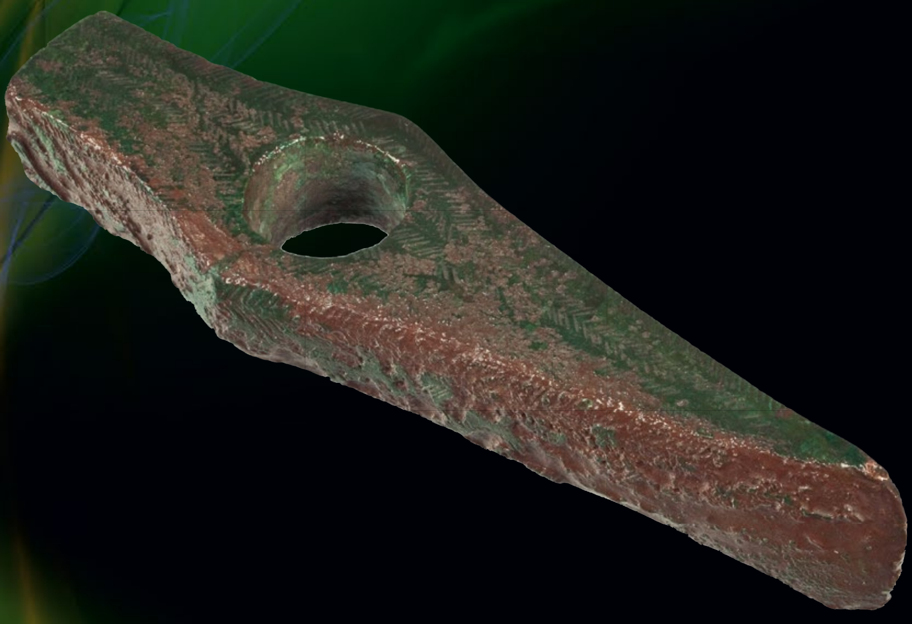
The Rise of Metallurgy in Eurasia

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

ARCHAEOPRESS

Miljana Radivojević holds the Archaeomaterials Lectureship at the UCL Institute of Archaeology (UK), where she graduated in Archaeometallurgy. She has spent more than 20 years publishing on early metallurgy in the Balkans and southwest Asia and the role of aesthetics in the invention of novel technologies. She continues to explore the evolution of metallurgy across most of prehistoric Eurasia as a means of uncovering the histories of metalsmiths, and the societies and environments they lived in.

Benjamin Roberts has spent over 20 years researching and publishing on European Copper and Bronze Age archaeology and frequently metallurgy and metal objects across Europe. He co-edited with Chris Thornton *Archaeometallurgy in Global perspective: Methods and Syntheses* (2014) and is currently leading Project Ancient Tin. Prior to joining the Department of Archaeology at Durham University, he was the Curator for the European Bronze Age collections in the British Museum.

Miroslav Marić is a specialist in the Neolithic-Bronze Age of the central Balkans at the Institute for Balkan Studies, Serbian Academy of Sciences and Arts, Serbia. He is the field director of the Gradište Iđoš project. His research interests include settlement archaeology, landscape archaeology, the Neolithic and Bronze Age of the Balkans, and radiocarbon dating.

Julka Kuzmanović-Cvetković was the Senior Custodian (now retired) at the Homeland Museum of Toplica in Prokuplje, Serbia. She spent more than four decades excavating the site of Pločnik, and developed a unique open air archaeo-park on the site that attracts tourists from the region, and across the globe.

Thilo Rehren is the A.G. Leventis Professor for Archaeological Sciences at the Cyprus Institute in Nicosia, Cyprus. In 1999 he was appointed to a Chair in Archaeological Materials at the UCL Institute of Archaeology in London, UK. Following a five-year secondment to establish UCL Qatar as a postgraduate training and research Centre of Excellence in Museology, Conservation and Archaeology he joined the Cyprus Institute in 2017. He places particular emphasis on the integration of archaeological, scientific and historical information, and on investigating the correlation and cross-fertilisation between different crafts and industries in the past.

