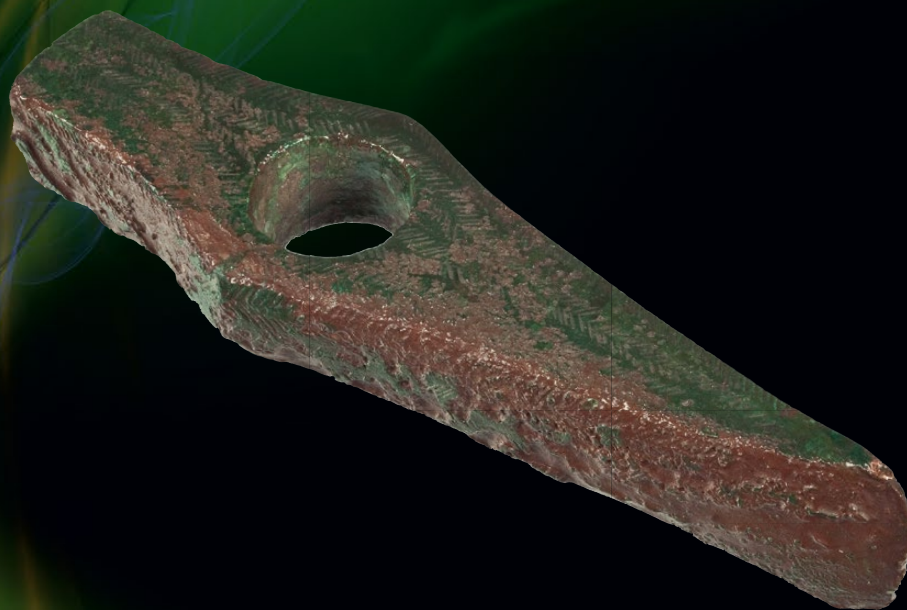




# The Rise of Metallurgy in Eurasia

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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(from Pločnik, Serbia) - Julka Kuzmanović Cvetković.

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 32

# Bone industry from Pločnik

Selena Vitezović

### Introduction

The bone industry encompasses all artefacts (tools, decorative items, manufacture debris) made from osseous raw materials (bone, antler, teeth, ivory, mollusc shells) (Averbouh 2000; Poplin 2004). Along with stone and flint, bone raw materials were very important for making everyday tools and other artefacts in all prehistoric societies. Their use, however, depended upon their availability as well as the economic and cultural preferences of a given community. Osseous raw materials had an important place in the Vinča culture, and they were frequently used for both everyday tools and decorative objects, representing a significant proportion of the material culture.

The osseous industry from Pločnik was analysed from a technological perspective (cf. Inizan *et al.* 1995: 13 ff.), including the raw material choices, technology of manufacture, and typological data. The assemblage of about 60 artefacts includes those recognised during excavations as well as those separated during the post-excavation faunal analysis. Numerical data are not presented since they relate to only a segment of bone artefacts recovered so far at Pločnik, and therefore are not statistically meaningful.

### Techno-typological analysis

Predominant among the osseous raw material used within the Pločnik settlement are long bones and ribs from large and medium-sized mammals. Antlers are rare, and only from red deer, and *Bos* astragals and *Spondylus* shell were each found only once. Prehistoric craftspeople divided the bones into blanks by chopping, breaking, and direct and indirect percussion. The final shape of the artefacts was obtained by burnishing and polishing with various abrasive tools.

The typological classification used here is based on the link between the supposed function and form of the active part of the objects, originally created by H. Camps-Fabrer (1966; 1979) and now used for numerous European prehistoric assemblages, with some modifications and improvements (e.g. Voruz 1984; Pascual Benito 1998; Beldiman 2007). The artefacts were classified into several groups: I pointed tools; II cutting

tools; III burnishing tools; IV punching tools; V objects of special use; VI decorative items; VII non-utilitarian items; and VIII incomplete artefacts. Within these groups, further subtypes and variants were identified based on morphology, function, manufacturing technique, and raw material used (Vitezović 2007, 2011a, 2013a; 2016a: 79-98; see also Bačkalov 1979; Beldiman 2007).

### I. Pointed tools

*Subtype I1.* Several awls (medium-sized pointed tools) were discovered at Pločnik. They were made from longitudinally split segments of diaphyses of long bones (subtype I1A) or from longitudinally split ribs (subtype I1B). Most were fragmented with just tips or mesial parts preserved; very little information could be extracted on their manufacture and use.

