Copper Shaft-Hole Axes and Early Metallurgy in South-Eastern Europe

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Cover image: Experimental copper casting - tuyère and bowl furnace © J Heeb

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Introduction

The topic of this research is the first large cast copper objects in the Old World, namely the axes with central shaft-hole from south-eastern Europe. They appear at a time when the dynamics in south-eastern Europe are changing dramatically from a Neolithic way of life with hardly any hierarchical differentiation, to a Bronze Age which sees the development of stratified society. It is during this transitional stage, known as the Copper Age that metallurgy began to develop within south-eastern Europe. Whether this development was independent of the Near East is still a topic of debate (Radivojević et al. 2010).

1.1 The invention of metallurgy in the Old World

It is generally accepted that copper metallurgy developed due to the bright colours of native copper and its oxidised ores which would have been noticed whilst prospecting for other raw materials already in use (Chapman and Tylecote 1983, 373; Coghlan 1975, 21-27; Hamlin 1996, 12-17; Ottaway 1994, 13; Parkinson 2004, 318). In the Near East as well as in south-eastern Europe, a period can be identified in which coloured minerals were not used for their metallic properties, but as pigments and ornaments, produced and made in the already known lithic traditions (Radivojević et al. 2010, 2776; Roberts et al. 2009, 1013; Strahm and Hauptmann 2009, 118-119). This 'preliminary stage' begins in the Near East between the 11th and 9th millennium BC (Moorey 1994, 255; Roberts et al. 2009, 1013; Solecki et al. 2004, 96; Strahm and Hauptmann 2009, 118; Yalçin 2000, 19) and starts in south-eastern Europe about 6500 BC (Borić 2009, 237; Radivojević 2007, 8). Early finds have been made in Serbia, Bulgaria and Romania, belonging to the earliest Vinča, Karanovo, and Criş groups respectively (Ottaway 1994, 231). The two early finds from Romania have been hotly debated as the context of the awl from Balomir, and the date of the entire horizon of a copper fragment from Iernut have been questioned (Luca 1999, 282-283). However, as mentioned above the 'cold' working of copper mineral is now accepted to have started in Europe around 6500 BC meaning that two artefacts from Romania could well have such an early date (Borić 2009, 237; Radivojević 2007, 8).

The first evidence in the Near East for the use of annealed native copper in the form of beads, awls and other amorphous fragments dates to the late 9th and early 8th millennium BC (Pernicka 1995a, 29; Pernicka *et al.* 1997, 46; Maddin *et al.* 1999, 38; Özdoğan and Özdoğan 1999, 14-15; Yalçin and Pernicka 1999, 46). However, this initial annealing was not carried out at high temperatures, and could be argued to be still part of the so-called 'cold' working of metallic objects as part of the lithic industry (Radivojević *et al.* 2010, 2776). It is only with the first evidence for smelting and/or casting that one can talk about 'hot' metallurgical processes (Radivojević *et al.* 2010, 2776). The smelting of copper possibly occurs for the first time during the 7th or 6th millennium BC in Anatolia although the evidence, two melting or smelting crucibles from Çatalhöyük, is contentious (Borić 2009, 237; Roberts *et al.* 2009, 1013). Interestingly the first conclusive evidence for the smelting of copper comes from Belovode (Serbia) and Tal-i Iblis (Iran) around 5000 BC (Borić 2009, 238; Radivojević 2007; Roberts *et al.* 2009, 1014). The evidence from Iran comes from a layer with a very long time window, from the late 6th to the late 5th millennium BC, making the Serbian evidence the earliest not only in Europe but probably in the old world (Radivojević *et al.* 2010, 2778). This early evidence for smelting confirms the early dates for some large cast axes from Pločnik which have been dated to the first centuries of the 5th millennium BC. Mining activities at Rudna Glava can now be dated to at least the mid 6th millennium BC, maybe even to the late 7th millennium BC (Borić 2009, 237).

The picture emerging at the moment is that the first use of copper minerals as well as the manufacture of small hammered copper objects using the known lithic techniques clearly happened in the Near East. The first evidence for 'hot' or 'real' metallurgy (smelting and the casting of large objects) actually comes from south-eastern Europe. The early occurrence of large cast axes under study was one of the arguments Renfrew used for the autonomous development of metallurgy in south-eastern Europe (1969). This premise is favoured particularly in south-eastern Europe itself, indeed Todorova even speaks about "ex balkanae lux" when talking about the origin of developed metallurgy (Todorova 1978, 1). However, in recent years, an increasing number of scholars are again postulating a single origin in time and space for metallurgy in Eurasia and its diffusion to south-eastern Europe possibly at the same time as the introduction of agriculture (Borić 2009, 237; Hansen 2009, 139; Pernicka *et al.* 1997, 48; Roberts *et al.* 2009, 1014; Strahm and Hauptmann 2009, 125-126). In a paper on the 'development of metallurgy in Eurasia' the authors use the two earliest sites with definitive evidence for the smelting of copper, Belovode in central Serbia and Tal-i Iblis in south-eastern Iran, as an argument for a single invention of smelting that happened somewhere in Anatolia (Roberts *et al.* 2009, 1014). Although the oldest copper finds do come from this region, it seems somewhat simplistic to use the midway point between the two earliest occurrences of copper smelting as the centre of origin for this innovation, especially as one of them is still contested.

