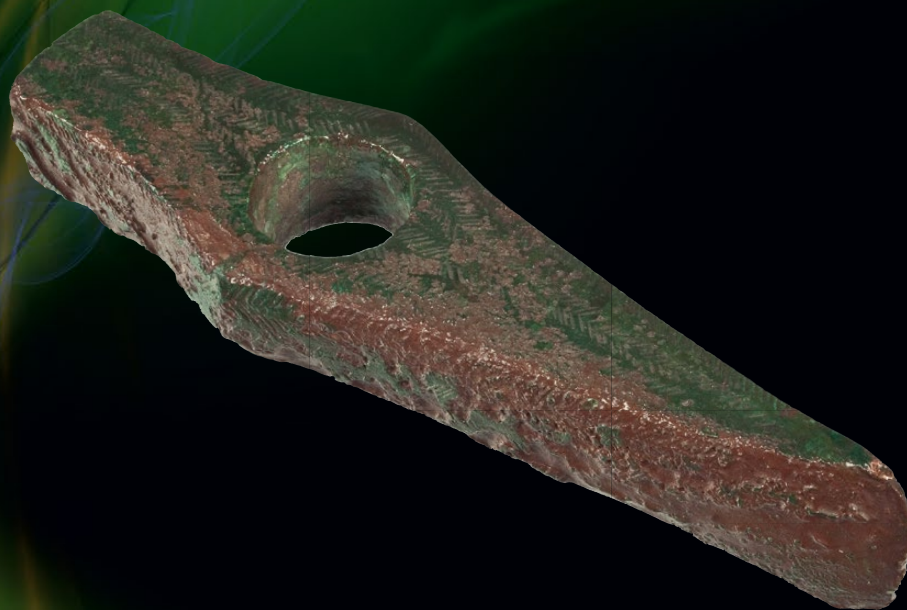




The Rise of Metallurgy in Eurasia

Evolution, Organisation and Consumption
of Early Metal in the Balkans



Edited by

Miljana Radivojević, Benjamin W. Roberts,
Miroslav Marić, Julka Kuzmanović Cvetković
and Thilo Rehren



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Inner back cover: Reconstruction of the world's earliest copper smelting. Green flames come from the extraction of metal from malachite. Experiments at Pločnik, Serbia (2013) - Marko Djurica

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To the memory of Borislav Jovanović, our colleague, friend and inspiration

(1930 - 2015)

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Chapter 46

Bone tool technology at Belovode and Pločnik

Selena Vitezović

Introduction

Osseous raw materials had an important place in the Vinča culture and were used for everyday tools along with flint and stone, as well as for decorative objects. A technological approach to their study (cf. Inizan *et al.* 1995: 13 *ff.*), which involves the analysis of the raw material choices, technology of manufacture and typological repertoire, is used here to provide important data relating to methods of raw material acquisition and management and to craft production and technological know-how. It can also give indirect evidence on crafts that have left little or no trace in the archaeological record, i.e. 'perishable technologies' (cf. Choyke 2013; Vitezović 2013a; 2016a).

Despite its importance, and despite over one hundred years of Vinča culture studies, the bone industry is among the least known categories of Vinča technologies. Faunal remains were not carefully collected on early excavations and the assemblages of bone objects were published only as short reports or mentioned in summary in excavation reports. Most of the publications where bone tools do feature are merely descriptive; very few have an analytical approach (Bačkalov 1979; Russell 1990; Vitezović 2007; 2011b).

The assemblages from Belovode and Pločnik, excavated in 2012 and 2013, are not large, probably due to the limited area of excavations, however careful sampling and collecting has yielded some important data, especially regarding the raw materials used and the typological range of the objects produced.

Raw material management

At most Vinča culture sites, the preferred osseous raw material was ovicaprine metapodials, which would be used to make fine and medium-sized points such as needles and awls. Next in abundance are large mammal ribs, which were used to make awls and various burnishing tools. In addition, other long bones from cattle and ovicaprines such as tibiae and radii, and astragals were occasionally used. Pig bones were mainly avoided and the use of certain skeletal elements such as scapulae or cranial bones (such as mandibles) is extremely rare (cf. Vitezović 2013b).