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

Archaeopress Archaeology

Archaeopress Publishing Ltd
Summertown Pavilion
18-24 Middle Way
Summertown
Oxford OX2 7LG

www.archaeopress.com

ISBN 978-1-80327-042-5
ISBN 978-1-80327-043-2 (e-Pdf)

DOI: 10.32028/9781803270425

Cover: Ljiljana Dinić; Copper hammer-axe, type Pločnik, c. 4600 BC
(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

Copyeditor: Kate Sharpe

This book is available direct from Archaeopress or from our website www.archaeopress.com

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

(1930 – 2015)

Contents

Chapter 41

Metallurgical knowledge and networks of supply in the 5th millennium BC Balkans: Belovode and Pločnik in their regional context

Miljana Radivojević, Thilo Rehren and Ernst Pernicka

The recent set of excavations (campaigns 2012 and 2013) at the sites of Belovode and Pločnik (see Chapters 11 and 26) have shown the use of copper minerals and metallurgical activities to be highly consistent with results from previous analytical research (Radivojević 2007, 2012, 2013, 2015; Radivojević *et al.* 2010a; Radivojević and Rehren 2016). Specific aspects to emerge so far include: persistent selection of black and green manganese-rich copper ores for metal extraction; similar engineering parameters involved in the early copper smelting technology; field evidence from Belovode supporting the presence of pottery-lined hole-in-the-ground installations; consistent metal making and working technology remains at both sites; and direct absolute dating evidence that leaves no doubt for *c.* 5000 BC as the beginning of copper metallurgy in the Balkans. In this chapter we will synthesise the evidence for this *c.* 7,000 years old copper production technology within the Vinča culture, in its local and regional perspective, including data and debates on the provenance of copper ores.

Tainted ores as the main trait of the Vinča culture copper smelting

The persistent selection of black and green manganese-rich copper ores at both sites speaks, yet again, of shared practices for copper smelting technology between these two sites, and within the wider Vinča culture phenomenon. Previous research has already revealed the enduring practice of the selection of these minerals in the Early Neolithic in the Danube Gorges (*c.* 6200 BC), together with a parallel set of criteria applied to the selection of copper minerals with largely green appearance (free of impurities) (Radivojević 2015). While we cannot claim that these black and green minerals were already used as ores for smelting as early as *c.* 6200 BC, this particular preference for these distinctively coloured 'precious stones' implies either a potentially long experimentation phase or an alignment with ideology and rituals of which these may have been a significant part; a discussion of these hypotheses is beyond the scope of this chapter. Importantly, the 'purer' green minerals, more commonly used for bead making, still presented black impurities (most likely manganese oxide) in some of the 25 studied examples (see Figure 16 in Chapter 11, and Figure 7 in Chapter 26, both this volume), which moderates our initial assumption of an exclusive selection of black and green minerals for metal extraction (Radivojević *et al.* 2010a), and reinforces the close link between the preceding bead making linked to lithic technology and the emerging metallurgical technology.

Oxidic copper minerals were, however, often mixed with primary (sulfur-rich) copper minerals at both sites, as confirmed through the analysis of copper metal droplets (Bf56/13 and P61/12) with chalcocite inclusions (Bf56/13, see Figure 21d in Chapter 11, this volume) in both rounded (heated) and more angular (natural) form (also see Figure 9b, Table 5 in Chapter 26, this volume). Another type of similarly (dark)coloured minerals appeared consistently alongside black and green manganese rich copper ores at Pločnik; these were preliminarily called 'magnetic' minerals, as they were highly responsive to a magnet. Compositional analysis identified them to be a mixture of iron oxides and members of the olivine family of minerals (see Figure 6, Table 4 in Chapter 26, this volume). In the absence of any slag from this site, we cannot say whether these formed as part of the smelting process; however, their distinctive colour (dark green) could have played a role in their initial selection by the prospectors at that time.

Another indication for the types of copper ores selected for metallurgical activities at Belovode and Pločnik came from EPMA and LA-ICP-MS analyses of metal phases in production evidence and artefacts. Close scrutiny of the data confirms the consistent selection of manganese-rich copper ores that most commonly also contained nickel and cobalt, some remnants of primary copper minerals (iron, sulfur) and a potential association with polymetallic deposits that contain arsenic, tin, lead and bismuth (see Tables 8, 8a, 11, 13, 15 in Chapter 11 and Tables 6 and 6a in Chapter 26, this volume). Polymetallic deposits that could potentially match sources used to make these metals exist in the

Table 1. EPMA compositional data of metal phases in copper production evidence, droplets and finished artefacts from the sites of Belovode and Pločnik, given as µg/g. Values above *c.* 0.01 wt% (100 µg/g) are considered reliable based on CRM measurements; values below this are indicative only. All data are corrected for values obtained from the reference material, using a procedure reported in the methodology section of the Belovode metallurgy chapter (11). Values sought but not found at levels above *c.* 0.01 wt% were indicated as not detected (n.d.). Bold figures stand for data reported in this volume (Chapters 11 and 26) and normal figures for previously conducted analyses in Belovode and Pločnik (Radivojević 2012; Radivojević and Rehren 2016). Belovode and Pločnik data were analysed with the same Electron Probe Micro-Analyser (EPMA) located at the UCL Institute of Archaeology (see Table 3a, Chapter 11 in this volume).