The authors do say that the debate is not settled, and more scientific research is necessary to clarify the situation once and for all (Roberts *et al.* 2009, 1014).

In a recent paper on the first extractive metallurgy in Europe, the Near Eastern impulse or origin is postulated also (Radivojević *et al.* 2010). The authors argue that the distinction between 'cold' and 'hot' metallurgy is vital in understanding the transmission and origin of metallurgy (Radivojević *et al.* 2010, 2784). They argue that the knowledge of 'cold' metallurgy came to Europe with the 'Neolithic package' from the Near East (Radivojević *et al.* 2010, 2784). This would fit the evidence for the first small copper and malachite artefacts from south-eastern Europe around 6500 BC which were all made using the known lithic techniques. The advent of smelting and casting, however, was an independent discovery within south-eastern Europe, in an area extremely rich in copper deposits (Radivojević *et al.* 2010, 2784). Although this hypothesis does sound plausible, it is difficult to make such statements about the transmission of 'cold' metallurgy, when we are only dealing with a handful of finds from across all of south-eastern Europe. As south-eastern Europe was full of easily accessible and visible copper deposits, it might not have needed an impulse from the Near East to explain the few known finds, especially as they can all be produced using the known lithic techniques. An impulse might also have come at a slightly later date, after the very first introduction of farming to Europe. A distinction should also be made between working copper ore into beads or pigments and the hammering of native copper. The former really is using lithic techniques, as the qualities of ore are very much like stone. The hammering of native copper, however, is different as it takes into account the different properties of an entirely new softer and more malleable material. Another problem with the transmission of the so called 'cold' metallurgy with the 'Neolithic package' is the complete absence of copper and copper ore artefacts from the rest of Europe at the time of the introduction of farming. In fact the earliest copper objects from southern Germany date to the second half of the 5th millennium BC, over one millennium after the introduction of farming (Schier 2010, 30)

Despite these problems this hypothesis is worth keeping in mind for the debates on the origins of metallurgy in the future which are still ongoing. The second part of the theory, concerning the independent development of the 'hot' metallurgy (smelting and casting) in the Balkans is probable, especially due to the downright explosion of metallurgy shortly after the first evidence for mining and smelting in the form of the heavy copper axes. The reason for this explosion in metallurgical expertise in the Balkans was probably a combination between the highly developed pottery repertoire, controlling high temperatures in purpose built furnaces (Sherratt 1994, 169), the presence of rich copper deposits throughout south-eastern Europe and, of course, the 'readiness' on the part of (some) Copper Age persons not only for the invention, but also for the uptake of these new techniques and skills.

1.2 The copper axes with central shaft-hole

Besides their importance in the debates on the origin of metallurgy, the copper axes with central shaft-hole were chosen as a topic of study due to the many unanswered questions which arise when looking at the assemblage in more detail. The assemblage consists mainly of hammer-axes and axe-adzes, although some pick-axes and adzes as well as double-axes and adzes have also been found. The hammer-axes have a hammer-end and an axe-end, and the axe-adzes, as the name suggests, consist of an adze– and an axe-end. The characteristic, which stands out most, is their weight. Compared to other metal artefacts in circulation at the time, the vast majority of copper axes weigh between 600 and 1500gr., although some hammer-axes weigh up to 3785gr. (see database ID 676). However, to use this as an argument for the 'special status' of all these axes is not tenable, as quite a number, especially the most common Jászladány –type axes, often weigh less then 1kg, and have a very light and practical 'feel' to them.

