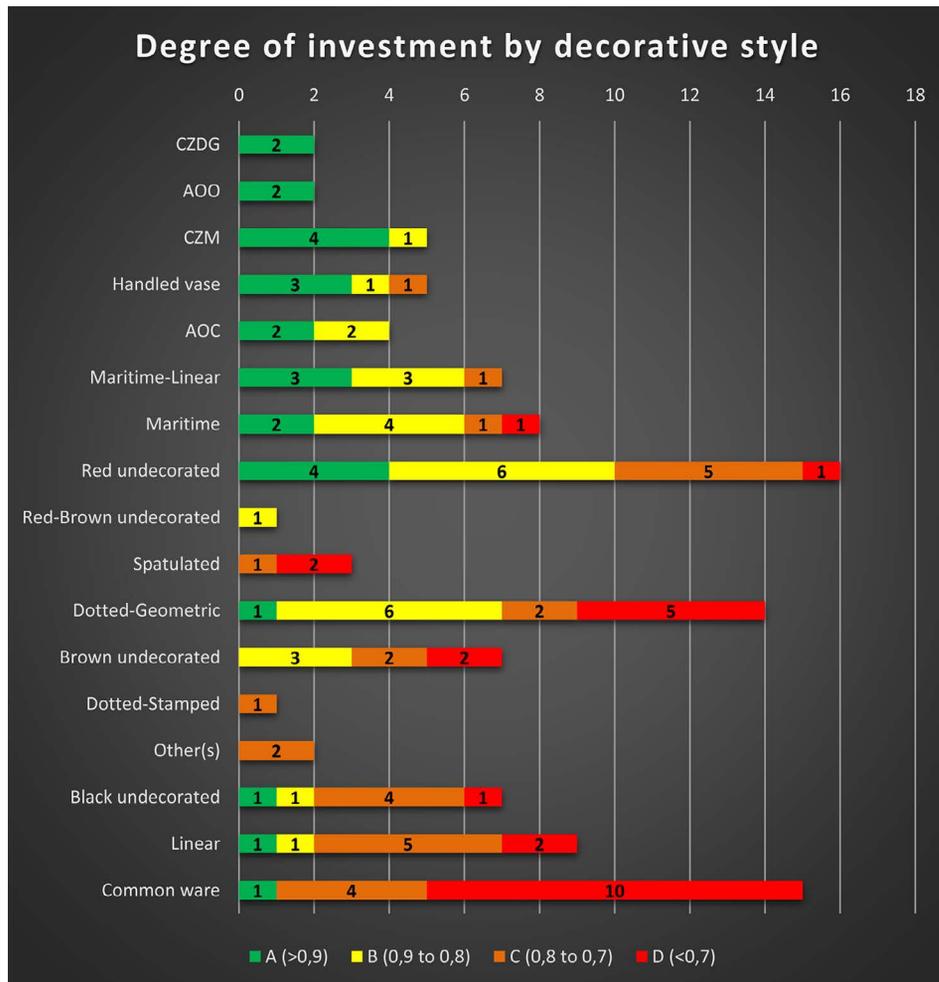


Figure 6: The number of vases in each of the four class of investment defined for each styles.

The most invested vessels are those decorated with cord and shell or comb, corresponding to CZDG, AOO and CZM styles (Figure 7a). Beakers with handles, dated to the third stage of the phenomenon are almost as invested, despite the lack of decoration, but they have more complex shapes, mostly mid-bellied with a narrow neck and covered with red slip (Tomalin, 1988). It is almost surprising to see Maritime and AOC beaker ranked below these styles, generally with a little less investment, as they were used to define classic Bell Beakers in the Tagus Estuary (Salanova, 2004) or in the Lower Rhine (Lanting and Van der Waals, 1976). Maritime-Linear style and red undecorated style are in the same category as Maritime and AOC styles, and are undoubtedly closely related to Maritime beaker, since the shape, building technique and fabrics are mostly identical (Figure 7b). Perhaps cord impression reduces the number of errors involving to discontinuity or overlapping during the decoration, partially explaining why mixed styles have the highest investment.

The investment seen in the Dotted-geometric style is generally average, with only one vessels in class A

(Figure 7c). Some vessels are really invested nonetheless and lie close or equivalent to the Maritime style in class B. On the other hand, there are only two vessels in class C, but five in class D, with clear cases related to a lack of potter's knowledge. This case is intriguing, because in the Maritime style we see a norm and one outlier: the beaker from Mané-Beg-Portivy. For the Dotted-geometric style it seems that the production is considerably heterogeneous, and can almost be divided into two equivalent groups. Apprenticeship hardly explains this situation. If too many vessels are under-invested, this rather reflects a specific degree of investment shared by a fair part of the potting community, and they cannot be considered apprentices. Data remain sparse nonetheless, with only 14 vessels in this style suitable for a deeper analysis.

The last vessels related to Bell Beakers are under average when it comes to investment. They include undecorated black and brown beakers and, more puzzling, the Linear style (Figure 7c). The position of most Linear beakers in the class C is unexpected, as they belong to the standard in the same way as Maritime and LBR



Figure 7: Examples of vases belonging to the four different class. 1: La Roche, Donges; 2 & 9: Crugou, Plovan; 3, 4, 11, 12, 15, 16: Men-ar-Rompel, Kerbors; 5: Kerebrevost, Belz; 6: Kergazec, Plouharnel; 7: Beg-er-Vil, Quiberon; 8: Le Net, Saint-Gildas-du-Rhuys ; 10: Er-Roh, La Trinité-sur-Mer; 13: Mané-Beg-Portivy, Saint-Pierre-Quiberon; 14: Le Grand Carreau Vert, Saint-Michel-Chef-Chef; 17: La République, Talmont-Saint-Hilaire.

beakers. Unfortunately we couldn't not include vessels from the latter style, because the number of observable parameters was too low. But looking at the vessels under study this situation is quite logical: many Linear beakers have irregularity in decoration, and most of them are not particularly fine-walled either. The shapes tend to be 'rectilinear', following the term coined by L. Salanova, meaning the neck is almost cylindrical and therefore less complex than in the classic Maritime style. This situation raises questions about the place of the Linear style in the standard, especially as it is the least invested of the Bell Beaker styles.

Besides Bell Beakers we also included some common ware in this study; they are by far the least invested ceramics (Figure 7d). Only one vessel belongs to the A class, and it might be considered as a Bell Beaker with a cordon, which are still rare, but not unknown in northwestern France. This reinforces the evidence of local influence on Bell Beaker pottery. Others common ware vessels are less invested than the average Bell Beakers. While some parameters like temper visibility and wall thickness could be explained by vessel function, others are related to a lack of investment. There are frequent problems regarding the irregularity of thickness, surface topography, asymmetry or the firing process, all denoting the potter's lack of will or knowledge in trying to resolve these issues.

5. Discussion: at least two different traditions

There is a marked difference in investment between, in the one hand, Maritime Bell Beakers and the most closely related styles (CZMB, CZDG, AOO, Red undecorated) and, on the other hand, common ware, despite both being found together during the first stage of the Bell Beaker phenomenon. As shown by earlier research, Bell Beakers are an indigenous influence appearing in the North-West of France in the middle of the third millennium, and this cannot be explained without at least some movement of a few peoples from outside the region (Salanova 2000 fig. 120). The common ware, however, belongs to the cultural background of the Late Neolithic population (Blanchet *et al.* 2019; Favrel 2020). In theory, there is contemporaneity between at least two distinct traditions during the Bell Beaker phenomenon (stage 1). This is a minimum number of traditions, and the situation is likely to have been more complex, as we lack associations with Bell Beakers and fine decorated ware of the Late Neolithic, and we acknowledge that there were different Bell Beaker networks (Gallay, 2001, 1986). In the short term there is evidence for apprenticeship, as well as copy or transfer of decoration technique or motifs between two groups of potters. But in the long term, considering the association of both spatial, chronological and functional factors, the lines between these traditions are blurred. It seems plausible that different groups of potters belonging to various

traditions merged their knowledge to different degrees at different places, in a more or less conscious process. However, this apparent 'fusion' is not complete, as during the second and third Bell Beaker stage differences are still clearly visible between common ware and the Bell Beakers. It rather seems that the gap between the two traditions narrowed down in a twofold process: first they became closer, exchanging some respective aspect of their *chaîne opératoire* (decoration technique, motif, surface treatment, shape), then intermediate production appeared, that might be seen either as low invested beakers or copy by local potters overinvesting their ceramics. The transition from one tradition to the other could thus be more gradual. The belonging of intermediate production to one of the two previous traditions is not obvious, either because Bell Beaker and common ware traditions overlap after some time and become homogeneous. Or perhaps intermediate production represents an intermediate tradition? Intermediate production includes some vessels in the Dotted-geometric style, most black or brown undecorated beakers as well as the Linear style and probably the LBR style as well. Another implication of this varying degree of investment is that certain level of knowledge was maintained over time. The undecorated Bell Beakers from the beginning of the Early Bronze Age are as invested as the Maritime beaker, for example. This shows that there were very skilled potters during the whole sequence of the Bell Beaker phenomenon, and not only the first stage. More interesting, neither Maritime beakers nor AOC beakers are the most invested vessels, despite both of them being as the origin of the phenomenon by various authors. The most impressive vessels are all related to the CZMB, CZDG, AOO and CZML styles. In the current state of research, we consider them as hybrids between Iberian and Rhine influence. Whatever the origin of the phenomenon, this implies that the skill of potters making Bell Beakers kept progressing, at least for some generations after the start of the phenomenon.

6. Conclusion: evidence of technical transfer, copy or apprenticeship

We can interpret the degree of investment in various manners, it can be related to apprenticeship, a local influence in a specific stage of the *chaîne opératoire*, or a deeper influence suggesting a more conscious copying process. If we define the norm as Maritime Bell Beaker and common ware, we see a symmetrical process of technical transfer, and /or influence, but also copy or apprenticeship (Figure 8). The same process possibly occurs for Bell Beakers in other regions, such as the Netherlands. There is evidence of apprenticeship in Wolfheze, Gelderland (Wentink, 2020) and incorporation of Maritime influence with hatched band and shell impression on three tall beakers from Vasse, Buinerveld and Uddelermeer (Salanova

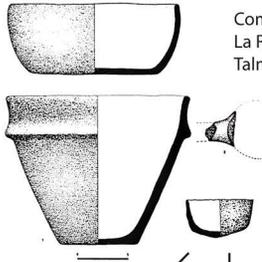
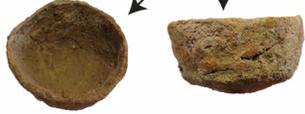
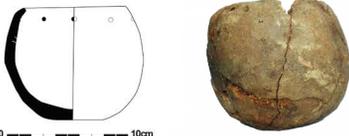
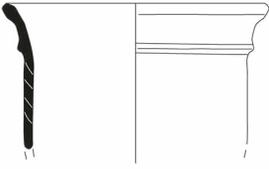
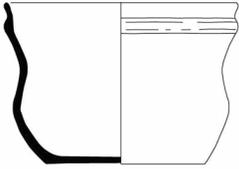
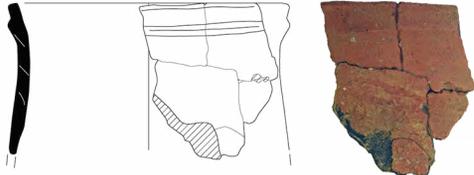
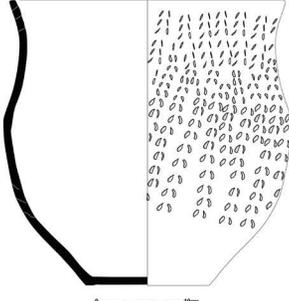
	Bell beaker	Common ware
«Norm»	 <p>Maritime beaker La Roche, Donges (44)</p>	 <p>Common ware La République Talmont-Saint-Hilaire (85)</p>
Apprenticeship?	 <p>Maritime beaker, Mané-Beg-Portivy Saint-Pierre-Quiberon (56)</p>  <p>Dotted-geometric beaker La Roche, Donges (44)</p>	 <p>coarse micro-bowl, La République, Talmont-Saint-Hilaire (85)</p>  <p>coarse spherical bowl, Men-ar-Rompét, Kerbors, vase n°39 (22)</p>
Incorporation of neighboring influences	 <p>cordoned Bell Beaker Le Coin des Petits Clos Trémuson (22)</p>  <p>cordoned Bell Beaker Lost-er-Lenn Grandchamp (35)</p>	 <p>S-shaped common ware with orange paste, La République Talmont-Saint-Hilaire (85)</p>  <p>Beaker shaped common ware, Men-ar-Rompét Kerbors, vase n°15 (22)</p>
Incorporation of allochthonous influence	 <p>AOC style Bell Beaker Men-ar-Rompét, Kerbors vase n°4 (22)</p>  <p>CZM style Bell Beaker Men-ar-Rompét, Kerbors vase n°5 (22)</p>  <p>AOO style Bell Beaker Men-ar-Rompét, Kerbors vase n°26 (22)</p>  <p>Bell Beaker with acacia leaf decorative style, Leião, Oeiras, Portugal (Cardoso 2019)</p>	  <p>Giant Bell beaker with nail decoration Bréhuidic, Sarzeau (56)</p>

Figure 8: Comparison of the norm, the evidence of apprenticeship, copy and stylistic transfer for Maritime beakers and common ware.

and Drenth, 2012). Moreover, this situation is quite similar to the making of 'false-AOC' in Brittany, with a classic shape for the Netherlands but decorated with unusual techniques and motifs. This model, suggesting two major traditions, probably overlapping at some point, does not account for all the ceramic production, because intermediate vessels hardly fit the current model. Further analysis is needed in order to explain the appearance of these vessels and their position within the overall Bell Beaker phenomenon.

It also raises questions about the definition of the standard (Salanova 2000), since the Linear style is relatively uninvested, and bibliographical comparison with known vessels from the LBR style shows similar results. The Maritime beaker alone could be considered as a stylistic canon, but like decoration motifs, decoration techniques can be and were copied. Therefore, we should not use these stages of the *chaîne opératoire* to define the core of a tradition, as they are unstable. Some Bell Beakers from Portugal have acacia leaf decoration technique and motif (Cardoso, 2019). Some Bell Beakers from Brittany have a horizontal cordon under the rim, while others have Maritime shape and fabric but AOC style. In this sense we should distinguish two things inside the Maritime tradition, its technical style (shape, surface treatment, building technique), from the decorative style (decoration technique and motifs). Even if they are often associated, we showed that the Maritime technical style might present different decorative styles (acacia leaf, cordon, AOC), and the Maritime decorative style or its ersatz are found in other traditions (tall beakers from the Netherlands, Artenac cups).

Our approach shows evidence of technical transfer, apprenticeship and various degrees of copy between Bell Beaker and local common ware productions at the local scale, and some transfer between different beaker networks. Our understanding of the role and place of decoration technique and motif is improving, and the situation is much clearer today. Yet the definition of a tradition cannot be based solely on decorative techniques and motifs. The next stage of our research should enable us to define Bell Beaker traditions, by focussing primarily on building technique, surface treatment and firing process.

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A Bipartite Network Analysis of Bell Beaker Decoration Diversity in Camino De Las Yeseras (Madrid, Spain)

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Abstract: In Central Iberia, recent studies of Bell Beaker funerary contexts have revealed recurrent practices, such as the construction of funerary areas, artificial caves and deep hypogea sealed with heavy stone slabs. Otherwise, the extraction and movement of human bones and Beaker sherds is well known in the Camino de las Yeseras site. In a previous study, a unipartite network analysis based on a similarity index of ceramics' decorative patterns was able to establish the presumed intra-site relations between two female tombs from different funerary areas. In this contribution we compare and improve these results, using a bipartite network analysis, more suitable for visualizing diffusion phenomena and graves that sport associations of similar decorative patterns. The analysed vessels belong to eight more or less contemporaneous Bell Beaker tombs from the second half of the third millennium cal BC. The validation or otherwise of this initial protocol performed for the site provides useful data for further studies on a larger ceramic corpus, to shed new light on the geographical distribution of Bell Beaker decorative patterns and to gain a greater understanding of the social relations among these first metallurgical societies.

Keywords: Bell Beaker, burials, Bipartite Network Analysis, Madrid region.

1. The Camino de las Yeseras site: Bell Beaker tombs and grave goods for the network analysis of Bell Beaker decoration

Camino de las Yeseras, located in the NE of the town of Madrid, is a one of the largest Chalcolithic Iberian ditched enclosures (ca. 22ha) in Central Iberia (Ríos, 2011; García Sanjuán *et al.*, 2018).

Strategically located at the confluence of two important rivers, it was probably a central place in a favourable landscape and well-connected territory with control over two fertile valleys for livestock and farming activities, and close to a rich catchment area, where flint, salt, and clay resources were available (Ríos, 2011). Chalcolithic occupation starts at the end of the fourth millennium BCE and lasts until the first centuries of the second millennium BCE.

More than 8500 structures have been documented by surface scraping and more than 2000 were excavated: mainly pits, ditched enclosures, huts, and tombs (Blasco *et al.*, 2007, Blasco *et al.*, 2005, Blasco *et al.*, 2011, Liesau, 2017, Liesau *et al.*, 2008, Liesau *et al.*, 2013-2014, Ríos, 2011, Ríos, 2016). In fact, five fieldwork campaigns allowed us to conduct our survey, especially in the southern area where several Chalcolithic huts and tombs have been excavated, as well as hundreds of pits with a high variability in size and function. The Bell Beaker funerary contexts documented at this site are found in areas where non-Bell Beaker Chalcolithic remains also exist (Blasco *et al.*, 2011, 2019).

The first occurrence of Bell Beakers in large peninsular settlements such as Camino de las Yeseras seems to generally be around 2500 cal BCE (Liesau, 2017, Márquez and Jiménez, 2010, Mataloto and Boaventura, 2009, Valera, 2017, among others), although there are few places where the Bell Beaker impact and its role within domestic structures have been studied in detail. In the Madrid region, we know that Bell Beakers are present since 2500 cal BCE when the last enclosures were still in use. Aside from that, the Chalcolithic communities kept their traditions unchanged with collective burials in simple pits (Ríos, 2013; Blasco *et al.*, 2019).

Contemporary to the last enclosures, in the southern area of the site, the Bell Beaker tombs were arranged in three large hut-like structures with sunken floors (30-60 m²) incorporating graves of different morphology and size (artificial caves and hypogea) which we call 'Funerary Areas', FA1 (A-31), FA2 (A-35) and FA3 (F-5), in addition to another tomb as a double pit (A21) (Blasco *et al.*, 2011, Blasco *et al.*, 2019, Liesau, 2017, Olalde *et al.*, 2018, Olalde *et al.*, 2019).

In this contribution, we only refer to those characteristics that are relevant for network analysis; we summarise the general data in Figure 2.

Funerary Area 1 (30 m²), delimited by an oval sunken floor, contained two graves (see FA1 in Figure 1 and 3A-1). In its central area was a large, deep hypogea with stepped access. The chamber was sealed with large flint slabs (Figure 3A-2 to 4). On the east side of the feature,

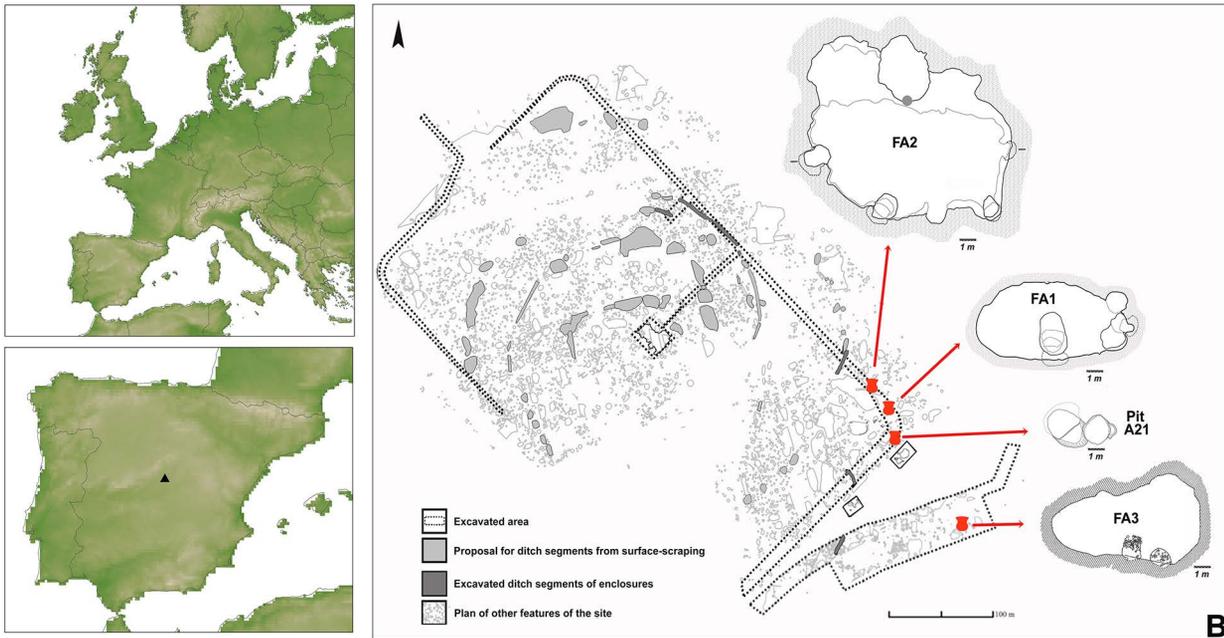


Figure 1: A: Situation of Camino de las Yeseras site; B: Plan of Camino de las Yeseras with the Bell Beaker Funerary areas (A1, A2, A3) and a Bell Beaker grave in a pit (A21) (Yeseras-UAM Research Group, Argea Consultores, S.L.y Gestión del Patrimonio Cultural S.L.).

another tomb in the form of an artificial cave with stepped access was documented (Figure 3A-7).

Funerary Area 2 (c. 60 m²), delimited by a quadrangular sunken floor feature, contained three graves (see FA2 in Figure 1). In the centre, a hypogeum with stepped access, sealed with a large flint slab, and another two artificial caves have been documented (Figure 3A-5). In addition, this area was surely used for funerary commensality rituals, and an excavated bench in the centre as well as a non-Bell Beaker large domestic pot were found *in situ* (Liesau and Blasco, 2015). Funerary Area 3 (c. 30 m²), delimited by an oval sunken floor (see FA3 in Figure 1), housed two more graves in the form of artificial caves (Figure 3A-6). Finally, the eighth Bell Beaker grave (see Pit A21 shown in Figure 1), was formed by two interconnected pits that contained a collective burial with a particularly complex sequence of deposits. As also evidenced by the radiocarbon dates, several openings and construction events took place over an extended period of time in this pit. Remarkable is the recovery of a high number of well manufactured pottery sherds with different Bell Beaker styles: international, geometric impressed, Ciempozuelos and plain (Blasco *et al.*, 2009; Ríos, 2011) (Figure 3B-3 to 5 and Figure 4).

Four of the eight Bell Beaker graves are collective and successive burials, the others are primary individual or double graves. Occasionally when further individuals or secondary burials were added, the pre-existing remains

were 'reduced', or simply displaced, in order to make room for the new interment (artificial cave A-35 VII from Funerary Area 2). What really characterizes these tombs, however, are secondary burials resulting from complex processes that involved the extraction and movement of human bones, as in the artificial caves A-31-II, F-5 C1 and F-5 C2 from Funerary Areas 1 (Figure 3B-1) and 3 (Figure 3A-6).

Alterations of the tombs – primary or secondary burials – were very probably made by the Bell Beaker communities themselves as a consequence or continuation of their so called 'funerary cycle' (Weiss-Krejci, 2011). This has affected the original structure of the tombs as well as the quality of the archaeological record. Frequently we are restricted to documenting different taphonomic categories and only the last sequence with limited remains of human bones and intentionally broken pottery sherds (Gómez Pérez *et al.*, 2011, Liesau *et al.*, 2020, Liesau *et al.*, 2014)

These manipulations are scarce in simple pit burials, which are sealed with sediment and stone tumuli, and in which decomposition occurs within a filled space. By contrast, they are frequent in pits with niche burials or in small artificial caves excavated into the wall of the funerary areas, where they tend to remain in empty spaces protected by a lithic or organic seal which could be reopened before the tomb was permanently closed by large and heavy slabs or stone mounds.

Figure 2: Characteristics of the Bell Beaker graves from Camino de las Yeseras site.

	BB grave	Characteristics of the buried individuals				BB vessels associated	Other grave goods	C14 dates
		Nº	sex	age	Ancient DNA	Nº & style	Objects & ritual materials	
1	Funerary Area 1 Hypogeum A-31 01-I	1	♂	senile	No data	2 Bell Beaker vessels	Small embossed and bent gold leaf; granite mill with the hand millstone; cinnabar.	-
		3	-	adult	No data	1 Bell Beaker carinated bowl		Ua 58525: 3879 + 31 BP (Ind 1)
2	Funerary Area 1 Artificial cave A-31 01-II	1	♀	adult	Local	2 Bell Beaker bowls (Ciempozuelos style)	-	-
		1	♂	senile	No data	1 Bell Beaker bowl (Ciempozuelos style)	Cinnabar stripe on the skull	-
3	Funerary Area 2 Hypogeum A-35 E03-III-A	1	♀	adult	Steppe ancestry	1 Bell Beaker carinated bowl (Ciempozuelos style)	Cinnabar, ivory beads, gold beads	Ua 58523: 3895 + 30 BP
4	Funerary Area 2 Artificial cave A-35 E03-VII	1	♀	adult	Local ancestry	2 Bell Beaker bowl (Ciempozuelos style)	-	PSUAMS-2320 3875 + 20 BP Ua 58465: 3864 + 31 BP
		1	♀	infant	Steppe ancestry	1 small Bell Beaker bowl (Ciempozuelos style)	-	Ua 35021: 3525 + 40 BP
5	Funerary Area 2 Artificial cave A-35 E03-X	1	♂	adult	No data	1 Bell Beaker vessel and 1 bowl (Ciempozuelos style)	-	Ua 58524: 3894 + 30 BP
6	Funerary Area 3 Artificial cave F-5 C1	1	♀	adult	Local ancestry	1 Bell Beaker vessel and 1 bowl (Ciempozuelos style)	-	-
		1	♀	adult	No data	-	-	-
		1	♂	adult	No data	-	-	-
7	Funerary Area 3 Artificial cave F-5 C2	1	♂	adult	North African origin	1 Bell Beaker vessel, 2 bowls and 1 carinated bowl (Ciempozuelos style)	A granite millstone, a sandstone mortar and a copper pin	PSUAMS-2119 3910 + 30 BP
		1	♀	senile	No data			PSUAMS-2120 3870 + 90 BP
		1	♂	adult	No data			-
8	Pits A-21	3	-	adult	No data	13 Bell Beaker: 2 Bell Beaker vessels (Maritime style), 4 impressed geometric bowls, 2 plain vessels, 1 plain bowl, and 2 bowls, 1 carinated bowl and 1 vessel of Ciempozuelos style.	A copper pin, a gold bead and a bone button (sperm whale bone) with lateral appendages, cinnabar.	Ua 39309: 3752 + 30 BP
		1	-	infant	No data			Ua 39310: 4004 + 30 BP*

*: Charcoal

These types of burials imply that, in some cases, we cannot specify the association of the vessels and, therefore their decoration, to a specific individual in the tomb and the characteristics of the individuals in the group. But in some cases, this was possible as is shown in Figure 2 and Figure 3A-5 to 7.

Among the other four Bell Beaker burials, two are individual tombs and, therefore, we can associate grave goods with the buried persons (artificial cave A35-X and hypogeum A35-III). But in the other two tombs, hypogeum A31-I and Pit A21 (Figure 3B-2 to 4), only a few highly fragmented scattered human remains were

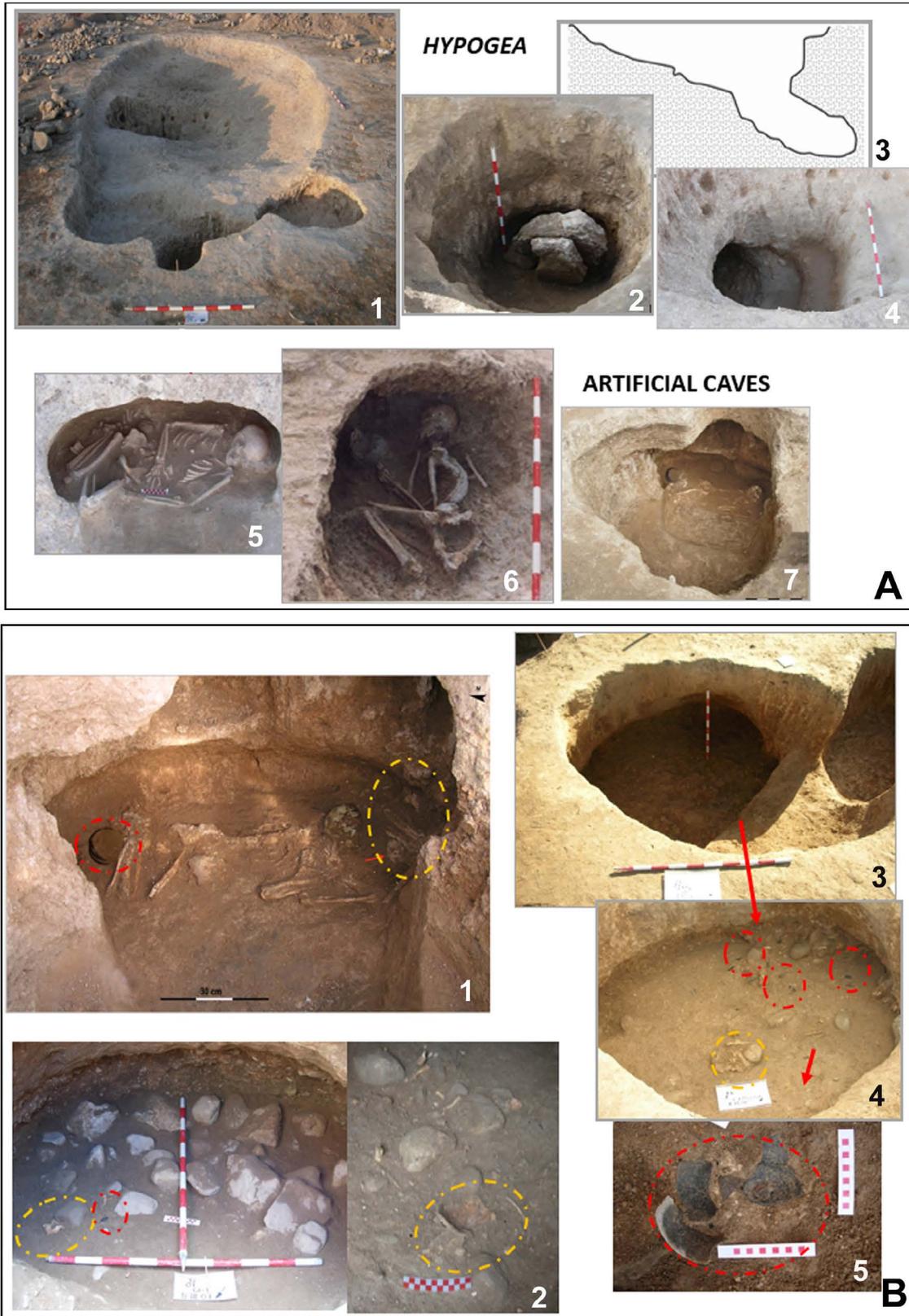


Figure 3: A - 1. General view of the Funerary Area 1 as an example of this type of pantheon type structures; 2. View of the flint slabs that sealed the hypogeum of Funerary Area 2; 3-4. Section and access of the hypogeum of Funerary Area 1; 5-7. Artificial caves of different Funerary Areas. B - Details of some tombs of Camino de las Yeseras indicating secondary burials with scattered human remains and pottery sherds (Argea Consultores, S.L.). 1. Grave goods between the legs of the primary individual and the area where the secondary individual was found; 2. Human and ceramic remains scattered inside the hypogeum chamber from Funerary Area 1; 3. Burial pits A21 with detail of the human and ceramic remains scattered (4) and an intentionally fractured Bell Beaker bowl (5).

recovered from the partly dismantled burials. Moreover, the associated Bell Beaker vessels were also intentionally fragmented (Liesau *et al.*, 2018, Liesau *et al.*, 2020) (Figure 3B-5).

The genetic results of a large study carried out on Bell Beaker and non-Bell Beaker individuals from central Iberia have been analysed. Thanks to an initial connection of our research team to several international projects led by Kurt Alt (Szécsényi-Nagy *et al.*, 2017) and Kristian Kristiansen, it has been possible to advance within a research framework of European projects, later developed on a greater scale with David Reich's team (Liesau *et al.*, 2020, Olalde *et al.*, 2018, Olalde *et al.*, 2019).

With this extensive sampling, it has been possible to obtain mitochondrial and nuclear DNA from several individuals. For Camino de las Yeseras, the information obtained to date with good results corresponds to a total of 37 individuals, 13 of which belong to Bell Beaker burials.

The results show, in addition to the expected local origin of a series of Bell Beaker individuals, the presence of other Bell Beaker individuals with recent ancestors from central and Eastern Europe. The confirmation of the existence of a Bell Beaker migrant with 100% North African ancestry should be highlighted. This genetic profile is a unique case among the almost two hundred peninsular Chalcolithic individuals analysed to date (Liesau *et al.*, 2020).

Anthropological studies carried out by J.L. Pérez and G. Trancho are based on the classic parameters of physical anthropology on the buried remains. But genetic analyses have also been able to determine some family relationships and biological sex.

Radiocarbon dates for this set of Bell Beaker tombs (Figure 2 and Figure 4) are dispersed throughout the second half of the 3rd millennium BCE, with the majority being centred around 2450/2300 cal BCE. The Bell Beaker vessels associated with these burials should not exceed the change of millennium. We have detected a second Bell Beaker phase in the site in the first centuries of the second millennium cal. BC (Blasco *et al.*, 2019), but without a clear connection with the contexts under study in this contribution. However, one of the dates obtained in the F-5 C2 burial from Funerary Area 3 (PSUAMS-2120 3870 ± 90 BP) could belong to this final moment of the Bell Beaker in Camino de las Yeseras.

2. A bipartite network analysis protocol

2.1. Main issues

In a previous work (Caraglio *et al.*, Accepted), we carried out a Similarity Network Analysis with a corpus of 31 vessels distributed in 8 graves and 3 funerary areas and a funerary pit, based on the Jaccard coefficient, a very commonly used index in archaeology studies (Besse, 1996; Cauliez, 2011, Vaquer and Remicourt, 2008). By collecting data in a simple binary database, it was easy to calculate this Jaccard coefficient (similarity index matrices or abstract distance) between the assemblages'

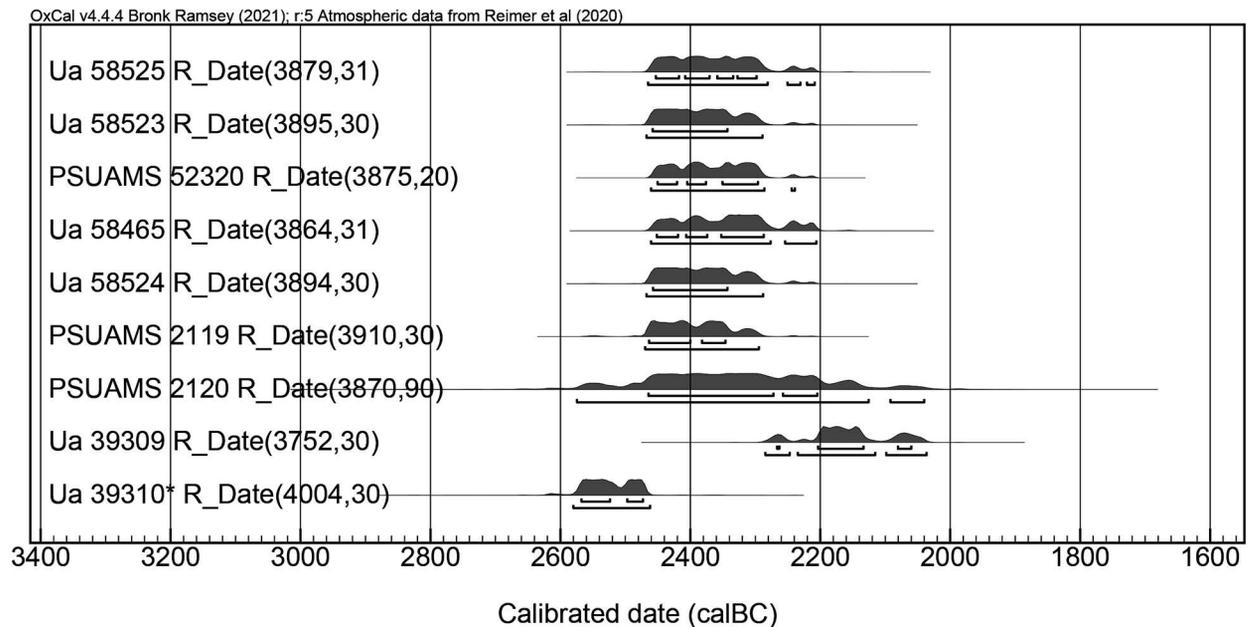


Figure 4: Multiple plot of the Bell Beaker dates in Camino de las Yeseras site (Yeseras-UAM Research Group). See figure 2 for the associated structures.

wares of each burial deposit and it allowed us to identify the attributes that are mutually null for each entity compared to one another (Habiba *et al.*, 2018). This network analysis approach, which is quite common in archaeology, helps to visualise the similarity links between the assemblages and to highlight which are the most similar assemblages (Brughmans, 2013; Mills *et al.*, 2013; Bernabeu Aubán *et al.*, 2017). But as recommended by J. L. Munson (2019), ‘it is important to emphasize that ties based on similarity should not be construed as evidence for direct social interaction. Rather, similarity ties represent conditions or states that increase the probability of forming other kinds of ties such as [social relations, interactions and flows]. While this means that archaeologists need to be careful when interpreting these types of network ties, the upshot is that archaeological networks based on similarity have the potential to explain the formation of more meaningful social relations, past interactions, or information flows if modeled and evaluated using proper methods.’ Furthermore, the small samples easily influence this kind of network analyses based on these similarity indexes by preventing the detection of homogeneous subsets and reducing too much the richness of the raw data collected. Indeed, the totality of possible hardware connections are generally displayed and the interpretation of the results is often difficult. In our previous study, we highlighted the presumed intra-site relations between two women and a girl buried in different funerary areas of this site (Caraglio *et al.*, Accepted, fig. 9 and 10). In this present paper, we would like to compare these results based on Unipartite Network Analysis and the new results, produced by a Bipartite Network Analysis.

2.2. Some principles of Bipartite Network Analysis

Bipartite Network (or ‘2-mode network’) Analyses are normally more suitable for visualizing diffusion phenomena (Feugnet *et al.*, 2017). In this type of network, there are two types of nodes (Feugnet *et al.*, 2017, fig. 3); in this study, one type corresponds to Bell Beaker burials, the other type to the ceramic decorations and shapes present in the burials. Links cannot be established between nodes of the same type, but only between two different types of nodes, i.e., between burials and ceramic decoration types, but never between two burials or between two types of decoration. This ‘2-mode’ network can then be projected into two ‘1-mode’ networks: a network of burials, connecting deposits with the same ceramic decoration types and a network of decorations, connecting motifs present in these deposits. It is then possible to attribute weight to the links. For the network of burials, the weight refers to the number of decorations in common between two burials, which highlights similar burials. For the decorations network, the weight refers to the number of burials where pairs of decorations are present, which can highlight the most commonly associated motifs.

To sum up, these Bipartite Network Analyses allow us to take into account the number of patterns in each vessel and in each grave, to have a better reading of the combinations of patterns and to detect homogeneous subsets because they show all possible material connections in a quantitative way.

2.3. Proposal for analysis protocol

The analysis protocol is simple enough. Indeed, the purpose is to transform a simple contingency table of decorations and forms by vessel to a simple contingency table of decorations and forms by grave, because our interest is in comparing the assemblages of each burial. All in all, each burial has been described, recording the presence/absence of different variables, grouped into 3 shape variables and 94 decoration variables (all the motifs of the different Bell Beaker styles known in Central Iberia). The code names of ceramic decorations and forms are based on R. Garrido Pena’s typology (Garrido Pena, 2000). For a visual summary of the corpus, we can refer to Caraglio, 2020 (fig. 7), Liesau *et al.*, 2020 (fig. 4, 7, 8, 9) and Caraglio *et al.* (Accepted). Several attempts to radiocarbon date all individuals failed, but from the dating obtained we assume that the graves are more or less contemporaneous, except one dating of Pit A21 with a long-term use and another dating for an individual from a double burial in Funerary Area 2 (Figure 1 and 4). In this contribution, we do not use directed networks. The aim is, first, to highlight the main connections between burials, on one hand, and between the different types of ceramic shapes and decorations, on the other hand.

Then, we have to format the simple contingency table of decorations and forms by grave in a simple ‘text document’ which can be read by the Pajek 5.10 program. This document is a frame of a ‘2-mode network’ with two types of nodes: graves and ceramics variables. The Pajek program permits us to divide this ‘2-mode network’ in two ‘1-mode networks’: one with the links between the graves and one with the links between the ceramics’ variables. Lastly, the Pajek program can draw a graphic representation for these two networks and allows a complementary reading of the data.

3. Results and comparison with similarity network analysis

3.1. Results of Bipartite Network Analysis

As explained in sections 2.2. and 2.3., Bipartite Network Analysis firstly shows a network with two types of nodes. Figure 5 presents this 2-mode network with the Camino de las Yeseras’ Bell Beaker burials and all the ceramic decorations and shapes observed (Figure 5): the high decoration variability by grave and the most commonly used ceramic decorations and forms are easily discerned

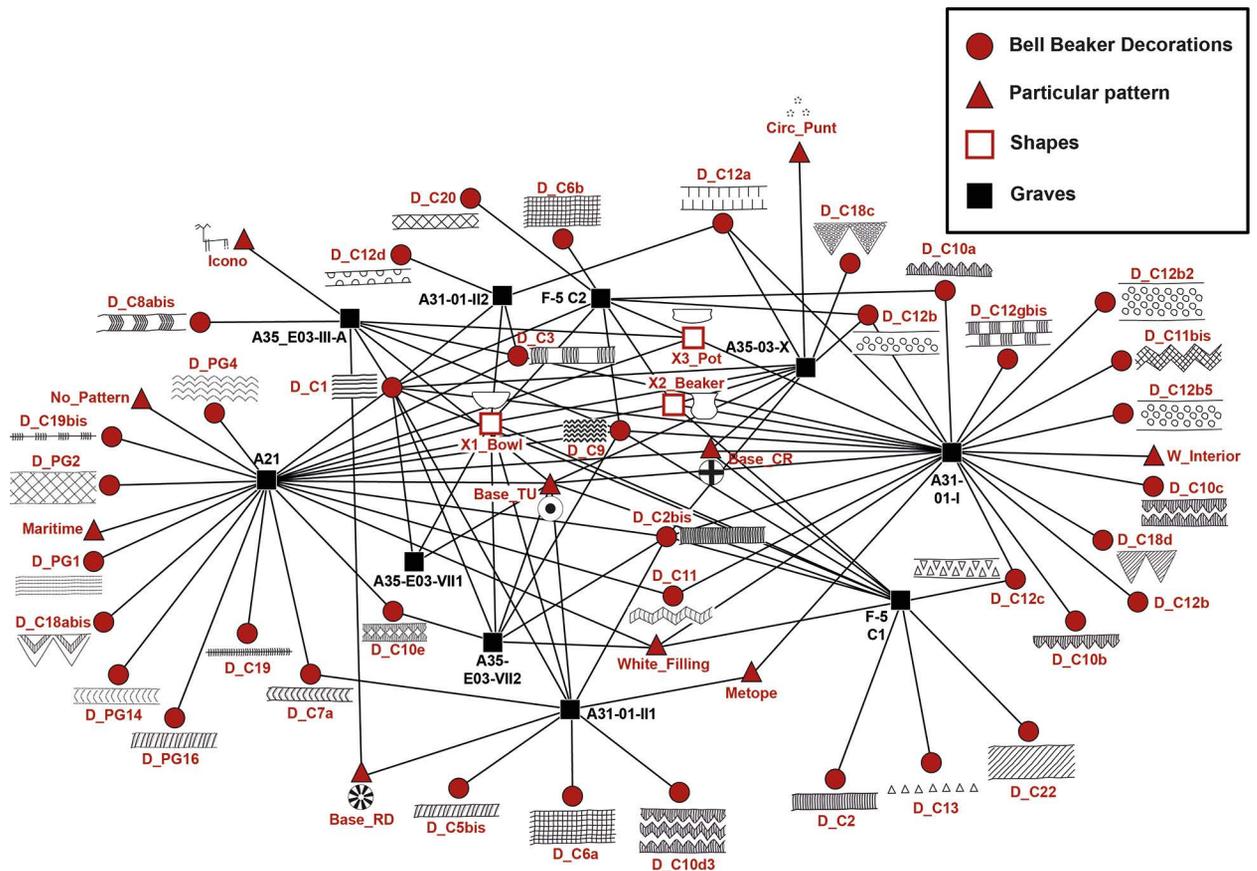


Figure 5: 2-mode network with the Bell Beaker burials and the ceramic decorations and shapes observed, as a demonstration of the variety of Bell Beaker decorations in Camino de las Yeseras Site (San Fernando de Henares, Madrid).

here. Then, from this original network, the Pajek program produces one graph with the graves' network (Figure 6) and one graph with the ceramics' variables network (Figure 7).

3.1.1. The graves network

In the graves network, only the ties corresponding to more than three shared ceramics variables have been displayed (see Figure 6). We can observe that no individual seems to have 'privileged position' for the diffusion of patterns and forms of ceramics, maybe because of the high diversity of ceramics in the collective burials (pit A21, hypogeum A-31-01-I from Funerary Area 1, artificial cave F-5 C2 from Funerary Area 3). The graves network seems to demonstrate strong links between the ceramics from Pit A21 and those of the three other Funerary Areas.

Indeed, collective burial A21 with male dominant individuals shares more than 9 ceramics variables with four different burials (the female burials A-35 E03-VII2 from Funerary Area 2 and F-5 C1 from Funerary Area 3 and the collective burials A-31 01-I from Funerary Area 1 and F-5 C2 from Funerary Area 3) and 6 to 8 ceramics

variables with three other burials (the female burials A-35 E03-III-A from Funerary Area 2 and A-31 01-II1 from Funerary Area 1 and the male burial A-35 E03-X from Funerary Area 2). The collective burial A-31 01-I from Funerary Area 1 and the female burial F-5 C1 from Funerary Area 3 share more than 9 ceramics variables.

The collective burial A-31 01-I from Funerary Area 1 and the female burial F-5 C1 from Funerary Area 3 also share together more than 9 ceramics variables, and A-31 01-I and F-5 C1 share 6 to 8 ceramics variables with three (the girl burial A-35 E03-III-A from Funerary Area 2, the male burial A-35 E03-X from Funerary Area 2 and the collective burial F-5 C2 from Funerary Area 3) and two (the female burial A-35 E03-VII2 and the male burial A-35 E03-X from Funerary Area 2) other burials, respectively.

To sum up, the results display a strong triad between Pit A21, collective burial A-31 01-I from Funerary Area 1 and female burial F-5 C1 from Funerary Area 3. However, despite the diversity of ceramics decorations and biological origins of the deceased, a general and strong 'cohesion' can be read, thanks to different ties which correspond to four or five shared ceramics variables between several graves.

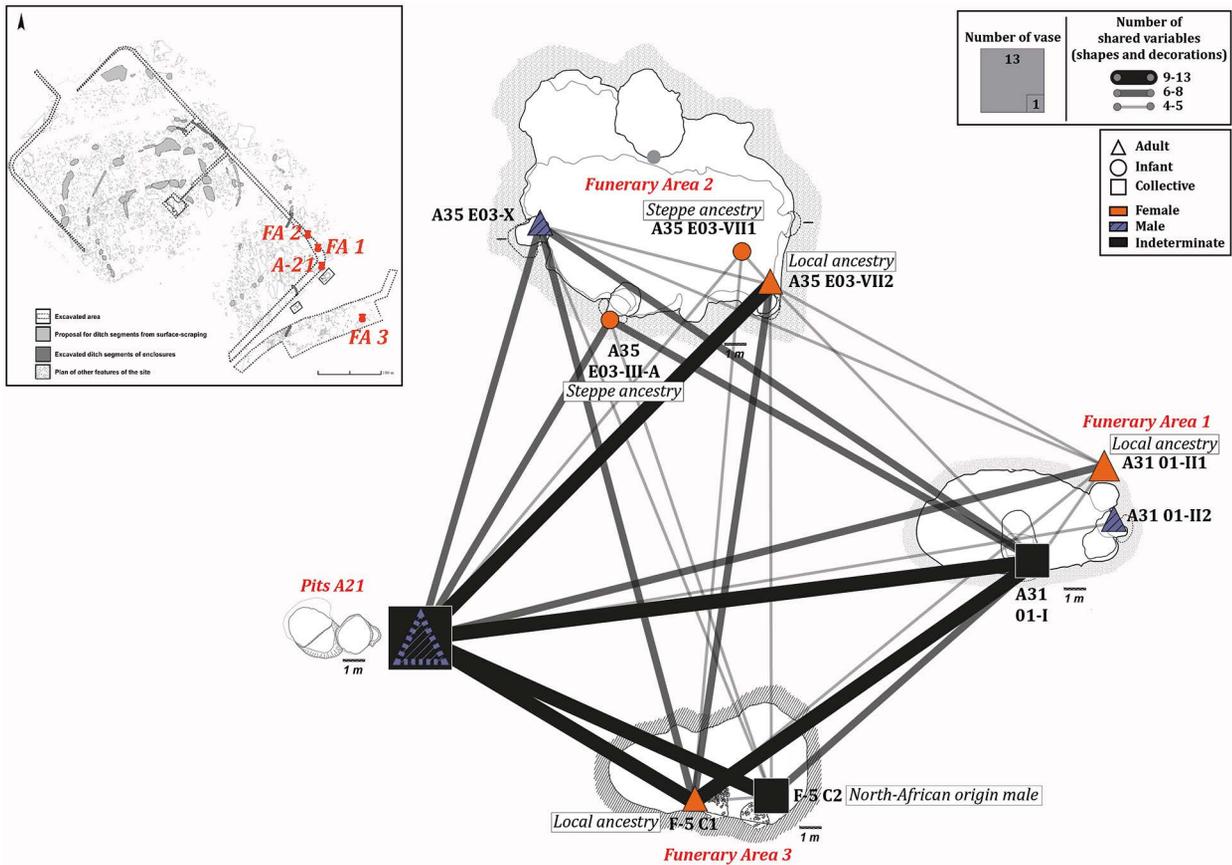


Figure 6: Map of 1-mode graph with the graves' network. The thickness of the lines expresses the number of shared variables between two graves and the size of the nodes is linked to the number of vessels in the graves.

3.1.2. The decorations network

In the decorations network, only the ties corresponding to more than three ceramic variables shared between two burials have been displayed (see Figure 7).

The most recurrent associations are those between bowls (X1) and horizontal stripe motifs (D_C1) and between horizontal stripe motifs (D_C1) and bases with omphalos (Base_TU). These associations are recorded in eight pairs of burials, respectively.

Then, a strong connection can be read between horizontal stripe motifs (D_C1), vertical stripe motifs (D_C2bis), wave motifs (D_C9), bases with omphalos (Base_TU), bowls (X1) and beakers (X2). These associations are recorded in four to six pairs of burials.

Three ceramic variables are a little bit less common: pots (X3), cruciform bases (Base_CR) and white fillings.

To sum up, some trends for each ceramic shape could be highlighted. Indeed, bowls (X1) seem to mainly be associated strongly to horizontal stripe motifs (D_C1), generally to vertical stripe motifs (D_C2bis) and bases with omphalos (Base_TU), and less strongly to wave

motifs (D_C9) and beakers (X2). Beakers (X2) generally match with horizontal stripe motifs (D_C1) and less strongly with vertical stripe motifs (D_C2bis), wave motifs (D_C9), bases with omphalos (Base_TU), cruciform bases (Base_CR) and bowls (X1). Finally, pots (X3) basically present horizontal stripe motifs (D_C1) and wave motifs (D_C9).

3.2. Comparison with Similarity Network Analysis and discussion

The Similarity Network Analysis we carried out previously (Caraglio *et al.*, Accepted) has firstly shown that the different network global index seemed to illustrate a strong cohesion between all the different Bell Beaker graves, despite a high diversity of ceramic shapes and decorations, and by extension between all funerary areas. The local index of this Similarity Network Analysis highlighted, secondly, the privileged position in the 'network' of some subjects: the two local women (A-35 E03-VII2 from Funerary Area 2 and F-5 C1 from Funerary Area 3) and a man (the A-35 E03-X from Funerary Area 2) (Figure 2).

With the Bipartite Network Analysis in this present study, the heterogeneity of Bell Beaker ceramics' shapes

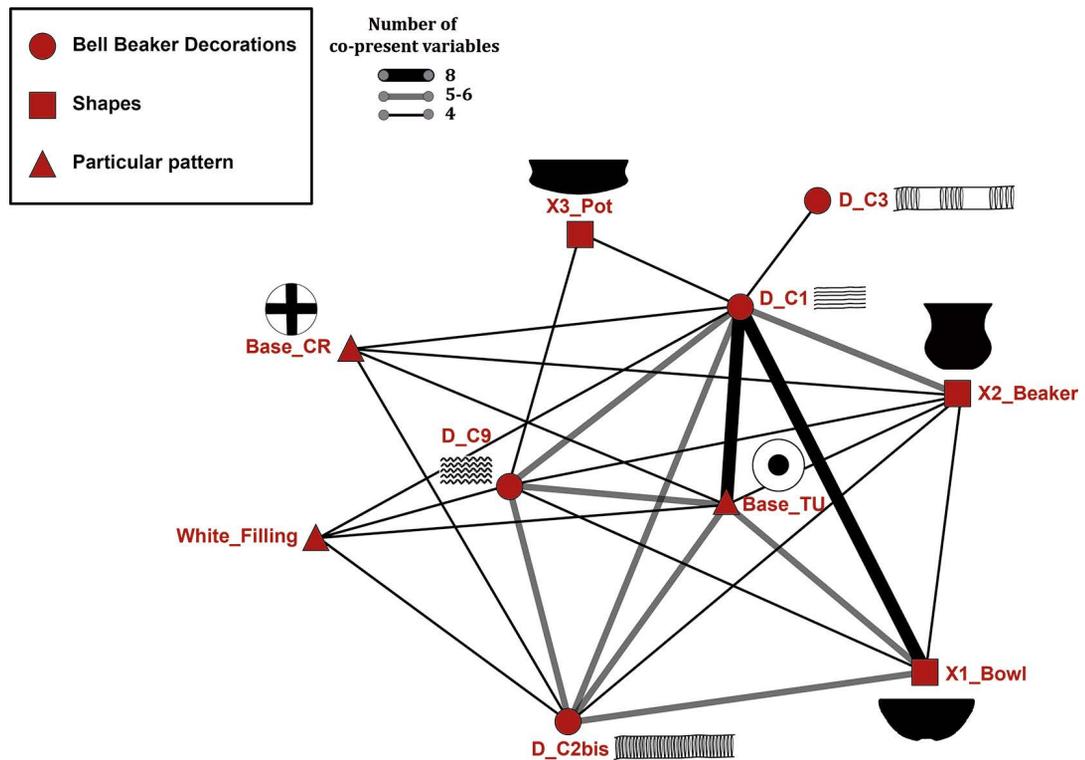


Figure 7: 1-mode graph with the ceramics' variables network. The thickness of the lines expresses the number of cases, where the association of two ceramic variables is found in one grave.

decorations in Camino de las Yeseras site is brought out too. On one hand, we have observed the clear and strong relations between the ceramics associated with the three different Funerary Areas and the collective double Pit A21, and it helps to support the idea of 'cohesion' at necropolis scale. It could reinforce the hypothesis, already put forward by studying bone remains, of specific Bell Beaker funerary practices involving the moving and the extraction of human remains and grave goods as 'relics' inside the site (Liesau *et al.*, 2020). On the other hand, beyond this high diversity, the Bipartite Network Analysis allowed us to determine, in a more easy and direct way, a common background for the Bell Beaker ceramics' elements inside the site: the recurrent association between horizontal stripe motifs (D_C1), vertical stripe motifs (D_C2bis), wave motifs (D_C9) and bases with omphalos (Base_TU) on bowls (X1) and beakers (X2). This is not surprising and confirms what is already known, as it is commonly observed in Central Iberia (Garrido Pena, 2000, fig. 48 p. 212 and fig. 15, p. 124 ; Garrido-Pena *et al.*, 2019, p. 161-193). If this kind of analysis does not reveal, as in Similarity Network Analysis, some prominent individuals, it is maybe a sign of the better reliability of Bipartite Network Analysis for these data, as it brings to a better reading of the direct data and the combinations of ceramics' patterns in a quantitative way. However, the higher number of vessels (13, highly fragmented) in Pits A21, could introduce a bias, but could also speak in favour of a 'house of the dead' hypothesis, where commemorative practices,

removal and relocation of human remains or reopening and closing events of the grave, could have taken place (Liesau *et al.*, 2020, Liesau, 2017).

As this last analysis appears to highlight, each type of vessel (bowls, beakers or carinated bowls) might be assumed to have specific decoration diversity, which could be analysed with Bipartite Network Analyses, individualised by type of vessel. But it would be interesting, then, to go even further and apply this methodology to the technological data of these ceramics, as is exposed in the study of Kroon *et al.* (2019), for instance, by soliciting data about investment in ceramic building technic (Favrel, this volume, Favrel, 2020) and about the direction of the fitting of the coils' joins, the use of beating or polishing (Derenne *et al.*, 2020).

4. Conclusions

The Similarity and Bipartite Network Analyses of Bell Beaker decorations in Camino de las Yeseras ceramics suggest several remarkable aspects.

Despite the extraordinary richness of some tombs, none of them are relevant for the diffusion of pottery types and patterns. The obtained graves network demonstrates strong links between the ceramics from Pit A21 and those of the three other Funerary Areas. Without discarding that this result may be the result of the high diversity of ceramics in this pit, it reinforces the 'house of the dead'

hypothesis, due to the long-term chronology, dispersed bones of several individuals, the ritual sealing of this structure and the beginning of the process of breaking the ceramics into halves.

These kinds of analyses could probably also reflect some kind of ‘métissages’, that is to say, the acceptance of cultural ‘oscillations’ (Capanema *et al.*, 2015) which neither establishes patterns for individual identities, nor creates standards. Without ‘celebrat[ing] fluidity and hybridity over belonging and solidarity’, the idea is ‘to distinguish instances of strongly binding, vehemently felt groupness from more loosely structured, weakly constraining forms of affinity and affiliation’ (Brubaker and Cooper, 2000, p. 20-21). To some extent, if ‘the world of death was a place of broad social expression’, we need to identify what should exist between the ‘devoir-faire’ (what must be done), and the ‘pouvoir-faire’ (what can be done) (Bocquentin *et al.*, 2010).

These first tests could also evoke the idea of ‘Communities of practice’ (Wenger, 1998) inside a site, where each individual can learn, take part, coordinate actions and identify itself within a specific and symbolic world, no matter their biological origins. Thus, Camino de las Yeseras is a unique site for Bell Beaker burials, including in several cases in the same tomb individuals with local, Steppe and/or North-African origin. In such an ‘open minded’ society the ceramic decorations seem to go beyond ‘ethnic identity’ and rather testify to potential personal or apprenticeship relationships (Dietler and Herbich, 1994), as well as a mutual engagement, a joint enterprise and a shared repertoire (Wenger, 1998, p. 73).

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Chalcolithic Bell Beaker Pottery from a Habitational Context at the El Portalón De Cueva Mayor Site (Sierra de Atapuerca, Spain)

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Abstract: El Portalón de Cueva Mayor cave (Atapuerca, Spain) is a settlement site at the entrance of a natural cave. This Holocene archaeological site shows a record of a long archaeological sequence that includes a Chalcolithic occupation starting from 3090 to 2240 cal. BC 2σ . During this phase, different human activities have been identified: habitational floors and fireplaces, post-holes and *fumier* layers. After a funerary use during the onset of the Chalcolithic (Pre-Bell Beaker, dating from 3090 to 2710 cal. BC 2σ) the cave was used for stabling and habitational purposes during the late Pre-Bell Beaker and Bell Beaker phases, where abundant archaeological material (pottery, lithics, bone and metal tools) was deposited. The archaeological remains demonstrate that the human groups that used the cave during this period developed a mixed economy, with farming and hunter-gatherer strategies. This cave shows a small amount of typical Bell Beaker pottery remains, which indicate a continuous use as a stabling and habitational area during the late Pre Bell Beaker and Bell-Beaker phases (dating from 3090 to 2240 cal. BC 2σ).

Keywords: Chalcolithic, Bell Beaker, North Spain, Habitational context, El Portalón de Cueva Mayor, Atapuerca.

1. Introduction

Bell Beaker pottery is normally found in funerary contexts as grave goods and marks a specific period of the European prehistory: the Bell Beaker Chalcolithic. Bell Beaker pottery is frequently found related to other types of non-funerary archaeological contexts, such as salt extraction or copper mining (de Blas Cortina, 2019; Lemercier, 2019; Guerra-Doce *et al.*, 2019). The pottery from this period spread throughout Europe during the 4th millennium BP (Garrido-Pena *et al.*, 2005; Salanova, 2004, 2005). However, the Bell Beaker societies were not uniform and changed their social practice over time, with the adoption of many innovations related to farming practices, dietary habits, etc.

In this paper, we present Bell Beaker (dating from 2480 to 2240 cal. BC 2σ) pottery and the archaeological record from the site of El Portalón de Cueva Mayor (Atapuerca, Spain). A stabling and/or habitational use of the cave is presented, showing the use of Bell Beaker

pottery unrelated to funerary contexts, where it would be typically found (Salanova, 2004, 2005).

2. El Portalón de Cueva Mayor archaeological record

El Portalón de Cueva Mayor is a Holocene archaeological site located in the Sierra de Atapuerca, 15 km from the city of Burgos (north Spain) (Carretero *et al.*, 2008; Alday *et al.*, 2011. Figure 1a). The site is located at the natural entrance to the karst system of the Sierra de Atapuerca. This Sierra is internationally well-known for its sites with evidence of Pleistocene hominins (Carbonell *et al.*, 1995; Arsuaga *et al.*, 1997; Bermúdez de Castro *et al.*, 1999; Carbonell *et al.*, 2008), but it also provides a rich stratigraphic sequence for the Holocene period (Clark *et al.*, 1979; Apellániz and Domingo, 1987; Carretero *et al.*, 2008; Pérez-Romero *et al.*, 2010, 2013, 2017; Vergés *et al.*, 2002, 2008). The stratigraphic sequence of El Portalón is more than 10 m deep (Carretero *et al.*, 2008. Figure 1b-c) and contains stratigraphic units rich in archaeological evidence dating from the Mesolithic to the Middle Ages

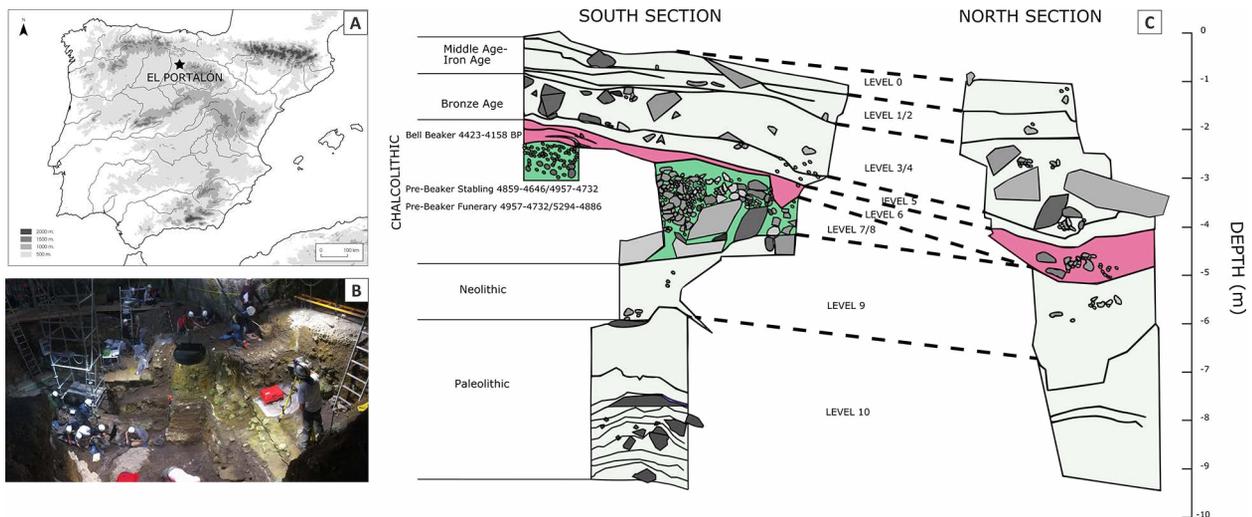


Figure 1: El Portalón de Cueva Mayor archaeological site. (A) Location of the site in the northern Iberian plateau and within the Sierra de Atapuerca karstic system (Burgos). (B) General view of the excavation area during the 2017 campaign. In the upper excavation sector Bronze Age units are being excavated, in the bottom area, Neolithic units. (C) Stratigraphic record of the profile of the excavation area with Chalcolithic levels (Level 6 Bell Beaker, Level 7-8 pre-Bell Beaker).

(from ca. 8000 yr cal BP to 796 yr cal BP; Clark *et al.*, 1979; Carretero *et al.*, 2008; Günther *et al.*, 2015; Galindo-Pellicena *et al.*, 2017; Pérez-Romero *et al.*, 2010, 2013, 2017; Rofes *et al.*, 2021; Galindo-Pellicena *et al.*, 2022). This indicates that El Portalón has been occupied by humans during a prolonged period. The present excavation is focused on two different stratigraphic units: Neolithic (Level 9) and Bronze Age (Level 5).

2.1 The Chalcolithic of the El Portalón de Cueva Mayor

The Chalcolithic stratigraphic unit of El Portalón de Cueva Mayor site is divided into two cultural phases: Pre-Bell Beaker phase (Levels 7-8) and Bell Beaker phase (Level 6) (Figure 1c). At the beginning of the pre-Bell Beaker period (Level 8) the cave indicates a funerary context, and later (Level 7) a stabling and habitational context is seen. The settlement-like occupation of the cave continues during the Bell Beaker phase (Level 6) (Pérez-Romero *et al.*, 2017).

2.1.1 Pre-Bell Beaker Funerary Context

The burial phase is comprised of an oval shape tumular stacking of decimetric limestone clasts approximately 8 m in diameter and 2 m high in the centre. The tumular structure was built by a progressive vertical and lateral accumulation of limestone clasts over a basal floor covered with pottery 'pavings' and numerous circular small fire pits filled with partially burned wooden fragments (Figure 2). Around the fire pits, nearly complete ceramic bowls are found, along with the remains of immature domestic fauna, mainly lambs, in anatomical position. Among the limestone clasts and

sometimes lying on the floor, various human remains have been found, defining funerary contexts with some archaeological elements typical of grave goods (Pérez-Romero *et al.*, 2017).

The funerary context seems to be the result of repetitive burial activity, showing a minimum of eight individuals, following a similar funerary pattern over time. The later habitation and stable use of the cave seems to have contributed to the disturbance of some of the funerary structures (Pérez-Romero *et al.*, 2017; Castilla *et al.*, 2014).

2.1.2 Pre-Bell Beaker and Bell Beaker Habitat and Stabling Context

The latest part of the pre-Bell Beaker phase (Levels 7 and 8) and the Bell Beaker phase (Level 6) of the site is characterised by similar archaeosedimentary findings and inferred past activities. Well-delimited stabling areas, characterised by *fumiers*, are found in habitational stratigraphic levels with prepared clay floors, excavated hearths and abundant archaeological remains, indicating the presence of both herds and shepherds, in the cave.

The archaeosedimentary record is composed of alternating *prepared floors* and *activity floors* that are in the same stratigraphic layer as the *fumier*-type stabling layers. Prepared floors are composed of orange-brown silty/clayey levels less than 10 cm thick and do not include significant archaeological remains. After analysis, these floors have been determined to be man-made floors composed of endokarstic silts and clays

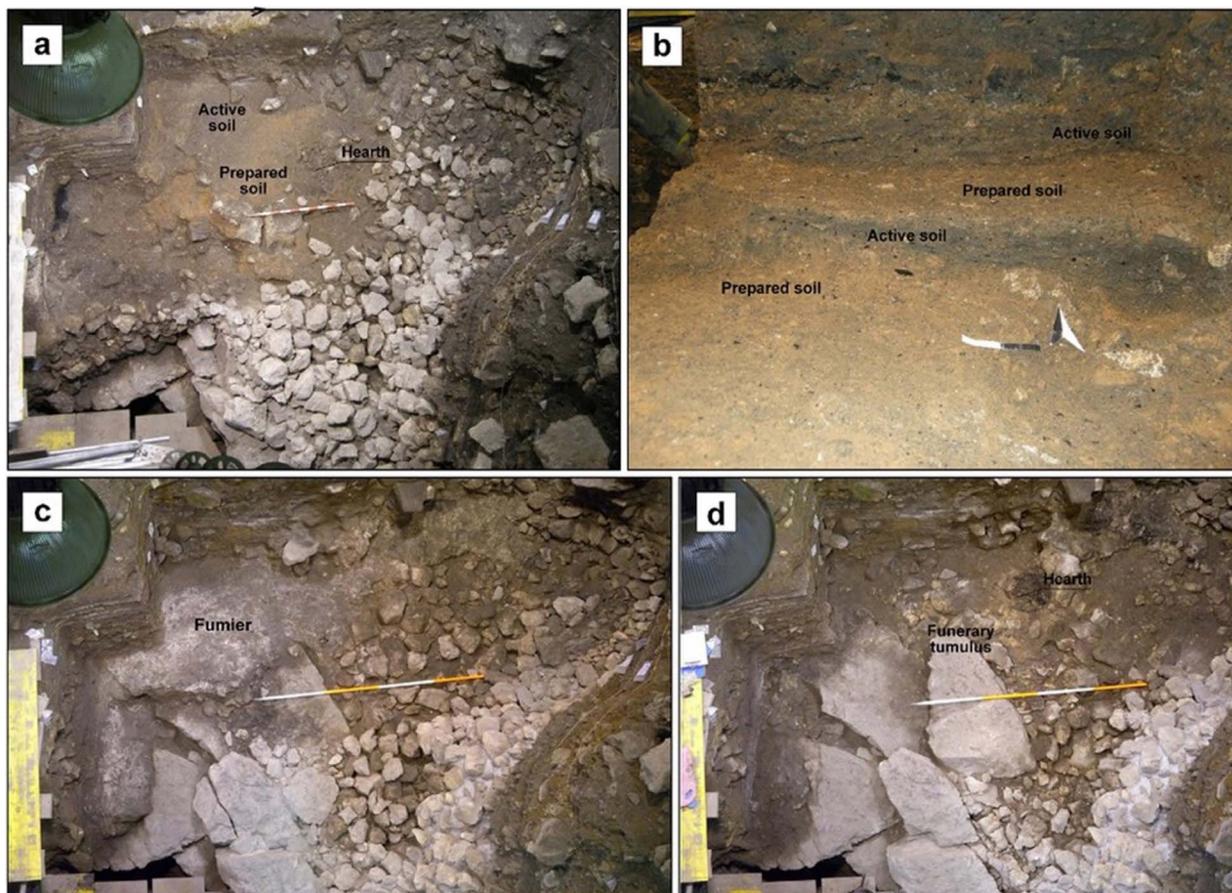


Figure 2: Different archaeological contexts of the Chalcolithic level of the El Portalón de Cueva Mayor site: a) General view during the excavation of a prepared floor and active soils from the stabling and habitational phase. Note the overlapping disposition of these units in relation to the limestone blocks of the funerary tumulus from the previous phase; b) detailed view of the alternation of prepared clay floors (orange) and active soils (dark) from the habitat/stabling context; c) partially excavated white ash layer (fumier) covering the funerary tumulus; d) general view of the funerary tumulus; note the basal large limestone blocks which originated from a collapse of the cave roof.

extracted from the internal galleries of the cave where the pits are still visible. They usually contain anthropic structures, such as hearths and postholes, and appear interspersed with grey sediments belonging to *activity floors* (Fig. 2a-b). Activity floors consist of dark clayey layers formed by the remains of human activities that took place on them (ashes, charcoal, bone fragments, pottery, vegetal remains, etc.) mixed with fine sediments, trampled and normally deposited above the prepared floors. They have variable thickness, from a few centimetres to decimetres (Figure 2b). Stabling layers or *fumiers* appear as fine alternating horizontal (millimetric to centimetric) units with abundant charcoal and ash presence. They represent burned remains of vegetal elements (herbaceous and branches) and manure from livestock stabling areas. These units appear either attached, laterally equivalent to or interspersed with the prepared floors and the activity floors (Fig. 2a-b). Thus, compartmentalisation and alternating uses of the cave space are observed.

2.1.3 Chronology

Seven different samples from the Chalcolithic stratigraphic units studied in this work have been radiocarbon dated (Figure 3). These samples are from both the funerary and stabling contexts. The sample set comprises two human samples, two samples from faunal remains and one cereal seeds (*Triticum sp.*). Radiocarbon dating was performed using accelerator mass spectrometry (AMS) at Beta Analytic Inc. (Miami, Florida) (Pérez-Romero *et al.*, 2017; Günther *et al.*, 2015). Calibration was made by using Oxcal v4.4 software based on the IntCal20 radiocarbon age calibration curve (Reimer *et al.*, 2020).

2.2 Human remains

There are 20 elements of human remains in the Bell Beaker (Level 6). These remains belong to a minimum of four individuals, two subadults and two adults. The

Figure 3: Radiocarbon dates of the Chalcolithic levels of the El Portalón de Cueva Mayor site. Con.: conventional; cal.: calibrated. Calibration in year's cal. BP was made by using Oxcal v4.4 software based on the IntCal20 radiocarbon age calibration curve (Reimer *et al.*, 2020).

Sample	Chalcolithic Cultural context	Lab. Code	Age (yr cal BP)	Age (yr cal BC 2σ)	Reference
Charcoal	Late Bronze Age/Bell Beaker Chalcolithic	Beta-212189	4280-4100	2330-2060	This study
Human radius	Bell Beaker Chalcolithic	Beta-269494	4430-4190	2480 -2240	Alday <i>et al.</i> 2015
E. caballus	Bell Beaker Chalcolithic	Beta-253408	4430-4240	2480-2290	This study
Sediment	Bell Beaker Chalcolithic	Beta-153363	4520-4150	2580-2200	This study
Triticum sp. seed	Pre-Bell Beaker/Stabling (UE209)	Beta- 347579	4859-4646	2900-2710	Pérez-Romero <i>et al.</i> , 2017
Human	Pre-Bell Beaker/Funerary (UE80)	Beta-368295	4960-4829	3011-2881	Günther <i>et al.</i> , 2015
Bos sp.	Pre-Bell Beaker/Funerary (UE80)	Beta-337299	5042-4860	3090-2910	Pérez-Romero <i>et al.</i> , 2015

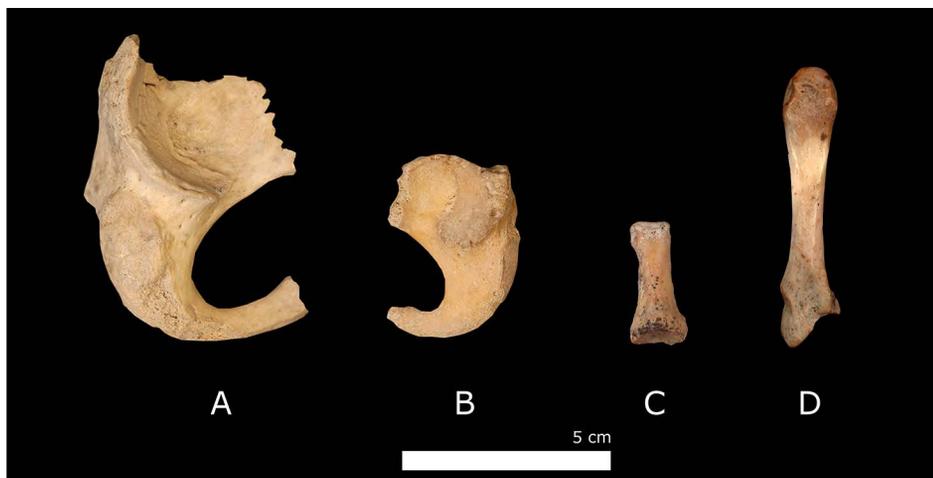


Figure 4: Human individuals represented in the Bell Beaker level of the Portalón site: A) adolescent individual, B) infant individual, C) Male adult individual, D) Female adult individual.

subadult individuals consist of an adolescent and an infant, represented by one ischial bone each - one left (infant) and one right (adolescent) (Figure 4a-b). Adult individuals are a male and a female, represented by a third metacarpal (female) and a proximal phalanx of a thumb (male) (Figure 4c-d). These two bones were sexed by DNA analysis (Günther *et al.*, 2015). Three fragments of the same mandible which are scattered in three different stratigraphic units (UE4, UE5 and UE20) are compatible by size with the female individual. These human remains are not related to any burial complex and they were in secondary position, without any skeletal connection.

2.3 Stone tools

The lithic artefact collection is composed of 347 remains (Bell Beaker, Level 6; Figure 1). The primary raw material used is chert, making up 70% of the objects (n = 249). Other secondary raw materials used are sandstone (n = 30; 8.7%), quartz (n = 5; 1.5%) and ophite (n = 2; 0.6%). Slate, granite and rock crystal are only used in one case each. The industry is mainly knappable (Figure 5a-f), primarily blades (n = 31), but there are 4 polished tools as well (n=4): a sharpener, a fragment of an axe and two ornaments (Figure 5i-j).

2.4 Bone tools

In the Bell Beaker horizon there were also 34 bone items recovered. Their typological description is made following Poplin (1974) including some additional information (Maicas, 2007; Pérez-Romero *et al.*, 2015).

There are various types represented, depending on their use as tools, weapons and ornaments. In the case of pointed tools, it is possible to distinguish amongst the various types: awls (Figure 5k-o), needles (Figure 5p), and bi-pointed fish-hooks (Figure 5s). The 11 awls make up the majority of the sample. The weapons were used for war and/or hunting purposes. Ornamental bone industry with perforations such as beads or buttons ($n = 6$) are also seen (Figure 5w-x). They have different morphologies, such as tubular (Figure 5w), discoidal or circular designs (Figure 5y) as seen in the beads, or prismatic (similar to other examples in Pyrenees range, Alday, 1987) or triangular with a 'V' section as seen in the buttons (Figure 5z).

One of the awls (Figure 5o) is made from a human radius. Other similar examples were found in the Iberian Peninsula at Arnillas (Delibes, Rojo and Sanz, 1986) and Zumacales (Alonso Díez *et al.*, 2015), as well as in Europe, at Goyet (Toussaint, 2005).

2.5 Metal remains

There are two copper pieces (Bell Beaker, Level 6; Figure 1), one bi-pointed awl and the other a fragment from a possible awl. We have no evidence of any metallurgical activity at the site (Figure 6).

2.6 Faunal remains

The numbers of identified specimens (NISP) from the Bell Beaker Chalcolithic (Level 6) habitational context constitute 988 elements of faunal remains. The domestic forms make up 96% of the determinable remains. The ovicaprines (*Ovis aries/Capra hircus*) are the best represented taxa, with 62% of the determinable remains and *Bos taurus* represented by 29%. Bone remains of *Sus domesticus* (4%); *Equus* sp. (2%); *Canis familiaris* (0.2%) represent less than 5%. One mandible with teeth belongs to *Sus scrofa* was found and one phalanx is included in the metrical variation range of *Bos primigenius*. *Cervus elaphus* make up 0.5% of the sample. Bone remains of *Leporidae* *indet.* (1.4%) and avian remains (1.2%) are also represented in the level.

The minimum number of ovicaprine individuals is 18. Concerning the mortality profile of the ovicaprines, five individuals were slaughtered at an age above four years (adult: Greenfield and Arnold, 2008) and four individuals were younger than four years old, calculated by dental eruption and tooth wear (Payne, 1973). This slaughter

profile shows a relatively high proportion of adults, which can be indicative of fleece production (class G: Vigne and Helmer, 2007) and the keeping of livestock for reproduction. However, meat and milk production is represented primarily by individuals under four years of age.

The minimum number of *Bos taurus* is 12: two were older than four years (adult: O'Connor, 1991); three older than six years (elderly: O'Connor, 1991); and one younger than four years, as calculated by dental eruption and wear. The mortality profile indicates a similar situation to the ovicaprine livestock, with a relatively high proportion of adults. The data on tooth eruption and wear indicates that the individuals slaughtered between four and six years were used for breeding and dairying. The older livestock suggests the use of cattle for traction or load bearing (Galindo-Pellicena *et al.*, 2017). The sex distribution indicates that cows were focused on breeding and dairying and do not present pathological signs. On the other hand, bulls were probably used as draught or traction animals, as indicated by skeletal lesions (Galindo-Pellicena *et al.*, 2017).

3. Bell Beaker decoration pottery in a non-funerary context

3.1 Pottery decoration

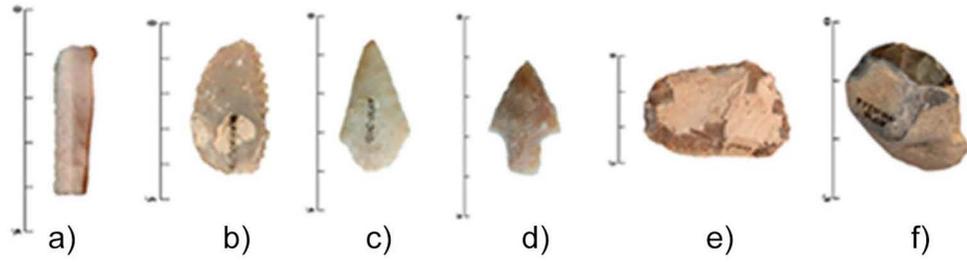
Of the more than 14000 archaeological remains recovered in the Bell Beaker Chalcolithic stratigraphic level (Level 6), 70.69% are pottery sherds ($n = 10162$). Only 0.2% have typical Bell Beaker decoration ($n = 19$) related to peninsular and international styles of decoration (Salanova, 2000, 2004; Cardoso, 2014): International MHV (2 sherds, Figure 7a) and CZM (5 sherds, Figure 7b-e); Ciempozuelos (6 sherds, Figure 7f-i); Somaén (1 sherd, Figure 6j); and, Silos/La Vaquera (5 sherds, Figure 7k-o). Of the 19 sherds, nine are walls, eight are rims and one is a base. Due to the shape and decorative design, it is possible to determine a MNP (Minimum Number of Pots) of 15. Because of the high level of fragmentation (sherds *ca.* 4x4 cm), it has been only possible to identify two shapes (a bowl and a large vessel; Figure 7b and f) characteristic of the Bell Beaker triad (Delibes, 1977; Delibes *et al.*, 2009).

International styles MHV and CZM (Harrison, 1977; Garrido-Pena, 2000; Alday, 2001; Garrido-Pena *et al.*, 2005; Camarero and Arévalo, 2018) are well-known decorative forms which originated in the Tagus estuary and spread across Europe, adding new designs (Salanova, 2000; Cardoso, 2014, 2017; Olalde *et al.*, 2019). In the El Portalón examples, the patterns consist of bands filled with impressions of a comb or cord (Figure 7a-e).