The antlers used were mainly from red deer and only occasionally from roe deer. In most cases these were shed antlers. The ratio between antlers and bones varies from site to site and it is likely that a level of regional specialisation existed as some sites were more engaged in antler procurement, manufacture, and use than others (cf. Vitezović 2013b). With the exception of boar tusks, which were used for tools, teeth occur only occasionally and were used as ornaments. The distribution of shells at Vinča culture sites is uneven although it is not clear if this is related to the sampling and recovery procedures or to other factors.

The evidence indicates that bone technology at Pločnik and Belovode did not differ greatly from the typical Vinča culture bone industry, though they each have certain specific traits. At Belovode, it is interesting to note the presence of pig bones, particularly two astragals, one from a wild and one from a domestic pig. Pig astragals were also mentioned from the earlier excavation campaigns at Belovode (Jacanović and Šljivar 2001) and therefore may be a specific trait of the Belovode settlement. The reasons for the avoidance of pig bones in the Vinča culture are not clear, although ruminant bones have a more regular axis and are therefore more convenient for manufacturing tools such as awls or points (cf. Vitezović 2013b: 68). Pig bones are not entirely unusable, as may be seen by their presence on other sites and in other cultures, for example, in the Bronze Age in Hungary or in the historic periods (e.g. Gál 2011: 145; Struckmeyer 2011: 188; Choyke 2013: 8, Figure 1.6; Colominas 2013: 90). The reasons behind the absence of pigs may be connected to butchery techniques, the related availability of adequate, usable pieces, or they may be entirely cultural. At Belovode, astragals were the only pig bones that were shaped into artefacts.

At Pločnik, there are occurrences of some less common skeletal elements, such as ulnae or radii, but very few, such as a spatula-chisel made from a cattle ulna and another from a cattle radius.

Antlers were present on both sites, although in varying quantities. At Belovode, there is evidence for the collecting of shed antlers, although more data is needed to establish whether this practice was planned

and a regular activity. This assemblage from Pločnik yielded only limited information on antler use despite them being found in previous excavation campaigns at this settlement site (Grbić 1929: Figures 123–125).

The presence of mollusc shells at Pločnik is very important for studying the geographical distribution of this raw material and the routes of trade and exchange (see Chapter 32, this volume, on the Pločnik bone industry for a full discussion). Shells were a preferred raw material for personal ornaments throughout the whole of prehistory (cf. Taborin 1993, 2004 and references therein). Their physical characteristics, such as durability and hardness, were important and their exotic origin also certainly contributed (cf. Trubitt 2003). However, there are also some ‘less technical’ traits that surely played a role in raw material choice; shells are smooth, bright, and white. Smoothness and brightness may be emphasised by manufacture, by burnishing and polishing. White is a bright and shiny colour and has a wide range of symbolic meaning in different cultures, from ‘death’ to ‘the divine’ (Vollmar 2009). The importance of colour in raw material choice for decorative items has been observed elsewhere (e.g. Wright and Garrard 2002; Thomas 2011) and particularly in relation to osseous raw materials (Luik 2007; Vitezović 2012). The significance of white colour is underlined by the presence of the same types of ornaments made in white stones (see Vitezović 2012 and references therein).

Osseous raw material choice is firmly linked with the mechanical properties of some of the skeletal elements (see also Guthrie 1983 and Christensen 2004 and references therein). For instance, long bones tend to split along their axes and are easily shaped into pointed tools, while antlers are resilient to shock and most often used for heavy cutting and percussion tools. The artisans of both the Pločnik and Belovode appear to have had a high level of knowledge regarding the properties of the raw materials, with some local, perhaps even personal, preferences towards certain specific skeletal elements.