	site	type	S	Mn	Fe	Co	Ni	Zn	As	Ag	Sn	Sb	Te	Au	Pb	Bi
			µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
B23/12	**Belovode**	**slagged sherd**	**67**	**46**	**15**	**14**	**84**	**n.d.**	**115**	**4**	**70**	**n.d.**	**50**	**n.d.**	**70**	**67**
B47/12/2	**Belovode**	**slag**	**96**	**26**	**117**	**32**	**64**	**n.d.**	**46**	**32**	**46**	**n.d.**	**82**	**n.d.**	**82**	**57**
Belovode 30a	Belovode	slagged sherd	n.d.	n.d.	10	n.d.	70	n.d.	20	n.d.	n.d.	n.d.	n.d.	20	n.d.	n.d.
Belovode 31a	Belovode	slagged sherd	n.d.	n.d.	n.d.	n.d.	60	n.d.	10	n.d.	n.d.	n.d.	n.d.	90	n.d.	n.d.
Belovode 31b	Belovode	slagged sherd	20	n.d.	20	n.d.	70	n.d.	0	n.d.	n.d.	n.d.	n.d.	110	n.d.	n.d.
Belovode 131	Belovode	slag	150	8150	36100	10600	960	3000	220	n.d.	n.d.	235	n.d.	150	n.d.	n.d.
Belovode 134	Belovode	slag	80	3000	10200	500	45	60	20	n.d.	n.d.	n.d.	n.d.	210	n.d.	n.d.
Bf21/12	**Belovode**	**droplet**	**45**	**39**	**15**	**27**	**135**	**n.d.**	**220**	**3**	**91**	**n.d.**	**40**	**n.d.**	**57**	**86**
Belovode M6	Belovode	droplet	34	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	42	n.d.	n.d.	n.d.
Pločnik 52	Pločnik	droplet	52	n.d.	n.d.	n.d.	37	n.d.	11	n.d.	n.d.	n.d.	34	120	n.d.	n.d.
B71/12	**Belovode**	**fragment**	**91**	**23**	**27**	**15**	**83**	**n.d.**	**112**	**90**	**98**	**n.d.**	**40**	**n.d.**	**62**	**162**
P10/13	**Pločnik**	**fragment**	**73**	**26**	**10**	**16**	**107**	**n.d.**	**78**	**21**	**64**	**n.d.**	**38**	**23**	**47**	**134**
C_P1/13	**Pločnik**	**loop**	**43**	**5**	**24**	**13**	**61**	**n.d.**	**34**	**181**	**80**	**n.d.**	**103**	**n.d.**	**2800**	**58**
C_P2/13	**Pločnik**	**band**	**160**	**40**	**23**	**43**	**50**	**n.d.**	**50**	**12**	**105**	**n.d.**	**85**	**n.d.**	**81**	**36**
Pločnik 67	Pločnik	tool (?)	96	n.d.	n.d.	n.d.	41	n.d.	n.d.	n.d.	n.d.	11	0	n.d.	n.d.	n.d.
Pločnik 73	Pločnik	bracelet	56	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0	107	n.d.	n.d.
Pločnik 75	Pločnik	sheet	31	n.d.	47	n.d.	49	n.d.	n.d.	n.d.	n.d.	n.d.	0	77	n.d.	n.d.
Pločnik 143	Pločnik	chisel	25	n.d.	n.d.	n.d.	53	n.d.	n.d.	n.d.	n.d.	n.d.	23	75	n.d.	n.d.
Pločnik 145	Pločnik	chisel	n.d.	n.d.	75	n.d.	28	n.d.	n.d.	n.d.	n.d.	n.d.	12	61	n.d.	n.d.

Bor mining region in eastern Serbia and include massive copper sulfide deposits dominated by pyrite and different copper sulfides (enargite, bornite, covellite or chalcocite) and accessory chalcopyrite, amongst others (Janković 1967; Antonijević and Mijatović 2014; Jelenković 1999; Neubauer and Heinrich 2003; Monthel *et al.* 2002; Sillitoe 1983). While provenance data will be addressed in detail below, in Table 1 we synthesise electron microprobe compositional analyses of copper prills in production evidence (slag and slagged sherds) and copper metal artefacts analysed thus far from the sites of Belovode and Pločnik (including data for copper metal artefacts from Radivojević 2012).