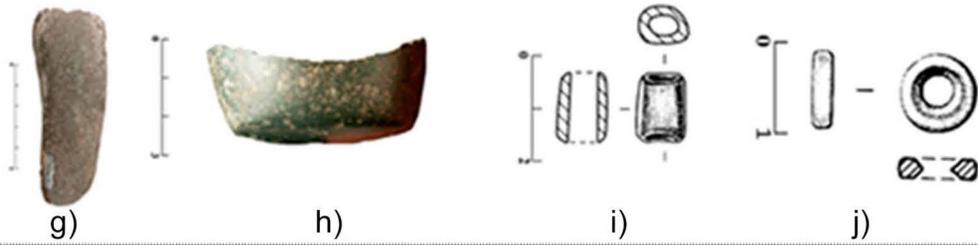
LITHIC TOOLS

BONE TOOLS

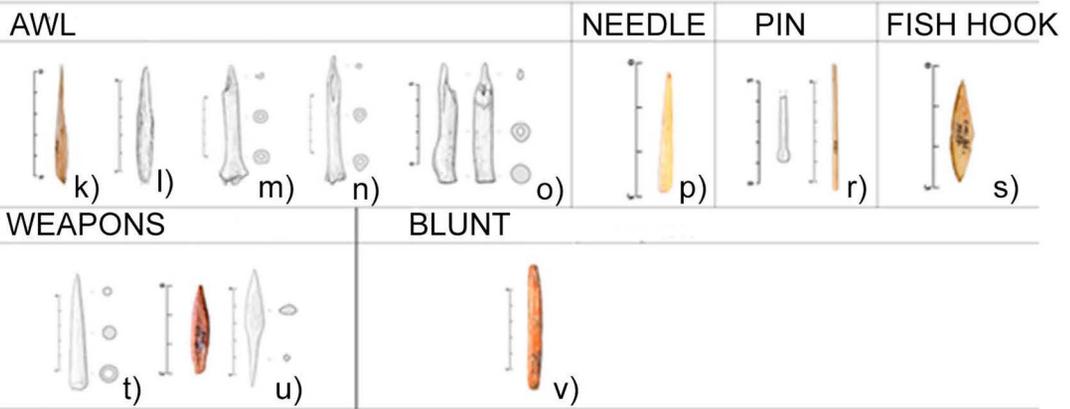
KNAPPED



POLISHED



POINTED



PERFORATION

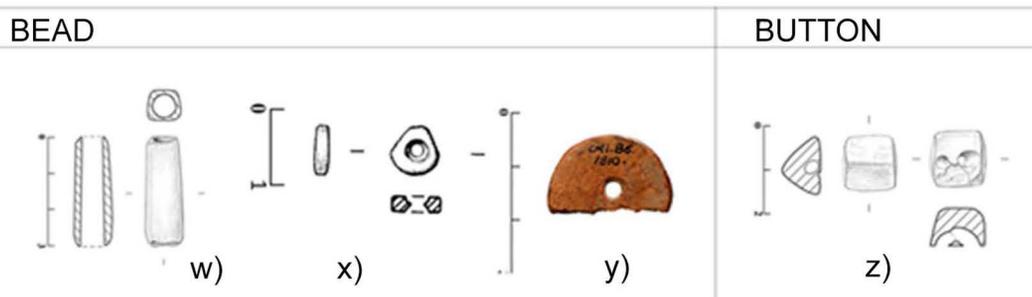


Figure 5: Lithic and bone remains from El Portalón in Bell Beaker units. Lithic tools knapped (a-f) and polished (g-j); and bone tools pointed (k-v) or perforated (w-z).



Figure 6: metalwork remains from Bell Beaker in El Portalón de Cueva Mayor. (a) metallic bipointed awl; (b) metallic fragmented awl.

On the other hand, the Ciempozuelos style is the most abundant in the north of the Iberian Peninsula (Delibes, 1977; Harrison, 1977 and Garrido-Pena, 2000). In El Portalón, this style is defined by two techniques: (i) incisions: bands filled with perpendicular incisions with other bands left blank; (ii) incision-impressed: bands left blank and a band filled with an impressed motif (Figure 7f-i). Somaén decoration constitutes bands filled by oblique and zigzag lines; these are similar to those from Inner Peninsula sites: Somaén (Soria, Spain. Barandarián, 1975; Cajal, 1981) or El Perchel (Soria, Spain. Lucas de Viña and Blasco, 1980). The final peninsular style is Silos/La Vaquera, named for the Santo Domingo de Silos and La Vaquera sites (Fernández-Posse, 1981; Delibes, 1988), where it was defined. These are similar to Ciempozuelos with incisions but are rougher and less polished than the original Ciempozuelos. In El Portalón, the designs are bands with oblique lines (Figure 7k-o).

The only recognisable vessel shapes are a bowl with Ciempozuelos decoration (Figure 7f) and a large-vessel with CZM typology (Figure 7b).

The firing method of the majority of the Bell Beaker decorated sherds is reducing ($n=16$), with no differences depending on decorative style. External surfaces are

polished on the sherds decorated with Ciempozuelos, MHV and CZM styles, while the others have a rough surface.

3.2 Raw materials

Petrographic examination has been carried out on the pottery remains of El Portalón. Some samples belong to the Bell Beaker chronology (dating from 2580 to 2240 cal. BC 2σ ; Level 6) ($n = 3$), and the results have been incorporated into a wider compositional study of the pottery through time at the site (Francés-Negro, 2020). This study has shown several Manufacture Groups (MG), and in the case of Bell Beaker pottery, a correspondence with other samples from the Chalcolithic pre-Bell Beaker and Neolithic. Thin sections were described using temper size tables and features according to Whitbread (1995) and Quinn (2013).

Thin section analysis has showed 3 Manufacture Groups (MG) with two main types: carbonate and siliceous tempers.

A) Manufacture Group 1 (Figure 8a)

Matrix: reddish matrix and high birefringence.

Voids: elongated pores and vughs, with meso and macropores (0.5 mm).

Natural Inclusions: characterised by calcite-filled gypsum crystal pseudomorphs and idiomorphic quartz grain inclusions.

Temper: pelloidal micritic limestone lithoclasts.

B) Manufacture Group 2 (Figure 8c)

Matrix: reddish and high birefringence.

Voids: planar and elongated pores and vughs, with meso and macropores (0.5 mm) and preference orientation to rim.

Natural Inclusions: small silt-size quartz grain inclusions with high sphericity and rounded habits.

Temper: characterised by slate and quartz sand-sized inclusions.

C) Manufacture Group 3 (Figure 8e)

Matrix: reddish and high birefringence.

Voids: Macropores (up to 2 mm) are present.

Natural Inclusions: small silt-size quartz inclusions rounded and with high sphericity in clay.

Temper: micritic limestone.

The paste preparation recipes reconstructed starting from the petrographic examination and hypothesised raw material provenance from the vicinity of the site were tested by means of experimental archaeology. Therefore, the authors collected clay at a distance <5 km (Arnold, 1985) from El Portalón Cave and

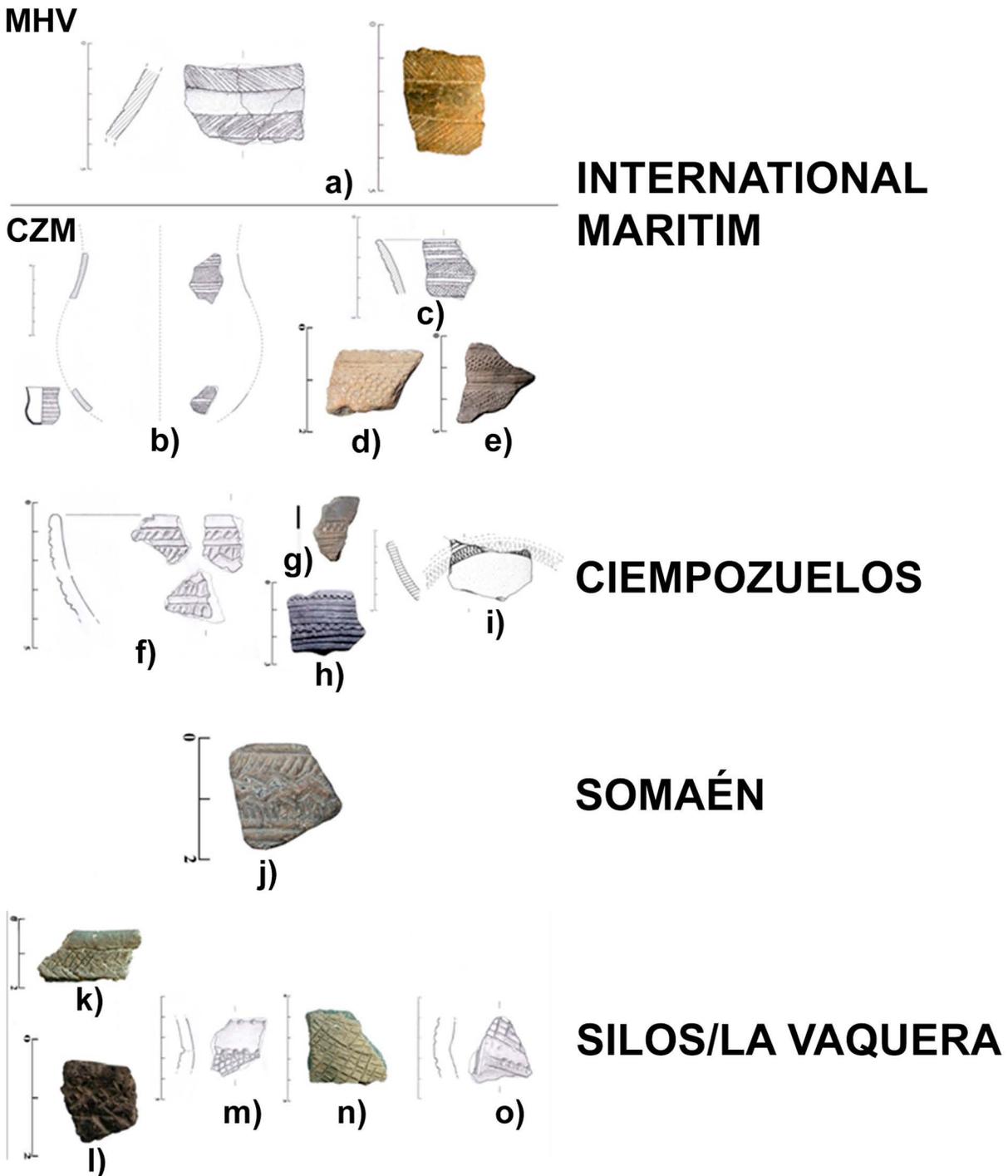


Figure 7: Bell Beaker pottery decorations in El Portalón de Cueva Mayor. a) International Maritime MHV; b-e) International Maritime CZM; f-i) Ciempozuelos; j) Somaén; k-o) Silos/La Vaquera.

prepared 10 experimental vessels following the *chaîne opératoire* described by Cau-Ontiveros *et al.* (2015). The paste preparation recipe of the experimental replica involved the addition of peloidal limestone, sandstone and micritic limestone rocks which were found in the surrounding area. The different MGs represent the exploitation of different clay and rock deposits, all located at <5 km from El Portalón Cave.

The petrographic Bell Beaker archaeological group is characterised by peloidal limestone temper (Figure 8a); this material has been identified in experimental samples (Figure 8b) made from Upper Cretaceous marine limestone facies recovered from the surrounding area of the site. The MG2 group is characterised by (siliceous) temper (Figure 8c). This has been also identified in experimental samples (Figure 8d) where Triassic sandstones were used. Finally, for the MG3

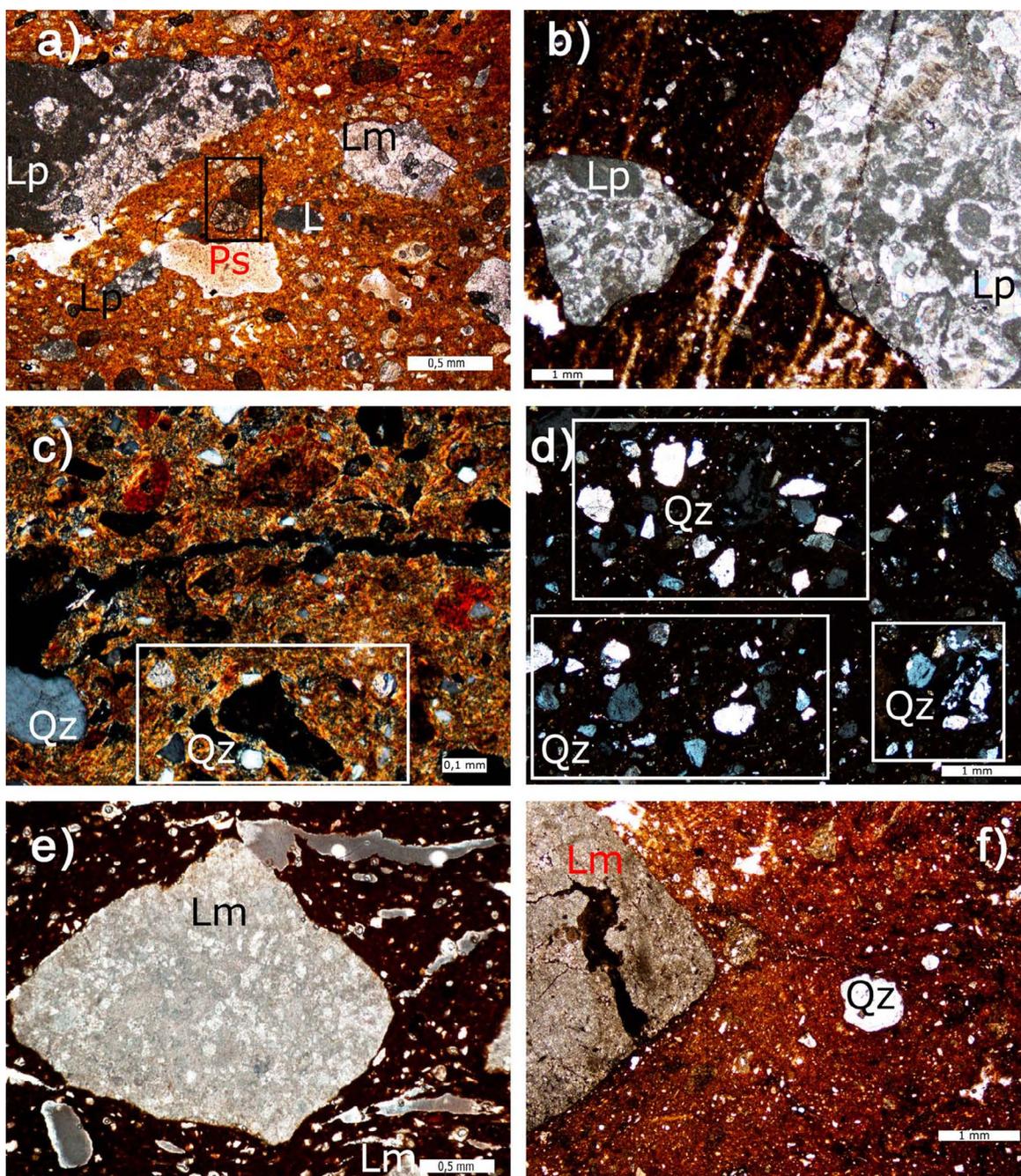


Figure 8: Photomicrographs of some thin-section potsherds showing the main textural and compositional differences observed. (a) Manufacture group 1 (MG1) sample ATP'07.38 with pelloidal limestone, non-polarized light. (b) Experimental sample 6 with pelloidal limestone, non-polarized light. (c) Manufacture group 2 (MG2) sample ATP'07.134 with monocrySTALLINE quartz grain, cross-polarized light. (d) Experimental sample 10 with monocrySTALLINE quartz grains (e) Manufacture group 3 (MG3) sample ATP'07.69 with micritic dolomitized limestone, non-polarized light. (f) Experimental sample 9 with micritic limestone, non-polarized light. Abbreviations: Ps-gypsum pseudomorphs, Qz-quartz, L-limestone, Lm-micritic limestone, Lp-pelloidal limestone. Scales are shown in pictures.

group the temper was identified as micritic limestone (Figure 8e) and has been found in experimental samples (Figure 8f) including Upper Cretaceous marine and/or Miocene limestone fragments.

The local manufacture of Bell Beaker products has been previously identified in Portugal (Cardoso *et al.*, 2003;

Carvalho-Amaro, 2011; Dias *et al.*, 2017), north-west Spain (Lantes-Suárez *et al.*, 2015; Salanova *et al.*, 2016), Cantabria (Vega Maeso *et al.*, 2021), Western Europe (Salanova *et al.*, 2016) and Central Europe (Všianský *et al.*, 2014). The local manufacture of Bell Beaker vessels led Brodie (1992) to propose that Bell Beaker products could be used as everyday vessels, not only for funerary

purposes, and points to the circulation of the 'idea' and some 'prototypes' (Blanco-González *et al.*, 2018), but with local production.

4. Conclusions

During the Bell Beaker Chalcolithic period (dating from 2580 to 2240 cal. BC 2σ) at El Portalón, 19 pottery sherds with typical Bell Beaker decoration were found in habitational-stabling contexts unrelated to the traditional funerary Bell Beaker contexts. Human occupation was continuous from pre-Bell Beaker chronologies, without significant changes in the stratigraphy and the archaeological contents. The stabling pre-Bell Beaker level 7 is characterised by *fumiers* and occupation floors. The same layers are observed in the Bell Beaker phase level 6. Human remains are not related to this habitational-stabling context, but belong to the previous funerary pre-Bell Beaker unit (Level 8). This level was flattened to adapt it to the new habitational and herding needs.

The site was used as a habitational and/or stabling place, shown by the presence of classic *fumier* layers, and prepared floors. The communities during 3rd millennium along the Duero river valley and Inner Plateau lived in small, scattered cave openings and close to fluvial banks near fertile plains (Rodríguez Marcos, 2008; Fabián, 2006; Carmona Ballesteros, 2013; Blanco-González *et al.*, 2018). These elevated sites gained in importance during the Bell Beaker phase. Using the division of the Northern Meseta by Villalobos García (2016), El Portalón is included in the eastern sector, which is characterised by a strong exchange network, observed in the influence of several decorative pottery styles (Blanco-González *et al.*, 2018).

The identified raw materials are available near the archaeological site, indicating local manufacture. In general, the MGs and raw materials are similar to previous Neolithic pottery at the site, indicating a continuity in pottery manufacture during the Neolithic and Chalcolithic (Francés-Negro, 2020).

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Author contributions

Conceptualisation, M.F.-N., A.P.-R., J.M.C. and A.A.; validation, all; formal analysis and investigation, A.P.-R., M.F.-N., J.M.C., E.I., M.Á.G.-P., L.R. and R.G.; discussion of the results, all.; writing—original draft preparation, A.P.-R., M.F.-N., J.M.C., E.I., M.Á.G.-P., R.G., and L.R.; writing—review and editing, M.F.-N.; A.P.-R.; funding acquisition, all.

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Stone Bracers in Continental Western Europe. New Insights from Bell Beaker and Early Bronze Age Contexts

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Abstract: This paper aims to collect and comment on up-to-date typological and contextual data for the study of items that are as problematic as they are emblematic of the Bell Beaker phenomenon: the so called ‘wrist-guards’ or stone bracers. The first stage presents the results, method and geographical distribution of a new critical inventory of continental Western Europe stone bracers (Netherlands, Luxemburg, Switzerland, France, Spain, Portugal). 186 stone bracers could be recognised while 79 items have been rejected as they do not meet the proposed criteria. The second step is a descriptive analysis of the recorded stone bracers’ typological features. These appear simple except in the most easterly regions where the typological pattern is richer. The third part deals with contextual reliability and relationships of the corpus. The vast majority of contexts are funerary; however, reliable assemblages are in a minority. Metallurgy and archery seem to be equally represented among associated grave goods, the former more particularly in the Iberian Peninsula and the latter in the Rhine basin. Both typological and contextual data can be compared to what occurs in Great Britain and Central Europe. Finally, chrono-cultural and functional issues remain unresolved and need further work.

Keywords: Archery, Copper, Function, Lithic, Metallurgy, Methodology, Typology, Wrist-guards

Introduction

Stone bracers, also called ‘wrist-guards’, ‘*Armschutzplatten*’ or ‘*brassards d’archer*’, are typical items of the Bell Beaker culture (Harrison 1980; Sangmeister 1974; Treinen 1970). Known from Central Europe to Portugal, they seem to appear with this phenomenon then disappear shortly afterwards, at the end of the Early Bronze Age; the latest contexts were discovered in Slovakia, northern Italy and south-eastern Spain (Grigoriev 2019; Aspes and Fasani 1976; Siret and Siret 1887).

They consist of polished stone plates whose rock type varies from region to region and whose length generally ranges from 6 to 13 cm (Ekemans 2009; Grisse and Schaack 2009; Woodward and Hunter 2011; Nicolas 2020a). More or less narrow or compact, they can also be distinguished from each other by both long sides and cross-section morphologies. Opposite holes must have supported a fastener at the forearm or the elbow, as evidenced by both contextual and use-wear analyses (Delgado Raack 2008: 398; Fokkens *et al.* 2008; Vaart-Verschoof 2009; Woodward and Hunter 2011; Muñoz Moro 2019; Nicolas 2016, 2020a, b).

The actual purpose of these abstruse plates has been debated from the 19th century to this day. Mere ornaments, archer’s wrist-guards, power, prestige, masculinity, martiality and/or archery symbols, sharpening-polishing tools for copper-based, bone or wooden objects and touchstones are among the several functional hypotheses that have arisen throughout the history of research (Ingram 1867; Evans 1872: 383; Siret

and Siret 1888: 32; Martin 1898; Castillo Yurrita 1928: 41; Degen 1976; Risch 1995: 221; Delgado Raack and Risch 2006; Smith 2006; Heyd 2007; Delgado Raack 2008: 398; Fokkens *et al.* 2008; Vaart-Verschoof 2009; Woodward and Hunter 2011; Turek 2015; Nicolas 2020a).

Thus, as the functional debate about stone bracers is still open (Muñoz Moro 2017), this calls for further investigation. Other questions are: where, when and by whom were these plates worn and how did they evolve through time, space and cultures?

Taking up these challenges, we thought a new critical inventory of all stone bracers discovered over continental Western Europe was necessary. Indeed, a systematic documentation of their morpho-technical characteristics as well as their archaeological background should help to prepare both functional and chrono-cultural studies. Moreover, while examples from Great Britain and Central Europe have benefited from recent works (Vaart-Verschoof 2009; Woodward and Hunter 2011; Nicolas 2020a, b), the latest inventories including the western part of the European continent were, as far as we knew, those published by Edward Sangmeister (1964, 1974).

In this paper, we will first present the outcome, method and geographical distribution of our critical inventory of Western Europe stone bracers. In a second step, we will draw up the typological patterns of the corpus. The third part deals with its contextual reliability and relationships. After having discussed the chrono-cultural and functional issues in a fourth stage, we will conclude our study then outline research perspectives.

I. Updating Western European data

I. 1. Results of the critical inventory

Our survey has resulted in a critical inventory of 186 actual stone bracers discovered in France, Luxemburg, the Netherlands, Portugal, Spain and Switzerland. These 186 confirmed stone bracers constitute the study corpus. Another 79 items have not met the proposed criteria (see below) and have therefore been rejected from the corpus.

We think the inventory is almost up-to-date for France, the Netherlands and central Spain. It is well advanced for Portugal and southern Spain. Northern and eastern Spain, Switzerland and Luxemburg would need further queries. It seems that no stone bracer is known in Belgium, which could mainly be the state of research (pers. com. E. Warmenbol, Dec. 2020).

I. 2. Methodology used for the critical inventory of stone bracers

The items of our critical inventory are divided into two main categories: stone bracers (SB), rejected items (RI). The proposed classification rules follow archaeological, analogical and functional criteria.

Bell Beaker archaeological contexts are the starting point for our definition of the study object. The Bell Beaker homogeneous assemblages we are aware of yielded stone plates with opposite holes. None of the reliable Bell Beaker contexts provided such plates with opposite holes which were made of a material other than stone. To be included in the study corpus, items from uncertain contexts must therefore have a lithic material and opposite holes. In addition, they must have a plate morphology and dimensions that allow them to be attached to the forearm or elbow through the opposite holes, as evidenced by the above-mentioned contextual and use-wear studies. The sum of these criteria defines the object of study as stone bracers (SB).

Items referred to as ‘stone bracers’ or ‘wrist-guards’, but which do not meet the proposed criteria, are rejected from the study. Rejected items (RI) are divided into four subcategories (R1, R2, R3, R4) following the reasons of their exclusion, from minor to major reasons (see Supplementary Information, ‘RANK’ column).

R1 items are stone plates with little or no fragmentation that cannot fully meet the above criteria. Some of them may be unfinished stone bracers as well as unfinished or re-worked pendants (or any other artefacts). Further R1 items have two opposite holes, one of which is broken, and morphometric features that are insufficiently knowable or characteristic of the known stone bracers to distinguish them from re-worked pendants.

R2 items are fragments of a stone plate perforated at the remaining end that could not be reconstructed into an actual stone bracer with other fragments. Fragments with a single hole could just as easily have been a stone bracer or a pendant. Fragments of lithic plates with more than one hole at the remaining end are often admitted to the study corpus (SB) as this feature, together with morphometric matches with the known stone bracers, make these fragments more characteristic. Fragments that have more than one hole but lack morphometric matches are classified as R2 items.

A further techno-functional analysis may recognise within R1 and R2 items actual stone bracer roughouts or fragments, hence the interest in distinguishing them from items with a more questionable identity.

R3 items are bracer-like plates made of a material other than stone. Made of bone (e.g., ID 259), amber, jet or gold (ID 189, 194, 195, 198), certain R3 items might be the same functional class as the Bell Beaker stone bracers, as well as copies with a different function, unless this similarity was merely accidental and neither functional nor mimetic in origin. None of the recorded R3 items have been documented as having been found near a deceased’s arm. Some of them may be prestigious imitations from the Early Bronze Age (Nicolas 2019: 132). Further works may prove that R3 items and stone bracers had the very same functionality, which is currently debated (Muñoz Moro 2017), hence our choice in keeping the first out and focusing on the latter to avoid dispersion.

R4 items have an even more questionable archaeological identity, either because they are unrecognisable fragments with no perforation, or they are bracer-like lithic items with possible anachronistic attributes and/or contexts that could suggest an off-topic or a fake (e.g., ID 227), or they are lost and never figured, or they may be documentary duplicates.

I. 3. Corpus geography

Geographical distribution of the 186 stone bracers (SB) recorded in Western Europe is not homogeneous at all (Figure 1). Eight main geographical groups can be delimited: southern Portugal, the Spanish Meseta, south-eastern Spain, Brittany, the lower Rhone Valley, the upper Rhine Valley, French Moselle/Luxemburg, the Netherlands. Four minor regional groups seem to be northern Portugal/Galicia, the Atlantic Loire, the Paris Basin, the Saone Valley.

Other scattered bracers occur in the western Gulf of Lion, the Massif Central, northern France, south-western Alps, Corsica, the Swiss Plateau, northern, southern and eastern Spain. The latter Swiss and Spanish regions are, however, less known than the

previous ones. By contrast, it appears fairly certain that a wide 'vacuum diagonal' crosses France from the Pyrenees to Belgium.

II. Typological analysis

II. 1. Choice of a typology

In order to describe stone bracers morphological and mechanical features, we have decided to use Smith's (2006) typology as slightly developed by Harry Fokkens *et al.* (2008; Figure 2: A; see Supplementary Information, 'TYPE' column). This system is an innovative reinterpretation of Atkinson's typology (Clarke 1970; Figure 2: B). While the latter created standard types adapted to British stone bracers, Smith's descriptive

system makes immediately clear, by means of transparent and universal encodings, the modalities of the three variables among the most characteristic of a stone bracer: total number of opposite holes, long sides morphology, cross-section morphology.

Nevertheless, Smith's typology does not take into account the general plate morphology (rectangular, oval, spindle-shaped, etc) nor its dimensions and proportions. Including these variables following the same encoding system would be too much. Together with the previous three ones, these features were taken into account in Sangmeister's (1974) typology (Figure 2: C). Certain types of the latter remain effective (B, D, E, F). However, some of the recorded bracers do not match Sangmeister's types (ID 9-10, 22-23, 37, 45, 59, 61, 70,

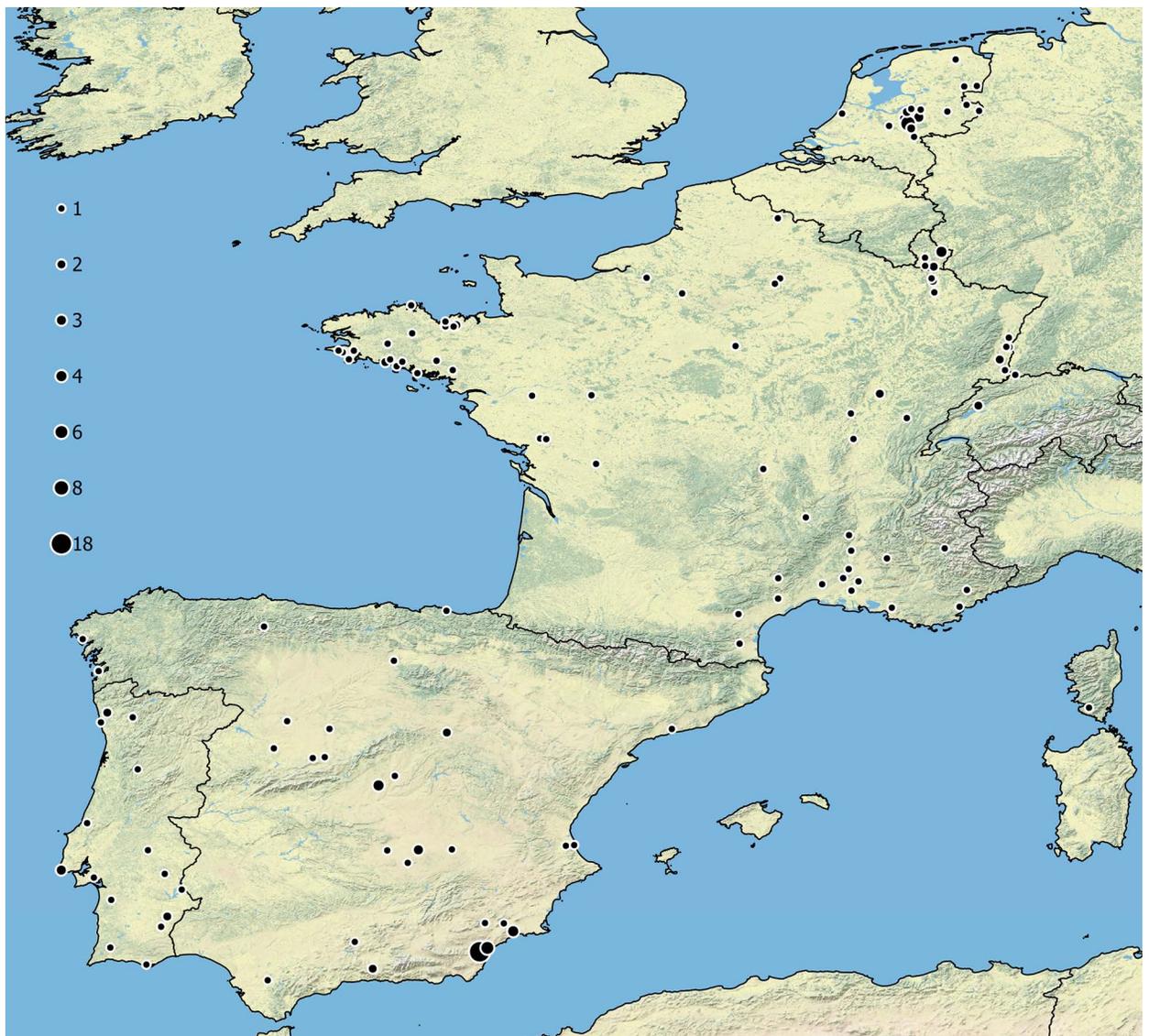
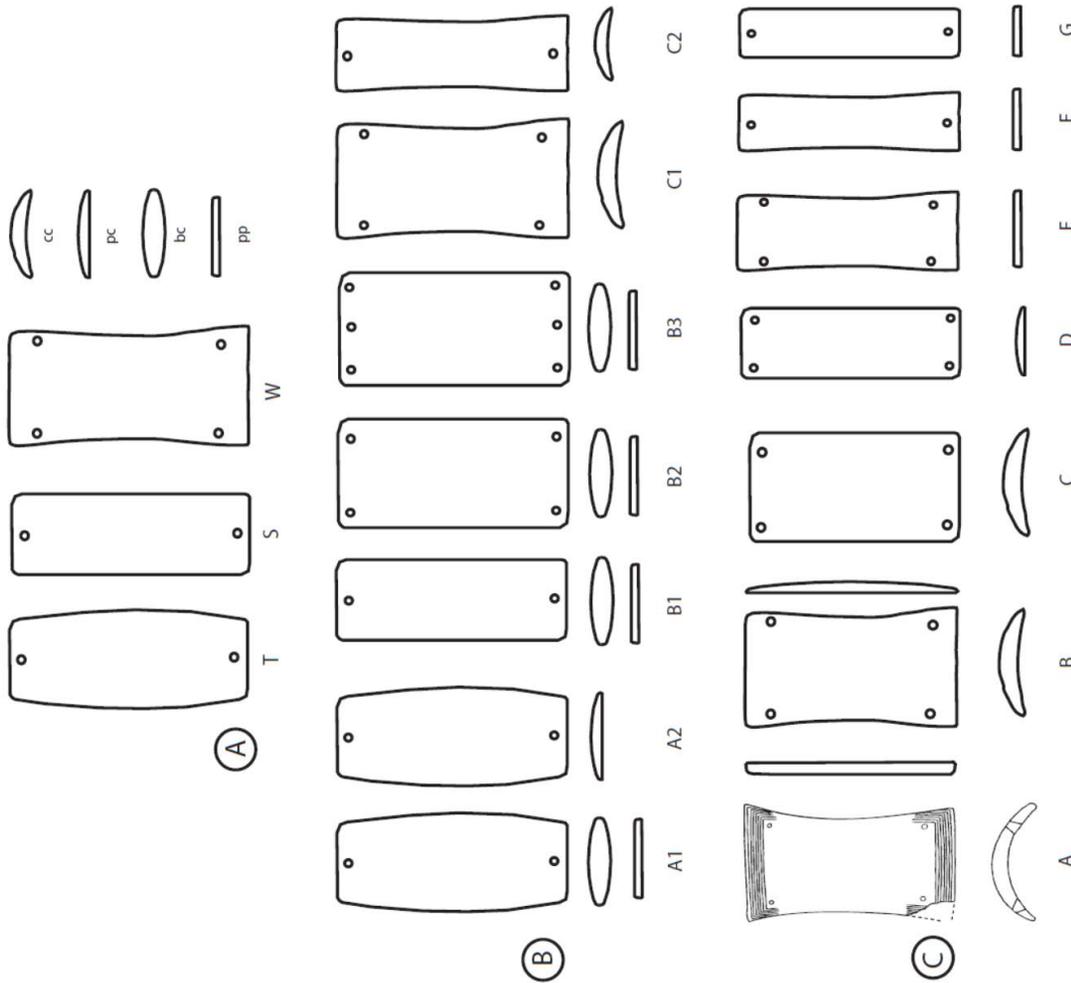


Figure 1: Geographical distribution of the 186 stone bracers inventoried in Western Europe. The list of the sites can be accessed in the Supplementary Information section. A further 79 bracer-like items have been rejected from the study and are therefore not mapped (see section I and Supplementary Information). Map © Julien Vitani (Paris I – Trajectoires) & Guy André (CNRS – LAMPEA)

D. Western Europe stone bracers typological matrix (Smith's typology)

Plate morphology		Number of opposite holes						TOTALS	
LONG SIDES	CROSS-SECTION	2	3	4	4#	6	6#		
"CONVEX (Tapered bracer)"	Tcc	1	1	0	0	0	0	2	
	Tpc	14	0	0	0	0	0	14	
	Tbc	25	0	0	0	0	0	25	
	Tpp	6	0	0	0	0	0	6	
	Tx	24	0	0	0	0	0	24	
	Total Tapered		70	1	0	0	0	0	71
			70	1					
STRAIGHT	Scc	0	0	0	0	0	0	0	
	Spc	8	1	4	2	0	0	15	
	Sbc	2	0	0	0	0	0	2	
	Spp	5	0	0	0	0	0	5	
	Sx	12	0	1	0	0	0	13	
	"Total Straight-sided"		27	1	5	2	0	0	35
			27	8					
"CONCAVE (Waisted bracer)"	Wcc	0	0	7	3	1	0	11	
	Wpc	18	0	2	1	0	0	21	
	Wbc	17	1	1	1	0	0	20	
	Wpp	5	0	1	1	0	0	7	
	Wx	13	0	1	1	0	3	18	
	Total Waisted		53	1	12	7	1	3	77
			53	24					
UNDEFINED	Xpc	1	0	0	0	0	0	1	
	Xx	2	0	0	0	0	0	2	
TOTALS		153	3	17	9	1	3	186	
		153	33						

Figure 2: Stone bracers typological scheme and matrix. Scheme first published by H. Fokkens *et al.* (2008: 111; modified). A: Smith's typology (Smith 2006). B: Atkinson's typology (Clarke 1970). C: Sangmeister's typology (Sangmeister 1974). D. Typological matrix of the 186 stone bracers recorded in Western Europe. Modalities of three typological variables are distributed and correlated by using Smith's descriptive encodings (this figure: A; see section II).



95, 106, 134), while type G, admitting both convex and straight long sides, accepted too many varied bracers. Furthermore, Sangmeister's typology was mostly adapted to a 50-year-old Central Europe corpus. We therefore think the Smith's system will be here suitable as a first descriptive, consensual step, and preliminary to an in-depth typological study.

Smith's descriptive encodings work as follows: **#Xx** (Figure 2: A). The quantitative variable **#**, placed at the beginning of the code, gives the total number of opposite holes. The qualitative variable **X** refers to the long sides morphology and has three modalities: **W** (*Waisted*: concave long sides), **S** (*Straight-sided*), **T** (*Tapered*: convex long sides). The qualitative variable **x** refers to the cross-section morphology and has four modalities: **bc** (*biconvex*), **pc** (*plano-convex*), **pp** (*plano-plano*), **cc** (*concavo-convex*). We will use the **#**, **X** and **x** signs as undefined or uncertain modalities. II. 2. Typological distribution of the corpus

II. 2. 1. General pattern

Total number of opposite holes, an essential feature of the pre-established definition (section I. 1.), logically does not include any undefined numbers (Figure 2: D). It does, however, have some uncertain numbers due to the fragmentation of a few stone bracers. 153 stone bracers obviously have two holes (82.26%). On the other hand, 33 stone bracers (17.74%) have or certainly had more than two opposite holes. Of these, 17 are whole stone bracers with four holes (9.14%) and 9 further ones (4.76%) are fragments of stone bracers that probably had four opposite holes, if one admits a symmetry of the device, which cannot be assured (4#). One stone bracer obviously has 6 holes (ID 186) and three fragmented stone bracers maybe had 6 opposite holes (ID 129, 130, 143: 6#). Three further stone bracers have three holes (ID 61, 70, 95).

In order to reduce the risk of error, we will group these 33 stone bracers together in the same modality 'bracers with more than 2 holes' (>2 holes bracers'), as opposed to the 'two-holed bracers' modality.

Long sides morphology could be defined for 183 stone bracers, i.e., 98.39% of the corpus (Figure 2: D). Out of the 186 recorded stone bracers, 71 have convex long sides; these tapered bracers represent 38.17% of the corpus. 35 other stone bracers have straight long sides (18.82%). 77 further stone bracers have concave long sides; these waisted bracers represent 41.40% of the corpus. Due to gaps in the documentation, 3 stone bracers (1.61%) have undefined long sides (ID 43, 117, 119).

Cross-section morphology is much less known than the previous variable, with 129 defined cross-sections,

i.e., 69.35% of the corpus (Figure 2: D). Only 13 stone bracers have a concavo-convex cross-section (6.99% of the corpus). The cross-section is plano-convex for 51 bracers (27.42%). It is biconvex for 47 bracers (25.27%) and plano-plano for 18 further ones (9.68%). Due to gaps in the documentation, the cross-section could not be defined for 57 stone bracers, i.e., 30.65% of the corpus.

II. 2. 2. Number of holes and long sides morphology

II. 2. 2. 1. Correlation patterns

70 two-holed bracers have convex long sides (2T), i.e., 45.75% of the 153 two-holed bracers (Figure 2: D). This rate is somewhat higher than the proportion of these 2T bracers within the corpus (37.63%). In contrast, only one bracer with more than 2 holes and convex long sides is known (>2T), i.e., 3.03% of the 33 bracers with >2 holes and 0.54% of the corpus.

27 two-holed bracers have straight long sides (2S), i.e., 17.65% of the two-holed bracers. This rate is a little higher than the proportion of these 2S bracers within the corpus (14.52%). Among >2 holes bracers, straight long sides are even better represented, with a total of 8 which represents 24.24% of the bracers with >2 holes. These >2S bracers form 4.30% of the corpus. This is only 3.4 times less than the rate of 2S bracers within the corpus (14.52%), considering that >2 holes bracers are 4.6 times less numerous than two-holed bracers (153:33).

53 two-holed bracers have concave long sides (2W), i.e., 34.64% of the two-holed bracers. This rate is somewhat lower than the proportion of these 2W bracers within the corpus (28.49%). Among >2 holes bracers, concave long sides are much better represented, with a total of 24 which represents 63.64% of the bracers with >2 holes. These >2W bracers form 12.90% of the corpus. This is only 2.7 times less than the rate of 2W bracers within the corpus (34,64%), considering that >2 holes bracers are 4.6 times less numerous than two-holed bracers.

Thus, if we try to detect typological preferences within our corpus, we can assume that straight long sides are more characteristic of >2 holes bracers than two-holed bracers. We then see that concave long sides are even more characteristic of >2 holes bracers than are the straight long sides. On the contrary, it appears that convex long sides are an almost exclusive attribute of the two-holed stone bracers: in our corpus, this morphology tends to exclude bracers with more than 2 holes, as a single >2T bracer is known (ID 70).

Finally, if we simply rank the typological numbers from largest to smallest, the first combination is 2T with 70 examples. The next most numerous combinations of holes devices and long sides morphologies are 2W,

2S and >2W with 53, 27 and 24 specimens respectively (Figure 2: D).

II. 2. 2. 2. Typological geography

Two-holed bracers are present in every region of the corpus (Figures 1 and 3). Among them, this is also the case of 2T bracers, which are proportionally well represented everywhere (Figure 3). 2T bracers especially concentrate in the Netherlands, Brittany, Moselle/Luxemburg and south-eastern Spain; they are in majority in the latter three regions. 2S bracers are more scattered and do not concentrate in any particular area, except in south-eastern Spain where numerous stone bracers of all long sides morphologies could be recorded. 2W bracers are scattered north of

the Pyrenees, except in the Netherlands where they are as well represented as the 2T bracers. South of the Pyrenees, 2W bracers concentrate in the Spanish Meseta, south-western Portugal and north-western Portugal/Galicia. In Iberian Peninsula, 2T and 2W bracers rarely share the same areas. On the one hand, 2W bracers are in majority in the Spanish Meseta. On the other, every 2W bracer from Portugal and Galicia is distributed along the Atlantic coast, whilst 2T bracers from the same area are mostly in the hinterland. It should also be noted that the 2W bracers mapped in Brittany are all distributed along the southern coast of this peninsula, facing the Iberian Peninsula. Similarly, the only 2W bracers recorded in southern France are not distributed in the hinterland but along the Gulf of Lion.

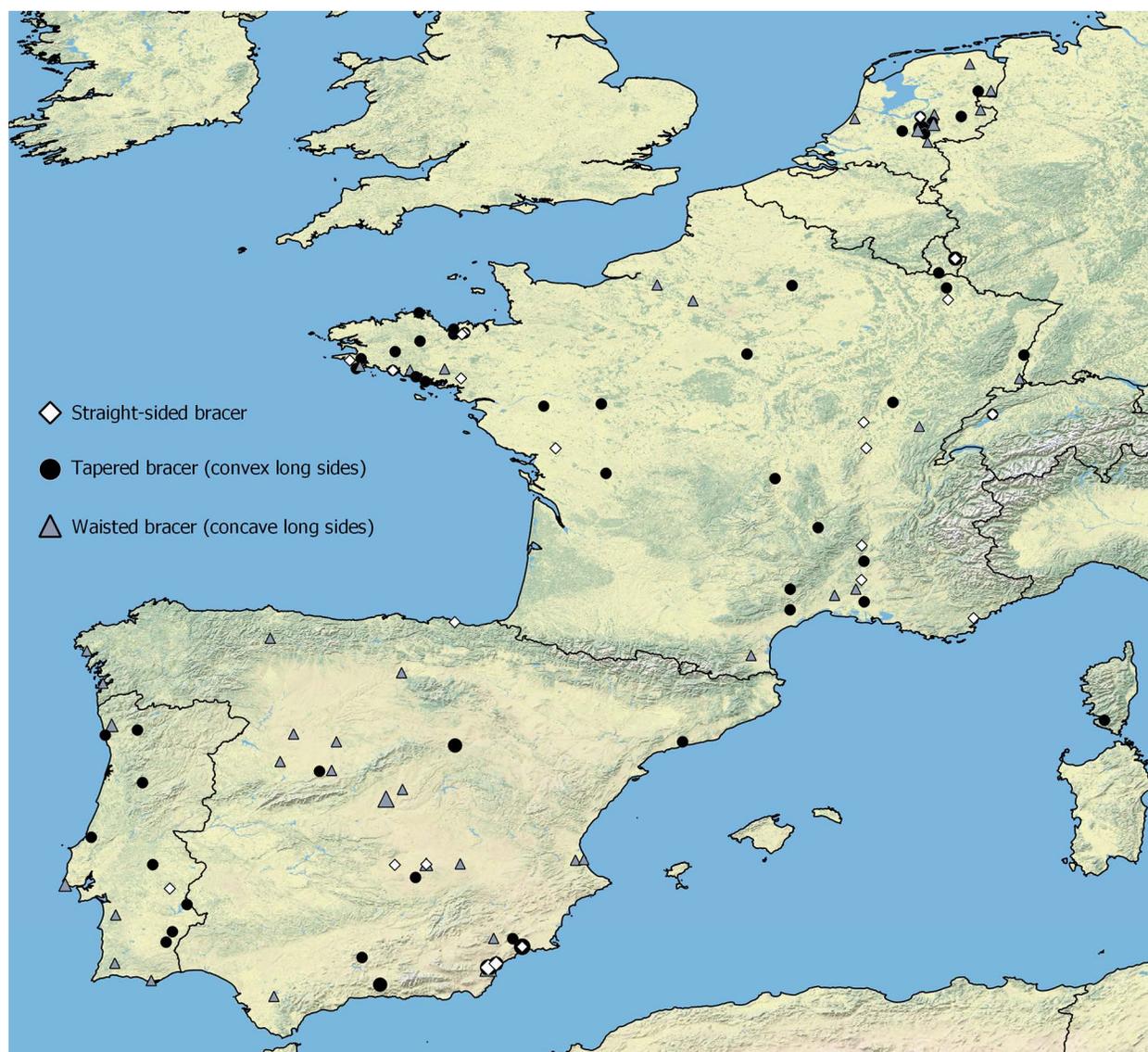


Figure 3: Geographical distribution of the two-holed stone bracers inventoried in Western Europe, distinguished following the long sides morphology (see section II, Fig. 2 and Supplementary Information). Map © Julien Vitani (Paris I – Trajectoires) & Guy André (CNRS – LAMPEA)

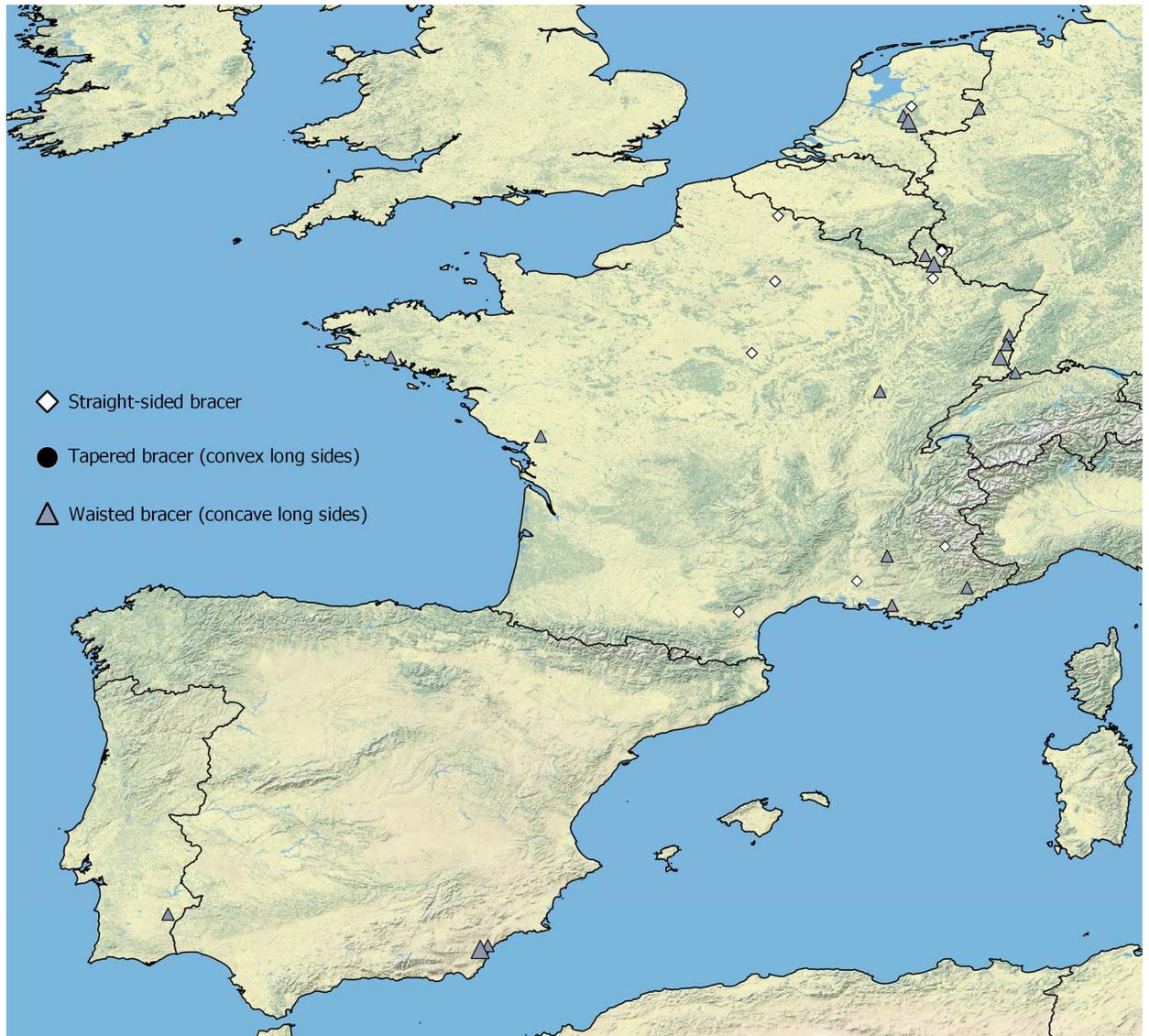


Figure 4: Geographical distribution of the stone bracers with more than two holes inventoried in Western Europe, distinguished following the long sides morphology (see section II, Fig. 2 and Supplementary Information). Map © Julien Vitani (Paris I – Trajectoires) & Guy André (CNRS – LAMPEA)

The geographical pattern is very different for bracers with more than 2 holes: they concentrate in the eastern half of the map, especially in the upper Rhine Valley, French Moselle/Luxemburg and the Netherlands, while they are very rare in the western area (Figure 4). Most of the eastern >2W bracers concentrate in these three Rhine regions, especially in the upper Rhine valley where they are the only known >2 holes bracers. The other eastern >2W bracers are quite scattered in central- and south-eastern France. The six last >2W bracers are the only >2 holes bracers known in the western area; moreover, they occur in regions where the 2W bracers are quite well represented (Figure 3: north-western France, southern Portugal, south-eastern Spain) and belong with them to a wide Iberian and Atlantic area. On the contrary, >2S bracers, less numerous, are very scattered and do not seem to contribute to any

geographical logic, except that they all belong to a large eastern, non-Iberian and non-Atlantic half of the map, like most of the >2 holes bracers. A unique 3T bracer occurs in Luxembourg.

II. 2. 3. Cross-section morphology

II. 2. 3. 1. Geographical pattern

All of the bracers with a concavo-convex cross-section belong to the most north-easterly regions of the corpus, i.e., the Netherlands (ID 80, 84), Luxembourg (ID 70, 72-74), Burgundy (ID 6) and especially the upper Rhine valley (ID 34-37, 39, 186). Most of the cross-sections from the upper Rhine valley are concave. Then, the further west you go, the more the concavo-convex morphology coexists with the other shapes

(Netherlands, Luxembourg, Burgundy), or even disappears in their favour west and south of the Rhine basin and Burgundy.

In southern France (ID 2-4, 50-56, 61-66) and the Netherlands (ID 76-104), a plano-convex cross-section is in the majority while a biconvex cross-section is in the minority. Then, the further west you go, the more the biconvex section seems to dominate, especially in Brittany (ID 11-31) and Iberian Peninsula (ID 105-183). However, while cross-section is well documented in the eastern regions, this is unfortunately less known in the latter two western areas.

II. 2. 3. 2. Typological correlations

In our corpus, a concavo-convex cross-section is an almost exclusive attribute of >2W bracers, which concentrate 11 of the 13 recorded concavo-convex cross-sections (Figure 2: D). The last two are a 2T and a >2T bracer. Concavo-convex cross-section thus tends to combine with both concave long sides and >2 holes devices.

Waisted bracers concentrate 21 plano-convex cross-sections (Wpc), i.e., 41.18% of the plano-convex cross-sections. This rate is equivalent to the rate of waisted bracers in the corpus (41.40%). By contrast, the 14 Tpc bracers represent only 27.45% of the plano-convex cross-sections, considering that tapered bracers constitute 38.17% of the corpus. On the other hand, the 15 Spc bracers form 29.41% of the plano-convex cross-sections, while straight-sided bracers constitute 18.82% of the corpus. It therefore seems that a plano-convex cross-section and straight long sides are preferably combined. However, there are more than a third of undefined cross-sections among tapered bracers in balance (24 Tx). About opposite holes, Spc morphologies have proportionally far more >2 holes bracers than the Wpc morphologies.

Waisted bracers concentrate 20 biconvex cross-sections (Wbc), i.e., 42.55% of the biconvex cross-sections (Figure 2: D). This rate too is equivalent to the rate of waisted bracers in the corpus. We then note that Sbc bracers are only 2, whilst Tbc bracers are 25 (53.19% of biconvex cross-sections). Thus, we can assume that a biconvex cross-section and convex long sides are preferably combined. There are more than a third of the undefined cross-sections among straight-sided bracers, though (13 Sx). About opposite holes, only the waisted bracers have specimens with both a biconvex cross-section and >2 holes.

Straight-sided bracers concentrate 5 plano-plano cross-sections (Spp), i.e., 27.78% of the plano-plano cross-sections. This rate is higher than the rate of straight-sided bracers in the corpus (18.82%). Consequently,

rates of Tpp and Wpp bracers among plano-plano-cross-sections are respectively a little lower than those of tapered and waisted bracers in the corpus. However, plano-plano cross-sections are too rare and undefined cross-sections too frequent to draw preferential combinations with any certainty. We can just note that again, only the waisted bracers have specimens with both a plano-plano cross-section and >2 holes.

III. Contextual overview

III. 1. Methodology for evaluating the archaeological interest of contextual information

In order to study the contextual relationships of the 186 recorded stone bracers on a reliable scientific basis, we have graded their archaeological contexts into five unequal interest levels reflecting the whole range of stratigraphic and documentary situations that can be confronted: 3, 2, 1, X, 0 (Figure 5).

Level 3 rounds up closed homogeneous assemblages confirmed by a superior archaeological operation. That is, each of them is guaranteed to be a complete assemblage of items deposited at the same time. Level 2 collects homogeneous assemblages which, according to a superior or average operation, may have been truncated (re-used or amputated site), and also all homogeneous assemblages delimited by an average operation. In both cases, although a homogeneous stratigraphical core is identified, the known assemblage may be partial.

Only level 3 and 2 assemblages are constituted of strict associations. Level 3 assemblages, definitively closed, do not admit probable or uncertain associations. On the contrary, level 2 assemblages, maybe partial, can admit probable or uncertain associations which could complement them. Furthermore, level 3 and 2 assemblages can be linked by peripheric associations to other assemblages which suggest a site logic (e. g., a pottery deposit above a grave).

Level 1 gathers hypothetically homogeneous assemblages. These may have been affected by stratigraphic or methodological defects which question the deposit homogeneity (disturbed context, unskilled excavation, etc). Hypothetical assemblages can at most admit probable and uncertain associations. While some may see them as strict associations, other (including us) may still have doubts: no archaeological consensus seems possible.

The terms 'probable' and 'uncertain' reflect our own opinion: rather positive with the first term, rather negative with the second one; both terms give room for doubt in either direction. We will only comment on strict and probable associations, while listing the associations we consider uncertain.

Methodological factor		Stratigraphical factor (after documentation)				Operations methodological limitations
		heterogeneous or undefined assemblage or isolated find	hypothetically homogeneous assemblage	homogeneous assemblage, but possibly partial	closed and homogeneous assemblage	
Operation quality	High	0	1	2	3	"Superior operations: optimal field view"
	Average	0	1	2	2	"Average operations: partial field view"
	Low	0	1	1	1	"Inferior operations: minimal or no field view"

Archaeological interest level	3	closed homogeneous assemblage
	2	possibly partial homogeneous assemblage
	1	hypothetically homogeneous assemblage
	X	hypothetical assemblage awaiting further information
	0	definitively no substantial contextual data

Figure 5: Proposed methodology for evaluating the archaeological interest of contextual information © Julien Vitani (Paris I – Trajectoires) & Agnès Caraglio (Éveha – LAMPEA). A: Combination of methodological and stratigraphic factors involved in the assessment of contextual data. B: Scale of archaeological interest of contextual information (see section III. 1).

Level X collects hypothetical assemblages which are still awaiting further information. Like level 1 assemblages, they can at most admit probable and uncertain associations.

Level 0 puts together heterogeneous (i.e., mixed) or undefined assemblages as well as isolated finds: no substantial contextual data.

III. 2. Archaeological interest of the recorded contextual data

11 stone bracers (5.91% of the corpus) belonged to a closed homogeneous assemblage confirmed by a superior archaeological operation (level 3). 15 further bracers (8.06%) come from a level 2 homogeneous assemblage (possibly partial). This makes a total of 26 stone bracers, out of 186 (13.98%), that belonged to a confirmed homogeneous assemblage (see Supplementary Information, ‘LVL’ column).

36 stone bracers (19.35%) come from a hypothetically homogeneous assemblage (level 1) and 9 others (4.84%) are still awaiting further contextual information (level X). These 42 stone bracers can at most admit probable and uncertain associations (24.19%).

The last 115 stone bracers (61.83%) are separated from any reliable contextual relationship, either as isolated finds or from mixed or undefined assemblages (level 0).

III. 3. Kinds of contexts

Out of the 186 stone bracers recorded in Western Europe, 109 belonged to a funerary context (58,60%). 23 further stone bracers come from a domestic context (12,37%). The last 54 bracers (29,03%) are isolated finds or come from an undefined kind of context (see Supplementary Information, ‘CTXT’ column).

Among the recorded domestic contexts, 1 is level 2 (ID 105), 2 are level 1 (ID 6, 54), 20 are level 0. We will therefore focus on the most reliable among the numerous recorded funerary contexts, which have yielded 25 homogeneous assemblages (levels 3 and 2) and 38 hypothetical assemblages (levels 1 and X).

III. 4. Association patterns in Western European funerary contexts

III. 4. 1. Strict associations

Copper-based weapons (metal arrowheads, Palmela points, copper daggers, other copper weapons) constitute the most significant set of stone bracers’ contextual relationships with a total of 17 strict associations (Figure 6). The second set is formed by Bell Beaker ware with 11 strict associations. A third set can be delimited by archery-related items with 9 strict associations (arrowheads and 1 grooved-stone interpreted as a shaft polisher).

However, the latter set would be more important if it included the 5 associations of Palmela points, whose functionality remains unsure: these items may equally have been mounted on either an arrow or a javelin (Gutiérrez Sáez *et al.* 2010, 2014).

III. 4. 2. Probable associations

Here too, copper-based weapons are the largest set with 14 probable associations. Archery-related items are the second set with 9 probable associations (arrowheads and one bow-shaped pendant), 10 if one includes Palmela points. Bell Beaker ware is the third set with seven probable associations (Figure 6).

However, six probable associations of undefined ware might be attributed to the Bell Beaker phenomenon as well as to an Early Bronze Age culture.

III. 4. 3. Geographical distribution

13 out of the 17 strict associations of stone bracers with copper-based weapons come from the Iberian Peninsula (Figure 6: lower part); the last four are spread across the lower Loire (ID 60), Burgundy (7), Moselle (41) and the Netherlands (86). This country (ID 84, 87), southern Brittany (22-24), northern and southern France (46, 52, 55), Corsica (33) and the Iberian Peninsula have provided the 14 probable associations of stone bracers with copper-based weapons. These are unknown within both strict and probable associations from the upper Rhine valley.

The latter region and the Netherlands have each yielded two strict and three probable associations of stone bracers with archery-related items (ID 35-36, 38, 81, 85-87, 100). Between these two regions, Moselle has

Figure 6: Presence-absence table of the contextual relationships of the 63 stone bracers from the most reliable funerary assemblages recorded in Western Europe. Strict, probable and uncertain associations. P: peripheric associations (see section III. 1).

				●	0	2	5	8	2	0	6	1	8	4	3	11	4	2	2
Strict associations				●	0	2	5	8	2	0	6	1	8	4	3	11	4	2	2
Probable associations				◇	4	0	1	12	1	3	8	1	5	0	4	7	1	6	0
Uncertain associations				○	6	0	3	5	2	2	7	1	8	1	6	14	3	6	0
“Stone bracers from the most reliable funerary assemblages”				metal ornament	metal arrowhead	Palmela point	copper dagger	other copper weapon	other metal industry	lithic arrowhead	other archery item	other lithic industry	other bone industry	other ornament	Bell Beaker ware	EBA ware	undefined ware	single gravegood	
ID	CTRY	SITE	LVL																
1	FRA	La Gravière Peer II	3							●									
2	FRA	Sabatas	1									○		○			○		
7	FRA	Le Nicolot	2				●					●			●				
11	FRA	Men-ar-Rompert	1												◇				
22	FRA	Coatjou-Glas	1				◇		◇	◇				◇			○		
23	FRA	Penker	1				◇			○		◇		◇	○		◇		
24	FRA	Lothéa	1	◇			◇		◇	◇		○		◇					
31	FRA	Kerallant: dolmen 2	1	○								○			○				
33	FRA	Palaghju	1	◇			◇		◇			◇					◇		
35	FRA	Reguisheim: g. 221	X							◇	◇			◇	◇				
36	FRA	Reguisheim: g. 8182	X	◇						◇					◇				
37	FRA	Gravière Hohwald	1												◇				
38	FRA	Les Villas d'Aurèle	3							●	●	●			●				
40	FRA	La Sente: g. 515	3							●						●			
41	FRA	La Sente: g. 722	3		●											●			
42	FRA	ZAC Chèvre Haie	3									●	●		●				
43	FRA	Usine Solblank	3							●		●	●		●				
46	FRA	Arenberg	1				◇			◇					◇				

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"Stone bracers from the most reliable funerary assemblages"				metal ornament	metal arrowhead	Palmela point	copper dagger	other copper weapon	other metal industry	lithic arrowhead	other archery item	other lithic industry	other bone industry	other ornament	Bell Beaker ware	EBA ware	undefined ware	single gravegood	
ID	CTRY	SITE	LVL																
47	FRA	Les Bretelles	3																•
52	FRA	Colombel	1				◇												
55	FRA	Grotte 4 du Rhinocéros	1					◇							○				
60	FRA	Les Bouloires	3				•									P			
61	FRA	Le Villard	1				○				○	○		○	○				
66	FRA	L'Agriotier	1							○		○		○			○		
80	NET	Ginkelse Heide: Girhen	1				○		○	○		○			○		○		
81	NET	Harskamp 1: Hondslög	1							◇		◇			○				
84	NET	Korte Struiken	1				◇								○				
85	NET	Lunteren 1: De Valk	1							◇		◇							
86	NET	Lunteren 2: Vlooiënpol	2				•			•		•			•				
87	NET	Lunterse Heide: g. 1.50	1				◇			◇					○				
91	NET	Hunderberg	2												•				
94	NET	Oostereng	1							○		◇			○				
96	NET	Holten: Tum. IV	1							○		○				○			
98	NET	Dalen	2									•			P				
100	NET	Harenermolen	2							•		•		•	P				
102	NET	Maarsbergen	1												◇		◇		
106	POR	Godinho	1	○													◇		
112	POR	Ferradeira	1				◇										◇		
114	POR	Seixas	X			○		○							○				
120	POR	Regedoura 2	1			○						○					○		
121	POR	Chã de Arefe: g. 1	2			•											•		
122	POR	Chã de Arefe: g. 2	2																•
133	SPA	El Argar: g. 154	1										○	○					
134	SPA	El Argar: g. 425	1	○															
135	SPA	El Argar: g. 530	1				○												
136	SPA	El Argar: g. 692	1				○										○		
137	SPA	El Argar: g. 767	1	○															
148	SPA	Cu. de los Granadillos	1															◇	
150	SPA	Los Bermejales: g. 8.5	1				◇										◇		
153	SPA	Morra del Quintanar	2												•				
161	SPA	El Alto del Reinoso	2		•										•	•			
163	SPA	La Sima: UE 18	2				•								•				
164	SPA	La Sima: UE 6	1		○	○	○	○	○					○	○				
165	SPA	Perro Alto	1	◇	◇	◇				○					◇				
169	SPA	Humanejos: UE 455.7	2	○		•									•				
170	SPA	Humanejos: UE 455.8	2	○		•	•								•				
171	SPA	Humanejos: UE 680	3												•				
172	SPA	Humanejos: UE 1853	2			•	•	•	○				•	○	•				
175	SPA	Agra da Ínsua	2				•												
176	SPA	Gandón	2			•											•		

"Stone bracers from the most reliable funerary assemblages"				metal ornament	metal arrowhead	Palmela point	copper dagger	other copper weapon	other metal industry	lithic arrowhead	other archery item	other lithic industry	other bone industry	other ornament	Bell Beaker ware	EBA ware	undefined ware	single gravegood
ID	CTRY	SITE	LVL															
177	SPA	Los Cipreses	3				●	●				●	●					
181	SPA	Zapata: g. 15	1				◇										○	
186	SWI	Hörnlfriedhof	X												○			

provided three strict associations with arrowheads (40-41, 43). Most of both strict and probable associations of stone bracers with archery-related items thus belonged to the Rhine basin. The last two archery-related strict associations come from central France and the Spanish Meseta (ID 1, 161). Brittany and northern France have yielded the last three archery-related probable associations (22, 24, 46).

Every Palmela points association occurs in the Iberian Peninsula.

IV. Discussion

IV. 1. Geochronology

A typological dichotomy between Western and Central European stone bracers has long been recognised by past leading works (Sangmeister 1964; Treinen 1970; Harrison 1980). Indeed, whilst the latter bracers show a greater typological diversity, the former are simpler from this point of view. With two-holed types, Central European bracers admit various >2 holes types, including >2T types, and numerous concavo-convex cross-section morphologies (Nicolas 2020a). As an interface between Western and Central Europe, the most western areas where such a typological variety is known are Great Britain (Woodward and Hunter 2011), the Rhine basin, eastern France (see section II) and Italy (Aspes and Fasani 1976; Delpino and Pellegrini 1999; Ferrarese Ceruti 1997). Then, the further west you go, the simpler the holes device and cross-section morphology (section II).

The above-mentioned reference studies proposed a typo-geochronology of stone bracers which consisted in their *simplification* from East to West, from Central Europe to the Iberian Peninsula. Since then, this idea has been discussed and replaced by its logical reverse: a *complexification* gradient of stone bracers from the Iberian Peninsula to Central Europe (Nicolas *et al.* 2013; Nicolas 2020a). This gradient may be more coherent with the Maritime Model which supports a growth of the Bell

Beaker phenomenon from simple Iberian beaker types to more complex sets of ceramic wares and from West to East (Guilaine 2004; Salanova 2011). Nevertheless, this model can be challenged (Beckerman 2012; Vander Linden 2012; Jeunesse 2014; Bailly 2020).

The earliest radiocarbon-dated stone bracer contexts recorded in Western Europe do not seem to be older than the earliest radiocarbon-dated Central European stone bracer contexts we are aware of (Figures 7 and 8). Those from the Rhine basin (ID 38, 98) and the Iberian Peninsula (ID 105, 169-172) might be contemporary to those in Central Europe; some of the latter might even be a little bit older (U Isidorka, Záhlinice, Sutny). All other radiocarbon-dated Western bracers, from France, may belong to the beginning of Early Bronze Age (Figure 7). These data might corroborate the old stone bracer typo-geochronology and disprove the recent one, while suggesting a very fast phenomenon on a continental scale by 2450 cal. BC. However, reliably radiocarbon-dated bracer contexts remain scarce in continental Western Europe and even absent from certain bridge regions (e.g., Brittany, southern France); thus, new or unknown data could affect our assumptions.

IV. 2. Functionality

Out of 186 stone bracers, only 25 come from homogeneous funerary assemblages (section III). Among these, 18 bracers share strict associations with either copper-based weapons (13 bracers) and/or archery-related items (8, 13 bracers if Palmela points were arrowheads), while seven bracers share no strict association with either copper-based weapons or archery-related items (Figure 6). Among 38 hypothetical funerary assemblages, 17 stone bracers share probable associations with either copper-based weapons (13 bracers) and/or archery-related items (8, 9 bracers if Palmela points were arrowheads), while 21 bracers share no probable association with either set. Of these 63 bracers coming from the most reliable funerary contexts, 28 share no strict or probable association with either set.

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Figure 7: Radiocarbon-dated stone bracers contexts in continental Western Europe (INTCAL2020). Three stone bracers from Dutch graves are not listed here as their direct link with radiocarbon-dated material cannot be ensured (ID 80, 84, 86).

ID	CTRY	Municipality	Site	CTXT	Locus	Material	Carbon-14 BP dates	Cal. dates (INTCAL2020)	Type	References
1	FRA	Riom	La Gravière Peer II	FNR	SP 2	human bone	3830 ± 55 [Ly-7681]	2463-2140 cal BC (95.4%)	2Tpc	Loison 2003
7	FRA	Genlis	Le Nicolot	FNR	UF 24	cremated deposit	3805 ± 30 [Poz-64785]	"2396-2388 cal BC (0.8%) 2344-2140 cal BC (94.7%)"	2Tbc	Christin <i>et al.</i> 2016
38	FRA	Sierentz	Les Villas d'Aurèle	FNR	SP 68	human bone	"3875 ± 35 [Poz-41226] 3910 ± 35 [Poz-41227]"	"2552-2238 cal BC (95.4%) 2465-2209 cal BC (95.4%) "	2Wpc	Vergnaud 2013
40	FRA	Mondelange	La Sente	FNR	SP 515	?	"3805 ± 35 [GrA-44685]"	"2446-2424 cal BC (1.3%) 2405-2378 cal BC (2.8%) 2350-2136 cal BC (91.3%)"	2Tx	Lefebvre 2010
47	FRA	Saint-Martin-la-Garenne	Les Bretelles	FNR	F.54	dental collagene	"3800 ± 30 [Beta-467207]"	2343-2138 cal BC (95.4%)	2Wbc	Domenech & Corona 2018
60	FRA	Saint-Martin-de-Fraigneau	Les Boullaires	FNR		human bone	3700 ± 50 [Ly-7487]	"2276-2255 cal BC (2.1%) 2206-1946 cal BC (93.3%)"	2Spc	André 1998
98	NET	Coevorden	Dalen	FNR		burnt human bone	"3910 ± 50 [GrA-13617]"	"2566-2531 cal BC (4.3%) 2496-2277 cal BC (85.3%) 2254-2206 cal BC (5.8%) "	2Tpc	Lanting & Plicht 2000
105	POR	Mourão	Porto das Carretas	DOM	"M13 C.2B2 Hearth A"	wood charcoal	"3920 ± 40 [Beta-196681] "	"2566-2531 cal BC (4.5%) 2495-2286 cal BC (90.4%) 2246-2239 cal BC (0.5%)"	2Tpc	Soares & Tavares da Silva 2010b
					"ibid. Hearth B"	wood charcoal	"3860 ± 40 [Beta-204062]"	"2462-2470 cal BC (77.8%) 2260-2204 cal BC (17.6%) "		
					"ibid. Hearth C"	wood charcoal	"3840 ± 60 [Beta-193743]"	2470-2136 cal BC (95.4%)		
163	SPA	Miño de Medinaceli	La Sima	FNR	"SIMA III UE 18"	human bone	"3860 ± 30 [KIA-17999]"	"2460-2276 cal BC (80.5%) 2256-2206 cal BC (15.0%)"	2Tpp	Rojo Guerra <i>et al.</i> 2005
						human bone	"3862 ± 28 [KIA-18000]"	"2459-2280 cal BC (82.9%) 2253-2208 cal BC (12.6%)"		

ID	CTRY	Municipality	Site	CTXT	Locus	Material	Carbon-14 BP dates	Cal. dates (INTCAL2020)	Type	References	
169	SPA	Parla	Humanejos	FNR	UE 455	human bone	"3825 ± 37 [Ua40218]"	"2454-2418 cal BC (5.5%)	2Wbc	Garrido Pena <i>et al.</i> 2019	
170								2409-2194 cal BC (83.4%)			2176-2144 cal BC (6.5%)"
171					UEx 680	?	"3920 ± 20 [GrM-15289]"	"2470-2341 cal BC (93.1%)	2318-2306 cal BC (2.3%)"		2Wpp
172					UEx 1853	human bone	"3917 ± 33 [Ua43524]"	"2555-2544 cal BC (0.9%)	2488-2483 cal BC (0.4%)		2476-2290 cal BC (94.1%)"

As the other 49 bracers from funerary contexts have a mixed or undefined assemblage and 54 further stone bracers come from an undefined context (see Supplementary Information), it is difficult to estimate the representativeness of those associations in continental Western Europe. Only regional trends may be suggested (section III. 4). Archers' sets from the Rhine basin graves can be compared to those from Central Europe (Nicolas 2020b), while Palmela points from Iberian graves are very specific to this Peninsula (Gutiérrez Sáez *et al.* 2010).

If the recorded funerary associations were given some importance in the functional debate, it could be assumed that both hypotheses of archery-related bracers and sharpening-polishing tools for copper-based weapons would be equally plausible. This equality of chances may also be reflected in the funerary contexts of stone bracers from both Britain and Central Europe, where, again, copper-based weapons and archery-related items are equally represented (Woodward and Hunter 2011; Nicolas 2020b).

However, only further use-wear analyses will be able to identify the actual functionality of these obscure plates. Stone bracers' functionality probably has more to teach us about their contexts than the other way around. Contexts 'suggest' avenues, but these must be rectified by functional studies taking into account a wide and varied range of possibilities, otherwise they could lead to the circular reasoning of imaginary prehistory (Stoczkowski 2002). At present, there is no consensus on the interpretation of stone bracers' marks. Into the same kinds of marks have been read either the sharpening-polishing of copper weapons (Delgado Raack and Risch 2006; Muñoz Moro 2017) or technological stigmata; the latter identification,

combined with the perceived absence of use marks other than wearing the bracer, has recently been linked to a mainly ornamental function (Woodward and Hunter 2011; Nicolas 2020a).

Conclusion and perspectives of research

Our survey has been able to gather, comment on and compare most of the up-to-date typological and contextual stone bracer information from the investigated Western European areas. We hope the proposed methodologies and collected data may have laid the foundation for future works and debates. We think that both chrono-cultural and functional issues need further in-depth studies. We must try to reason without any confirmation bias and remain open to every possibility. With this in mind, the first author is preparing a PhD thesis including the functional analysis of these curious stone plates.

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Figure 8: Radiocarbon-dated stone bracers contexts in Central Europe (INTCAL2020).

Country	Municipality	Site	CTXT	Locus	Material	Carbon-14 BP dates	Cal. dates (INTCAL2020)	Type	References
Czechia	Hrobčice	Radovesice-Bílina III	FNR	"grave 53/80-II"	?	3860 ± 40 [Kl-4449]	"2462-2270 cal BC (77.8%) 2260-2204 cal BC (17.6%)"	4Wcc	Nicolas 2020a
Czechia	Hulín	U Isidorka	FNR	grave 63	human bone	"3950 ± 30 [KIA-34665]"	"2570-2519 cal BC (20.8%) 2500-2342 cal BC (74.6%)"	4Scc	Peška 2013
Czechia	Hulín	Záhlinice	FNR	grave 48/89	human bone	"3935 ± 40 [VERA-5230]"	"2568-2528 cal BC (10.1%) 2496-2296 cal BC (85.4%)"	4#Xpc	Nicolas 2020a
Czechia	Kyjovice / Těšetice	Sutny	FNR	grave 27	dagger wooden sheath	"3940 ± 40 [Poz-44322]"	"2570-2521 cal BC (13.6%) 2499-2296 cal BC (81.8%)"	4Scc	Nicolas 2020a
Czechia	Tvořihráz	Tvořihráz	FNR	grave 2/91	wood charcoal	"3869 ± 40 [Bln-4497] 3746 ± 52 [Bln-4498] 3771 ± 44 [Bln-4499] 4011 ± 52 [Bln-4500] 3838 ± 42 [Bln-4501]"	"2464-2206 cal BC [95.4%] 2340-1978 cal BC [95.4%] 2341-2035 cal BC [95.4%] 2846-2348 cal BC [95.4%] 2458-2150 cal BC [95.4%]"	6Tbc	Nicolas 2020a
Hungary	Szigetszentmiklós	Felső Űrgehegyi dűlő	FNR	grave 49	human bone	"3830 ± 40 [VERA-4749]"	"2456-2196 cal BC (90.3%) 2172-2146 cal BC (5.1%)"	4Wcc	Nicolas 2020a
Hungary	Szigetszentmiklós	Felső Űrgehegyi dűlő	FNR	grave 626	human bone	"3845 ± 35 [VERA-4757]"	2456-2202 cal BC (95.4%)	4Scc	Nicolas 2020a

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Supplementary information

Our critical inventory of Western Europe stone bracers (SB) and rejected items (RI) is hosted online by the University of Geneva's publications server. It can be accessed via the following link:
<https://archive-ouverte.unige.ch/unige:156838>

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2. FUNERARY ARCHAEOLOGY AND ANTHROPOLOGY

St-Martin-de-Corléans (Aosta, Italy) Tomb TII: The Chronological and Cultural Sequence

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Abstract: The paper illustrates the first occupation phases of the ritual and funerary site of Saint-Martin-de-Corléans (Aosta, Italy) based on the reassessment of data from a new season of research carried out between 2007 and 2017. In particular, this contribution focuses on the description and interpretation of the Dolmen TII context, a monumental tomb featuring a complex sequence of ritual and funerary actions that took place from the Chalcolithic to the Early Bronze Age (ca. 2900-1800 BC cal.). The study of the funerary context has also been considered through a comparative analysis with dolmens of the Petit-Chasseur necropolis (Sion, Valais, Switzerland) due to the close analogies that exist between the two sites.

Keywords: Chalcolithic, Bell Beaker, Early Bronze Age, funerary rituals, megalithic area

Research history

The site of St-Martin-de Corléans (hereinafter SMC), discovered in 1969, was excavated in a series of fieldwork campaigns that continued up until 1991 under the direction of Franco Mezzena (Mezzena 1997, Mollo Mezzena 1997). The inauguration of the SMC museum and archaeological park catalysed research at the site with a new season of in depth studies (2008 -2018), furthermore archaeological investigations were carried out albeit in a limited number of sectors. Activities were coordinated by a joint scientific committee in collaboration with RAVA.

The committee's line of work followed a multi-disciplinary approach, involving various researchers (geologists, archaeobotanists, experimental archaeologists, anthropologists, GIS-specialists and others) in order to assess the sequence of ritual and funerary actions that occurred in the megalithic area, the preliminary results of which were edited in 2018 (De Gattis *et al.* 2018). While referring to that publication for more detailed information, the present contribution traces the chronological sequence, cultural context and funerary rituals of the main megalithic tomb of the site: Dolmen TII and its triangular platform. The results are compared with the sequence of ritual actions observed in Dolmen MVI of the Petit-Chasseur necropolis in Switzerland (hereinafter PC).

The chronological sequence of SMC

Following new and consistent C dating as well as a complete stratigraphic re-evaluation, the chronological sequence – set between the Neolithic and the Early Bronze Age – has been revised, also in light of the Mezzena sequence. Accordingly, it can be divided as follows:

- the 'ploughing phase' (*fase aratura*) directly relates to numerous plough mark traces, recorded on almost the entire extension of the investigated area and generally following a NE-SW pattern. Ploughing is the first action to have been documented in the site's stratigraphy and slightly predates the following phase (*fase pozzi*), whose features cut directly into the plough furrows;
- the "pits" sarebbe meglio phase (*fase pozzi*) is characterised by a series of large-sized pits located in the north-western part of the site; their function still remains unclear. Despite the lack of typological information provided from lithic or ceramics finds, their chronology is based on 23 consistent C measurements (4200-4000 BC);
- no traces of anthropic actions are recorded for more than a millennium between the pits and following 'alignment phase' (*fase allineamenti*) dated to around 2900 BC. At least six orthonormal alignments have been observed in the northern part of the site (*area nord*)

made up of wooden posts and successively of stone monoliths (menhirs, perforated slabs and anthropomorphic stelae). A main axis, the alignment 'a', presenting a NE-SO orientation, is well documented in the northern sector of the site (Figure 1A);

- the 'tombs phase' (*fase tombe*) is characterised by the raising of megalithic tombs, organised according to the main alignment axes. Whole or fragmentary stelae appear as re-employed in the construction of almost all the burial chambers. Two tombs were built on platforms like TII (triangular) in the northern part, or TV (semi-circular) in the southern one. C measurements carried out on charcoals and bones along with the study of the material culture recorded from inside the funerary contexts allow to date the 'tombs phase' to the Chalcolithic (pre-BB), Bell Beaker (BB) and Early Bronze Age (EBA) periods, between 2900 and 1800 BC cal. The stratigraphic sequence, artefact types and C dating show that posts and steles were apparently still being raised when the first funerary monuments were built; in the megalithic area structures and rituals relating to different phases not only coexisted but saw concurrent use – at times, perhaps, in an inter-related manner (Mezzena 1997, p. 70).

Within the general sequence at SMC, focus will be given to those activities related to the raising, use and transformation of Dolmen TII and its role during BB and EBA phases. The following paragraph traces a schematic sequence of this phase where new analytical perspectives are introduced with an aim at improving past interpretation.

Tomb TII. The structural sequence

Dolmen TII (Figure 1A and 1B) is located in the northern sector of the Megalithic Area (*area nord*), its short SE side positioned along the main alignment 'a'. The standing walls of the megalithic chamber (2,50 x 2,20 metres) are constituted by three large unadorned slabs; the fourth wall to the SW was removed while the tomb was still in use. Likewise, the cover slab was broken in antiquo. This imposing monument stands on a triangular platform made up of small slabs and stones, well organised and regularly stacked on its external front.

The SE side of the dolmen is marked by the presence of two '*antennae*'; these two stone slabs are further connected by a semi-circular structure, bordered by and paved with smaller slabs, in turn surrounded externally by six large post-holes.

The dolmen together with the semi-circular and triangular platforms are part of a consistent architectural design, although there is no C evidence that attests to a

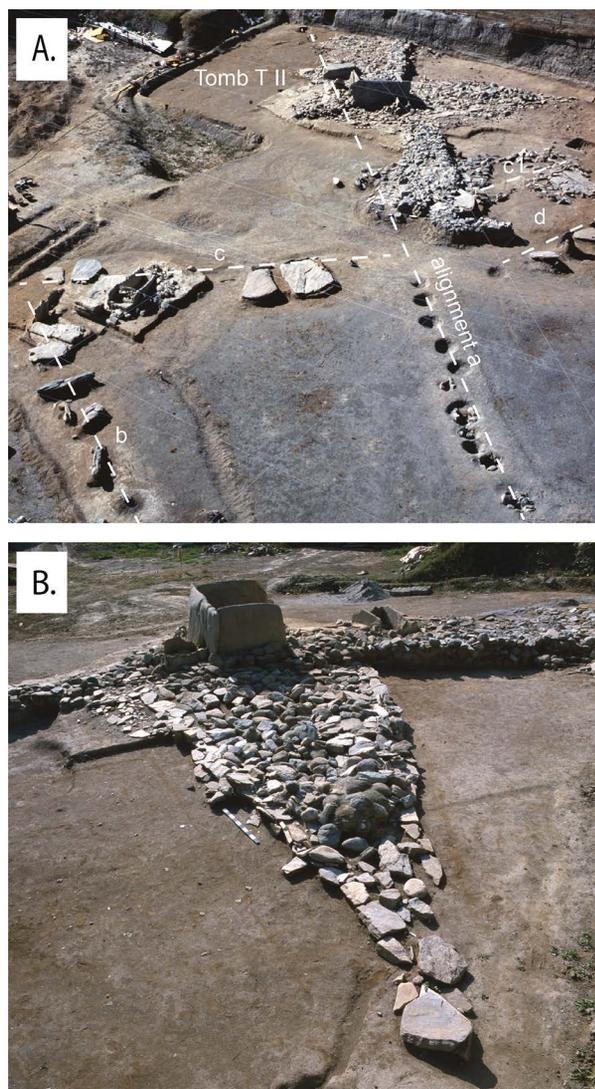


Figure 1: Saint-Martin-de-Corléans. A: General view of the northern part of the site in 1978. Dotted lines: alignments of monoliths or wooden posts (De Gattis *et al.* 2018, p. 275, fig. 1 modified). B: view of tomb T II and its triangular platform (De Gattis *et al.* 2018, CD).

possible chronological relationship between the structures.