Two awls made from large mammal (cattle- or red deer-sized animals) ribs (subtype I1B) were somewhat better preserved with basal and mesial parts, and only their pointed distal ends are missing. These were made from longitudinally split ribs, then shaped by grinding and burnishing. The base was carefully cut and burnished. The awls are heavily worn; the distal end was probably broken during use and the spongy tissue on the lower (inner) surfaces is smoothed and abraded (Figure 1).

*Subtype I2.* One heavy point was made from a cattle ulna. The epiphysis was preserved (although now fragmented) and the diaphysis was shaped into a large point. Polish from use is visible on most of the tool's surface. Ulnae points are not common in the Vinča culture, although they do occur occasionally at Neolithic and Chalcolithic sites in southeast Europe (e.g. Elster 2001: Figure 20; Gál 2011: Figure 3; Beldiman *et al.* 2012: Plate 6).

*Subtype I3.* Several fine-pointed tools (needles) were also discovered. These were made from split ribs or from very small segments of long bones. They are well made, polished and have very fine, sharp tips (Figure 2). These small, slender tools may have been used in fibre processing, or for various tasks such as net-making, basketry or similar. Fine-pointed tools are common in Vinča culture bone industries (cf. Russell 1990; Vitezović 2007) and similar artefacts are widely found across



Figure 1. Awls produced from ribs.

Neolithic and Chalcolithic sites in Europe (e.g. Hüser 2005: Table 5; Deschler-Erb *et al.* 2002: Table 511/4–26). No examples of eyed needles were recovered at Pločnik.

### III Burnishing tools

*Subtype III2.* Scrapers at Pločnik were made from longitudinally split ribs (Figure 3). They have straight or slightly curved working edges and vary in shape and size due to fragmentation. Manufacturing traces are not preserved because of the intensive use. The bone is heavily worn at the distal part, the spongy tissue at the inner surfaces is completely abraded in the active part, and the outer surfaces are worn, showing polish and with striations.

Scrapers are a simple tool type that is encountered on various sites across Neolithic and Chalcolithic Europe (cf. Hüser 2005: Table 8; Lang 2005: Table 183/1–5). Like rib awls, these they can be overlooked if the faunal record is not carefully examined, so it is difficult to assess how common they truly were. In the Vinča culture, they are noted at several sites, although in varying quantities at Vinča-Belo Brdo (Sreјović and Јовановић 1959: Figure 6; Perišić 1984: Table 12/98, 101; and Pavlovac-Kovačke Njive (Vitezović 2014: Table I/6).

*Subtype III4.* Several artefacts from Pločnik are classified as spatula-chisels. Their main characteristic



Figure 2. Fine pointed tools (needles) produced from ribs.



Figure 3. Scraper produced from split rib.

is a relatively sharp working edge that is straight or curved from use. They were used for tasks that combined cutting and scraping. One example is made from a large, proximal segment of cattle radius, with a segment of proximal epiphysis at the base and a large portion of diaphysis shaft. It is fragmented, but probably comprised the entire epiphysis and diaphysis in the proximal and mesial part. In the distal portion it was obliquely cut. On the distal end, it has a curved

working edge, smoothed and worn from use. This is an expedient, *ad hoc* tool, and the entire form and the raw material are very unusual.

Another spatula-chisel was made from a cattle ulna, from the epiphysis segment (fragmented) and the diaphysis. The diaphysis is cut from both sides in order to obtain a sharp, straight cutting edge. The basal part is fragmented, and the distal end is worn from use (Figure 4). Ulna cutting and scraping tools are more common in the Chalcolithic period (cf. Beldiman *et al.* 2012: Plates 140–145; Lang 2005: Table 194/1) and are previously unknown from Vinča culture sites.

The third specimen is the most carefully worked, from a flat segment of long bone. It is trapezoidal in shape, with a small, straight and sharp working edge that was intensively used (Figure 5). It imitates the shape of fine, small-sized stone chisels (cf. Antonović 2003). The working edge is only 1 cm wide; it is heavily worn, polished, and slightly chipped from use. Its small dimensions and intensive polish suggest the use on soft, organic materials (cf. Maigrot 2003; Legrand 2007) however, it is not possible to determine precisely the contact material at this stage of analysis. Similar artefacts are known, for example, at Arbon Bleiche 3 (Deschler-Erb *et al.* 2002; Table 514/3–7).



Figure 4. Spatula-chisel made from cattle ulna.

### V Objects of special use

*Subtype V4.* Used astragals. Only one *Bos* astragal with traces of use was recovered at Pločnik. It does not have any traces of deliberate modification, but the prominent parts are completely flattened and abraded from intensive use. (For a discussion on the possible use of astragals and references see Chapter 17, this volume, on the bone industry at Belovode.)