Although the data come from metallurgical materials from the same sites, and in places from the same occupational horizons. For instance, the freshly analysed copper metal phases from the production evidence from Belovode present only slightly more elevated readings of As than the Pločnik metal artefacts, but significantly less Pb (which is *c.* 0.3 wt% in C_P1/13), Ag (c. 180 ppm in C_P1/13) and S (c. 160 ppm in C_P2/13), being used at each site, although such a generally low variability may also occur within the same mineralisation (Table 1). Ni remains consistently present in all data, confirming the previously assumed wide availability of this element in the copper ores exploited by the Vinča communities (Radivojević 2012; Radivojević and Rehren 2016). We shall use ppm (parts per million) to discuss µg/g (microgram per gram) concentrations throughout this text.

In conclusion, the low variability of trace elements such as As, Pb, Ag and S between these two sites is more likely to reflect the use of different batches of copper ores than the use of different copper ore sources. This assumption is possibly corroborated by the fact that the observed artefacts cluster in different 'workshop' areas at both sites. For example, the four samples, Pločnik 67/73/75/145, come from the same dwelling (Radivojević 2012, also Chapter 6 in this volume), and Belovode 23/12, 47/12/2, f21/12, 71/12 from the wider area of Feature 6 ('workshop area', see Chapter 11 in this volume). Hence, we could interpret this as different craftsmen or workshops using different copper ores or ore batches for metal making within these settlements.

On the whole, the Vinča culture communities of Belovode and Pločnik exploited copper ores with relatively pure copper carbonate (malachite) associated with black minerals (manganese oxide) and residual primary ore minerals (e.g. chalcopyrite, chalcocite) and consistent (albeit at low concentrations) nickel content. The variability of the concentrations of As, Ag, Pb or S is not so large as to imply the use of different copper sources, and we are inclined to propose the use of different batches of copper ore from a single deposit. The connectedness of these two sites when it comes to shared copper resources has been indicated before (cf. Pernicka *et al.* 1993, 1997; Radivojević *et al.* 2010a); however, the provenance study offers more data and therefore a more complex picture of copper supply to these two settlements, as will be shown in the next section.

The most precious ten grams of early Balkan metallurgy

The research conducted thus far has confirmed the consistently ephemeral nature of early copper smelting technology in the first half of the 5th millennium BC in the central Balkans. To the previously analysed 8.3 g of (free) slag samples (Radivojević 2007, 2012), this research has now added a further 0.82 g (see Table 1, Chapter 11 in this volume), taking the whole assemblage to slightly short of 10 g of available direct metal production evidence for the stated time frame. Although this excludes the volume of slag adhering to the ceramic sherds from Belovode, it is clear that the early copper smelting technology in the Vinča culture is consistent in its near invisibility, as recognised in the results of both macro- and micro-analytical approaches conducted here and in previous research.

A common feature of all slag finds (free samples and slagged masses on sherds from Belovode) is that they solidified quickly from being almost fully liquefied at the time of the smelt, resulting in a high proportion of glassy phase. The slag matrix areas are mostly located towards the surfaces of the samples, in contact with copper-rich phases such as metal droplets, 'dross' and corrosion products. The latter also fill the pores scattered across visible sections. Hence, copper containing compounds are the dominant phases in all samples; these are followed by various phases which are evenly distributed throughout a particular area of crystallisation (e.g. delafossite, spinels; see Tables 7 and 10 in Chapter 11, this volume).

The bulk composition of the glassy matrices of all slag samples predominantly consists of silica, alumina, lime, and iron and copper oxides, followed by fuel components: phosphorus oxide, potash and magnesia, and other ore elements (besides copper): manganese, cobalt and zinc (see Tables 6, 7 and 9 in Chapter 11, this volume). The ternary plot of components understood to represent typical pottery ($SiO_2/Al_2O_3/TiO_2$), fuel ash ($CaO/MgO/P_2O_5/K_2O$) and ore ($FeO/MnO/ZnO/NiO/CoO/As_2O_3/SnO_2/Sb_2O_3$) contamination in the glassy slag matrices (re-cast as Cu-free) in Figure 24, Chapter 11 of this volume, illustrates the consistency of metal smelting practices across several Vinča culture sites: Belovode, Vinča-Belo Brdo and Pločnik. The strong concentration of all glassy matrices in the silica+alumina+titania corner implies that they were predominantly formed by mostly acidic oxides, which explains their enhanced viscosity. A small number of copper metal droplets: B29/12 and P61/12 (see Chapters 11 and 26, this volume), together with Belovode M6 and Pločnik 52 (Radivojević and Rehren 2016) may be seen as the exceptions to the 'slagging' rule: they exhibit a smelting attempt together with the presence of primary copper minerals, but not much slag. Yet, given the huge discrepancy between the number of implements (estimated at *c.* 4,300 items, or 4.7 tonnes in the 5th millennium BC Balkans) (Pernicka *et al.* 1997; Ryndina 2009) and production evidence (such as <10 g slag), the 'slagless' metallurgy may well have been the 'rule' rather than the exception. At this point it is important to emphasise that the identified slag from the Vinča culture sites covers the first half of the 5th millennium BC, and that the overwhelming majority of the 4,300 artefacts are from the second half of the 5th millennium BC. This leaves many open questions about the nature of copper extraction technology in the second half of that millennium, including its location and identification during the excavations (cf. Radivojević *et al.* 2010a).