The NE upright slab shows an elliptical-shaped opening that allowed the deceased to be laid out inside the chamber; this opens onto a *dromos*-like passage made of re-used steles (Figure 3A). During the EBA an individual was buried in this area, attesting to the use of the structure as an adventice cist and consequently showing that during EBA this access to the chamber was not in use anymore (Figure 3B).

Between the two '*antennae*' of the dolmen (SE side) another funerary structure was built, the so-called TIISE, re-employing fragments of decorated steles as features for a wall of sorts supporting its southern side.

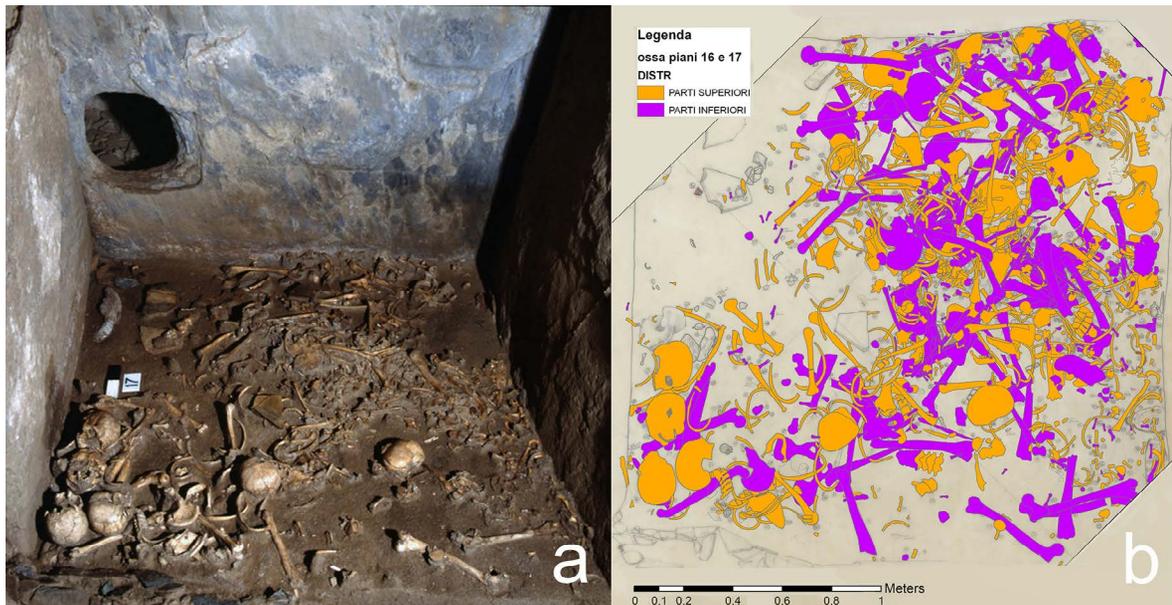


Figure 2: Saint-Martin-de-Corléans. T II, main chamber. A: View of layer 17 (De Gattis *et al.* 2018, p. 423, fig. 80); B: layer 16 & 17, distribution of the upper (yellow) and lower (purple) skeleton parts (© G. Pizziolo).

The cover slab of the dolmen was intentionally broken in antiquo (late EBA – *phase 4* see below) probably in order to open a new access to the funerary chamber once the opening porthole (Figure 2A) was completely occupied by individuals. The two large fragments making up the cover slab were covered with stones during the final phase of the dolmen; this mass of pebbles and stones reached the external part of the structure, covering also the SW side where the upright slab had by then already been displaced.

The act of filling and covering the tomb with stones may be interpreted as a defunctionalisation of the funerary structure, a practice attested in other tombs of SMC.

With regards to burial activities and taphonomic processes, TII is the most complex and articulated funerary context of SMC due to the following characteristics:

- high number of individuals (39) in primary and secondary deposition;
- different rituals attested (inhumation, primary and secondary cremation) in a complex and repeated sequence of funerary actions;
- different taphonomic dynamics due to anthropic and natural actions taking place in the inner area of the dolmen.

The funerary chamber infill consists of an uninterrupted stratification of individuals deposited almost without any traces of sedimentation. The practice of inhumation is prevalent although primary and secondary cremations are also documented, attested by the charred skeletal remains of both young

and adult individuals, recorded in varying amounts all mixed together. Decomposition took place in an empty space. Often the original bone connections in the lower layers have been lost, the result of skeletal removal and displacement in antiquity. Repeated use of the chamber and natural post-depositional actions affected the distribution and conservation of the bones: 90% of these were partly or totally disarticulated (Figure 2B). Despite the chaotic state of the assemblage – less marked in the upper layers – it is possible to recognise the intentional disposition of certain anatomical parts. The detailed archaeological documentation in the form of photographs and overlays, all acquired into a GIS system, accurately describes the distribution of the bones. This dataset, together with the anthropological evidence, has allowed for taphonomical interpretation – taking advantage of the GIS tools – while at the same time identifying several individuals. The dolmen contained the remains of at least 39 persons, buried at different times. Taphonomy and ritual analysis is particularly complex due to the high density of burial evidence and depositional formation.

Phase 1 (pre-BB period)

The construction and first use of the dolmen might be dated to the pre-BB phase on the grounds of C dating of the platform (see below). Furthermore, small bone fragments, some of which cremated (the result of primary and secondary cremation) in the lower layer of the funerary chamber were found together with artefacts referring to pre-BB contexts (see below). These finds might be interpreted as residual features of primary burials and cremations, removed from the chamber prior to the BB depositions. A similar action

could also be identified in the first phases of Tomb VII from the southern area of SMC and attested by a C dating of bones in primary connection recorded in the lower layers of that Tomb (De Gattis *et al.* 2018; Curdy *et al.* in press).

Phase 2 (BB and EBA)

sub-phase 2A (BB)

sub-phase 2B (EBA)

During the second phase new individuals and artefacts were gradually deposited inside the dolmen. The distinction between sub-phases, not recognisable in the stratigraphic sequence, is defined on the basis of find typology and C dating of the bones.

The first evidence almost complete of an inhumed individual was recorded in the NW corner of the chamber, on the lower surface (piano 18): a young male in partial anatomical connection is the result of later displacement.

Following this first inhumation, a series of other depositions occurred in a repeated sequence of actions which resulted in the chaotic piling up of bones concentrated in the central part and the NE corner of the chamber, totalling at least 18 individuals; charred bone fragments were also deposited inside the chamber.

In this progressive accumulation process some individuals in partial connection can be recognised. The distribution of the skeletal remains has also revealed some open areas around the main accumulation and in front of the porthole. A female individual was identified, her skull (see figure 7, S35: 2300-2000BC cal) lying on the piano 17 while her legs, in partial connection, go up to layer 15. Her position shows that during this phase chamber space was still available and the decomposition process was in an empty space. Still in this phase a deliberate and gradual alignment of skulls was laid out in the NW corner.

The accumulation of bones occurred between the BB and EBA1, as demonstrated by calibration dates (see Figure 7) as well as by the typology of grave goods and offerings (see below).

Phase 3 (EBA)

The structure of the dolmen remains unmodified and the passage through the opening still accessible. The previous accumulation of bones (layers 18-15) is gradually covered by earthen layers deposited inside the chamber (layers 14-13) including few bone remains. These activities possibly testify to a change in use of the internal chamber, with a reorganisation of the burial space. The upper layers show a decrease in funerary-

related practices. Only three individuals have been identified, few in anatomical connection, suggesting possible bone manipulation. The C dates indicate a BA chronology.

Phase 4 (EBA)

In the last phase the opening is partially sealed by infill layers. It is reasonable to hypothesise that the deposition of individuals inside the chamber took place through the cover slab.

The main chamber is characterised by a continuity of use but also by significant changes, namely:

- absence of cremated remains;
- inhumated individuals (MNI 17) often found in primary deposition; empty space decomposition. In some cases the remains are still in complete connection (Figure 3C). A general decrease in secondary interventions on bones or anatomical districts;
- most of C measurements refer to the EBA;
- absence of grave goods with the exception of a metal pin from piano 6 (see below).

In the same phase two adventice cists (TII SE and the so-called *dromos*) were used; the chronology of their construction is not attested but their use testifies to a EBA2 burial (see Curdy *et al.* in press).

The elongated *dromos* in front of the opening held the remains of at least one individual in partial anatomical connection (Figure 3A) and associated with a Polada mug (see below).

TIISE next to the SE dolmen upright, lined with two rear slabs (*antennae*) re-employing decorated stele fragments, contains the remains of at least 7 individuals, mainly adult males. Unlike the internal phase 4, burial ritual comprises both inhumated (5) and cremated (2) individuals (De Gattis *et al.* 2018, pp. 439-440).

The finds

The finds from tomb TII, that include lithic, ceramic objects, metal artefacts and animal bones, were documented both inside and around the dolmen chamber, specifically: in the adventice stone cists (*dromos* and TIISE), the semi-circular structure, inside pits A and B, and on the triangular platform.

In particular, the lithic industry consists not only of retouched tools but also numerous debitage by-products; the presence of small waste debris might be accidental, a result of the secondary deposition of skeletal remains mixed-in with anthropic sediment (Figure 6).

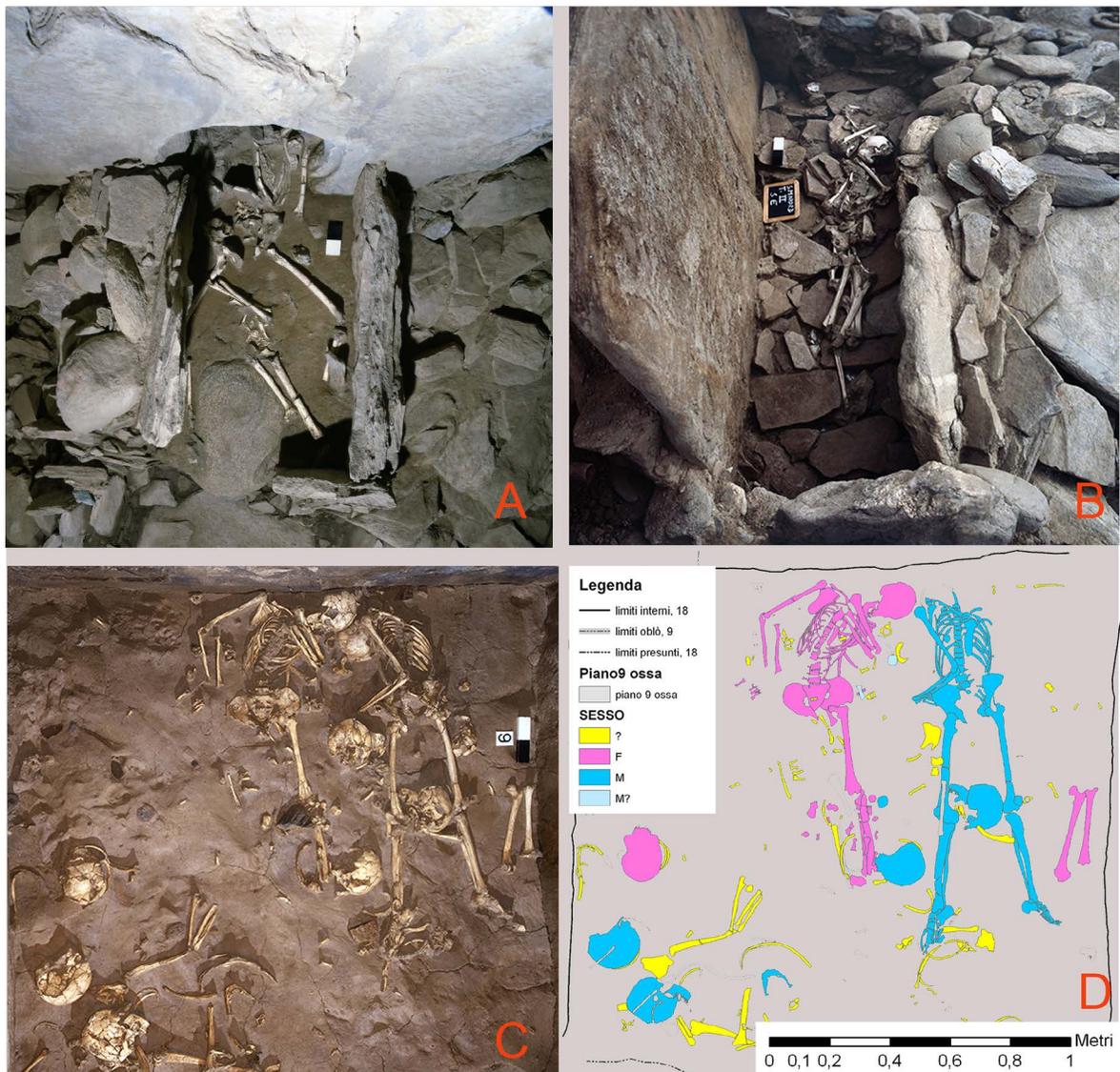


Figure 3: Saint-Martin-de-Corléans, T II. A: view of the *dromos* with an individual, the skull probably lying inside the main chamber (De Gattis *et al.* 2018, p. 381, fig. 10); B: plan of the last inhumation in the secondary chamber (Poggiani Keller *et al.* 2016, p. 46); C: main chamber, view of layer 9 (De Gattis *et al.* 2018, p. 405, fig. 46); D: main chamber, map of layer 9; human remains according to sex (© G. Pizziolo).

The main chamber

In relation to the high number of buried individuals, the finds, identified as either elements of funerary equipment or ritual offerings, appear as few and not referable to a single burial. Rare ceramic fragments have been recorded from within the chamber, allowing to hypothesise either the removal of pottery during the successive deposition rituals or its positioning outside the burial room.

Phase 1 pre-BB

Some ornaments which refer to pre-BB typologies have been found in the lower layers of TII in particular on the basal layer in association with bone fragments

(also charred). These could be the residual remains of primary burials and cremations, removed from the chamber prior to the BB depositions.

Five beads made of rolled copper sheet, were found in layers 18, 17 and 16 (Figure 4: 11-12, 23, 29, 31). Artefacts of this kind are recorded in Central-Eastern Europe as early as the Late Neolithic of the Carpathian Basin and in the Pecel Culture, spreading to various Early Bronze Age cultures such as Straubing (Ruckdeschel 1978). They are already attested in the pre-Bell Beaker Copper Age from burial caves and shelters in the present-day northern Italian regions of Lombardy and Trentino; specimens are also documented in PC Dolmen MXII (Favre, Mottet 2011, pl. 62, 1-4).

Four crescents made of western Lombard chert and recorded from layer 18 (Figure 6: 12-15) (Lo Vetro *et al.* 2018), might pertain to this phase; although the crescent is an emblematic artefact of the BB toolkit, this typology is already attested in several pre-BB contexts, both domestic and ritual, from the Lombard Prealps (Poggiani Keller *et al.* 2010 and references therein). In addition, crescents also occur among the artefacts from PC - Dolmen MXII (Winiger 2011) and Dolmen MVI, in layers preceding BB inhumations (Boksberger 1976). A lozenge-shaped arrowhead of hyaline quartz (layer 17) might also refer to Phase 1 (Figure 6: 6); the same the same tool type (but made on chert) is attested in PC - Dolmen MXII (Winiger 2011), and also occurs in Eneolithic sites of the Italian Prealps (Poggiani Keller *et al.* 2010) as well as in French Midi (Winiger 2011 and references therein).

Numerous chloritoscist (n. 33) and steatite (n. 31) beads can be ascribed to this phase, discretely documented in layers 18, 17 and 16. Similar finds are commonly attested in Copper Age contexts across the north of the Peninsula, in burial caves and shelters relating to the Civate Culture and in flat tombs of the Remedello Cultural Group. Stone beads were also recovered at Sion-Petit-Chasseur (PC), inside the pre-BB Dolmen MXII (Favre, Mottet 2011, pl. 58, pp. 152 and following).

Phase 2: sub-phase 2A Bell Beaker and 2B Early Bronze Age

Bone ornaments (V-perforated buttons; head buttons) and shell (lunula pendants), as well as a stone wrist guard and flint crescents in layers 17 and 18 can all be ascribed to a full BB phase. As mentioned above, finds referring to the beginning of the EBA, come from the same lower layers attesting subsequent manipulation.

A pair of *Rudernadeln* type pins were found in layer 16 alongside a triangular flattened head decorated along its edges with a row of embossed points (Figure 4: 3-4). This type while rare in Italy, is commonly attested in Europe from contexts related to the cultural groups of Singen (Krause 1988, Abb. 23) and Straubing (Ruckdeschel 1978). A similarly decorated artefact was found in deposit 1 of the PC Dolmen XI in Sion (Gallay, Chaix 1984, pl. 12, p. 142, n. 1042).

From the same level a rare copper sheet lunula pendant was also found, featuring double spiralling ends and richly embossed decorations (Figure 4: 13); the find presents close analogies to BB metal sheet artefacts such as the pectoral of Villafranca Veronese and gold sheet *lunulae* from the British Isles. Nevertheless, given its size the SMC lunula pendant could rather be compared to the category of *lunulae* pendants known as *Blechlunulae* (*lunules* in French) and widespread throughout southern

Germany, Switzerland and northern Italy in an early phase of the EBA. Similar artefacts are known also in Valais, in tomb 2 of Conthey Sensine, together with a pin of the *Rudernadeln* group (David-Elbiali 2000, p. 254, ill. 125, 10) and at Ayent Les Places (David-Elbiali 2000, p. 254, ill. 125, 1-9; distribution map 69).

A copper awl with thickening in the central portion (Figure 4: 14) was found in the same layers; an analogous type has been recorded in the cemetery of Singen and in PC - Dolmen MVI.

Thirteen crescents have been recorded in layers 17 and 16 (Figure 6: 1-5, 7-11), mainly made of lithotypes from Western Lombardy with a small number attributable to the area of south-eastern France.

Crescents are preferentially made on bladelets, rarely on flake (Figure 6). In general their size is small – hypermicro- (between 12 and 15 mm) and microlithic (between 16 and 23 mm) – with a length ranging between 12 and 18 mm. Morphology is relatively varied and includes both short and wide (hypermicrolithic items) crescents as well as more elongated, at times slender ones (microlithic items).

At the present stage of data elaboration the interpretation should be treated with caution. However we propose to associate layer 17 with BB period and layer 16 mainly to EBA.

Phase 3 EBA

This phase encompasses layers 14-10. It is characterised by a limited use of the chamber, a sediments deposit, which will partly cover the bones, and absence of finds.

Phase 4 EBA

The most recent object to have been recovered from layer 6 in the main chamber is the metal pin with an oval head. The item finds comparisons in the transalpine area (Figure 4: 1). Pins of this type are already attested in the first centuries of the EBA, as are the pins from layer 16, up until 1900-1800 BC (Brunner *et al.* 2020).

Outside the main chamber

The BB evidence, in the form of numerous decorated pottery fragments, is for the most part found outside the chamber:

Dromos

Three fragmentary vessels, a bottom and other decorated wall fragments referring to two vessels were recorded from the *dromos*-like passage.

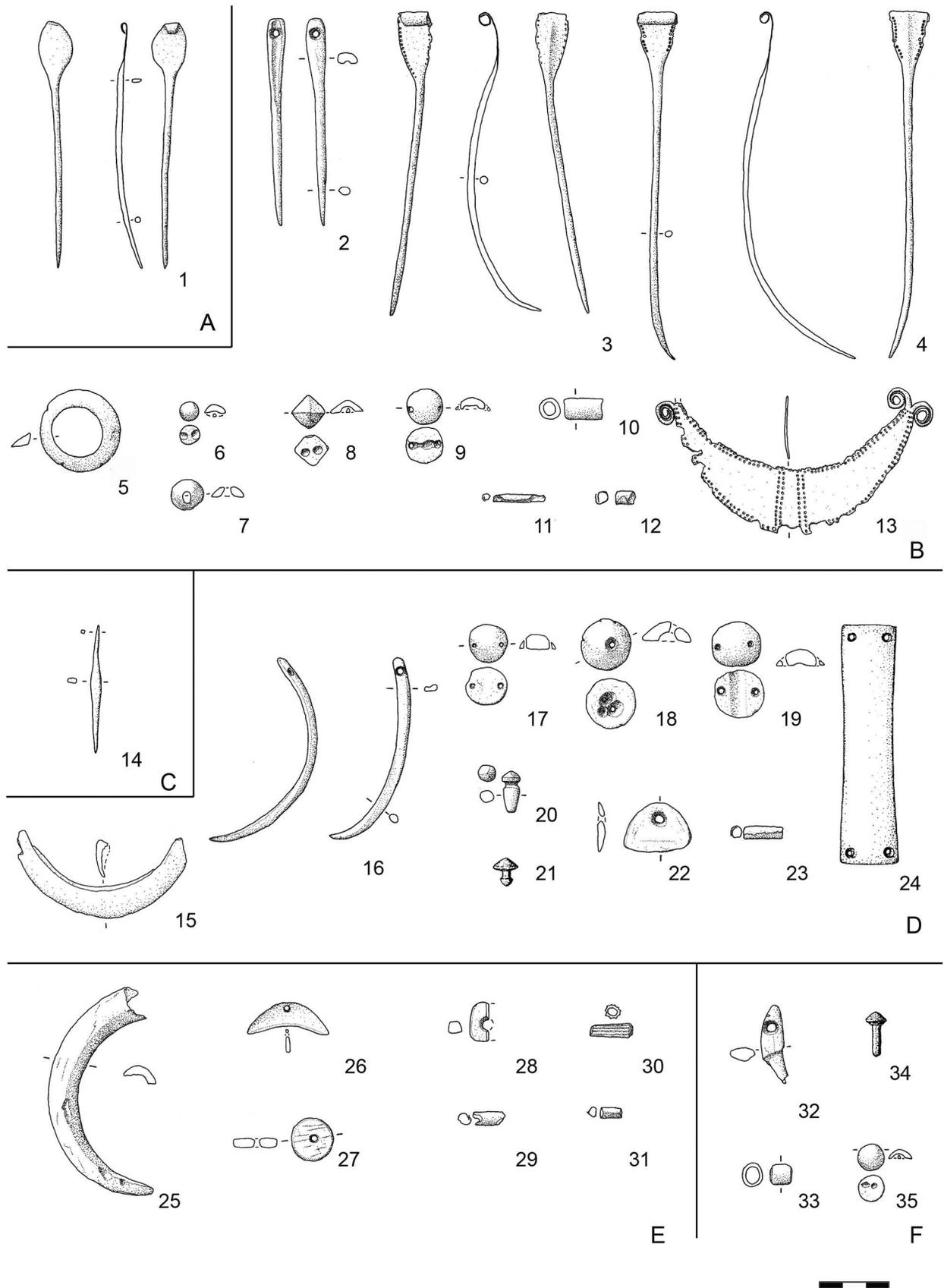


Figure 4: Saint-Martin-de-Corléans. T II. Archaeological finds from the main chamber. A: layer 6; B: layer 16; C: layer 16 & 17; D: layer 17; E: layer 18; F: finds without context. Copper (1, 3-4, 11-14, 23, 29, 31); animal (2, 59, 15-21, 25, 27, 32, 34-35); shell (10, 22, 26, 30, 33); stone (24, 28). Drawings Paolo Rondini, scale 1:2.

Moreover, a BB vase handle, decorated with horizontal comb bands according to the traditional Maritime style (Figure 5: A 2) was found near the *dromos*, possibly relating to a later deposition.

A jug with bent elbow handle and button appendix (Figure 5: A 3) of a shape characteristic of the Polada culture, marks the final moments of the *dromos*, employed in this phase as a burial structure. As for the lithic finds, only two waste products are attested from the passage.

In the area outside the *dromos* (Layer 2a) a vase bottom and wall fragments with impressed notches (Figure 5: A 4-5) belonging to two distinct vessels can be noted. This type of decoration, reminiscent of nail impressions, is observed both on decorated BB pottery and on the accompanying common ware ceramic.

TIISE

This feature contains burials dating to the EBA according to the funerary chamber Phase 4. Finds confirm this chronology and include: a carinated beaker decorated with impressed circles as well as a pin and dagger (De Gattis *et al.* 2018, p. 438-443, figs. 6-10), all items dated to the EBA, referable in particular to the Polada culture from the area of modern-day Lombardy. Among the chipped stone tools from TIISE two crescents can be noted, one made of Lombard chert, the other French.

Semicircle

In this area, characterised by the deposition of white quartzite fragments, parts of two decorated BB pots were recovered (Figure 5: B 6-8). The first is a large Bell Beaker vessel of the jar class, with typological and decorative characteristics similar to the late BB syntax. The second vessel is a cylindrical jar bottom. Among the chipped stone tools it is possible to note five crescents in Lombard chert (Figure 6: 18-21, 23), and a crescent (Figure 6: 22) and a transverse arrowhead both made of south-eastern French chert.

'Pits' and outside the tomb

A corded BB vessel with decorative pattern (AOC) (Figure 5: C 9), assembled from numerous fragments, was recovered from pit A, the latter interpreted as a 'foundation pit' (Mezzena 1997). Two Lombard chert crescents can be noted among the chipped stone finds (Figure 6: 16). Two beakers were recovered from pit B: a corded one and a second decorated with horizontal rows of comb impressions on the entire surface (Figure 5: D 10-11). This last is comparable with a BB from PC - Dolmen MVI, that is also associated with corded shapes (Bocksberger 1976, pl. 31, n. 14).

Fragments of decorated Bell Beaker ceramics, referring to at least five vessels, as well as an unadorned ovoid-shaped vessel, were also recorded outside TII (Figure 5: E 12-35). One crescent made of south-eastern French chert was found on the triangular platform (Figure 6: 17).

14C dating

Twenty-five samples, collected from TII and the platform, have been dated, fourteen of which bone. Five of these, including two bones, were collected from the secondary TIISE grave. Two dates, UtC1669 (4220+-110 BP) and LTL4088A (4237+-45 BP), are from charcoal remains from the platform.

At this time, it is not possible to precise the sequence on the base of the C dates because some samples could not be exactly positioned within the layers. It is worth to mention that the continuous use of the chamber led to bones displacements. The construction of the megalithic monument might have occurred between 2900 and 2400 BC cal. Table (Figure 7) shows the calibrated dates organised according to the layers inside the dolmen. Complete data can be found in: De Gattis *et al.* 2018 (p. 386, Tab. 1a; p. 441, fig.5). Despite some inconsistencies in the lowest layers, the diagram clearly shows that the last burials refer to layers 6 -13 inside the main chamber and in the adventice stone cist and *dromos*.

Anthropological analysis

The skeletal remains documented in TII correspond to at least 39 individuals, 31 adults - 18 males, 8 females, 5 undetermined - and 8 children, both inhumated and cremated.

The biological picture shows a uniform population with respect to skull shape, characterised by short and broad forms (*brachycephalic*).

Repeated human activities (successive body deposition, manipulation) and natural phenomena (floods, animal actions, subsequent soil infiltration) often caused the loss, dispersal and fragmentation of the bone joints, not allowing the results of the anthropological analysis to be divided according to the proposed sequence.

General state of health and evidence of physical activities

The state of health of the individuals from TII was generally good:

- few cases of tooth decay and gum infection.
- few cases of injury - all apparently due to accidents or defence against blunt force trauma,

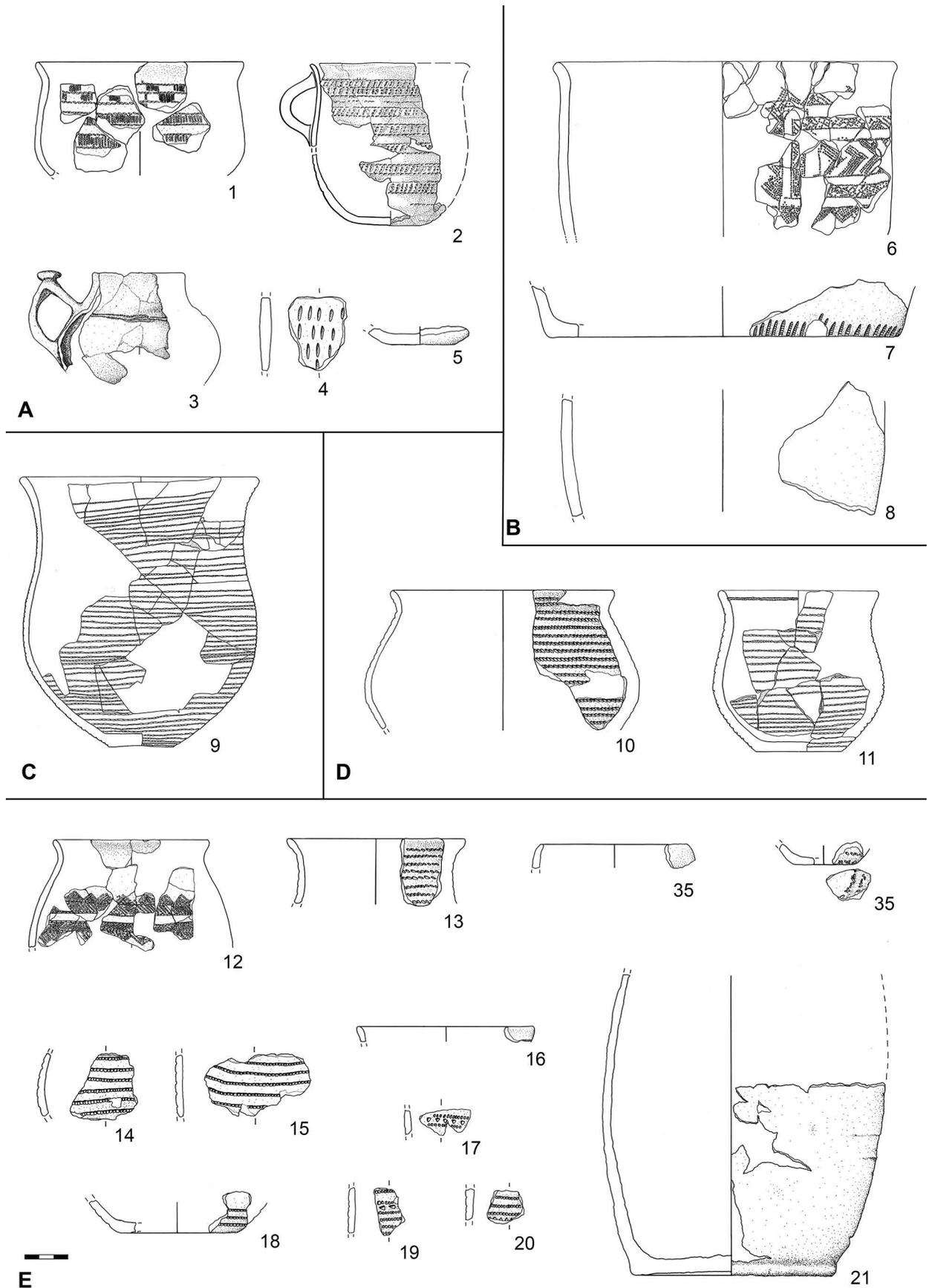


Figure 5: Saint-Martin-de-Corléans. T II. Archaeological finds (ceramic) from the secondary chambers and external levels. A: "Dromos"; B: "Semicircle"; C: "Pit A"; D: "Pit B"; E: finds from outside the grave. Drawings of Paolo Rondini, scale 1:3.

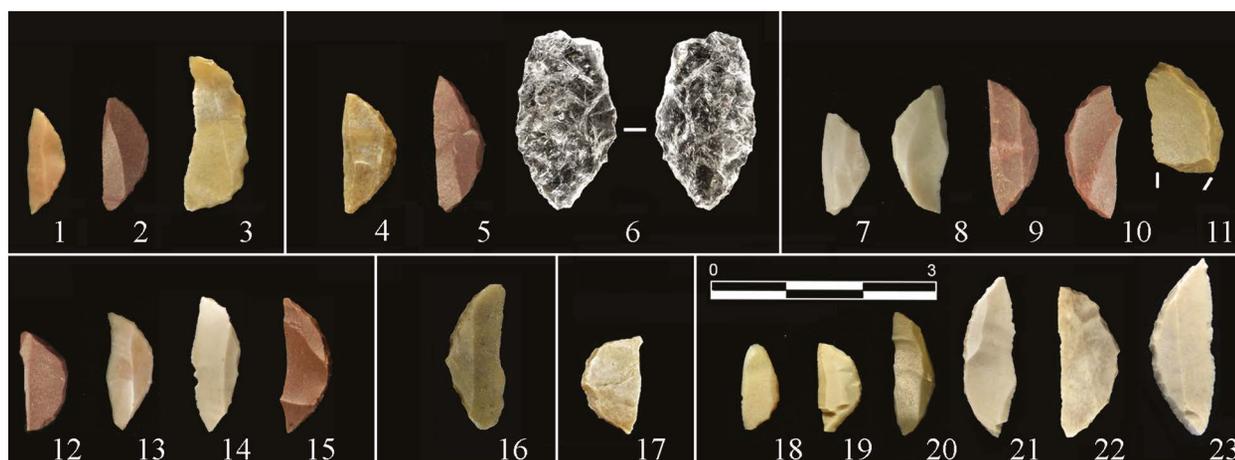


Figure 6: Saint-Martin-de-Corléans. Selection of chipped stone tools from T II and related structures. Crescents (1-5, 7-23), arrowhead (6). 1-3: main chamber, layer 16; 4-6: layers 16 & 17; 7-11: layer 17; 12-15: layer 18; 16: "Pit A"; 17: "platform"; 18-23: "semicircle". Drawings Paolo Rondini, scale 1:2.

including fractures of a left radius (displaced and not healed) and a right ulna (healed).

- Arthritic processes, mostly in line with age-related averages on vertebrae, and femur-hip joints, due to age or mechanical stress, for example, by weight excess or physical activity.
- few traces of anaemia and other metabolic disorders.

Osteoarthritis is the most common disease recorded among the individuals from TII, often associated with age, in some cases possibly the result of lifestyle-related factors.

The overall picture of the degree of muscle development, traumatic pathologies and osteoarthritis alterations, indicates that the individuals found at SMC were accustomed not only to walking long distances but also on steep uneven slopes typical of a mountain environment.

Skull Trepanations

Trepanation, a practice carried out by some prehistoric peoples for magical/ritual purposes or in an attempt to cure physical or mental illnesses, was carried out using various techniques. The most commonly employed at SMC is scraping, a technique that involves the gradual removal of bone in an elliptical area using a small sharp tool such as a chisel or thin flat blade and applying a strong pressure in a circular or sideways motion.

Frontal trepanation. TII/ Level 8/FP. The skull is of a male individual approximately 35 years old. The hole is of a considerable size (57 x 28 mm) and located on the right side of the frontal bone. The lower margin of the lesion is not present, but the upper portion clearly shows that bone reaction and repair occurred,

evidence that the subject survived for some time after the procedure.

Double trepanation. TII/ Level 17/ 71. The skull of a male aged between 45 and 55 years, is pierced by two trepanning holes. In both cases the operation was performed using the scraping method, employing a small pointed instrument. Bone regrowth around the margins of these two trepanations demonstrates that the subject survived both procedures.

Fatal trepanation. TII/180/ Level 17. The skull is of an adult male more than 50 years old and shows a trepanation hole on the right parietal bone (52 x 58 mm). The perforation is surrounded by evident scratch-marks left by the pointed tool used to remove scalp tissue. On the sides of the opening the internal part of the bone is still visible, indicating that the subject survived the operation for a short period or not at all.

In comparison, we have to note that some cases of trepanation were also observed in the PC necropolis (Favre & Mottet 2011, pp. 206-209). In dolmen MXII, three adults (2 men and 1 women) survived the trepanation; near cist M III, some fragments of the skull of an adult male show traces of a triple trepanation, without lethal consequences (ibid., p. 208).

Conclusive remarks

The megalithic area of SMC, frequented by alpine populations, can be set in a wider picture of multidirectional relationships that develop over the course of the Chalcolithic and up until the BA.

The collective funerary structures of the megalithic monument can be compared with examples from western Europe, established in the pre-BB period, re-

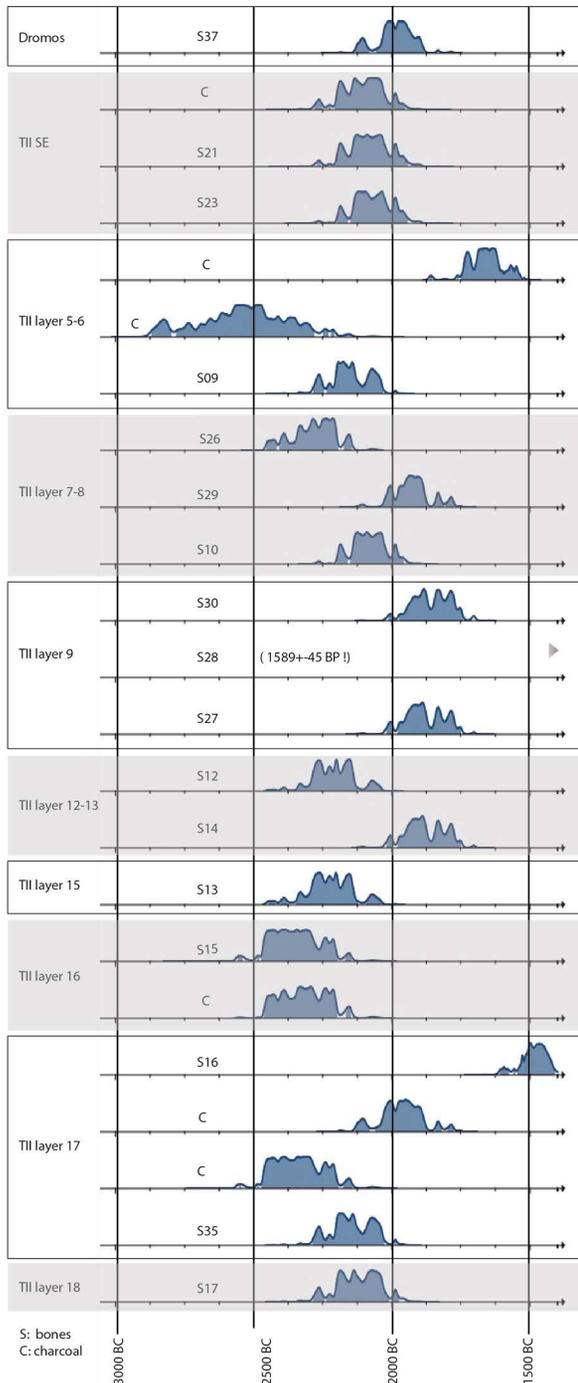


Figure 7: Saint-Martin-de-Corléans. TII and TIISE. Diagram of the 14C dates from inside the dolmen and secondary chambers (TIISE & "Dromos").

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employed during the BB until the BA, as opposed to single burials in plain graves prevalent in the Po Valley area and in central-eastern Europe. Recent evidence (Lemerrier *et al.* 2004; Lemerrier and Tchérémissinoff 2011) shows the presence in western Europe of different

funerary procedures characterised by greater or lesser continuity with earlier rituals (Jeunesse 2014). These megalithic structures can be associated to other types of burials (burial caves and shelters) and elements featuring posts and monolith alignments set in a NE-SW orientation. The alignments at SMC recall central south-eastern alpine contexts. The SMC platforms can be compared to analogous features from Val d'Adige (see Velturmo-Tanzgasse and Campi Neri di Cles: Dal Ri *et al.* 2004; Endrizzi *et al.* 2009; Mottes and Nicolis 2019) and Veneto (Arano: Salzani 2015). Other elements of comparison are found to the north of the Alps (Laporte *et al.* 2011; Schwegler 2016).

The BB funerary ritual is varied and testifies the simultaneous presence of both inhumations and primary and secondary cremations, although in an advanced phase of the BA primary inhumations in connection are prevalent.

Within the burial area TII is set in a distinct position already in a pre-BB phase, dominating a wide and isolated area and following a NE-SW alignment. During the EBA it is flanked by the adventice stone cists (TIISE, *dromos* burials) and TIII, structural elements that do not affect its isolation; its monumentality is further evidenced by the backdrop of stelae (alignment 'a'), one of which (stele 29) remains standing and is still visible during the Roman period, whereas the others were overturned but still *in situ* (stele 30 and 38).

The monumental nature of the dolmen, with a triangular platform dominating the megalithic area is comparable to the triangular platform dolmens of PC, in particular with dolmen MVI which presents an analogous chronology. This evidence further reinforces the unitary construction project of TII between the dolmen and platform in the pre-BB.

It has often been said that SMC and the PC necropolis can be considered as twin sites, both in terms of architecture and decorative style of the anthropomorphic stelae. Even though the excavation methods and the extension of the investigated areas were different, the comparison between SMC TII and the PC MVI dolmen reveals strong analogies, suggesting similarities of ritual and funerary practices on both sides of the Alpine range (Figure 8), possibly referring to the same cultural identities.

The following are a number of select analogies that emerge from the comparison with dolmen MVI of PC.

The extremely articulated sequence at MVI comprises 10 phases (Bocksberger 1976, pp. 144-145; p. 207, Fig. 42). The monument was established prior to the mid 3rd millennium BC, with stelae raised in front of the chamber that held the first burials (phase 1, pre-BB). At SMC the stelae refer to different alignments (see

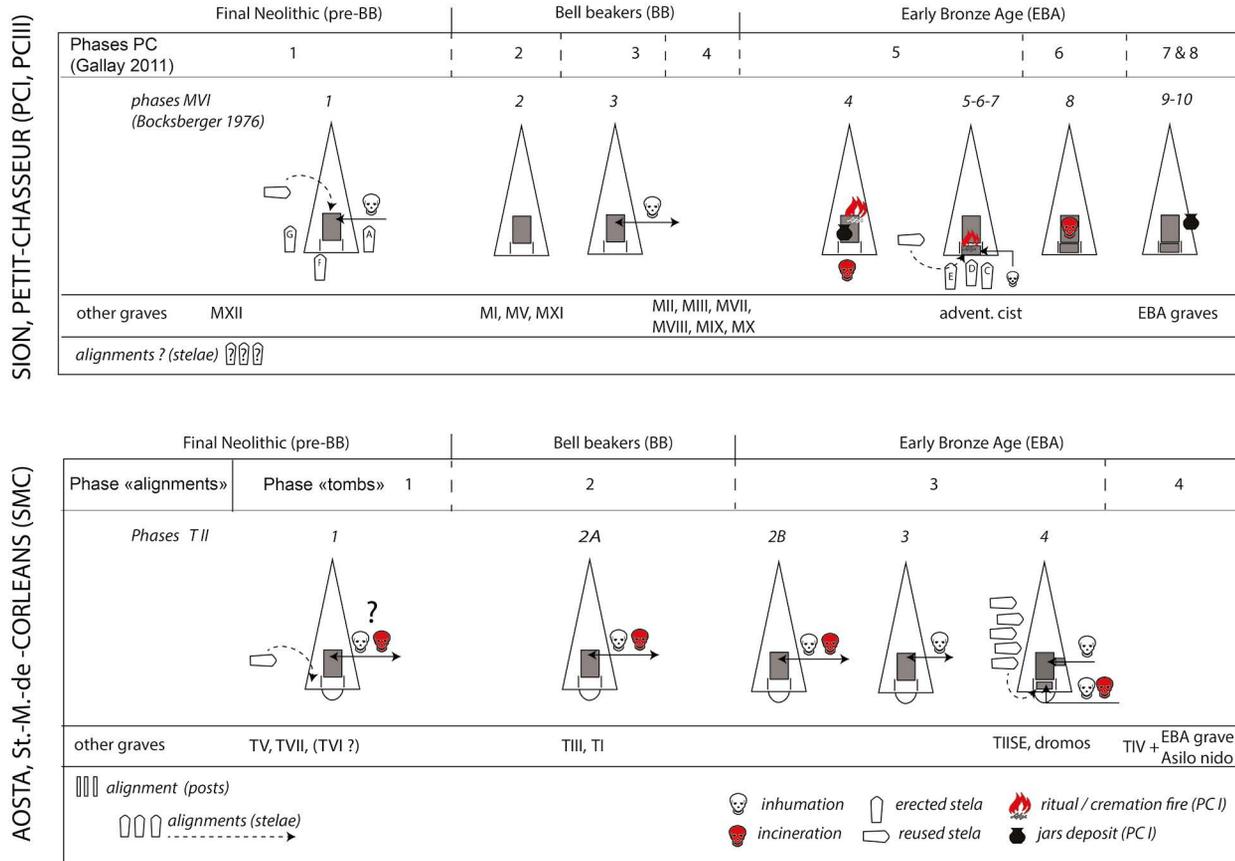


Figure 8: Saint-Martin-de-Corléans, tomb T II & T II SE and Sion, Petit-Chasseur, dolmen MVI. Comparison of the chrono-structural sequences (after Gallay 2011, Bocksberger 1976, De Gattis et al. 2018). © Philippe Curdy.

above) with the SE side of TII placed along the main one. Consequently, it is possible to hypothesise that the architecture of the dolmen is somehow spatially connected to the presence of the stelae, either raised or intentionally broken *in situ*. The relationship between the monument and the stelae is further marked by the re-use of the latter as part of the structure of the two adventice cists TIISE and *dromos* (see Harrison and Hayd, p. 135 about PC; p. 162 about SMC).

The pre-BB phase shows strong analogies in the forms of clearance management, partial at TII (some finds are still present) and complete at MVI, confirmed by chronological dating of the two sites (see above).

The BB phase (2a at TII) is attested by the presence of inhumed in partial connection and associated with burnt remains from the external cremation areas, as testified by the infill soil levels and debitage by-products.

TII appears to have been in use during the BB and EBA with a continuity of bone manipulations, resulting in a single phase with the 14c dating and the BB phase 2 and EBA phase 2b materials. These phases are comparable

with phases 3 and 4 of dolmen MVI, where the finds are recorded from clearly distinct layers.

Within the chamber personal objects of the deceased typical of the BB set (i.e. button and brassard) and of the EBA phase (i.e. Singen type pins, lunules, etc.) are recorded, at times located near skeletal elements still in partial connection. This confirms a sequence of funerary actions that not only involved individuals but also personal funerary accoutrements and offerings. While the BB vessels recorded at SMC are found only around the dolmen, at PC MVI BB pottery is directly deposited inside the structure.

The lower levels show more clearly the effects of manipulations and mixing between the BB and EBA, therefore questions still remain as to the organisation of the rituals and the deceased. The upper layers instead reveal a change in ritual and a difference in the management of the space following the sealing off of the porthole access.

A decrease in activities occurs at SMC (phase 3), materially recorded through the accumulation of a thick lime deposit, possibly of anthropic origin, that

constitutes a break between the two most consistent phases. A similar decrease is not attested at PC.

The increase in activities during phase 4 at SMC corresponds to a lessening in the manipulations of the inhumed individuals, although there is evidence of secondary inhumations with the repositioning of earlier remains and finds.

The funerary use of the chamber continues during this phase along with the external structures, namely the *dromos* and TIISE, which begin to be used during this period. During the same moment at Sion (phase 5) an individual is inhumed in the stone cist while the main chamber is no longer used for burial purposes. The most recent phases inside dolmen MVI attest only to the lighting of ritual fires and the depositing of jars.

The defunctionalisation, with the laying of stones both internally (on the last layers) and externally on the now fragmented cover slab, also finds analogies with MVI. The progressive accumulation of stones interpreted as a cairn at Sion can be referred to phases 7 – 10.

The identification of the groups that frequented the necropolis as well as the possible selection process that permitted access to the funerary contexts of the megalithic area of SMC is still ongoing. Study of the finds and the first results of the DNA analyses would seem to point at long-distance relationships. The monumentality of the tombs, variety of structural types, assortment of finds, origin of the raw materials and high number of individuals seem to suggest that the megalithic area played an intercommunal role and place of reference for several human communities.

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The Bell Beaker Phenomenon in the Southern Upper Rhine Valley. A Presentation of Old and New Excavated Graves of the South Baden Group in Germany

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Abstract: The southern Upper Rhine Valley forms the most westerly part of the Bell Beaker East Group and is archaeologically particularly significant due to its border to the West Group. By analysing old and new excavated graves in the South Baden region of Germany, a classification of the remains can be presented. Despite the special location and many possible reference points to other Bell Beaker areas, the southern Upper Rhine Valley seems isolated from foreign influences from the middle Bell Beaker phase onwards (after Heyd 2000) also within the Eastern Group.

The archaeological and anthropological examination of the graves also emphasises how important the combination of both disciplines is. The South Baden sample provides valuable insights into the people of the Bell Beaker phenomenon and their living conditions. It is shown that the grave goods and the bipolar gender-differentiated burial habit give clues to the gender role of the buried, but this does not necessarily coincide with the sex of the deceased. This study supports findings (e.g., Metzler 2005) that suggest Bell Beaker societal flexibility concerning the individual ingestion of gender and that biological women and men could take on both roles in different variations.

Keywords: Archaeology and Biological Anthropology, Bell Beaker East Group, South Baden Group, Isolation, Gender Roles

1. Introduction

The Bell Beaker East Group extended within Central Europe from present-day Poland and Hungary to the westernmost part, which is called the Southern German Group (Schmid 1995: 84). This includes the southern Upper Rhine Valley with parts of southwest Germany, Switzerland and Alsace (Heyd 2004: 181).

The entire area was characterised by almost uniform burial rules, which are shown by individual body burials in single grave pits (Müller 2005a: 36-37). Distinctive is the bipolar gender-differentiated orientation and crouched position. Female individuals were usually buried S-N aligned lying on the right side of the body, whereas male individuals were laid down on the left along the N-S axis. Both genders therefore look to the east. In addition to the typical bell beaker and the characteristic complementary ceramics, special grave goods were added depending on the gender (e.g., Heyd 2007: 332). The typical ceramic decoration style is the metope decoration, which became characteristic for the entire Eastern Group from the younger Bell Beaker phase B1 onwards (Heyd 2000a: 312).

The study area of this article is located in the southern Upper Rhine Valley and marks a geographically limited area between the Black Forest in the east, the Vosges in the west and the Basel Rhine knee in the south. Northerly, the area is limited by an absence of finds and features to the northern Upper Rhine Valley

(Sangmeister 1966: 104; Pape 1978b: 25). The reason therefore was probably the appearance of the Corded Ware Culture on the French side north of Strasbourg (Preuß 1998: card 9; Hald and Strahm 2008: 14). On the German side, this may be explained by a high risk of floods (Sangmeister 1966: 104; 1971: 32; Pape 1978b: 25; Bodenübersichtskarte Baden-Württemberg, 2019; Party, Muller and Sauter 2012: 10, fig. 5). In addition, the Bell Beaker material of the northern Upper Rhine Valley is more closely related to the central German complex (Sangmeister 1966: 93). Since the south is strictly based on the southern German Bell Beaker phenomenon (Sangmeister 1966: 102; Hey 2000a: 345), a limitation at this point is also supported by the characteristics of the archaeological material.

Detailed research on the area's Bell Beaker complex began at the end of the 19th century. At this time, the first Bell Beaker graves were discovered in this region. Various researchers then classified the material historically and chronologically (Schmid 1995: 84). Predecessors for the currently accepted chronological structure of the Upper Rhine area were Kraft (1941-1947: 127-137), Sangmeister (1966: 81-184; 1974; 1976), Gallay (1970), Bill (1976) and Pape (1978a). In 2000 Heyd published a relative chronology for the Danube area in southern Germany, which shows generally strong similarities to the southern Upper Rhine Valley (Heyd 1998: 87; 2000a, 2000b) and forms the basis for the typological and chronological classification of the finds and features discussed in this article.

An important figure in the research of the area was Edward Sangmeister. He pointed out that the southern Upper Rhine Valley was a regional part of the Eastern Group (Sangmeister 1951; 1964) which was mainly related to the Danube region in southern Germany (Kraft 1941-1947: 129; Sangmeister 1966: 81; Heyd 1998: 89). He also discovered that the southern Upper Rhine Valley compared to other regions hardly showed any influences from other areas and seemed to be isolated (Sangmeister 1966: 102). Since then, new sites have been discovered, and the assumptions of Sangmeister will be reviewed again as a main part of this article.

The Bell Beaker complex of the southern Upper Rhine Valley currently consists of 106 single finds, burials and

settlement complexes from 39 sites. Figure 1 shows the find distribution, with supplementary information available online through the University of Geneva's Archive Ouverte (<https://archive-ouverte.unige.ch/unige:156835>).

With 73% (77/ 106), burials are the main category of Bell Beaker features known from this area. Thereof, 20 graves are seemingly isolated while 13 grave groups with two to eleven burials have been documented so far. These contain a total of 77 individuals of which, as expected, only 3% (2/ 77 burials) were cremations.

The single finds represent around 20% of the total corpus (22/ 106). 86% of them are ceramic vessels or

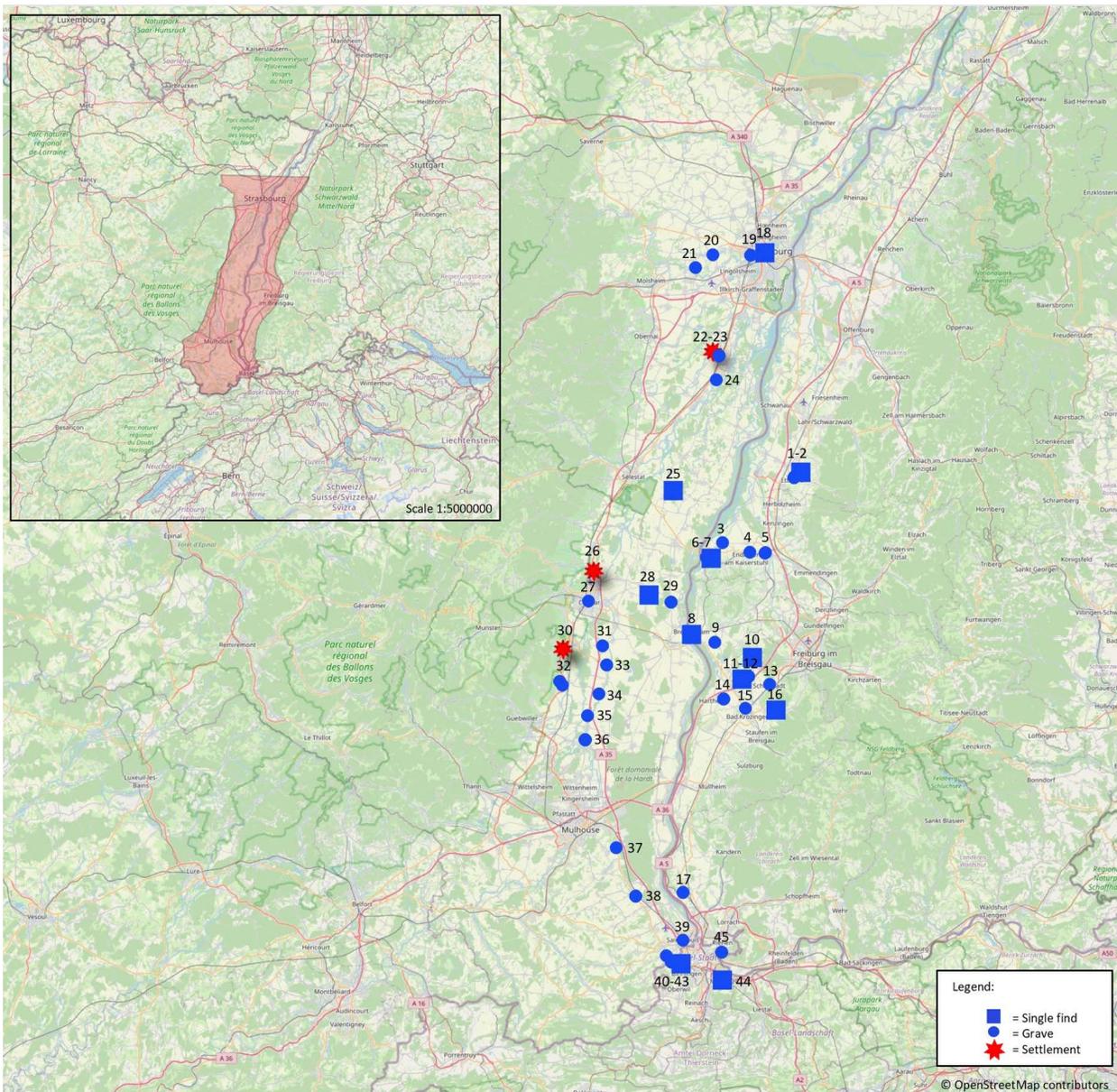


Figure 1: The southern Upper Rhine Valley with the Bell Beaker feature and find distribution numbered by site (scale 1:1500000, north-oriented). For more information, see the Supplementary Information available online at the University of Geneva's Archive Ouverte (<https://archive-ouverte.unige.ch/unige:156835>).

fragments of such (19 of 22 single finds). Wristguards can be documented in three cases.

The indication for settlements in the southern Upper Rhine Valley is less than 3%, because only three Bell Beaker settlements are known in Alsace (Erstein (no. 22), Hattstatt (no. 30), and Houssen (no. 26)).

Overall, the sources in the southern Upper Rhine Valley fit into the general pattern of the Bell Beaker period (Heyd 2007: 332). Out of the just summarised overall material, this article focuses on the archaeological and osteological analysis of the death ritual of the South Baden Group. This refers to the graves on the eastern side of the Rhine, which in turn form a group themselves. Figure 1 shows the South Baden Group's find distribution with the numbers 1 to 17.

2. Archaeological Features

The South Baden Group currently comprises 29 buried individuals in 27 graves. These are analysed here with a focus on burial type, burial ritual, grave shape and regularities in added grave goods (Eggert 2012: 55-78).

Most of the South Baden individuals were buried in grave groups while only 22, 2 % (6/ 27) were isolated. Here it is important to note that many of the grave complexes are located in today's settlement areas and could only be discovered in limited areas due to construction work or test trenches. The surroundings are often built over or difficult to access archaeologically for other reasons.

Overall, inhumations, following the typical Bell Beaker tradition (Müller 2005a: 36-37), are by far the most common. For the South Baden Group, only one cremation from Bad Krozingen (no. 15) can be noted. Why this individual was not buried in the usual way is still unclear. Since this type of burial occurs mainly in the eastern areas of the Bell Beaker phenomenon, an influence e.g. from the Csepel Group (Hungary) (Kalicz-Schreiber 1976; Heyd 2007: 332) could be assumed. It should be noted, however, that the individual from Bad Krozingen was buried with two decorated Bell Beakers, an undecorated beaker, a cup and a sickle insert. With such a comprehensive grave inventory, which culturally fits perfectly into southern Germany, the deceased belongs to the particularly rich equipped individuals in the South Baden region. Possibly this was a person of higher social status or a migrant who had used the death ritual to separate themselves from their surroundings.

The burials in South Baden exclusively took place in flat graves. The grave pits were mainly created in a rectangular shape with rounded corners. Only three graves of buried males appeared in a clear rectangular shape. Rounded pits only appear in two cases and

square shape only occurs in one female burial. The expected grave size is 145.0 cm by 102.4 cm.

Three graves stood out from the group because of their special burial structures. This includes a double grave from Efringen-Kirchen (no. 17), where one woman was buried atop of another. In the rest of the southern Upper Rhine Valley only one other double grave was found, located in Achenheim (no. 20).

Another exceptional burial variation was excavated in Riegel, Grasäcker (no. 5) in 1940 when a cable trench was built (Kraft 1941-1947: 131). Later, several circular ditches could be discovered by taking aerial photographs of the same area. The burial mentioned above was positioned in the centre of one of these ditches. Therefore, this can be interpreted as a Bell Beaker necropolis consisting of at least seven graves with surrounding circular ditches (Heyd 2000b: 129). Until now, this is the only case in the whole southern Upper Rhine Valley (see Supplementary Information). In addition, there is a burial in Riegel, Breite I (no. 5) with a rectangular grave pit surrounded by a 10 cm to 30 cm wide darkly discoloured border. This could be caused by an additional wooden cladding or burial chamber (Schlenker and Stöckl 1989: 77-78). This particular kind of grave building can be found two more times in the southern Upper Rhine Valley. These two male burials from Sierentz (no. 39) even provide clear indications of wooden box constructions (Verгдаud 2014: 173-210).

The individuals who stand out due to their grave construction can be described as rather richly equipped in comparison to the other flat graves. Only one of the two female individuals from Efringen-Kirchen (no. 17) was buried without any grave goods. Due to the lack of anthropological data, nothing can be said about the age distribution. The construction of a double grave pit cannot be compared to circular ditches or the construction of burial chambers in terms of complexity. Therefore, it can be assumed that the extraordinarily elaborate graves in South Baden were mainly built for male individuals due to their higher social status.

The typical funeral ritual of the Eastern Group can also clearly be recognised within the South Baden Group (Müller 2005a: 36-37; Heyd 2007: 332). The grave and corpse orientation was carried out in accordance with the rules of the preferred southwest-northeast axis. The positioning of the deceased facing east was also strictly followed. Even though the arms were usually found in a parallel position, the crossed arms variation could be documented in two cases. The legs were found in a typically crouched position, although in different flexion degrees as depicted in Figure 2.

In general, there were burials without any grave goods, but also individuals who had been equipped with up to

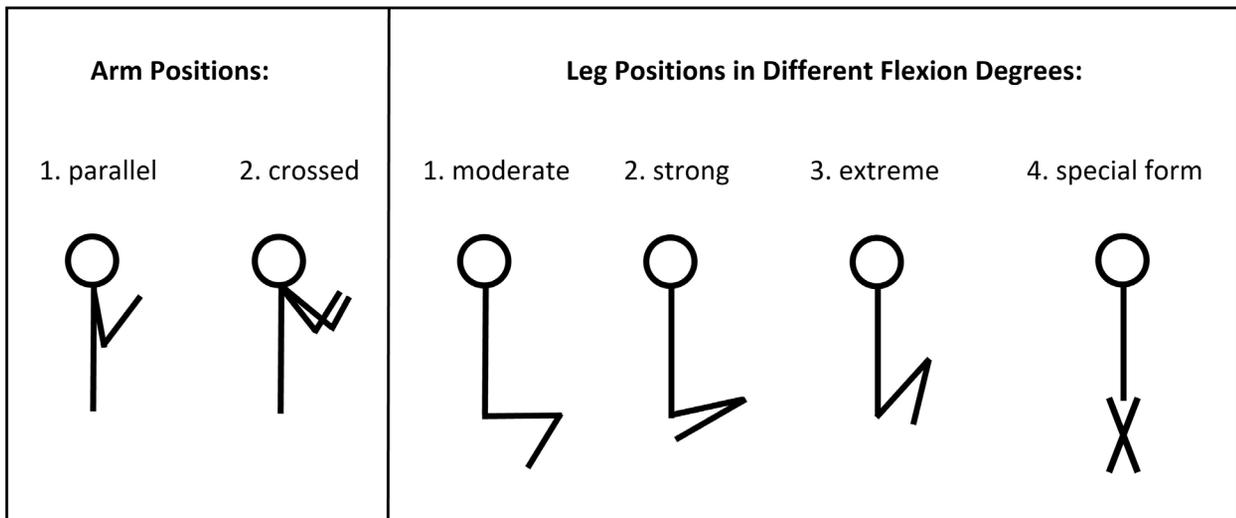


Figure 2: Arm and leg positions of the Bell Beaker South Baden Group.

six objects each. However, the latter was rare. In total an average of two objects were found in the graves. In general, male individuals ($\bar{\emptyset} = 3.5$ grave goods) received more grave goods than females ($\bar{\emptyset} = 2$ objects). In reference to age, adults ($\bar{\emptyset} = 4$ grave goods) were better equipped than children and adolescents ($\bar{\emptyset} = 2$ objects).

Most grave goods are ceramics. Stone and bone objects, which also include meat offerings (Bökönyi 1978; Peške 1985; Heyd 2007: 339), are rather rare and only in two cases metal awls were found. Regarding the placement of the artefacts, it could be determined that pottery is mainly laid down in the foot area or behind the heads, but they can occur anywhere in the grave. Bone objects are more commonly placed close to the torso. On the other hand, metal and stone artefacts can only be described as occurring irregularly due to their low appearance. In general, the areas in front of the body were mostly used for storing grave goods while no objects were placed directly in front of the face.

Nevertheless, the South Baden Group also shows some atypical burials, for example by discrepancies between the osteologically determined sex and the presumed gender as evidenced by orientation and position of the individuals (see Supplementary Information).

For example, the Munzinger grave group (no. 12), which differs significantly from the norm due to its east-west orientation, is striking. Further information about the archaeological feature was not documented during the excavation in 1935. However, the grave goods can be assigned to the Bell Beaker complex based on their shape (Kraft 1941-1947: 130, pl. 43a; Sangmeister 1964, pl. 4; Heyd 2000b: 129). This could be a combination of Bell Beaker and Corded Ware burial traditions (Turek 2001: 1; Heyd 2007: 362) due to cultural exchange or other relationships between the two groups (Müller

2001: 592). One of the Munzinger skeletons (no. 12, grave 1) was also discovered in a prone position with crossed legs. However, due to the poor excavation documentation it remains questionable whether this was the original position of the corpse. Furthermore, there is one South Baden individual from Ettenheim (no. 1, grave 3) who was buried in contradictory orientation and crouched position (SW-NE, left side) without any gender-indicating grave goods. Therefore, this individual can be assigned to both or neither gender role. The osteological sex determination gave no result due to poor preservation. Two other inconclusively buried individuals are known from the southern Upper Rhine Valley. These include the skeletons from Erstein (no. 23, grave 104) and Sierentz (no. 39, grave 137). In the Bell Beaker East Group, such cases also occur in other areas. Much more often there are burials in which it is not the burial ritual *per se*, but rather sex and gender that is contradictory to the supposing burial rules (Müller 2005b: 45; Müller 2001: 597). These include the individual from Ettenheim (no. 1, grave 1, socially female, biologically male) and the skeleton from Gündlingen (no. 9, socially male, biologically female), as well as two more cases from the entire southern Upper Rhine Valley (Sainte-Croix-en-Plaine (no. 31), Allschwil (no. 42, grave 1)).

In addition, the overview reveals a man from Ettenheim (no. 1, grave 1) buried with a bone toggle button and further buttons, which are usually interpreted as typically female grave goods, as well as a woman from Efringen-Kirchen (no. 17, grave 1), who was buried with an arrowhead which is considered a typically male object (Harrison and Heyd 2007: 188, fig. 41). Further such cases are known from the entire Bell Beaker East Group (Müller 1998: 123-124; Heyd 1998: 91; Müller 2005a: 37; Müller 2005b: 45).

These examples show the importance of an exact and critical osteological examination of the skeletal material for comprehensive archaeological evaluation. The individuals mentioned above could provide evidence that the Bell Beaker society was more flexible regarding the individual gender roles and that women and men could even take on both roles (Metzler 2005: 63). However, regarding the social position of gender, the South Baden group shows a rather patriarchal orientation according to the higher number of grave goods and the more elaborate grave constructions for men.

3. Archaeological Material

The archaeological material of the South Baden Group is typologically and chronologically analysed according to Heyd (2000a).

Regarding the range of ceramic shapes, the South Baden Group fits well into the Bell Beaker East Group of southern Germany. The cups fit in shape group 3 defined by Heyd, whereas the bowls are mainly assigned to shape type 1. The undecorated cups were mostly squat, the decorated ones on the other hand show various shapes. The only exception is the jug from Riegel, Grasäcker (no. 5, Fig. 6) because the vessel shape shows a direct relationship to ceramics from Bohemia and Moravia (Heyd 2000a: 351). The decoration styles of the ceramics shown in Figure 3 also clearly fit into the Bell Beaker Group of southern Germany. A total of eight patterns can be classified. Mainly, in South Baden, as well as in the entire southern Upper Rhine Valley, there are line decorations ranging from horizontal or oblique to vertical, which are attached to continuous horizontal bands in a constant pattern. Style number 2, the horizontal lines, can also be impressed by cords and show a possible Corded Ware influence (Sangmeister 1966: 100). Overall, the South Baden Group shows a uniform and reduced decoration range compared to southern Germany and the rest of the Bell Beaker East Group (e.g., Heyd 2000b, pl. 35-38). Considering the entire southern Upper Rhine Valley, the Alsace offers five more decoration styles, which are not currently found in the German or Swiss parts. However, the French styles represent mostly variations of the already known ones.

Furthermore, the typical Eastern Group metope decoration is completely missing in the whole study area (Sangmeister 1966: 93; Heyd 2000a: 346). This is noteworthy, since the adjacent areas such as the northern Upper Rhine Valley or the otherwise always comparable Danube area of southern Germany have an extensive metope repertoire (Heyd 1998: 90).

In the 29 South Baden graves, only eight stone artefacts can be documented. Moreover, only ten bone objects

occur in just two different variants (one toggle button, nine v-perforated buttons). In addition, two metal awls were discovered. One greenish discoloration on a skull can be added here, which could indicate a further metal awl, due to its shape (Heyd 1998: 92; Otto *et al.* 2003: 71).

The non-ceramic objects, in contrast to the ceramics, show traces of use and were probably used secondarily as burial objects. Regarding their range of shapes, they are clearly oriented towards the Bell Beaker East Group but are comparatively less varied. Influences from the Bell Beaker West Group or other areas of the Eastern Group can almost not be recognised. Only for the toggle button, the nearest and best comparisons can be found in the northern Upper Rhine Valley (Sangmeister 1984: 79).

Overall, the origin of the raw materials can be located in the South Baden region. The stone artefacts consist of locally occurring Jurassic chert (Hahn 1991: 11) and red sandstone (Bundsandsteinvorkommen Baden-Württemberg 2019). According to many researchers the ceramics mostly are made out of local clays (Rehman, Robinson and Shennan 1992; Convertini 2001: 550). However, this could not be verified in the presented study. The nearby copper deposits Hardt and Schauinsland in Baden-Württemberg (Sangmeister 1971: 32) also support the argument of using local resources.

The location of the study area as a direct neighbour of the Bell Beaker West Group should receive special attention at this point. Until now western influences, like typically tanged arrowheads (Othenin-Girard 1998: 60) or other complementary ceramic shapes (Strahm 2014) are absent in the archaeological material of the South Baden Group at this point. Whether the absence of the metope decoration can be interpreted as a relation to the West is still questionable (Sangmeister 1966: 91). Even in parts of the Western Group, metopes are visible and interpreted as a clear eastern influence (e.g., Rhodano Provençal Group in France (Lemerrier 2012: 133, fig. 13.7). However, it has never been documented in the southern Upper Rhine Valley which is considered the western part of the Eastern Group. This observation is quite striking and will be studied further later on.

4. Anthropological Material

From a total of 29 skeletons found in South Baden, the osteological information of only twelve individuals can be included in the study. Just one of these skeletons was previously age and sex determined (Gündlingen (no. 9)). For this article it was only possible to systematically study the skeletons from more recent excavations (n = 11) according to the procedure of Harbeck (2014) by using standard methods for age determination (Nemeskéri, Harsány and Acsádi 1960; Brothwell 1963;

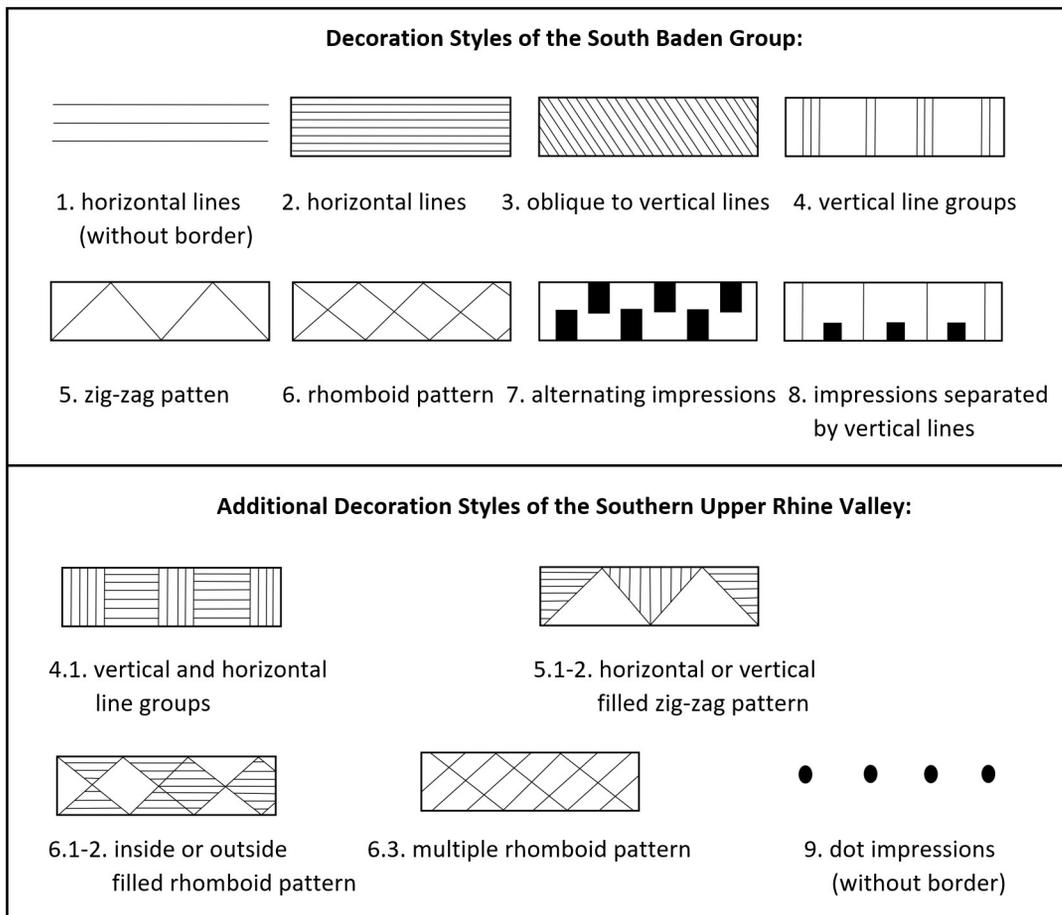


Figure 3: Decoration styles for ceramics of the South Baden Group and the whole southern Upper Rhine Valley.

Ubelaker 1978; Lovejoy 1985; Isçan and Loth 1986; Wahl 1988; Herrmann *et al.* 1990; Mann *et al.* 1991; Buckberry and Chamberlain 2002; Scheuer, Black and Schaefer 2010; Calce 2012), sex determination (Herrmann *et al.* 1990; Schutkowski 1990; Grupe, Harbeck and McGlynn 2015) and body height estimation (Pearson 1899; Ruff 2007; Ruff *et al.* 2012). Therefore, the examined sample represents 41% of the South Baden Group. Although this limits the significance of the results achieved in this study, the outcome is nonetheless interesting when compared with the Mittel-Elbe-Saale series of Bell Beaker skeletons from central Germany (Nicklisch 2017: 76-80).

The general conservation status of the skeletal material is considered as astonishingly good, with most individuals almost fully represented and with a very low grade of fragmentation. Only one skeleton from Ettenheim (no. 1, grave 2) and the highly fragmented cremation from Bad Krozingen (no. 15) must be described as poorly preserved (Grupe, Harbeck and McGlynn 2015: 253).

The age distribution ($n = 12$), which is 50% children and adolescents and 50% adults, conforms to the expectation of palaeodemographic studies, which show that the proportion of children and adolescents in prehistory was around 50% (Häusler 1966; Neustupný 1983). Most of the individuals died within an age range of 20-40 years. The youngest ones were buried at an age between two and four while only one female individual died at a more mature age ranging between 40-60 years. Nicklisch's comparison series confirms the results (Nicklisch 2017: 76-77).

For the adult individuals ($n = 6$) the sex distribution shows approximately 50% males, 33% females and 17% indeterminate. For the children and adolescents ($n = 6$) 33% females, males and indeterminate can be documented.

Male adults from the South Baden Group are estimated to have an average body height of $1.66 \text{ m} \pm 3 \text{ cm}$ in contrast to females with $1.54 \text{ m} \pm 4 \text{ cm}$. Both values correspond with the calculated heights from the Mittel-

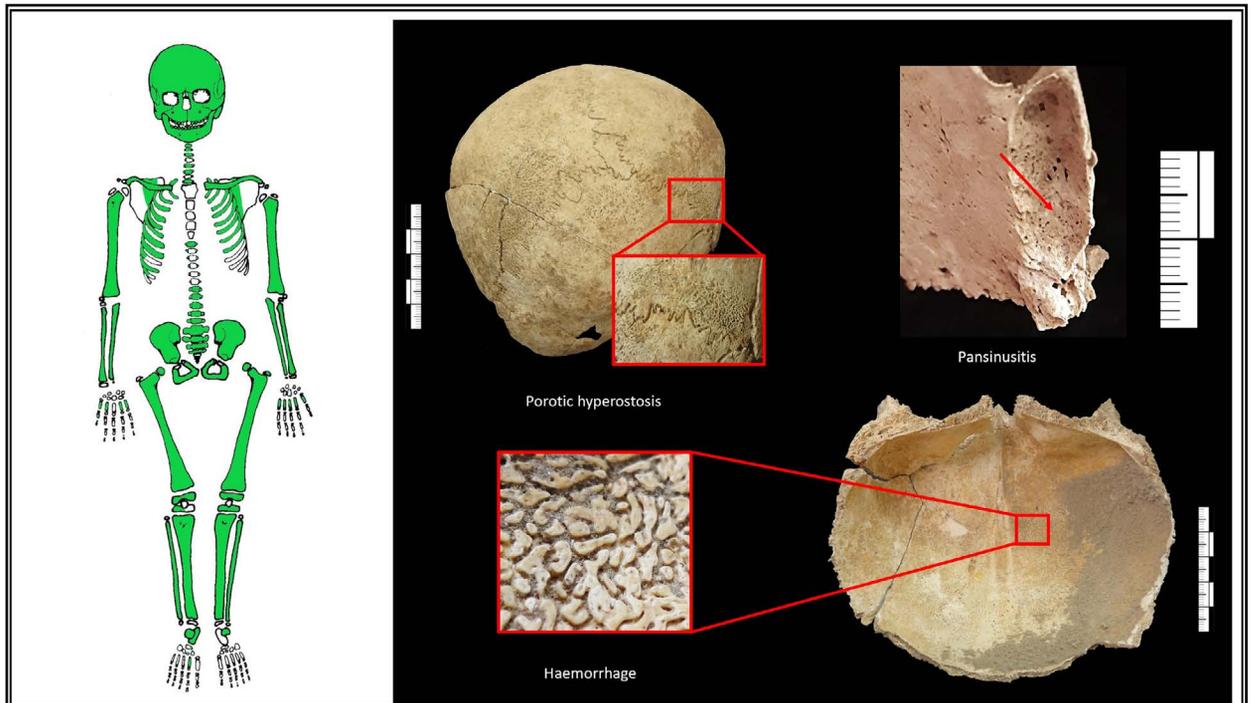


Figure 4: Pathologies of the seven-year-old female from Endingen (Supplementary Information no. 4).

Elbe-Saale area (Nicklisch 2017: 78-79) which were conducted using the same methods as in the present study.

The health status of the sample can be evaluated by examining occurring pathologies on teeth and bones (Nicklisch 2017: 22-23). Mostly inflammatory bone reactions like periostitis (no. 5, Breite I and III) or spondylodiscitis (no. 5, grave 2), are indicators for physical overload such as tendopathy followed by exostosis (no. 1, grave 3), healed fractures e.g., of the tibia (no. 1, grave 3) and deficiency symptoms like anemia (no. 4) can be documented on the South Baden sample.

Overall, the individuals in South Baden show an increased stress level e.g. regarding the dental hypoplasia which are 100% for adults and 60 % for children and adolescents compared to Nicklisch's series with around 29% for adults and approximately 8% for subadults (Nicklisch 2017: 79-80).

One illustrative example of pathologies linked to health is the seven-year-old girl from Endingen (no. 4, also see Figure 4). The individual displays heavily thinned cortex of the long bones with enlarged marrow spaces, indicating characteristic symptoms of anemia (Grauer 2019: 514-519, fig. 14.25c). Corroborating this diagnosis, cribra orbitalia and porotic hyperostosis can be observed (Herrmann *et al.* 1990: 168-169; Grauer 2019: 514-519). Other porotic changes can be found on the entire

palatinum, pointing to a stomatitis or paradontitis as a possible reason for those issues. This can be supported by a tooth abscess that was found as well (Herrmann *et al.* 1990: 155-156; Grupe, Harbeck and McGlynn 2015: 311). In addition, newly built fine porotic bone deposits in the maxillary and paranasal sinuses as well as in the nasolacrimal ducts can be documented. This indicates an inflammation of the associated mucous and thus for a pansinusitis (Schultz 2003: 102-105). Overall, the morbid changes point to a chronic vitamin C deficiency, which probably caused scurvy (e.g., Schultz 2003: 105). Presumably, anemia and chronic vitamin C deficiency led to a weakened immune system, causing various inflammations in the mouth and nasal area. As a result of haemorrhage (Schultz 2003: 94, fig. 6.33) coarse ramified appositions can also be found on the inside of the skull calotte. These bleedings could also be the cause of death (Schultz 2003: 93).

5. Results and Discussion

All in all, the analysis of the archaeological features and material shows that the South Baden Group is strongly related to the Bell Beaker East Group of the Danube area in southern Germany. However, it is also shown that a comparatively reduced range of pottery shapes and decorations as well as a low artefact repertoire seems to be characteristic. Common and widespread types like bow-shaped bone pendants or various beads and button types are not documented. Objects made out of gold or amber are missing entirely.

A look at the entire southern Upper Rhine valley displays a similar picture. In Switzerland only five graves are known. These fit perfectly into the South Baden image. The French material, however, is slightly different: for example, a greater number and variation can be observed in the added stone and bone artefacts. In addition, a few beads made of amber could be discovered in the grave from Kolbsheim (no. 21). Nevertheless, no gold objects and only one metal bead could be found. Furthermore, the ceramic ornamentation styles are strongly oriented towards the South Baden patterns with a few additional variants. In total, the French material shows a little more variance in relation to the artefact and decoration repertoire, which is probably due to the higher find density of the sub-area (Figure 1). Nevertheless, even in this area no metope style decorations have been found so far. Overall, the whole study area fits well into the image of the South Baden Group.

It is questionable, whether the presented artefact and variation scarceness in South Baden is possibly due to a deposition filter. Conservation problems cannot be assumed in the study area. The skeletons as well as the inorganic and organic grave goods are in particularly good condition. The metals have also been preserved in the ground. A greenish, awl-shaped discoloration on one of the skeletons, where a metal object was not otherwise present, is the only indication for a lack of artefact preservation. However, other taphonomic processes should also be considered, such as geological sediment rearrangements or bioturbation (Schiffer 1987; Sommer 1991). A likely explanation could be a later grave robbery (Kümmel 2009). However, there is no such evidence. The skeletons were all discovered undisturbed and in correct anatomical articulation. Even a generally simpler burial tradition does not seem to be conclusive since the study area was culturally strongly oriented towards the southern German neighbouring area with additional influences from farther east. Especially from these more eastern regions, richly equipped burials, which differ significantly from the South Baden Group (e.g., Heyd 2007: 333; Hackelberg 1995: 29-40; Hecker 1995: 41-66), are known.

Overall, the Bell Beaker society in South Baden appears to have buried their people comparatively modestly. If one considers the Eastern Group as a whole, the study area lacks particularly rich equipped graves as well as valuable grave goods. The health status of the sample examined also indicates some overworked, stressed and malnourished individuals.

As a result, a rather impoverished society within the Bell Beaker East Group can be assumed for South Baden. The natural conditions of this area, which are mostly predestined for agriculture (Bodenübersichtskarte Baden-Württemberg 2019), cannot be considered as

a valid argument for this. One reason could be the possible separation of the group already argued by Sangmeister in 1966.

Finally, if the earlier results of Sangmeister and the insights gained from this work are considered in conjunction, the following scenario is possible (Figure 5):

1. The Bell Beaker phenomenon met the local Neolithic population of the South Baden area.
2. Afterwards, there was an exchange between the South Baden group influenced by the Bell Beaker and the Corded Ware culture in the discussed area. This resulted in the cord-decorated Bell Beaker ceramics (Figure 6), which date back to the early Bell Beaker period (A1 after Heyd 2000a: 391-392). This can be supported by the graves from Munzingen, which were oriented east-west according to the Corded Ware tradition and belong, indicated by their grave goods, to the Bell Beaker phases A1 to A2 (Heyd 2000b: 257, fig. 99).
3. Subsequently, an influence from the eastern part of the Bell Beaker East Group was exerted. Until now this is documented by the jug from Riegel (no. 5, A2 to B1 after Heyd 2000a: 351, fig. 8) and the cremation from Bad Krozingen (no. 15, A1 to B1 after Heyd 2000b: 257, fig. 99). The mentioned jug shows references to comparable objects from Bohemia as well as Moravia. The stated burial ritual probably derives from the Csepel Group located in today's Hungary.
4. Ever since the younger Bell Beaker phase (B1), the whole Eastern Group developed the metope decoration (Heyd 2000a: 312). However, this did not have an impact on the southern Upper Rhine Valley, although their culture was strictly orientated towards the Bell Beaker East Group. To miss such a comprehensive development, some kind of separation must have taken place beforehand. Also, according to the current state of research, the eastern and Corded Ware influences on the area must have ended by then. After that a possible isolation of the southern Upper Rhine valley from the rest of the Bell Beaker East Group took place.