### VI Decorative objects

Only one decorative object was discovered, but it is an extraordinary find: a large bead fashioned from *Spondylus* shell. It has an elongated, cylindrical shape and vertical perforation (Figure 6). The traces of manufacture have not been preserved, but polish and wear from use can be seen. The outer surface is also slightly damaged, but it is not clear what caused this wear. A further stray find in the vicinity of the Pločnik settlement should also be mentioned: over 300 *Spondylus* shell beads (also elongated, but with much smaller dimensions), probably originating from the same context and possibly of Vinča culture date. These are currently stored at the National Museum in Niš (Stojić and Jocić 2006).

Very large beads made from mollusc shells are not usually found within the Vinča culture area. In the central Balkan region, the most common objects made from mollusc shells are bracelets (i.e. curved fragments,



Figure 5. Spatula-chisel made from long bone segment.



originally in the shape of an open or closed circle – cf. Срејовић and Јовановић 1959; Dimitrijević and Tripković 2002, 2006; Игњатовић 2008: 227, Catalogue 221). Only from the cemetery of Botoš-Živanića Dolja are several large, elongated beads known (Marinković 2010).

*Spondylus* ornaments are a pan-European phenomenon (cf. Comşa 1973; Willms 1985; Siklósi 2004; Séfériadès 2010; Ifantidis and Nikolaidou 2011) and appear in numerous prehistoric cultures and in diverse contexts. They caught the attention of researchers very early, and are usually associated with status, prestige, and luxury (cf. Séfériadès 2010, with references). There are, however, still many questions that remain unanswered, including the extent of their distribution in time and space and the modes by which they were exchanged. In the central Balkans region, *Spondylus* items were previously thought to be concentrated in the Danube valley (cf. maps in Willms 1985; Dimitrijević and Tripković 2006; Séfériadès 2010). New finds, however, and the careful examination of previously published data, demonstrated that they were also present in the Pomoravlje region, for example, at Divostin (McPherron *et al.* 1988); Drenovac (Vitezović 2007); and Vitkovo (Vitezović 2013c) (see also Vitezović 2016b).

The find of large *Spondylus* beads with contextual data at Pločnik is very important, since it demonstrates the presence of these ornaments within the settlement. Furthermore, large beads are rare in the modern Serbian territory with no identical specimens known. This find suggests a much wider typological repertoire of mollusc shell ornaments within the Vinča culture than was previously thought.

## Results and discussion

The osseous artefacts recovered from Pločnik during the 2012 and 2013 excavation seasons represent a cross-section of the entire bone industry from the Vinča culture settlement. Most are heavily fragmented, suggesting that this was a refuse area (at least for osseous industry), although it may have also been an abandoned activity area, where bone objects were exploited and then broken, and tools that were no longer usable were discarded.

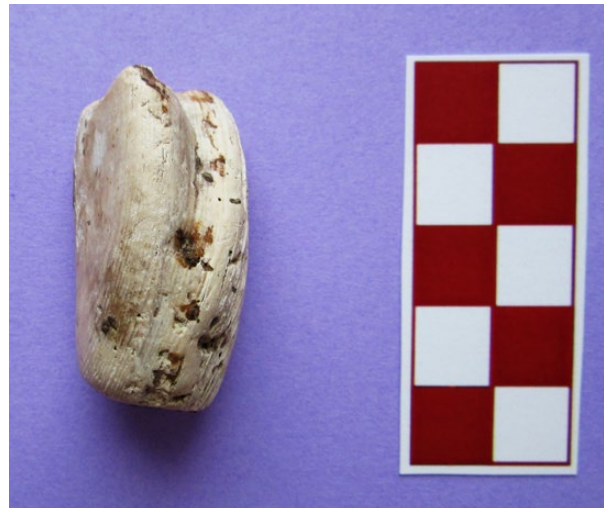


Figure 6. Cylindrical bead from *Spondylus* shell.

The predominant objects are pointed and burnishing tools, used mainly on organic materials such as leathers, hides or plants. Only a few objects of special use and decorations were discovered. Some tool types are not represented, such as heavy-duty tools such as axes or hammers, or hunting and fishing gear. Manufacture debris is also absent, suggesting that the working area where the osseous artefacts were produced was outside of the excavated area. Ribs were most commonly used, followed by variety of long bone segments, including some that do not often occur in Vinča culture industries, such as ulnae or radii. Antlers were found only in fragments although earlier finds from Pločnik suggest it had a rich antler industry (Grbić 1929: Figures 123–125).