Both sites fit well into the general model for the acquisition and use of osseous materials proposed for the Vinča culture (Vitezović 2013b). Within this model, osseous materials were obtained as products from animal husbandry and hunting, through selective collecting, and through exchange. Bones were the most common and easiest to obtain and therefore were the material predominantly used, although with careful choice of the most appropriate and/or most desired skeletal elements. A prevalence of bones from domestic animals is observed on most sites (cf. Perišić 1984; Vitezović 2007). Antlers were acquired in the vicinity of the settlement, probably collected in conjunction

with other raw materials, and may have been objects of small-scale exchange, as either raw materials or finished products. The teeth used for decorative purposes were obtained mainly through hunting, while shells were acquired through exchange networks about whose mechanisms our knowledge is still very limited.

The presence of raw materials obtained by hunting (such as the astragal or wild boar and red deer tooth) is interesting in terms of the relationship between animal husbandry and hunting and general relationships between wild and domestically obtained raw materials, however at this point the data are insufficient for any conclusions.

Technology

One of the conceptual frameworks that enables a better understanding of osseous industries is the concept of the ‘manufacturing continuum’ (*sensu* Choyke 1997; Choyke and Schibler 2007). The manufacturing continuum is largely focused on the effort put into the manufacturing of individual objects and their life duration. Two main classes are distinguished using the following criteria:

- 1) the regularity in raw material choice (species and skeletal elements);
- 2) the number of stages used in their manufacture;
- 3) whether they have been repaired; and
- 4) their exploitation index, which measures the degree of working, as defined by the proportion of the surface covered by manufacturing marks, relative to the degree of use (Choyke and Schibler 2007: 57).

Artefacts from an assemblage at a single site, or multiple assemblages from several sites, can therefore be aligned on an imaginary axis: at one end are carefully planned, standardised tools (Class I) and at the opposite end are *ad hoc*, expedient tools (Class II) (Choyke 1997; Choyke and Schibler 2007). Such a concept enables the analysis of the overall character of the industry in question and may also provide indirect information on the contexts in which the artefacts were found. For example, the prevalence of *ad hoc* tools may suggest non-permanent settlement, or completely used tools may come from a rubbish pit.

Craft production in the Vinča culture, and particularly its level of standardisation and specialisation and its role within society, are still not adequately analysed. More detailed technological case studies and new theoretical frameworks are needed for a more thorough approach to the problem. Increased standardisation and an increase in the production of diverse types of artefacts are observed as a general trend in the Vinča

culture (cf. Tringham and Krstić 1990c; Tripković 2007; Vuković 2011) but have not yet been fully analysed.

For the bone industry, only a few preliminary observations can be outlined. Standardisation is visible (in the Vinča culture, in general in respect to the earlier, Starčevo culture) and an increased consistency led to a somewhat simplified process of manufacture. Although the investment of time and skill are not always extremely high, the overall quality of the tools is generally excellent. *Ad hoc* tools do occur, but rarely. Unfortunately, it is not possible to define any diachronic changes in the Vinča culture bone industries given the current state of research.

At Belovode, all the tools incline towards the Class I category and were made using the same techniques and following virtually the same sequence of operations. A somewhat larger number of *ad hoc* tools is present at Pločnik, but this deviation is small and may be explained by sample bias. Differences in manufacturing techniques between the two sites were not observed.

Standardisation within the bone industry has been noted previously for the sites of Drenovac and Slatina-Motel, located in the Pomoravlje region (Vitezović 2007). The implications are that the increased standardisation in bone manufacture signifies that the flint and stone tools used for production of bone tools were also standardised, while standardised tool shapes reflect the high production of 'perishable crafts' such as the processing of hides and plant fibres. However, more detailed analyses of multiple technologies are needed to establish more clearly the relationship between ground stone, chipped stone, and bone industries and as well as other crafts practised by communities of the Vinča culture. Workshops or working places were not identified with certainty at either site, although the identification of such areas is generally very difficult, especially in a limited area of excavation.

