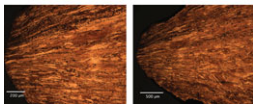


sample to carry out a meaningful metallographic study of copper objects. Tobias Kienlin has now shown that at least the first preoccupation is not justified. He has investigated close to 80 copper objects from the southeast European early metal ages, providing us with a consistent metallographic dataset of typologically coherent Chalcolithic and Early Bronze Age copper axes. The only comparative study available was undertaken by Natalia Ryndina and co-workers just over a decade ago (Ryndina *et al.* 1999). However, Kienlin wants more than to merely produce a study of early metal technology. The author, motivated by genuinely archaeological questions, tries to integrate the results of his “cognitive approach to the wider debates on craft specialisation and social context”. He therefore addresses subjects of broader archaeological relevance in a study that should interest an archaeological audience more extensive than that primarily concerned with his scientific results. This is, of course, the aim of all such interdisciplinary work but unfortunately it often ends up either as a barely annotated appendix in a primarily archaeological publication or as a journal article that addresses a scientific audience that is less interested in the wider archaeological implications.

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TOBIAS L. KIENLIN. *Traditions and transformations: approaches to Neolithic (Copper Age) and Bronze Age metalworking and society in Eastern Central Europe and the Carpathian Basin* (British Archaeological Reports International Series 2184). iv+406 pages, 302 illustrations, CD. 2011. Oxford: Archaeopress; 978-1-4073-0740-4 paperback £61.



Metallographic studies of copper are not very common in archaeometallurgy compared to those dealing with iron. This mainly for two reasons: iron usually contains a large number of inclusions, and

small amounts of minor elements like carbon or nitrogen introduce a complexity in the physical chemistry of iron that can be used to make inferences on the production process; in contrast, the metallography of copper is usually considered relatively dull. The second important reason is that it is much more difficult to obtain a large enough

Kienlin is a prehistorian at heart, who has endeavoured to master and apply a scientific method, namely metallography. In this book he extends his study of Early Bronze Age flat axes which formed the core of his PhD dissertation, published in 2008. This is now expanded by earlier material, mainly southeast European hammer axes and axe-adzes. These have been the subject of much debate and speculation, reviewed here in a very readable chapter on the evidence for the earliest metallurgy in south-eastern and central Europe. The author then presents the results of his metallographic investigations: they show that there is a remarkable uniformity in casting technology from the fifth to the third millennium BC in that pure copper was cast most probably in closed moulds and was then finished by either hot-working or repeated annealing and cold-working. Kienlin prefers the interpretation of hot-working at around 500° C but does not make any suggestion as to the tools used. On the other hand, he found practically no traces of cold-working so that one must assume that the knowledge of hardening copper by cold deformation was not known, or not desired. Hardness is essentially achieved through oxygen that is taken up by molten copper and partly remains

in a specific (eutectic) form in the copper and makes it harder. Anyone who has ever tried to cast pure copper in air in a closed mould can only admire this achievement of the prehistoric metalsmiths.

In the second part, on the Early Bronze Age in central Europe—again introduced by a concise review of the evidence—Kienlin suggests that there were technological choices involved in the selection of copper sources and in the adoption of tin bronze, observing regional differences in the use of available copper types as well as different reactions to the introduction of tin alloying. There is no space to discuss this in detail here but it is worth commenting on the two chapters at the end of each part which discuss the function and the social contexts of the axes. Kienlin criticises the commonly accepted link between elites and metallurgy and presents an alternative model for a kinship-based organisation of metalworking and the spread of metallurgical knowledge in Copper Age society. While this line of argument is convincing, it is hardly sufficient to explain the famous cemetery of Varna—with its clear differences reflected in the wealth of the grave goods—simply as the manifestation of a special ‘ritual practice’ and denying any indication of social differentiation.

For the organisation of metal procurement in the Early Bronze Age, Kienlin follows the same line but here it may be more controversial. While he rightly criticises evolutionist grand narratives linking formalistically perceived technological progress to the emergence of a hierarchical society (e. g. Strahm 1994), there is a case for social hierarchisation and craft specialisation, as indicated by admittedly few but exceptionally rich ‘princely’ graves which also contained tools for metalworking, such as at Leubingen in central Germany. These hierarchies may not have been stable, as the famous Nebra disc, which went through at least three different stages with different symbolic meanings within a few generations, indicates. The calculated output of some 15 000 tons of copper from the Mitterberg mining region alone cannot be explained by seasonal activity. Furthermore, the mines reached a level of 180m below the surface as early as the Middle Bronze Age. If left unattended such galleries would quickly fill with water and become inaccessible. Such an operation doubtlessly required at least an organisation of the workforce and certainly some specialisation. Since this cannot have arrived overnight; it must have had forerunners

which are simply not (yet) visible in the archaeological record.

Kienlin, on the other hand, is right to dismiss the conclusions concerning the organisation of metal procurement and distribution by elites in the north alpine region and around Lake Constance (Krause 2003) as based more on wishful thinking than on facts. Kienlin’s results do away with the idea that Early Bronze Age Salez type axes could be interpreted as ‘axe ingots’ and that their geographical distribution points towards the (assumed) ore deposits of the alpine Rhine valley from where the copper was ‘traded’ to the north alpine region with Singen as a relay station.

There are some flaws in this work, like the irritating use of the term ‘trace elements’ when these elements make up more than 10 per cent of the total. But these are minor points compared to the whole. The two appendices contain all the information required to check the conclusions drawn. The numerous figures with metallographic structures are highly welcome as are the twenty pages of references. Anyone interested in central and south-eastern European early metallurgy and its role in the socioeconomic development of these regions must have this book on his or her shelf.

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