Nevertheless, although the early slagging process in the Vinča culture is characterised as heterogeneous, almost fully liquefied and resulting in highly viscous debris that needs to be crushed in order to extract metal, when compared to similar evidence throughout the Near East, dated between the mid-5th to the 3rd millennium BC, this fits well within the general picture of borderline stable metal extraction processes (cf. Bourgarit 2007). Of particular interest for comparison here is the recently discovered pit (no. 28) at the site of Akladi Cheiri on the southern Bulgarian Black Sea coast (see Figure 3, Chapter 3, this volume) (Rehren *et al.* 2016, 2020). This context, broadly dated to the middle of the 2nd half of the 5th millennium BC, yielded around 100 kg of copper ores, tailings, and production debris, including some 300 fragments of slagged sherds and one largely preserved (melting) crucible. Microstructural analyses of the slag on these sherds reveal striking similarities with the *c.* 700–800 years older examples from Belovode, with the main components being copper-rich phases, delafossite and magnetite (Rehren *et al.* 2020: 144, Figures 9–2). The regular occurrence of copper and copper-iron sulfide phases, however, implies that the copper ore was a mixture of carbonate and sulfide minerals (strong iron presence suggests chalcopyrite or bornite), which fits well with the estimated age of this exceptional late-5th millennium BC metallurgical assemblage. The ternary plot of pottery ($SiO_2/Al_2O_3/TiO_2$), fuel ash ($CaO/MgO/P_2O_5/K_2O$) and ore ($FeO/MnO/ZnO/NiO/CoO/As_2O_3/SnO_2/Sb_2O_3$) contamination in the glassy slag matrices (re-cast as Cu-free) of Vinča culture and Akladi Cheiri slag (Figure 1) exhibits broadly consistent smelting conditions, modified by a stronger iron and fuel ash component for Akladi Cheiri.

The Akladi Cheiri assemblage also confirmed another connection with the Vinča culture metallurgy: the hole-in-the-ground smelting installations lined with fragmented pottery sherds (Rehren *et al.* 2020). This is well exemplified with hundreds of Akladi Cheiri sherds presenting a pattern of localised heat impact and slag cover that goes around broken sections, clearly implying that these were not crucibles, but lined smelting installations similar to those hypothesised for the sites of Belovode and Gornja Tuzla (Radivojević and Rehren 2016). This is yet another point that strongly indicates the transmission of metal smelting technology from the Vinča culture sites to the later KGK VI settlements on the Bulgarian Black Sea coast.

The excavation campaigns of 2012 and 2013 at Belovode yielded more support for the shape and nature of these 'hole-in-the-ground' installations: the charred and burnt soil in the bowl-shaped feature, F6, and its clear association with the slagged sherds and other production debris in Trench 18 (Table 1, Figures 2 and 3 in Chapter 11, this volume) was a highlight of this project. Taken together with the initial research at this site (Radivojević and Rehren 2016) and the growing number of examples from Bulgaria (Akladi Cheiri) and Romania (Foeni) (Rehren *et al.* 2016; Radivojević *et al.* in preparation), the new evidence confirms that the pottery-lined hole-in-the-ground installation was the earliest type of a smelting 'furnace' in this part of the world.

Another highlight of the excavation campaign was the thorough dating programme for organic samples directly associated with the metallurgical remains from both Belovode and Pločnik (see Table 1, Chapter 37, this volume). As a result of the former, metallurgical activities were firmly placed within the period from the 49th to the 47th centuries cal. BC, respectively, confirming conclusions from previous research (Radivojević *et al.* 2010a). In the latter, a metal bead (C_P4/13) was directly dated (with associated charcoal) to the beginning of the 5th millennium BC, which makes it the earliest secure date for the beginning of metallurgy at Pločnik (see Chapters 11 and 26, this volume). The end date for Belovode occupation (and metallurgical activities) can be placed at the turn of the 46th century cal. BC, in alignment with what we know thus far about the (fiery) end of the Vinča culture settlements in the northern (Danubian) area. Pločnik, on the other hand, preserved evidence for prolonged site activities, well into the second half of the 45th or the first half of the 44th century cal. BC, with metallurgical activities following through to the very end of its occupation (see Table 2 in Chapter 26, this volume). These dates are also in agreement with the dating of metallurgical activities at the site of Gornja Tuzla in Bosnia (Radivojević and Rehren 2016). The Vinča culture metallurgy was therefore actively practiced for *c.* 600 years (5000–4400