This theory of separation is not only supported by the analysis of ceramic styles. Also, the rest of the archaeological material suggests that all contacts with other groups had been cut off at one point. Despite its location at the Rhine as an important transport and exchange axis (Schmid 1995: 85; Heyd 2004: 177) no further cultural influences from other areas can be detected from Heyd's younger Bell Beaker phase onwards. Although the group strictly maintains its

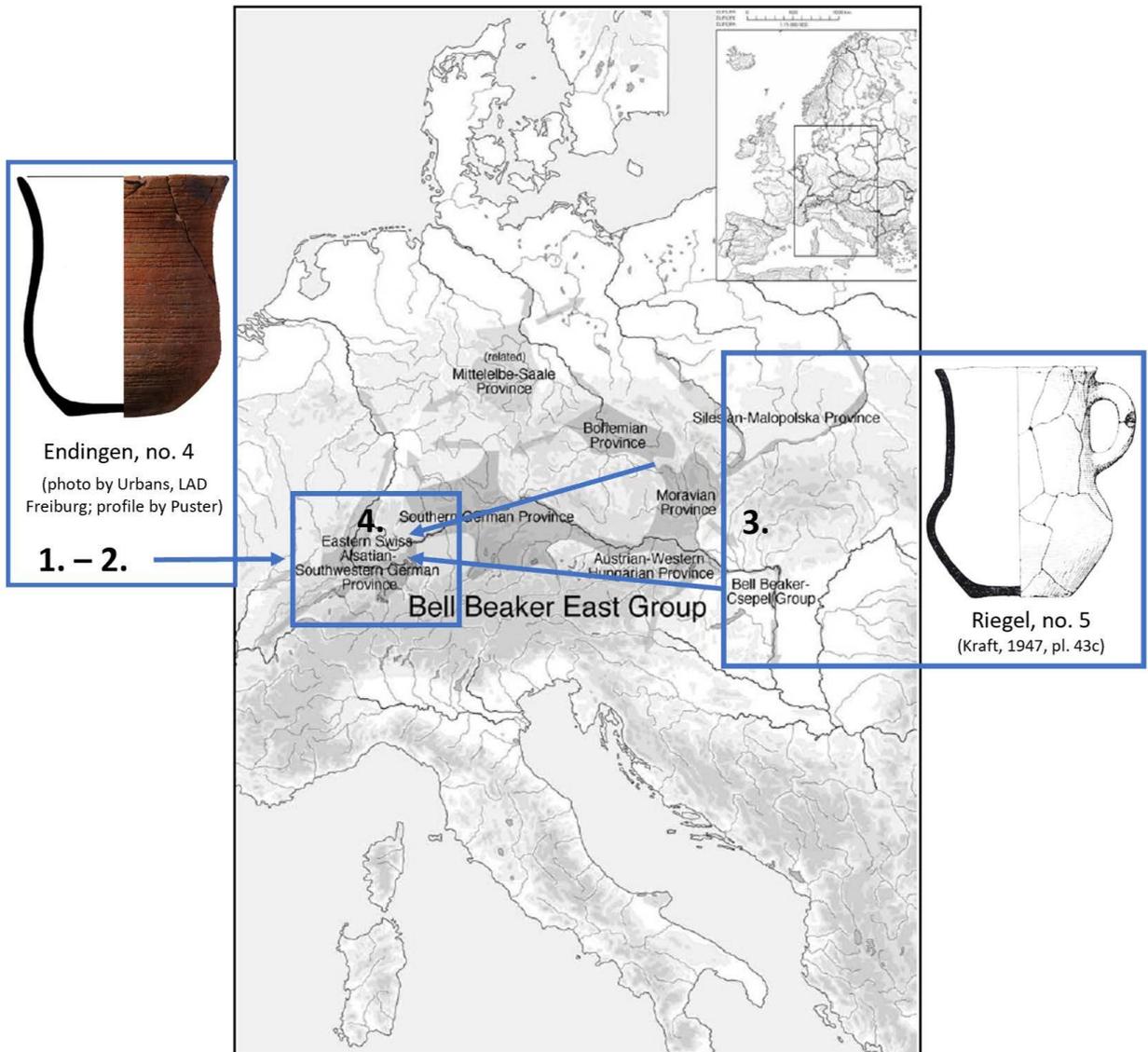


Figure 5: Hypothesized scenario for Bell Beaker influences and interactions in the southern Upper Rhine Valley (map after Heyd *et al.* 2004, modified).

East Group traditions it did not accept any further developments. The reason therefore could be the hindered connection to the Bell Beaker East Group through the adjacent and unpopulated Black Forest in the east. Perhaps maintaining the connection to each other had been too difficult over time so that the South Baden Group became isolated.

6. Outlook

A comprehensive publication is still in preparation but so far it can be said that future Bell Beaker research in South Baden would greatly benefit from further discoveries and excavations of the complex. These would be necessary to enlarge the current material basis to close the remaining feature and finding gaps in the geographic distribution (Figure 1), and also to

investigate, confirm or disprove the theory of isolation based on new findings.

Moreover, an excavation of the suspected necropolis of Riegel, Grasäcker (no. 5) would be particularly interesting because only one of the seven graves has been excavated and clearly assigned to the Bell Beaker phenomenon so far. Due to the exceptional construction of this amount of graves, the cemetery could be of greater importance for the entire South Baden Group.

Finally, it was noted that only the osteological information of 41% of the South Baden individuals could be included in this study, mostly because dedicated analyses are missing. This demonstrates the neglect of osteology and its underestimated value for answering archaeological questions in earlier times. A detailed

osteological analysis of the remaining skeletons is necessary to obtain a complete picture of the South Baden Group, especially regarding the burial ritual and the gender roles.

*Supplementary Information is available online at the University of Geneva's Archive Ouverte: (<https://archive-ouverte.unige.ch/unige:156835>)

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Health and Diseases in Commingled Remains from Final Neolithic and Bell Beaker Populations: The Site of Petit-Chasseur, Sion, Valais, Switzerland

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Abstract: Palaeopathology, the study of diseases in past populations, can offer clues as to the state of health of prehistoric humans. Through bone lesions, inequalities in access to resources, issues of violence, and the general evolution of health over time can be studied. In this research, the Final Neolithic and Bell Beaker populations of the site of Petit-Chasseur, in western Switzerland, were studied using a holistic methodology tailored to commingled remains. Results show the two populations did not differ much from one another, and that their health profiles correspond to that of a primary agrarian prehistoric population. Nonetheless, the presence of infectious lesions and trepanations, as well as the particular context of the burial site of Petit-Chasseur, raise further questions. These are addressed in the discussion and conclusion, in which future research perspectives which could lead to answers on who exactly was buried in these megalithic tombs are proposed.

Keywords: Bell Beaker, palaeopathology, palaeoepidemiology, prehistoric Switzerland, commingled remains, infectious diseases.

I. Introduction

The site of Petit-Chasseur, located in the town of Sion, canton of Valais, Switzerland, is of major significance to the comprehension of the Final Neolithic and Bell Beaker periods of the western part of the country. In this research, we present an in-depth analysis of the Final Neolithic and Bell Beaker skeletal remains found at the site, aiming to establish the state of health of these populations.

Palaeopathology is “the study of pathological occurrences in the past, based on the observation of ancient biological tissues, skeletal or mummified, and which can be complemented by information from medical historical sources” (Dutour, 2011, p. 24, *author’s translation*). Consequently, establishing the frequency and expression of pathologies in past and present populations informs modern societies on how our current “health status” came to be. In the case of the Neolithic period, the study of lesions in skeletal remains is particularly relevant; this period marks a drastic change in lifestyle (sedentary settlements, domestication and therefore constant proximity to livestock, notion of territory...) which is currently held as mainly responsible for a turn in health patterns observed in human populations (Zammit, 2005; Hershkovitz *et al.*, 2015; Ash *et al.*, 2016; Dutour, 2018).

We focus here on the later part of the Swiss Neolithic. The data was part of a PhD research project conducted by the author on Neolithic Western Switzerland, which was defended in 2019 (Abegg, 2019). Due to the nature of the burials found at the Petit-Chasseur necropolis, a

holistic, adaptable methodology was devised in order to be able to account for all lesions encountered, whilst producing meaningful quantified data. In this article, we give a brief site biography of Sion Petit-Chasseur, describe the materials at our disposal and the methods used to analyse them, and provide both quantified and qualified results based on our observations. Finally, we discuss the potential meaning of these results in the general context of Neolithic Switzerland, and demonstrate how such non-destructive, inclusive palaeopathological approaches are the first step towards identifying areas that will yield beneficial insights when investigated using more invasive or destructive analyses.

II. The Site of Petit-Chasseur, Sion

i. Excavation history

The site of Petit-Chasseur is located within the town of Sion, canton of Valais, Switzerland. It benefits from a long excavation history that is still ongoing to this day, as new constructions within the town reveal new vestiges of past life and death. Over 50 publications are available on the findings made at the site, from a series of volumes tracing each excavation phase to specialised papers on topics such as fauna and raw materials (Bocksberger, 1976, 1978; Gallay and Chaix, 1984; Gallay, 1989; Mottet and Favre, 1990; Affolter, 2011; Besse and Piguet, 2011; Chiquet, 2011).

First excavation campaigns (PCI) at the site took place between 1961 and 1971 and were directed by Olivier Bocksberger followed by Alain Gallay. The second

	Ancient neolithic (5500-4700 BC)	Middle neolithic (4700-3300)		Final neolithic (3300-2200)	
		I	II		Bell Beakers
Plateau / Lemman basin	5500-4800 BC few indications traces of La Hoguette	protoCortailod Saint-Uze group, with Chasséen influences as soon as 4300 BC	classic Cortailod (3900-3650 BC) late Cortailod (3650-3580 BC) recent late Cortailod (3580-3500 BC) Port-Conty Cortailod (3500-3350 BC)	Horgen ? Lüscherz (2900-2700 BC) Auvemier-Cordé (2700-2440 BC)	
Valais	5500-4700 BC southern influences = Isolino, Vho, Gaban cultural groups	protoCortailod Saint-Uze group, influences from the Chasséen	before 4000 BC protoCortailod phase La Roberte (4050-3850 BC) Petit-Chasseur Cortailod (3850-3750 BC) Saint-Léonard Cortailod (3750-3550 BC) late Saint-Léonard (3550-3350 BC)	a first phase with Ferrières and Cortailod influences Lüscherz followed by Auvemier-Cordé 2700-2300 BC	Bell Beaker culture (2400-2200 BC)

Figure 1: Chronology of the Neolithic of the plateau/Leman basin and the Valais region, inspired by Burri-Wyser and Jammet-Reynal (2014, pp.79 and 82, upper table) and adapted from Abegg (2019).

campaign (PCII) was undertaken in the years 1968, 1969, and 1972 (Besse, 2011). The third campaign (PCIII, 1987 and 1988) was led by Manuel Favre and Sébastien Mottet and explored (among others) the dolmen MXII. PCIV excavations were directed by Marie Besse and revealed settlement structures (Besse, 2011). In 2002 and 2003, Mottet conducted an excavation in order to establish stratigraphic links between the various parts of the site, and discovered structures dating from the Middle Neolithic II of the region (Besse, 2011). In order to better understand where the site and its monuments fit in terms of chronological attributions, a summary of the various Neolithic cultures and their timeline is provided in figure 1, for western Switzerland. The town of Sion is located along a major travelling axis of Europe, the High Rhone Valley. As such, it is constantly in a state of development and changes, and new constructions and remodelling today and in the future will bring to light other pieces of the puzzle that is the site of Petit-Chasseur.

ii. Funerary monuments: description and archaeological interpretations

Many megalithic funerary monuments were uncovered during the excavations, making the Petit-Chasseur site an important reference for the megalithic phenomenon within Neolithic Europe. We will mention them here by number and chronological attribution, but it is important to remember that the necropolis functioned as an ensemble, a “gathering place” for communities of

the area, and that this heavily impacts the significance given to the funerary practices witnessed at the site, from grave preservation to interpretation of findings (Besse and Mottet, 2009). Second, almost all graves were disturbed, some “recycled” by later occupants of the site. Therefore, in figure 2 which provides a plan of the necropolis, the various monuments are coloured according to construction date.

Two main phases can be described in the construction and use of the Final Neolithic and Bell Beaker monuments. First, the triangular-based dolmens MVI and MXII were built by the Final Neolithic populations, and their dead deposited inside. As their name indicates, these dolmens are in the shape of a triangle, the funeral chamber being located within the widest part, at the base (figure 3). The dolmens, which were visible above ground and not buried, were re-opened often to deposit new deceased, which led to the re-arrangement of the now-skeletonised previous deposits. Some of these arrangements are discernible; a few individuals can be identified through anatomical connections, whilst some bones (craniums, femurs) tend to be deposited in “pockets” to the side (Bocksberger, 1976). Chronologically speaking, it appears that MXII was built slightly before MVI (Favre and Mottet, 2011). Both underwent the same “monument history”: they were used by the Final Neolithic populations, and then the Bell Beaker population emptied (partially or totally) the funeral chambers, placing the bones of their predecessors outside. They then deposited

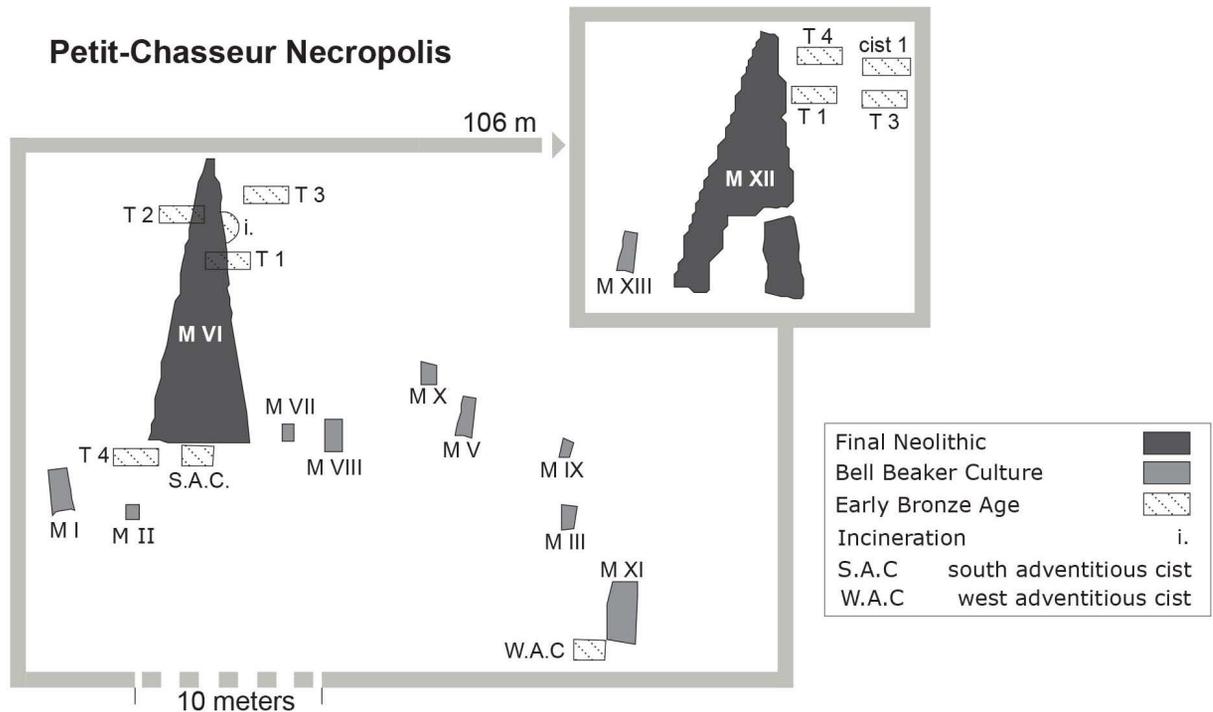


Figure 2: Plan of the Petit-Chasseur necropolis, with the various monuments represented. Note the triangle-based dolmens built by the Final Neolithic population, MVI and MXII. The monuments are color-coded according to construction attribution, not final use. Plan inspired by Corboud and Curdy, (2009, p.20) in Abegg (2019, p. 103).

some of their own dead inside the funeral chambers. Additionally, the Bell Beaker population dismantled some of the rock slabs making up the dolmens and re-used them elsewhere (Favre and Mottet, 2011).

The Bell Beaker population then sought to implement their own graves at the site. Again, within this construction phase, two ensembles are discernible. First, monuments MIII, MV, MVI, MIX, MXIII, and MXI were built, followed by graves MI, MVII, MVIII, and MX (Bocksberger, 1978; Gallay and Chaix, 1984; Gallay, 1989; Favre and Mottet, 2011). They contrast in shape with the Final Neolithic triangular-based dolmens. Bell Beaker constructions are rectangular, sometimes with “antennas” made of rock slabs prolongating the edges of the funeral chamber (figure 3). It appears some of the engraved stelae found nearby were re-used in order to build some of these graves, an act that is not without significance considering the symbolic value attributed to these stelae (Brunetti, 2017).

The taphonomic events taking place after the deceased were deposited in these tombs, both man-made (disturbance of Final Neolithic tombs by Bell Beaker populations) and natural (terrain movements, erosions, water passage) mean the bones exhibit various levels of alteration. Altogether, the history of the use of the various tombs at the site as well as their excavation means the individualisation of skeletons, distinct from one another, is currently impossible. As such, the tombs

of Petit-Chasseur constitute commingled material, which greatly influences the methodology used to study the remains. Moreover, the history of re-use of Final Neolithic dolmens by the Bell Beaker population raises the question of continuity or rupture between the two populations, and therefore of any potential similarities and differences between the two.

iii. Previous anthropological research

Research usually builds upon previous results, and this is no exception. Several studies have investigated specific aspects of the Petit-Chasseur populations. This includes anthropological analysis of specific monuments (Claivaz-Carruzzo, 1975; Kramar, 1975) and of their internal organisation (Mariéthoz, 1996), as well as demographic research (Eades, 1996). The topic of continuity or rupture between Final Neolithic populations and Bell Beaker culture has been looked at by mobilising various European populations including those of Petit-Chasseur (Desideri and Eades, 2002), using non-metric dental traits and isotopes. More recently, some of the Petit-Chasseur craniums yielded ancient DNA which was used to investigate the same issues (Olalde *et al.*, 2018). Our research, however, is the first to have a look at all the available bones of the Final Neolithic and Bell Beaker period at the site and to record all pathological lesions in order to reconstruct the health profile of these populations.

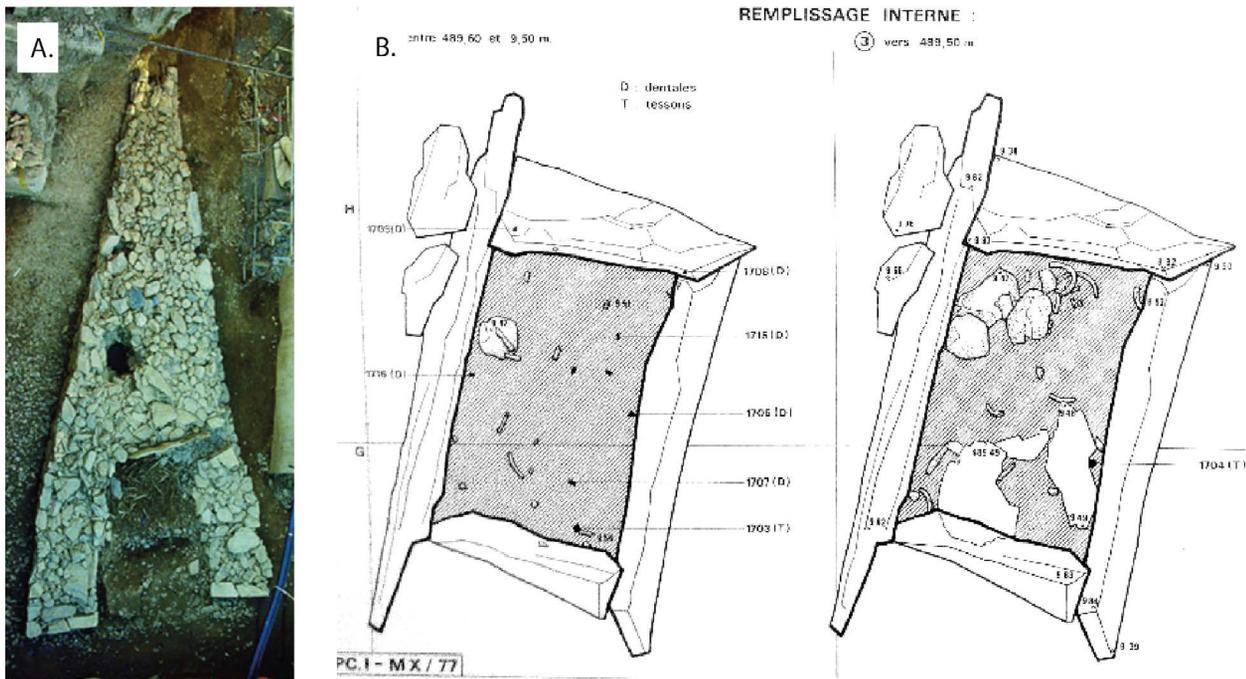


Figure 3: Examples of the Final Neolithic and Bell Beaker megalithic architecture at Petit-Chasseur. A: MXII during excavation (adapted from Favre and Mottet (2011)). Note the triangular shape of the dolmen, with the funeral chamber located at the widest part of the base. B: M X, plan of the monument (adapted from Gallay, 1989). It is constituted of four rock slabs, with a fifth covering the tombs. Its construction is attributed to the Bell Beaker period, with further disturbance during the Early Bronze Age.

III. Materials and Methods

i. Materials

All bones belonging to the Final Neolithic and Bell Beaker populations of the site of Petit-Chasseur were included and individually observed macroscopically for this research.

ii. Methods

The methods used to study the bones of the Final Neolithic and Bell Beaker populations of Petit-Chasseur are part of a methodology established by the author for her PhD (Abegg, 2019; Abegg *et al.*, 2021).

Since the bones of Petit Chasseur are commingled, they must be considered as an ossuary deposit, meaning the unit of reference of the study is the bone rather than the individual. Each bone was individually registered into an Access Database designed for this purpose.

First the bone was identified, lateralised if applicable, and its state of preservation evaluated in terms of state of fragmentation (1. Less than 50% of bone present; 2. 50 to 95% of bone present; 3. 95 to 100% of bone present) and in terms of taphonomic alterations on the bone surface (according to criteria adapted from Brickley and McKinley (2004)). This means that the state the bones are in can be evaluated and

helps explain why some pathologies might not be systematically observable. It also allowed us to estimate which parts of the skeleton, if any, were preferentially preserved within the archaeological record. To achieve this last step, the minimum number of elements and survival ratios of various skeletal elements (Binford, 2012) were used. Specifically, the minimum number of individuals (MNI) was established based on the number of craniums (most represented element). The number of each skeletal element present in each assemblage was then divided by the expected number of elements in an individual. This number was then further divided by the corresponding MNI, giving us a survival ratio for each skeletal element. The closer this survival ratio is to 1, the better preserved the element (Abegg *et al.*, 2021).

Secondly, each and every bone was evaluated for the presence of nine types of lesions: cribra orbitalia, porotic hyperostosis, posterior sacral dehiscence (or *spina bifida*), degenerative joint disease, vertebral joint disease, Schmorl's nodes, periosteal reaction, osteomyelitis, and trauma. Of course, not all of these lesions are applicable to all bones (cribra orbitalia and porotic hyperostosis are found on craniums, vertebral joint disease and Schmorl's nodes on vertebrae, etc.). This is why the pathologies were first graded in terms of scales of severity (see Abegg, 2019 for details) and then recorded as unapplicable (the bone under observation is not pertinent to this kind of lesion), not observable (the part(s) of the bone where the lesion might be observed

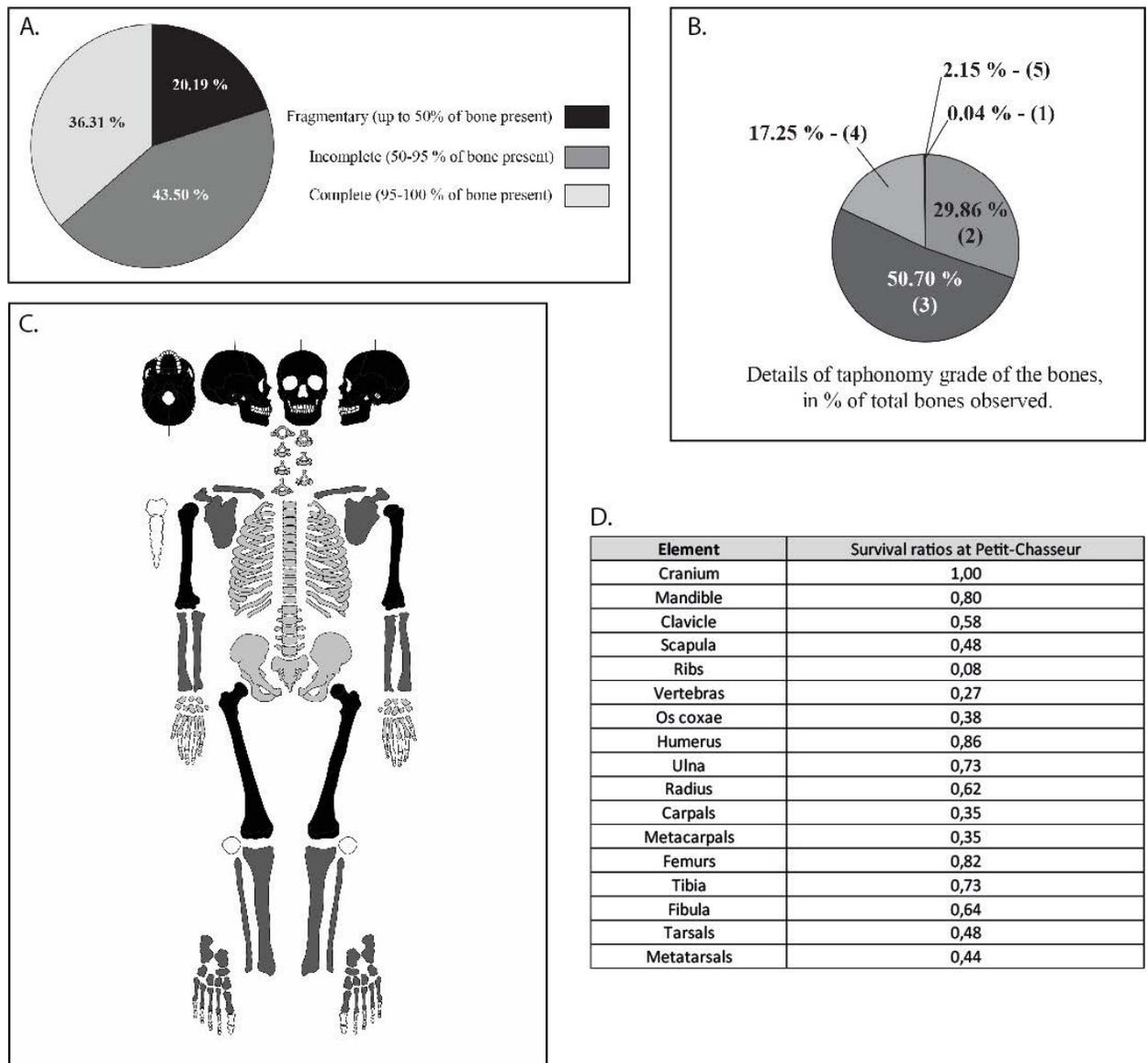


Figure 4: Taphonomic analysis of the bones of Petit-Chasseur. A: breakdown of the level of preservation of the bones. B: grading of the various levels of taphonomic alterations exhibited by the bones. C: schematic representation of the various survival ratios of the skeletal elements, with D: associated raw data. Black = well represented, 0.80 - 1.00 survival ratio; dark grey = average representation, 0.40-0.80 survival ratio; light grey = poor representation: 0.00-0.40 survival ratio. Bones in white were not accounted for in this analysis.

is absent or in such a taphonomic state that it is not visible), present, and absent. Through this evaluation, we establish both simple present/absent frequencies that can be mobilised for statistics, as well as having the option to dig deeper into the severity of some lesions by investigating the severity of their presence among a population.

Finally, the database held space for *ad hoc* recording of any lesion encountered that did not fit into the above-mentioned ones. This way, the unexpected could be recorded, and taken into account when discussing the subtleties of the state of health of these commingled individuals.

The results of this methodology are presented below. Frequency tables summarising the presence and absence of each of the nine systematically observed lesions are provided for both the Final Neolithic and the Bell Beaker populations of Petit-Chasseur. All statistical tests were undertaken using Stata (*Stata Statistical Software*, 2017), with the level of significance placed at 95%.

IV. Results

i. Preservation and taphonomy

The results of the taphonomic analysis of the bones of Petit-Chasseur are presented in figure 4. Of

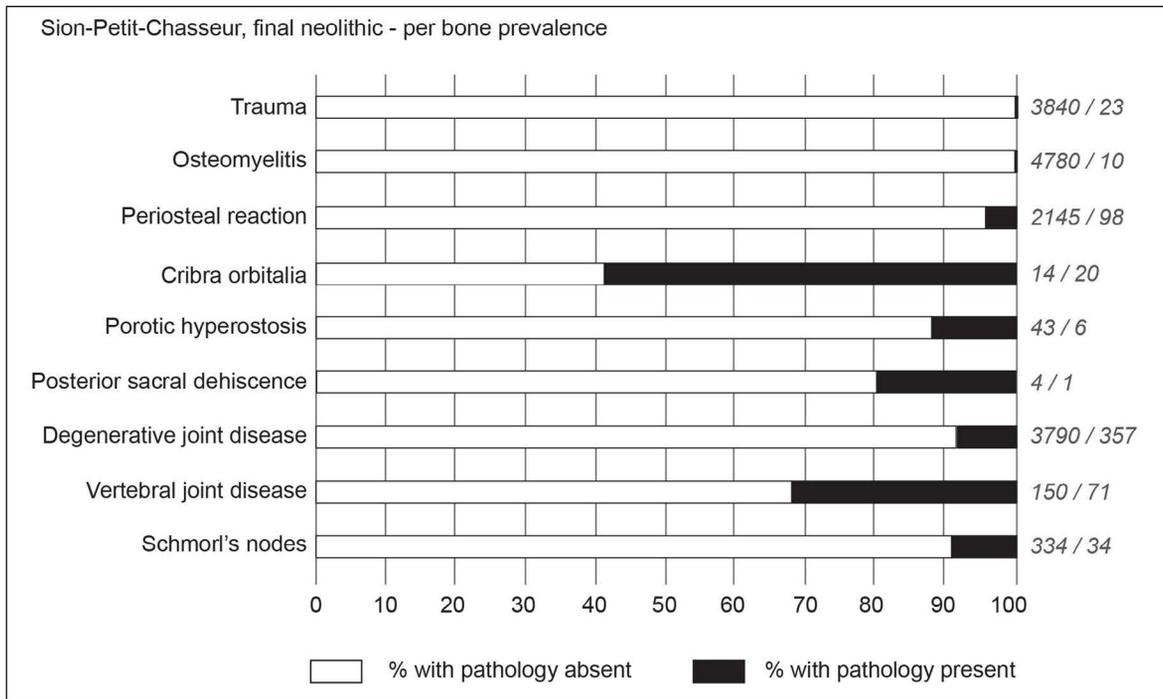


Figure 5: Pathological profile for the Final Neolithic population of Petit-Chasseur. The schematic representation is given as white = % with pathology absent, and black = % with pathology present. The numbers at the end of each row correspond to the raw data for each lesion type, first the number of bones without the lesion present, and then the number of bones with the lesion. From Abegg (2019, p. 237).

particular interest here is the relatively high number of fragmentary bones (20.19%) coupled to the state of alteration of the exterior surface of the bone, with 70.1% graded as a stage 3 (“most of bone surface affected by some degree of erosion, general morphology maintained but parts of surface masked by erosive action” (Brickley and McKinley, 2004)) or a stage 4 (“all of bone surface affected by erosive action, general profile maintained and depth of modification not uniform across whole surface (Brickley and McKinley, 2004)).

These results prompted an investigation into the rate of preservation of various skeletal elements, which can also be found in figure 4. This step was deemed necessary since a bias could arise from some of the systematically observed pathologies being graded only on poorly preserved skeletal elements. It appears craniums, mandibles, humerus, and femurs are well represented (0.80 – 1.0 survival ratio); clavicles, scapulas, ulnas, radius, tibias, fibulas, tarsals, and metatarsals are average in representation (0.40 to 0.80 survival ratio); ribs, vertebrae, coxals, carpals, and metacarpals, however, fare poorly (poorly = up to 0.40 survival ratio). Whilst the under-representation of small, highly fragmented bones such as ribs (poorest survival ratio at 0.08) and vertebrae (0.27) is expected in a commingled sample with re-opening and re-arrangements of the content of the tombs, the poor survival of coxals (0.38), which are heftier, is curious.

Altogether, the taphonomic and preservation state observed at Petit-Chasseur is one that is expected of commingled tombs that have undergone a number of processes during their use (re-openings, re-arrangements, emptying, re-fills) and afterwards (filling by soil, waterlogging, erosion).

ii. The Final Neolithic population of Sion Petit-Chasseur

The MNI for the Final Neolithic period of Petit-Chasseur is 107, based on craniums. Unfortunately, due to the state of preservation presented by the remains, only a few could be given any biological identification. At the most, we can state that 13 are adults (20+ years old), one is a teenager (10 to 19 years old) and 13 are children (2-9 years old). Infants (0-1 year old) are absent.

Figure 5 provides the pathological profile for this Final Neolithic population (graphical representation and raw data). The graph is constructed according to the number of bones observable for each pathology, with raw data given at the end of each line. Traumas, for example, were absent from 3840 observable bones, and present in 23 observable ones, for a total of 3863 bones observable for this specific pathology.

Rates of cribra orbitalia are high (58.82% present), whilst rates of traumas (0.60%) and osteomyelitis (0.21%) are low. Vertebrae showed a fair amount of vertebral joint

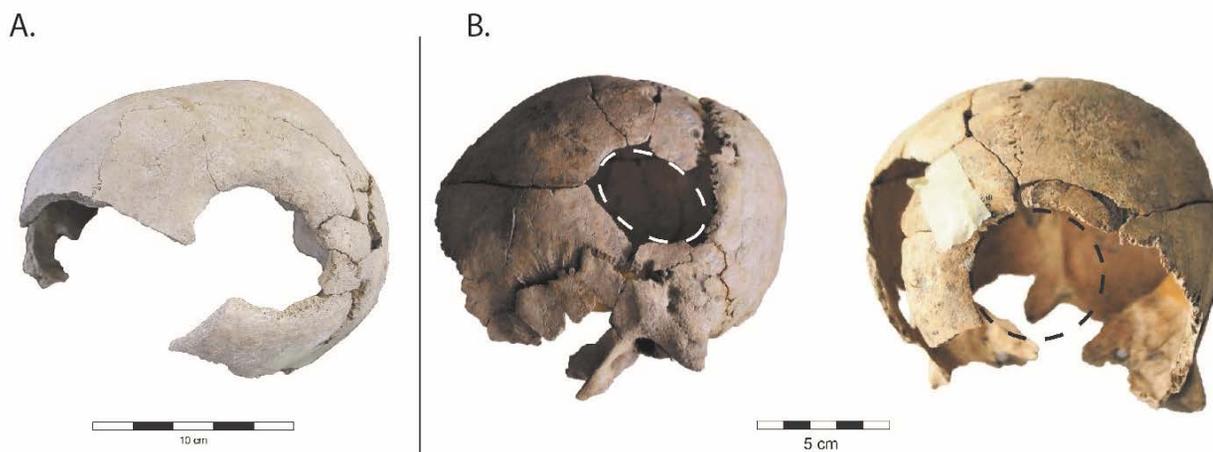


Figure 6: Trepanations in the Final Neolithic populations of Petit-Chasseur. A: individual with a single, apparently healed, trepanation on the left parietal. B: individual presenting two trepanations, one healed and one with healing status uncertain. Adapted from Abegg (2019).

disease (32.13%), which is interesting considering this often goes hand in hand with degenerative joint disease (wear of articulations other than vertebrae) which appears much lower here (less than 10% of bones affected).

In addition to the systematically observed types of lesions, a few individuals from this Final Neolithic population presented interesting pathologies. One adult individual, which is represented only by a skull, presents a case of congenital torticollis, appearing as a slight asymmetry of the parietal and temporal bones, which are skewed laterally. This would have caused the head of this individual to be permanently inclined to the left, as well as potentially cause neck pain and muscle tension, but is otherwise a non-threatening condition (Hollier *et al.*, 2000).

Two individuals presented trepanations (figure 6), which are holes in the calvarium intentionally created to remove an oblong or circle-shaped bone fragment (Aufderheide and Rodríguez-Martín, 2011). The first individual presents a single trepanation on the left parietal, which appears healed. The second individual underwent two procedures. The first, on his/her left parietal, appears healed, whilst for the second, located at the junction of frontal and parietals, the healing status of the lesion is undetermined due to part of the edges missing for observation.

iii. The Bell Beaker population of Sion Petit-Chasseur

The MNI for the Bell Beaker population of Petit-Chasseur, when considering the most represented element (the craniums) would be 14. This, however, appears extremely small when considering all the monuments used and built by this population.

Practically, many more individuals were buried at this necropolis, but poor taphonomic preservation in this particular chronological subset could have played a role here. There are at least two infants, one child, three teenagers, and four adults within this sample. It is interesting that despite the small MNI, infants are represented within this corpus when they are absent from the larger Final Neolithic one.

The pathological profile of the Bell Beaker population is presented in figure 7. Although it may be due to the fewer bones available absolutely, proportionately it appears that the Bell Beaker population exhibits less bone lesions, with no trauma, osteomyelitis, or posterior sacral dehiscence observed. Rates of cribra orbitalia are, however, high, at over 50%. Rates of vertebral joint disease and Schmorl's nodes are consistent with one another, and higher than the rate of degenerative joint disease (respectively 18.18%, 23.38%, and 9.57%).

The Bell Beaker population also presented one interesting case of pathological lesions that did not belong to the systematically observed ones. A child's cranium (2 to 4 years old at death) exhibits lesions on the endocranial surface, namely *serpens endocrania symmetrica*, as well a circular lesion comparable to a bone abscess (figure 8). These types of lesions have several differential diagnoses, including metabolic diseases, traumas, or infectious diseases (Hershkovitz *et al.*, 2002; Lewis, 2004; Sun *et al.*, 2019). Considering other pathological findings made in the Middle Neolithic corpus of the same area, as well as the lack of evidence towards a metabolic or traumatic cause, in this corpus these kind of lesions are likely attributable to the presence of infectious diseases, such as tuberculosis, within the population (Abegg *et al.*, 2020).

Sion-Petit-Chasseur, Bell Beaker period - per bone prevalence

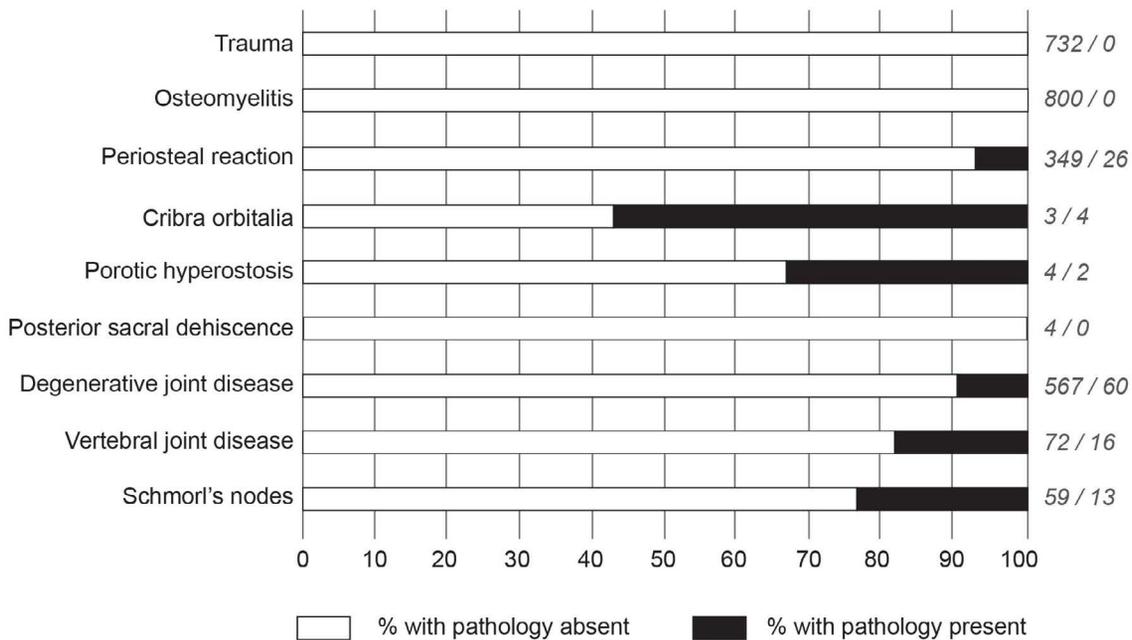


Figure 7: Pathological profile for the Bell Beaker population of Petit-Chasseur. The schematic representation is given as white = % with pathology absent, and black = % with pathology present. The numbers at the end of each row correspond to the raw data for each lesion type, first the number of bones without the lesion present, and then the number of bones with the lesion. From Abegg (2019, p. 238).

iv. Final Neolithic and Bell Beakers: similar but different?

In order to test the differences in the frequency of the types of lesions observed in both populations present at Petit-Chasseur, a statistical analysis was attempted. Specifically, the bones most affected by each lesion type were selected from the entire study population (with other sites from the Middle Neolithic of the region included). The frequency with which the lesion appeared on this specific bone across the corpuses was compared using ANOVA tests.

The results of this analysis are to be taken as indications and are subject to many limitations that must be openly stated. First, in the general study (Abegg, 2019), the Middle Neolithic corpus is far better preserved and more numerous than the Final Neolithic and Bell Beaker ones, which are only represented by Petit-Chasseur. Second, the ANOVAs only compared the prevalence for the most affected bones for each lesion type. Whilst this is not a problem in the case of cribra orbitalia, porotic hyperostosis, posterior sacral dehiscence, or vertebral joint disease, which are observed on specific bones, it could bias the analysis for other pathologies that are observed on several or all bones of the skeleton.

Keeping these potential pitfalls in mind, the ANOVA did yield several significant results. Vertebral joint disease significantly decreased between the Final Neolithic and

Bell Beaker period, from 34.83% to 14.29%. Schmorl's nodes, however, increased from 10.06% to 24.66%. Periosteal reaction, which was judged based on their presence on femurs, significantly increased from 24.11% in the Final Neolithic population to 62.5% in the Bell Beaker period.

V. Discussion and conclusions

To discuss the results of this research, we must first remember the archaeological theoretical framework within which it was undertaken. The transition from the Final Neolithic to the Bell Beaker period, especially in Switzerland, represents an age of transformations, from the final phases of the Neolithic to the appearance of metals (copper, followed by bronze) in the archaeological record. The Bell Beaker phenomenon is also particularly enticing due to its reach; here, for the first time, we have an association of artefacts that can be found across Europe and North Africa (Besse and Strahm, 2001). Researchers wonder if the adoption of the Bell Beaker culture was due to population movement, and to a rupture with previous populations, or if it was adopted as part of a continuous evolution by the local Neolithic substrates, who adopted major aspects of it while retaining pieces of their own cultures (Gallay, 2001; Salanova, 2001; Price *et al.*, 2004; Besse, 2014).

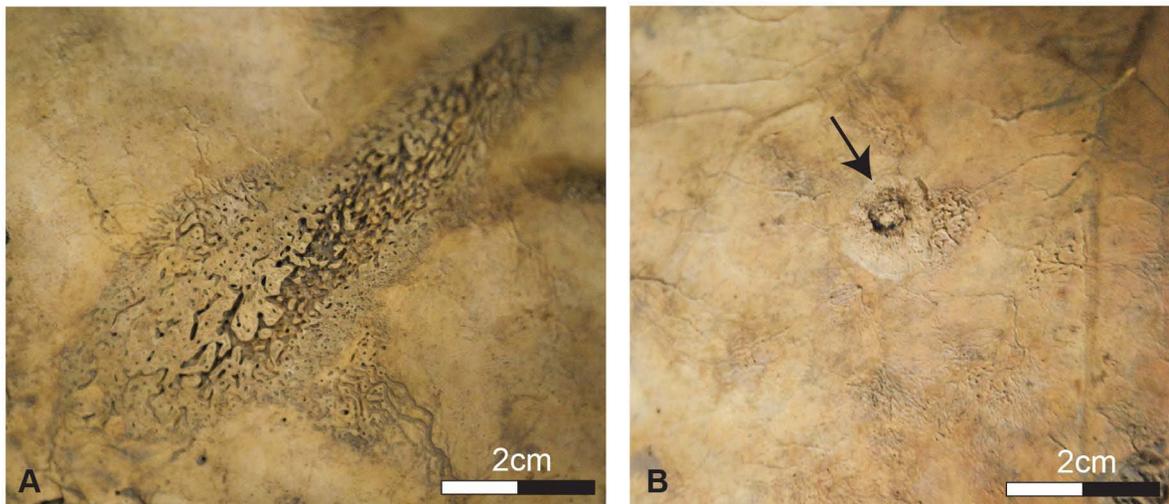


Figure 8: Endocranial lesions in a child from Petit-Chasseur, Bell Beaker population. A: serpens endocrania symmetrica. B: abscess, with adjacent serpens endocrania symmetrica. From Abegg (2019, p. 242).

In Switzerland, the Final Neolithic and Bell Beaker periods are marked by a strong megalithic culture, with funerary monuments, raised stones, and stelae all figuring in the archaeological record. Although some identify the Chamblandes cist tombs phenomenon of the Middle Neolithic as an early manifestation of megalithism (Moinat and Gallay, 1998), it is with the last phases of the Neolithic that the phenomenon truly reaches its full amplitude. This itself raises another question, that of the purpose of building such monuments, and who was represented or placed within or on them. Neolithic studies tend to agree that sedentarism, domestication, and the new notion of “territory” allowed for resource control and specialisation in tasks, which are prime conditions for the development of stratified societies, with distinct roles attributed or taken by individuals/kinship lineages (Scarre, 2005; Zammit, 2005; Renfrew and Bahn, 2008; Bentley, 2013; Bowles and Choi, 2019). This in turn could have led to some individuals acquiring particular status, having their representations on megalithic monuments such as stelae (Brunetti, 2017), and to them and their kin being buried in megalithic chambers to the exclusion of other lineages (Cassidy *et al.*, 2020). What made these individuals/kinship lineages so important, however, remains supposition. Some clues might be found in the few still-living megalithic building communities, in which the ability to summon others to build such monuments and to provide for others while they are being built is, in itself, a sign of the wealth and power of the individuals and their families commandeering them to be built (Steimer-Herbet and Besse, 2016; Steimer-Herbet, 2018).

Studying the bones of the Final Neolithic and Bell Beaker populations of any given region, therefore,

we look for who these individuals were. In the case of megalithic communities like that of Petit-Chasseur, we know the numbers buried at the site are too low to represent the entire population. We therefore suppose that a selection was made in who was buried there. As palaeopathologists, we wonder if any clue can be found in the patterns of lesions they might exhibit or in the demography of the buried people. Two factors hinder this endeavour: the commingled nature of the deposits, and the taphonomic processes that have damaged the bones over time. The latter, we can only quantify and keep in mind when discussing results, the former, we mitigated by adapting our research methodologies to start from the common denominator, the bone.

This research showed that the Final Neolithic and Bell Beaker populations buried at Petit-Chasseur present, on the whole, a pathological profile congruent with that of a primarily agricultural society. They suffered from vertebral joint disease, degenerative joint disease, and Schmorl’s nodes, all of which are consequences of the wear and tear inflicted on skeletons by age and physical activities (Rogers *et al.*, 1987; Waldron, 2008; Aufderheide and Rodríguez-Martín, 2011). Cribra orbitalia and porotic hyperostosis are also present. These are manifestations of metabolic problems, the aetiology of which is disputed as it has been attributed to many causes, from iron deficiencies to respiratory diseases (Wapler, Crubézy and Schultz, 2004; Brickley, 2018; Cole and Waldron, 2019; O’Donnell *et al.*, 2020). They are a staple of prehistoric populations and found worldwide, and their presence at Petit-Chasseur is unsurprising and comparable to that observed in the Middle Neolithic populations of the region (Abegg, 2019).

The few traumas at Petit-Chasseur are interesting. The Neolithic period is often described as marking the beginning of organised violence, and indeed evidence can be found in the archaeological record (Erdal and Erdal, 2012; Fibiger *et al.*, 2013; Meyer *et al.*, 2015, 2018). Here, however, traumas are few and far between, are healed or healing, and generally pertain to everyday life accidents: broken fingers or toes, Colle's fractures of the forearm, or ossified haematomas. Is it that these populations were particularly peaceful, or simply that the individuals that were buried in megaliths were not the ones conducting or subjected to violence? In the absence of skeletal remains from the rest of the population, this question remains unanswered for now.

The presence of *serpens endocrania symmetrica* as well as an abscess in a child's cranium from the Bell Beaker population, as well as the high rate of periosteal reaction observed in that population, is questionable. *Serpens endocrania symmetrica* were observed in the Middle Neolithic population, as well as vertebral lesions attributable to infectious processes, cases of hypertrophic osteoarthropathy, and non-specific signs of inflammation (periosteal reaction on many bones) (Abegg *et al.*, 2020). Altogether, these hint at the endemic presence of infectious diseases, possibly tuberculosis, within these Neolithic populations. In the future, pathogen DNA studies could be beneficial to understand if it was indeed tuberculosis that affected these populations, and if yes, to what extent.

Finally, two cases of trepanations are present in the Final Neolithic population of Petit-Chasseur, whilst none was found in the Bell Beaker one. This could however be explained by the few individuals attributable to the Bell Beaker period. They have been observed in the Middle Neolithic populations of the region (Abegg, 2019). Trepanations are of interest to palaeopathologists, despite not being strictly pathological in nature, since they are an anthropic action inflicted on the bone. It is a practice found in many ancient societies, from South America to Oman to Russia (Littleton and Frifelt, 2006; Guinto and Guinto-Nishimura, 2014; Gresky *et al.*, 2016). The motivations behind the act, however, remain unclear. Proposed explanations include a ritual purpose, a rite of passage, treatment for cranial wounds, or perhaps treatment for mental illnesses (Arnott, Finger and Smith, 2002; Chauvet, Sainte-Rose and Boch, 2010; Beyneix, 2015; Faria, 2015; Moghaddam *et al.*, 2015; Kushner, Verano and Titelbaum, 2018). It seems if a rite of passage was the explanation, trepanations would be more widespread within a population. If it was a treatment for cranial wounds, then surely more would be associated with signs of cranial trauma – whilst this hypothesis is valid in more modern times, evidence in its favour appears tenuous in prehistoric populations. For the Final Neolithic populations of Petit-Chasseur, their significance remains an open discussion for now.

Contextualising palaeopathological research tends to be difficult, for reasons worth a digression to explain. Often authors do not use the same grading system when looking at similar lesions. In many cases, the taphonomic state of the remains is not quantified, or is resumed to an appreciation of how much of the skeleton is present. This is problematic considering that if all bones are present, but the periosteum is all but gone due to taphonomic processes, many lesions will not, by definition, be observable. There have been attempts at synthesising the health of populations following a given protocol but these are few and far between (Steckel *et al.*, 2002). There are however many palaeopathological studies from which parallels and comparisons can be drawn. Evidence of the presence of infectious diseases, and in particular tuberculosis, can be found throughout neolithic Europe (Hershkovitz *et al.*, 2008; Nicklisch *et al.*, 2012; Sparacello *et al.*, 2017). Trepanations are also found. Although many hypotheses have been proposed as to their etiology (linked to trauma, ritual, rite-of-passage...), none are completely satisfactory (Weber and Wahl, 2006). Other lesions, such as cribra orbitalia, porotic hyperostosis, or periosteal reaction are often mentioned in neolithic palaeopathological studies, but their grading system differs so much it is difficult to synthesise what their presence truly means, save for the fact that it was likely part and parcel of neolithic life, considering how common it seems to have been.

To conclude, this palaeopathological analysis of the human skeletal remains of the Final Neolithic and Bell Beaker period of Petit-Chasseur allowed us to establish that in terms of their health, these two populations do not differ much. The same kind of lesions, in comparable frequencies, are observed, all pointing to a health profile comparable to one another and to the previous Middle Neolithic populations of the region. The presence of particular afflictions within these populations raise questions that can only be answered by aDNA analysis: what types of pathogens were present, and what are the kinship links (if any) of the individuals buried in these megalithic chambers? What (if anything) distinguished the trepanned individuals from others?

Finally, a concluding note must be made on the methodology employed in this analysis. By starting from the common denominator (the individual bone), it allowed for the quantification of the taphonomic state of the remains and to establish the differential preservation of skeletal elements. By quantifying the presence of certain lesions on each and every bone, commingled remains can be analysed and compared and contrasted to other commingled assemblages or to individualised remains (Abegg *et al.*, 2021). The presence of other lesions/pathologies are accounted for in the database, and registered on an *ad hoc* basis, allowing for the unexpected to be taken into account in the final analysis. The entire methodology is

non-destructive. Such studies are fundamental in bioanthropological research, since they are a first step in establishing patterns and recognising where further, often destructive analyses such as isotopic studies and DNA sampling, can be used to produce the best results. This in turn maximises the chances of successful and meaningful results in those and minimises risks and costs. In the case of Petit-Chasseur, it is our hope that in the future this research can be used as a springboard to further investigations into its populations to answer some of the questions raised above.

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Examining the Role of Bell Beaker Archery through Techno-Functional and Osteological Analyses: Reinvestigating the Hoštice-I Cemetery (Czech Republic)

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Abstract: This paper combines lithic and osteological research in order to reexamine the Hoštice-I cemetery with respect to archery. These studies focus on questions concerning the role of Bell Beaker archers and the presence of habitual and functional archery practice. Specifically, a techno-functional analysis of lithic artefacts examines the ways of production and the presence of use-wear on archery-related items, namely bracers and arrowheads, with the goal of assessing the involved know-how and the likelihood of these objects having been functional pieces of equipment. The osteological analyses further evaluate previously established determinations of possible specialised archer occupations with regard to the specific context of the Hoštice-I cemetery. The findings of these independent research projects support hypotheses linking Bell Beaker archery to a more social ideology rather than to a functional practice. The combination of these studies allows for the contextualisation of the Hoštice-I cemetery within the broader context of the Bell Beaker Culture's Eastern Complex.

Keywords: Bell Beaker archery, Hoštice-I cemetery, Czech Republic, osteology, lithics

1. Introduction

A unique material culture, geographic range, migration, and funerary practices have long characterised the Bell Beaker Culture of the third millennium BC in Europe and North Africa (Besse, 2015, 2014; Kristiansen *et al.*, 2017; Kruřová, 2003; Olalde *et al.*, 2018; Piguet and Besse, 2009). During this time, stone bracers emerge in the archaeological record and an 'archer's package' appears in select burials of the Eastern Complex (Dvořák, 1993). The complexity of the Bell Beaker Culture means that exceptional sites with an abundance of material are especially valuable for identifying trends within a given society. Indeed, the study of large cemeteries, such as Hoštice-I, provides researchers the opportunity to study several objects and individuals sharing a context in time, space, and culture. This current study combines lithic and osteological analyses of the Bell Beaker Hoštice-I cemetery in order to assess the question of specialised archery as well as to contextualise the site within the broader Bell Beaker Culture. Specifically, this research aims to apply techno-functional analyses of stone bracers and arrowheads as well as osteological analyses of occupation in order to address questions surrounding the role of Bell Beaker 'archer' burials.

2. The Hoštice-I cemetery and the archer's graves

The Institute of Archaeological Rescue Research in Brno excavated the Bell Beaker cemetery of Hoštice-I (Hoštice-Heroltice, Vyškov, Moravia, Czech Republic) in 2002-2003, which researchers have extensively examined providing a solid basis for study (Figure 1a) (Drozdová *et al.*, 2011; Matějčková and Dvorak, 2012).

Excavations uncovered a 1 ha area with 157 graves, 141 of which contained the skeletal remains of 143 individuals. The smaller sizes of many of the remaining 16 graves indicate that they might have contained children. The individual burial orientations (males with their heads to the north and females to the south) as well as sex and age distributions are consistent with the broader Bell Beaker trends (Figure 1b) (Drozdová *et al.*, 2011). Grave goods, including regional decorated Bell Beakers, place the cemetery within the stage 2 of the Central European Bell Beaker chronology, and radiocarbon dating classified a time frame between 2470 and 2130 cal BC (Heyd, 2001; Matějčková and Dvorak, 2012). Indeed, several groupings and grave orientations suggest a use over several generations as well as specific social or familial relationships.

Within the cemetery, 17 'suspected archer's' graves yielded arrowheads, bracers, or bow-shaped pendants (10.2%), some of which were also associated with daggers or arrow shaft smoothers (Figure 2). The suspected archer's grave distribution is uniform (one to four in each group) and their pit dimensions are equivalent to others (Figure 1d). Suspected archer's graves belong mostly to adult males (35% of males in the cemetery), indicating a clear age and sex differentiation in the deposition of archery-related items (Figure 1b-c). However, there are a few exceptions for arrowheads and bracers, with a younger male (15-20 years) and a likely adult woman each having one arrowhead. These observations are consistent with age and gender differentiation in Bell Beaker funerary practices (Turek, 2011).

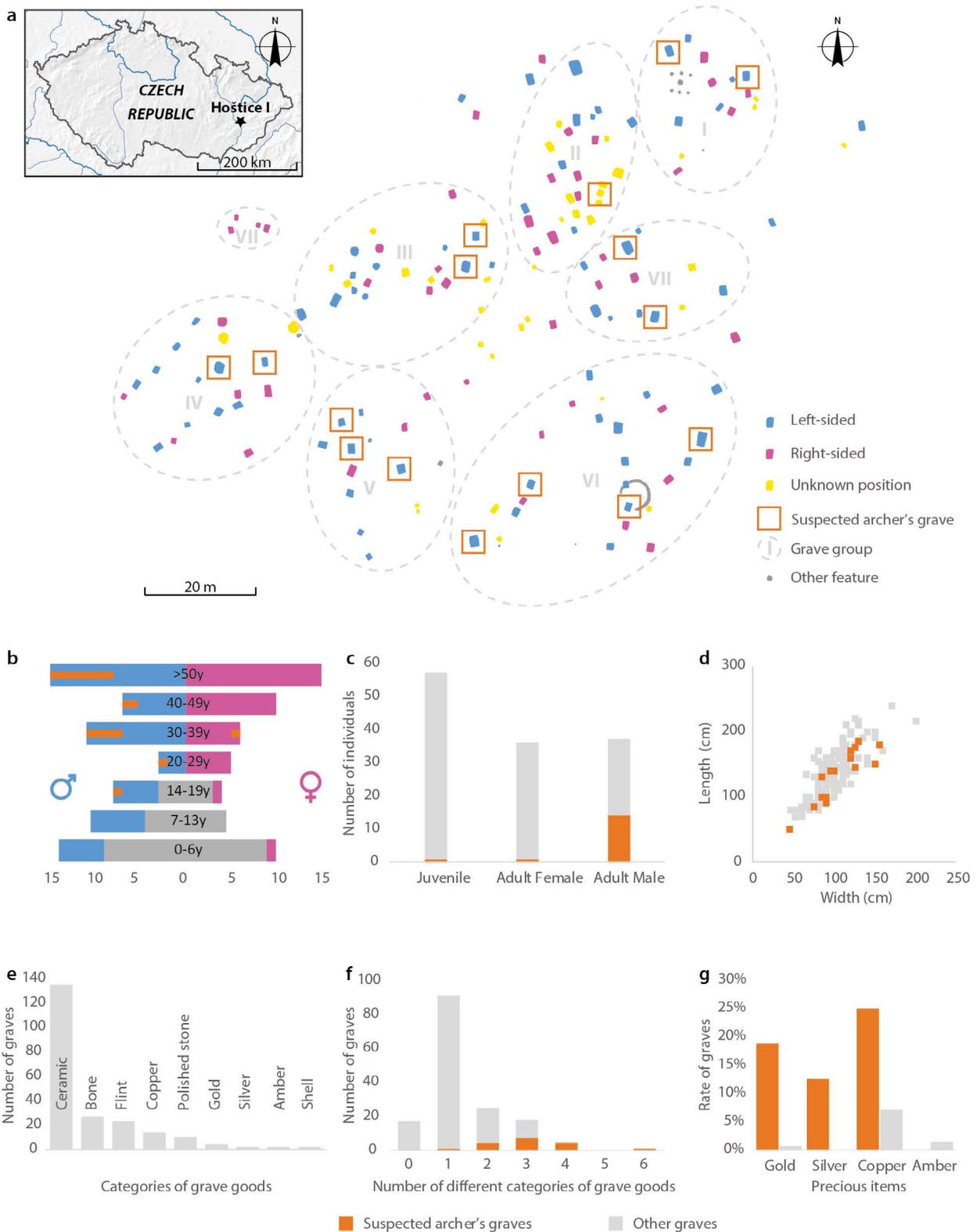


Figure 1: The suspected archer's graves within the Hoštice-I cemetery. a. Location and cemetery plan; b. Age-at-death pyramid; c. General age and sex classes; d. Grave dimensions; e. Distribution in graves of the different categories of grave goods according to raw material; f. Number of different categories of grave goods per grave; g. Rate of graves with precious items. Plan and data according to Matějčková and Dvořák, 2012.

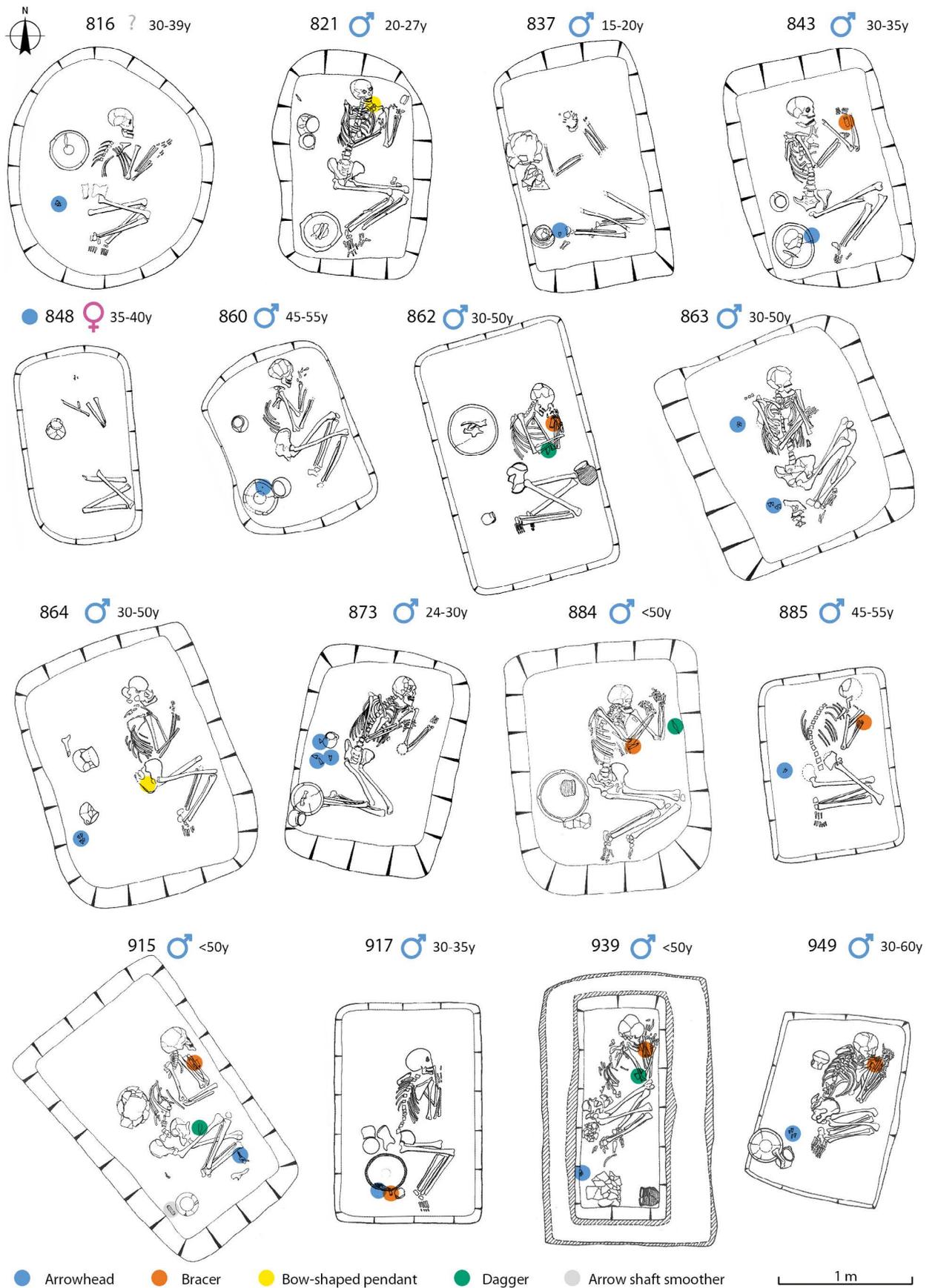


Figure 2: Grave plans of the suspected archers; grave 911 without a skeleton has been omitted. According to Matějčková and Dvořák, 2012.

Looking at grave wealth reveals a more contrasted pattern. One definition of wealth examines the number of different artefact categories according to raw materials (Manolakakis, 2005). This avoids analyzing the overall quantity of items, which can be biased when considering composite objects, such as a group of arrowheads or beaded necklaces (Figure 1e). At Hoštice-I, graves mainly yield zero to four different categories of object usually comprising one or several pots (bell beaker or common ware) along with less frequent items such as bone, flint, or copper artefacts (Figure 1f). Suspected archer's graves are among the wealthier burials with one to six different artefact categories. More particularly, they contained most of the precious items made of gold, silver, or copper (Figure 1g).

3. Lithic Analyses

The biographies of Bell Beaker arrowheads and bracers have been tracked from the raw materials to the final deposition in order to assess the role they played in structuring the lives of their makers and users (van Gijn, 2010). The following section will synthesise results of previous studies and personal observations from a larger study of Czech material, of which additional details and methodological approaches appear in other publications (Nicolas, 2020a, 2020b, 2017).

3.1. Arrowheads

At Hoštice-I, 13 graves yielded a total of 32 arrowheads (Figures 2 and 3). Within these graves, the arrowheads are generally found bundled and facing the same direction, suggesting that they were kept in quivers either fastened at the shoulders (graves 816, 863, 885, 949) or placed next to the body (graves 864, 939), while others seem to have been deposited with funerary pots (Figure 2, graves 843, 860, 917) (Matějčíková and Dvorak, 2012).

Except for one straight-based arrowhead, all others are hollow-based with pointed, rounded, or, more frequently, squared barbs that probably result from an acculturation between Corded Ware hafting traditions (hollow base) and the Western Bell Beaker models (squared barbs) (Nicolas, 2020b). As elsewhere in Europe, their sizes are not standardised and vary by a factor of two: 19.3–38.9 mm long, 13.6–22.6 mm wide, and 3–6.5 mm thick.

For the supply of raw materials, a regional procurement (60–70 km) prevails with the use of either Krumlovský les chert (varieties I & II; n=10) or Scandinavian silicite from glacial sediments (n=8). However the main flint source (n=12) is extra-regional (220 km) with the use of Cracow-Częstochowa Jurassic flint (Little Poland). In comparison to other lithic industries at the site,

this fine-grained flint, in particular its brown, pure, and translucide variety A, was particularly desirable for producing arrowheads (Přichystal and Všianský, 2012). This attests to an investment in the acquisition of distant raw materials and highlights connections with Bell Beaker communities settled in Little Poland (Budziszewski and Włodarczak, 2010).

The arrowheads do not show a specific *chaîne opératoire* in the production of blanks. They correspond to full *débitage* flakes, with one case of a Kombewa flake (with two bulbar faces; Figure 3, grave 917a), that are used in various axes, probably depending on desired volumes (Nicolas, 2017). Shaping is made by a short to covering and usually invasive retouch. Finishing is generally sketchy, consisting of some micro-retouch (<2 mm) regularizing the edges, with the exception of one arrowhead with serrated edges (Figure 3, grave 816a). Such arrowheads do not require a high level of technical expertise even though they appear to have been worked significantly better than the rest of the lithic industries. Together with the low shape standardisation, this argues for a low-scale production that could have been widely mastered by the Bell Beaker societies (Nicolas, 2020b, 2017).

The function of Bell Beaker arrowheads as projectiles is well attested and was previously investigated by Sosna (2012). He observed that 19% of arrowheads bear diagnostic traces of impact; using both low and high magnification, he identified two step-terminating bending fractures, one lateral fracture, and three microscopic linear impact traces (MLIT). This current study's results show slight variations as it used a more up-to-date experimental framework (Chesnaux, 2014; Coppe and Rots, 2017). A significant number of the tips (n=14) are damaged but only two are characteristic of an impact, while four have a limited extension (<2 mm) making a diagnostic impossible. Impact fractures here include one spin-off and one burination (Figure 4a-b), while non diagnostic impact-like breaks are represented by two step-, one feather-, and one complex-terminating bending fractures. In sum, two arrowheads (6.2%) show a macroscopic diagnostic impact, with three microscopic traces (MLIT) observed by Sosna (2012) (15.6% in total). The impact and impact-like fractures produced limited damage on the tips, while three arrowheads with larger non diagnostic breaks nonetheless appeared as grave deposits (Figure 3, no. 816a, 848, 915). The rate of macroscopically impacted arrowheads at Hoštice-I is similar to those observed elsewhere in Central Europe (4.8%) (Nicolas, 2020b). Further traces have been observed on a similar number of arrowheads (n=13). They bear blunting on their barbed edges that extend marginally on the removal ridges (Figures 3 and 4d-g). Observed under low-magnification (×20–35), blunting smoothes the edges and looks grained and bright when well-developed.

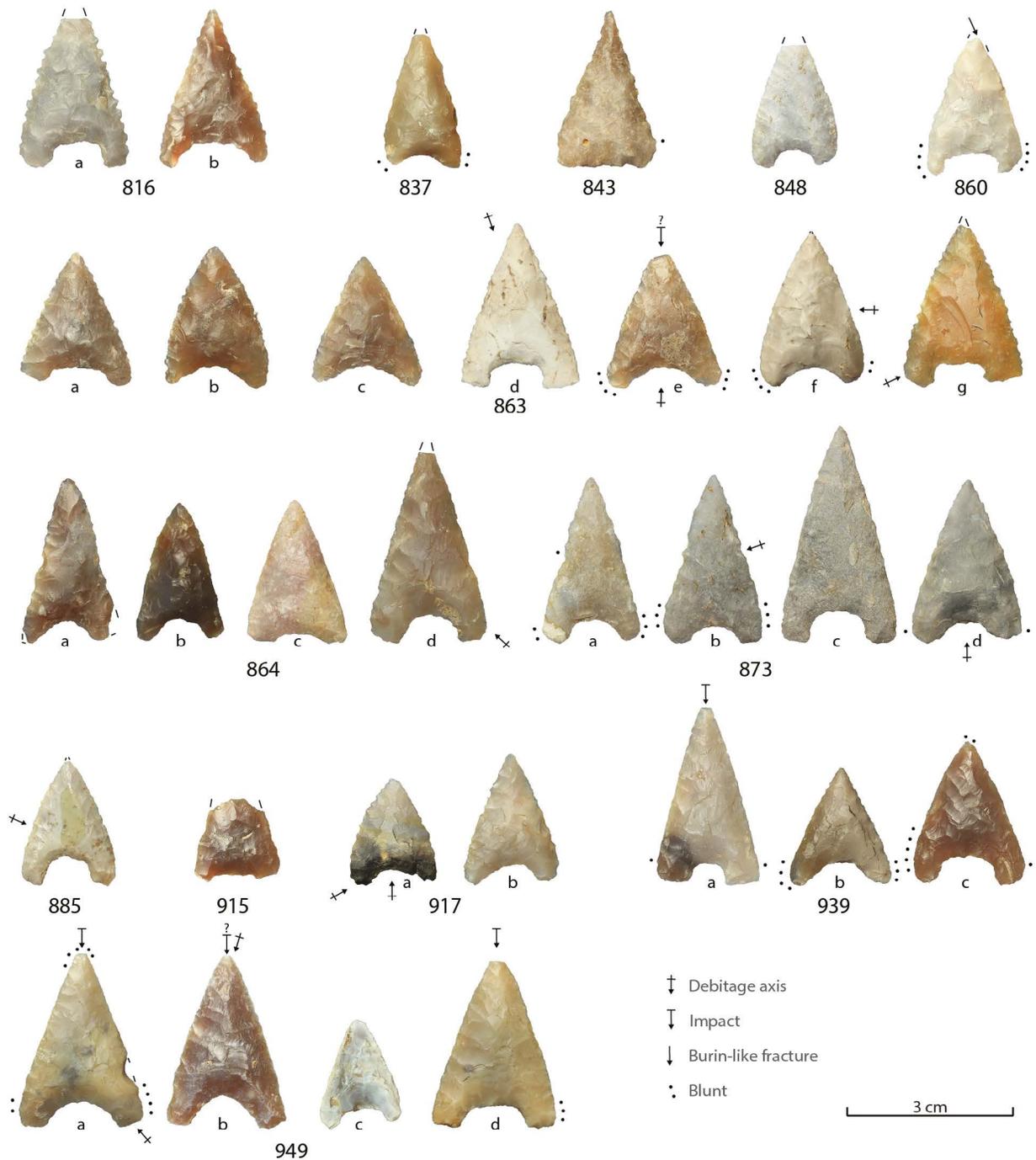


Figure 3: The arrowheads from Hoštice-I cemetery. Photographs C. Nicolas.

Similar blunting appears on two tips and, in one case, after a non-diagnostic impact-like break (Figure 4c). Investigations of Corded Ware and Czech Early Bronze Age arrowheads revealed similar patterns and, under high magnification, studies have identified this as being the result of friction against dry skin (Kaňáková *et al.*, 2020; Pyżewicz, 2017). Experimental studies also found similar use-wear produced by the movement of arrows in quivers while walking (60 h) or running (100 km) (Kaňáková, 2020; Wolski and Kalita, 2015).

Although Hoštice-I arrowheads - and more generally Bell Beaker arrowheads - do not reveal a high level of knowhow, there is a certain degree of investment in acquiring exotic and quality flint. Except for a few badly damaged examples, the arrowheads appear to be effective weapons, with some having been used as projectiles. The absence of barb blunting on a majority of them (19 out of 32) could suggest that quivers were maintained in a usable condition. However, the blunting (a difficult process to estimate) might also be

a clue for a more display-like function, as highlighted by some non-functional highly rounded-off examples found elsewhere in the Czech Republic (Nicolas, 2020b).

3.2. Bracers

Nine graves from Hoštice-I each yielded one stone bracer (Figures 2 and 5). Their placements in the burials include: close to the forearm (5 left, 1 right), next to the right elbow (1), deposited below a large bowl (1), and within an empty grave (1) (Figure 2). Precise placement assessments were possible for three bracers, each of which appeared on the outside of the forearm (Fokkens *et al.*, 2008) (graves 915, 939, 949).

Each bracer has a plano-convex to curved section with generally concave longitudinal edges. They are mainly four-holed while one has three small cup-marks as ornamentation (Figure 5, grave 862). They follow the Central European tradition of curved bracers, six belonging to Sangmeister's type B, while three correspond to types C, D, and G (Sangmeister, 1974). Beige-colored sedimentary stones were predominant, corresponding to various grained rocks ranging from claystone and marlstone to fine- or coarse-grained sandstone. One exception is a black fine-grained silty Culmian shale. The origin of these stones probably lies in the surrounding region (<12 km) (Přichystal and Všíanský, 2012). Taphonomic processes affected five of the bracers, which eroded the original surface and even altered the original shapes (Figure 5, graves 843, 917, 884, 862, 885).

Regarding manufacture, some oblique striations on the edges might suggest the sawing of a preform from a blank, such as small block or pebble. Abrasion techniques could then shape the rough-out, as shown by longitudinal abrasions on the inner face. A finer abrasion, generally longitudinal, would have allowed for the smoothing of the faces, especially on the exterior. The perforations are usually biconical, but in the case of the bracer from grave 915, they are drilled from the inner face, which causes chipping on the outer face. Bracers from graves 915 and 939 show one or two attempted perforations abandoned due to misalignment (Figures 4h and 5, graves 915, 939). Striations around the perforation are usually very regular and perfectly circular, suggesting the use of a bow drill.

The presence of abandoned holes and the deep striations on the outer face of the bracer from grave 939 suggest a quite basic know-how. Experiments reproducing the simplest, flat bracers suggest that fabrication times were only between two and four hours (van der Vaart, 2009). However, the curved pieces would still have required more time for hollowing out the inner side. Yet the point remains, and as with the arrowheads, that everyone would have been capable of producing

their own bracers. It is likely that the varying balance of shapes and the perforation symmetry reflect the different skill levels of each individual. For instance, the finely polished bracer from grave 915 adopts a complex trapezoidal form, a deep curved section, and a relative symmetry of perforations, which likely indicates a certain level of know-how.

The majority of Central European bracers are perfectly profiled to fit the forearm, especially the bracer from grave 915. Currently, a few experiments have demonstrated that well-dimensioned bracers perfectly fulfilled the function of archery protection (Muñoz Moro, 2017; van der Vaart, 2009). Additionally, experiments carried out by Muñoz Moro (2017) found that marks on bracers produced by archer activity appeared after about 20 minutes of use. These marks generally took the form of millimetric chips. However, this research has revealed no unambiguous and repeated chipping on the outer face of the bracers that might indicate a protective function. One could question the over-polished central part of the black bracer from grave 939, which might be due to rubbing by the bowstring but there is no associated chipping. Some bracers from Iberia also exhibit groups of short, parallel striations interpreted as use as a sharpener (Muñoz Moro, 2017); however, none of the Czech examples display indubitably such markings. Indeed, the surface of the same black bracer bears parallel longitudinal striations related to shaping abrasions as well as transverse or slightly oblique, shorter striations. Both seem to intersect, but they are over-polished in the central area. This association and the absence of differential distribution make it unlikely that sharpening could have produced the short transverse striations, which are more likely related to the shaping of the curved section of the bracer.

Several previous studies have revealed traces of use linked to the wearing of the bracers. These traces include wear along the edges and perforations (Nicolas, 2020a; van der Vaart, 2009; Woodward and Hunter, 2011) and are generally matte, limited to the edges of both faces. When well-developed, the traces can extend slightly onto the faces of the object and take on a shiny aspect (Figure 4h-k). Without long-term experimentation, it is difficult to determine the wear mechanisms as they could result from rubbing against various materials, such as threads, skin, or an organic cuff (e.g. leather).

There is considerable evidence indicating that bracers had a significant role as personal adornments, and they have very few unambiguous use-wear marks linked to a protective function (Fokkens *et al.*, 2008; van der Vaart, 2009; Woodward and Hunter, 2011). For instance, the bracer from grave 949 has three damaged and worn corners, including a broken hole, suggesting that stable attachments were no longer possible. Most depositional

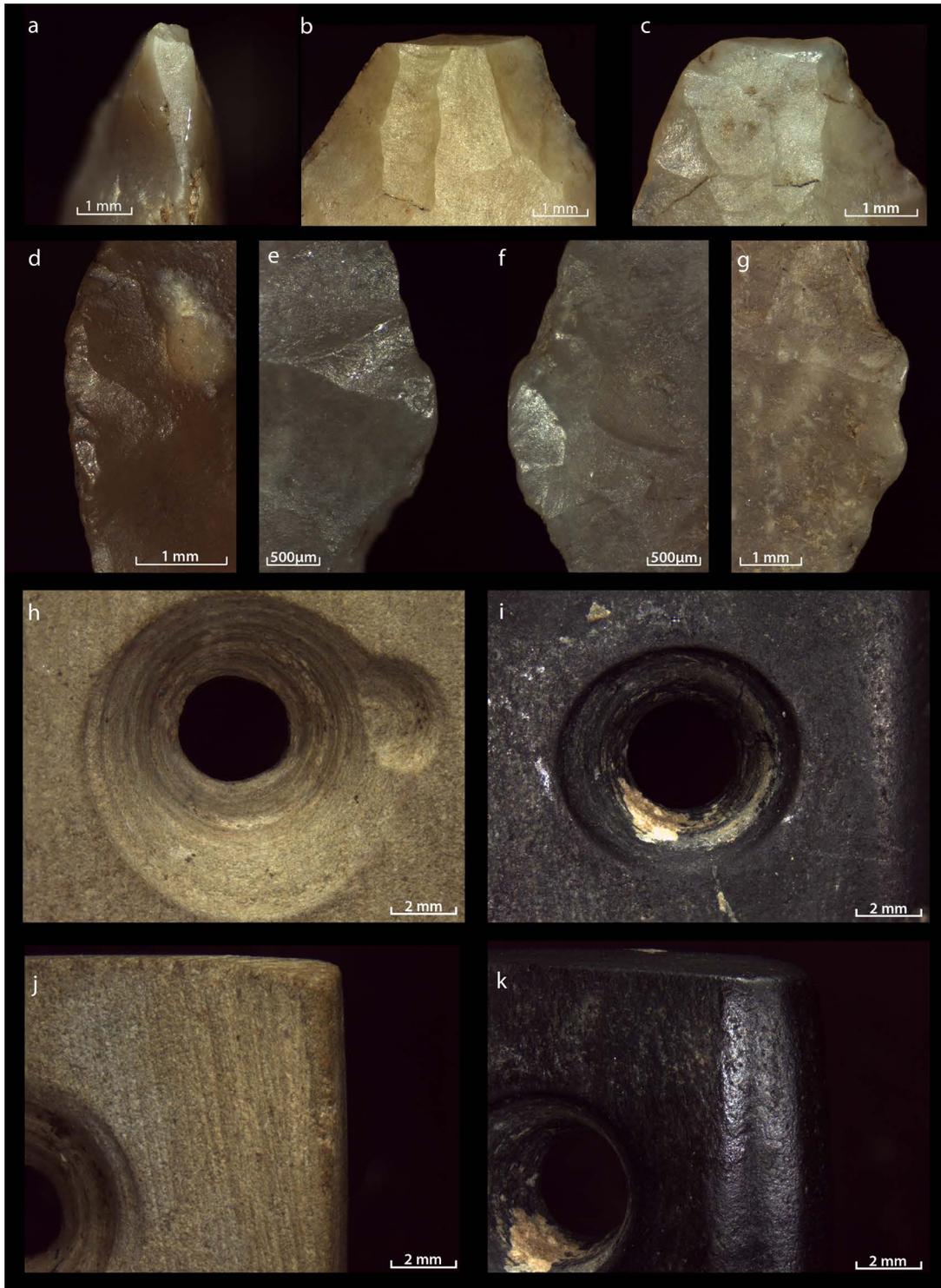


Figure 4: Use-wear analysis of arrowheads and wristguards from Hoštice-I. a. Burination of the tip, diagnostic of an impact (>2 mm), arrowhead 860; b. Snap fracture with spin-off on the tip, diagnostic of an impact (>2 mm), arrowhead 949a; c. step-terminating bending fracture, non diagnostic of an impact (<2 mm) and slightly blunt, arrowhead 949d; d. Slight and shiny blunting on left barb edge, arrowhead 863e; e. Slight and shiny blunting on right barb edge, arrowhead 860; f. Slight and shiny blunting on left barb edge, arrowhead 860; g. Slight and shiny blunting on left barb edge, arrowhead 843; h. Detail of the slightly worn perforation with regular drilling striations and an abandoned hole, upper central hole, inner side, bracer 915; i. Detail of a worn perforation, the worn edges and surface contrast with the more hollowed-out and striated parts (to the left), while perforation edges are more worn to the right, probably due to the binding threads, upper left hole, inner side, bracer 939; j. Detail of corner showing a slight wear covering the longitudinal striations produced by shaping abrasion, upper left corner, inner side, bracer 915; k. Detail of a well-developed and shiny wear on the upper left hole corner, inner side, bracer 939. Photographs C. Nicolas.



Figure 5: The bracers from the Hoštice-I cemetery. Photographs C. Nicolas.

contexts correspond to single objects physically tied to the deceased's body, mainly outside the forearm. All these observations indicate that the bracers had a value that largely exceeded their presumed practical archery function and that these small stone plaques were first and foremost items of personal adornment (Nicolas, 2020a).

4. The Osteological Findings

The osteological data used for this article was part of a larger PhD dissertation (Ryan-Despraz, 2021) looking to identify specialised archer activity from the skeletal remains of 'archer' burials from the Bell Beaker Eastern Complex. The two base classifications from this study are: suspected archer ('A' -- an individual interred with a bracer, arrowhead, or bow-shaped pendant) and non-suspected archer ('N' -- an individual not interred with an archery-related item). After analyses of enthesal changes (i.e. modifications at the insertions for muscles, tendons, and ligaments often linked to biomechanics), the study then further subdivided group A into two new groups: 'confirmed' archers ('C' -- the individual demonstrated muscular development consistent with specialised archery) and 'unlikely' archers ('UA' -- the individual did not present a bone development profile consistent with expectations for specialised archery). The purpose of the following analysis is therefore to take a subset of this data, the individuals from the Hoštice-I cemetery, and reexamine it with respect to its own unique attributes.