The presence of trade and exchange can be confirmed with certainty only for artefacts made from exotic raw materials, such as *Spondylus* and *Glycymeris* shells. The find of the *Spondylus* bead from Pločnik, the first of this type from a Vinča culture site in a secure context (cf. Chapter 32, this volume on the bone industry from Pločnik for detailed references), is extraordinary and supports the argument that the *Spondylus* trade routes were by no means limited to the Danube valley. *Spondylus* trade and exchange is an important phenomenon involving numerous Neolithic and Chalcolithic cultures (see Sfériadès 2010 and references therein). For a long time it was considered that the *Spondylus* ornaments were restricted to the Banat and the region immediately around the Danube, and that they did not exist in the areas south of the Danube and Sava rivers (see, for example, the distribution map in Willms 1985,

and especially the discussion in Chapman 1981). Such distribution maps, however, reflect the state of research and available data at the time. Recent research (e.g. at Drenovac or Vitkovo, cf. Vitezović 2007, 2013c) has revealed new finds of decorative shell items, and future studies will undoubtedly bring more new finds and new information. The find from Pločnik indicates the need for a revised model of general trade and exchange in the Neolithic period.

Typological repertoire

Within the typological repertoire of bone artefacts in the Vinča culture, tools are predominant with a much smaller proportion of weapons and personal ornaments, while non-utilitarian items are extremely rare: only a few possible musical instruments have been identified and figurines or other objects of ritual function were not fashioned from osseous raw materials (cf. Bačkalov 1979; Perišić 1984; Russell 1990; Vitezović 2007, 2011b).

Most of the tools recovered from Belovode and Pločnik were used in everyday tasks and crafts such as plant processing, textile production, the working of leathers and hides, and woodworking. The tools include awls, eyed and plain needles, heavy points, scrapers, spatulas, spatula-chisels, axes, and auxiliary items such as worked astragals, most likely related to textile production. Finer tools (awls, needles, scrapers) dominate the assemblage while heavy duty tools were not found in large number (only one preserved axe and no preserved heavy percussion tools). This may be related to the activity areas excavated within each of the settlements.

There are only a few personal ornaments from Belovode and Pločnik and no non-utilitarian objects. Furthermore, some of the artefact types that were noted on some other Vinča culture sites, such as hunting and fishing equipment, or tools related to flint processing such as retouching and pressing tools, were also absent.

Discussion and conclusion

The bone industries from Belovode and Pločnik fit well within the broader Vinča culture bone industry, both in terms of the techniques used and the typological repertoire produced (cf. Bačkalov 1979; Russell 1990; Vitezović 2007, 2011b). They demonstrate a high technological know-how and strong familiarity with the raw materials. They also provide indirect evidence of the importance of crafts related to textile production and to leather and hide working.

Each Vinča culture bone industry has locally specific special traits. For the Belovode assemblage, it is the use of pig astragals, and the previously unknown type of decorative item in a shape of a small ring with prong at one side. For the Pločnik assemblage, it is the use of

unusual skeletal elements: ulnae used to make heavy points and spatula-chisels, and the unique find of a cattle radius. It is for future studies on bone industries in the Vinča culture to determine whether these traits remain unique for these sites or are more generally characteristic for the region and/or period.

At this stage, it is not possible to make any hypotheses on the diachronic development of the bone industries in any of its aspects: raw materials, techniques of manufacture or typological repertoire, however the data provided by these two sites will have an important place in future analyses.

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Appendices

Appendix A – Excavation data for Belovode and Pločnik (seasons 2012 and 2013)

Available online at <https://doi.org/10.5522/04/14769990>



Appendix B – Data relating to specific chapters

Appendix B_Ch5

Radivojević, M. 2007. Evidence for Early Copper Smelting in Belovode, a Vinča Culture Settlement in Eastern Serbia. Unpublished MSc dissertation. UCL Institute of Archaeology, London.

Available online at https://doi.org/10.32028/9781803270425/AppendixB_Ch5



Appendix B_Ch11

Certified Reference Materials - basalt glass

EPMA

Optical Microscopy

SEM EDS

Technical documentation_images of studied materials_Belovode

Available online at https://doi.org/10.32028/9781803270425/AppendixB_Ch11



Appendix B_Ch14

Belovode Catalogue

Belovode Petrography

Available online at https://doi.org/10.32028/9781803270425/AppendixB_Ch14



Appendix B_Ch15

Belovode Figurines Database

Available online at https://doi.org/10.32028/9781803270425/AppendixB_Ch15

**Appendix B_Ch20**

20.1. List of all taxa in the analysed samples from Belovode (prior to the taxa amalgamation and extrapolation of item counts).