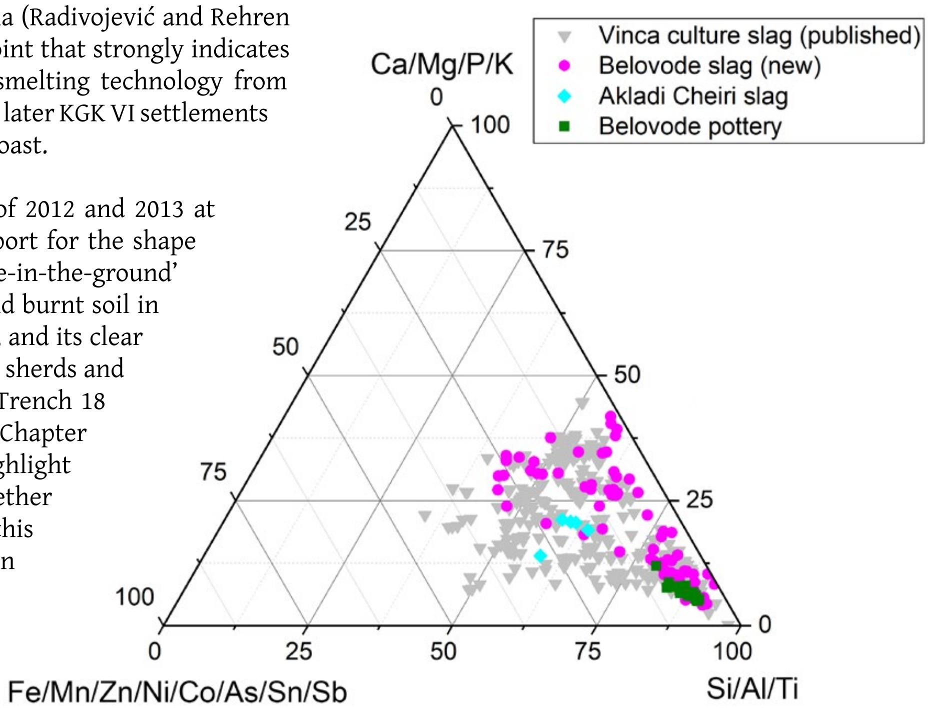


Figure 1. SiO2/Al2O3/TiO2-CaO/MgO/P2O5/K2O-FeO/MnO/ZnO/NiO/CoO/As2O3/SnO2/Sb2O3 ternary plot (cast as Cu-free) for all Vinča culture metallurgical slag matrix data and 'cold' pottery analysis (from Radivojević 2007; 2012 and Chapter 11, this volume), with Akladi Cheiri slag (Rehren *et al.* 2020).

BC) and technological knowledge was transmitted across the Balkans during the 5th millennium BC, confirming the conclusions of previous research (e.g. Radivojević 2015).

Acquisition and circulation of copper minerals, ores and artefacts: lead isotope analysis

A total of 19 artefacts were analysed for provenance (lead isotope and trace element analysis, see Table 2) within the scope of this project. The rationale for their selection ranged from association with production debris and metal artefacts, to minerals of various qualities marking top, bottom and middle stratigraphic points during the excavations (Table 2). The methodology for sample preparation and analysis has been extensively reported elsewhere (cf. Nørgaard *et al.* 2019)

The lead isotope abundance ratios in all investigated objects are summarised in Table 3 and illustrated in Figures 2–11 with comparative datasets (datasets are also available as Appendix to this Chapter). Sample P8/13 (an iron-based mineral) is excluded from further consideration as it plots far from the copper-based group of artefacts and is not relevant to the discussion on copper metallurgy in this chapter. The clustering of samples is evident in the plots of two sets of isotope abundance ratios of lead: $^{207}Pb/^{206}Pb$ vs $^{208}Pb/^{206}Pb$ (Figure 2) and $^{206}Pb/^{204}Pb$ vs $^{207}Pb/^{204}Pb$ (Figure 3). All samples fit broadly into four categories:

Table 2. List of samples selected for provenance analysis (lead isotope- LIA and trace elements- NAA) and rationale for selection.