These analyses apply the classifications for the Hoštice-I individuals from Ryan-Despraz (2021) and model them together in search of consensus and variable similarities. The goal is to take the broad results presented in Ryan-Despraz (2021) and apply them to a single society to assess whether or not the general findings hold true for a smaller, closely linked, population. Secondly, the examination of a single Bell Beaker society will hopefully contribute additional insight into the identification of specialised archer activity at Hoštice-I.

4.1 Materials and Methods

Figure 6 presents a list of the examined Hoštice-I individuals and their archaeological contexts. Of the available adult skeletons from the cemetery, 13 had a high enough level of bone surface preservation to allow for analyses. This study examined males only for the continuous data (measurements) and males and females for the categorical (enthesal change scores) data. The samples for the Hoštice-I comparisons include four 'confirmed' archers (C), three 'unlikely' archers (UA), and six non-suspected archers (N). As preservation allowed, the original study gathered the following data for each skeleton:

- measurements (clavicle, scapula, humerus, radius, ulna, femur, tibia, and fibula) following the criteria established in (Martin and Saller, 1957) and ratios taking into account potential robusticity differences
- scores for enthesal changes following four different methods: Coimbra Method (Henderson *et al.*, 2016, 2013), Mariotti *et al.* Method (Mariotti *et al.*, 2007, 2004), Villotte Method (Villotte, 2006), and an Absence/Presence Method
- six additional observations (absence or presence): degenerative joint disease (DJD), rheumatoid arthritis (RA), diffuse idiopathic skeletal hyperostosis (DISH), ankylosing spondylitis (AS), septal aperture (SA), and os acromiale (OA)

All calculations were made using R version 3.6.3. The presence of missing data necessitated the application of multiple imputations in order to perform the dimension reduction analyses. For the continuous data, this was done using the package MICE (Multivariate Imputation by Chained Equations) which imputes a missing variable by using the surrounding variables to model the conditional distribution (Buuren and Groothuis-Oudshoorn, 2011). However, excessive missingness for three N individuals still necessitated their removal from this model. The specific imputation parameters include:

- The number of multiple imputations (Bodner, 2008; White *et al.*, 2011)
- Predictive Mean Matching as the imputation model
- 50 maximum iterations
- Seed set to 99

The imputed dataset was then used to perform a principal component analysis (PCA) which allowed for the illustration and interpretation of the principal components (PCs) most responsible for the dataset's variation.

Imputations of the categorical dataset followed a similar approach. For this type of data, imputations were performed using the missMDA package which applies iterative MCA (multiple correspondence analysis) (Husson and Josse, 2014; Josse *et al.*, 2012). The parameters of this method were:

- Method = regularised
- 50 maximum iterations
- Seed set to 99
- Number of components

This imputed dataset was then used to perform an MCA which allowed for the illustration of individuals with correlations in their enthesal change scores. As with the PCA, the top five dimensions representing the

Suspected Archers			
Grave Number	Sex	Age (years)	Grave Context
821	M	20-27	Bow-shaped pendant, pitcher, bowl, small container, worked stone tip, animal bones (domesticated), worked bone (Drozdová, 2011; Růžičková, 2008, 2009)
862	M	30-50	Wristguard, copper dagger, bell beaker, pitcher, bowl, bone button, animal bones (Drozdová, 2011; Olivik, 2009)
863	M	30-50	7 arrowheads, gold and silver fragments, animal bones (Drozdová, 2011; Olivik, 2009; Peška, 2013; Sosna, 2012)
864	M	30-50	Bow-shaped pendant, 4 arrowheads, bell beaker, pitcher, animal bones (domesticated) (Drozdová, 2011; Olivik, 2009; Růžičková, 2009; Sosna, 2012)
884	M	<50	Wristguard, copper dagger, 3 pitchers, bowl, animal bones (Drozdová, 2011; Olivik, 2009)
915	M	<50	Wristguard, arrowheads, copper dagger, 2 bell beakers, lithic blade, polishing stone, animal bones (domestic) (Drozdová, 2011; Olivik, 2009; Sosna, 2012)
949	M	30-60	Wristguard, 4 arrowheads, 2 pitchers, bowl, 2 silver spirals, 3 gold spirals, bone object (ring?), animal bones (domestic) (Drozdová, 2011; Olivik, 2009; Peška, 2013; Sosna, 2012)
Non-Suspected Archers			
Grave Number	Sex	Age (years)	Grave Context
818	M	<50	Ceramics, fragments of a copper plate (Drozdová, 2011)
854	ND*	19-34	Ceramics, amber bead (Drozdová, 2011)
856	F	<50	Ceramics, v-shaped buttons, fragments of a copper plate, animal bones (Drozdová, 2011)
859	M	<60	Ceramics (Drozdová, 2011)
931	M	<50	Ceramics, stone tool, animal bones (Drozdová, 2011)
947	F	30-60	Ceramics (bell beaker, jugs), bone buttons, animal bones (Drozdová, 2011; Matějčíková, 2007)

*Anthropological sex analyses were rather male, but only the Walker method for the skull was applicable. Archaeological burial orientation is female. Analyses from the primary source also established a female sex.

Figure 6: The archaeological contexts for the 13 adult skeletons from the Hoštice-I cemetery, from Ryan-Despraz (2021, Tables 47 and 48).

highest levels of variation were examined. The goal of both models is to reveal any potential correlations between individuals based on their raw data.

For accurate imputations, datasets should not exceed 30% missingness (Serneels and Verdonck, 2008), though even lower proportions are always ideal. Due to the age of the material used in this study, missingness levels were always exceedingly high, therefore listwise deletion was also required for all datasets. With the exception of the three N individuals for the PCA analyses, only variables with exceptional levels of missingness were removed in order to preserve the already small sample size.

4.2 Comparison of ‘confirmed’, ‘unlikely’, and ‘non-suspected archers’ from Hoštice

PCA Results

These PCA calculations were performed on an imputed dataset that contained 28% missingness. The PCA

results for groups C, UA, and N reveal a second principal component (PC) that manages to create some basic clusters (Figure 7a-b). First and foremost, an illustration of PCs 2 and 3 exhibit three distinct groups with one outlier from each. A visualisation of PCs 2 and 4 also exhibit some level of clustering for groups N and C, however the individuals of group UA appear in three different sections of the graph. One observation from both of these plots is that group C tends to be most similar to group N.

The individuals most responsible for this variation are 884 (C) and 863 (UA), and all others fall below the contribution midline (i.e. their contributions to the variation are less than expected). Both of these individuals are outliers on the graphs, appearing on opposite ends of the PC 2 scale. This data implies two main concepts: the clusters are slightly less reliable since the individuals in these groups were not responsible for the majority of the variation, and PC 2 is still largely differentiated by two individuals hypothesised to be unlike, and indeed the PCA shows that they are. The

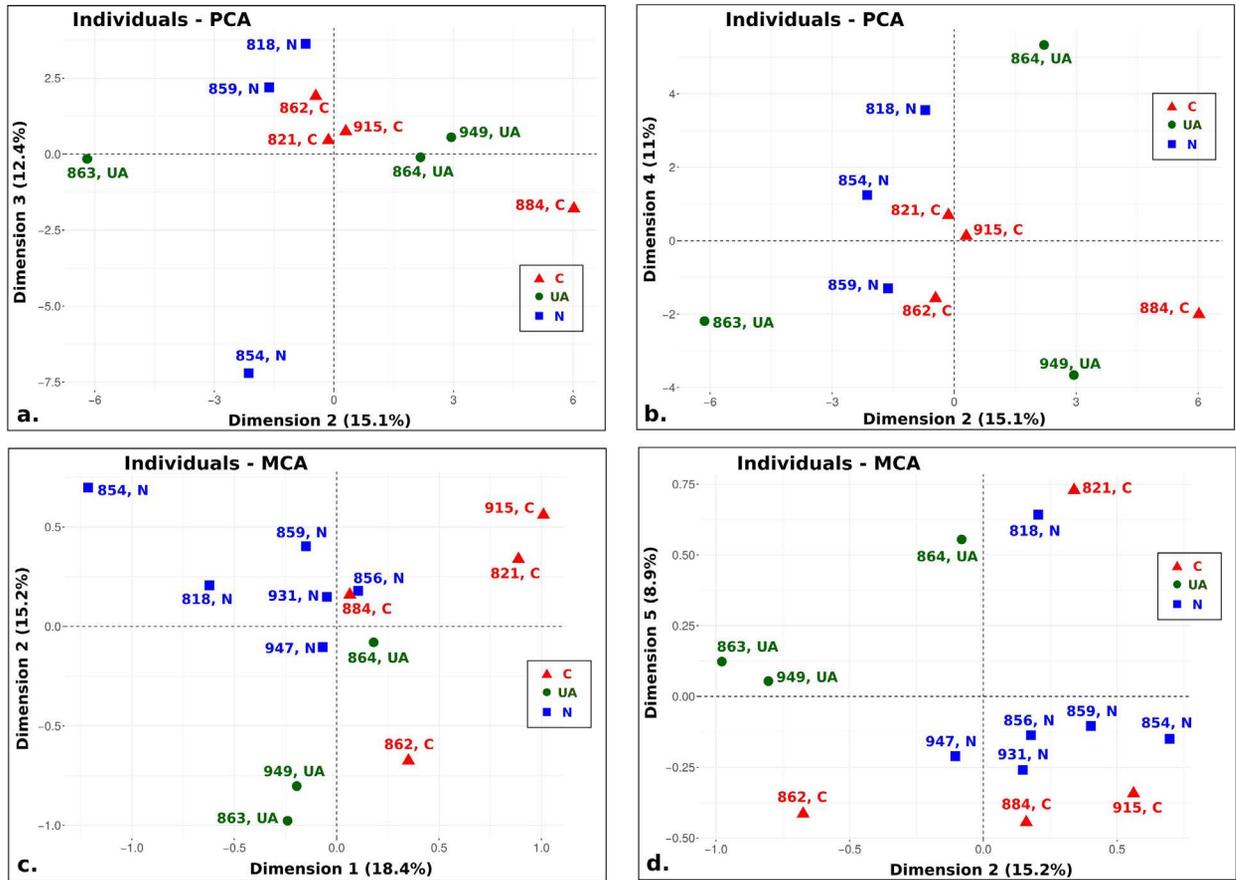


Figure 7: Visualizations of the PCA and MCA analyses for the Hoštice-I individuals; a. Principal components 2 and 3; b. Principal components 2 and 4; c. Dimensions 1 and 2; d. Dimensions 2 and 5.

top 15 variables contributing to this second dimension are almost entirely measurements from the upper limb (with the exception of two tibia measurements), and seven of the top ten variables are proportions calculating bone robusticity with respect to sidedness, which means they are more likely to reflect variation related to biomechanics. These measurements and ratios from the upper limb include: humeral maximum midshaft diameter (ζ_5), ulna minimum circumference (θ_3), breadth of humeral proximal epiphysis (ζ_3), trochlea breadth (ζ_{11}), clavicle vertical midshaft diameter (δ_4), clavicle sagittal midshaft diameter (δ_5), ulna dorso-volar diameter (θ_{11}), clavicle midshaft circumference (δ_6), and radial minimum sagittal shaft diameter (η_{5a}) (Martin and Saller, 1957).

MCA Results

The MCA results are based entirely on the enthesal changes scores; therefore any clustering is more likely to be based on various biomechanic activation. Three different dimensions illustrate clustering trends for the three groups (Figure 7c-d). Dimension 1 places groups C and N on opposite sides of the midline with UA in

the middle. Dimension 2 distinguishes between UA and N with C remaining most similar to N. And lastly Dimension 5 manages to cluster all three groups, with a couple of outliers. Some level of clustering is visible in each dimension, with groups C and N tending to be the most similar (as with the PCA findings). The individuals most responsible for the variation of the first dimension are 854 (N), 915 (C), 821 (C), and 818 (N). The individuals most responsible for the variation of the second dimension are 863 (UA), 949 (UA), 854 (N), 862 (C), and 915 (C). Lastly, the individuals representing the majority of the variation for the fifth dimension are 821 (C), 818 (N), 864 (UA), 884 (C), and 862 (C). The muscles that contribute the most to the variation for all three dimensions are the *m. biceps brachii*, *m. deltoid*, *m. pectoralis major*, *m. brachioradialis*, *m. supinator*, and the *m. triceps brachii*.

4.3 An Interesting Case of Septal Aperture

Septal aperture (SA) is a perforation in the olecranon fossa. It appears in 4-22% of a given population, and more commonly in women, indicating that it is partly hereditary, though other potential causes include

congenital conditions and biomechanics (Bradshaw *et al.*, 2020; Mann and Hunt, 2005; Mays, 2008; Ndou, 2018; Pires *et al.*, 2019; Sahajpal and Pichora, 2006). In the case of a biomechanics origin, SA could appear as the result of flexion because excessive stress can lead to impingement of the humeral septum (Glanville, 1967; Mays, 2008).

Of the thirteen individuals examined, eight had confirmed instances of this bone formation, six of whom were suspected archers. Only four individuals did not present signs of SA, and each was a non-suspected archer (Figure 8). It is also necessary to note the sexes of these individuals; of the six suspected archers with this appearance, all were males. And the two non-suspected archers with SA included one male and one female. This appearance rate could indicate a link between specialised archer activity and the development of SA. In the context of the Ryan-Despraz (2021) study, six out of 15 suspected archers with SA were from Hoštice-I, and all 'confirmed' archers with SA were also from Hoštice-I.

These proportions are not statistically significant; indeed more studies on more individuals are necessary. However, these rates are also too important to ignore. An upper range of what researchers expect for the appearance of SA is around 20%, but for Hoštice-I that value rose to 67%. The sex distribution suggests a link to biomechanics, and the fact that four were possible specialised archers could suggest a link to archer activity. For these reasons, despite its ties to genetic predisposition, septal aperture is potentially an important observation when controlling for possible specialised archer activity.

At the same time, other collections not necessarily linked to archery have also noted high appearances of this observation. Glanville (1967) found significantly higher rates of appearance in a sample from Mali (47%) than in a sample from the Netherlands (6%) and data from Hirsh (1927) revealed a >50% appearance rate for samples from ancient Sri Lanka, Arkansas and Saladoan Native Americans, proto-historic Libya, and ancient Mexico. However it is necessary to note that the latter examples could have contained hunters and that no population presented higher appearances in men than in women. More recently, a study of the Spreitenbach collective burial (Switzerland, 2500 BC, Final Neolithic period) found that of twelve individuals, seven had confirmed instances of septal aperture (three individuals did not have preserved distal humeri), including 3/6 confirmed males and 3/3 confirmed females (Meyer and Alt, 2012). However, while such examples remain important points of comparison, Hoštice-I remains of interest due to both its overall prevalence as well as its higher-than-average appearance in males.

5. Discussion

The archaeological contexts for groups UA and C are too small to perform any correspondence analyses; however it remains interesting to note the distribution of certain archery-related objects (Figure 8). All three UA individuals had arrowheads, whereas only one out of four C individuals had a single badly damaged arrowhead. In contrast, group C had three bracers whereas group UA only had one, but with a broken hole. Additionally, the three C burials with a bracer also had a copper dagger. More research is necessary, but this study does indicate a potential link between a specialised archer occupation and bracer/dagger presence for this Hoštice-I community. This finding slightly contrasts the results of Ryan-Despraz (2021), which found no link between bracer presence and a 'C' classification. Independent of a C or UA classification, the Hoštice-I suspected archers also had overall 'wealthier' burial contexts (four to seven object categories) compared to the non-suspected archers. Indeed two of these burials (both UA) even contained gold and silver pieces. This variation in burial goods is one indication that the Hoštice-I group recognised some level of association between wealth (social prestige?) and archery, either as a practice or as an ideal.

The PCA and MCA models illustrate two main findings: clusters are visible for each of the three groups and groups N and C are consistently more similar to each other than to group UA. The first finding indicates that the variables are indeed capable of differentiating between test groups, meaning that the measurements and enthesal changes most responsible for this variation could be important factors to consider in osteological analyses of activity. This supports the efficacy of the methodological approach developed in Ryan-Despraz (2021). Specifically, the clustering shows that the individuals of group C exhibit important and similar characteristics. The second finding, that N and C tend to be more similar to each other than either group is to UA, could be due to both groups having a generally more active lifestyle than group UA. This could act as an additional support for the finding in Ryan-Despraz (2021) that suspected archers had less enthesal development than the non-suspected archers, indicating a possible labor distribution illustrated by burial wealth. However, the 'confirmed' archers would be an exception to this finding. The strenuous activity required for specialised archery practice would make the muscular development of group C more similar to that of group N. Another interpretation of these findings could additionally support the hypothesis that some non-suspected archers were specialised archers, simply without the corresponding burial context. Be this the case, this provides yet another indication that the functions of the 'archer' burials tended to be social rather than practical. Finally, it is also necessary to

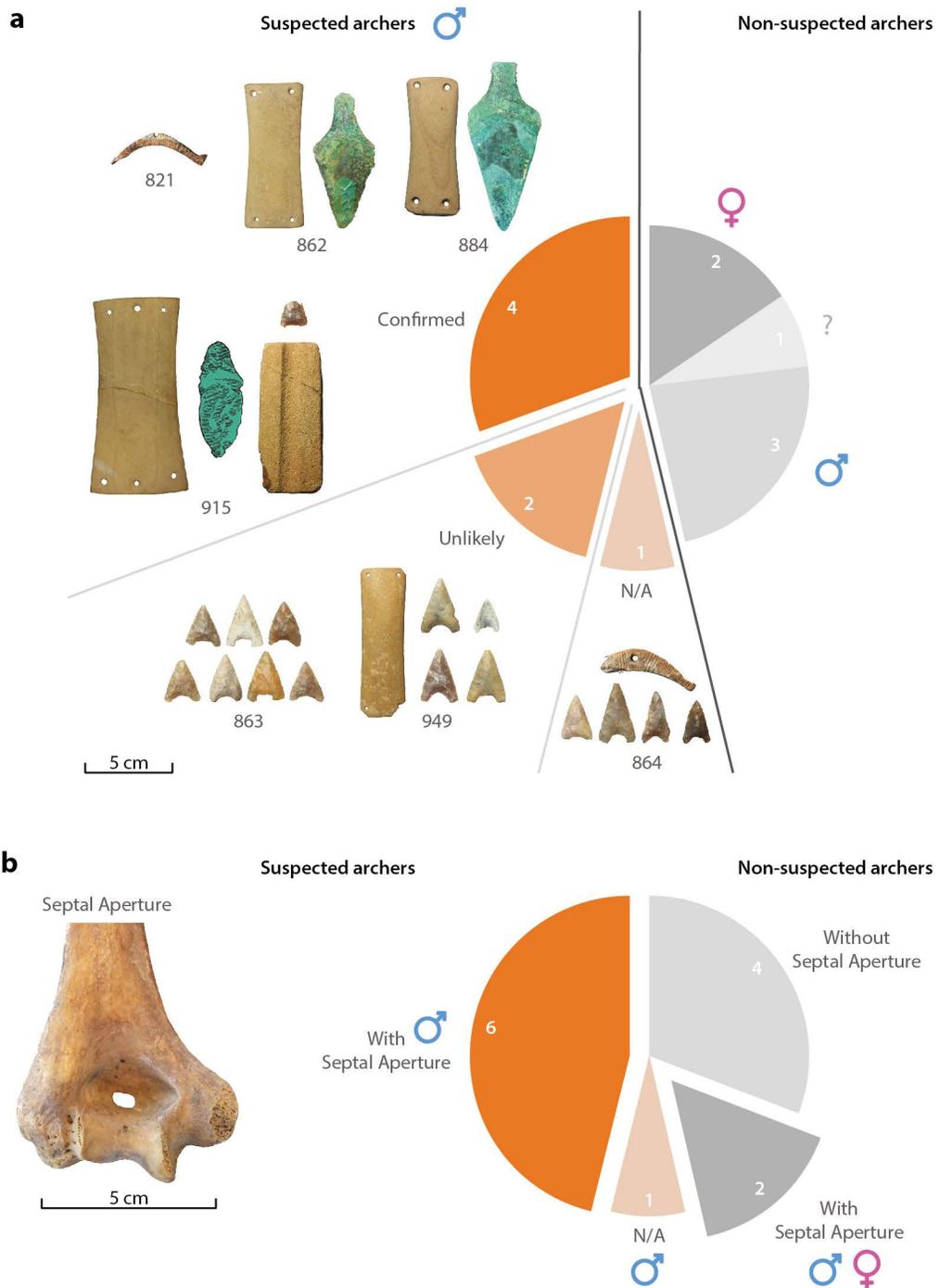


Figure 8: a. The sex distributions and archaeological contexts for the Hoštice-I suspected archers examined in the osteological analyses, artifact images by C. Nicolas and dagger drawing according to Matějčíková and Dvořák, 2012; b. The distribution of septal aperture among the examined adult skeletons, image by J. Ryan-Despraz.

emphasize that the two UA individuals both contain gold and silver objects. The only two other burials with such a context belong to a woman (aged 30-35 years) and another individual (likely aged 15-20 years), both of whom this study could not examine due to a lack of preservation. This link between precious metal, archery-related objects, and an unlikely specialised

archer occupation could additionally act as an indication for the presence of social hierarchy as well as its possible association with archery.

Lastly, the distribution of septal aperture between suspected and non-suspected archers implies a possible link with specialised archery. Overall, these osteological

results from Hoštice-I further support the assertion that not all suspected archers were also specialised archers. This would mean that an archer burial context is not necessarily indicative of occupation, which provides further indication that Bell Beaker ‘archer’ burials likely had a more social significance.

6. Conclusion

This study hopes to have demonstrated the benefit of applying multi-disciplinary methods to the study of archery evidence, led in particular on large cemeteries like Hoštice-I. Such an approach allows for interpretations even in the presence of small sample sizes, both in terms of material goods and osteological remains.

The presence of archery-related goods clearly expresses the importance of archery not only at the Hoštice-I cemetery, but also for the Bell Beaker Culture as a whole. However, the findings of these combined studies demonstrate that this importance likely reflected social ideals rather than a practical archery function. Lithic analyses reveal minimal signs that bracers functioned as practical archery equipment, yet their wear still suggests a long life as adornment. Likewise, arrowhead production suggests their effectiveness as projectiles, but the presence of blunt arrowheads could also be a sign of their use for social display. The osteological results support previous findings (Ryan-Despraz, 2021) that not all suspected archers were also likely specialised archers and that there is no link between the presence of archery-related items and a likely archer occupation. Indeed, it is possible that some non-suspected archers were specialised archers, yet did not receive the same burial context. Following these assertions, a complete evaluation of the lithic and osteological material is necessary before classifying a burial as ‘archer’.

Each of these findings supports the hypothesis that archery-related burials had a primarily social significance, and thus the grave goods, specifically stone bracers, were primarily symbolic. As seen at Hoštice-I, and indeed other sites throughout the Bell Beaker complex, ‘archer’ burials are often among the wealthiest graves, and variation in grave wealth serves as a strong indicator for social inequality. This wealth distribution therefore creates a direct link between an elevated social status and archery. Keeping this in mind, it would be interesting for future studies to explore further the possible motivations behind an archery ideology. The exploitation of data from large cemeteries and comparisons with ethnographic data will continue to be an excellent opportunity for developing multi-disciplinary approaches aimed at addressing the questions surrounding Bell Beaker archers.

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3. RECONSTRUCTING BELL BEAKER SOCIETY

Mind the Gap: Bell Beaker Presence in Copper Age Campania, Southern Italy

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Abstract: The aim of this paper is to analyse the Bell Beaker evidence currently known for the Campania Region, South Italy, between old discoveries and new excavations in light of broader Bell Beaker trends in Italy and Europe. South Italy is particularly receptive of external influences during the Copper Age, either coming from the Balkans and Aegean or from the rest of Italy and Europe. Nevertheless, the Bell Beaker phenomenon is poorly attested, documented mainly as few and isolated fragments in different sites. This pattern strongly differs from the considerable evidence attested in North Italy and Central Italy. In the case of Tyrrhenian South Italy, and especially the Campania region, two main types of evidence are generally detected: fragments of actual Bell Beakers in different contexts both funerary and domestic (e.g., Paestum) or objects generally circulating in Bell Beaker environments such as metal and bone ornaments detected in different sites (e.g., Paestum and Acerra). The spot presence of Bell Beaker influences in Campania from one side confirms the large diffusion of this phenomenon also in peripheral areas, on the other suggests different degrees of permeability to external influences in the Copper Age communities across the Italian Peninsula.

Keywords: Copper Age; Campania; Italy; Bell Beaker; pottery; t-headed pins; disk-headed pins.

Introduction

The Bell Beaker presence in Italy is characterised by a diversity of phenomena and evidence that spread across the peninsula with different times and modes. In particular, in the Southern Tyrrhenian shore only few Bell Beaker specimens have been reported in literature, often coming from uncertain contexts or partly unpublished ones (Fugazzola Delpino and Pellegrini, 1998; Cocchi Genick, 2004; Giannitrapani, 2009; Pacciarelli, 2011). This sporadic presence, mainly inferred from ceramic fragments, is very different from the structured presence that progressively emerged in Central-North Italy (among others Nicolis, 1998; Leonini et al, 2008; Bernabò Brea and Mazziere, 2013) where specific groups can be distinguished (Vander Linden, 2006, fig. 116; Lemercier, 2018, p. 83). Therefore, Southern Italy, except for Sicily which has its own development (Giannitrapani, 2009), has always been regarded as a periphery of the Bell Beaker influence (Vander Linden, 2006, p. 102; Heyd, 2013; Lemercier, 2018).

This framework certainly leads to several questions about the pattern of Bell Beaker diffusion and at the same time about the network of interaction of Southern Italian communities during the 3rd millennium BC and their permeability to foreign influences. In recent years, the gap in this area is progressively being filled, especially thanks to preventive archaeological excavations, such as in the area of Rome (Anzidei and Carboni, 2020) and in the Campana plain (Nava et al,

2007; Di Vito et al, 2021), which hint to different and more complex interactions with the Bell Beaker world. The aim of this paper is to further investigate the evidence yielded from the Campania Region, between old discoveries and new excavations in order to examine the connections with Bell Beaker routes and environments.

The Bell Beaker in Campania

In the literature two main evidence are classically reported for Campania: fragments of Bell Beakers have been detected in two sites located in the southern part of the region, in the area of the Sele River Plain, south of Salerno. The first Bell Beaker specimen comes from the site of Paestum in the southern part of the plain (Figure 1.1), where the later Greek colony flourished. In this site, a fragment of a Bell Beaker has been reported from the Tomb 1 of the Laterza burial ground near the temple traditionally known as Temple of Cerere (currently reinterpreted as the Northern Sanctuary, Arcuri and Livadie, 1988; Albore Livadie et al, 2011; Aurino, 2019). This context is located about 2 km away from the more renowned Gaudio burial ground, and it is quite close to another Laterza burial site and living area beneath the greek Agorà (Aurino et al, 2017). The site near the Temple of Cerere was excavated in the 1960s (Voza, 1962) and later reanalysed (Arcuri and Livadie, 1988; Albore Livadie et al, 2011; Aurino and De Falco, 2021). The exploration revealed a 200 sq. m. triangular depression in the travertine bedrock, which yielded a considerable Neolithic phase (Serra d'Alto and Diana



Figure 1: Map of Campania Region with the sites cited in the text: 1. Paestum; 2. Olevano sul Tusciano; 3. Oliva Torricella; 4. Pompei, S. Abbondio; 5. Gaudello, Acerra; 6. Afragola; 7. Gricignano d'Aversa.

cultures, Voza, 1962; Aurino et al, 2017), followed by the onset of five burials attributed to the Laterza culture. The burials were partly located in natural niches of the bedrock and partly in the central area of the depression. They show different structures: in two cases burials in rocky niches (Tomb 4 and 5), one closed with stone slabs and hosting a collective burial of about ten individuals (Tomb 4), in the other cases (possibly tomb 1, 2 and 3) graves with single or double inhumations.

The old excavation did not allow for a proper reconstruction of the tombs plans and stratigraphy and in some cases the provenance of the materials is not clear. According to the reconstruction by Albore Livadie et al (2011, p. 330), Tomb 1 probably hosted two individuals crouching in opposite position and in anatomic connection. The burial yielded mainly materials fully ascribable to the Laterza culture, such as the typical decorated bowls and patera, one flint dagger and three arrowheads. The Bell Beaker fragment (Figure 2A) is very small but with a clear impressed decoration below the rim, made by impressed comb, as suggested by the type and shape of the impressions (Lipowicz et

al, 2008; Forte, 2020, pp. 57-68). The type of decoration and motive is typical of the International style widely attested in Central-North Italy and the Mediterranean (Leonini and Sarti, 2008a, p. 90 fig. 3.2, p. 91 fig. 4.2-3; Fugazzola Delpino and Pellegrini, 1998, fig. 49.30). The small dimension of the fragment, unfortunately, did not allow for a more accurate typological and technological characterisation.

The second Bell Beaker known in literature for Campania comes from the Cave of St. Michele at Olevano sul Tusciano (Figure 1.2), located in the Picentini mountains in the northern part of the Sele Plain, in a river valley that serves as a natural route towards the Adriatic shore. This is a natural cave excavated during subsequent campaigns and frequented from Prehistory to the Middle Age. Its prehistoric sequence spans from the Neolithic to the Middle Bronze Age (Gastaldi 1974; Capodanno and Salerno 1992). During a survey of the inner cave in the 1970s over seventy fragments of a Bell Beaker were collected (Gastaldi 1974). These fragments were recently re-analysed and recorded. They probably belong to a single very fragmented beaker, only partially

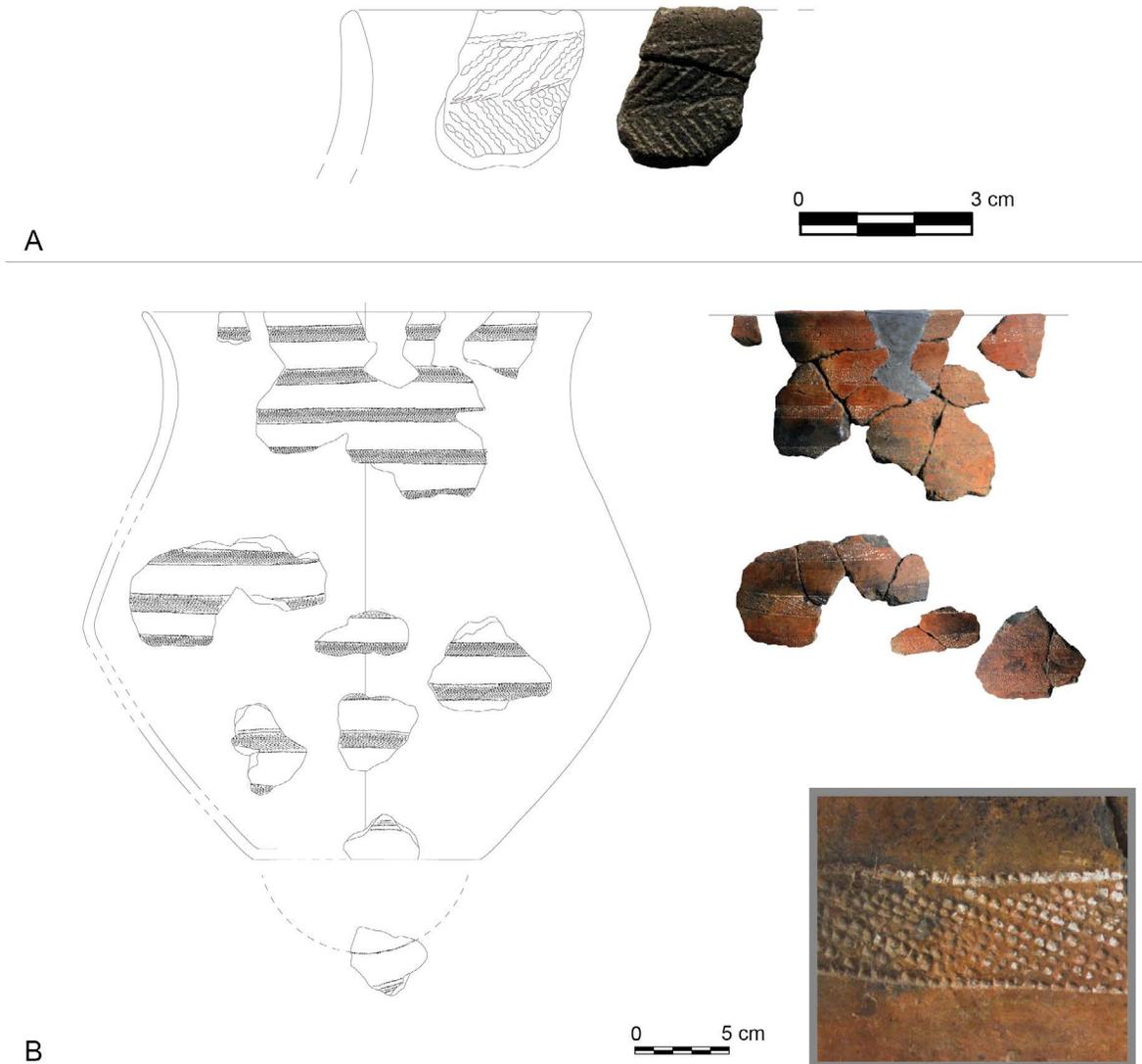


Figure 2: Bell Beaker fragments from the sites of Paestum (A) and Olevano sul Tusciano (B).

reconstructed (Figure 2B). The beaker is decorated in the Maritime style, the surfaces are reddish and thoroughly burnished, and the decoration is made by impression of a fine comb or indented tool filled with white paste still partially preserved. Its shape, decoration, and technique can be compared to several examples of Bell Beakers from Central-North Italy (e.g., in the site of Fontanile di Raim, Fugazzola Delpino and Pellegrini, 1998), and also further south in Calabria from Passo Murato (Lo Torto et al, 2001; Pacciarelli 2011, fig. 13) and from the wider European context (especially in the Atlantic area, e.g., Gallay 2001, p. 46). The beaker was found in association with fragments of Laterza style collected during the same survey (this culture is documented also in the nearby site of Pontecagnano; Bailo Modesti and Salerno 1998, pp. 34-38; Aurino and Bailo Modesti, 2009). Unfortunately, the uncertain circumstances of the find do not allow for a better understanding of the original context, but a re-

analysis of the Copper Age material yielded by the cave is currently ongoing.

In both these cases there is evidence of International and Maritime style beakers in association with the Laterza culture. These styles of decorations are generally dated in Italy between about 2670-2470 cal. BC in the area of Rome (Phase I and II of Ortucchio; Anzidei and Carboni 2020: 229) and correspond to Steps 1 and 2 of the Florentine area (Leonini, Sarti 2008a). In Europe, the International and Maritime styles relate to the early Bell Beaker phase (2550/2500 – 2400/2350 cal. BC in France, Lemerrier, 2018, p. 79; 2500-2440 cal. BC in the Danube area, Heyd, 2007, pp. 333-334), though with some later attestation as well (e.g., in the British Isle, Fitzpatrick, 2011). The dates currently available for the Laterza culture in Campania match this chronology well, with dates spanning between 3340 and 2470 cal. BC (2 σ), with a major concentration from 2880 cal. BC



Figure 3: Tomb 495. Example of a typical burial from the cemetery of Gaudello, Acerra (excavation AC3_620) and detail of the metal grave goods represented by a disk headed pin and a hair ring.

onwards (radiocarbon dates recalibrated in Anzidei and Carboni, 2020, pp. 201-202, tab. 3.7.1). This culture is characterised by a variety of evidence in South and Central-North Italy, from the collective cemeteries of South-East Italy (Biancofiore, 1967), to the villages of Tyrrhenian Italy (Fugazzola Delpino et al, 2003, 2007; Anzidei and Carboni, 2020). It was formerly hypothesised that this culture could represent an area in which Bell Beaker failed to permeate (Cocchi Genick, 2004). As mentioned above, though less evident and structured, a certain connection between these communities and the Bell Beaker world is attested especially along the Tyrrhenian shore in Campania and Lazio. Nevertheless, this type of Bell Beaker influences become more evident in later phases on the verge of the Early Bronze Age. An example is the area of Rome, where locally produced Bell Beakers and local adaptation of the style are attested in the 'Dragged-comb' phases (also known as the Ortucchio culture), spanning between 2700 and 2120 cal. BC (2 σ , Anzidei and Carboni 2020, p. 250, tab. 3.8.1). A similar pattern is emerging also in the Campana Plain, both from previously known excavations (such as Gricignano d'Aversa, Figure 1.7, and Afragola, Figure 1.6, Fugazzola Delpino et al, 2003, 2007; Nava et al, 2007), but especially from the large preventive excavations

recently carried out in the site of Acerra, which suggest a more complex network of connections.

Acerra is located about 2 km far from the river Clanis, in the north-eastern area of Naples. Here, in Gaudello locality (Figure 1.5), a large village and a wide adjoining burial ground were excavated, dating to a transitional phase between Copper and Bronze Age (Mancusi and Bonifacio, 2020; Di Vito et al, 2021). The village is located on a plateau directly on top of the Agnano Monte-Spina eruptive layer (4420 ± 58 BP, Lirer et al, 2013; Zanchetta et al, 2019; 3335-2913 cal. BC, 2 σ , recalibrated with IntCal 20) where 7,500 sq. m. were excavated. The site consists of several dwellings with two apses on the short sides and in some cases also with a concentric outer corridor, a building type already attested in the site of Gricignano (Fugazzola Delpino et al, 2003, p. 201). The last phase of occupation of the area consists in a wooden palisade and longhouses which cut some of the earlier structures and can be dated to an initial phase of the Early Bronze Age. On the opposite side of the village a large burial ground of over one hundred tombs was set between the end of the Copper Age and the beginning of the Bronze Age. It consists generally of single inhumations inside large sub-rectangular pit-graves (Figure 3). The tombs are regularly organised with a NW-SE orientation and they sometimes preserve traces of a possible original cover made of stones and calcareous pebbles. The grave goods are not always present, they are generally ceramic vessels, often fragmented, or personal ornaments in metal or bone, or weapons such as daggers and halberds. The material culture of the settlement points towards the Laterza culture as also suggested by the settlement organisation. Its pottery has parallels both from Southeastern Italy (Biancofiore 1967), from the closer settlements of Gricignano (Fugazzola Delpino et al. 2003, 2007) and Carinara (Laforgia et al. 2007) and from the Laterza and Ortucchio/Dragged Comb phase detected in the area of Rome (Anzidei and Carboni, 2020: 203-52).

Pottery with Bell Beaker or 'Pseudo-Bell Beaker' style was yielded both by the settlement and by the burial area. The most striking example comes from tomb 319. This burial yielded two fragments of a beaker with a dragged comb decoration (Figure 4.1). The pattern resembles Bell Beaker styles for its organisation on parallel registries, as in the sites of Torre Crognola and Poggio Nebbia (Anzidei and Carboni, 2020: 210, Fig. 3.8.7), even though it must be noted that the technique does not match the classical Bell Beaker impressed decoration since it is realised by incision with a three-toothed comb dragged rather than impressed. Nevertheless, the shape, the decorative pattern, the presence of a white paste in the incision, the reddish and highly burnished surfaces seem to point towards Bell Beaker models (Strahm 1998: 27; Anzidei and

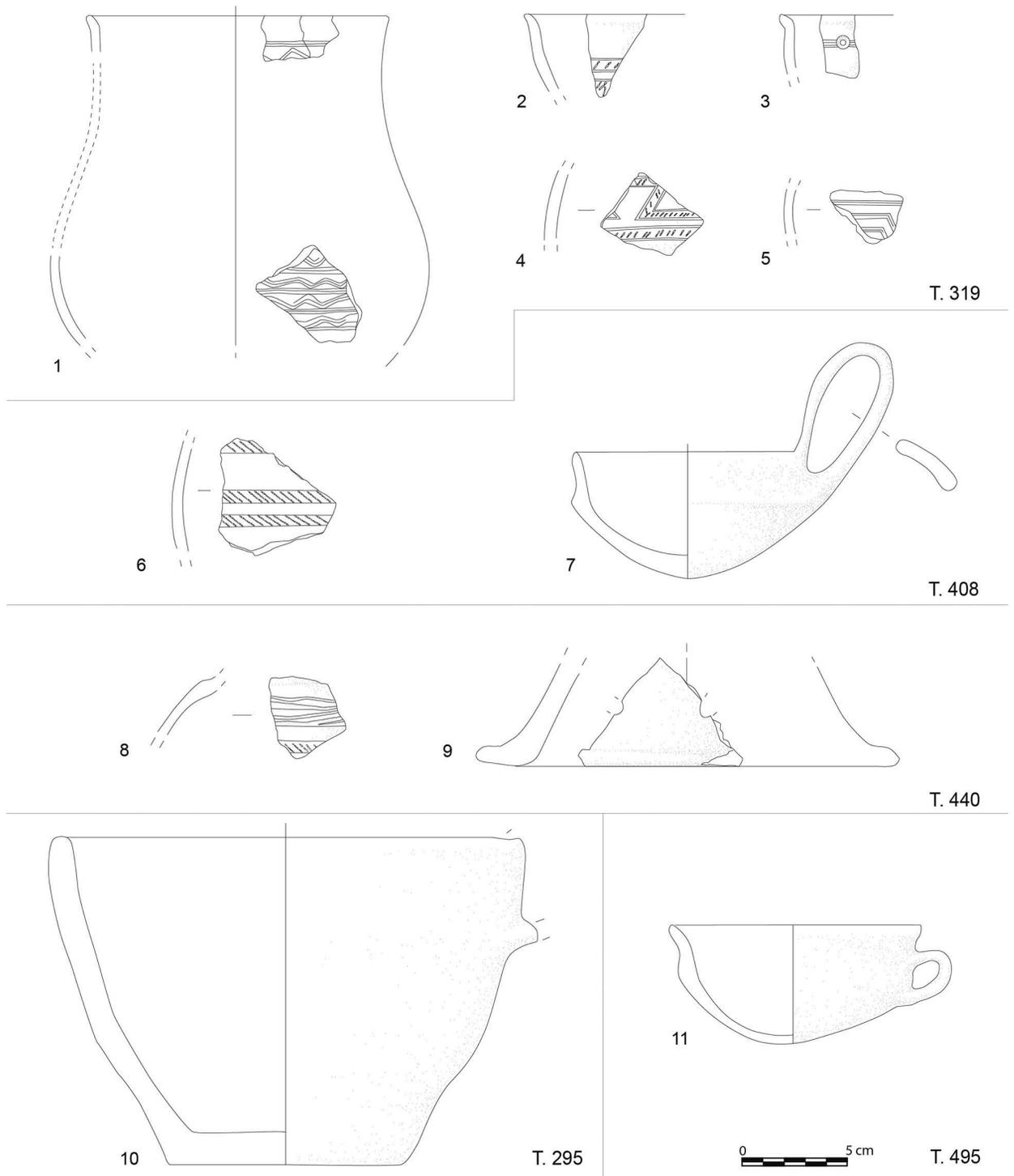


Figure 4: Pottery repertoire yielded by the tombs showing Bell Beaker influences, Gaudello, Acerra, excavation AC3_620. 1-5 : tomb 319; 6-7 : tomb 408; 8-9 : tomb 440; 10: tomb 295 ; 11: tomb 495.

Carboni 2020: 224). Fragments with a dragged comb decoration and bands filled with impressions were also found in the infill of the tomb (Figure 4.2-5). Other tombs (408 and 440) yielded fragments decorated with the so called 'Pseudo-Bell Beaker' style (Anzidei and Carboni 2020, p. 225), characterised by the classic

impressed comb decoration in bands, but with incised linear margins, rather than impressed ones (Figure 4.6, 8). These fragments were found in association with ceramic material, such as carinated bowls (Tomb 408, Figure 4.7), biconical pedestal so called 'sostegni a clessidra' or cups on high feet (Tomb 440, Figure 4.9),

typical of the Palma Campania repertoire (Soriano 2020, p. 180 n. 66, p. 170 n. 7). This culture is widely attested in Campania and Northern Apulia and its early phase can be dated between 2376–1829 cal. BC (2 σ , Lanos et al, 2020, pp. 75, 81–82).

Several further ceramic vessels with this 'Pseudo-Bell Beaker' and dragged comb decorations were yielded by the area of the cemetery (Figure 5A) and of the village (Figure 5B). The decoration motives, especially the complex meander and angular ones, find strong parallels in the area of Rome in particular with phases II and IV of Ortucchio (Anzidei and Carboni, 2020, pp. 242, 248). The Ortucchio/Dragged Comb phases are dated between 2700 and 2120 cal. BC (2 σ), with original Bell Beakers attested in phases I and II and 'Pseudo-Bell Beakers' in phases I, II and IV. In this case the impressed comb decoration has been interpreted as an adaptation of the Bell Beaker models (Anzidei and Carboni, 2020, p. 225). A similar organisation on parallel registries and decorated bands is widely attested also in the Laterza phase (as also noted by Guilaine, 2004; e.g., the rich repertoire of Tomb 3 of the Laterza cemetery, Biancofiore 1967), but the decoration technique differs since it is never made by the impression of such fine combs or indented tools; it is generally made by incision or in some cases impression suggesting a variety of tools. A change can be detected also in the morphology of decorated vessels, shifting from the low hemispheric bowls of Laterza to the slightly S-shaped bowls or slightly necked shapes typical of the Dragged Comb phases (Figure 5.5-7, 12, 14-15). A similar pattern is attested also in the area of Rome in Ortucchio phases (I-IV, Anzidei and Carboni, 2020, p. 249), while in the Florentine area similar shallow S-shaped bowls, in this case with a Bell Beaker decoration, represent the regional evolution of the style proper of step 2 and 3 (Leonini and Sarti, 2008a).

Some fragments with a comparable angular pseudo-Bell Beaker decoration are also attested in the site of Afragola (Figure 1.6), where some potsherds with a 'Bell Beaker style' decoration were reported in a possible living context in association with some Laterza and Capo Graziano style pottery (Nava *et al.* 2007: 111, fig. 5C). In particular, they find parallels with some fragments from Acerra (Figure 5.9), Gricignano (Figure 1.7; Salerno and Marino, 2011, p. 325, fig. 1.4) and Casetta Mistici (Anzidei and Carboni, 2020, p. 249, fig. 3.8.53). Similar angular motives are also attested in Ligurian and Sicilian contexts, either incised or with impressed comb/cord (Nicolis 2001, p. 210, fig. 2; Del Lucchese, Odetti 1996, fig. 1.1; Tusa, 1998, p. 204, fig.1).

Overall, this pottery repertoire characterised by Bell Beaker influences seems to develop from a previous Laterza tradition, but with strong correlation with the

Dragged Comb phase and with the later Palma Campania culture. The presence of dragged comb in association with Bell Beaker has been already attested in Central Italy and it was interpreted as a local tradition with Bell Beaker contaminations in the decorative organisation and motives (e.g., at Torre Crognola, Leonini and Sarti, 2008b, p. 126). On the contrary, the correlation between Pseudo-Bell Beaker and Palma Campania features is at present a peculiarity of these sites of the Piana Campana. In fact, in the area of Rome and Florence, the later Early Bronze Age phases are generally preluded by a transitional Epi-Bell Beaker phase (Anzidei and Carboni, 2020, pp. 249–252; Sarti, 2004).

Metal objects

The foreign influences in the pottery are paralleled also by the acquisition of a new repertoire of metal objects, such as weapons and ornaments, once again pointing to connections with Central and Western Europe. In particular, several burials from the same cemetery of Gaudello, Acerra, yielded metal ornaments rarely attested elsewhere in Campania. Tomb 295 yielded a lozenge-shaped pin (Figure 6.4) which has a wide circulation in the Early Bronze Age (Carancini 1975, p. 93, tavv. 1-2) occurring also in Western European Bell Beaker contexts (Van Vilsteren, 2004, p. 30, Fig. 8). The grave good consisted also in a fragmented cup typical of the Laterza culture repertoire (Figure 4.10, parallels in Gangemi 1988; Laforgia and Boenzi, 2011, p. 251, Fig. 2D; Anzidei and Carboni 2020, vol. 2 p. 195). Another type of artefact detected in the cemetery and generally dated to the Early Bronze Age is represented by disk-headed pins made of a copper alloy. In the Tomb 427 two disk-headed pins were found on the right side of the skeleton near the shoulder. The disks are decorated with circles on both sides, alongside the edge and in the centre (Figure 6.2-3). Tomb 495 yielded a disk-headed pin (Figure 6.1) and other types of ornaments such as a hair ring and two beads. On top of the grave, in the first layers of the infill a flipped ceramic cup was deposited (Figure 4.11), with general parallels in the Early the Bronze Age.

This type of pins is generally rare in Southern Italy, but further examples are attested in two Early Bronze Age contexts in Campania. An undecorated specimen was found in Tomb 26 in the Palma Campania cemetery of S. Abbondio, Pompei (Figure 1.4; Albore Livadie, 2020, p. 229) and a highly decorated one from the area of Salerno, in the site of Oliva Torricella (Figure 6.5; Albore Livadie 2020, p. 226–227, fig. 1.4, 2.6, pp. 230–231). This site (Figure 1.3) yielded two tombs covered by pebbles and located near a larger settlement with eight huts with ovens, working and butchering areas. In Tomb 1 the deceased was deposited on the right side and only had the bronze disk-headed pin as grave good, located

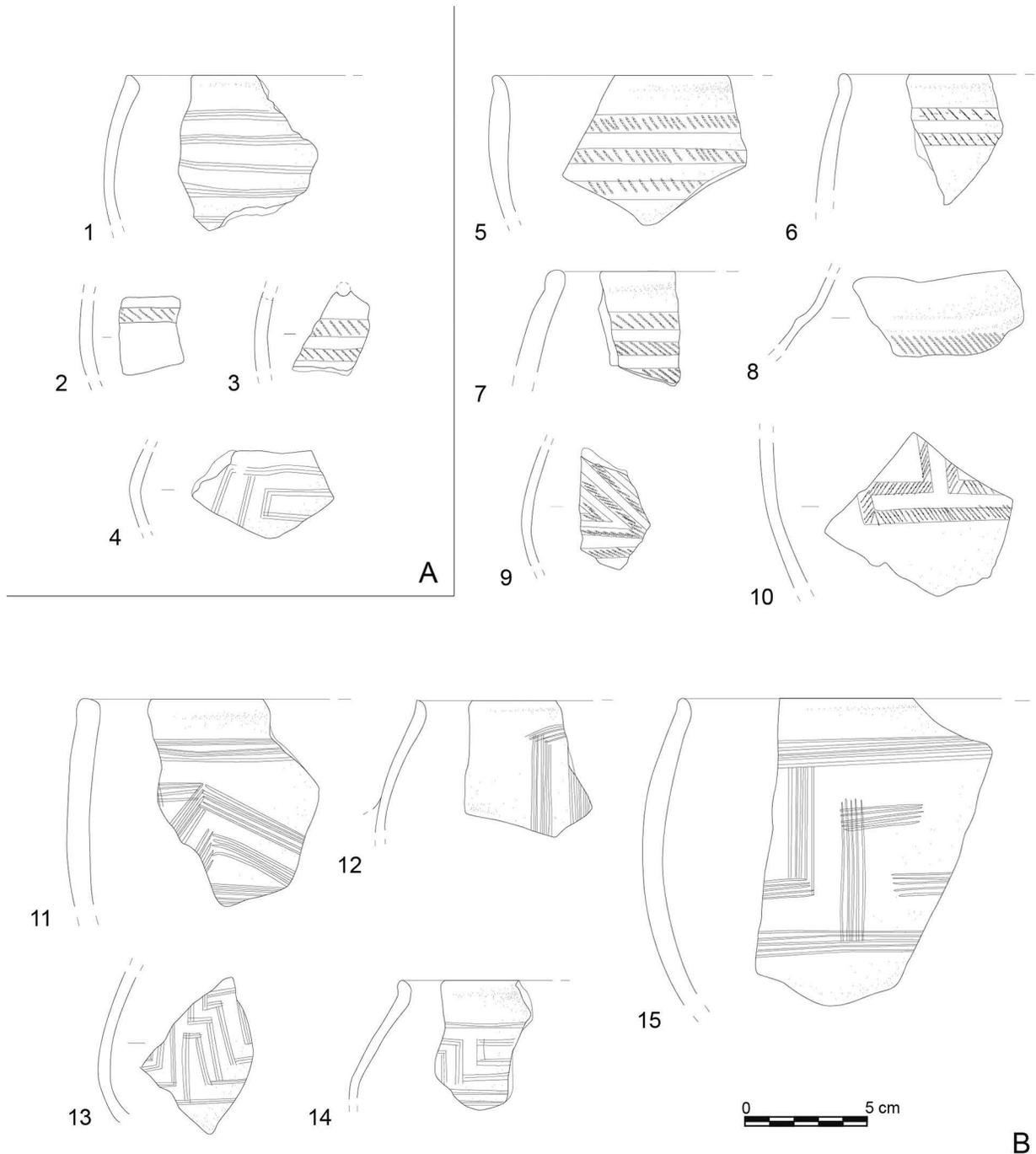


Figure 5: Pseudo-Bell Beaker and Dragged Comb style pottery from the burial area (A) and the village (B), Gaudello, Acerra, excavations AC3_600 and AC3_620.

between the right arm and the left forearm. The bronze pin has a highly decorated laminar disk with four rows of incised triangles and a bending stem. The decoration motive is very similar to specimens from the area of the Middle Danube, Lower Austria, Moravia and Slovakia between the end of the Early Bronze Age A1 and the beginning of Early Bronze Age A2, such as in Gemeinlebarn, Galgweis-Gerweis in Baviera, Kyjovice in Moravia and Vycapy-Opatovce in Slovackia (David-

Elbiali, 2000, pp.143-147, fig. 13.1-4). Further examples come from the cemeteries developing between the Early Bronze Age A1a-b and A2 in Mintraching, Ziegelei Orter and Ziegerlei Jungmeier where similar disk-headed pins are found together with other metal artefacts, such as daggers, halberds and ornaments like rings, lozenge and roll-headed pins very similar to those yielded by the Acerra cemetery (Kim 2005, pp. 106-108). The disk-headed pins from Acerra characterised by



Figure 6: Metal ornaments from the Campania Region. 1-4. Metal pins from the cemetery of Gaudello, Acerra, excavation AC3_620: 1. Disk-headed pin from Tomb 495; 2-3. Two disk-headed pins from Tomb 427; 4. Lozenge-shaped pin from Tomb 295. 5. Disk-headed pin from the site of Oliva Torricella (SA), Tomb 1 (Albore Livadie 2020, p. 226, Fig. 1.4).

circular decorations have parallels mainly in Northern and Central Italy (Carancini 1975, pp. 92-94, tavv. 1-2). This type of pins is generally attested in a later Early Bronze Age phase, A2a, in the area of Sion and in the Valais, such as in the cemetery of Vollèges Plachouet, with close connection with groups from Southern and Western Germany (Straubing e Adlerberg) (David-Elbiali, 2000, p. 145, fig. III.58.6,9).

Foreign connections

A precedent to these connections with Northern Italy and Central Europe can be also found in earlier phases of the Copper Age in the site of Paestum (Aurino, 2016, 2019). In the already cited Gaudo Burial ground, dated between the mid-4th and mid-3rd millennium BC, five t-headed or hammer-headed bone pins have been found in four different burials (Figure 7). This type of artefact is very rare in the Italian peninsula especially when made of bone. Some parallels can be found in metal or hybrid pins from Central and North Italy. The cemetery

of Remedello (Tomb BSII, Cornaggia Castiglioni, 1971, p. 62), yielded a metal pin of transalpine typology, often associated with the so-called 'Yamnaya set' or 'package' acquired in Northern Italy and the Western Alpine region (de Marinis, 2013, p. 333). Two metal pins of Straubing type were found in the Buca di Spaccasasso (Pellegrini, 2007, Figg. 3-4) and attributed to the Corded Ware. A further example comes from Petralia Sottana (Fontebrera, 2011), with parallels with the roll pin and double spiral pin common during the 3rd millennium BC in the Near East (Calvi Rezia, 1967). A possible *trait d'union* between these metal examples from Northern Italy and the animal bone pins of Paestum is represented by a silver pin head from the Rinaldone cemetery of Sette Miglia (Anzidei et al, 2007, p.554, fig. A). This pin head was probably mounted on a bone or wooden stem.

The hammer-headed pins made of bone, deer antler or pig tooth are mainly attested outside the Italian Peninsula in the area of the Corded Ware in western and central Europe (Strahm, 1979, pp 44-66) as in the

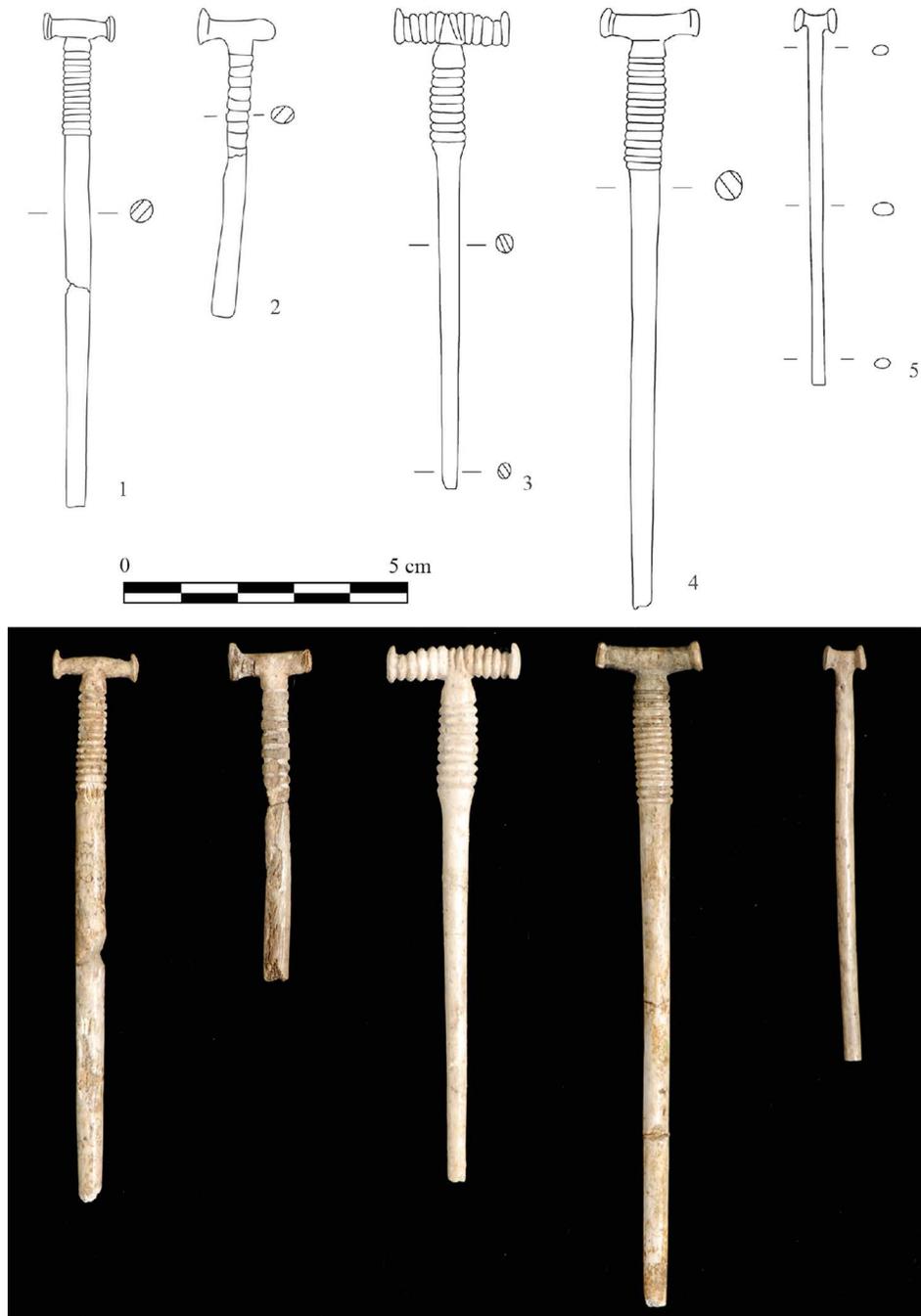


Figure 7: T-headed bone pins from the Gaudio burial ground, Paestum (Tombs IV, II, and IX).

case of the Bleckendorf grave, (Sachsen-Anhalt, D), and in Switzerland (Vinelz, Corcellettes and St. Blaise, Strahm, 1979, Fig. 1, 5) especially undecorated ones. Their origin is generally set in the Caucasus around 3000 BC, as a typical Yamnaya production (the earliest date is between 3300 and 3000 BC), their maximum expansion around 2800 and 2600 BC and their disappearance around 2600 BC (Shislina et al, 2011). Therefore, both the Remedello (4070±70 BP, 2874-2467 cal. BC, 2σ recalibrated with IntCal 20, de Marinis, 1997; Bagolini and Biagi, 1990; de Marinis, 2013, p. 346) and

Rinaldone (Anzidei et al, 2007, p. 558) metal examples might correspond to the period of maximum expansion of this model. The bone pins from Paestum have more uncertain dates since the burial contexts have been used for several centuries (between 3550 and 2500 ca. BC, Aurino 2013) and given the old excavations the association between the artefacts and the individuals is not clear. Though their closer models might be the European t-headed pins, the specific type attested in Paestum for decoration and material mostly resembles the examples from the Caucasus where, between the

Caspian Steppe and the lower Don region, about 221 t-headed pins were recorded in 1200 tombs (Shishlina et al, 2011, p. 109). In this area, in the cemetery of Kabardino Park in Nalcik, Russia, a metal t-headed pin similar to the Remedello example is also attested (de Marinis 2013, p. 333; Heyd and Harrison 2004, pp. 163-168, fig. 14).

A further point to consider is the presence of this type of pins in some Bell Beaker burials from the UK. In the famous Amesbury Archer burial (tomb 1289, Fitzpatrick, 2011, p. 69-87) a hammer-headed pin, possibly in antler, was buried on top of the black bracer (Fitzpatrick 2011, pp. 157-158). It was dated to 2470-2239 cal. BC (2σ , 3895 \pm 32 BP, recalibrated with IntCal 20, Fitzpatrick, 2011, p. 169). Another example from England was found in Barrow Hills, Radley (Tomb 4660, Barclay and Halpin, 1999) together with a copper dagger and a Maritime style beaker dated to the same period. The presence of these pins contributes to testify the mobility of Copper Age peoples and the long circulation of these models also in the later Bell Beaker environment. The same models are attested earlier in Western-Central Europe as in the case of the examples from Vinelz (Kanton Bern, Switzerland, dated to 2734-2626 cal. BC, Winiger, 1989, pp. 157-162, Winiger, 1993, pp. 60-78) and in the cemetery of Franzhausen in lower Austria (Neugebauer 1992, p. 152, abb. 3,7). The bone pins from Paestum might date back to the same period of these last specimens since the burial site is still in use until the mid-3rd millennium BC (Aurino, 2013).

The close similarity between the Amesbury Archer's pin and the ones from Paestum might suggest that the acquisition of the model or the artefact took place within the same network. This system of relations might be connected with the procurement of metal raw materials, absent in Campania, which might have brought Gaudo people in contact with Central Italy and probably also further north. Other bone and shell ornaments found only in the tomb XIII of Paestum might be linked to the same area of circulation (Aurino, 2016, pp. 196-197). In this burial, two rectangular shell plaquettes with side holes and five pierced pendants from boar teeth and shells were found. Similar ornaments are attested in the same Italian and European contexts considered for the pins, such as in the case of the plaquettes found in the necropolis of 'Le Petit Chasseur' Sion (Final Neolithic 2500 BC, Heyd and Harrison, 2004, p. 153, fig. 7). These contacts with the broader Central European world and the acquisition of foreign objects or models might have further continued in the later phases of the Copper Age as suggested by the evidence from Paestum, Olevano sul Tusciano and Acerra. A possible mediation was probably represented also in this case by Central and North Italy, in particular by the Florentine area, where the need of metal raw materials might have brought the Copper Age communities of Campania during the

second half of the 3rd millennium BC, on the verge of the Bronze Age.

Conclusions

In conclusion, the Campania Region shows a lack of a widespread Bell Beaker presence compared to Central-North Italy. However, the Copper Age communities of the region appear highly connected to the broader European environment throughout 3rd millennium BC. On one side, the pottery evidence suggests the presence of original Bell Beaker models in some funerary and cave contexts (Paestum and Olevano sul Tusciano). On the other side, it also shows the local re-adaptation of foreign influences, especially towards the end of the 3rd millennium BC (e.g., Acerra). Similar patterns can be also detected by looking at other classes of artefacts, such as metal ornaments which show strong transalpine connections. These connections suggest a broad circulation of ideas, technologies, and raw materials between different communities. This trend well reflects the constant movement of people and ideas that emerged thanks to aDNA and isotopic analyses for Europe during the 3rd millennium BC (a recent review on these topic applied to the Bell Beaker is in Lemerrier, 2020, p. 123 and references).

Was it a movement of goods, people or ideas? The latest excavations helped to understand more about the mechanisms of absorption of these influences by local communities, characterised by different degrees of permeability. The highly coded Gaudo culture reveals a strong cohesion to its identity and self-representation, poorly permeable to foreign influences. Its long duration and consistency is testified also by the long use of the collective burials such as in the case of tomb IX from Paestum, used for almost a millennium (Aurino, 2013). Nevertheless, the presence in the Gaudo cemetery of metal objects and of artefacts of foreign models, such as the t-headed pins, suggests that long-distance contacts with the same environments were already in place. Considering this long time span of use, the continuity and homogeneity of the funerary rituals and material repertoire appears striking (Bailo Modesti and Salerno, 1998; Bailo Modesti, 2006). Later Copper Age communities seem to respond in a different way to foreign influences. The evidence available for the period suggests a more receptive environment, more variable and propense to re-adapt foreign models and ideas as exemplified by the site of Acerra. Similar evidences are already available for the area of Rome where the local production of typical Bell Beakers and their local re-adaptation took place roughly in the same period (Auricchio and Medeghini, 2020). In the Campania Region, the absorption and remodelling of foreign influences will directly result in the codification of another repertoire and set of habits emerging in the Early Bronze Age culture of

Palma Campania. The ongoing research on these sites involving archaeometric analyses on ceramic and metal objects, isotopic and aDNA analysis of the populations, will probably contribute to the biographies of objects and life histories to reconstruct a more complex and intertwined broader historical picture.

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On the Edge of the Swamp. Absorption and Transformation of the Bell Beaker Phenomenon in the Later Copper Age Settlement of Poggioreale (Naples - Italy)

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Abstract: In this contribution we present some reflections on an important context of materials found during the preliminary excavations for the construction of the Poggioreale station of the Naples L1 underground.

The sequence, datable between the advanced Copper Age and the early phase of the Bronze Age, allows us to document the presence of an important occupation on the slopes of the hill and the related arrangement of the river banks.

The corpus of materials consists in abundant fragments of both common ware, and semi-fine and fine pottery, which represent an extraordinary and characteristic variety in decorative motifs. In addition to pottery, the presence of an abundant lithic industry is documented, and subordinately bone and copper.

Both pottery shapes and decorative motifs attested with a remarkable variety and quality of execution associated to that of the pastes, refer to a late moment of the Laterza facies which sees progressive hybridisation with Bell Beaker, Cetina and Eastern Europe elements, giving life to a particular cultural aspect, very similar to that of the 'dragged comb ware'.

Keywords: Bell Beaker culture, Laterza facies, Cetina Horizon, Chalcolithic, syncretism, hybridisation, Italian Prehistory.

Introduction

This contribution is intended to provide some data on the archaeological investigations preliminary to the construction of the Poggioreale station of line 1 of the Naples Underground. It is located in the eastern sector of the city, on the slopes of the Poggioreale hill which rises up to an altitude of 80 metres above sea level, and dominates the topographical basin determined by the Sebeto river plain, affected by sedimentation of a humid marshy environment until modern times. Today the area is occupied by the industrial zone of the city (Figure 1a-b).

The excavations and geoarchaeological core-drilling have made it possible to reconstruct the complex and articulated palaeomorphology of the area determined by the tufaceous substrate on which the eruptive levels, attributable to both the activity of the Phlegraean caldera and the Somma Vesuvius complex, have been deposited in the last 13,000 years. In the prehistoric and protohistoric ages, the area was then furrowed by deep palaeo-channels, progressively filled.

During the excavation, various evidence was identified that can be traced back to the layout of the territory of the city of *Neapolis* which, starting from the Roman age and up to the modern age, characterises this area; a significant discovery is a short stretch of the road axis out of the city, dating from the Roman Republican

age up to the beginning of the imperial period, then abandoned owing to the Vesuvian eruption of 79 AD, as well as a section of the Bolla aqueduct dating back to the Byzantine age. In the fifteenth and sixteenth centuries, this area continued to be crossed by an important road axis that left the city and led first to the famous Aragonese residence and then continued towards the hinterland. This territory is well known through cartographic sources and whose arrangement determines a deep shaving action, but also from branches of the Bolla aqueduct (Figure 2b).

Of particular importance are the data that emerged for the prehistoric and protohistoric periods, when the area, characterised by steep gradients, was scored by deep palaeochannels (Figure 2e). These were then progressively filled between the Bronze Age and the historical era by heavily humified eluvial sediments on whose surfaces traces of cultivation are evident – plowing furrows, which document stasis in sedimentation.

The subject of this contribution is the important evidence relating to a settlement context that developed on the banks of one of the palaeo-riverbeds that furrowed the area. It was located on the slopes of the Poggioreale hill and a short distance from the marshy area near the Sebeto river. The levels ascribable to it, dating back to the end of the Chalcolithic, are identified immediately above the volcanic deposits attributable



Figure 1: Topographical framework of the Poggioreale site.

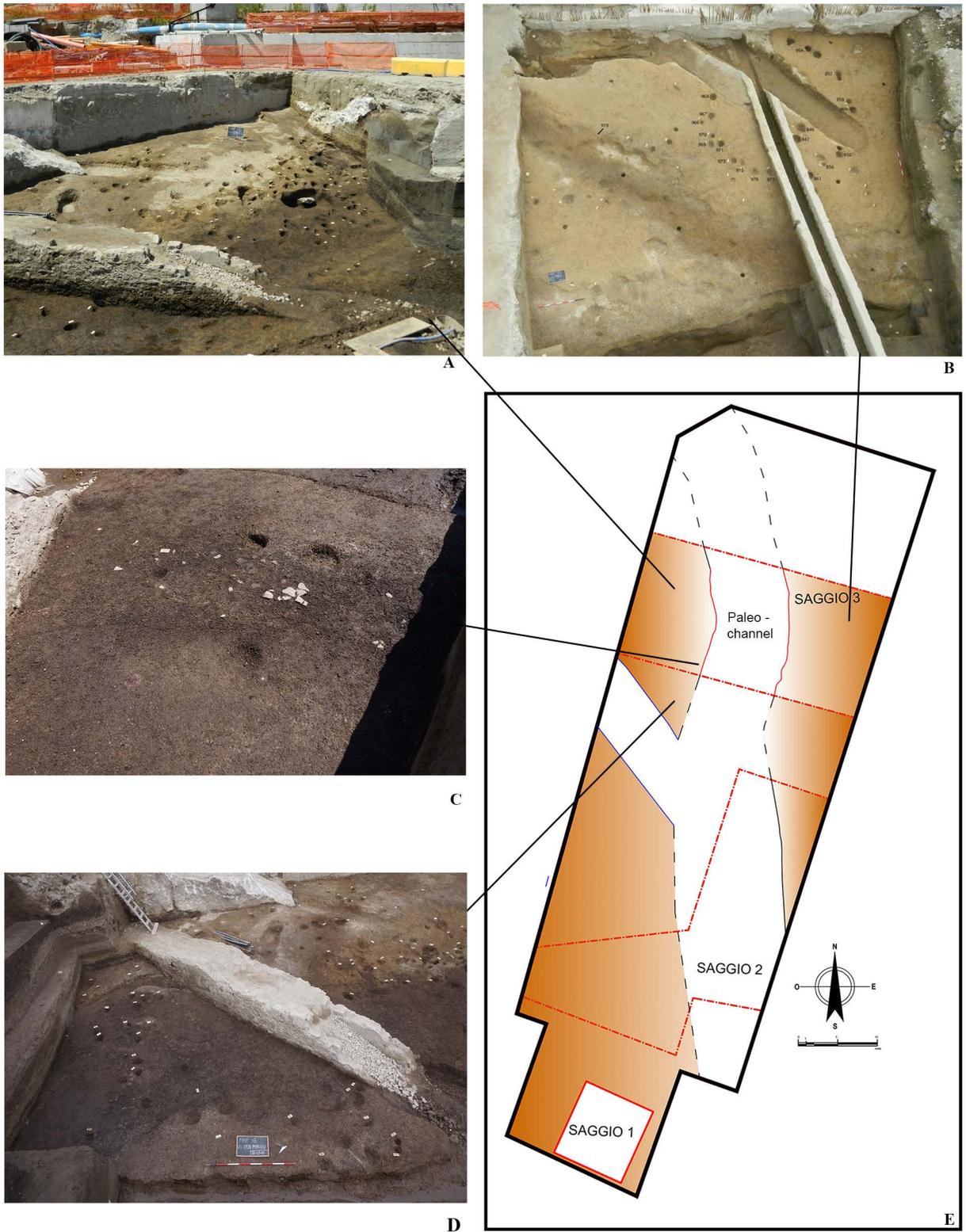


Figure 2: A) western bank of the palaeochannel; B) western shore of the palaeochannel and the hut; C) reclamation layer of the western bank with a potsherd; D) reclamation layer of the western bank.

to the Phlegraean eruption of Agnano-Monte Spina (CAMS35681: 4130±50 BP, 2760-2620 BC; de Vita et al, 1999; Smith, Isaia and Pearce, 2011) and are sealed by the ashes of three of Astroni's Phlegrean eruptions – dated to the second half of the third millennium BC (Smith, Isaia and Pearce, 2011). The chronological data available for the eruptions give us useful *ante* and *post quem* terms for the formation of the archaeological levels, for which radiometric dating is in progress.

The site

The conservation of the archaeological levels has peculiar characteristics on the two banks of the palaeo-riverbed, being strongly conditioned by palaeomorphology. The eastern bank is in fact characterised by marked slopes both from north to south and from east to west and the consequent strong erosive dynamics that led to the lack of conservation, except for some parts, of the palaeosoil formed above the eruption of Agnano-Monte Spina as well as the progressive subsidence of the bank of the valley itself. On the surface of the so-called member C of the eruption it was possible to identify and investigate a circular hut, damaged by posterior cuts, but the perimeter of which is clearly legible due to the presence of the 17 postholes relevant to the elevation of the wall and the two holes relevant to the internal support posts (Figure 2b). The structure has a diameter of about seven and a half metres and the postholes have a depth ranging between 20 and 40 cm. We have to consider that the structure was set on palaeosoil which increased on the eruption and therefore the postholes were much deeper. The hut finds precise comparisons with structures of the same period investigated in Gricignano d'Aversa (Fugazzola Delpino e 2003, fig. 1, Fugazzola Delpino, Salerno and Tinè, 2007, fig. 2), in Gaudello in Acerra (Boenzi et al, 2019, di Vito et al, in press), Afragola (Nava et al, 2007) and Trasano near Matera (Guilaine, 2016, fig. 15). It was bounded by a natural reservoir, probably a runoff that ran down the slope (fig. 2b, US 919). Unfortunately, the strong erosion activity did not allow diagnostic materials to be preserved, but in the palaeosoil we find fragments of common ware and jars for foodstuffs, obviously the heaviest and least subject to sliding phenomena.

Different sedimentation dynamics characterise the western banks, which are also characterised by a very strong slope from west to east (Figure 2a-b-c). In the upstream area, subject to substantial erosion phenomena, evidence was investigated on the surface of the thin palaeosoil on Agnano- Monte Spina eruption that can be traced back to the edge of a settlement area (Figure 2a), associated with materials attributable to an evolved Laterza horizon confirmed by the absence of the characteristic 'paterna', the fossil guide of the facies. There are fragments of decorated pottery with open

shapes and triangular motifs filled with dots (Figure 3.1-2; Figure 4.1) that are comparable with finds from Foglianise (Langella, 2005, fig. 4, 4b; Langella et al, 2008, fig. 5.1), Quadrato di Torre Spaccata (Anzidei et al, 2020b, fig. 2.5. 52.36-37), Osteria del Curato in Rome (Anzidei et al, 2020b, fig. 2.5. 472.16-17; Carboni and Anzidei, 2013, fig. 2, 9) and the settlement at Afragola (Nava et al, 2007, fig. 5c). There are also examples of bowls with a partial decoration of triangles filled with dots, which do not seem to have precise comparisons.

Almost intact forms were also recovered, such as a cup with a high carinated shape and everted rim found upside down near a fireplace (Figure 4.2). The surfaces of the artefacts are always well polished and the mixtures are fine, a similar specimen is attested at Oliva Torricella (Soriano and Livadie, 2016, fig. 2), but there are no precise comparisons for the base.

However, there are also examples of real 'hybrids' – rounded profile bowls that bear complex decorations with an engraved band covered with oblique strokes, below which an engraved band filled with rows of dots is set and also followed by engraved triangular motifs, always filled with oblique strokes (Figure 3.4, Figure 4.3). In this case the decoration is completely filled with white paste and the surfaces are strongly polished. The mixture is black, fine with no inclusions and very compact, the thicknesses are rather thin, about 3 mm.

Where the west bank degrades, unlike the east one, thick humified levels rich in organic material have been identified between the eruption of Agnano-Monte Spina and that of Astroni 6, the placement of which as well as natural phenomena is determined by anthropic actions related to the arrangement and reclamation of the riverbed (Figure 2c-d). This activity is evident in the potsherd levels (Figure 2c) which have yielded a large amount of material, not only ceramic.

It is precisely from these levels that the presence of a large amount of ceramics was found, attributable to a phase of hybridisation between the Laterza facies, the Bell Beaker horizon and the Cetina one, the so-called facies of Ortucchio or of the 'dragged comb ware' (Carboni 2020b).

The finds

Among the open forms, classic globular bowls decorated with double, triple or quadruple bands obtained with incised oblique strokes or by engraving with the 'dragged comb' technique are documented, which go back to phase I of the Ortucchio facies, or with fields with 'thin cord technique', typical of the Bell Beaker horizon (Figure 3.3-6). This type of artifact finds comparisons with the pseudo-Bell Beaker materials of the Rome area (Casetta Mistici: Anzidei et al, 2020b, fig.



2.5. 66, 4; 8; Torre della Chiesaccia: Anzidei et al, 2020a, fig. 2.4.204, 5; Osteria del Curato via Cinquefondi: Anzidei et al, 2020b, fig. 2.5.506, 12; Tenuta Quadraro – Via Lucrezia Romana: Anzidei et al, 2020b, fig. 2.5.554, 16, 18) and the settlement and cemetery of Gaudello in Acerra (Mancusi and Bonifacio, 2020, fig. 6.3, fig. 7.4, 5).

However, there are examples of bowls with straight rims and engraved dragged-comb decoration with an upper band covered with an oblique hatch, under which an incised triangular decoration is set, always covered with oblique lines. (Figure 3.7; Figure 4.4).

In association with the above-mentioned finds there are bowls with a continuous rectangular panel decoration fielded with a 'cord' motif and filled with white paste (fig. 3, 8-11) that are comparable to a bowl with an everted rim from Casale Massima (Anzidei et al, 2020a, fig. 2.4.192, 1), Quadrato di Torre Spaccata (Anzidei et al, 2020b, fig. 2.5.50, 11, 19) or Casetta Mistici (Anzidei et al, 2020b, fig. 2.5.66, 13, 15). In this case, the treatment of the surfaces is very different, they are splinted with shimmering polishing and have a maximum thickness of 4 mm. The mixture is fine and is a type of prestige fine ware.

With the same type of mixture, the presence of a cup with a slightly everted rim and decoration with triangles filled with circles is documented (Figure 3.12), which is compared with the materials from Quadrato di Torre Spaccata (Anzidei et al, 2020b, fig. 2.5.52, 39, 41, 42) and from the site of San Fili referable to the Calabrian facies of Zungri-Corazzo (Pacciarelli, 2012, p. 281, fig. 14, 4).

There are also fragments of fired cups and a beaker with a grooved band decoration filled with a continuous 'triangular' grooved motif (Figure 3.13). They can be compared with the Bell Beaker materials from the sites of Ortucchio (Carboni, 2020, fig. 3.8.1, 11), Valle dei Morti in Rome (Anzidei, Carboni and Ragni, 2020, fig. 2.6.23, 2) and Gaudello in Acerra (Mancusi and Bonifacio, 2020, fig. 9, 2). Cups have well polished surfaces with a colour that slopes down towards brown-red, while the glass has a gray color; a typical characteristic of the cultural horizon mentioned above.

Some fragments, on the other hand, have decoration in pairs of lines obtained with the 'groove' technique that form triangular motifs in the 'dragged comb' style (Figure 3.14-15); they refer to fragments from the Roman territory (Vermicino- Vigna di San Matteo site: Anzidei et al, 2020b, fig. 2.5.572, 2.5.573, 1; Osteria del Curato - via Cinquefondi: Anzidei et al, 2020b, fig. 2.5.467, 5, 8; Trigoria- via de Zerbi in Rome: Anzidei et al, 2020a, Fig. 2.4.198, 6) and to single-handled cups with a continuous profile found in the ritual complex of Fosso Conicchio (Viterbo) (Fugazzola Delpino and

Pellegrini, 1999, tav. II, 2). The surfaces of the fragments are highly polished with a colour that fades from dark-ocher to brown-gray and the mixtures are fine.

Some finds show the association of decorations described above. In fact, there are fragments of bowls with a pair of two furrowed lines, below which two incised bands are set and filled with incised oblique hatching (Figure 3.16). The mixture is fine red-brown in color, with an almost total absence of inclusions. The surfaces are heavily burnished. This typology of artifacts falls more within the Bell Beaker panorama, finding few comparisons in the peninsular area.

Of great interest are the large carinated or rounded-profile bowls that show a highly articulated geometric decoration (Figure 3.17-18; Figure 4.5-6). The decorative typology is divided into two styles: the first (Figure 3.18; Figure 4.5) presents a series of geometric lines forming triangular motifs with continuous oblique hatching obtained with the 'dragged comb' technique; the second (Figure 3.17; Figure 4.6) is characterised by an organised sequence of complex geometric motifs broken up with triangular meanders, however, with the 'cord' technique. In this case it is possible to speak of complex Bell Beaker materials whose decorations do not find precise comparison in Italy, but in the deep Balkan area, specifically, with the most ancient 'combined decorations' on the wall structure and on the pottery of the Chalcolithic site of Tell Yunatsite in Central-Southern Bulgaria (Todorova 2003, tab. 5, 3-4; 7, 27-28; Boyadzhiev 2015, fig. 4, 15), where the end of the Chalcolithic phase dates to 4100 BC .

A fragment of a globular jar with a short neck and continuous decoration in bundles of five furrowed lines that form continuous panel motifs pertinent to the typical Cetina influences has been found; in this case the mixture is light beige, very fine, without inclusions and strongly purified (Figure 3.20; Figure 4.7). Both the shape and the decoration do not find close comparisons in the Tyrrhenian area.

These artefacts are associated with productions, perhaps local, of low carinated bowls and with decoration always in bundles of five furrowed lines forming panels (Figure 3.19, Figure 4.8) whose decorative motif is comparable with the artefacts coming from the site of Trigoria via de Zerbi (Anzidei et al, 2020a, fig. 2.4.198, 2).