20.2. Images of some of the archaeobotanical remains from Belovode: 1. einkorn grain; 2. einkorn glume base; 3., 'new type' hulled wheat glume bases; 4. 'new type' hulled wheat grains; 5. flax/linseed seeds; 6. barley rachis; 7. bitter vetch seeds; 8. *Rubus idaeus/fruticosus* seeds; 9. *Corylus avellana* nutshell fragments; 10. *Prunus cf. domestica* var. *insititia* fruit stone fragment; 11. *Lapsana communis* seed; 12. *Chenopodium album* type seeds; 13. *Trifolium arvense* type seed; 14. *Trifolium repens* type seed; 15. *Cerastium* seed; 16. *Fallopia convolvulus* seed; 17. *Galium aparine* seed; 18. Indeterminate plant matter (? nutmeat); 19. Indeterminate (*Scrophularia* type) seed.

Available online at https://doi.org/10.32028/9781803270425/AppendixB_Ch20

**Appendix B_Ch26**

EPMA

Optical Microscopy

SEM EDS

Technical documentation_images of studied materials_Pločnik

Available online at https://doi.org/10.32028/9781803270425/AppendixB_Ch26

**Appendix B_Ch29**

Pločnik Catalogue

Pločnik Petrography

Available online at https://doi.org/10.32028/9781803270425/AppendixB_Ch29



Appendix B_Ch30

Pločnik Figurines Database

Available online at https://doi.org/10.32028/9781803270425/AppendixB_Ch30**Appendix B_Ch34**

34.1. List of all taxa in the analysed samples from Pločnik (prior to the taxa amalgamation and extrapolation of item counts)

34.2. Images of some of the archaeobotanical remains from Pločnik: 1. emmer grain; 2. emmer spikelet fork; 3. terminal spikelet fork (cf. emmer); 4-5. 'new type' hulled wheat spikelet forks; 6-8. tetraploid free-threshing wheat rachis segments; 9. *Cornus mas* fruit; 10. *Rubus idaeus/fruticosus* seed; 11. *Corylus avellana* nutshell fragments; 12. *Fragaria vesca* seed; 13. *Solanum nigrum* seed; 14a-b. possible food remains (with embedded fragment of a cereal grain visible in 14b); 15. fragment of dung pellet; 16. *Hypericum* seed; 17. *Chenopodium album* type seed.

Available online at https://doi.org/10.32028/9781803270425/AppendixB_Ch34**Appendix B_Ch38**

GIS data on the Late Neolithic houses of the Vinča settlements Belovode, Drenovac, Pločnik, and Stubline. The file in WTK-format contains data of all house ground plans which were reconstructed on the basis of the magnetic prospection data. The file also contains the information (size in sqm and orientation) for each house that was taken into account in the statistical evaluation. This is the size of the ground area of the houses are in square metres. The house orientation refers to the north azimuth.

Available online at https://doi.org/10.32028/9781803270425/AppendixB_Ch38**Appendix B_Ch41**