Most of these axes have been published as part of the series 'Prähistorische Bronzefunde' (Antonović in prep.; Mayer 1977; Novotná 1970; Patay 1984; Říhovský 1992; Todorova 1981; Vulpe 1975; Žeravica 1993). At the heart of these PBF volumes is a catalogue of finds, including drawings. The contextual and technological aspects of the copper axes are only covered in a short introduction. Although essential for any scholar working with these objects, the PBF volumes do not go much beyond listing the axes under consideration and many questions therefore remain unanswered. There are invaluable examples of published material, (Coghlan 1961; Kienlin and Pernicka 2009; Pittioni 1957; Ryndina and Ravich 2000, 2001), both old and new, which have looked closer at their production, but the last significant contextual overview was written in the 1960s (Schubert 1965). It is also, so far, the only work looking at the axes on a transnational basis. The PBF volumes cover the axes based on modern countries, making it difficult to interpret trends and patterns in the data for the entire distribution area. The scientific studies concentrating on the production are highly specialised in terms of space and/or numbers of specimens (Coghlan 1961; Kienlin and Pernicka 2009; Pittioni 1957; Ryndina and Ravich 2000, 2001). Although they are exceptionally important sources of data, specifically for answering questions regarding their production, they are not useful for large scale contextual studies of the copper axe assemblage as a whole. It was therefore a necessity to approach these axes a-fresh, ignoring national interests and borders.

The main aims of this thesis were to better understand how the axes were made and used, what the overall context and place of them was within the cultures and settlements of the Copper Age, and how the production and context might relate to the living experiences of the individuals in the Copper Age. The overall approach can be described as holistic, using different methodologies as well as putting the axes in their wider context. So far, such an integrated analysis has been missing. They were considered within their overall environment looking at all aspects of Copper Age life directly relevant to the axes. This was important as most of them are isolated finds, and are therefore often considered as a 'stand alone' class of material culture. The second meaning involves using as many available research methods as possible suited to answering the relevant questions (see Chapter 2).

To begin with, a theoretical framework had to be established, in order to define the relationship between humans and their environments, and how, through the interactions, artefacts come into being and change. In archaeology, change is often taken for granted within all theoretical frameworks; they merely describe changes in settlement patterns and material culture over time without looking at how and why the changes occurred in detail (van der Leeuw 1989, 300). This is true for traditional cultural-historical, processual and indeed post-processual archaeology (Chapman 1997; Ciugudean 2000; Bailey 2000; Kalicz 1998b; Pavúk 1998). Although post-processual archaeology acknowledges that individual and group actions are responsible for the changing cultural landscapes (Bailey 2000, 190; Chapman 1997, 138), the time frames used are often far too long for any real analysis of individual action. The long accepted tendency from a so-called "communal" Neolithic to a more "individual" Bronze Age (Bailey 2000, Hodder 1990) is a generalisation which would not have been perceived by the people in the past. It is only with hindsight that we can define these broad patterns in material culture. This is why a reversal of approach can be useful, as it tries to understand the techniques and skills involved in production from the point of view of the artisan (van der Leeuw 2008). It is also from this perspective that the dichotomy between the natural and social world can be overcome, as in any material engagement the two mingle and are combined in an extensive *meshwork* of relations and associations between materials, ideas, humans, gestures and traditions to name but a few (Ingold 2000; Latour 2005; van der Leeuw 2008).

As well as this theoretical framework and a thorough review of the available literature, there are two core approaches of data collection that are essential to this work. The first is the database and the second the use of experiments, together with the metallographic analysis of the results (see Chapters 7, 8 and 10). The experiments, as well as the metallographic analyses were the only ways to try and further the debate on the production of the copper axes. One could say that the database was used to investigate the contextual patterns in the data on a larger scale, whereas the experiments helped to engage with the specifics of how the axes were made. The results of both approaches were combined and integrated into the larger picture as obtained through the literature.

Besides these two main approaches, other aspects were also considered. While investigating and thinking about these axes and the related questions in more detail, it was seen to be vital to re-appraise the typology used to categorise them (see Chapter 9). The debate about the methods of production was reinvigorated through the re-discovery of a possible axe blank (see Chapter 6 and Fig. 9). The axe blank did not have a shaft-hole and had a very rough outline of an axe-adze. It had been lying in the storerooms of the Museum für Vor-und Frühgeschichte Berlin since the early part of the 20th century without having been recognised for what it is, until now. Unfortunately, it was only discovered after the experiments had been finished. Otherwise it might have been possible to concentrate more on the questions raised by this unique find.

Through these different approaches, the place and importance of the copper axes with central shaft-hole from south-eastern Europe was illustrated within the relevant cultural groups, as well as on an individual level of production and use. Be it the potential magico-religous aspects of mining and smelting or the individual choices made during the production process, understanding all aspects from the level of the individual to the level of archaeological groups and cultures has been the aim. It is in the larger scale developments that change is most visible, although it was always started by an individual action. The question is whether the larger changes seen by archaeologists, like the change in burial practices leading to an increasing archaeological visibility of the individual in the Copper Age, happened fast enough to be actually experienced as a dramatic shift by the people in the past. The aim of this investigation of the Copper Age axes was to better understand this interesting time period a little better.