No	trench	spit	find no.	EDM	type of material	LIA	NAA	reasoning for provenance analysis
B21/13	18ext	S4	1378	420	malachite (green)	X	X	top layer malachite
B23/12	18	S5	77	182	slagged sherd (metal phase)	X	X	slagged sherd
Bf21/12	18	S6	112	272	metal droplet	X	X	metal droplet
Bf22/12/2	18	S6	116	276	malachite	X	X	workshop area mineral
B47/12/3	18	S6	112	272	metal prill associated with the slagged sherd	X	X	production evidence / metal
Bf43/13	18/F21	S12	1492	477	metal droplet	X	X	metal droplet
B108/13	18	S13	1691	550	malachite (black and green)	X	X	associated with Bf43/13
B350/13	18ext/F39	S13	2429	881	malachite	X	X	Near ash feature 39
B155/13	18	S14	1785	612	copper mineral	X	X	a different type of a copper mineral
B385/13	18	S19	2596	937	malachite	X	X	earliest malachite occurrence
P8/13	T24	S10	214	977	(magnetic) iron mineral	X	X	the earliest magnetic mineral
P10/13	T24	S10	220	988	fragmented metal (foil/stock)		X	metal artefact
P13/13	T24	S11	233	1017	fragment of a metal bracelet/wire		X	metal artefact
P14/13	T24	S12	242	1054	malachite	X	X	malachite near P13/13
P55/13	T14/F15	S16	366	1606	malachite	X	X	ore choice consistency
P121/13	T24	S21	537	1958	malachite	X	X	earliest malachite occurrence
C_P1/13	T24	S9	155	587	Metal loop / ring	X	X	metal artefact
C_P2/13	T24/F2 (north)	S9	195	908	Metal band / ring	X		metal artefact

Table 3. Lead isotope abundance ratio for selected copper-based materials from the sites of Belovode and Pločnik. The isotope ratios measured were 208Pb/206Pb, 207Pb/206Pb, and 206Pb/20Pb, with relative uncertainties of less than 0.01 for the first two ratios and less than 0.03% for the last. The ratios 208Pb/204Pb, and 207Pb/204Pb, were calculated from the other ratios.

Lab no.	original label	description	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$	$^{206}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$
MA-140907	B23/12	Slagged sherd (metal)	2.0686	0.82887	18.891	39.077	15.658
MA-140908	B108/13	Malachite (black and green)	2.0729	0.84099	18.544	38.440	15.596
MA-140909	B47/12/3	Slagged sherd (metal)	2.0634	0.83062	18.855	38.904	15.661
MA-140910	B21/13	Malachite (green)	2.0348	0.82165	19.071	38.806	15.670
MA-140911	B155/13	Copper mineral	2.0676	0.83777	18.663	38.586	15.635
MA-140913	B385/13	Malachite	2.0749	0.84209	18.511	38.409	15.588
MA-140914	Bf21/12	Metal droplet	2.0690	0.83813	18.662	38.610	15.641
MA-140915	Bf22/12/2	Malachite	2.0764	0.84264	18.505	38.425	15.593
MA-140916	Bf43/13	Metal droplet	2.0762	0.84260	18.506	38.421	15.593
MA-140917	P8/13	(Magnetic) iron mineral	2.1666	0.91460	16.934	36.689	15.488
MA-140920	P14/13	Malachite	2.0725	0.83601	18.749	38.857	15.674
MA-140921	P55/13	Malachite	2.0766	0.84262	18.508	38.435	15.595
MA-140922	P121/13	Malachite	2.0750	0.84241	18.500	38.387	15.584
MA-140923	C_P1/13	Metal loop / ring	2.0805	0.84766	18.440	38.363	15.630
MA-140924	C_P2/13	Metal band / ring	2.0628	0.83206	18.812	38.805	15.653

Group 1 is a tight cluster predominantly comprising minerals, both from Belovode (Bf22/12/2, B108/13, B385/13) and Pločnik (P55/13, P121/13), accompanied by a single copper metal droplet (Bf43/13). The $^{206}Pb/^{204}Pb$ isotope abundance ratios of these objects cluster around 18.544–18.500;

Group 2 is a pair of samples consisting of copper metal droplet Bf21/12 and copper mineral B155/13. The $^{206}Pb/^{204}Pb$ isotope abundance ratios of these objects cluster around 18.663–18.662;

Group 3 consists of artefacts that form a dispersed agglomeration away from Groups 1 and 2. It includes metal from the production process at Belovode (B47/12/3), a slagged sherd (B23/12) and a copper metal band (or a ring) C_P2/13, from Pločnik. These artefacts show a clear association with metal droplets / prills in slags (B47/12/3 and B23/12) from F6 (workshop) at Belovode, as well as confirming the contemporaneous links to the Pločnik community and the metal band / ring (C_P2/13), all dated to the 46th century BC (see Chapter 26). Their $^{206}Pb/^{204}Pb$ isotope abundance ratios vary between 18.855 and 18.812.