Tables from Chapter 41

Available online at https://doi.org/10.32028/9781803270425/AppendixB_Ch41

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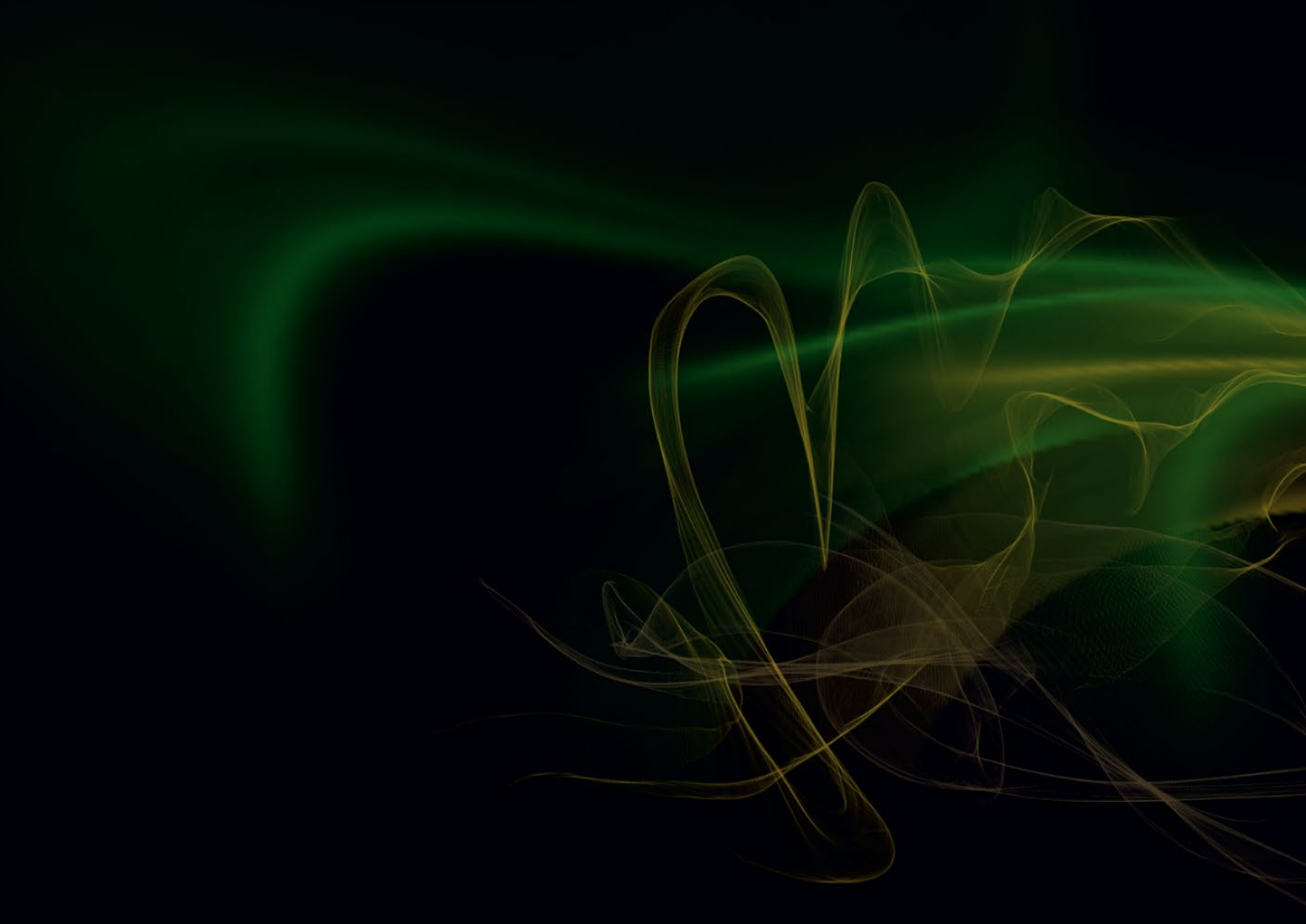
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The Rise of Metallurgy in Eurasia is a landmark study in the origins of metallurgy. The project aimed to trace the invention and innovation of metallurgy in the Balkans. It combined targeted excavations and surveys with extensive scientific analyses at two Neolithic-Chalcolithic copper production and consumption sites, Belovode and Pločnik, in Serbia. At Belovode, the project revealed chronologically and contextually secure evidence for copper smelting in the 49th century BC. This confirms the earlier interpretation of c. 7000-year-old metallurgy at the site, making it the earliest record of fully developed metallurgical activity in the world. However, far from being a rare and elite practice, metallurgy at both Belovode and Pločnik is demonstrated to have been a common and communal craft activity.

This monograph reviews the pre-existing scholarship on early metallurgy in the Balkans. It subsequently presents detailed results from the excavations, surveys and scientific analyses conducted at Belovode and Pločnik. These are followed by new and up-to-date regional syntheses by leading specialists on the Neolithic-Chalcolithic material culture, technologies, settlement and subsistence practices in the Central Balkans. Finally, the monograph places the project results in the context of major debates surrounding early metallurgy in Eurasia before proposing a new agenda for global early metallurgy studies.