The techniques used and typological repertoire evidenced fits well with current understanding of the Vinča culture bone industry (cf. Bačkalov 1979; Russell 1990; Vitezović 2007). The specific traits of the Pločnik assemblage are the use of unusual skeletal elements, e.g. ulnae used for heavy points and spatula-chisels, and the unique find of a cattle radius (for raw material choices in the Vinča culture, cf. Vitezović 2013b). The *Spondylus* bead is very important for the analysis of exotic raw materials within the Pločnik settlement, but also for the wider study of their distribution and the study of trade and exchange routes.

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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](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](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](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](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](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](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](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](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](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](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](https://doi.org/10.32028/9781803270425/AppendixB_Ch41)



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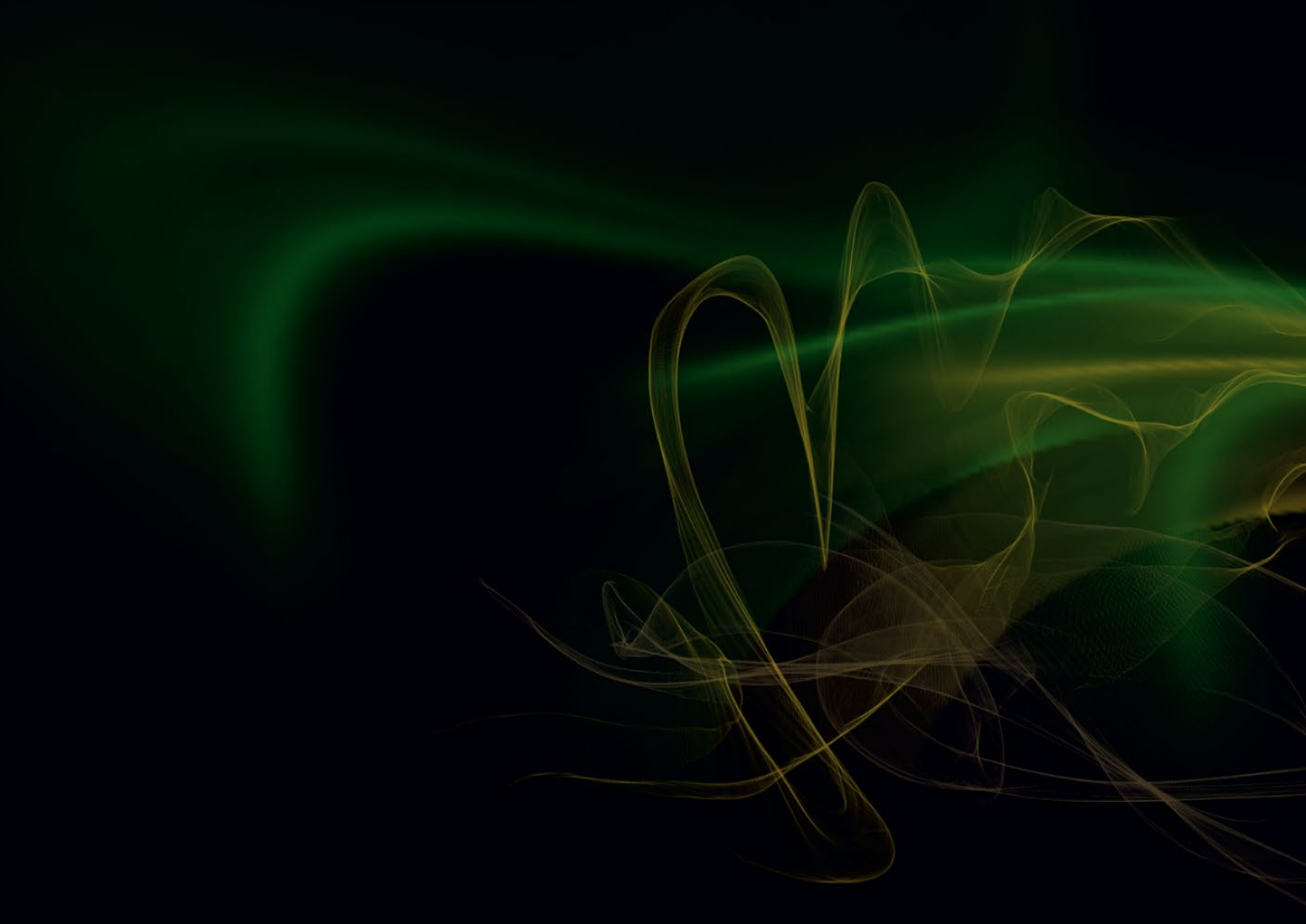
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*The Rise of Metallurgy in Eurasia* is a landmark study in the origins of metallurgy. The project aimed to trace the invention and innovation of metallurgy in the Balkans. It combined targeted excavations and surveys with extensive scientific analyses 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.