The site does not lack fragments of undecorated bowls, in a semi-fine mixture with polished surfaces, rounded rim slightly introflexed and slightly heeled bottom. Among the undecorated shapes there is an intact single-handled cup, with an everted rim and a ring handle in fine black mixture (Figure 3.22), which shape finds comparison with a artefact from Fosso Conicchio (Fugazzola Delpino and Pellegrini, 1999,

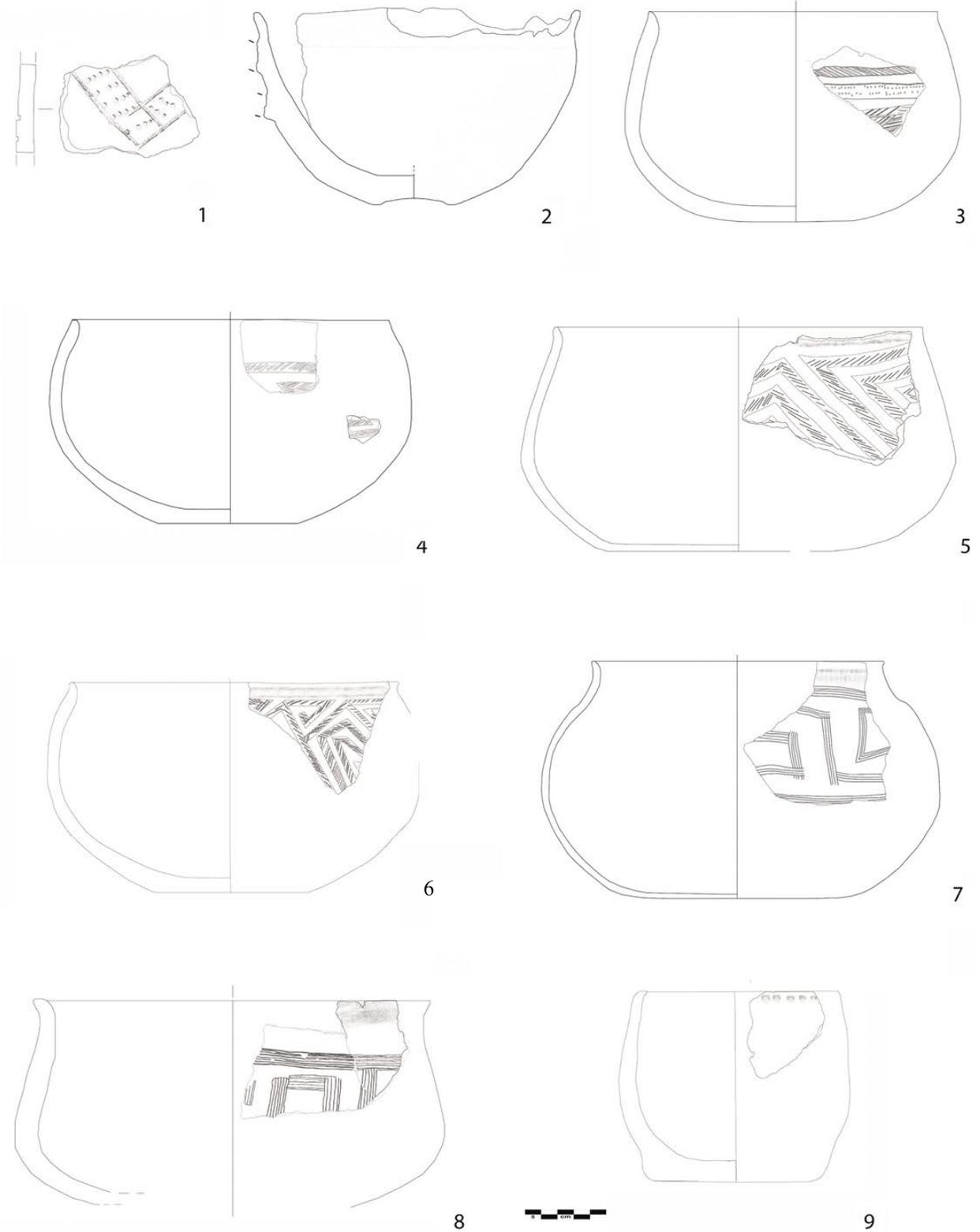


Figure 4: Pottery from the context of Poggioreale (scale 1:3).

tav. III, 26), but the one from Poggioreale has a handle set on the edge. Also interesting is the discovery of a miniaturised bowl, made of coarse dough, which can serve both as a container and a lid (Figure 3.23). The presence of an elbow handle with a developed tongue cant (Figure 3.21) is also documented, which finds comparisons with some finds from Tenuta Quadraro – via Lucrezia Romana (Anzidei et al, 2020b, fig. 2.5.555, 20). Sometimes decorated close shapes in coarse dough are also well attested. There is a beaker with an everted rounded rim under which a punch decoration is set (Figure 4.9, Figure 5.1), which is comparable with a find from Osteria del Curato, via Cinquefrondi (Anzidei et al, 2020b, fig. 2.5.5507, 1) and a jar with a flat rim and decoration with deep grooves (Figure 5.2), which also finds similar comparisons to Osteria del Curato – via Cinquefrondi (Anzidei et al, 2020b, fig. 2.5.472, 26).

The plastic decorations documented on jars with vertical ribs are well attested (Figure 5.3), which fully fall within the decorations of the Lazio contexts of the Ortucchio facies (Torre della Chiesaccia, Osteria del Curato via Cinquefrondi: Anzidei et al, 2020b, fig. 2.5.468, 19, 540, 44), and in the Ortucchio site (Carboni 2020, fig. 3.8.1, 6) there are also bowls with double button-shaped ashlar (Figure 5.7) that find comparisons with Lastruccia in Tuscany (Sarti and Leonini, 2007, fig. 7.14). Of particular interest is a fragment of a lid, in semi-fine black mixture with concentric plastic rib decoration (Figure 5.10).

For the foodstuff forms there are jars and dolia. The former have typed rims and large sockets set just before the point of maximum expansion of the vessel, or a rounded and introflex rim with developed button sockets (Figure 5.6, which have comparisons with Torre della Chiesaccia: Anzidei et al., 2020a, fig. 2.4. 208, 20-26; Casetta Mistici: Anzidei et al., 2020b, fig. 2.5.62-1). The dolia, on the other hand, have plastic decorations with a typed cord that is set between three and five centimetres below the rim of the vase (Figure 5.5). In some storage forms there are plastic decorations with saddle bosses (Figure 5.4, which have comparisons with Torre della Chiesaccia: Anzidei et al, 2020a, fig. 2.4. 208, 25). Many fragments of pots in coarse mixture have restoration holes, almost always through holes (Figure 5.8), only in case there is a pair of holes, one is through and the other is not (Figure 5.11). In coarse dough there is also a perforated ring bottom (Figure 5.9).

Near to the ceramics there is the presence of large fragments of cooking plates with a smooth main surface (Figure 5.12) and with an insulating level of whitewash (Figure 5.13). The lower surface is rough and sometimes bears the traces of the support surface. There are also small spindles for weaving (Figure 5.14).

Of particular importance is the industry on bone as well as an intact awl (Figure 6.1 – which have comparisons

with Osteria del Curato via Cinquefrondi: Anzidei et al, 2020a, fig. 2.5.551,2; Stellacci 2020, fig. 10.5 2,b); the discovery of a small bone plate bearing the incised decoration of a fish is exceptional and today seems to be unique in the panorama of this facies having no precise comparisons (Figure 6.4). Other bone plates were found from the levels in phase with the latter along with reworked fangs as tools (Figure 6.2).

Some data and finds suggest the presence of activities related to fishing. The previously described bone awl refers, ethnographically, to the large bone needles used by fishermen to weave nets. Furthermore, the discovery of a fictile fishing spool (Figure 6.6), together with a hook and a copper awl (Figure 6.5), seem to confirm this hypothesis.

The lithic industry is also well represented. Working splinters were found, even of large dimensions and still with the presence of cortices (Figure 6.9), associated with finished products such as blades, cut-off blades, lamellae (thin blades), points and transverse scrapers (Figure 6.7). The retouching is inframarginal, not very invasive; the artefacts never seem to have traces of rework and some blades show use-wear traces (Figure 6.8). There were two supply points for the raw material: the Campanian Apennines and the Gargano area. The artefacts have not been washed as they must undergo specific analyses on residues and use-wears.

Lastly, we point out the presence of a votive idol (Figure 6.3), which also seems to be characterised as a unicum in this panorama. The artefact has a double interpretation: as an anthropomorphic idol with rounded head and hinted legs or, turning it, as a zoomorphic idol with horns and bull snout.

Conclusions

Most of the materials presented in this work come from unit levels of drainage and reclamation created to fix the banks of the palaeochannel at the boundaries of the settlement; therefore the arrangement and the association of shapes and decorations do not allow us to highlight a chronological typological series of artifacts. The layers that have produced these materials are accretions that cover the humified palaeosurface above the deposits of the Agnano-Monte Spina eruption and are sealed by the eruption of Astroni. In the upper part of the western bank, as well as in the eastern one the sedimentation /erosion characteristics did not allow the formation or preservation of successive levels of development of the palaeosols. The area was probably abandoned at the time of the deposition of the ashes from Astroni. Subsequently, in a no better definable moment of the ancient Bronze Age preceding the deposition of the ashes of the Avellino eruption, the area was affected by substantial traces of cultivation.

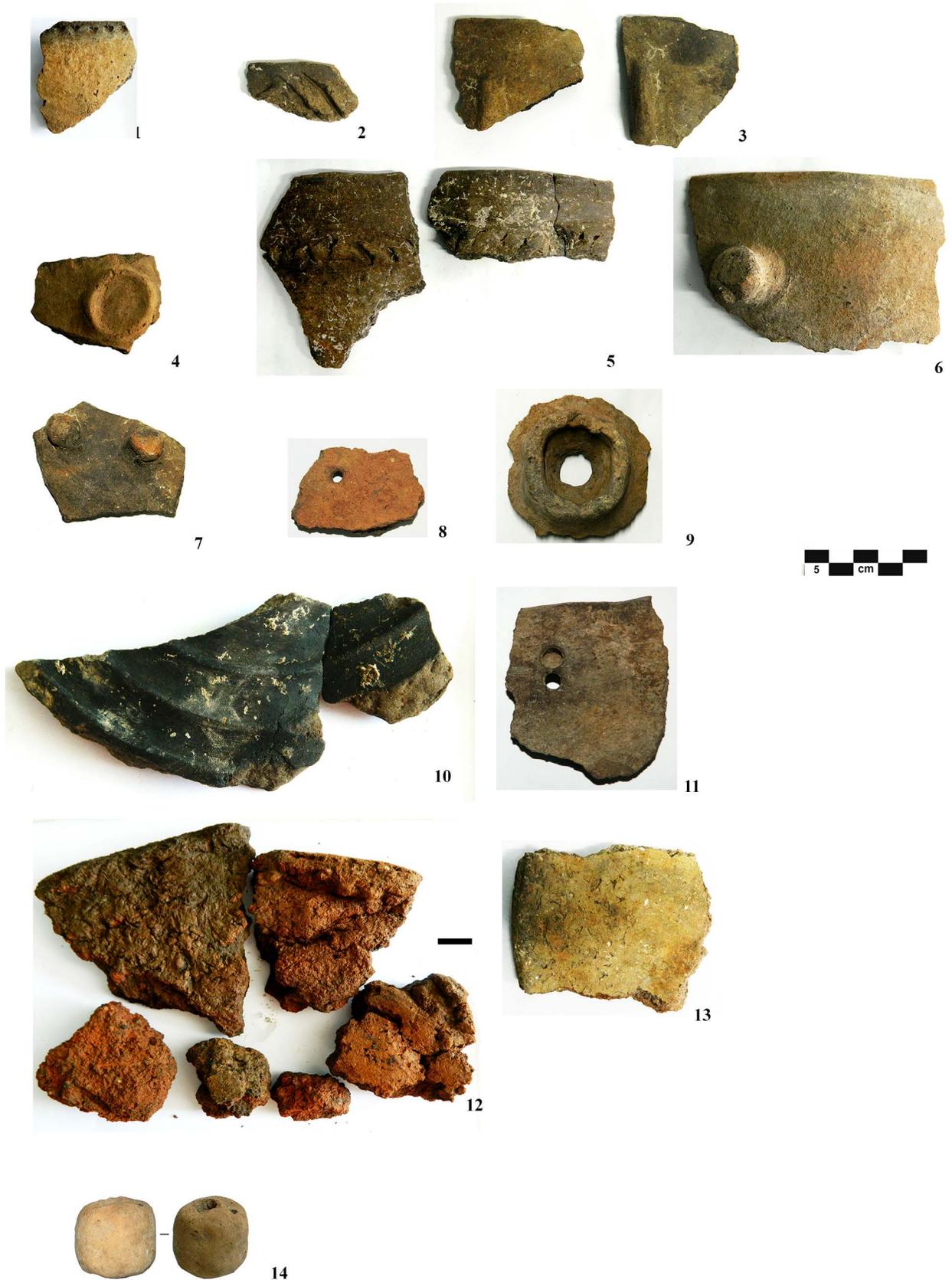


Figure 5: Ceramics and other artefacts from the context of Poggioreale.



Figure 6: 1-2-4) Bone industry; 3) votive idol; 4) bone with a fish incised; 5) Copper industry; 6) fishing reel; 7-8-9) Lithic industry.

Ceramic materials belong both to fine ware and to common ware, which together with other industries: lithic, bone and metal, fully refer to a peculiar context.

For the prehistoric and protohistoric eras, the context of Poggioreale has yielded a good quantity of materials, 11,562 fragments, of which about 76% fall within the context presented here. Of this 76% about 50% is made up of fine open ware, richly decorated. The study of the latter is still in progress, but allows us to attribute the finds to an advanced moment of the Laterza facies with very strong Bell Beaker influences. In fact, the characteristic elements of the most ancient phase of the aforementioned facies are completely absent, like the patera, handles with a plastic raised button and imbricated pottery, present instead in Gricignano, but above all in Carinara (Laforgia et al, 2007), which seems, to date, to be one of the oldest Laterza contexts in the Campania plain. In the Poggioreale context both the shapes and especially the decorations lead back to a phase of hybridisation between the Laterza facies, the Bell Beaker horizon and the Cetina and Aegean aspects, called the Ortucchio facies or dragged comb ware in the literature (Carboni 2020b).

The materials find stringent analogies with contemporary contexts of the Lazio area (Anzidei Carboni, eds 2020) and in part with the sites of the Campania plain of Afragola, Gricignano and Acerra in the Gaudello area. The quality, complexity and heterogeneity of the decorative apparatus of Poggioreale materials seems, however, to be greater than that of the sites mentioned. This is clearly evident from the complex decorations on the pottery fragments of Poggioreale, some of which find precise comparisons in the decorative engravings on the walls of the structures of Yunatsite (fig. 3.17-18; fig. 8.1-2), certainly older than our site. This type of ceramic with such articulated decorations only partially finds comparisons within the whole Italian territory; on the other hand, the bone plate that bears the incision of a fish does not find any comparisons in our territory.

During the last phase of the Eneolithic to Early Bronze Age, there is a very strong opening of the Laterza facies towards external models, probably derived from contact with new structured groups. On the part of the Laterza people we are witnessing an absorption of new cultural flows where a phenomenon of syncretism is evident in the elaboration / association of ceramic forms, decorations and types of mixtures. This is very evident in the Poggioreale context where permeation of models, ideas and styles appear very strong. In all the decorative motifs there is a clear influence and a legible absorption and assimilation of Bell Beaker motifs and shapes that mix with some decorations of the Cetina horizons, creating a process of hybridisation. A cultural aspect is highlighted with a completely

new local ceramic production both in the particular workmanship of the mixtures and in the remarkable quality of the very articulated decorations.

This hybridisation phenomenon must have had a long incubation period, born from an overlapping and intertwining of different itineraries of cultures, styles and ideas.

The site of Poggioreale fits perfectly into the pattern of settlements close to rivers such as Gricignano and Gaudello in Acerra, both located adjacent to the course of the Clanis, and Afragola on the edge of the Sebeto depression (Figure 7); the same subsistence model can be seen in the distribution of the sites in the Roman area (Carboni 2020b, p. 211). It is likely that the location of the settlements near water courses was connected to the climate crisis that occurred in the Chalcolithic (Celant and Magri 2020, pp. 34-36). The Agnano-Monte Spina eruption (4482-4625 BP, Smith, Isaia and Pearce, 2011, pp. 3638-3660) marks the beginning of a dry phase that culminates between 4.2 and 3.9 ka BP (2200-1900 BC), which chronologically corresponds with the phenomenon called the '4.2 ka BP mega-drought' (Weiss 2017, pp. 69-161) or '4.2 ka BP Event' (Bini et al, 2019, pp. 555-577). These terms indicate the rapid and systemic period of climatic change – not uniform but variable during the third millennium across Europe and the Mediterranean basin (Kleijne et al. 2020, Schirrmacher et al. 2020). According to some authors, this would have caused progressive collapse and the beginning of a strong mobility of human groups from the areas of the ancient Near East (Karol 2020). For these reasons the depression of the Sebeto river, the marshy area surrounding it and the plain of the Clanis river seem to constitute, during the phases of the final Eneolithic - Early Bronze Age, important attractors for the establishment of settlements. The latter are arranged along the Tyrrhenian belt, between Lazio, Campania and the first offshoots of Abruzzo (Carboni 2020b, fig. 3.8, p. 206), areas that even during this dry phase continue to maintain small wooded portions and marshy lagoons.

With great caution, it could be assumed that there would be a shift from the area hit by the climate crisis to the more hospitable territory on the Tyrrhenian coast, an area rich in river courses, close to the sea, the hills and Apennine chains, but above all a point controlling traffic and rich in raw materials. This hypothesis could explain the distribution of this type of settlement, attributable to this hybrid cultural horizon, which are arranged along 'a hinge territory' which favored the dialectic between northern Italy, with the importation of prestigious metal goods as demonstrated by some tombs at Gaudello (fig. 8.3, 8.4, 8.4.1), between central Europe with the arrival of Bell Beaker pins (Figure 8.5, van Vilsteren 2004, pp. 23-39) and pottery, and between

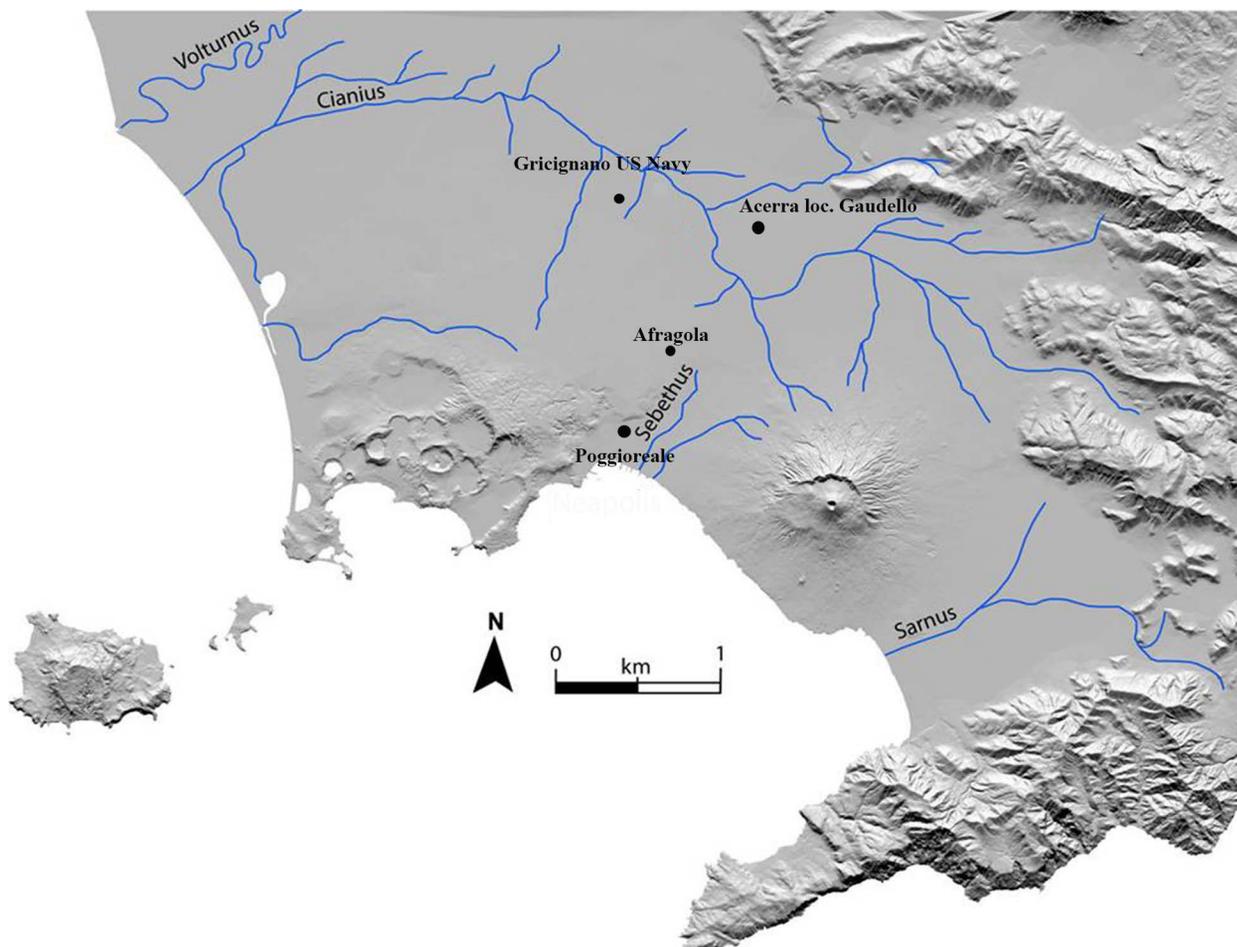


Figure 7: Campania sites of the late Chalcolithic phase located near rivers mentioned in the text.

areas of Eastern Europe, as the articulated decorations present on the ceramic fragments in the context of Poggioreale would attest.

The cultural horizon of the dragged comb ware would therefore originate from the mixture of a complex set of several cultural aspects that were grafted onto the Laterza facies, thus creating learned, shared and common pottery patterns.

According to the current archaeological record, this cultural horizon seems to occupy a very specific territorial area. Instead towards northern Italy, starting from Tuscany, for this period a 'pure' Bell Beaker presence seems to be much stronger and more structured (Leonini and Sarti 2008, p. 126; Baioni et al, 2008); while this form of hybridisation would move between the Lazio and Campania areas, where the heritage of the Laterza facies is strongest (Cocchi Genick 2007, pp. 437-455). In fact, the latter does not seem to extend into the central-northern area except for exceptional cases such as the Laterza jug with an elbow handle and a raised button from tomb II of Saint-Martin-de-Corléans, associated with 'original' Bell Beaker pottery (Sarti et al, 2018, pp. 377-401).

In Campania the influences of the Bell Beaker, Balkan and, probably, Aegean horizons can be documented in the types of ceramic mixtures, in the decorated motifs obtained with both incised and impressed techniques and the arrival of prestigious goods, such as daggers, halberds and pins, found in the tombs of Gaudello (Mancusi and Bonifacio 2020, pp. 49-50). In the Lazio area the Bell Beaker elements seem to be greater than those of the Cetina horizon, which are present, but in a very fleeting way (Carboni 2020b, pp. 225-228).

In the final phase of the Chalcolithic, at the beginning of the Early Bronze Age, the communities that occupied the territories between Lazio and Campania gave birth to a particular cultural enclave that is expressed through the production of completely new and peculiar goods where the presence of external elements referable to the culture of the Bell Beaker pottery are completely clear and legible.

For the reasons expressed above for the context of Poggioreale, the necropolis of Gaudello in Acerra, the advanced Eneolithic phases in Afragola (Nava et al, 2007, fig. 5b-c) and for that which is defined as the facies of Ortucchio and/or of the dragged-comb-ware

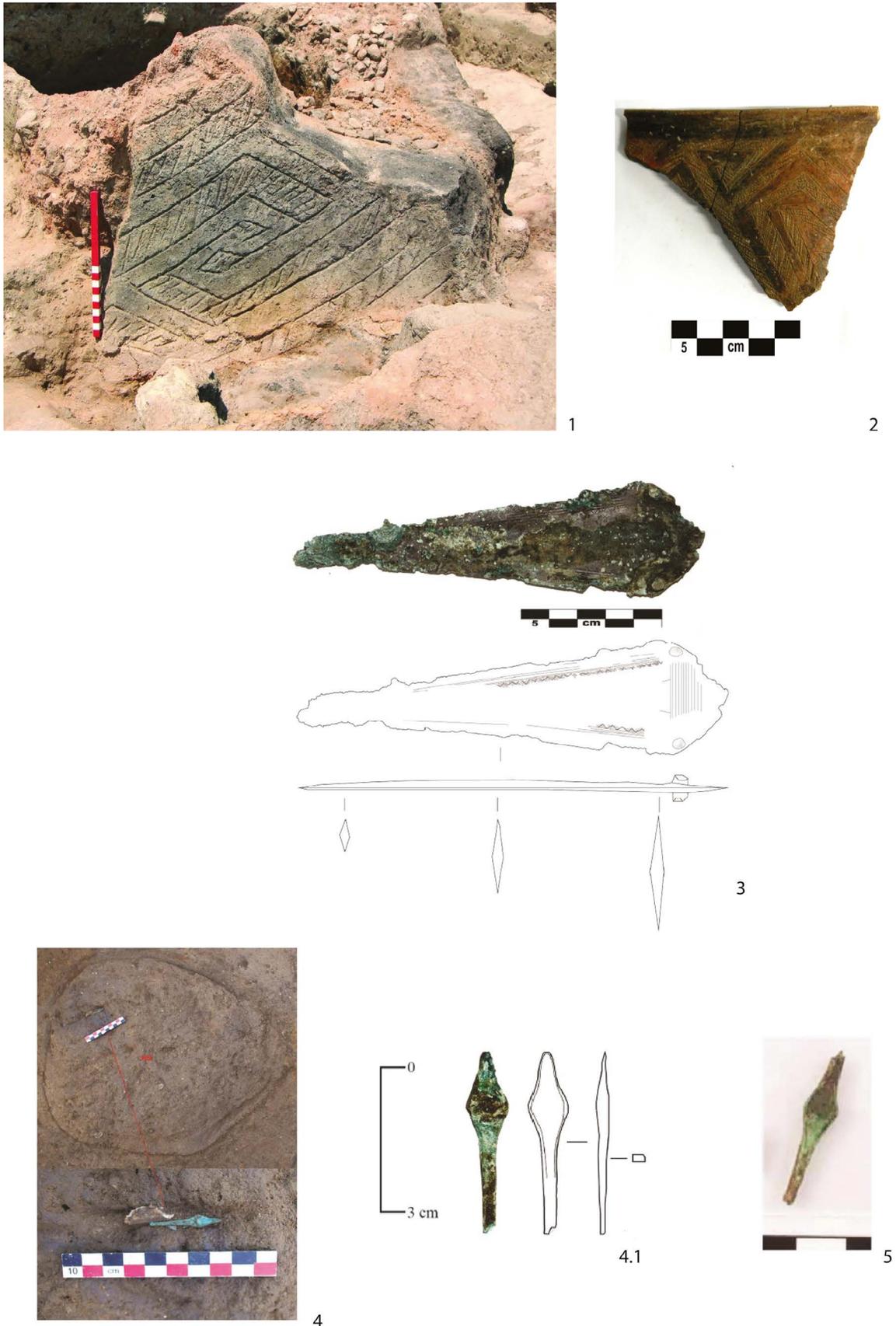


Figure 8: 1) Tell Yunatsite wall with incised decoration; 2) Poggioreale pottery; 3) Bronze halberd from the Gaudello cemetery – Cetina horizon; 4-4.1) Pin with diamond-shaped head from the Gaudello cemetery Bell-Beaker horizon; 5) Pin with diamond-shaped head from Odi's mound in Drenthe, Netherlands – Bell Beaker culture (from van Vilsteren, 2004).

in the Lazio area, the authors prefer to identify a hybrid cultural aspect that originated in the Tyrrhenian belt between the end of the Chalcolithic and the beginning of the Early Bronze Age. The term 'hybridisation' refers to a cultural process where symbols carrying information circulate thanks to verbal and visual communication; with this definition, therefore, we want to denote a characteristic of these cultures that implement a dynamic process of encounter, transmission and exchange.

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Torre Crognola (Northern Latium, Italy): A Large Settlement with Bell Beaker Findings

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Abstract: During an archaeological survey carried out in the 1970s by the *Gruppo Archeologico Romano* (GAR) an important prehistoric settlement was discovered at the site of Torre Crognola, located in northern Latium along the Fiora river, about 3.5 km north of the Etruscan city of Vulci. The survey made it possible to collect in the ploughed fields a large amount of Late Copper Age artefacts, densely distributed over a large area, covering no less than 3 hectares (an extent that ranks in the highest range of contemporary settlements). The material culture of the site is largely attributable to the Bell Beaker culture (in a version that presents interesting comparisons with Sardinia) and the coeval cultural group of central Italy recognised as the *Ortucchio facies*. This latter cultural aspect can now be better studied and understood thanks to the detailed chrono-cultural sequence reconstructed through many excavations carried out in the area around Rome, recently completely published in the comprehensive work *Roma prima del Mito*. The abundance of Bell Beaker pottery and other artefacts of local type, its remarkable extent, and also the presence nearby of several caves and shelters with finds dated to the 4th-2nd millennia BC make the Torre Crognola site an archaeological complex of great potential for the study of the Copper Age, and in particular of the Bell Beaker phenomenon.

Keywords: Copper Age, Bell Beaker, Vulci, Torre Crognola, Survey

Introduction

The recent publication of the two volumes *Roma prima del Mito*, edited and partly written by one of us (GC), has represented a considerable step forward in the knowledge of the Eneolithic of central Italy and especially of the Latium region, which allows us to give a new interpretation of numerous older sites. One of the most critical Eneolithic settlements of Latium is that of Torre Crognola, located close to the Etruscan city of Vulci, near the border with the Tuscany region. This site – which produced very abundant artefacts found during surveys of the 1970s – is known for its relevant Beaker artefacts. The latter were found together with numerous ceramic finds of different types, which can now be framed correctly thanks to comparisons with the sequence of the late Eneolithic of central Italy outlined in *Roma prima del Mito*.

Contextual background

The archaeological surveys conducted in central Italy during the last fifty years have highlighted a significant presence of Bronze Age settlements in almost every explored area. These findings point to a widespread and often intense territorial occupation in the second millennium BC, marking a difference from the Neolithic and Eneolithic sites, concentrated in areas particularly favourable for agricultural and water resources. Two of these areas are recognisable in the plain of Sesto Fiorentino near Florence (Sarti 1997; Sarti, Martini

2000; Leonini, Sarti 2008) and the plain located in the south-eastern periphery of Rome between the Prenestina and Appia roads (Anzidei, Carboni 2020). Another area of concentration is the travertine plain located close to the Etruscan city of Vulci in northern Latium, investigated by the *Gruppo Archeologico Romano* (GAR), an archaeological volunteer association that carried out several archaeological surveys in the Latium region. The site of Torre Crognola, discovered in 1973, is the largest and most important Eneolithic settlement of the Vulci area.

Torre Crognola is located on the western edge of a large travertine platform overlooking the Fiora river. Below the edge of the platform there are steep rocky slopes where numerous caves and shelters of archaeological interest open up (Figure 1B). In the cave called Don Simone, Ferrante Rittatore Vonwiller of the University of Milan conducted a brief excavation, bringing to light Early and Middle Bronze Age pottery (Rittatore 1951). Subsequently, the GAR survey led to the discovery of prehistoric material from the same cave and the so-called Grotta del Lago cave (Pennacchioni 1977). Additionally, a shelter called Le Bagnare with Final Bronze Age materials was found by one of us (MPa) with Giorgio Filippi in 1977 (di Gennaro 1979, note 3, fig. 1 and fig. 3, 4-5). A recent survey carried out by the University of Naples Federico II has identified two other caves and a shelter, with Eneolithic and Bronze Age pottery.

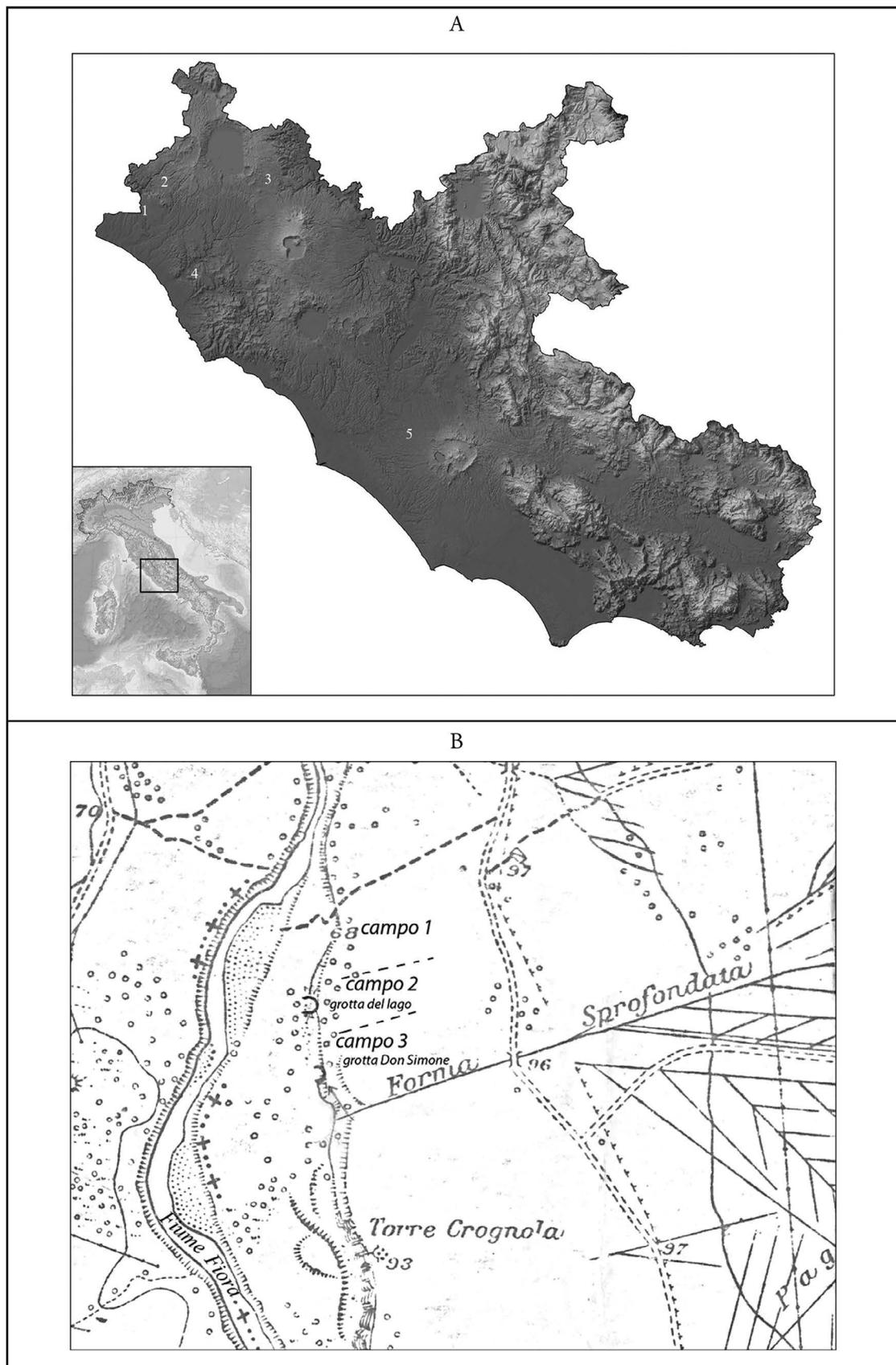


Figure 1: A. Distribution of Bell Beaker sites within Latium mentioned in the text: 1) Torre Crognola; 2) Fontanile di Raim; 3) Fosso Conicchio; 4) Poggio Nebbia; 5) Roma. B. Topography of Torre Crognola with the position of two caves (Grotta del Lago and Grotta Don Simone) and the fields (Campo 1, 2 and 3) investigated by the GAR (Gruppo Archeologico Romano).

However, the most significant findings remain those made by the GAR on the travertine platform in the area north of the medieval tower named Torre Crognola. Here, deep ploughing brought to light an enormous amount of pottery and lithic artefacts across an area of more than three hectares. Those findings point to a vast late Eneolithic settlement, with sporadic Early Neolithic and Recent Bronze Age ceramic fragments. One of us (MPe) promptly published these findings in a monograph that also collects evidence from other sites located in the same travertine plain, including the Neolithic and Eneolithic settlement of Monte Rozzi (d'Ercole 1977; Pennacchioni 1977). The publication assigned the Torre Crognola materials to the Late Eneolithic, highlighting the relevant presence of Bell Beaker pottery (Pennacchioni 1977; 1979). Even if many other Beaker discoveries were made in central Italy in the following decades, the Torre Crognola complex remains one of the most conspicuous groups of artefacts and the largest settlement documented.

More than forty years later, the finds from Torre Crognola deserve to be re-evaluated in order to insert them in the updated framework of knowledge on the Italian Eneolithic, which has seen important discoveries and publications in recent years.

Settlements and cemeteries entirely and organically referable to the Bell Beaker culture are well represented in Northern Italy. Burials in wooden chambers with typical Bell Beaker artefacts, similar to those reported in central Europe, have also been found (Bernabò Brea, Mazziere 2013). In Southern Italy and the Middle Adriatic area, the situation is different. Isolated Beaker pottery finds are attested, with no evidence of settlements and cemeteries entirely assignable to that cultural sphere. A more relevant presence of Bell Beaker sites emerges in central Tyrrhenian Italy (Tuscany and Latium),

where very intensive research was carried out and published in two main areas, giving a strong impulse to the knowledge on the Eneolithic period (Figure 1A).

One of these areas is that of Sesto Fiorentino near Florence. Here, the universities of Florence and Siena carried out several excavations, mainly of settlement sites, and studies of the archaeological record, that provided a chronological sequence for the local Late Eneolithic, divided into four phases or 'steps'. In the earliest step, some classic Bell Beakers of international style and local ceramics are documented, while in phases 2, 3 and 4 a local Bell Beaker style is widely established, characterised by rounded profile shapes and complex decorative motifs (Leonini, Sarti 2008).

The second area corresponds to the south-eastern periphery of Rome. Here a very intense activity of rescue archaeology carried out for more than forty years led to the excavation of dozens of settlements and burials dating to the Neolithic and the Eneolithic. In 2020 one of us (GC), together with our late colleague Anna Paola Anzidei edited two volumes of over 1600 pages, which include an organic publication of this research and archaeometric, bioarchaeological and environmental studies alongside interpretative syntheses (Anzidei, Carboni 2020).

The late Eneolithic of the Rome area was divided into six different phases, well dated using stratigraphy and C. After a first phase correlated with the Laterza culture, there are four phases of the Ortucchio culture group, and a last phase named Epi-Bell Beaker. These phases are quite well correlated with those of Sesto Fiorentino (Figure 2).

The local Ortucchio culture group is associated with some probable ritual vases linked to the latest

Figure 2: Synoptic table with the Ortucchio phases of the Rome area correlated with those of Sesto Fiorentino and other areas.

Dates BC	Rome	Sesto Fiorentino	Other areas
2650-2550	Ortucchio 1 - Local material culture, few Beaker pottery	Step 1 - Local material culture, some beaker pottery (international style)	
2580-2470	Ortucchio 2 - Local material culture, few Beaker pottery	Hyatus?	Sardinia (Marinaru, Locci Santus)
2470-2290	Ortucchio 3 - Local material culture, no Beaker pottery	Step 2 - Local Beaker culture	Emilia (Rubiera)
2290-2130	Ortucchio 4 - Local material culture, few Beaker pottery	Step 3 - Local Beaker culture	Northern Latium (Fontanile di Raim, Fosso Conicchio)
2130-1950	Epi-Bell Beaker?	Step 4 - Epi-Bell Beaker	

manifestations of the Rinaldone funerary cultural tradition, and with some Bell Beaker pottery. The Bell Beaker decorative motifs also partly influenced the local Ortucchio style, but there is a lack of settlements or burials entirely attributable to the sphere of the Bell Beaker culture (Carboni, Anzidei 2013; Carboni 2020a).

The area of Vulci, with Torre Crognola, is placed both geographically and culturally in an intermediate position. Many types of the culture group of Ortucchio, which find comparisons in the Rome area, and a conspicuous amount of Bell Beaker pottery are documented at the site. Here we propose a comparative reanalysis of the finds from Torre Crognola, inserted in the framework of the most updated knowledge.

Torre Crognola: analysis and comparisons

The earliest phase of Torre Crognola could correspond to Ortucchio phase 1 of the Rome area: this phase can be placed, in terms of absolute radiometric chronology, between 2670 and 2550 BC (Figure 3). The main guide fossils are a kind of flat dish, named *teglia* in Italian (Figure 3A,1-2); bowls with rounded profile and with inverted rim, some of which have a typical decoration obtained with a dragged comb (Figure 3A,3-5); troncoconic cups with handle (Figure 3A,6). Among the bowls, there are also carinated examples (Figure 3A,7) and globular ones with a collared edge (Figure 3A,8-9). Typical of this phase is the troncoconic jug with a raised handle (Figure 3A,10). Additionally, there are handles with axe-shaped ends (Figure 3A,12-13) and with horn-shaped ends (Figure 3A,11). The decorations include geometric combed motifs (Figure 3A,8) and other incised ones (Figure 3A, 14). Concerning Bell Beaker pottery, the main context of the Rome area is that of Quadrato di Torre Spaccata, which produced a few fragments belonging to the 'AOC' and to the 'International' styles (Carboni, Anzidei and Delpino 2020). These styles, in the current state of knowledge, are absent at Torre Crognola, but it is interesting that the site began in this first phase of Beaker presence in central Italy.

The next phase of Torre Crognola corresponds to the Ortucchio 2 phase of the Rome area, placed between 2580 and 2470 BC (Figure 4). One of the main contexts of the Rome area is the site of Torre della Chiesaccia (Anzidei et al 2020). Among the peculiar artefacts, there are bowls with strongly inverted rim (Figure 4A,2); carinated cups with a maximum diameter at the rim (Figure 4A,3); globular bowls with a slightly distinct rim or with a slightly inverted rim (Figure 4A,4-5); jars with inverted rim and with engraved triangular motifs (Figure 4A,6). Worthy of note are also geometric and angular motifs obtained with a dragged comb (Figure 4A,7-9).

Typical Bell Beaker pottery attributable to this phase (considering similarities with well-dated pots of the Rome area) is attested at Torre Crognola. The carinated Beakers are among the most characteristic shapes, both plain or decorated with an impressed comb (Figure 4A,10-13). There are also some jars with high everted rims (Figure 4A,14-15). The most common decorations are bands of triangles and angular motifs bordered by lines obtained with an impressed comb. This style is attested at Poggio Nebbia near Tarquinia (Figure 4B,24) (Carboni 2020a) and at the Roman site of Torre della Chiesaccia, where there is a vase quite similar to the types from Torre Crognola (Figure 4B,26-27) (Anzidei et al 2020). This style is also well documented in Sardinia, especially in the south-western sector of the island: here we propose a comparison with pottery from chamber tomb IV of Locci-Santus (Figure 4B,25) (Atzeni 1996).

The following phase is placed between 2500 and 2290 BC, according to the radiometric dates of the Ortucchio 3 phase obtained for the Valle dei Morti site in the Rome area (Figure 5) (Carboni 2020b). Characteristic of this phase are some very open basins (Figure 5A,1), bowls with everted rim (Figure 5A,2) and spindle whorls with radial incised decoration (Figure 5A,10). During this phase, the dragged comb decoration continues, with quite complex motifs (Figure 5A,3). Combed engravings are often combined with circular impressions (Figure 5A,4-8) or with excised decoration (Figure 5A,9).

No Bell Beaker products are documented in the Rome area in this phase. Some comparisons for Bell Beaker pottery from Torre Crognola (Figure 5A,11-14) can be established with sites of Step 2 of the Florentine area and with coeval sites of Emilia Romagna, which have C dates compatible with Ortucchio phase 3. These sites are Olmi 1, area B (Figure 5B,24) (Leonini, Sarti 2008) and Lastruccia 3, layer 6 (Figure 5B,23) for the Florentine area (Balducci 2000), and Rubiera (Figure 5B,21-22) for Emilia Romagna (Bermond Montanari, Cremaschi and Sala 1982). Among the best comparisons, there are some jars or beakers with high everted necks decorated with angular motifs obtained with an impressed comb and with some peculiar patterns, such as lozenge motifs. In the Rubiera site, this style is present on beakers characterised by a rounded profile.

The next phase could coincide with Ortucchio phase 4 of the Rome area, which in terms of absolute C chronology, is placed between 2350 and 2130 BC (Figure 6). The typical ceramic products are troncoconic bowls with a dragged comb decoration (Figure 6A,1); globular bowls with a collared edge – these latter are already present in the previous phases but in phase 4 are characterised by a more protruding shoulder and a more flattened body – (Figure 6A,2,5); biconical jars (Figure 6A,6); and handles with axe-shaped (Figure 6A,4) or button-shaped ends

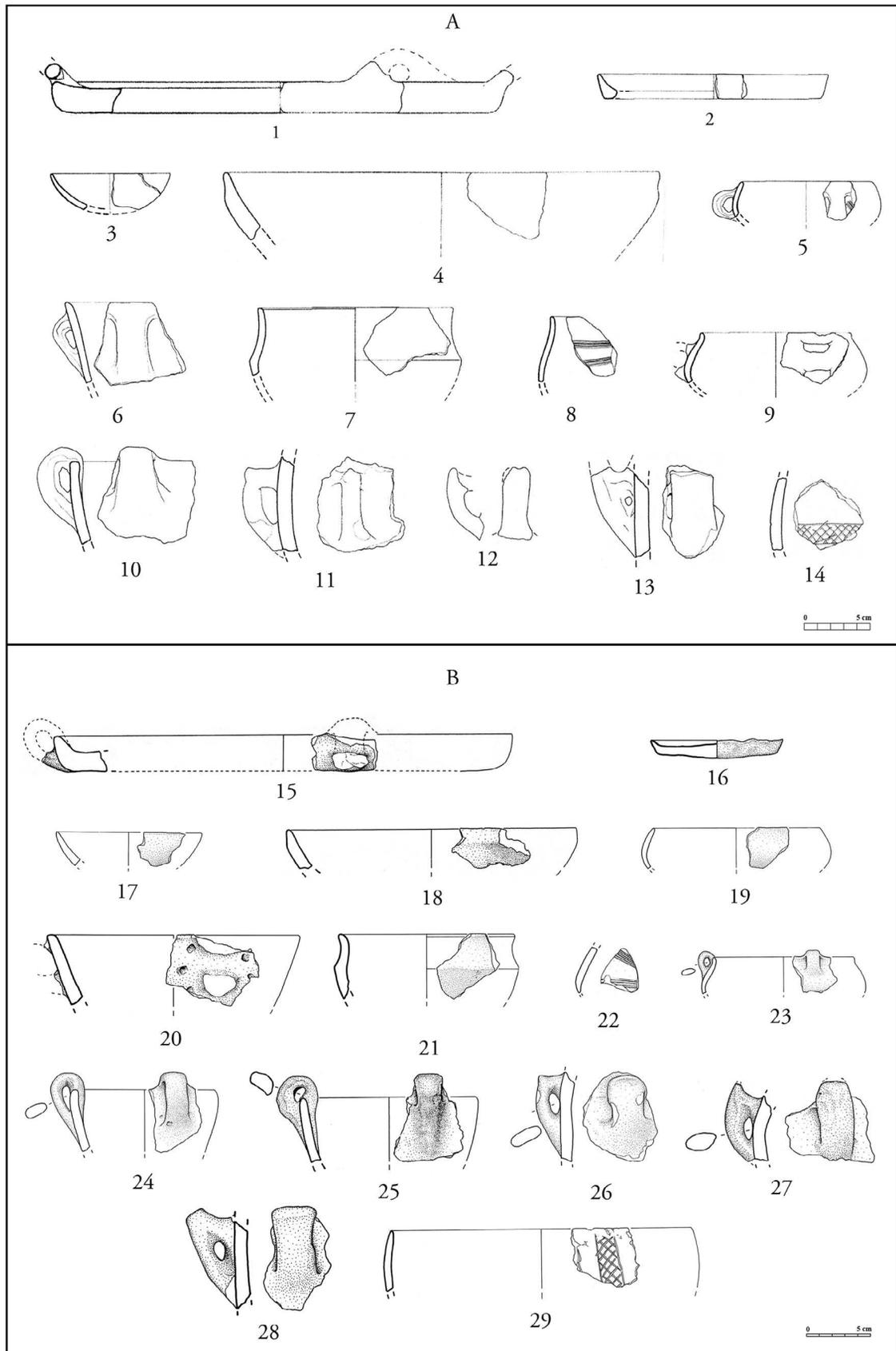


Figure 3: Ortucho phase 1. A. The main guide fossils from Torre Crognola (1/4 size). B. Comparisons with Rome area (Quadrato di Torre Spaccata: 15,16,18,21,25; Osteria del Curato, via Cinquefrondi: 17,19,22-24,26,27; Torre della Chiesaccia 3, abitato zona W: 20; Tor Pagnotta: 28; Piscina di Torre Spaccata: 29).

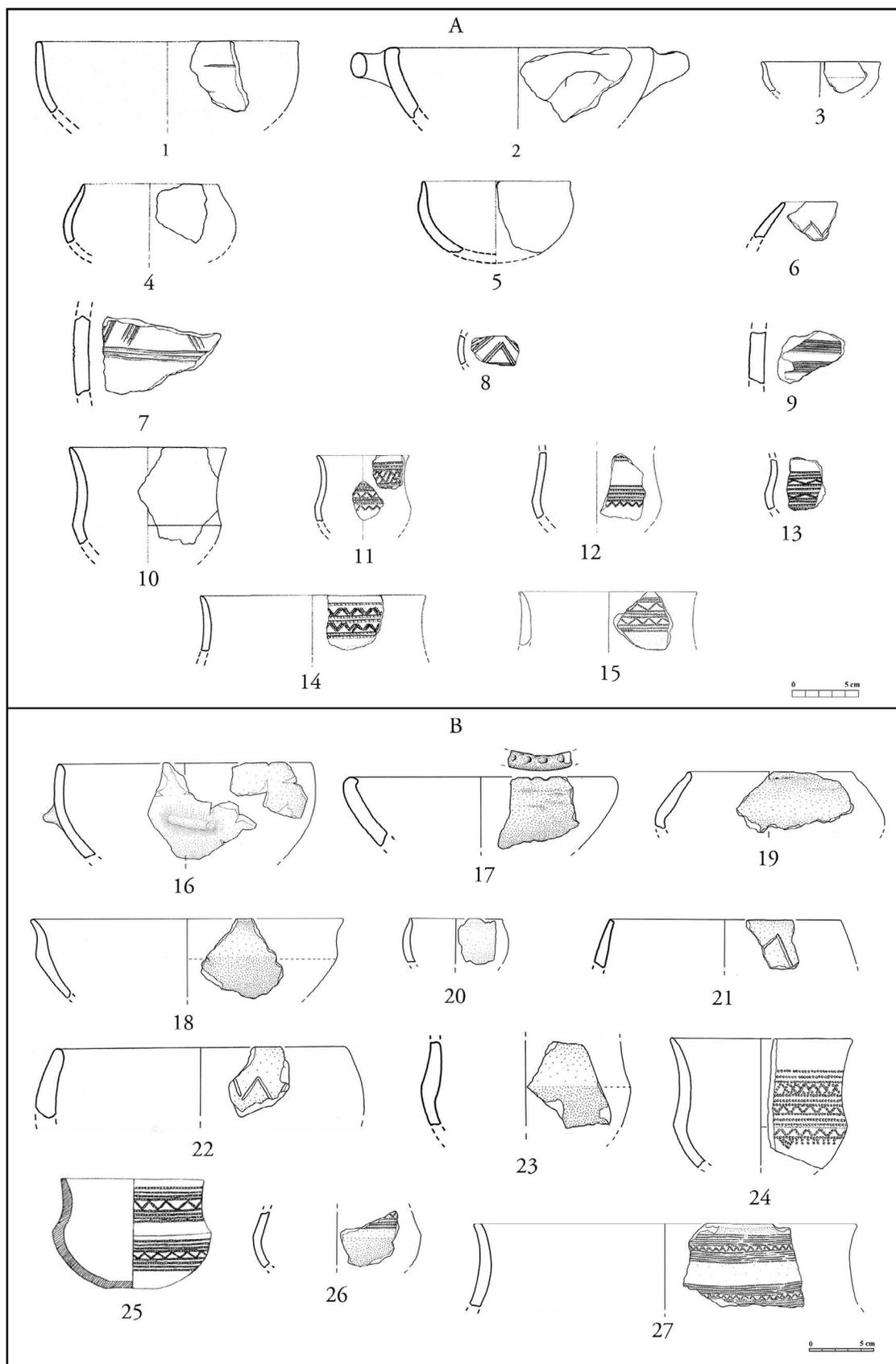


Figure 4: Ortucchio phase 2. A. The main guide fossils (1-9) and Bell Beaker finds related to the same phase from Torre Crognola (10-15) (1/4 size). B. Comparisons with Rome area (Torre della Chiesaccia 2: 17,19-21,26,27; Tenuta della Selcetta 1: 16; Vitellara di Quarto delle Tortorelle: 18,23; Casale del Cavaliere: 22), Northern Latium (Poggio Nebbia: 24) and Sardinia (Locci Santus: 25, no size).

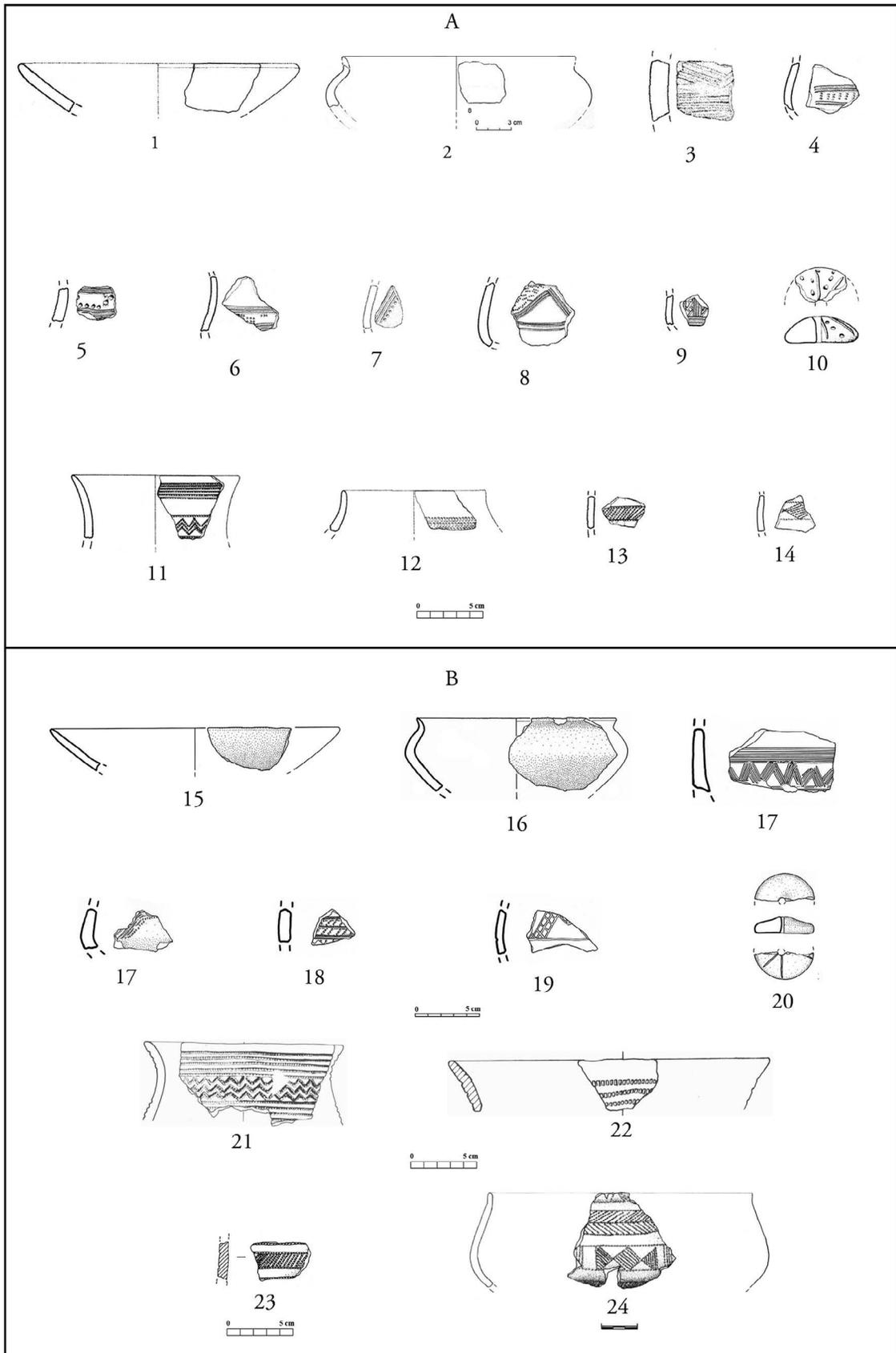


Figure 5: Ortucchio phase 3. A. The main guide fossils (1-10) and Bell Beaker finds related to the same phase from Torre Crognola (11-14) (1/4 size). B. Comparisons with Rome area (Valle dei Morti: 15-20), Emilia Romagna (Rubiera: 21,22 - 1/4 size) and Florentine area (Lastruccia 3, layer 6: 23 - 1/4 size; Olmi 1, area B: 24).

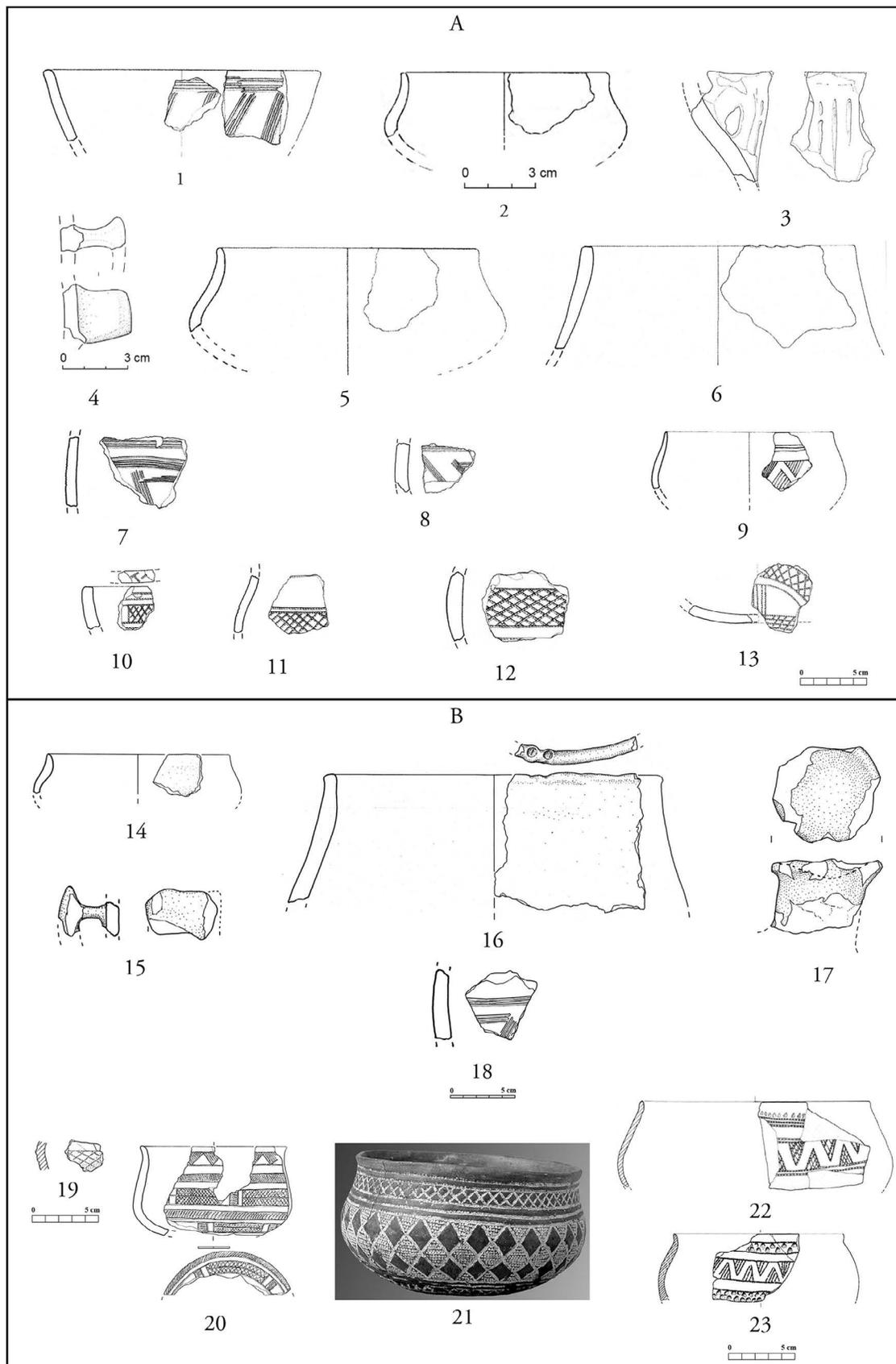


Figure 6: Ortucchio phase 4. A. The main guide fossils (1-6) and Bell Beaker finds related to the same phase from Torre Crognola (7-13) (1/4 size). B. Comparisons with Rome area (Casetta Mistici: 14-18), Northern Latium (Fontanile di Raim: 20; Fosso Conicchio: 21 - no size) and Florentine area (Lastruccia 2B, layer B: 19 - 1/4 size; Lastruccia 1/S: 23 - 1/4 size; Semitella: 22 - 1/4 size).

(Figure 6A,3). In the decorations the peculiar technique of the dragged comb continues, mostly with angular motifs (Figure 6A,7-9).

At Torre Crognola there is Bell Beaker pottery likely attributable to phase 4, such as the fragments decorated with crossing oblique lines obtained by means of an impressed comb (Figure 6A,10-13). This style is present in northern Latium at Fosso Conicchio (Figure 6B,21) (Fugazzola Delpino, Pellegrini 1998; 1999) and Fontanile di Raim (Figure 6B,20) (Carboni 2020a). The latter context has a radiometric date compatible with Ortucchio phase 4. This style finds interesting parallels also in the Sesto Fiorentino area (Figure 6B,19) (Arrighi 2000).

A subsequent phase – likely the final one of the Torre Crognola settlement – is characterised by some types that find comparisons in the so-called Epi-Bell Beaker contexts, which, based on radiometric dates from the Rome area, are placed between 2140 and 1950 BC (Figure 7A). The main types are the jar with inverted rim and decoration with a dragged comb (Figure 7A,2,5), and a type of large carinated bowl (Figure 7A,1) that can be compared with a specimen from layer 3E of Termine Est 2 of the Florentine area (Figure 7A,4) (Modeo, Sarti 2000), whose radiometric date corresponds to the date range of this phase in the Rome area (Carboni 2020a). During this phase late Beaker style decorations are present, such as the fragment from Torre Crognola characterised by the so-called barbelé ornamentation (Figure 7A,3), which can be compared with a fragment from the Roman site of Ponte Linari-La Barcaccia (Figure 7A,6), whose radiometric date is consistent with the chronological limits of this phase (Carboni 2020a).

The sequence we have presented shows the long duration of the Bell Beaker products of Torre Crognola, referring to a period that covers at least the entire second half of the third millennium BC. In the light of the data we have presented, it is possible to highlight the peculiarity of the Torre Crognola site, which lies between two relevant and well-known concentrations of Late Eneolithic settlements, the Rome and the Sesto Fiorentino areas. On the one hand, we see that Torre Crognola shares with the Rome area the presence of pottery referable to the local Ortucchio culture group. On the other hand, the percentage of Bell Beaker products from Torre Crognola is far higher than that from the Eneolithic sites of the Rome area. The Bell Beaker pottery from Torre Crognola, especially in the presumably later phases, also has comparisons with finds from Sesto Fiorentino, Emilia Romagna and northern Latium.

Another interesting aspect concerns the clear similarities of the Torre Crognola pottery with finds from sites on the west coast of Sardinia, including the

chamber tombs of Marinaru near Alghero (Atzeni 1996), of Anghelu Ruju in the northern sector (Ferrarese Ceruti 1981) and of Locci-Santus in the Sulcis-Iglesiente area, located in the south-western part of the island (Figure 7B) (Atzeni 1996). In this regard, the result of an isotope analysis carried out on a silver sheet from tomb 12 of the Roman site of Osteria del Curato-via Cinquefrondi is particularly interesting. This burial is attributed to a late period of the Rinaldone funerary culture, contemporary to phase 2 of the Ortucchio culture group (Carboni 2020c). This analysis showed that the silver came from Sardinian minerals of the Sulcis-Iglesiente area (Auriscchio, Medeghini 2020). The cultural similarities between the Italian Tyrrhenian coast and Sardinia could therefore underlie relationships based also on the exchange of precious materials. It cannot be excluded that the relevance of the Torre Crognola site may partly depend on having played an active role in the framework of these relationships.

Conclusions

The relevant comparisons established with the Eneolithic settlements excavated in the Rome area and published in the volumes of *Roma prima del Mito* have allowed us to reach some conclusions:

1. The Beaker artefacts of Torre Crognola are associated with abundant ceramics that it is now possible to refer to the late Eneolithic culture group of Ortucchio, documented in several other sites of Latium and especially in the Rome area.
2. Close parallels have been recognised with all the phases of the Ortucchio culture group of the Rome area, and also with the last Eneolithic phase defined as Epi-Bell Beaker. This is an indication of a very long duration of the Torre Crognola settlement, at least from 2600 to 2100 BC.
3. The great abundance of artefacts found at Torre Crognola, its very long duration – perhaps five centuries – and its extent of at least three hectares, remarkable for the Italian Eneolithic, are all factors that testify to the great importance that the site must have had during the late Eneolithic, that is, during the whole period that sees the great diffusion of the Beaker style in central-northern Italy, in Sardinia and in Sicily.
4. The presence of Beaker pottery is much higher in percentage terms at Torre Crognola than in the Rome area.
5. The most abundant and relevant Beaker ceramics of Torre Crognola refer to a style that finds comparison in the Ortucchio 2 phase of the Rome area, datable to approximately between 2580 and

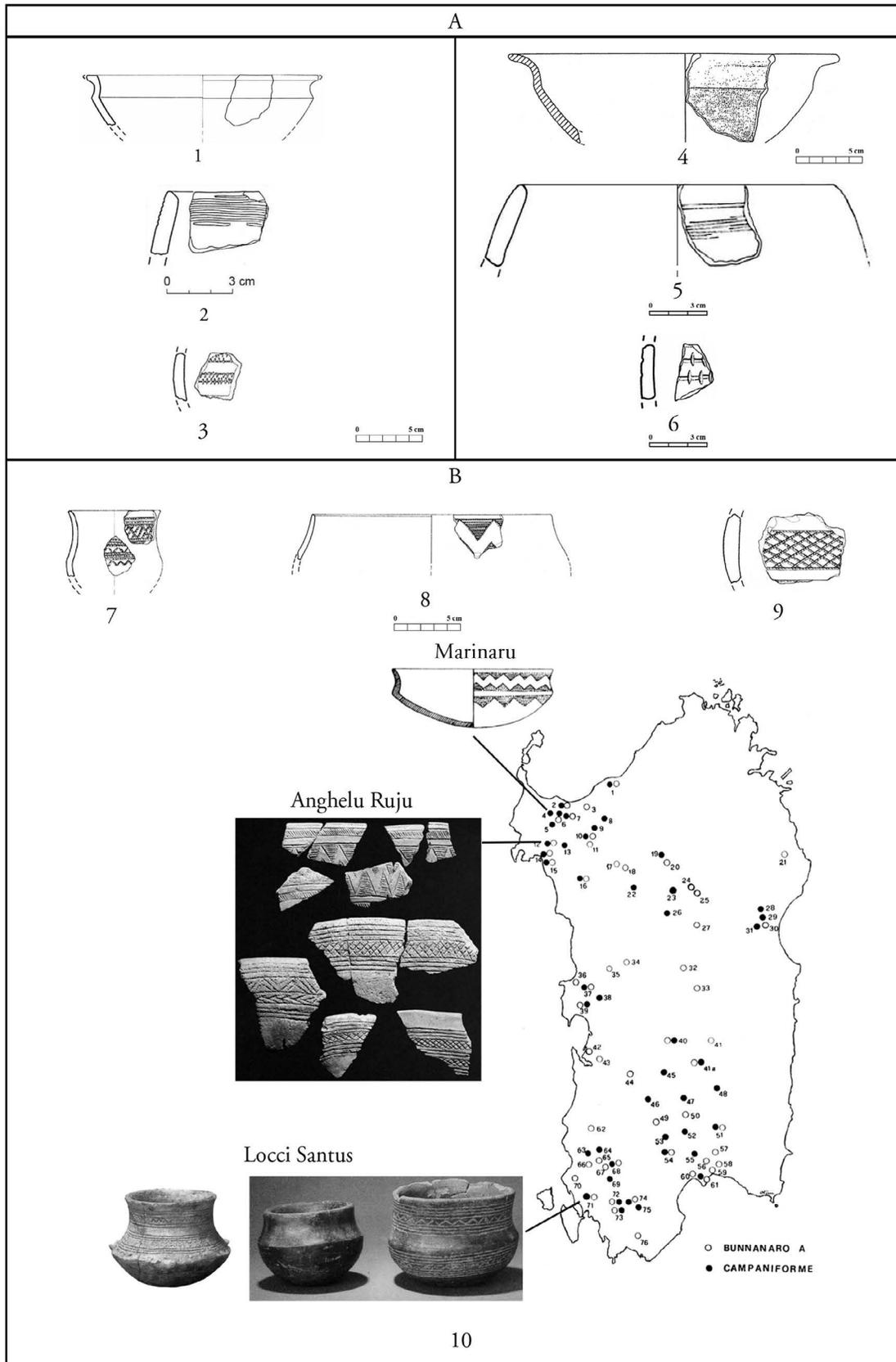


Figure 7: A. Epi-Bell Beaker phase. The main guide fossils from Torre Crognola (1-3) (1/4 size) and comparisons with Rome area (Pantano Borghese: 5; Ponte Linari – La Barcaccia: 6) and Florentine area (Termine Est 2, layer 3E: 4 – 1/4 size). B. Bell Beaker Torre Crognola syle (7-9) and comparisons with Sardinia (10). Sardinia's map with distribution of the Bell Beaker finds and the photos of finds of Anghelu Rujù and Locci Santus is after Ferrarese Ceruti (1981); the drawing of the comparison with Marinaru is after Atzeni (1996).

2470 BC, and which also has excellent parallels in contemporary funerary contexts of Sardinia. It has therefore been hypothesised that Torre Crognola may have played a role in relations with Sardinia, anticipating by over a thousand years those exchanges that are attested at Vulci for the ninth century BC by the well-known tomb of Sardinian bronzes (Falconi Amorelli 1966).

6. Beaker artefacts are probably present at Torre Crognola also in later phases, as indicated by comparisons with findings from the Sesto Fiorentino area near Florence and from northern Latium dated between 2500 and 2100 BC.

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Environmental and Economic Assets of the Bell Beaker Culture in the Florentine Plain (Italy). New Data from Fosso di Lumino

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Abstract: Zooarchaeological analyses provide useful information on the subsistence strategies of the people who lived at the site of Fosso di Lumino and offer at the same time valuable elements for palaeo-environmental reconstructions. The study of the Fosso di Lumino archaeofauna is part of a wider research project on the faunal remains from the Sesto Fiorentino area that started in the 1980s and provides new insights into the habits of Bell Beaker populations. At Fosso di Lumino, cattle are the most important animals, followed by pig, sheep and goats. Meat was largely derived from livestock and only minor amounts came from game, mainly deer. The presence of a single specimen of *Equus* sp. in the assemblage again raises the question of when the domestic horse was first introduced in Italy.

Keywords: Bell Beaker Culture, Florentine Plain, Italy, Subsistence strategies, Zooarchaeology

1. The site and the research

In the 1980s, the growth of urbanisation in the Sesto Fiorentino area (15 km North-West of Florence) (Figure 1) led to the discovery of various archaeological sites, thereby fostering a large number of excavations. The first campaign was carried out in Querciola (1982); it formed the basis for a full range of preventive archaeological activities and stratigraphic surveys. The coordinated efforts of numerous cultural institutions, made a great amount of information on the prehistory and protohistory of the Florentine Plain available for research (Martini and Sarti, 2015; Sarti, 2014; Sarti and Martini, 2000). Various studies revealed a steady demographic growth from the Mesolithic to the Iron Age (9th millennium - 8th century BC) in the area of Sesto Fiorentino. People were likely attracted to the Florentine Plain by its high agricultural potential (which depends greatly on the abundant water supply offered by the Firenze-Prato-Pistoia basin), the proximity to major communication routes (i.e. the Apennine passes provide access to and from the Emilia-Romagna region) and the availability of mineral resources (e.g. copper deposits are reported near Impruneta and Mount Ferrato) (Martini and Sarti, 2015; Sarti, 2014; Sarti and Martini, 2000). The landscape was characterised by sparse oak-forests, with hornbeams (*Carpinus betulus*), oaks (*Quercus* sp.), maples (*Acer* sp.), ashes (*Fraxinus excelsior*) and elms (*Ulmus minor*). Ericaceae, Asteraceae and Apiaceae spread as a direct consequence of cropland expansion by deforestation, which, from the 3rd millennium BC, was aimed at the creation of wheat (*Triticum* sp.), barley (*Hordeum* sp.) and legumes (Leguminosae crops) but also of meadows for livestock husbandry (Birtolo and Foggi, 1987/1988;

Carra, 2008; Martini and Sarti, 2015; Sarti, 2014; Martini and Sarti, 2000).

During the second half of the 3rd millennium BC, the Bell Beaker Culture spread across the Florentine Plain. Widely diffused in Europe, in Sesto Fiorentino this culture witnessed the establishment of new economic systems and the introduction of new building styles, alongside unique forms of funerary ritual and material culture. Settlement strategies included the use of partly sunken structures, either conforming to or modifying pre-existing palaeo-riverbeds. Because of its remarkable cultural, economic and settlement continuity, the final Bell Beaker Culture phase, which is dated to the early Ancient Bronze Age, is locally known as 'Epi-Bell Beaker period' (Martini and Sarti, 2015; Sarti, 2014; Sarti and Leonini, 2007).

Fosso di Lumino is located in the northwestern area of Sesto Fiorentino (Figure 2). The site was found in 2007 during a stratigraphical excavation led by Università degli Studi di Siena under the scientific direction of Professor Lucia Sarti. The investigated area, around 1.000 m, provided rich amounts of archaeofaunal specimens and cultural artefacts. Below is a scheme of the stratigraphic sequence:

- Layers 1-2: contemporary agricultural terrain.
- Layers 3-4: silty levels.
- Layer 5: barren layer.
- Layers 6-7: Renaissance and Roman levels yielding rare archaeological remains.
- Layer 8: settlement layer; the archaeological evidence (pottery, lithics and faunal remains) was dated to the early Ancient Bronze Age (local

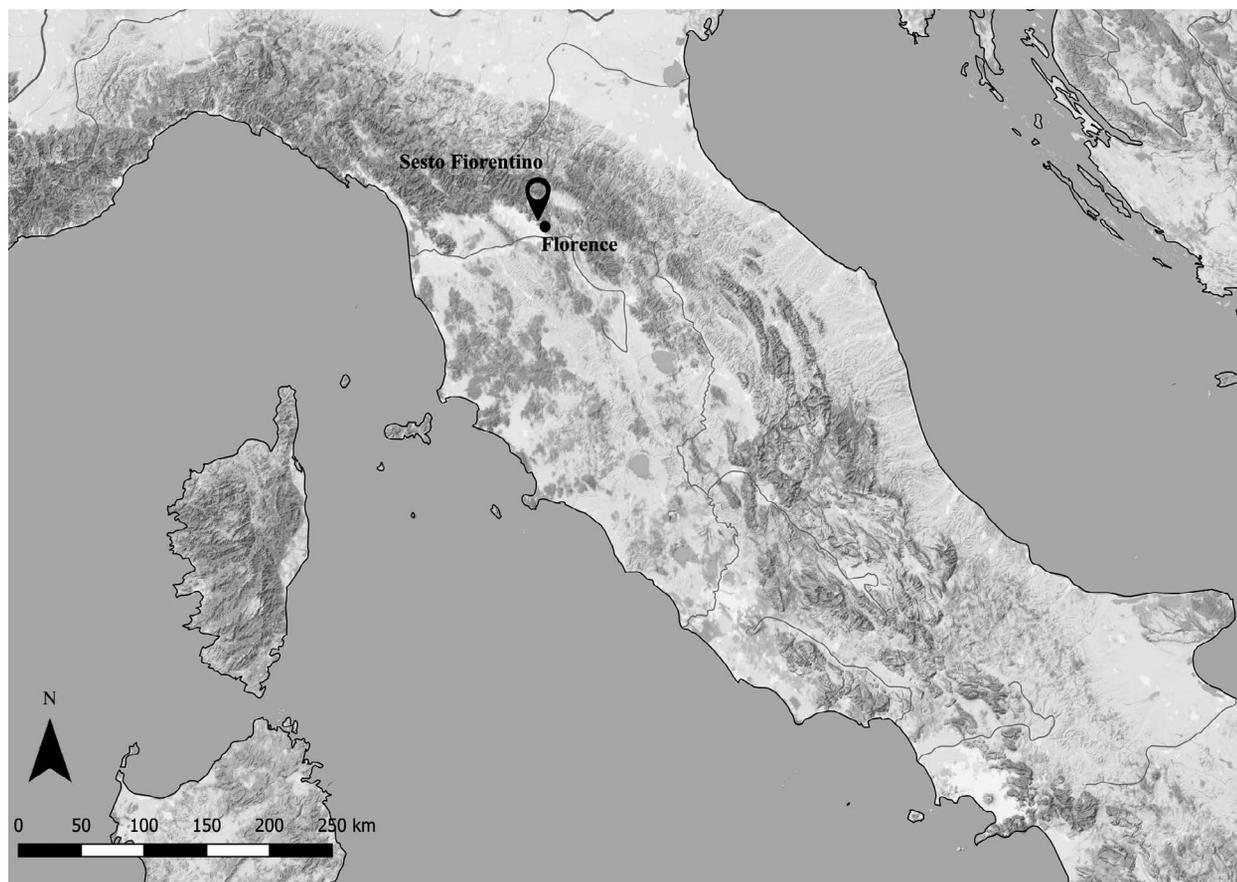


Figure 1: Sesto Fiorentino, near Florence, in central Italy.

Epi-Bell Beaker period). Crucibles, nozzles and metal items were found around a fireplace.

- Layer 9: at the base of a palaeo-riverbed, free-draining gravels yielded rare charcoal, hearths encircled by stones, sherds, lithics and faunal remains dated to the Evolved Bell Beaker period.
- Layer 10: pseudogley soil rich in clay with iron-manganese coating and limestone concretions. It bears no traces of anthropic activities.

2. Archaeozoological analysis

Archaeozoological research on faunal remains from the Sesto Fiorentino area first started in the 1980s. Numerous studies carried out thereafter targeted both settlements (Cioppi and Mazzini, 1985; Corridi, 1991, 1994, 1997, 2000, 2001, 2002; Perusin et al, 2008; Perusin, 2014; Rocci Ris and Volante, 2005) and other peculiar archaeological contexts (Cencetti, Chilleri and Mazza, 2006; Corridi, 1987/1988; Perusin and Mazza, 2010; Sarti and Anastasio, 2001). The people of the Florentine Plain always relied far more on animal husbandry than on hunting; domestic species constantly outnumber wild animals in every prehistoric and protohistoric site that has been studied. During the Copper Age (first half of the 4th millennium - first half of the 3rd millennium

BC) sheep and goats were more expendable as meat producers than cattle and pigs. During both the Bell Beaker and the Epi-Bell Beaker periods, subsistence strategies relied primarily on cattle; sheep, goats and pigs were also exploited, but at lower intensity. As today, cattle were generally slaughtered at a young age for meat and at an adult age when used for secondary-by-products. In the absence of draught-related bone modifications (e.g. markers linked to joint-loading strain), it is impossible to assert whether cattle were used for heavy duty work, such as traction. The withers height of cattle at Sesto Fiorentino averaged around 112-120 cm; they were therefore smaller than other European counterparts of the period, which ranged around 124-132 cm. The relatively high number of juvenile pigs, sheep and goats represented in the sites indicates that these animals were raised to be exploited especially for meat. In sum, Sesto Fiorentino Bell Beaker/Epi-Bell Beaker farmers were apparently specialised in meat production from domestic animals. Hunting was not as important to indigenous subsistence, and was directed primarily towards deer, wild boars and roe deer. Several other wild species were recorded at the various sites of the Sesto Fiorentino area, and most are woodland or wooded grassland species (e.g. bear, fox, wolf, hare, land tortoise, pond turtle, vole, toad).

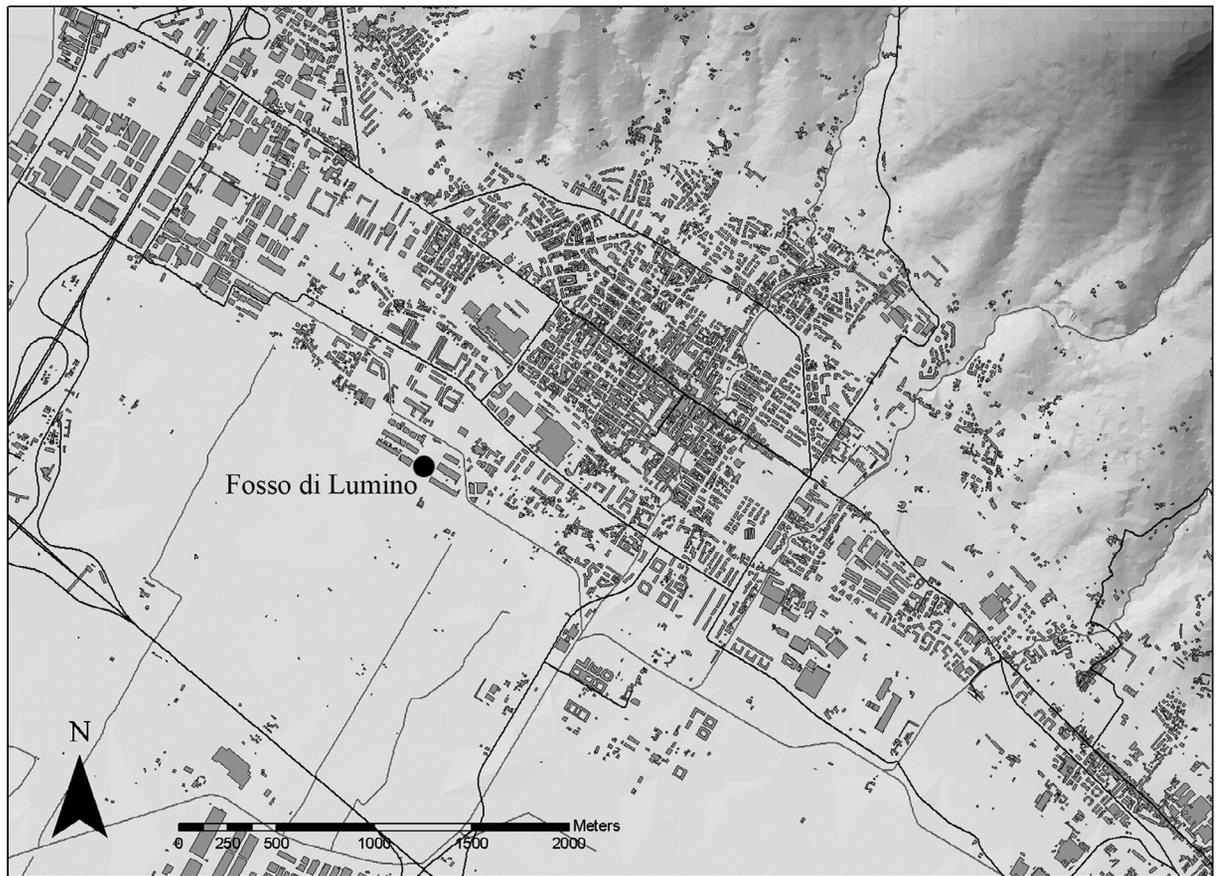


Figure 2: Fosso di Lumino, in the area of Sesto Fiorentino, near Florence (central Italy).

During both the Bell Beaker and the Epi-Bell Beaker periods horn cores, antlers and bone fragments were used as raw material for manufacturing artefacts (e.g. spatulas, awls and hoes).

Hereafter we present a report on the study focused on the archaeofauna from Fosso di Lumino, an Evolved Bell Beaker/Epi-Bell Beaker period site in Sesto Fiorentino. Our target has been updating knowledge of people's habits and ways of life in the Florentine Plain during the final phase of the Copper Age.

3. Materials and methods

The sample analysed for the study includes faunal remains from Fosso di Lumino's Layer 8 (Epi-Bell Beaker period) and Layer 9 (Evolved Bell Beaker period). The zooarchaeological analysis started with the anatomical and taxonomic (class/gene/species) identification of the specimens. This was done by reference to the comparative osteological collection kept at the Museo e Istituto Fiorentino di Preistoria (Florence). Because of the very fragmentary state of preservation of most of the bones, the Fosso di Lumino specimens were carefully described, identified by side and portion of element (e.g. proximal-distal epiphysis, shaft, medial,

lateral). Discrimination between sheep (*Ovis aries*) and goat (*Capra hircus*) was made using the dental and postcranial discriminants proposed by Payne (1985) and Prummel and Frisch (1986). Because of the difficulty in discriminating between wild and domestic counterparts, equids have been classified as *Equus* sp. (*Equus ferus*, *Equus caballus* or *Equus asinus*) and suids as *Sus* sp. (*Sus scrofa* or *Sus domesticus*). Third lower molars of wild boar (*Sus scrofa*) and domestic pig (*Sus domesticus*) were distinguished using Davis' (2006: p. 28) scatterplots. In these diagrams the length of the tooth (L) is plotted against the width of the anterior pillar (Wa) divided by the width of the central pillar (Wb).

The relative abundances of the different taxa were expressed in terms of the number of identified specimens (NISP) and of the minimum number of individuals (MNI). Specimens have been attributed to single individuals by side-matching, which was based on size, proportions, degree of ossification, age and state of preservation. The frequencies of element portions have also been tallied to calculate the minimum number of skeletal elements (MNE). The MNE were based on bone refitting as well as on the attribution of fragments to elements. This implied considering size, proportions, bone thickness and structure, degree of

ossification and state of preservation, but also type and intensity of modification of the specimens. The skeletal representation was assessed by comparing the observed versus MNI-based expected frequencies (i.e. expected amounts were obtained by multiplying the number of times an *i*-element occurs in a skeleton of a given *taxon* by the MNI counts for that species).

The specimens were further examined for pre- and post-depositional taphonomic evidence. All possible cortical bone alterations, of both biotic (e.g. plant root alterations, carnivore-ravaging and human-produced modifications) and abiotic origin (e.g. weathering), were searched for. Weathering, which is a typical abiotic pre-burial modification, was scored using Behrensmeier's (1978) Weathering Stages (where bones are assigned to stages of progressive meteoric alteration, from Stage 0 - non-altered - to Stage 5 - heavily altered). Carnivore-ravaging is revealed by bites, puncture marks, scorings, gnawing marks, and gastric corrosion (Binford, 1978); human-derived modifications consist of skinning, defleshing and dismemberment evidence (Binford, 1978; Braun, Pobiner and Thompson, 2008; Cilli, Malerba and Giacobini, 2000, 2000; Guilday et al, 1972), as well as of possible thermal alterations. Burned specimens may have different colours, which change with temperature. David's (1990) and Shipman, Foster and Schoeninger's (1984) colour/temperature scaling charts have been used for this kind of alteration.

Various procedures have been adopted to obtain specific biological information about the animals represented in the Fosso di Lumino assemblage. The ontogenetic ages were assessed based on long bone epiphyseal fusion, degree of ossification (Reitz and Wing, 1999) and Grant's (1982) tooth eruption and wear scheme, together with Hambleton's (2001) conversions of Grant's wear stages using Payne's (1973) style. The latter are wear-scoring techniques based on the wear stages of lower cheek teeth (fourth deciduous premolar and molars). By adapting Grant's method to Payne's (1973), Hambleton (2001) attributed ranges of ontogenetic ages to Grant's wear stages. As the teeth are less liable to biostratigraphic damage than postcrania, they provide fairly reliable age estimates. Most of the specimens from Fosso di Lumino were impossible to sex; only a few *Sus scrofa/domesticus* canines could easily be sexed, due to the marked dimorphic differences shown by these teeth. A single *Bos* sp. metapodial was sexed using Nobis' (1954) index (Nobis index = proximal end breadth/bone's greatest length × 100). Withers height has been estimated using the coefficients proposed by Matolcsi (1969) for *Bos*, Godynicki (1965) for *Cervus* and Teichert (1969) for *Sus*. These indexes are given by the ratio between the greatest length of particular bones and the shoulder height in various individuals. Metacarpal bones were used for bovids (coeff. 6.18), metatarsal bones for cervids (coeff. 4.08)

and third metacarpal bones for suids (coeff. 10.72). Measurements, in millimetres (mm), have been taken using sliding callipers and following von den Driesch's (1976) protocols.

4. Results

The studied sample includes a total of 3.140 specimens; 2.404 (76.56%) are undetermined. The NISP counts sum up to 736 (23.44%). The Fosso di Lumino fauna consists of bovids, suids, cervids, rare equids and testudines (Figure 3). The Bovidae are represented by Bovinae (*Bos* sp.) and Caprinae (sheep, *Ovis aries*, and goat, *Capra hircus*). *Bos* sp. is the most common *taxon* in NISP counts (33.14%) and Caprinae in MNI counts (41.86%). Bovines, ovine and caprine on the one hand, and cervids and testudines on the other, form the sure domestic and wild components of the assemblage, respectively.

It has not been possible to affirm whether equids and primarily suids were domestic or wild. During both the Evolved Bell Beaker period (Layer 9) and the Epi-Bell Beaker period (Layer 8) the ratio between feral *taxa* (*Cervus elaphus* and *Testudo hermanni*) and domestic animals (*Bos* sp. and Caprinae) is 15% and 85% in terms of NISP counts, respectively. The percentages, however, would be liable to change significantly if the suid remains could reliably be attributed to either the domestic *Sus domesticus* or the wild *Sus scrofa*. Unfortunately, only six third lower molars of *Sus* sp. could be measured; their sizes are compatible with those of M/3s of pigs (Figure 4). Five fangs are morphologically attributable to the wild boar; four of them are dated to the Epi-Bell Beaker period. Layer 9 (Evolved Bell Beaker period) provided a proximal half of I phalanx of *Equus* sp. (Figure 5) attributable to a domestic horse (*Equus caballus*) rather than to a donkey (*Equus asinus*); the glenoid cavities of the proximal epiphysis do not show marked morphological nor dimensional differences (Arloing, 1882) and the scar for the distal middle sesamoidean ligament is weakly developed with a blunt margin (Hanot and Bochaton, 2018). The size of the specimen falls in the range typical for horses, according to Dive and Eisenmann (1972) (Figure 6).

The comparison between observed and MNI-based expected frequencies shows that all elements are under-represented. In both phases, the bulk of the determined specimens is represented by cranial fragments (57.75%); isolated teeth represent 37.77% of the total of both Layer 9 (Evolved Bell Beaker period) and Layer 8 (Epi-Bell Beaker period). Distal limb ends (15.23%) are more abundant than proximal ends (11.39%). Ribs (6.17%) outnumber both scapulae-coxals (4.53%) and vertebrae (4.66%). During the Evolved Bell Beaker period (Layer 9) hindlimb remains (67.50%) outnumber forelimb remains (32.50%). Conversely, during the Epi-Bell Beaker period (Layer

Figure 3: Fosso di Lumino, Layer 9 (Evolved Bell Beaker period) and Layer 8 (Epi-Bell Beaker period) - NISP, MNI and MNE.

Taxon	Layer 9 (Evolved Bell Beaker period)			Layer 8 (Epi-Bell Beaker period)			Layer 8 + Layer 9		
	NISP	MNI	MNE	NISP	MNI	MNE	NISP	MNI	MNE
<i>Bos</i> sp.	73	7	63	171	9	149	244	16	212
Caprinae	14	2	12	78	4	60	92	6	72
<i>Capra hircus</i>	9	1	9	33	7	29	42	8	38
<i>Ovis aries</i>	11	2	11	46	5	44	57	7	55
<i>Cervus elaphus</i>	17	3	16	56	4	52	73	7	68
<i>Equus</i> sp.	1	1	1	/		/	1	1	1
<i>Sus</i> sp.	46	7	38	171	16	152	217	23	190
<i>Testudo hermanni</i>	1	1	1	9	1	9	10	1	10
	172	24	151	564	46	495	736	69	646

8) forelimbs (71.76%) are far more represented than hindlimbs (28.24%).

Many specimens (10.54%) are weathered. While longitudinal fissures, suggestive of very modest exposure (Weathering Stages 0 and 1), are rare (1.62%), flaking of the outermost layers (Weathering Stages 2 and 3), caused by more extensive weathering action, is quite common (8.18%). More heavily altered bones (Weathering Stages 4 and 5) are scarce (0.74%). Root etching was observed on 5.73% of the remains, while carnivore-ravaging evidence is completely absent.

Human-derived bone modifications include rare cut marks (2.32%) on remains of *Bos* sp., *Sus* sp., *Cervus elaphus* and Caprinae (Figure 7). Only 0.54% of bones are charred (Figure 7). They are small, underdetermined bone chips (with the exception of a fragmented

Figure 4: Fosso di Lumino, rounded down measurements in millimetres (mm) of six lower third molars of *Sus* sp. (L) Length of the tooth. (Wa) Width of the anterior pillar. (Wb) Width of the central pillar. According to Davis (2006), the size of the specimens is consistent with M/3s of *Sus domesticus*.

#	L (mm)	Wa (mm)	Wb (mm)
1	31	13	12
2	33	13	12
3	34	15	14
4	32	15	13
5	30	13	12
6	31	14	13

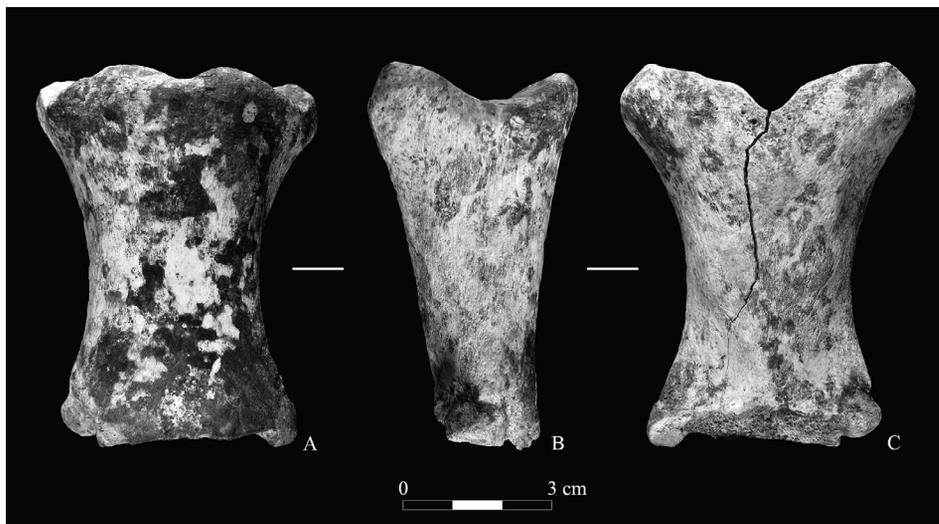


Figure 5: Fosso di Lumino, I phalanx of *Equus* sp. (A) Dorsal view. (B) Lateral view. (C) Palmar view.

Figure 6: Fosso di Lumino, measurements in millimetres (mm) of the I phalanx of *Equus* sp. According to Dive and Eisenmann (1972), the size of the specimen falls in the range typical for horses.

Greatest length	/
Anterior length	/
Smallest breadth	29,6 mm
Proximal breadth	50,8 mm
Proximal depth	36,0 mm
Distal supra-articular breadth	/
Greatest length of <i>trigonum phalangis</i>	48,7 mm
Smallest length of <i>trigonum phalangis</i>	44,1 mm
Posterior length	/
Medial supra-tuberosital length	56,1 mm
Lateral supra-tuberosital length	59,0 mm
Medial infra-tuberosital length	/
Lateral infra-tuberosital length	/
Distal articular breadth	/
Distal articular depth	/

Caprinae metapodial bone). Most are completely burnt, while a few others are charred only at one end. These burnt specimens range in colour from dark brown to black and from bluish to white. No evidence was found suggesting that the animals were used for work. Human-derived cracks on the bridge that attaches the carapace to the plastron of *Testudo hermanni* were detected.

The mortality patterns based on the tooth frequencies (D/4, M/1, M/2 and M/3) of *Sus*, *Bos* and Caprinae show a bulk of sub-adults followed by adult individuals. During the Evolved Bell Beaker phase (Layer 9) *Bos* shows peaks in the 8-18- (33.33%) and 18-30- (40%) month-old classes. Caprinae have peaks in the 1/2- (31.71%) and 2/3- (50%) years old classes, and *Sus* in 14-21- (26.66%) month-old class (Figure 8). During the Epi-Bell Beaker phase (Layer 8) *Sus* has peaks in the 7-14- (25%) and 14-21- (37.5%) month-old classes, and Caprinae in the 1/2- (38.64%) and 3/4- (27.27%) years old classes. *Bos*, by contrast, shows peaks in the 8-18- (23.53%) and 30-36- (29.41%) month-old classes (Figure 8). In both the Evolved Bell Beaker and the Epi-Bell Beaker sample *Cervus elaphus* is dominated by adult individuals (50%); juveniles (25%) and elders (25%) are equally represented. The proximal epiphysis of the only I phalanx of *Equus* sp. in the sample is completely fused, as occurs in individuals of at least 12 months of age (Barone, 1980; Habermehl, 1975; Silver, 1963).

The 66.66% of the remains of *Sus scrofa/domesticus* that could be sexed (six upper and six lower canines) belong to female individuals and 33.33% to males. The only measurable cattle metacarpal bone belongs to a castrate (Nobis' index = 32,29). The withers height could only be estimated for three individuals of three different species, a castrate *Bos* sp. (cm 122,36 cm), *Sus* sp. (81.42 cm) and *Cervus elaphus* (99,84 cm).

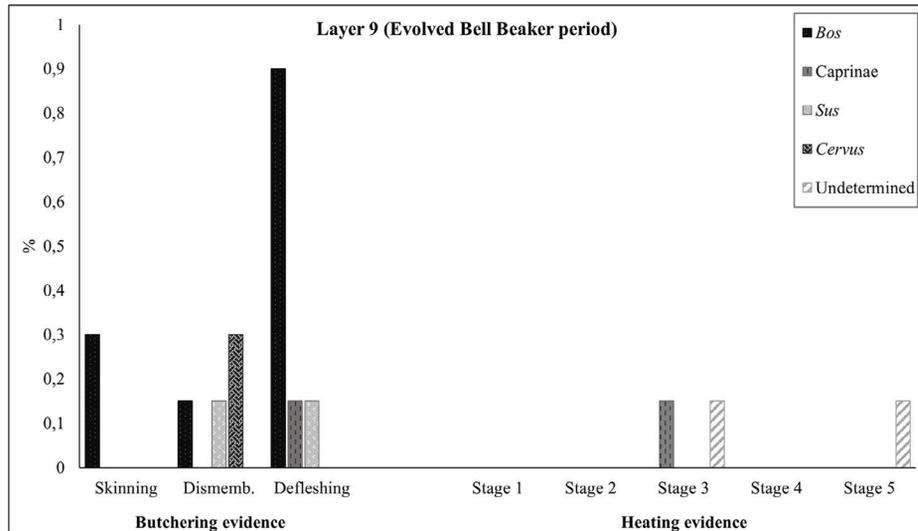
Layer 8 (Epi-Bell Beaker period) provided three awls, obtained from undeterminable long bone fragments, and a spatula, probably fashioned from a *Bos* sp. rib. Layer 9 (Evolved Bell Beaker period) yielded an awl obtained from an undeterminable long bone fragment and, above all, a hoe made from a shed deer antler.

5. Discussion

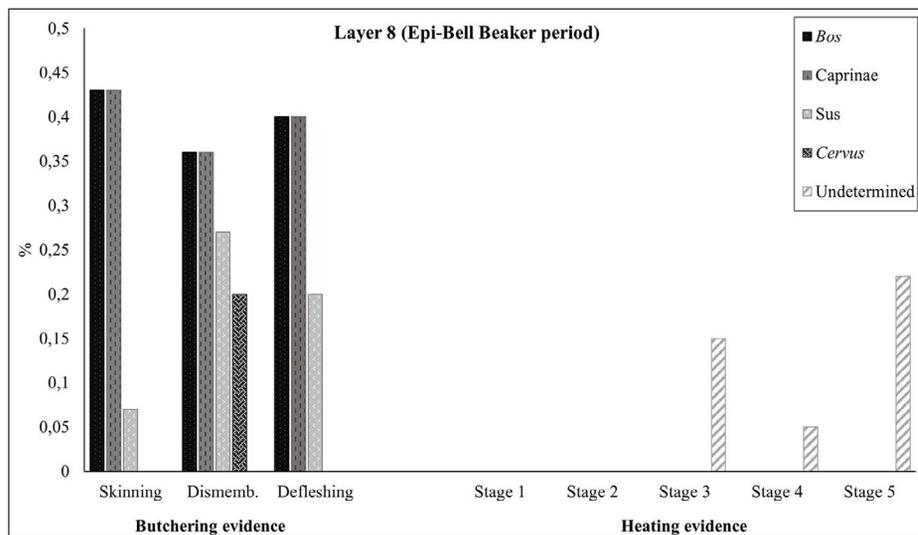
Fosso di Lumino combines a poorly diversified fauna dominated by domestic animals with minimum incidence of bone surface modifications. All types of natural alterations are nearly absent. The lack of scavenging evidence indicates that carnivores/suids had no access to the carcass remains and, together with the low degree of weathering, it indicates that the specimens were rapidly buried. The remains with signs of modification that can be associated with food preparation are rare, and most of them are charred fragments which were likely exposed to campfires.

The dominance of domestic animals, and in particular of cattle, pig, sheep and goat, is generalised throughout the Florentine Plain; in virtually every Bell Beaker/ Epi-Bell Beaker settlement feral *taxa* are present in low numbers (Perusin et al, 2008).

During both the Evolved Bell Beaker and the Epi-Bell Beaker periods the Fosso di Lumino human community bred and managed large-sized cattle (*Bos taurus*). The only bovine whose withers height could be assessed, a castrated individual of 122.36 cm), exceeds the average shoulder height of the Sesto Fiorentino cattle (112-120 cm). The small dimensions of some remains (together with the shape of some horns) indicates that small size cattle (*Bos longifrons*) were bred only during the Evolved Bell Beaker period. *Bos taurus* and *Bos longifrons* therefore coexist during the earliest settlement stage; they may have been exploited for different purposes. In the absence of bone pathologies related to draught exploitation (e.g. periostitis and osteoarthritis) the cattle cannot be indicated as beasts of burden or draught animals. Sheep and goats were less important economically than cattle, but they gained importance during the Epi-Bell Beaker period (that is to say early Ancient Bronze Age). From the Middle Bronze Age onwards they were crucial to the subsistence of the Florentine Plain people; in fact, the faunal assemblages of Frilli C (Corridi, 2002), Petrosa (Corridi, 1994) and



A



B

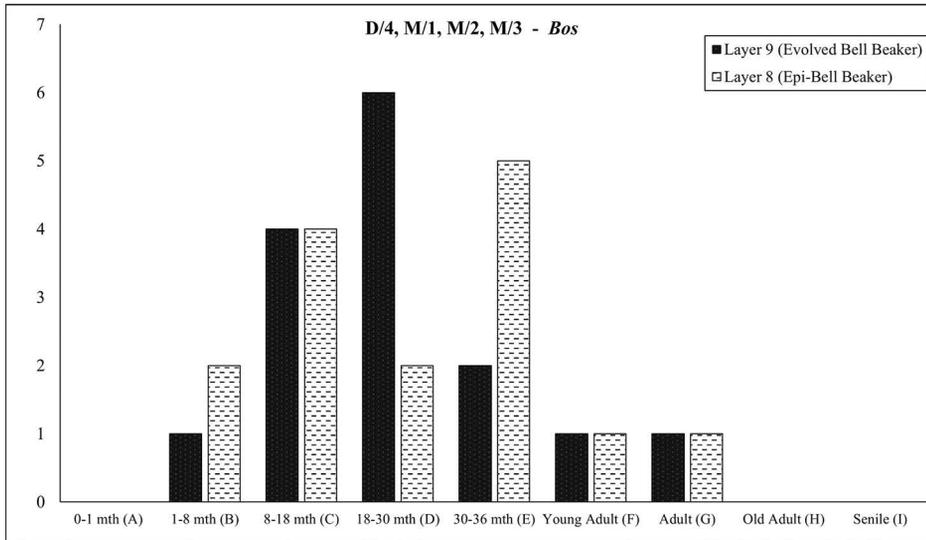
Figure 7: Fosso di Lumino, Layer 9 (Evolved Bell Beaker period) (A) and Layer 8 (Epi-Bell Beaker period) (B) - Incidence of human-derived bone modifications.

Rimaggio (Perusin, 2014) are dominated by Caprinae. In Fosso di Lumino sheep prevail over goats. Goats are less demanding than sheep, which need meadows to graze. Indeed, the extensive deforestation in the Sesto Fiorentino area from the 3rd millennium BC onwards created ideal conditions for sheep husbandry. The differential exploitation of these species could respond to different economic needs.

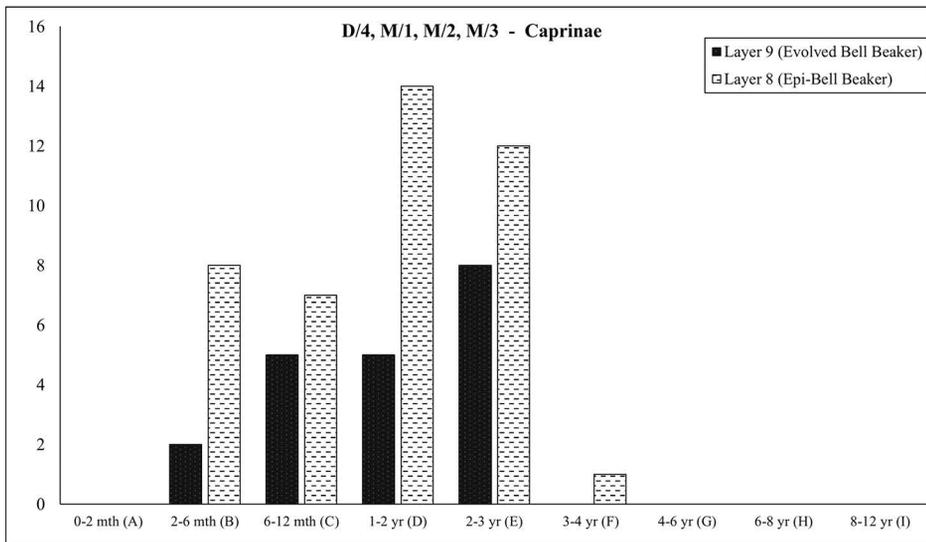
Based on the accumulated evidence, pigs had a certain economic importance for the Fosso di Lumino people. Besides the six M/3s of domestic pigs and the five fangs of wild boar, because of the difficulties in discriminating between *Sus scrofa* and *Sus domesticus* and of the high bone fragmentation, the relative amounts of wild boar and pig could not be confidently defined. In the contemporary sites of the Sesto Fiorentino area (e.g.

Via Bruschi and Lastruccia 3), wild boar remains are very scarce (Corridi, 1987/1988, 2000). The overall impression is that *Sus domesticus* was a preferred source of meat and other potential resources than *Sus scrofa*. Pigs can be easily bred, as they can be fed with a variety of food items, including human meal waste.

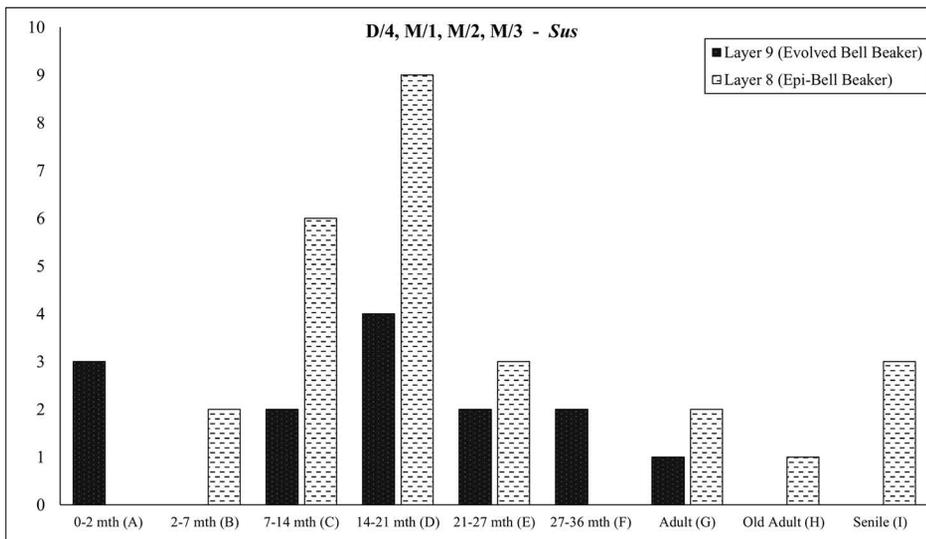
Cattle are generally butchered before reaching adulthood for meat; when they are exploited for fat, milk and dairy products they are slaughtered in adult age. The same applies to sheep and goats: those that are exploited for meat are slaughtered as sub-adults and those that provide wool, milk and secondary-by-products reach a more advanced age. Suids are butchered before reaching two years of age for meat. This shows that the animals that are preferentially slaughtered for meat are largely sub-adults; the logic behind this is reaching the



A



B



C

Figure 8: Fosso di Lumino, Layer 9 (Evolved Bell Beaker period) and Layer 8 (Epi-Bell Beaker period) - Mortality profiles in *Bos* (A), *Caprinae* (B) and *Sus* (C). Categories A-I are Hambleton's (2001) conversion of Grant's (1982) mandible wear stages using Payne's (1973) style; the age classes are specified for each *taxon*.

highest rate of return in meat per unit of investment in feed and care. The demographic patterns of the Fosso di Lumino archaeofauna are in line with those of the assemblages of the various contemporary sites of the Florentine Plain, such as, for instance, Querciola, where juveniles and sub-adults outnumber adults (Corridi, 1997). Mortality patterns argue therefore in favour of a non-specialised livestock management model, mainly addressed to the production of food supplies.

Stags represent the main hunting target in both periods, but the skeletal frequencies change; cranial remains and bones rich in meat prevail in Layer 9, which dates to the Evolved Bell Beaker period, whereas during the Epi-Bell Beaker period (Layer 8) virtually all the skeletal parts are equally represented. This suggests that during the Epi-Bell Beaker period entire deer carcasses were carried to the settlement, with great investment of energy (Tyler Faith and Gordon, 2007). *Cervus elaphus* was perfectly fit for the varied Florentine Plain environment, which offered forests, clearings and open spaces. The low percentage of antler fragments is consistent with the production of artefacts from animal raw materials attested at Fosso di Lumino.

Land tortoises seem to have been less interesting economically. They can be easily caught and kept in captivity for long periods of time. Cracks on the bridge that attaches the carapace to the plastron suggest processing of soft tissues, perhaps for food.

In the absence of draught-related pathologies (i.e. periostitis and osteoarthritis) it is not possible to establish if the equid of Fosso di Lumino had been used for heavy duty work. Anyway, the presence of an *Equus* sp. bone in the assemblage revives the problem of when domestic horses were introduced in Italy. In the recent past *Equus ferus*, which roamed Eurasian steppes and prairies during the Late Pleistocene, was thought to have disappeared from the central and western areas of the continent around 10,000 BP. (Bendrey, 2012; Sommer et al, 2011). Excessive human predation and, above all, the challenging Holocene climatic and environmental changes could explain this event. Recently, new evidence was found indicating the survival of wild horses in Europe (Italy included) between the Pre-Boreal and the Atlantic (9,600-3,750 BC) (Aprile et al, 2017; Bendrey, 2012; Bon and Boscato, 1993; Sommer et al, 2011). Presently, the earliest evidence of *Equus caballus* comes from sites dated to the 5th-4th millennium BC in Kazakstan and Ukraine (Bökönyi 1980; Gaunitz et al, 2018). According to Bökönyi (1978) the spread of domestic horses from the area of first domestication towards eastern and central-western Europe followed human migratory trajectories. Horse remains grow more frequent during the fast-spreading Bell Beaker Culture; horses were probably used as means of transport (Benecke and von den Driesch, 2003). In Italy,

undoubted evidence of domestic horses dates back to the Eneolithic: reference sites are Cerquete-Fianello (Maccarese, Rome) (Eneolithic, *facies* Rinaldone) (Curci and Tagliacozzo, 1995) and Querciola (Sesto Fiorentino, Florence) (Bell Beaker Culture) (Corridi and Sarti, 1989). Querciola yielded four remains of *Equus* sp.: two of them (lower incisor and distal metacarpus) are definitely attributable to domestic horse and the others (astragalus and scaphoid/great cuneiform pathologically fused together) appear taxonomically undeterminable. Tooth wear indicates an age of over 15 years; the pathological fusion of the tarsal bones seems consistent with an adult animal. Horse remains in two sites of the Bell Beaker period of Sesto Fiorentino recall similar elements from coeval sites of mainland Europe. The Copper Age Via Bruschi burial mound (Sarti et al, 1987/1988; Sarti et al, 2011), which finds no equivalent in Italy, recalls similar structures in both the Netherlands and the Rhine-Main valleys. The cattle burial of Semitella (Perusin and Mazza, 2010; Sarti and Anastasio, 2001) replicates models popular since the Neolithic and widespread in Europe during the Copper Age and Ancient Bronze Age. Alongside handicraft products, ritual practices and cultural models, the domestic horse could have appeared in the Florentine Plain as a result of the relationships between the local communities and the Bell Beaker European populations.

6. Conclusion

The results of the study of the Fosso di Lumino archaeofauna depict an animal-based economy perfectly consistent with that of the Bell Beaker settlements of the Sesto Fiorentino area reconstructed over the past forty years. The subsistence strategies relied almost entirely on a non-specialised model of livestock management mainly aimed at the production of food supplies. Cattle, pigs, sheep and goats were butchered at early ontogenetic stages to obtain high-quality meat with least investment in feed and care. Hunting, targeted mainly on deer, represented a minor strategy of food procurement; a more likely objective of hunting might have been antlers, which provided precious raw materials for artefact manufacturing. Ultimately, the Bell Beaker populations of the Florentine Plain shared not only a cultural substratum of technical expertise, ornamental taste and symbolic imagery, but also a common asset management system which had its roots in their awareness of environmental features.

Author contributions

Section 1 by L.S.; sections 2, 3, 4, 5 by M.P.; section 6 by both authors

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The Bell Beaker Rock Sanctuary Pigloneer Kopf (South Tyrol, Italy): Burnt Offerings and Local Metallurgy in the Eastern Alps

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Abstract: The archaeological site Pigloneer Kopf (Vadena/Pfatten, South Tyrol, Italy) has revealed unexpected elements related to the local Bell Beaker culture, like the local production of shaft-hole axes, typologically linked to the Balkans and the Danube region. The site also shows the oldest evidence of ritual burnt offerings in the Eastern Alps. The mostly burnt animal bones, cereals, flint tools and fragments of pottery could be interpreted as the remains of a rock sanctuary with burnt offerings. The site can be considered as a prototype of the alpine places of worship and mountain sanctuaries. These burning rituals were practised from the beginning of the Bronze Age until the late Roman Empire.

The aim of the paper is to present the results of the study of materials and their analyses, focussing on the metallurgical industry, composed mostly by objects produced with local copper, such as 10 miniaturised shaft-hole axes, 7 awls and a pin and also by imported objects like a dagger blade and spiral ornaments. The deposition of copper tools in hoards in association with burnt offerings suggest a ritual interpretation of the site, dated to the late Copper Age with Bell Beaker elements in lithics and pottery.

Keywords: Eastern Alps, archaeometallurgy, copper hoard, shaft-hole axes, melting, Bell Beaker common ware, burnt offerings, archaeozoology

1. The archaeological site

The site, Pigloneer Kopf, is located in the municipality of Vadena/Pfatten in the Adige valley (South Tyrol, Italy). Discovered in 1995, the site sitting upon a rock tower (Figure 1) was initially interpreted as a late Neolithic settlement in an exposed position (Oberrauch, 1996; Niederwanger and Oberrauch, 2001). The field research was authorised by the Ufficio Beni Archeologici of Bolzano/Bozen and the South Tyrol Museum of Archaeology in eight archaeological excavation campaigns overall, conducted between 1995 and 2013. The site is divided in two main areas (Figure 2): the platform on top of the rock tower has an extension of 60x30m and is dated to 2900 BC (Rame 1/2) and the rock shelter at the foot of the rock tower, a triangular area delimited by enormous rocks with an extension of 50m, is radiocarbon dated between 2700-2300 BC (Rame 2/3). The rock shelter was filled with a secondary deposit containing the Bell Beaker elements, which can be identified in the pottery (Bell Beaker as common ware) and lithic industry, associated with burnt animal bones and deposits of copper objects.

2. The geothermal phenomenon

The geology of the Monte di Mezzo/Mitterberg, the central hill in the Adige valley, reveals that it is composed of different strata of porphyry of Permian

volcanic origin. The upper geological layer, where the site Pigloneer Kopf is located at an altitude of 550m, is formed by a porphyritic sandstone, known as 'Formazione di Tregiovo' (TGV). This type of rock has the property of being divided by many cracks and crevices. A continuous warm airstream of 15°C effuses from some of them during the wintertime, thus the nomenclature 'warm holes' (Andergassen, 1981). This geothermal phenomenon (Figure 2, 1-9) is based on the difference of temperature inside and outside the cavity and pressure between the upper and the lower mouth of the deep rock crevices. The airstream inverts during the summertime, when a cold airstream effuses from the lower mouth, thus known as 'ice holes', often used as natural cellars in the Middle Ages.

3. The platform on top of the rock tower

The first phase of occupation of the rock tower Pigloneer Kopf falls in the beginning of the 3rd millennium BC. The findings on the platform of the rock tower Pigloneer Kopf, divided in two parts by a central rock crevice, consist of mostly coarse pottery decorated with fingerprints, a millstone, and tanged arrowheads, often fragmented by impact. Two hoard finds of flint tools were also discovered: hoard 1 is homogenous and contains 8 leaf-shaped points (Figure 3), hoard 2 is heterogenous and is composed of 6 semi-finished points, 3 scrapers and 4 blades. Both hoards are made



Figure 1: The rock tower Pigloner Kopf, South Tyrol, Italy (photo credit: H. Oberrauch)

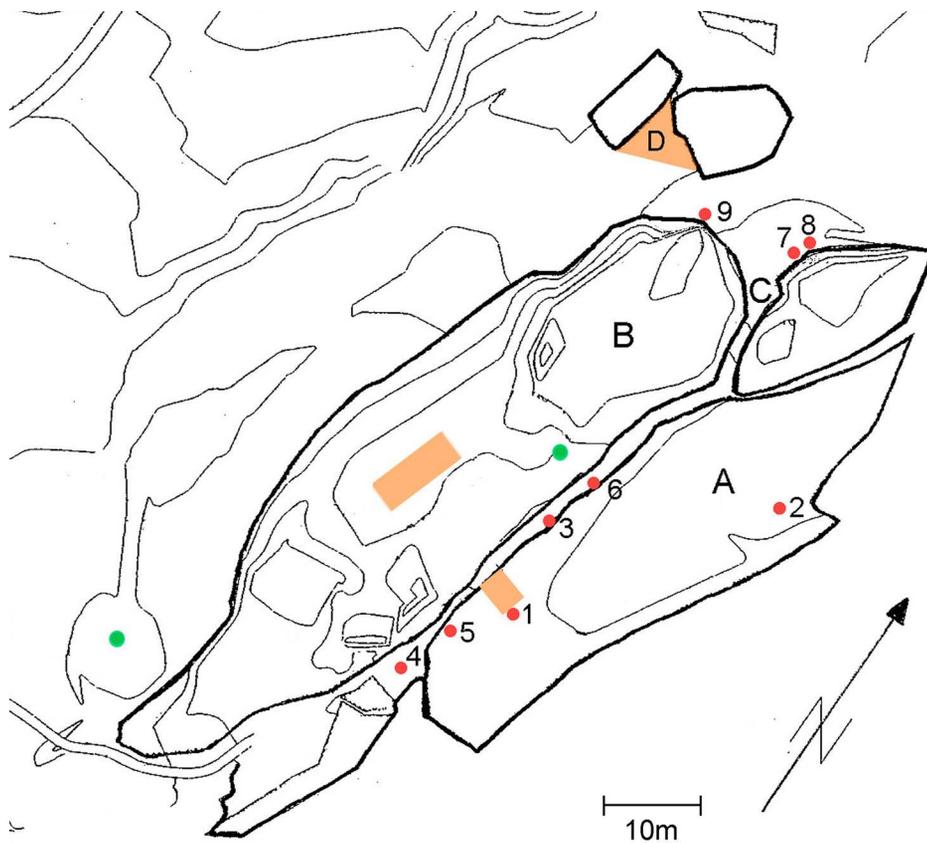


Figure 2: Location map of the Pigloner Kopf site with the eastern platform (A), the western platform (B), the entrance of the central rock crevice (C) and the rock shelter (D), the distribution of the 'warm holes' (1-9), the findings of roman coins (green circles) and the excavated areas colored in orange (graphics by H. Oberrauch)



Figure 3: Pigloner Kopf: Flint hoard no. 1 composed of 8 leaf-shaped points (photo credit: P. Chistè)

of imported maiolica flint from the Lessini/Baldo mountains, which are 120 km from the site. There are only a few hoards composed of flint points or daggers in Italy: the hoard from Doss Pipel near Isera (Rovereto, Trentino), found by Paolo Orsi in 1905 (Menghin, 1913; Barfield, 1970; Mottes, 1996), the hoard of Calendasco near Piacenza on the Po plain (De Marinis, 1990) and the hoard of Conelle di Arcevia (Marche), consisting of 8 flint daggers dated between 3350-2750 BC (Moscoloni and La Rosa, 2003; De Marinis, 2013). A hoard composed of flint scrapers was recognised at Arco-Linfano in Trentino (Mottes, 2002).

The excavation of the mouth of warm hole n.1, a deep vertical rock crevice, uncovered that it was filled by anthropic layers containing pottery, arrowheads and a deposit of birch tar fragments (hoard 3), two of which were radiocarbon dated to 2900 BC: combine 2914-2885 BC (Oberrauch, 2019). Only one copper object, the fragment of a flat axe in pure copper (Figure 8, n.15), was found on the top of the rock tower, in the filling of warm hole n. 1. This phase coincides with the transition from the first to the second phase of the Copper Age (Età del Rame 1/2 in Italian chronology) and it is dated after the extraordinary discovery of the famed Iceman, dated 3370-3110 BC, related to the Remedello 1 culture (Rame 1: 3400-2900 BC), and at the beginning of the period of engraved stelae, related to the Remedello 2 culture (Rame 2: 2900-2500 BC), followed by the Bell Beaker culture, dated between 2500-2200 BC (Rame 3).

The pre-Bell Beaker phase Rame 2 is a typological gap to be filled, because pluri-stratigraphic sites are very rare, and the period was subject to a backdating due to the Iceman and his copper axe. Before the discovery of the Iceman the Italian Copper Age (eneolitico) was generally dated too late.

Radiocarbon data of leaf-shaped points or daggers with a rounded base are available from Tolerait/Thalereit (South Tyrol), dated between 3332-3214 BC (Dal Ri and Tecchiati, 1994); the dagger found at the burial site of Acquaviva di Besenello (Trentino) is dated between 3340-2900 BC. The flint daggers from the Doss Pipel hoard were compared to a fragment found in the settlement of Isera-La Torretta (phase Isera 4), dated to the final Neolithic between 3600-3400 BC (Pedrotti, 2001). The flint dagger of the Iceman is dated to 3370-3110 BC (De Marinis, 1992) and it was compared to the dagger from Arbon Bleiche in Switzerland (Winiger, 1998), dendro-dated between 3384-3370 BC, and to the dagger from Pestenacker (Bavaria), dated to 3546 BC (Borello et al, 2002). The flint daggers from the necropolis of Remedello (Brescia) from tombs 97, 99, 107 and 102 seem to confirm its dating to the second half of the 4th millennium BC (De Marinis and Pedrotti 1997). The flint dagger from tomb 100 of Remedello was compared to the similar one from the burial of Fontaine-Les-Puits in Savoie, dated by radiocarbon to the second half of the 4th millennium BC: 3520-3190 and 3500-3090 BC (Rey et al, 2010). Flint daggers display

a long continuity of use, which is demonstrated by the burial of Ala-Le Corone (Trentino), dated by a human bone to between 2860-2470 BC (Mottes and Ziggotti 2012) and by the burial of Orno (Trentino), where a flint dagger is associated with half-moon shaped microliths, typical for the second half of the 3rd millennium BC (Pedrotti, 2001).

Flint daggers can be interpreted as goods for transalpine trading, as shown by the daggers made of southalpine flint from the Lessini/Baldo mountains found on the northern side of the Alps: Ergolding-Fischergasse, dated between 3700-3400 BC (Tillmann, 1993; Schlichtherle, 2003), Knöbling near Dobl in Bavaria, in a context of the Cham culture, dated between 3300-2800 BC, and Schellenberg (Liechtenstein), in a settlement of the Horgen culture (Borello et al, 2002).

The presence of imported flint tools deposited in hoards on the site Piglone Kopf, both finished and semi-finished objects, points to this trade in high-quality raw material from the Lessini/Baldo mountains. The flint trade seems to end in the middle of the 3rd millennium BC, when the flint daggers were gradually substituted by copper. The depositing of flint hoards, probably as offerings, at the site Piglone Kopf is verified as being from the early 3rd millennium BC and it seems to be connected to the strategic position of the site along a trade route above the river Adige/Etsch and to the geothermal phenomenon of 'warm-holes'.

4. The rock shelter

The rock shelter is located at the foot of the rock tower, 25 m above the platform. The triangular area was formed during the Ice Age and is delimited by three enormous rocks (Figure 2, D). The vale was completely filled with 150 m of layers containing charcoal, ash, 17,500 fragments of pottery with traces of secondary combustion, 14,200 mostly burnt flint tools and flakes, residues of carbonised cereals and collected fruits, 64,000 fragments of burnt and calcinated animal bones and 50 copper objects.

The filling of the rock shelter can be considered as a secondary deposit with a thickness of 3 m and it is formed by three main layers of charcoal and two separate layers of sand and stones. The burnt layers are composed of loam and contain many rocks of different sizes and mostly burnt findings distributed across the whole area. The secondary deposit in the rock shelter is typologically and chronologically homogenous and it dates between 2700-2300 BC. The radiocarbon dating at the ETH Zürich of two short-lived samples of an unburnt cattle scapula and a burnt seed from *Cornus mas*, found in the inferior layers, allowed us to restrict the phase of occupation to between the 25th-23rd century BC during the Bell Beaker period (2464-2298 BC).

4.1 The pottery

The 17,500 fragments of mostly coarse pottery, found in the rock shelter, couldn't be reassembled because of the fragmentation, the absence of decorations, the alteration of the surface colour caused by secondary combustion and the fact that not all of the vessel fragments were deposited in this area. It was not possible to assemble one entire vessel, because half of the pottery was missing, and matching pieces of the same vessels were distributed over different layers with an altitude difference of up to 2 m, indicating that the vessels were fragmented somewhere else and the fragments of the same vessel were partially thrown in the rock shelter in different moments of time during the filling.

The vessels of mostly coarse ware are decorated with impressions of fingerprints or tags on the rims and on the applied cordons. Some types can be attributed to the Bell Beaker common ware, according to the typology of Marie Besse (Besse, 2003): the handled pitcher (type 34) with a broad handle fixed on the rim (Figure 4), vessels with a cordon decorated by fingerprints (type 22) or decorated with notches (type 28), which makes up part of the local ware in the Final Neolithic tradition. Horizontal cordons immediately below the rim (type 5) or in an unknown position (type 6), vessels with a straight and flattened rim (type 63) and bowls with a flat bottom (type 19) were also present. There were some undecorated beaker-shaped vessels, but there was not one decorated beaker, which seems to be limited to burials and settlements in the region. The pottery found at the alpine burnt offering places of the Bronze and Iron Age is generally fragmented and it is mostly composed of domestic pottery, which is not different from the settlements (Steiner, 2010). At Piglone Kopf the use of repaired vessels is proved by fragments with holes made during reparation. Fine pottery makes up only 2% of the findings, with small burnished vessels similar to the findings from Lastrucchia near Sesto Fiorentino (Leonini and Sarti, 2008). Other vessels show deep incisions like type 8 and they can be compared to the vessels with the decoration 'a fori non passanti' (Piguet and Besse, 2009). Some pieces may show the influence of the typical Corded Ware decoration, like incisions similar to the decoration of the so called 'Tannenzweigamphoren' known from Sutz in Switzerland (Preuss, 1998) and from Bohemia (Buchvaldek, Novotny and Pleslová Štiková, 1988). The Corded Ware culture is thus far missing south of the Alps, but some influences could have arrived with the transalpine trading of flint and copper. Decorated beakers in the south-alpine region are very rare and often they are associated with burials like Velturmo/Feldthurns (Dal Ri and Tecchiati 1994) or settlements in Trentino (Nicolis, 2001a), where they are associated

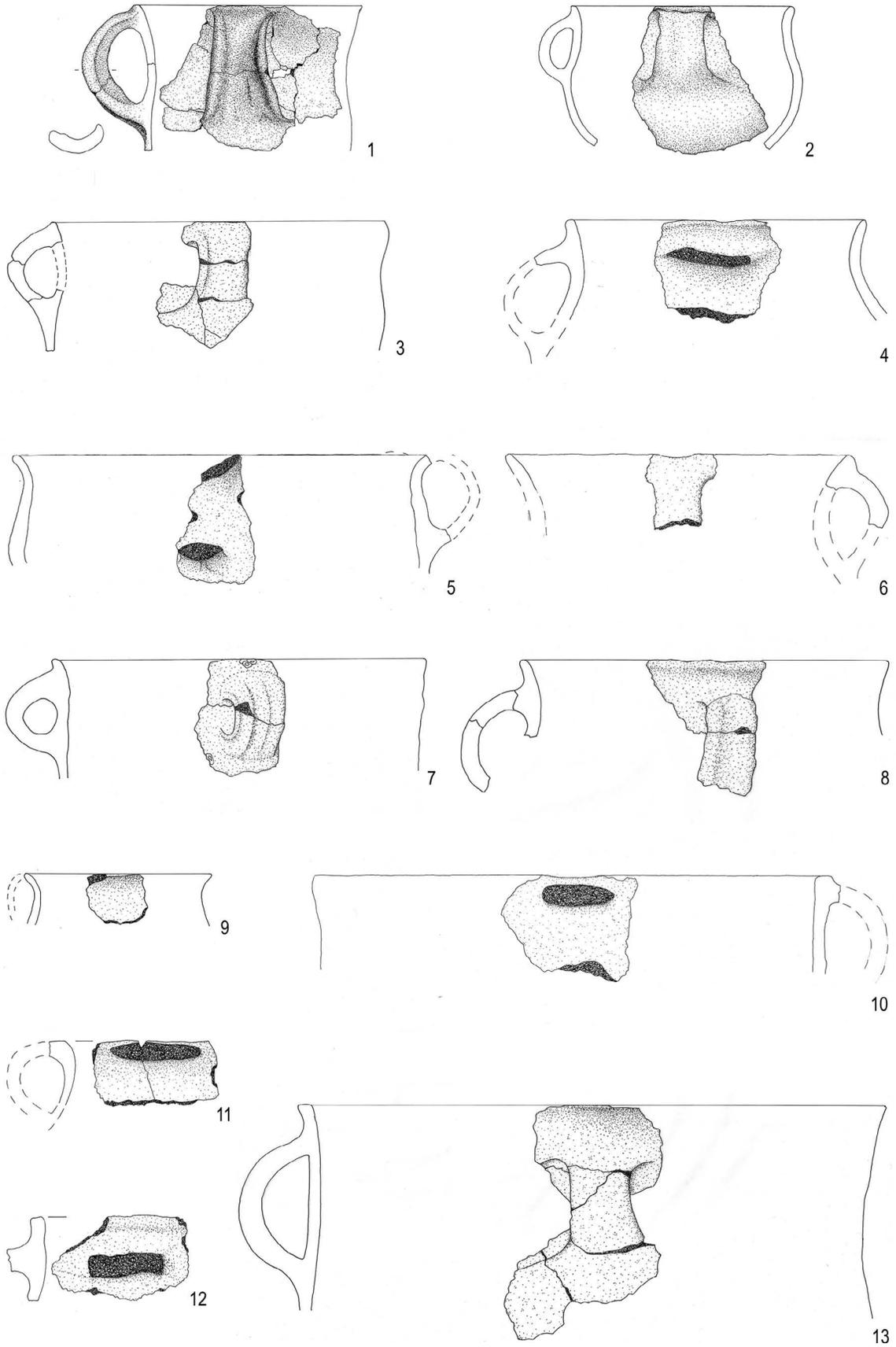


Figure 4: Pigloner Kopf: Handled pitchers of the Bell Beaker common ware (type 34 according to Besse, 2003) Scale 1:3 (drawings by H. Oberrauch)



Figure 5: Pigloner Kopf: Selection of flint arrowheads from the rock shelter (photo credit: P. Chistè)

with the Bell Beaker common ware, for example at Montesei di Serso and Monte Mezzana (Nicolis, 2001b).

4.2 The lithic industry

The 14,200 lithic findings of flint from the rock shelter consisted of 30 hollow-based and tanged arrowheads (Figure 5), some fragments of flint daggers, 130 used sickle blades, 307 geometric microliths, 100 scrapers, some cores, blades and thousands of flakes. The use of cores and the high percentage of flakes shows a rather disorganised use of the local raw material; such inconsistent flaking is typical for Bell Beaker assemblages in Northern Italy (Martini, 2008). Most (70%) of the lithic findings show traces of combustion, a change of colour and a thermally altered flint surface.

The hollow-based arrowheads with square barbs are typical for the Bell Beaker culture and can be compared to those from Monte Covolo (Lo Vetro, 2008) and from the Bell Beaker burial of Ca di Marco near Brescia (Nicolis and Mottes 1998), where they are associated with half-moon shaped geometric microliths (semilune). In the rock shelter on the Pigloner Kopf a

quantity of 307 geometric microliths was found (Figure 6). The half-moon shaped microliths can be compared to the findings from the contemporary cave burials ('grotticelle sepolcrali') in Northern Italy (Poggiani Keller, 1996) and to the grave goods in the megalithic necropolis of Saint-Martin-de-Corleans in Aosta (Baioni et al, 2018) and Sion-Petit Chasseur (Gallay, 1972) in the Valais.

The sickle blades are present in different states of use: almost new blades, sickles with evident traces of usage (sickle gloss) and blades nearly completely worn down. There are flint scrapers, some borers, some fragments of flint daggers with a broad base, broken by flexion, and one fire striker, made of a secondary transformed sickle blade with two notches for fixing the handle. A polished stone axe made with a broad neck and stone tools like percussors in porphyry and sharpeners in sandstone also make up part of the lithic industry.

The analysis of flint provenance, made by Stefano Bertola, has demonstrated the use of different sources of the raw material. The arrowheads and the fragments of flint daggers are all made of imported flint from the



Figure 6: Pigloner Kopf: Selection of flint halfmoon-shaped microliths (photo credit: P. Chistè)

Lessini/Baldo mountains. Otherwise, the used sickle blades, the geometric microliths, the scrapers, the cores, blades and the numerous flakes are all made of local flint from the Non valley (Val di Non), 15 km from the site.

The explanation for the presence of 14,200 lithic finds in the rock shelter is that the flint tools and flakes with clear traces of combustion in this particular case made up part of the burnt offerings such as the animal bones, the pottery fragments and the copper objects.

4.3 The animal bones

The faunal remains were determined by U. Tecchiati (Riedel and Tecchiati, 2007) and his team of archaeozoologists (S. Eccher, S. Bandera and A. Zanetti). The 64,000 mostly fragmented animal bones can be attributed to many different species. 95% of them are burnt or calcinated and cut marks are also present. 70% are wild animals and only 30% are domestic animals. The high percentage of combustion and the composition of the animal species is very unusual for the period if compared to contemporary settlements in the alpine region and in Tuscany (Perusin et al, 2008). The most represented animal is the deer (30,1%),

followed by pig and boar (27,5%). Some bones can be attributed to deer or cattle (7,1%). Domestic species are sheep/goat (9,5%), cattle (3,9%) and dog. Other wild species are roe deer (4,6%), wolf (dog/wolf 2,1%), birds (2,5%), tortoise (2,3%), bear (1,9%), fish (1,5%), badger (1,4%), hare (1,2%), beaver (1,1%), and fox (1%). Other species present below 1% are: chamois, ibex, wild cat, marten, otter, and sweet water mussels like *Unio* and *Anodonta* bivalves. The malacofauna was determined by A. Girod. There is only one perforated sea snail (*Nassarius*) of Mediterranean origin. Part of the findings are also burnt tools made of bone and antler like a burnisher made of a deer bone (metatarsus), awls, a bone spatula and a probable punch made of deer antler. The deer, the roe deer, chamois and ibex, the bear, the pig/boar and the dog/wolf, all represented in the rock art of Val Camonica associated with copper weapons, are animals with a symbolic value (Fossati, 1994). The different species of animals live in different areas, they were hunted on the valley floor near the Adige river or Lake Caldaro/Kaltrern (beaver, tortoise, otter, fishes, mussels), in the middle altitudes (deer, roe deer, boar) and in the high mountains (chamois, ibex). The prevalence of wild animals indicates well-organised hunting and we can deduce that, in this sanctuary, bloody sacrifices with the slaughtering of animals

was not practised, because massive animals like deer, boar or bear cannot be brought alive or intact to the site. In fact, they were likely hunted farther away and then brought to the burning sanctuary. Only the domesticated species could be brought alive to the site. The archaeozoological analysis shows cut marks, the presence of all parts of the animals and there is no sign of a selection of the extremities (skull and femora) of the skeleton similar to the more recent alpine burning rituals where mostly domestic animals are present as they can be brought alive to the sanctuaries, as is known from ancient Greece (Pausanias, 2010; Krämer, 1966). Burial rituals can be excluded because human bones are completely missing.

4.4 The botanical remains

The archaeobotanical analysis was made by K. Oegg and J. Gatringer (Gatringer, 2006) at the University of Innsbruck. The charcoaled seeds from the rock shelter can be attributed to different types of cereals (triticum dicoccum; triticum sp./aestivum; hordeum vulgare), linseed (linum usitatissimum) and the collected fruits of wild plants: acorns from the oak (quercus), hazel nuts (corylus avellana), cornus mas, wild cherry, sambucus, vitis sylvestris and prunus spinosa. The anthracological analysis has shown that the forest, in the first phase of occupation on the platform of the rock tower around 2900 BC, was composed of oaks (quercus robur, 41,8%), pines (pinus sylvestris, 46,7%) and ash (fraxinus, 11,3%). In the second phase of occupation, in the rock shelter dated between 2700-2300 BC, the forest changed, probably due to human impact: the pines (1,5%) almost disappeared and the wood for combustion in the rock shelter was composed of oak (54,5%), ash (25,4%), lime (12,4%) and elm (4,1%). An interesting point is that 65% of the charcoal derives from lumber and only 35% from collected dead wood showing traces of fungal infection. We can observe that the burning rituals and metallurgical activities were planned with the organisation of the appropriate wooden material for combustion.

4.5 The metallurgical industry

The remains of metallurgical industry consist of many different copper pieces: finished objects like 7 awls, one dagger blade, a pin with enrolled head and 3 ornaments in copper wire, semi-finished objects like 10 miniaturised shaft-hole axes (Figure 7) and many melting residues of copper casting.

On different levels two hoard finds were uncovered, each containing 5 copper axes. The first hoard (hoard 4) was distributed throughout the superficial layer (US2) and shows traces of secondary combustion, the second hoard (hoard 5) was found concentrated in the inferior ashy layer (US7).

Two of the miniaturised shaft-hole axes from hoard 4 were radiocarbon dated by charcoals included in their burnt surface: axe n.1 (2586-2281 BC) and axe n.2 (2703-2466 BC). The small and impractical axes of the Fresach type are known from 5 sites in the Eastern Alps: 3 sites in Austria (the Fresach hoard in Kärnten, composed by 7 axes, two axes found on the rock tower Rainberg in Salzburg and one axe from Dürrenberg near Hallein), one in Bavaria (Germany) and one in South Tyrol (Italy). Indeed, some authors have expressed their doubts about the practical use of these small axes, and rather they were considered as pre-monetary items of value (such as ingots) or as utensil money (Mayer, 1977; Franz, 1929). Collectively, the 21 axes of the Fresach type known in the alpine region have a length between 7-11cm and a weight between 34-108g. They seem to be semi-finished objects, not worked on after the casting and they have some casting errors. They probably can be interpreted as not-standardised ingots, destined for trading and subsequent melting to produce finished objects. Otherwise, they were deposited in hoards.

The alpine copper shaft-hole axes, typologically influenced by shaft-hole axes of the Kozarac type, known from the Balkans and the Danube area, represent the western limit of their waste area of diffusion in Eastern Europe to the Caucasus (Rahmstorf, 2010). Some casting moulds, found in Salzburg (Hell, 1943) and Trentino (Perini, 1972), evidence the local production of shaft-hole axes, also represented in the rock art of Val Camonica (Casini, 2001). The distribution map of shaft-hole axes shows that they were often found in hoard finds in the Balkans and in the Danube area. In some cases, they appear as grave goods in tumulus-burials (Bátora, 2003) and in graves containing the casting mould for shaft-hole axes (Kaiser, 2005), which can, based on the grave goods, be interpreted as graves of metallurgists. An interesting point is that the two hoards from Piglone Kopf, composed of similar axes (their weight oscillates between 45-65g) have nearly the same weight all together: 272g and 286g. The number of 10 axes may indicate a decimal system and the use of a simple balance for the miniaturised copper axes.

Two copper axes and one awl were analysed with ED-XRF by E. Pernicka in 1999 (97-99% Cu with traces of Pb and Ag). A large number of copper objects were analysed with PXRf at the University of Trento. This method was useful to select samples from a large scale of artefacts for further investigation.

The archaeometric analysis by SEM-EDS and EPMA on microsamples of 4 axes of both hoards, provided by G. Artioli, I. Angelini and C. Canovaro from the Dipartimento di Geoscienze of the University of Padova, attest that they consist of almost pure copper (99,35-99,87%) with traces of sulfur (0,01-0,07%), arsenic (0,06-



Figure 7: Pigloneer Kopf: The copper axes from hoard no.4 (left) and hoard no.5 (right) and the dagger blade (photo credit: P. Chistè)

0,12%), antimony (0,01-0,07%) lead (0,10-0,16%), zinc (0,02-0,51%) and silver (0,14-0,26%).

The faceted copper dagger (Figure 7; 8, n.5) was found under a rock and is considered as a single object hoard (hoard 6). This type of dagger, the first copper dagger found in the region, is not typical for the area and it is different from the Remedello and the Bell Beaker (Cienpuzuelos) types, known from burials, and present on the contemporary stelae (Tecchiati, 1998) and in the rock art of Val Camonica. The chemical analysis (EPMA) shows that it consists of almost pure copper (98,63%) with an elevated percentage of arsenic (1,13%), antimony (0,43%), nickel (0,11%), lead (0,10%) and silver (0,13%). The Lead Isotope Analysis (LIA) demonstrates that it is not made of local copper, but it is an imported object from Tuscany, Liguria or Southern France. Typologically it can be tentatively compared to the faceted daggers of the Fontbousse type, known from the French Midi (Gasco, 1980; Vaquer and Remicourt, 2012), and western Switzerland, like the examples from Saint-Blaise, Colombier and Lüscherz (Hafner and Suter, 2003).

In the rock shelter 7 copper awls with rectangular sections were found (Figure 8, n.1-4, 6-8). Some of them can be attributed to the Ig type, known from Trentino-South Tyrol (Italy) and Ljubljansko Barje (Slovenia). The chemical and isotopic analysis of 3 awls shows that they are all made of almost pure local copper (Cu 98-100%). A pin with a rolled head (Figure 8, n.9), made of almost pure local copper (99%), is similar to the Auvonnier examples from Switzerland (Yvonand IV and Auvonnier-Brise Lames), for which an Italian provenance was supposed (Strahm, 1994).

LIA reveals that most of the copper findings (axes, awls and the pin) fall in the field of the south-alpine ores while only the dagger and the spiral ornaments (Figure 8, n.10-12) are made of a different copper type. The LIA-analyses of 4 miniaturised copper axes of the Fresach type from the site Piglone Kopf were compared by G. Artioli to one axe of the Fresach hoard from Carinzia and to the other small axes, known from Austria (Dürrenberg and Rainberg near Salzburg), sampled by drilling by S. Krutter, R. Kastner and H. Wendling, analysed by ED-XRF and LIA at the CEZA in Mannheim. The lead isotope symbols of 7 analysed copper axes from 4 different sites on the north and south of the Alps are overlapping in the plot and it demonstrates that they have all the same south-alpine provenance. We can deduce that the small axes of the Fresach type were produced in the south-alpine region and they were probably exported as ingots to the north-alpine area.

There are 12 fragments of crucibles with traces of metal on the inner side, which were used for a step in secondary metallurgy when melting local copper

ores for the subsequent casting of finished and semi-finished objects. Some samples of them were analysed by EPMA and LIA and they display the same composition and isotopic signal as the shaft-hole axes. In the rock shelter about 30 small residues of copper melting were found (Figure 8, n.16), but no slags were recovered. The analysed samples are made of almost pure, local copper, and they prove the probability of casting at the site.

The group of G. Artioli has sampled ores, slags, and finished copper objects like the axe of the Iceman from the south-alpine mining districts in northern Italy (Artioli et al, 2017), in order to determine the provenance of the copper. In the Trentino-South Tyrol region there are two known principal mining areas in the Isarco and Sugana valleys and some traces of metal working (slags) in a few settlements and smelting sites of the 3rd millennium BC (Artioli et al, 2014; Artioli et al, 2015). The site Piglone Kopf is situated in the middle of the two mining areas. The region of the Eastern Alps is a zone of contact between the cultural areas of Bell Beakers, Corded Ware and the Balkan cultures, and is influenced by them.

According to the theory of the diffusion of metallurgy (Strahm, 2005), we can distinguish three principal phases: the first step was the import of finished copper objects (axes) from the Balkans in the 5th and 4th millennium BC (Dolfini, 2013; van Willigen, 2017); in the second phase local mining and copper production started in Liguria and Tuscany in the middle of 4th millennium BC (Maggi and Pearce 2005; Artioli et al, 2016) and in the third step the exploitation of local copper ores and the production of objects began in the Eastern Alps during the 3rd millennium BC (Dal Ri et al 2005).

Some of the copper findings from the site Piglone Kopf are not typical for Bell Beaker metallurgy and they possess some unusual aspects: Bell Beakers in the circum-alpine region are rarely associated with copper axes and never with hoard finds of shaft-hole axes. In this case study, we can demonstrate by using LIA-analyses that the Bell Beaker people were involved in the usage of south-alpine copper ores and transalpine copper trading in the zone of contact with the Balkans and the north-alpine area.

Some findings, like the singular-faceted dagger blade which was made of a different, imported copper type, demonstrate long distance connections that may be influenced by the Fontbousse culture in southern France. Two spiral ornaments are also made of imported copper. The fragments of crucibles and the copper residues prove the melting process on the site and the production of objects from local copper, using both oxidic and sulfidic ores.

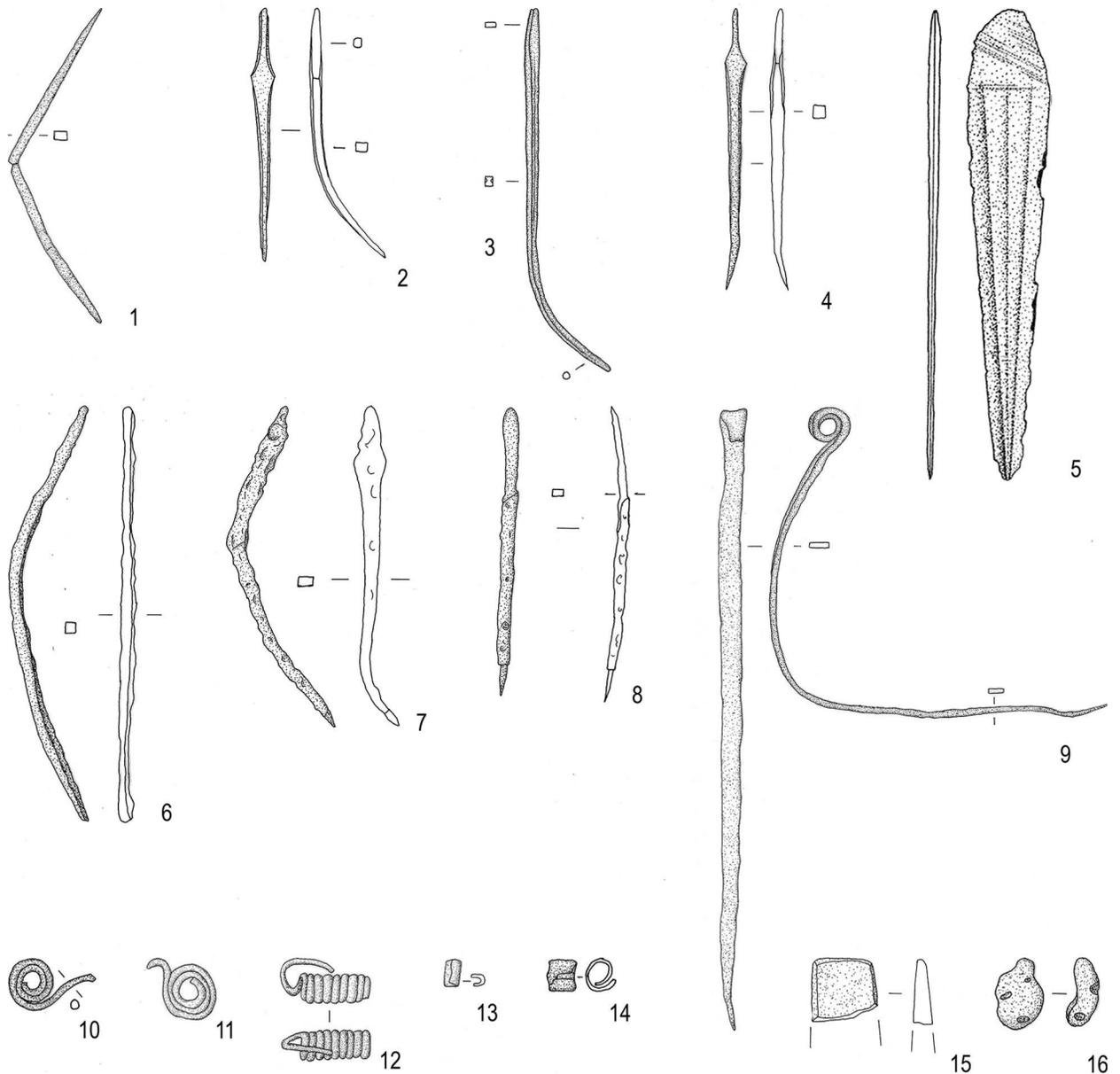


Figure 8: Pigloneer Kopf: The copper awls, dagger and ornaments. Scale 1:2 (drawings by H. Oberrauch)

Conclusion

The site Pigloneer Kopf shows clear evidence that the Bell Beaker people were involved in rituals with burnt offerings of animals and copper deposits. We can therefore suggest that the ritual behaviour was related to the fire cult. It seems to be the beginning of the alpine worship places of burnt offerings, known from early/middle Bronze Age until the late Roman Empire (1800 BC – 400 AD), but seem to begin even earlier around 2500 BC. The main criteria of the alpine burning sanctuaries (Steiner, 2010) are a natural, exposed archaeological site, thick charcoal layers containing calcinated animal bones, the absence of human bones, fragmented domestic pottery, metal votive offerings, food offerings

(cereals, fruits) and a long period of occupation (up to 2000 years). A form of dis-continuity of offerings at the site Pigloneer Kopf is proved by the depositions of an iron age Drago-fibula (6th century BC) and a small trove of 7 Roman silver coins from the 2nd-3rd century AD (Oberrauch, 2002). The presence of hoards from different periods, the burnt offerings of animal bones, flint and smashed pottery in association with the geothermal phenomenon of the so called ‘warm holes’ on the Pigloneer Kopf suggest a ritual interpretation of the site (Dal Ri et al 2005). The interpretation of the miniaturised unemployable copper axes as ingots is based on their chemical (almost pure local copper) and isotopical analysis (they have all the same southalpine provenance), on their distribution in the Eastern Alps

(transalpine export), on their archaeological context (they were found often in hoards and near rock towers) and on the observation that they are not finished and employable objects. The shaft-hole axes of the Fresach type were compared to the small axes made of electron, which make part of the Persinari hoard from Romania (Neumann 2015).

The ritual influences of the sanctuaries with burnt offerings could have arrived from the Mediterranean islands and Greece, where some sanctuaries can be dated to the late Neolithic period, like the one on Mt. Lykaion (Starkovich et al, 2013; Romano and Voyatzis 2014). Fire is the central element for metal production and for the rituals that are connected to burnt offerings. Copper axes as trading ingots could also be used as offerings. The Bell Beaker culture is not linked to the phenomenon of hoard finds, mostly known from eastern Europe, but there is also some rare evidence in western Europe, where Palmela points or axes were found in hoards (Hansen, 2019).

Prehistoric metallurgy was not a profane activity, but it was often associated with rituals connected to mining and smelting of the copper ores (Eliade, 1980) and probably also to the casting of copper. Fire is the linking element between metallurgy and burnt offerings and both activities were practised at the rock sanctuary Pigloner Kopf, where a portion of the copper products were offered in burning rituals during the Bell Beaker period.

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Beakers, Death and Monuments in the Ceremonial Landscape Around the Czech Mythical Mountain of Říp

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Abstract: This paper focusses on the possibility of reconstructing the ritual landscape and settlement areas in relation to Corded Ware and Bell Beaker cemeteries and ancestral monuments. Death as a social event was never isolated from other dimensions of social, economic and symbolic life of farming communities. The ceremonial level of funerary events connected to ancestral worship is reflected in the landscape by the variety of monuments and their intra and extra territorial relations. The Beaker ritual landscape was constructed in a symbolic system of a much earlier pedigree. Therefore within the current project we aim to reconstruct the changing ceremonial pattern of the Eneolithic cultural sequence (4500 – 2300 cal. BC) and the development of monuments and landscape division.

Keywords: Ceremonial Landscape; Funerary Monuments; Bell Beakers; Corded Ware; Bohemia; Spatial analysis

Research statement

This study is the initial part of an extensive research project (GA21-25440S) focussing mainly on the long barrows of the 5th and 4th millennium BC and the reconstruction of the ceremonial landscape around Mount Říp in Central/Northern Bohemia. The extensive landscape reconstruction project, including targeted excavations, is currently being developed in the region under study and further results will be presented in near future. The reconstruction of 3rd millennium funerary activities within the project's area of interest concerns the latest phase of our chronological analytical frame. The main aim of this paper is the reconstruction of the Corded Ware and Bell Beaker settlement pattern based mainly on the evidence of funerary sites. In this stage of our research we will examine the spatial setting of Beaker cemeteries in the landscape around Mount Říp. This research includes analyses of the altitude of individual sites, the slope aspect of cemeteries and the visibility of Říp as the main landmark in the landscape (Figure 1).

The database of analysed sites was created using the published evidence (for Corded Ware: Buchvaldek 1967; Buchvaldek et al 1997) and for Bell Beaker sites: Hájek 1968) and the unpublished record from the *Archaeological Information system of the Czech Republic* (www.aiscr.cz). GIS (ESRI ArcMap) analytical tools were used for the evaluation of spatial data. The aim of our project is to examine Eneolithic funerary activity within the landscape with a high density of archaeological findings from funerary monuments with regard to the nearby settlement areas. We will examine the spatial and chronological relations of individual monuments with specific sub-areas of the cultural landscape including their geomorphological settings.

The region under study

The area of our research is defined by distinct ecozones and geomorphological units. The choice of the research area is based on naturally defined landscapes interconnected by major Czech rivers (Labe, Ohře, Vltava).

Geomorphologically it can be described as the western part of the Central Bohemian Plain. The main axes of the region are lowlands and river beds of three main rivers, covering the area between two confluences (Vltava-Labe in south east & Ohře-Labe in the north). The rivers form one continuous lowland area with an abundance of prehistoric settlements and areas of land suitable for farming. The central part of this territory is dominated by Mount Říp (456 metres a.s.l.) located on the easternmost edge of the elevated plateau with a trapezoidal ground plan, delimited by all three major rivers and extending west to the Prague-Slaný region (Kladno plateau), which is remarkably structured by small watercourses running from the west towards the Vltava river. The northern border of the study area is enclosed by the scenery of the České středohoří highland formation. The plateau west of Mount Říp is generally over 200 metres a.s.l., which is about 40 metres higher than the lowland locations along the big rivers.

An area of 1108 km covering 229 present-day cadastres (parishes) represents the central part of the Bohemian basin, with a long pedigree of prehistoric settlement activity, including thousands of recorded archaeological sites and one of the most heavily occupied territories in Central Europe. Concerning the Eneolithic settlement (4500 – 2300 cal. BC, Late Neolithic) the *Archaeological Information system of the Czech Republic* (www.aiscr.cz) currently contains a record of 549 sites.



Figure 1: Říp (J. Jiroušek)

Death and the concept of ritual landscape

Archaeologists increasingly agree that in the prehistoric cultural landscape, in some places the profane and the sacred naturally intermingled, and that a number of utilitarian activities could take on ritual significance in a certain context. As seen in our research (Krištuf et al 2019), the most visible features of ritual landscapes are funerary monuments, which serve as crucial elements of the overall system structuring the prehistoric landscape. Specifically we are talking about the ritual landscape that has been repeatedly described mainly by British scholars (for the concept see: Tilley 1997; Robb 1998; Edmonds 1999; Pelisiak 2014; Pryor 2016; Parker Pearson et al 2020).

How can we describe the concept of ritual landscape? As an example, we can observe the remains of a prehistoric ritual landscape found in the county of Wiltshire in the south of England. There is certainly no doubt about the spiritual significance of Stonehenge. It can be said that due to its megalithic monumentality, the place has never lost its spiritual energy, whether it be the worship of the winter solstice by our Neolithic ancestors, Celtic druids, or hippies of the 20th century. But Stonehenge is not a solitary sanctuary without connection to the surrounding landscape. In recent years, Timothy Darvill (Darvill et al 2012) and Mike Parker Pearson (Parker Pearson et al 2020) have researched Stonehenge and the ritual landscapes around it. The large concentration of burials with evidence of various malformations led Darvill to interpret the stone circle monument as an important place of pilgrimage with healing potential,

a kind of prehistoric Lourdes. This is how Stonehenge was described by Arthurian legends, and even in the 18th century people believed that stones had a magical healing power. Mike Parker Pearson emphasises the importance of Stonehenge in relation to the moon and death. In his view, the extensive settlement and wooden shrine at Durrington Walls, which originally stood on the banks of the River Avon, was a sanctuary of the living connected by a ceremonial journey with Stonehenge. People travelled here from northern England and Scotland and slaughtered piglets and feasted in celebration of the winter solstice. It is possible to imagine similar religious festivities taking place at the same time in other local centres of their homelands, but the pilgrimage to the Neolithic 'Mecca' in Stonehenge was probably an important religious event. The River Avon was a sacred stream where cremated remains could have been deposited. According to others, Stonehenge was used as a ritual centre of the cult of the Sun and an astronomical calendar. One must probably assume a certain duality of the deities of the sun and moon, life and death, which structures the human spiritual world.

Ritual landscapes can be reconstructed in the vicinity of important communication crossroads, at the confluence of large rivers, in the vicinity of sacred mountains or at the divide between domesticated and wild territories.

In Bohemia, one of the best candidates for a prehistoric ritual landscape is perhaps the territory between the Labe, Ohře and Vltava confluences, with Mount Říp

being the natural landmark. The far-reaching tradition of using, enclosing and emphasizing these important parts of the landscape and accumulation of prehistoric cemeteries, causewayed enclosures and votive offerings in this territory is remarkable (Křišťuf – Turek et al 2019).

Perhaps a similar pattern can be found in Andalusia with a landmark of anthropomorphic rock formation, Peña de los Enamorados. This remarkable mountain is surrounded by numerous prehistoric sites including Chalcolithic settlements, votive deposits, tombs and caves (García Sanjuán et al 2016).

Monuments as landscape landmarks – a ceremonial tradition

Neolithic/Eneolithic enclosures, hill-top sites and long barrows acted as landmarks and elements of the cosmological legacy for generations. Therefore it is important to understand the pattern of Bell Beaker funerary areas and monuments in relation to preceding palimpsest of funerary and ceremonial land use in order to reconstruct the long term perception of the farmer's world and its structure.

In this approach some monuments, seemingly isolated, fit into the much wider spatiotemporal structure of prehistoric community areas. As mentioned above, in the current project we are analysing spatial relations of prehistoric monuments in a three millennia sequence.

The sequence of analysis starts with 5th millennium cal. BC causewayed enclosures. The ditch enclosures of the Proto-Eneolithic period, the so-called causewayed enclosures, occurred in the vast territory of central and north-western Europe, including the British Isles, after the mid-5th millennium BC. Regardless of the regional variability of archaeological cultures, there is an apparent cultural phenomenon unifying culturally and geographically very distant regions. This fairly orthodoxly replicated form of monument is obviously related to a shared cosmological concept that allowed the rapid spread of this phenomenon in the vast territory of continental Europe, southern Scandinavia and the British Isles. Although the actual nature of rituals and social interactions that were taking place within these enclosed areas has long been a disputed issue amongst archaeologists, it is clear that there was one common idea (religion) behind their spread (Křišťuf et al 2019, with further references).

The significant concentration of three Proto-Eneolithic sites (Jordanów and Michelsberg Culture) in the relatively small confluence area of the Labe and Vltava rivers leads us to re-consider the contemporaneity and thus the density of these sites within the landscape (Křišťuf et al 2019). Given their size, it can be assumed

that causewayed enclosures exceeded the needs of one community area and therefore probably served the activities of several communities within a wider region (Figure 2). The enclosures might have even maintained inter-regional social interaction. The fact that this enclosure concentration is located at the confluence of large rivers is certainly indispensable. The Labe and Vltava Rivers represented important landscape boundaries, but they also served as important communication corridors (Turek – Křišťuf et al 2019).

In several cases, human burials were recorded in these ceremonial ditches in Bohemia (Pleslová-Štiková 1985; Dobeš *et al.* 2016; Křišťuf – Turek et al 2019) and elsewhere in Northwestern Europe (e. g. Reiter 2005; Seidel 2008). There is also evidence of the manipulation of human remains, often even long after a person's death (e. g. Pollard – Banks 2007, 22–23). Such practices seem to illustrate the role of enclosures in practising an ancestral cult that has been documented in agricultural communities since the beginning of the Neolithic period. Undoubtedly, this was not the only burial practice in the Proto-Eneolithic period. The dead were also buried in long barrows.

It seems there were two main types of burial: those that were more public, within super-community ceremonial monuments (such as causewayed enclosures), emphasizing a broader shared cultural identity, and those that were more intimate, inside the 'houses of the dead', (long barrows). The latter type can be interpreted as a symbolic reflection of a small, closed social group, perhaps a household/family, particularly emphasizing local ties.

Long barrows also represent ceremonial landmarks. The purpose and meaning of the long barrows remain an issue of debate. One argument is that they are funerary and religious sites, perhaps erected as part of a cult of ancestors. An alternative explanation views them primarily in economic terms, as territorial markers delineating the areas controlled by different farming communities. It seems likely that both of these interpretations are valid and characterise the true nature of long barrows well. In relation to their Neolithic long house archetype (Turek 2005), they can also be perceived as landmarks of preceding habitation and as such also possible indicators of farming-friendly territory.

While enclosures and long barrows were shaping the ceremonial structure of the Central/North Bohemian landscape during the Proto- and Early Eneolithic period (sequence of Jordanów-Michelsberg-Funnel Beaker Culture), the Middle Eneolithic ceremonial sites (sequence of Baden and Řivnáč Culture, 3500 – 2900 cal. BC) seem to be less visible in the landscape. Funerary activity became practically invisible (with

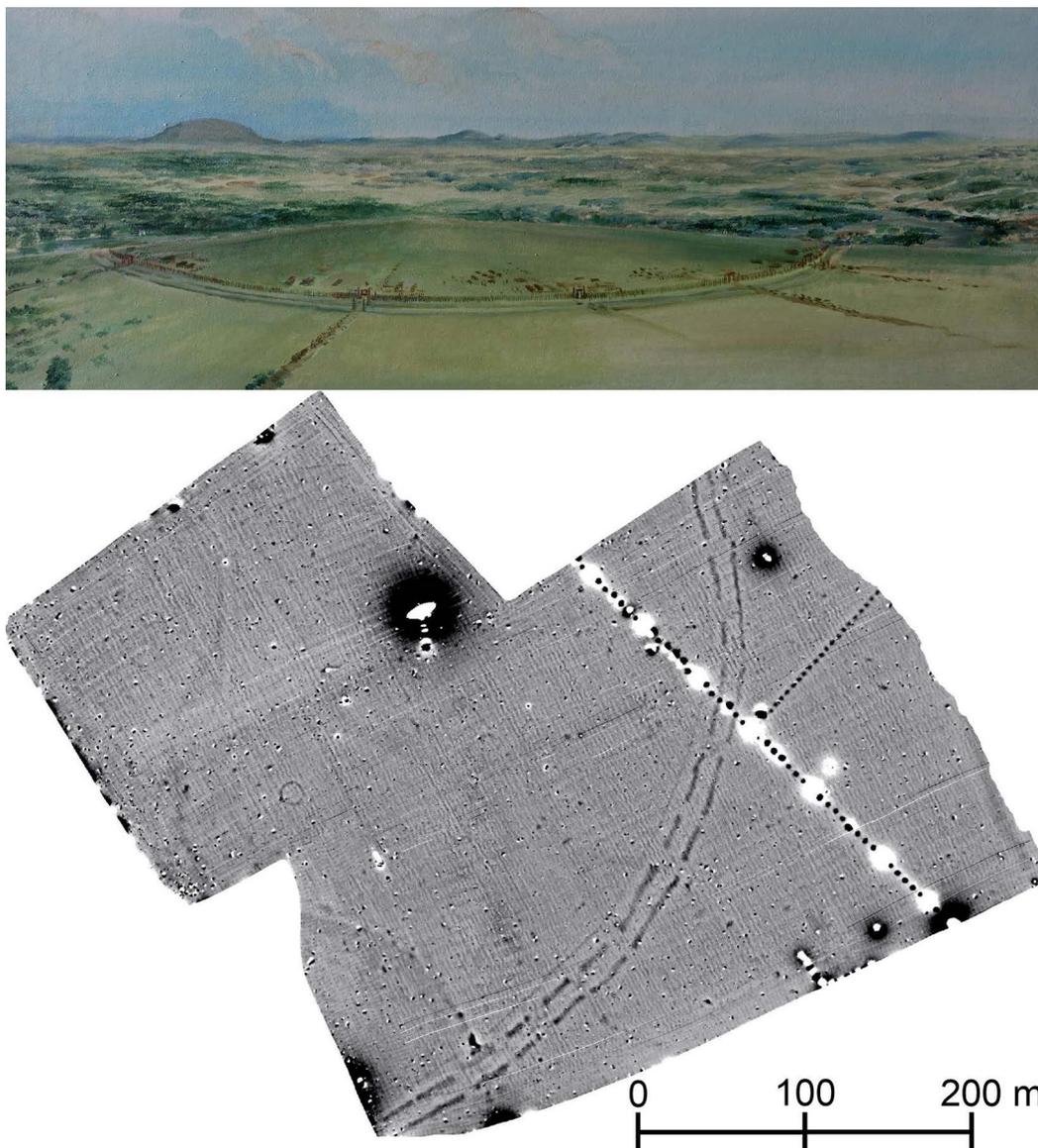


Figure 2: Kly (Mělník District), reconstruction of the Michelsberg Culture causewayed enclosure as part of the Říp ritual landscape (drawing by J. Svoboda) and ground plan of this site by magnetometric survey.

the exception of the late Baden stone cist tomb from Velvary, Kladno District). The enclosures moved to the hilltops (such as the Řivnáč Culture sites at Čertovka-Vraný and Homolka-Stehelčevy in Kladno District).

Corded Ware and Bell Beaker cemeteries in the landscape around Říp

The Late Eneolithic period (2900 – 2300 cal. BC) is represented in our research area by 174 sites, 94 of which are dated to the Corded Ware Culture, 55 to the Bell Beaker period and with 25 providing evidence of both cultures. The sites are mainly represented by cemeteries and single burial finds (Figure 3a-b).

For the Corded Ware there are 72 burial sites (60.5%) and 44 (37%) sites with isolated finds, many of which

were possibly items from destroyed graves, with poor archaeological records from the 19th and early 20th centuries. There are no finds that could be securely classified as the remains of settlement activity. Three records (2.5%) in the AISCR database represent a non-specific activity.

For the Bell Beaker Culture there is evidence of 70 burial sites (83.3%), 5 isolated finds (6%), six settlement sites (7.1%) and three records (3.6%) in the AISCR database representing a non-specific activity.

The data for the analysis were obtained from the Archaeological Information System (www.aiscr.cz), after our own revision. We used ESRI ArcMap software for the spatial analyses. The Kernel Density tool was used to analyse the density of the burial sites. The visibility

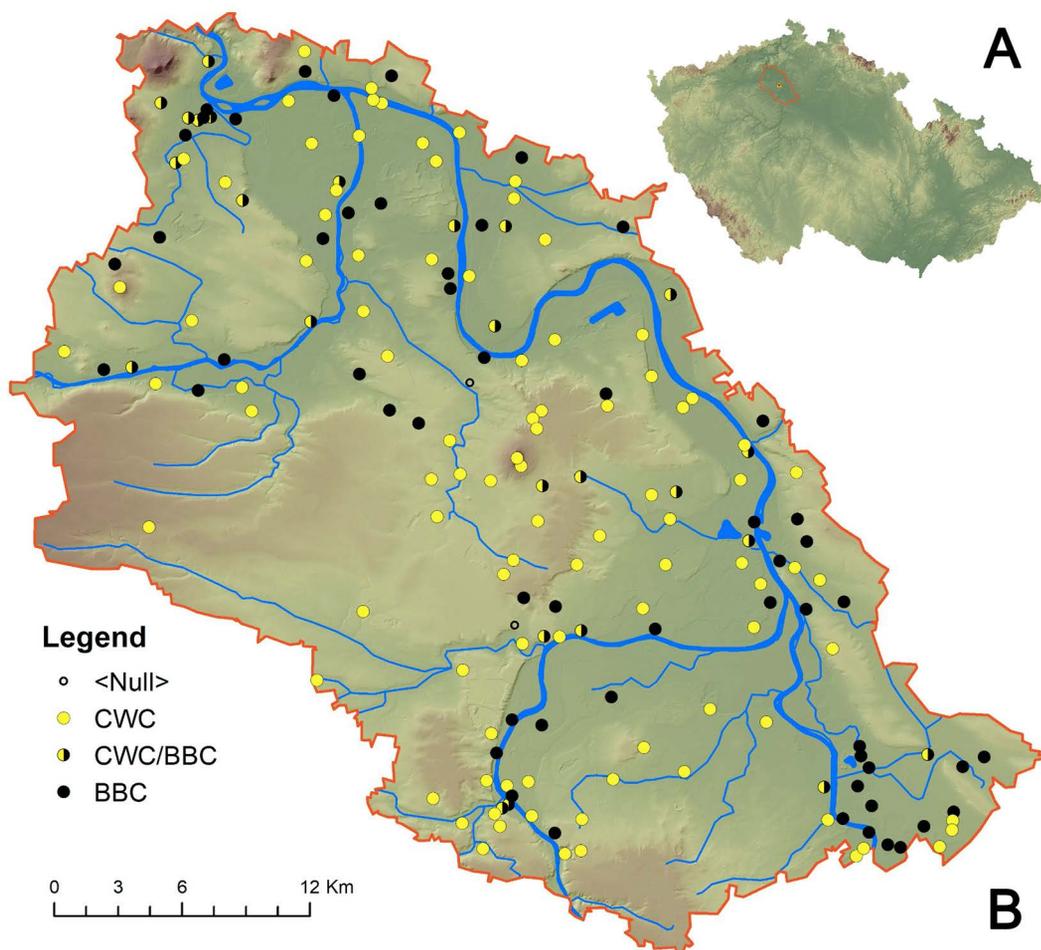


Figure 3: A: Localisation of the research area on the map of Czech Republic. B: Map of Corded Ware Culture (yellow) and Bell Beaker Culture (black) sites.

analysis was created on the basis of the DMR, which is based on airborne laser scanning of the Czech Republic. The same data was used to calculate slope aspect. Using the Aspect tool by ArcMap, the slope aspect raster was calculated. It was converted to polygons and values were assigned to each site. But the preference for slope aspects may be more apparent than real. Account should be taken of the overall distribution of slope aspects in the interest area. The PREcwc and PREbbc values show the predicted distribution of Corded Ware Culture sites and Bell Beaker Culture sites in case of random selection in the interest area. The calculation is based on the percentage of sites on each slope aspect. The value is then multiplied by the percentages of this slope aspect in the area.

Settlement/Funerary Pattern

The reconstruction of the settlement pattern of the Corded Ware Culture in Bohemia is generally limited due to the absence of settlement finds in the archaeological record (Turek 1995; 2019, Neustupný 1997). Thus, its reconstruction is clearly based only on funerary

and isolated finds (Figure 4) that may not be entirely relevant to the original distribution of the community areas, as in many other parts of Central Europe (Vencl 1994; Turek 1995; Neustupný 1997; Krautwurst 1999).

For the Bell Beaker period, the evidence of settlement sites is also scarce; however, we can trace up to six settlement sites, usually represented by single pits. Only the site of Kozly (Mělník District) produced evidence of a longhouse (Zápotocký 1960; 2014). However, it needs to be emphasised that all of these settlement sites are located in the lowland area near the major rivers (Figure 5). Tracing the settlement pattern based on evidence from funerary sites is challenging due to uncertainty over whether the distribution of cemeteries does, in fact, clearly reflect the nearby location of settlements. It is however important to emphasise that a majority of funerary sites, from both cultures, are located in the lowlands along the three big rivers, as are the scarcely recorded Bell Beaker settlements. This means that the majority of sites of both periods only rarely exceed 200 metres a.s.l. In this context it is important to note the Corded Ware sites

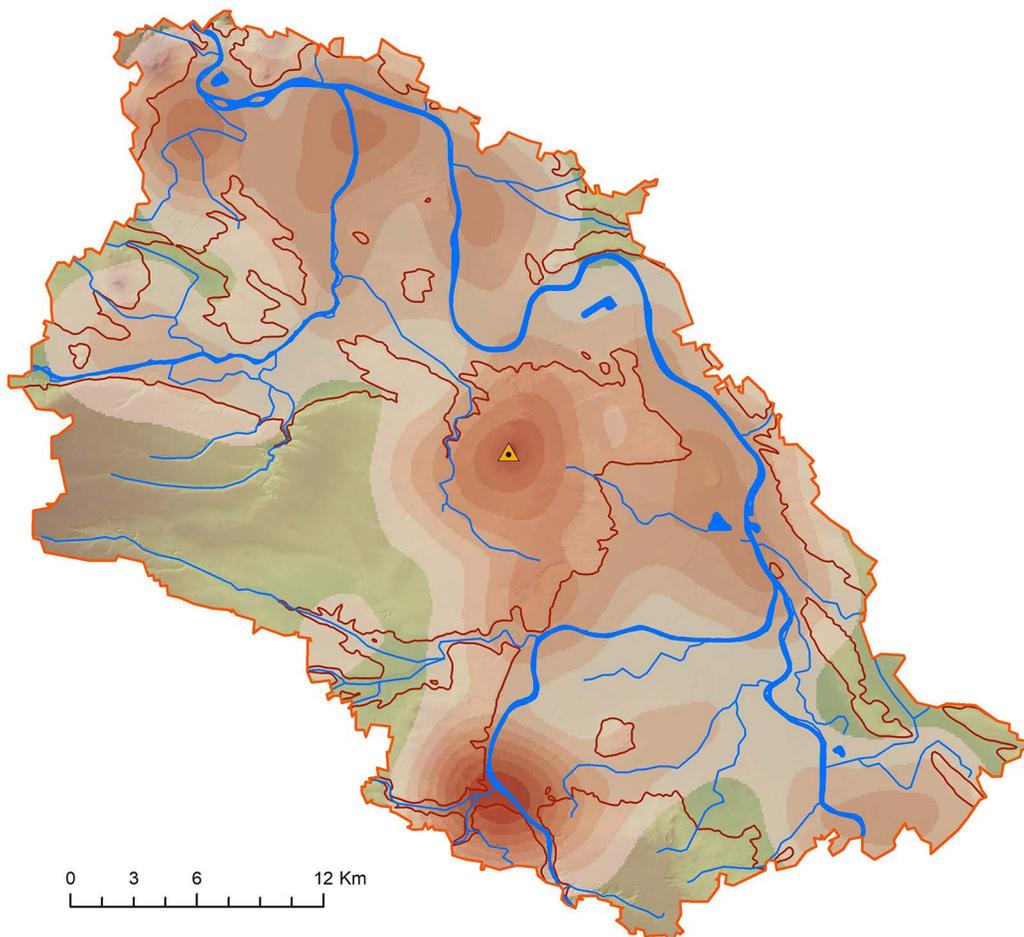


Figure 4: Map of the relative density of CW sites in the research area

over 200 m a.s.l., which are mostly related to Říp as the main landmark. The Corded Ware sites are particularly concentrated on a limited area within the waterless plateau in the immediate vicinity of Mount Říp. There are 18 Corded Ware sites while only two sites were recorded in the same area for the Bell Beaker Culture. These Corded Ware sites include 12 funerary sites and six isolated finds, including one faceted battle-axe directly from Mount Říp itself (Waldhauser et al 2008). It is possible that the affinity of Corded Ware Culture for funerary and perhaps sacrificial (?) activities directed towards Mount Říp was part of a wider cosmological concept of sacred mountains, natural shrines and an ancestral cult (cf. Chroustovský 2015, see below). It seems that in the flat landscape, the landmark of Říp, itself resembling a barrow, was dominant, attracting funerary and ceremonial activities. Mount Říp is a true landmark within the landscape between the Labe, Ohře and Vltava rivers, visible from most parts of the region. Its visibility possibly played a role in structuring the ancestral landscape and funerary activities. Our analysis proved that Mount Říp was visible from 90% of the funerary sites. However, it should be emphasised that the landscape around Říp is generally rather flat and locations without visual contact are rare. Therefore

this observation may rather be a result of the natural landscape relief.

In the next step of our analysis, we focused on the slope aspect of funerary sites. The results for the Bell Beaker cemeteries suggest that the use of slopes does not show any particular preference towards any slope exposition (Figure 6). The sites seem to respect the natural geomorphology of the area under study. The situation with the Corded Ware cemeteries is very different as they clearly avoid southern slopes and have a slight preference for northern slopes (Figure 7). Such observations are in contrast to the situation known from the Prague Basin, where there is a clear preference for eastern and north-eastern slopes for Corded Ware cemeteries and eastern and south-eastern slopes for Bell Beaker sites (Turek 1996; 2019). If we presume the bias towards eastern slopes as evidence of sunrise observation from Prague funerary sites (Turek 2019), then the flat landscape of the Říp study area perhaps offers such an opportunity from many different locations, and the slope aspect did not matter as much as in the much more rugged landscape of the Prague Basin.

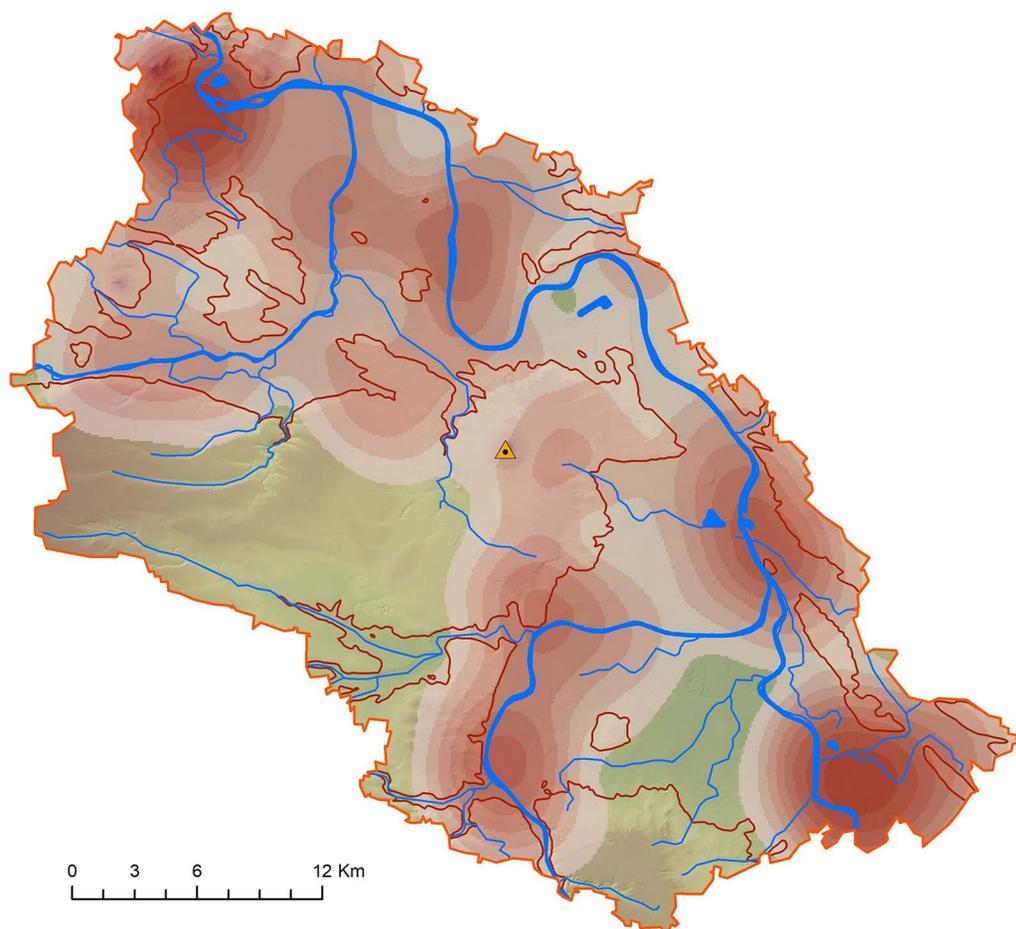


Figure 5: Map of the relative density of BB sites in the research area

Sacred mountains as natural shrines and gates to the underworld

Since the early Neolithic period, distinctive hills and mountains in Bohemia were used for non-residential activities, such as worship and sacrifice (Zápotocký and Zápotocká 2010; Chroustovský 2015). Such deposits are usually represented by stone polished axes, battle-axes and isolated pots. Zápotocký and Zápotocká (2010) summarised the Neolithic and Eneolithic finds (5300 – 2300 BC) from the hill-tops of northwest Bohemia, suggesting the sacred nature of most of them. The continuing Bronze Age tradition of depositing offerings and hoards of copper and bronze objects is recorded on many of the hills and mountains with evidence of earlier Neolithic/Eneolithic deposition (Smrž – Blažek 2002).

The most iconic sacred hill of Czech mythology is Mount Říp (456 m a.s.l.), located on an elevated waterless plain in the Litoměřice District. If Říp was located only 30 to 50 km northwest, it would have been one of the many formations of the České středohoří highlands, but its solitary location in the Elbe plain determines its very special role as the sacred mountain of Bohemia.

As we know from the botanical reconstruction of the vegetation cover, the mountain has been deforested for a long time. The shape of Říp was even more reminiscent of a mound, and it is possible that it also played such a role in the mythology of our prehistoric ancestors.

Distinctive hills, as well as rivers, fords and confluences were perceived as sacred places of worship and places for deposition of offerings (Bradley 2017, 189-198). Some mountains have been perceived and used as natural shrines throughout prehistory (Bradley 2000). The cult and ritual activities of the people at these natural formations are demonstrated by the remains of rock art and the sacrifices of people, animals and objects to the spirits of the mountain gods or ancestors in the underworld. People's lives in prehistory were very closely connected with an extensive system of symbols and rituals. Thus, people lived by almost constant ritual behaviour, which, however, did not only concern cult ceremonies; it can be said without exaggeration that all human activities were more or less ritualised. Social norms thus often created a ritualised taboo that defined and to some extent complicated some practical and purely secular acts. Today, after two millennia of monotheism, the prism of looking at a prehistoric cult is

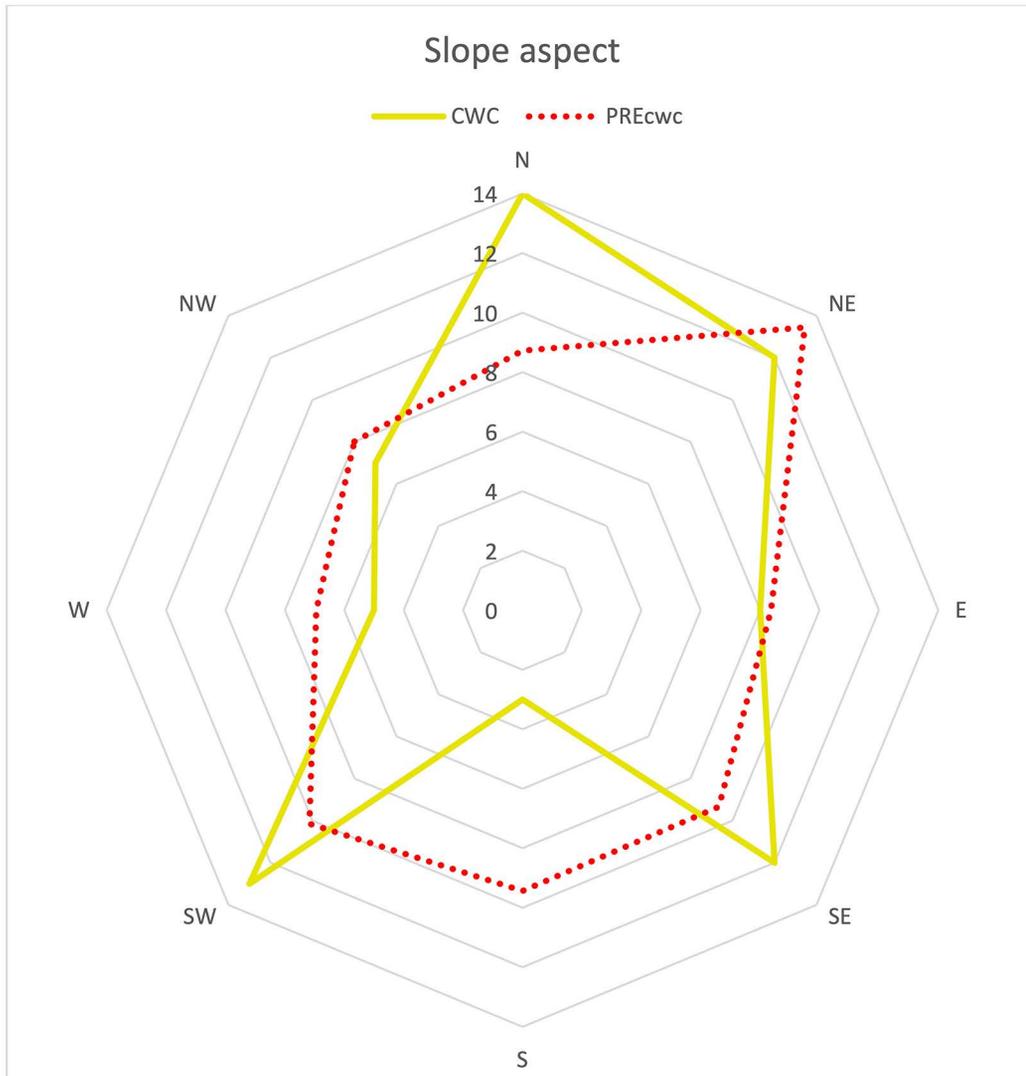


Figure 6: Distribution of cemeteries and individual burials in the research area according to slope aspect. Yellow – real distribution of Corded Ware sites. Red – expected distribution of Corded Ware cemeteries based on even distribution and natural slope aspect in the research area.

very much twisted by our cultural and religious norms, and it is likely that we are not yet able to interpret many obvious structures of past human behaviour correctly.

While from the Early to the Middle Eneolithic people gravitated towards elevated locations for their secular, but apparently also sacral activities, in the Late Eneolithic they abandoned hilltops altogether and concentrated their activities on plains. As far as the vertical direction is concerned, their cult was practiced only downwards, under the ground.

As mentioned above, in the 3rd Millennium BC we observe a fundamental change in the concept of verticality in Central Europe (Neustupný 2008, 26). While from the Early to the Middle Eneolithic, people in their secular, but probably mainly sacral, activities tended to the hill tops, in the Late Eneolithic their

activities were concentrated on the horizontal level. It is perhaps even possible that there was some kind of ritual taboo forbidding the digging of profane features deeper below the earth's surface. Therefore, especially since the Corded Ware period, no sunken features of residential or economic character have been preserved, unlike in most prehistoric agricultural populations. This means that people at that time followed very strict to fundamentalist rules when setting up their dwellings, managing residential waste and extracting raw materials such as clay or stone. The only vertical movement recorded was the digging of burials, during which people dug grave pits into the ground, usually covered with burial mound embankments after placing the unburned body into the grave. It seems that only in the case of a burial could people sink below the surface. This taboo is probably related to the conduct of their cult, which was directed in the vertical direction. It

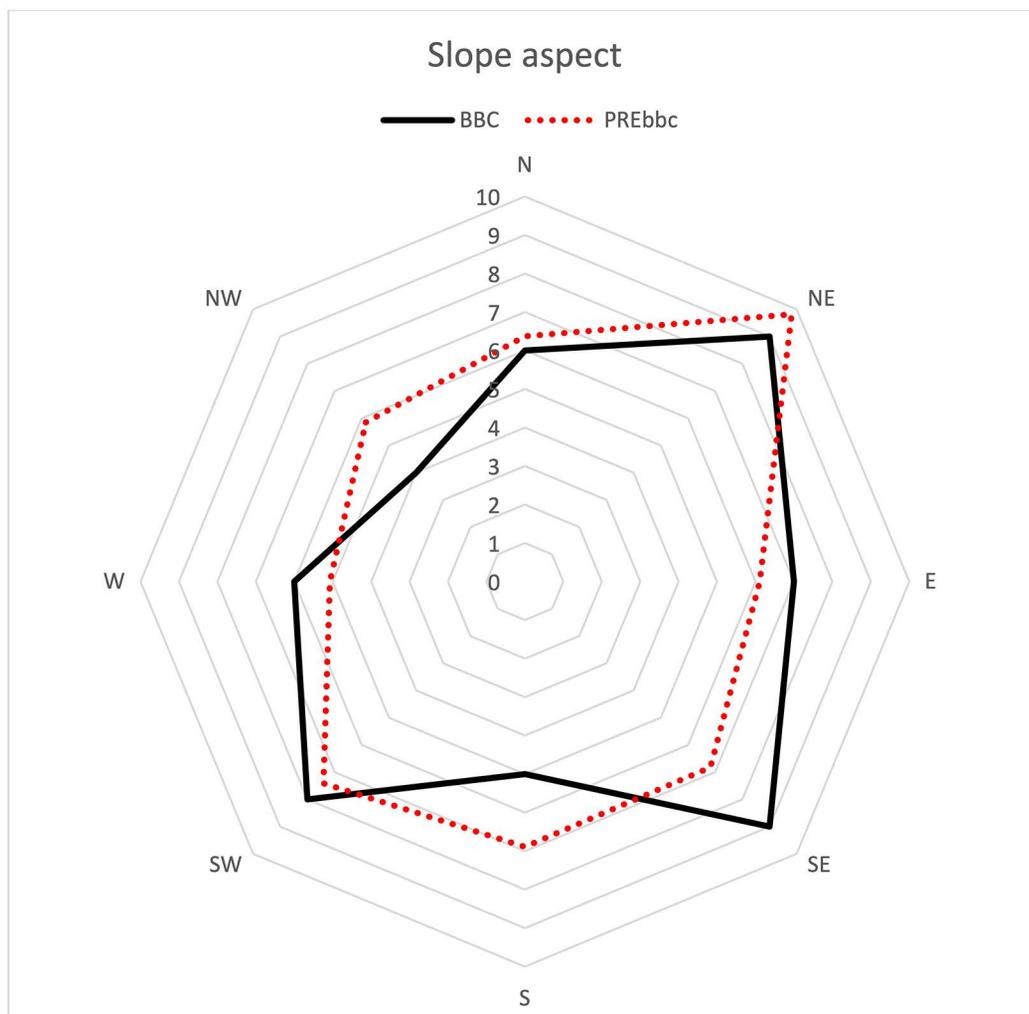


Figure 7: Distribution of cemeteries and individual burials in the research area according to slope aspect. Black - real distribution of Bell Beaker sites, Red - expected distribution of Bell Beaker cemeteries based on even distribution and natural slope aspect in the research area.

is possible that for our ancestors in the Corded Ware period, the underworld begun just below the earth's surface and it was thus not advisable for living people to intervene there. Karst sanctuaries, such as the one on Bacín hill (Figure 8) near Vinařice in the Beroun region (not in our research transect area) of Central Bohemia (Matoušek - Turek 1998; Matoušek 2005) can also demonstrate the practice of placing sacrifices into rock fissures. In one of the cracks, i.e. in the imaginary entrance to the underground, alongside offerings from other prehistoric periods, a whole Corded Ware storage vessel was found, which perhaps contained some sacrificial drink (beer?). Bacín hill is located on the very western edge of the Central Bohemian settlement area of this period and no other finds of string pottery are known in its vicinity. Such karst fissures in the mountain could just be perceived as sacred entrances to the underworld and thus as natural sanctuaries. The existence of natural shrines, as a kind of counterpart to man-made monuments, is well known in prehistory

and antiquity in Europe (Bradley 2000). Similar Corded Ware rock shrines are known from at least three sites in the Upper Franconia (mentioned earlier). In the site of Motzenstein near Wattendorf, Corded Ware sacrifices were discovered, found between two 10–15 metre high limestone rock outcrops from the Jurassic period, which, like Bacín, were characterised by numerous karst fissures (Seregély 2008). A number of artefacts found here represent symbolic miniature clay models of battle-axes, which played an important role in the presentation of the social prestige of the warriors (for souls of dead warriors), both in the ceremonies of living society and in the burial rites. It is probable that these models of real weapons were made specifically for the purpose of sacrificial worship of the spirits of the ancestors lingering in the mountain.

In the vicinity of the Czech mythical Mount Říp is a high density of Corded Ware burial finds, and on the mountain itself there was a battle-axe and a stone axe,



Figure 8: Bacín (Vinařice, Beroun District) CW natural shrine and sacrificial hill in the Bohemian Karst

which could be an example of offerings to gods and ancestors, similar to those clay axes in karst shrines in Franconia, or the sacrificial pot at Bacín. Depositing votive offerings and treasures (especially hoards of bronze artefacts) was again a ritual practice in the Bronze Age. And again, a large number of such treasures were discovered in some Czech sacred mountains. Folklore legends about mountains hiding fairy-tale treasures may also come from early discoveries of hoard finds.

By offering sacrifices, people already worshipped the souls of their deceased ancestors and heroes living inside the mountains during prehistoric times. Such ritual behaviour may be the basis of Indo-European legends about kings and knights sleeping in sacred mountains, such as Blaník, Kyffhäuser, Untersberg and many others.

Conclusion

In this ongoing project we investigate the dynamics and time-span of the monumental traditions in Bohemia represented by the sequence of ancestral worship and its changing forms. The crucial three stages that create a distinctive cosmological continuity can be summarised in following sequence:

- 4500-3800 BC **causewayed enclosures** – Public way of burial within super-communal ritual space emphasizing a broader shared cultural identity.

- 4000-3300 BC **long barrows** – Burials particularly emphasizing familial local ties and more private and intimate relationships towards ancestors.
- 2900–2300 BC Individual burials under **round barrows**, emphasizing personal/gender identity and creation of **natural shrines** with sacrificial evidence of ancestral worship.

Acknowledgements

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Commensality Through a Solar Cult. Ceramics, Social Practices and Symbolism Along the Atlantic Coast (2500-1650 BC)

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Abstract: The Bell Beaker phenomenon is characterised by new forms of ritual practices especially known through the study of Bell Beaker graves. These contexts are linked to the representation of individuals who represent elites of those Neolithic societies. Within the complex chiefdoms of the Early Bronze Age, social practices seem to acquire a collective dimension from which new social behaviours emerge. By extension, many domestic ceramic sets display particular organisations related to meaningful gestures and practices. At this time, the ceramic artefact itself is renewed in terms of forms and ornamentations. A significant number of vessels are associated with multiple handles, allowing more complex social interactions. New decorative schemes can be interpreted as astral (solar and lunar) representations. In Atlantic France, these representations undergo a major development during the Bronze Age and seem closely linked to ritual and social practices. They carry major symbolic features and the organisation of the scenery, linked to the relationship maintained between the user and the assistants, probably plays a major role in these collective events. This article will be the occasion to discuss the evolution of these practices, during particular and meaningful occasions but also in daily activities.

Keywords: Late Neolithic, Early Bronze Age, Ceramic, Brittany, Ritual, Social practices, Collective practices

Introduction

At the transition between the Neolithic and the Bronze Age, social hierarchy increased among the populations of the Atlantic coast. These changes are visible in funerary depositions, which display an increased number of social ranks compared to the Bell Beaker period. The Bell Beaker phenomenon is characterised by forms of ritual practices known especially from the study of graves and linked to the representation of individuals who are probably elites of those Neolithic societies (Fitzpatrick, 2011). The Early Bronze Age sees the development of wealthy graves along the Atlantic coast and beyond but also the development of cemeteries, used over a long period (Barclay and Halpin, 1999, Lisfranc and Vidal, 2017). Those phenomena are understood by many scholars as an increase in social hierarchy (Nicolas, 2016). These changes imply a new social organisation and the necessity of a particular interaction within communities, and between communities, to maintain these social structures. In this context, we see the development of community spaces like large enclosures and the erection of barrows, moreover of large barrow cemeteries organised around founder graves, probably linked to important authority figures, and displaying hierarchical and familial bonds (Barclay and Halpin, 1999, Lisfranc and Vidal, 2017).

During the Early Bronze Age, however, ceramics appear as a low social ranking feature in funerary deposition; vases play a major role at both consumption and depositional scale. Changes in funerary practices occur during the transition between the Neolithic and Bronze

Age along the Atlantic coast, and a larger set of ceramic types is from now on deposited in graves, compared to Bell Beaker practices. New and larger ceramic forms occurred with one or more prehensions. These handled beakers or vases allow new social interactions during particular events, involving a larger part of the community, and could play a part in the resilience of the social structure of those societies.

The Early Bronze Age also sees the development of a new ornamental grammar linked to solar or lunar symbols, produced on a large number of products (Figure 1). These representations are well known from metallic artefacts during the Early and Middle Bronze Age, but also seem to be displayed on many ceramics over western Europe. Those representations, increasing at the end of the third millennium and linked to particular beliefs, will be then widely represented during the major part of protohistory. In terms of symbolism, during this period the sun becomes more and more present in different depictions on various materials, including metallic artefacts (here the brightest of the material is itself suggestive), and linked to the representation of those elites. At this time geometric knowledge probably plays a major role in the making of those representations.

We will now firstly evoke the spread of astronomic representations, from their first occurrences during prehistory to their wider development among European cultures at the end of the third millennium BC. Then, we will consider the abundance of those representations on ceramics and observe their particular organisations over the surface of pots. Finally, we will try to figure out



Figure 1: Solar figure display on Solar discs and Bowls from Ireland, image not to scale (Cahill, 2015): 1 - Lough Gur, Co. Limerick; 2 - Rappa Castle (Ballina), Co. Mayo.; 3 - Kiltalown, Co. Dublin; 4 - Richardstown, Co. Westmeath.

the implications of those changes within Early Bronze Age collective practices, during particular events but also in everyday life.

Astronomic representations during prehistory and early protohistory

From the fifth millennium BC, populations show a particular interest in astronomic phenomena and particularly the lunar and solar cycles. Many megaliths and also rock carvings (Mont-Bego, Val Camonica for example) could be linked to the winter and summer solstice (Arnaud, 2007, Mathias, 2019). Solar depictions during prehistory are known from many areas: Western and Eastern Europe, India, Northern Africa, etc. (Huy, 2019). They are known from the Palaeolithic, like the shining aurochs (Rocher de l'impératrice, Brittany, Naudinot, *et al.*, 2017), but developed gradually during the Neolithic (Huy 2019). In several cases, we see the association of horned animals (aurochs, deer, goat...) with astronomic depictions (Prieto Martinez, 2013). Despite various changes in the scene and the actors involved, those representations seem to carry similar ideas and goals over a long period.

Unlike the previous period, for the Bronze Age we receive help from such textual productions as the Rig-Veda, Assyrian texts and the Hittite pantheon to understand the conception of the divine '(Later) surrounded by darkness, (and now) enlightened by the brightest of the stars, we present ourselves in front of the sun, the greatest god, the most beautiful of the celestial lights.' Hymn IV, to the sun, Rig-Veda (1500-900 av. J.-C.); Langlois 1848 (translated by the authors). G. Olmsted (2019), for example, considers that Indo-European beliefs appeared during the third millennium and were largely developed during the Bronze Age among populations who had the benefit of important knowledge of astronomic phenomena and long-distance routes connecting the elites. The towed figures and the twins are important and present in the Vedic texts. In the Rig-Veda, the twins are the Ashvins and can be compared to the Dioscures, Castor and Pollux, in Greek mythology. Both are descendants of an Ouranian god, Zeus for the Dioscures, Sanraya and Vivisat for the Ashvins, and are linked to animal figures (horses and birds; Mathias, 2019). Differences also occurred, and only the Ashvins are closely linked to a solar cult in writings. Other figures could be quoted like the duality of the Sun Goddess and the Weather

God known for the Hittite pantheon. In the Rig-Veda white horses tow a chariot associated with the figure of a god (most of the time a goddess) sometimes replaced by a solar figure. This depiction, and the twin figures, evoke archaeological artefacts like the Trundholm sun chariot from Denmark, where the two faces represent for the first, gold and shiny, diurnal travel, and for the second, in bronze, nocturnal mythological travel. This duality – diurnal/nocturnal – is also present in the Rig-Veda where the Ashvins tried to rescue their sister, the Goddess of the Sun, at the end of her diurnal travel (Olmsted, 2019). Indeed, in an archaeological context, this duality can be linked to wider attributes: day and night, the religious and the political world, or life and death. This last point could be related to another dual symbolism, wood and stone, as has been highlighted some years ago by M. Parker Pearson and Ramilisonina (1998) about Stonehenge and Durrington wall enclosures in southern Britain.

On decorative patterns linked to astronomic depictions (mostly concentric or radiating) an original interpretation was made by E. Pasztor (2017) with comparisons to climatic phenomena, involving the sun or the moon. In this idea phenomena like parhelia can be compared to cross-form ornaments, and by contrast, different kinds of halo could be linked to concentric ornaments. The first phenomenon is primarily linked to the sun and the second to the moon, therefore the common combination of these ornaments on different materials could also evoke the duality of those astronomic phenomena (like the Trundholm sun chariot, quoted above). Considering late Bell Beaker ceramics, the comparison has also been made with stelae, from both Eastern and Western Europe, depicting a trifunctional organisation of patterns (fecundity, strength, sovereignty; Prieto Martinez, 2013). Beyond this comparison, stela no. 1 from Petit Chasseur, Sion, is interesting for the relationship maintained between power and solar symbolism. Initially, the face of a ‘warrior’ was depicted on the stela and then replaced by a solar figure at the end of the third millennium, whereas the warrior attributes, armor and weapons, were maintained (Corboud, 2009).

Early Bronze Age ceramics and concentric and radiating ornaments

Ornaments on ceramics play a decorative function; however, they could also express identity or imply a particular relation with the user or assistants (see the cup with eyes for example). The location of the ornaments on the pots also seems significant, and hierarchy between different patterns could be expressed by a particular organisation (Pilar Prieto, 2013, see above), from the base to the top for example. How ornaments are read also depends on the use of the

ceramic and the position of the user. Ornaments could be read by the user before (ornaments on the upper part) or after consumption (ornaments on the inner part of the bottom, like sake glasses). Ornaments on the outer part of the bottom can be read by the user in a particular moment (rising the vase in the air, laying the pot inverted after consumption) but are also seen by a possible audience during a ritual. Thus changes in the organisation of the decoration could imply new ways of use and different kinds of interactions between the users.

From our point of view, an important dichotomy exists in Brittany between Bell Beaker ornaments during the late Neolithic and those emerging at the beginning of the Early Bronze Age. Fine ceramics from the maritime and geometric styles display ornaments all over the pots and are always produced without any prehension. On the contrary, during the Early Bronze Age the ceramic artefact itself is renewed in terms of forms and ornamentations (Figure 2). A significant number of vessels are associated with handles, from one (especially at the beginning of the Early Bronze Age) to four or more, and the decorative schemes are restricted to particular areas of the surface (the upper part, the carinated zone and the bottom of the vase). These changes could imply a new sense in the reading of those ornaments and therefore new ways of using those ceramics.

If ‘solar’ depictions (concentric or radiating symbols, or more naturalist depictions) are already known from the Early Neolithic in various regions, including France (Rubané and Cardial, Houbre, 2013), and then during the Middle and Recent Neolithic (Chambon (Villes, 2007) and Chasséen culture (Huet, 2017, 2018)), they gradually develop over Western Europe during the Late Neolithic. Considering the Late Neolithic and the third millennium BC, these ornaments are well represented from the start of the millennium in Helladic and Minoan cultures but also in the central part of Europe (Cotofeni and Kostolac for example, see Kapuran and Bulatovic, 2012, Vučedol, see Pasztor, 2015). They developed gradually during the first half of the millennium, covering different Mediterranean regions: Italy, Spain or Southern France (Ferrières and Fontbousse culture; see Peyrolles and Arnal, 1957, Courtin, 1974). The spread of the Corded Ware culture and the Bell Beaker phenomenon seem to play a major role in the diffusion of those patterns over Western Europe. In the Greek world, far from those networks, many solar depictions are also known, depending probably on other interactions with, for example, Central Europe. Those depictions are indeed also well represented in central European areas and linked to Corded Ware practices (some protruding foot beakers, and globular amphoras, for example, Lanting and Van der Walls, 1976; Woidich, 2014). They are also

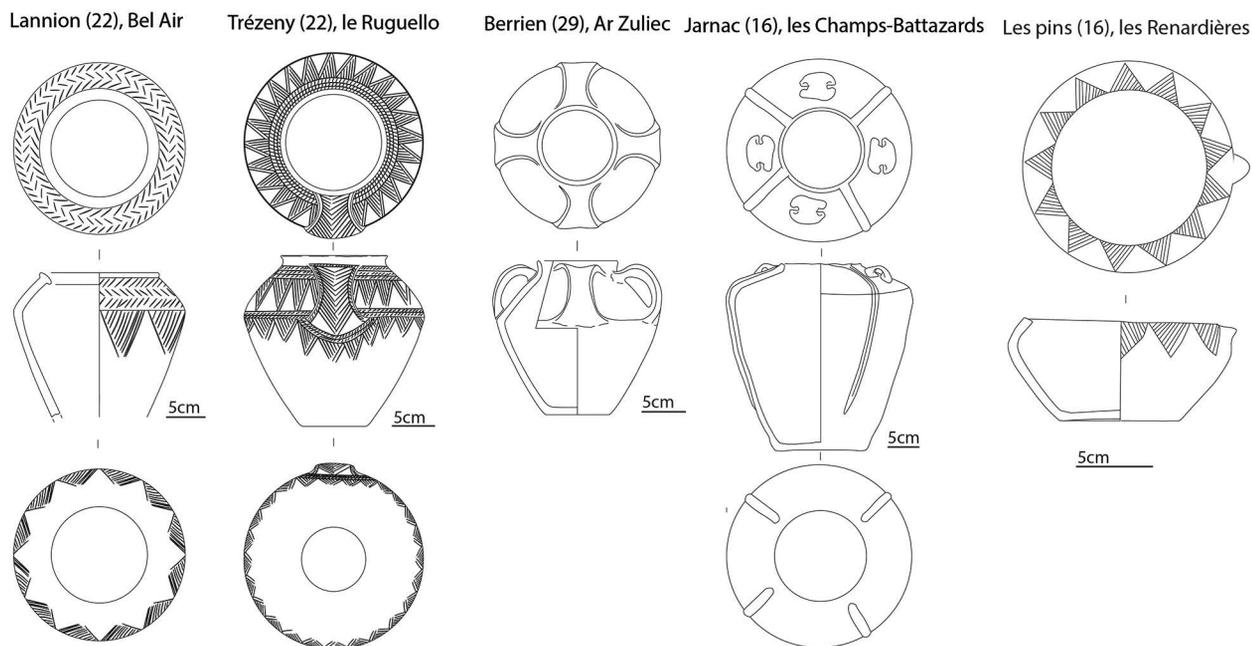


Figure 2: Biconical pots, Atlantic France, archaeological drawing and reconstruction.

well represented in the Iberian Peninsula from the start of the Bell Beaker phenomenon and even a bit earlier. Considering the origin of the Bell Beaker phenomenon in the Iberian Peninsula, solar depictions seem to follow the spread of this phenomenon over Western Europe to firstly Italy, Spain and southern France, and later western and northern France and the British Isles, in the second part of the third millennium. At the end of the Neolithic, these patterns are indeed still scarce along the northern part of the Atlantic coast (from south-western France, Figure 3), in the Netherlands and northern Europe. In Atlantic France, rare occurrences are known from Artenac and Conguel ceramic sets and later in geometric and dotted beaker styles. They seem absent in Britain during the first half of the millennia in the Peterborough Ware and early Grooved Ware sites. The rare concentric or cross-form ornaments linked to Grooved Ware, like the one from Overton Hill, Wiltshire (Pollard, 1992), seem to appear during the late phases of this culture in parallel with the first Bell Beaker productions in Britain. Again, more comparisons are available within Bell Beaker and especially late Beaker sets.

At the beginning of the Early Bronze Age, the patterns finally reached the northern part of the Atlantic coast and became well represented along the French coast and in the British Isles (Figure 3). The set of ceramics is renewed in a large part at the start of the Bronze Age and the productions (biconic pots, Irish pots, food vessels and possibly collared urns) are disconnected from the Bell Beaker standard in terms of forms and organisation of decorative schemes. By contrast, various beakers are

still recognised in the southern part of Europe, but also in England, displaying similar symbolism still linked to late Beaker influence. If comparisons with other areas are still possible, Atlantic productions will share, from now on, various traits: handle pottery (Atlantic France), close shape, high carinated biconical form and ornament located near the carination or the bottom for the lower part (for Brittany and Britain) and covering the upper part of the vessel (from Atlantic France to northern Britain, Figure 4). While many beakers from these areas are undecorated, biconical pots along the French coast become the most popular form to display hollow ornaments (impressed or incised). Productions associated with one or more handles are known from both funerary and ceremonial or particular/special domestic contexts: Lannion, Zac de Bel-air (Escats, 2013), Berrien, Ar Zuliec (Stevenin, 2000), etc. Outside of this area, other forms seem to locally replace those productions like the Irish bowls in Ireland (Ó Ríordáin and Waddell, 1993) or the pots with a flat opening from Galicia and northern Portugal (Nonat, 2017). If many ornaments display local traditions linked to ornaments or to the technique used to make them, they all share similar symbols and display close patterns. Most famous are:

- Radiating ornaments, including many cross-form ornaments
- Concentric ornaments, including line and triangle ornaments
- Concentric ornaments divided by vertical lines creating panels – a possible combination of the two first groups.

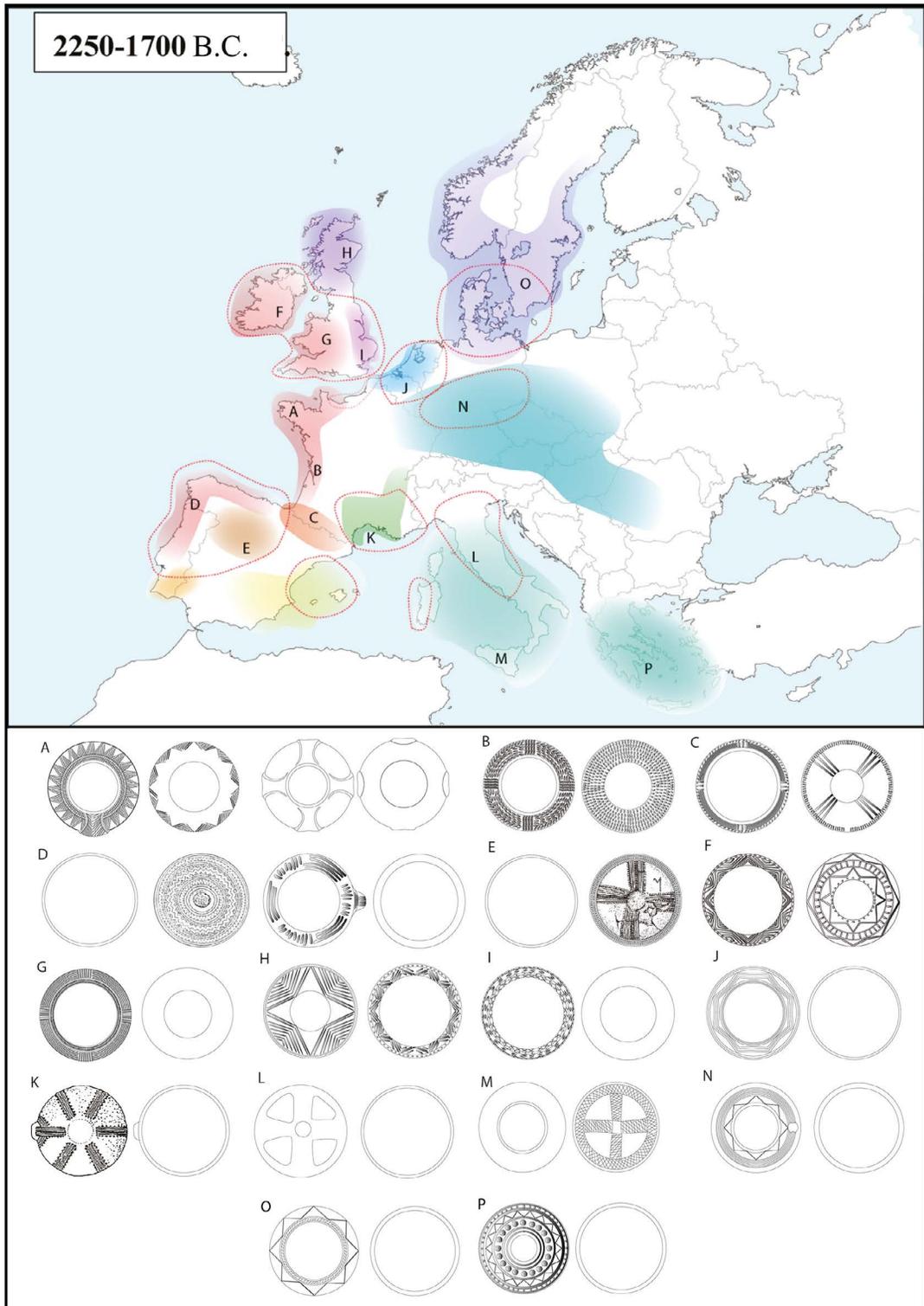


Figure 3: Solar ornaments on the top and bottom of ceramics in western Europe during the Early Bronze Age (red circles indicate late Bell Beakers groups) : A - Trezeny, Bretagne (Stevenin, 2000) ; Juno-Bella, Berrien (Briard, 1984) ; B - Jaunay-Clan, Nouvelle-Aquitaine (Lavoix *et al.*, 2013) ; C - Pyrénées : Artix, Nouvelle-Aquitaine (Blanc, Etchecopar and Tort, 2001) ; D - Collado de Palomero, la Rioja (Nonat, 2017) ; Felgueiras, Porto (Brochado de Almeida and Fernandes, 2007) ; E - Valladolid, Castille-et-León (Garrido Pena, 2000) ; F - Blanchfieldsbog, Co. Kilkenny (Ó Ríordáin and Waddell, 1993) ; G - Gwinear-Gwithian, Cornwall (Longworth, 1984) ; Winterslow, Wiltshire (Longworth, 1984) ; H - Isle of Islay, Hébrides (Sheridan, 2004) ; I - Inverkeilor, Tayside (Longworth, 1984) ; J - Molensgraaf, Holland (Louwe Kooijmans, 1974) ; K - Vinezac, Auvergne-Rhône-Alpes (Lemerrier, 2002) ; L - Indéterminé, culture de Polada (Leonardi *et al.*, 2015) ; M - Collection Venerose (Guilaine, Tusa and Venerose, 2009) ; N - Indéterminé, Paluki (Makarowicz, 2003) ; O - Mors, Jutland du Nord (Vandkilde, 2005) ; P - Alt-Agina, Ege (Papagiannopoulou, 1987).

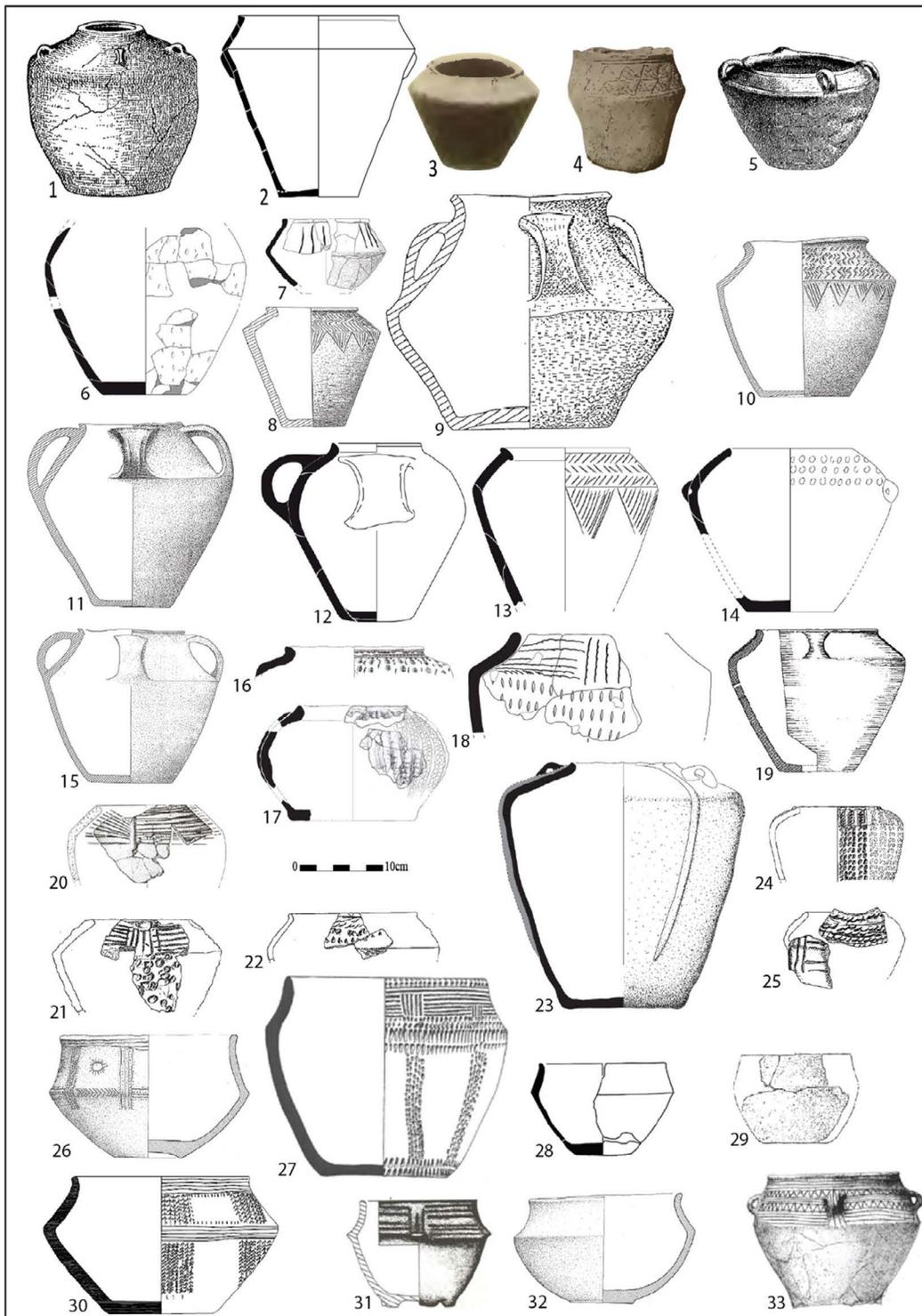


Figure 4: Early Bronze Age biconical pots along the Atlantic coast : 1 - Winterbourne Stoke, Wiltshire (Tomalin, 1988); 2 - Amesbury, Wiltshire (unedited); 3 - Winklebury Hills (Abercromby, 1912); 4 - Doddington, Northumberland (Abercromby, 1912); 5 - Île de Portland, Dorset (Abercromby, 1912); 6 - Alizay-Igoville, Normandie (Marcigny and Mazet, 2015); 7 - Moissy-Cramayel, Île-de-France (Brunet, Hammon and Iribarria, 2009); 8 - Berrien, Bretagne (Stevenin, 2000); 9 - Melgven, Bretagne (Stevenin, 2000); 10 - La Feuillée (Stevenin, 2000); 11 - Crozon, Bretagne (Stevenin, 2000); 12-14 - Lannion, Bretagne (Escat, 2013); 15 - L'Hermitage, Bretagne (Stevenin, 2000); 16-17 - Beauvoir-sur-Mer, Pays-de-Loire (Viau, 2005); 18-19 - Jaunay-Clan, Nouvelle-Aquitaine (Lavoix *et al.*, 2013; Taillet, 1955); 20 - Saint-Pierre-des-Corps, Centre-Val de Loire (Cordier, 2009); 21-22 - Saint-Léger, Nouvelle-Aquitaine (Bouchet *et al.*, 1990); 23 - Jarnac, Nouvelle-Aquitaine (Ranché *et al.*, 2009); 24-25 - Agris, Charente (Gomez de Soto, 1995); 26 - Sauvagnon, Nouvelle-Aquitaine (Gardes, 1993); 27 - Asque, Occitanie (Nonat, 2017); 28 - Laruns, Nouvelle-Aquitaine (Nonat, 2017); 29 - Bourgarber, Nouvelle-Aquitaine (Nonat, 2017); 30 - Labastide-Montréal, Nouvelle-Aquitaine (Nonat, 2017); 31 - Le Taillan-Médoc, Nouvelle-Aquitaine (Nonat, 2017); 32 - Sauvagnon, Nouvelle-Aquitaine (Nonat, 2017); 33 - Saint-Michel, Nouvelle-Aquitaine (Nonat, 2017).

For those patterns, differences occurring at a more local level allow us to define different areas showing southern and northern traditions, in which midwestern France and moreover Brittany appear as a crossroad displaying many of those productions and various traditions (including a local and strong one). In midwestern France, those ornaments are produced by corded and fingerprint impressions (fingerprints are organised to mimic corded impressions), incisions and in rare cases in a dotted style evoking the incoming Duffaits culture (Gomez de Soto, 1995). In most cases, the patterns produced are simple lines made all over the pot, divided into units by vertical lines and in some cases by cordons. The decoration of the lower part could display multiple ranges of fingernail impressions from the carination to the bottom. In Brittany incisions and impressions 'en grain de riz' are the most common techniques. Hatches are the most common pattern for the upper part of the vessel and a range of triangles are commonly incised on the lower part, from the carination and in some cases from the bottom. Another cross-form depiction common in Brittany appears as both decorative and functional. It is made by adding three, four or more handles to the upper part of the ceramic. On various Bell Beaker productions, the location of the ornamentation seems to imply a reading from the top and/or the bottom of the pot, involving the user and his possible audience during the use of the vessel. Other productions along the French Atlantic coast, despite a few forms and some ornamental original features, share many aspects of these decorative schemes. In this view, a close relationship emerges between midwestern France and southwestern France including Pyrenean cultures. Some imitation also occurred, notably in Armorican biconical four handled pots. They are found in southern England at Winterbourne Stoke, for example (Tomalin, 1988), and in the midwestern part of France at Les Champs-Batazards, Jarnac (Ranché *et al.*, 2006) and la Grotte des Perrats, Agris, (Gomez de Soto, 1995). In this last area, in some cases, the handle is simply applied onto the vessel and not even perforated. The handle, not functional, only preserves the symbolic aspect of the pattern. This pattern, in many cases, appears as the main aim of the potter in the production of those poor imitations from a decorative and typological point of view. Other productions are linked to solar depictions, like the miniature cups from England (Kavanagh, 1977, Cahill, 2015) which could be associated with lights (as a candle holder), in some cases, to produce luminous patterns and create a real staging for this ornament.

Considering these three main decorative schemes (radiating, concentric, and both), different areas of diffusion can be defined at an Atlantic scale. The first group (radiating ornaments) shows important regional differences and three subgroups: Ireland, the French Atlantic coast and the Iberian Peninsula. The first region shows a large number of these ornaments (See

Ó Ríordáin and Waddell, 1993, Brindley, 2007) especially among the Irish bowls but finds few comparisons with the rest of the British Isles. Indeed only a few examples of cups (covering the largest set of ornaments) from the British Isles (Moyhora, Co. Kilkenny for example, Brindley, 2007) could be part of this first group. Radiating and cross-form ornaments are still scarce in Brittany while observing hollow ornaments, nevertheless, multiple handles create (when read from the top) a cross-like ornament that must be included in this first group. Those decorations, numerous in this area, compose a second group and a second tradition for these radiating ornaments. Those depictions remain rare in the southern part of the Atlantic French coast and we have to go further to the Iberian Peninsula to find our last group. This one is composed mainly of late Bell Beaker productions, including the Cziempozuelos Beaker, which display a large number of radiating ornaments including a wide range of cross-form ornaments (and also find a close comparison with the ornaments on the bottoms of Irish bowls, see Cahill, 2015). This third group covers the major part of Spain and Portugal, and could be extended to productions from the south of France and Italy. It could connect, via the Bell Beaker tradition, the Mediterranean and the Atlantic world. If common traits can be observed on a symbolic level, these three subgroups display local traditions from a technical and typological point of view.

The second group to be considered includes a large range of concentric ornaments and especially those made with triangles. By contrast with the first group, those decorations cover a large area but again three main subgroups have been determined. The first one links Ireland in particular with, beyond the sea, Brittany. Indeed, such ornaments are well represented in both areas and linked to close techniques (incision). The triangles made on the lower part of the pot are commonly longer than the ornaments made on the upper part: Lannion, Zac de Bel-air (Escats, 2013), Saint-Vougay, Graeoc, Plouguerneau, Ran-ar-Groz or Guimiliau, Kerouaré (Stevenin, 2000), for example. This could be explained by the fact that the lower body of the pot, less inclined, changes the vision of the ornament from below. It is indeed interesting to consider those larger patterns as a compensation for the less inclined walls of the pot, compared to the upper part. Using this technique, the ornament displays a similar size when read from the top or the bottom. This could be a new proof of the purpose of those decorations, linked to the users and their counterpart, the audience. The main difference between Ireland and Brittany is the presence of more complex ornaments in the former, involving various combinations with other concentric ornamentations (lines) divided or not by vertical patterns and radiating ornaments. Some decorations of this type also occur in Cornwall (or even Wales)

appearing as a crossroads between Brittany and Ireland. The second main subgroup is located especially in England, Wales and Scotland. The ornaments are located on the external part or inner part of the rim and are limited to one narrow line, often associated with another pattern of lines divided by vertical elements (one pattern on the external part and one on the inner part of the rim). These ornaments find their best parallels outside of Britain in northern France (including also a part of Normandy and the Paris Basin) and in the Low Countries (linked mostly to Hilversum productions which have long been compared to English productions, see Theunissen, 1996). They are produced mainly by corded impressions and less often by incisions or other impression techniques, in contrast to the first subgroup considered. The last subgroup, known from southern Spain to midwestern France, is more heterogeneous and would deserve further investigation to be divided into subgroups. It is firstly linked to band-organised triangle lines well known in the late Beaker productions of the Iberian Peninsula and often visible from below. Locally other forms integrate this set, like some proto-Cogotas (see Castro-Martinez *et al.*, 1995) productions in Central and North-Western Spain and Portugal. Pyrenean productions share a similar organisation to Iberian pots with refined ornaments and present some affinities with the late beaker style of southern France. Midwestern France shows influences from the south as well as the north part of the Atlantic coast, but the simplicity of the composition links it primarily with the southern subgroup.

The last group (concentric lines divided by vertical elements) could be integrated into the second group (concentric patterns), or even be considered as a combination of the two first groups, but its originality and the fact that these ornaments cover a large part of western Europe led us to consider them as a separate group. They represent the most homogeneous group and this time only two subgroups are considered. Surprisingly, these ornaments are absent in Brittany and find only a poor comparison with the handled productions quoted above. The first subgroup covers a large area from the British Isles to northern France. Unlike the other groups, those ornaments are well-represented in Britain and are linked to collared urn productions. Mostly produced on the upper part of the vessel, they could replace, locally, the various schemes in use in Ireland during this period. Produced mainly by incision or corded impression, the patterns are also commonly recognised on cup productions and find comparisons with some Irish bowls. In this last case the decoration, located on the lower part, could replace the most common Irish ornaments present in the first two groups. The second subgroup is known from the Iberian Peninsula to midwestern France. Considering the first region they are especially found in Galicia and northern Portugal and are connected to the Atlantic maritime

trade routes. In those areas, they are especially linked to vases with a flat and large opening (see Nonat, 2017). The ornamentation itself can be compared to many pottery productions of the Pyrenean region, where it is linked to biconical pots (see Gardes, 1993; Marambert, 2000 for example). The making of the pattern itself, by incision or narrow rib, seems to bring those two areas together. The main difference is the location of the pattern, on various parts of the pots for the Pyrenean productions and only on the rim for the Galician and Portuguese productions. If this pattern is made with numerous techniques in midwestern France (incision again but also corded, fingerprint and fingernail impression) it remains particularly close to those from the Pyrenees, Portugal and Galicia, and similar ornaments are created mostly limited to the upper part of the ceramic. They are commonly associated with fingernail decorations on the lower part of the body. The associated productions, high carinated and biconical, are close to the Armorican pots and therefore integrate the group of biconical pots produced all over the French Atlantic coast.

Ceramic ornaments and social interactions

Regional associations of those different patterns could be explained by aesthetic preferences but also by variations in the use of pottery and in practices from one region to another.

The development of those ornaments located only on some part of the ceramic could imply new rituals and, as we already said, a pattern located on the upper part of the vessel is visible during its use to the actors (Figure 5). At the same time, the lower part is visible to the audience (Figure 5). Handles also lead to a new way of consuming the food or the beverage, and new manners of showing the vessel to the audience. If we admit that hypothesis, there is not only one scheme in use. Some ceramics display decorations that are only visible from below, like the Ciempozuelos beaker and many Irish Bowls, but some ornaments can only be seen from the top or from the top and the bottom, like many biconical pots along the Atlantic coast. In those different cases, a strong relation, which could be useful to maintain unity within the community, emerges between those patterns, the user and the audience. This relation could evoke later productions like cups with eyes from the Attic Greek period where the pattern is used to create emotions to/for the user and accompany him in achieving an altered state by alcohol consumption for example.

The development of handles in Brittany, on gradually larger pots during the Early Bronze Age, is also particularly interesting. During the spread of the Bell Beaker phenomenon along the Atlantic coast, the diversity of uses for pots with no handle remains

difficult to understand. Nevertheless, collective consumption is considered for productions in Central Europe in a different manner. Indeed, the use of straws (Turek, 2020) in association with Bell Beaker pots could allow more than one user at the same time. Emerging especially at the end of the third millennium, single handle pots remain linked to individuals – one or more – but do not imply a particular sharing process. Things could change with two handled pots which can be easily transmitted from one user to another. This could also imply a different use and handling of the pot itself in using it, emptying it, or even showing it to the audience. Therefore, three or four handled pots, emerging around 2000 BC, multiply the possibilities in terms of exchange and transmission (Figure 6). They could imply a larger number of users during the ritual and be linked to commensality. If collective consumption is already possible with Beakers and straws, the development of handles implies new ways of consumption and particularly new manners of sharing, strongly connecting the different users. Collective use is not only possible but becomes associated with the ceramic form itself, practically but also symbolically. The development of new rituals could be explained by the greater complexity of the social structures within those societies. Thus we could suppose an evolution from users limited to the elites to a larger number of users, including the elites again but also intermediate social ranks, like the specialist who emerges during this period, or other authorities, like religious ones, for example. Those ranks are visible with the deposition of various sets of grave goods in funerary contexts,

highlighting the social rank of the deceased (like the Armorican arrowhead or other objects made with exotic or rare materials including metal, Nicolas, 2016). Such changes could rely on a need for unity and cohesion within communities, which could be expressed in the making of large funerary structures and large collective enclosures during this period too. The rituals are needed to maintain the cohesion of new and complex chiefdoms including different grades within the social hierarchy. Collective events are even more important for unstable political systems like those of the Early Bronze Age (Brun 1996, 1998). Indeed, those powerful entities (the chiefdoms of El Argar, Wessex, Thuringia and Brittany for example) would collapse, in a brutal manner, at the end of the Early Bronze Age.

These rituals are not restricted to funerary contexts and could cover a large variety of functions within everyday life. Deposits, including rejections in a pit, are, in many cases, no ordinary move during the Early Bronze Age. Many deposits in pits, even within a habitat, cannot be seen only as waste or garbage. Deposition is also an opportunity to accumulate goods and to individualise people or the community during events. The lack of storage pots among the numerous ceramic forms discovered in ditches at Lannion (Brittany, Escats, 2013), including concentrations near the entry of the large enclosure (4 Ha), could rely on collective ‘ritual’ practices and accumulation practices more than on common domestic use as a set. The lack of large storage pots in this set indicates a particular function, not only domestic, and the fact that the site is located near two

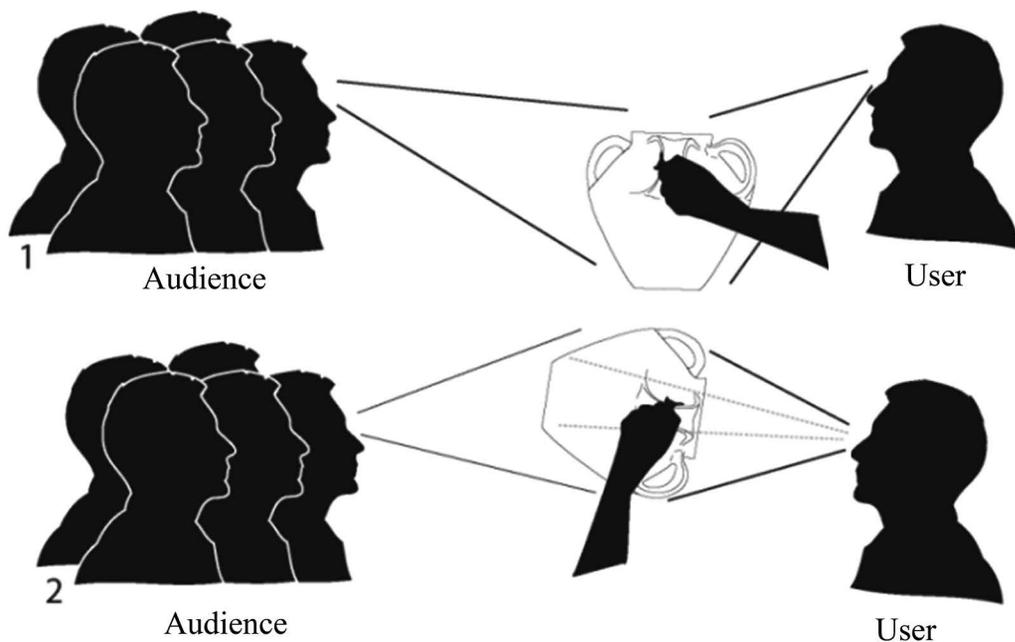


Figure 5: Schematic representation of the visible part of the pots (for the user and the audience) during a collective consumption.

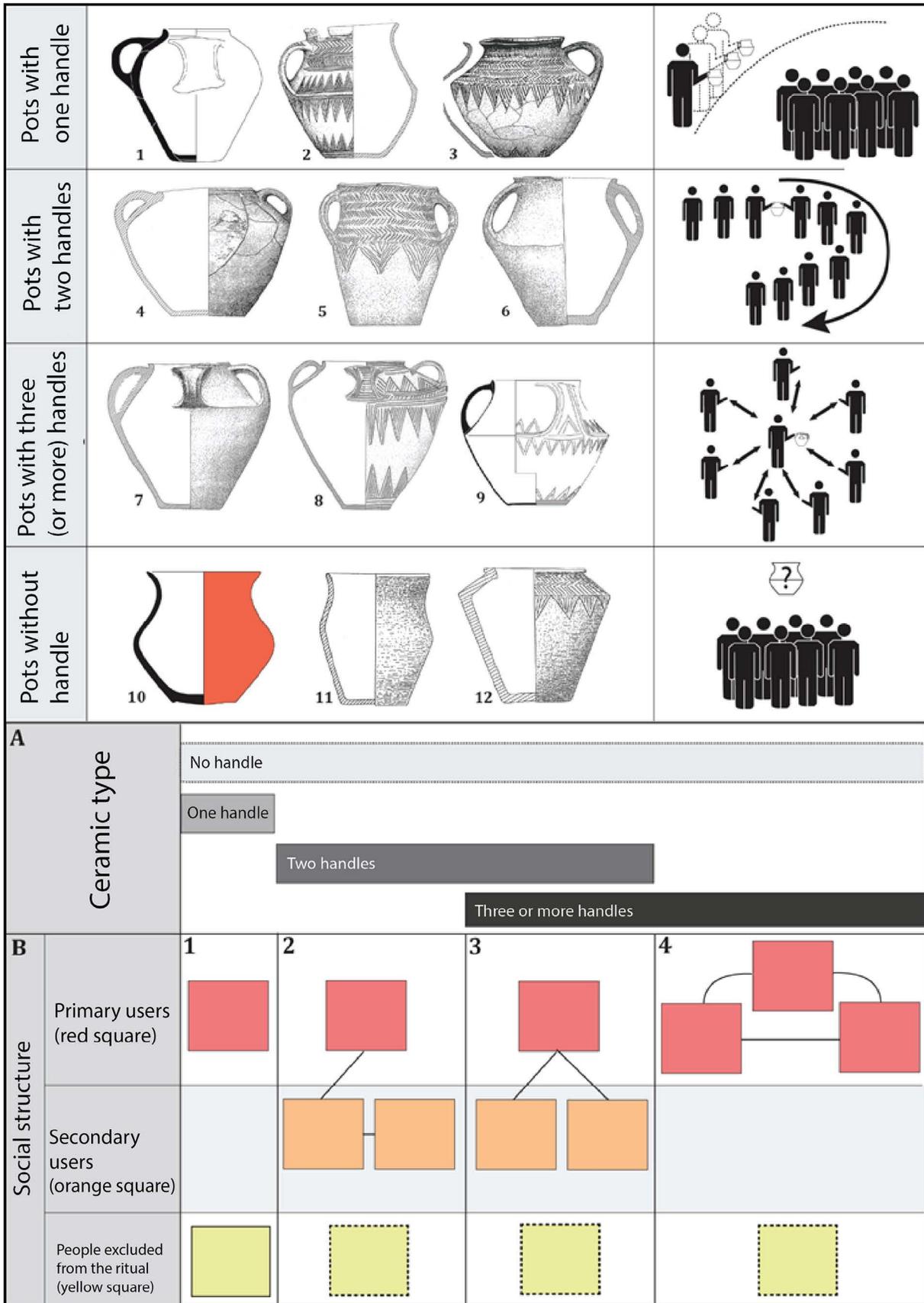


Figure 6: Upper part, possible interactions and transmission of pots allowed by the increased number of handles added throughout the Early Bronze Age. Lower part, hypothesis about the hierarchical representation of the actors (elite, intermediate social ranks, etc...) and of the relationship maintained between them (with hierarchical and more egalitarian hypotheses).



Figure 7: Biconical pots with three handles and solar depictions from Lannion Pen-an-Alé (Blanchet, 2016).

low-ranked barrows and an elite barrow could also support this idea. Later, during the middle Bronze age, the deposits at Plouedern (Brittany, Blanchet, 2013), associating parts of different pots gathered to create a symbolic new pot, also rely on particular and significant ritual activities. Similar activities could be suggested on other sites from Brittany from the later stage of the Early Bronze Age (Lannion Pen-an-Alé, Blanchet, 2016). This gesture of ceramic breakage brought together could evoke the unification of different persons or entities, or even the theory of the fractal person (Budja, 2012), and could create an inalienable link between people or functions. Other deposits, like the isolated beaker of Pen-an-Alé at Lannion (Blanchet, 2016, Fig. 7), located at the crossing of two ditches, could be linked to the need for territorial markers, but again both at material and symbolic scales. Other depositions, like pots with solar ornaments, set under a larger and inverted pot in funerary contexts, could also evoke an aggregation of materials and therefore persons together. They are also probably linked to astronomic symbolism. The light symbolised by the solar pattern could, for example, be extinguished by the larger inverted pots and create an interesting metaphor of death. Indeed, until modern times, many metaphoric parallels exist between a flame as a fragile light and life.

Conclusion

To summarise, we saw the evolution from smaller beakers (linked to individual rituals known especially from funerary contexts) to larger pots associated with more prehensions and new decorative organisations, allowing more complex social interactions within a community and expressing commensality. Astronomic identity attached to the elites of those societies plays a major role in these practices. These evolutions could take a part in the development of a more complex social hierarchy during the Early Bronze Age along the Atlantic coast. Power during the spread of the Bell Beaker phenomenon could rely on individuals and shows little hierarchy (linked to family units?). It is gradually replaced by the emergence of complex chiefdoms including intermediate social ranks and elites connected to each other along the Atlantic. Isolated tombs or family units are partially replaced by larger cemeteries used over a long period, at least till the collapse of those political entities. These practices, needed to maintain unity within the community, are not restricted to funerary practices; they are also used during particular events like collective consumption (evoking of course ethnological archetypes and probably covering a very large variety of functions). They also help with daily

problems like agriculture, which is closely linked to astronomical knowledge (Mathias, 2019) and extremely important for the subsistence and resilience of these early protohistoric societies.

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Giovanni Carboni† studied the archaeology of Neolithic and Eneolithic periods in central Italy. He served at the Museum of Origins at the University of Rome since 1991. From 2005 he was an ordinary member of the Italian Institute of Prehistory and Protohistory. He published several papers and the volume *Roma prima del Mito*, which collects the

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Delia Carloni (Specialist diploma 2018, University of Naples 'Federico II') is currently a PhD candidate at the Laboratory of prehistoric archaeology and anthropology, in the Department F.-A. Forel for Environmental and Aquatic Sciences, section of Earth and Environmental Sciences, Science Faculty, University of Geneva. A specialist in pottery compositional analysis, her research focuses on raw material selection and procurement in prehistoric times.

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Philippe Curdy, engineering studies at the Swiss Federal institute of technology (EPFL, Lausanne) and in prehistoric archaeology (Geneva University). 1980, creation of ARIA SA (Archaeological and interdisciplinary research office, Sion CH). 1992-1998, Curator at the Department of Prehistory (Swiss National Museum, Zurich), 1999-2008, Curator at the Cantonal Museum of Archaeology (Sion CH); 2008-2016, Curator at the Department of Prehistory and Antiquity (Valais History Museum). Research projects (INTERREG, Swiss national foundation, etc.) and publications in Celtic studies, alpine and glacial archaeology.

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Angela Maria Ferroni has been working as archaeologist at the Ministero della cultura since 1982. Currently, at Ufficio Unesco, she is responsible for procedures relating to UNESCO measures for protection and enjoyment of Italian sites inscribed on the WHList. Specialised in conservation and management of archaeological monuments and sites, she has planned and directed archaeological excavations, restoration and enhancement interventions on ancient monuments, and international research projects; has taught at universities, Istituto Centrale del Restauro in Rome, ICCROM; and has worked as an expert on behalf of UNESCO WHCentre and ICOMOS.

Marta Francés-Negro (PhD, University of Burgos) has been part of the archaeological team of El Portalón (Atapuerca) since 2006. Her main research focuses on archaeometric analysis of ceramic materials from prehistory. She has also worked on other Chalcolithic sites, such as Castillejo de Bonete (Ciudad Real, Spain). She co-leads excavations at a new Iron Age archaeological site, Los Ausines (Burgos, Spain).

Robin Furestier is a specialist in the Late Neolithic of South-eastern France and of the transition from the Neolithic to the Bronze Age. In 2005 he completed his PhD thesis on Bell Beaker lithic industries and continues to work on changes in Late Neolithic lithic productions, in Southern France as well as in Romania. He is an associate member of Laboratoire Archéologie des Sociétés Méditerranéennes (ASM-UMR 5140).

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Marco Pacciarelli received his PhD in Archaeology (Prehistory) at the University of Rome (1990). From 1992 to 2002 he worked at the Civic Museums of Imola (Bologna); from 2002 to 2017 he was associate professor of L-ANT/01-Prehistory and Protohistory at the Department of Humanities of the University of Naples Federico II. Since 2017 he has been full professor at the same Department. He is Vice-President of the Italian Institute of Prehistory and Protohistory (IIPP). From 1974 to 2021 he published three volumes and 207 papers. He has directed archeological excavations and surveys in Emilia Romagna, Tuscany, Latium, Campania, Calabria.

Pasquino Pallecchi is a scientific consultant to the Superintendency of Archeology, Fine Arts and Landscape for the metropolitan city of Florence and the provinces of Prato and Pistoia, formerly responsible for the diagnostic laboratory of the Archaeological Superintendence for Tuscany. He is Professor at the Graduate School at the University of Florence. His research concerns the development of technology in prehistory.

Annalisa Pedrotti is Professor at the Università degli Studi di Trento.

Matteo Penco is a specialist in archaeozoology at the University of Florence, collaborating with the University of Siena and the Florentine Museum of Prehistory. His academic interests concern the relationship between men and animals in prehistory and protohistory.

Massimo Pennacchioni graduated from the University of Rome (1983) where he attended the National School of Archeology (1990). He has participated in archaeological excavations and surveys both in Italy and abroad (Egypt, Ethiopia). He is a specialist in prehistory and protohistory and has carried out teaching activities at the Universities of Naples, Rome La Sapienza and Rome 3. Recent publications

include a volume on the drawing of archaeological finds and numerous articles on prehistory and the Copper Age, especially on the Bell Beaker in central Italy.

Amalia Pérez-Romero completed her PhD at the University of Burgos on the archaeological sequence at El Portalón de Cueva Mayor (Atapuerca, Spain), focusing on material culture, mainly potteries. She has been part of the archaeological team of El Portalón (Atapuerca) since 2003. Her principal research focuses on prehistoric remains, mainly in potteries decorations.

Giovanna Pizziolo is senior researcher in Prehistory in the Department of History and Cultural Heritage at the University of Siena (2018). Her research focuses on the prehistoric landscape and on intrasite analysis of prehistoric dwelling and funerary contexts in Italy and abroad. Through fieldwork she has developed different methods for the analysis of prehistoric settlement strategies. She proposes comparative studies on the assessment of archaeological potential at intrasite and intersite levels including the application of predictive modelling. She has developed GIS applications for taphonomic analysis dedicated to prehistoric funerary contexts, mainly in Central and Northern Italy, with special attention to the Metal Age.

Raffaella Poggiani Keller holds a degree in classical humanities from the University of Milano and a Diploma in Archaeology-Prehistory from the Postgraduate School for Prehistoric, Classical and Medieval Archaeologists at the University of Pisa. From 1980-2009 she was archaeological officer, specialising in prehistory and protohistory in the Ministero per i Beni e le Attività Culturali-Soprintendenza archeologica della Lombardia. From 2009-2013 she was Superintendent of Archaeological Heritage for Abruzzo (2009) and Lombardy (2009-2013). Research projects and publications focus on Neolithic and Chalcolithic periods and on alpine protohistory.

Katalin Puster studied prehistoric and medieval archaeology as well as palaeoanthropology at the Eberhard Karls University of Tübingen, Germany. In 2020, she completed her studies with an MA in prehistoric archaeology. Her research focuses on later prehistory, focusing on the Oppidum of Heidengraben in the Swabian Alps, as well as on the combination of archaeology and human osteology in Baden-Württemberg. For her masters thesis, she analysed aspects of the Bell Beaker Phenomenon in the southern Upper Rhine Valley, which is presented here.

Pierre-Jérôme Rey is an associate member of Edytem laboratory (UMR 5204) in Chambéry (Savoie, France). He is a Neolithic archaeologist and a specialist in mountain environments, working on ceramic production, cultural dynamics and

territorial occupation. He leads research projects in the Alps (excavation of Bozel, surveys around the Petit-Saint-Bernard pass) and conducts preventive archaeology operations in France and Switzerland.

Patricia Ríos Mendoza has been Assistant Professor at the Department of Prehistory and Archaeology of the Autonomous University of Madrid (Spain) since 2014, where she teaches Recent Prehistory, archaeological methodology and laboratory techniques. Her research has focused on the study of the site of Camino de las Yeseras (Madrid, Spain), which began with her PhD thesis. She has developed the interpretation of this site within the regional Chalcolithic period through lithic, ceramic and C14 dating studies, spatial and landscape analysis and the study of the funerary record, with particular analysis of the Bell Beaker phenomenon.

Julien Ripoché is currently working at the Service Archéologique de la Ville de Lyon as a Bronze Age specialist and is also finishing a PhD on the ceramic production of the Early Bronze Age in Brittany and Midwestern France. The primary aim of his research is the technological study of Bronze Age ceramics.

Laura Rodríguez PhD in Palaeontology in the University of Burgos is Assistant Professor in the University of León in the Anthropology area, and lecturer in the Biology department of Isabel I University (Spain). She has been part of the research team of the Sierra de Atapuerca sites since 2002. Her main research focuses on the study of the evolution of the body development pattern in *Homo* from the analysis of long bones. The main study material are the fossils recovered at the Sima de los Huesos site, as well as those recovered at the Pinilla del Valles (Madrid, Spain) site and subadult Neanderthal individuals.

Jessica Ryan-Despraz is a postdoctoral assistant at the University of Geneva (Switzerland). She holds an MSc in prehistoric archaeology and anthropology and a Doctorate of Science in prehistoric archaeology. She specializes in biological anthropology, with a focus on human biomechanics and its influences on skeletal morphology. Her PhD research led to extensive work on Bell Beaker skeletons in order to address questions surrounding prehistoric archery and warfare.

Lucia Sarti is Honorary Professor at the University of Siena and Lecturer in Prehistory and Protohistory. She is Professor at the Graduate School at the University of Florence and director of national and international research projects and excavations in Central-Southern Italy and Sardinia. Her main lines of research concern the Neolithic and the Metal Ages, with special reference to the 4th and 3rd millennium BC.

Umberto Tecchiati is Professor at the Università degli Studi di Milano

Jean-Michel Treffort (Inrap / Member of Arar laboratory (UMR 5138) in Lyon) is a protohistorian, archaeologist and Bronze and Early Iron Age specialist. He works on all aspects of material culture, questions of function and status of sites, complementary relationships between them, and dynamics of land use in the East and South-East of France.

Jan Turek currently works as an archaeologist (Center for Theoretical Study, Joint Research Institute of Charles University & the Czech Academy of Sciences) and has studied in Prague, Bratislava and Sheffield. Since 1993, he has organised several research and field projects and published several books and numerous academic papers. In 2007 he was awarded the Ian Potter Research Fellowship at the Flinders University, Adelaide (South Australia). He is a specialist in the Neolithic and Chalcolithic Periods of Europe, especially with regard to the reconstruction of social and gender structure and symbolic systems of prehistoric communities. From 2013 to 2020 he served as the Editor-in-Chief of *Archaeologies*, Journal of the World Archaeological Congress.

Julien Vitani is a contractual PhD student at Paris I University (dir. F. Bostyn & H. Procopiou) – Trajectoires (UMR 8215). He obtained a Research Master's degree in Archaeology at Aix-Marseille University in 2020 (dir. M. Bailly). His research interests are Neolithic, Bell Beaker and Bronze Age Europe, biography of people and objects, techno-functional studies, chrono-cultural and anthropological issues, epistemology, historical intellectual processes in prehistoric archaeology.

The Bell Beaker Culture in All its Forms contains the proceedings of the 22nd meeting of the 'Archéologie et Gobelets' Association which took place in Geneva, Switzerland in January 2021. The book is structured in three parts: *Archaeological Material* demonstrates how ceramics, lithics, wrist guards, and metal artifacts contribute to our understanding of the Bell Beaker Culture. *Funerary Archaeology and Anthropology* considers how the particular context of death and the human skeleton can be employed to gain information on Bell Beaker populations. The final section, *Reconstructing Bell Beaker Society*, builds upon archaeological evidence to discuss site interpretations as well as the wide-reaching topics of ritual, culture, and symbolism. With the publication of these proceedings, it is hoped that the conference interactions can facilitate future research and discussions on Bell Beaker societies and their roles within Neolithic Europe and beyond.

Claudine Abegg specialises in Forensic Archaeology and Anthropology. Her PhD work pertained to the establishment of the health profile of the Neolithic populations of Western Switzerland by analysing bone lesions to identify trends in the state of health in these societies. Currently, she works in both forensic and archaeological contexts, and her work focuses on interpreting skeletal pathologies with new methodologies to better understand how they affected, and still affect, human societies.

Delia Carloni is currently a PhD candidate at the Laboratory of prehistoric archaeology and anthropology at the University of Geneva. Specialising in pottery compositional analysis, her research focuses on raw material selection and procurement from prehistoric contexts.

Florian Cousseau's research focuses on the megalithism of Western Europe. His PhD dissertation, carried out in Western France, received international attention, winning the dissertation prize of the UISPP. He is currently a postdoctoral researcher and leads a major European excavation on the cairn of Goasseac'h in Brittany, France.

Eve Derenne holds a Doctorate of Science in prehistoric archaeology from the University of Geneva. Her research focuses on the evolution of social and cultural practices during the Neolithic and the Bronze Ages, particularly relating to the emergence, diffusion, and local integration processes of large-scale cultural phenomena such as the Bell Beaker complex.

Jessica Ryan-Despraz is a postdoctoral assistant at the University of Geneva. She holds an MSc in prehistoric archaeology and anthropology and a Doctorate of Science in prehistoric archaeology. She specialises in biological anthropology, with a focus on human biomechanics and its influences on skeletal morphology.