The three 'outlier' samples do not belong to any of the mentioned groups and include the copper metal loop / ring from Pločnik C_P1/13 and two malachite samples from Belovode (B21/13 and P14/13).

The grouping of these objects could indicate consistency with three or more distinctive ore deposits or may reflect a single geologically complex source. In order to locate potential sources exploited by the Vinča culture communities, these data were plotted against the existing database of lead isotope ratios of Balkan ores and artefacts (metal and mineral-based), which largely come from the same laboratories that analysed the samples in Table 3 (the Max-Planck-Institute for Chemistry in Mainz and the Curt-Engelhorn-Centre for Archaeometry in Mannheim, Germany, with labels HDM and CEZA, respectively) (Pernicka *et al.* 1993, 1997; Kunze and Pernicka 2020). Additional lead isotope data by Gale (1991) (label GALE) and the mean of two samples from Majdanpek by Amov (1999) (label AMOV) as well as Amov and Vǎkova (1994) (label A&V) for Bulgarian deposits are also included. The data presented in Table 4 is the Balkan copper

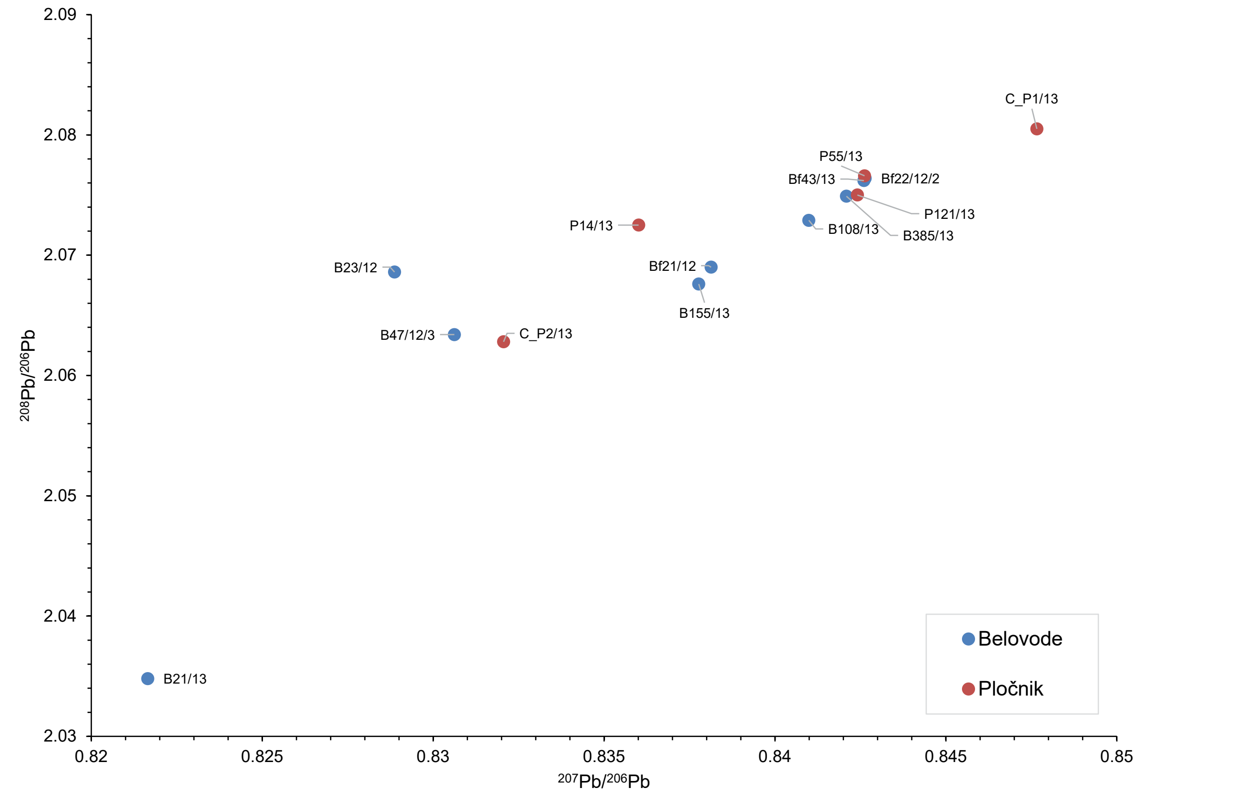


Figure 2. Lead isotope abundance ratios of Belovode and Pločnik artefacts presented in a $^{207}Pb/^{206}Pb$ vs $^{208}Pb/^{206}Pb$ diagram. Error bars are smaller than the symbol size.

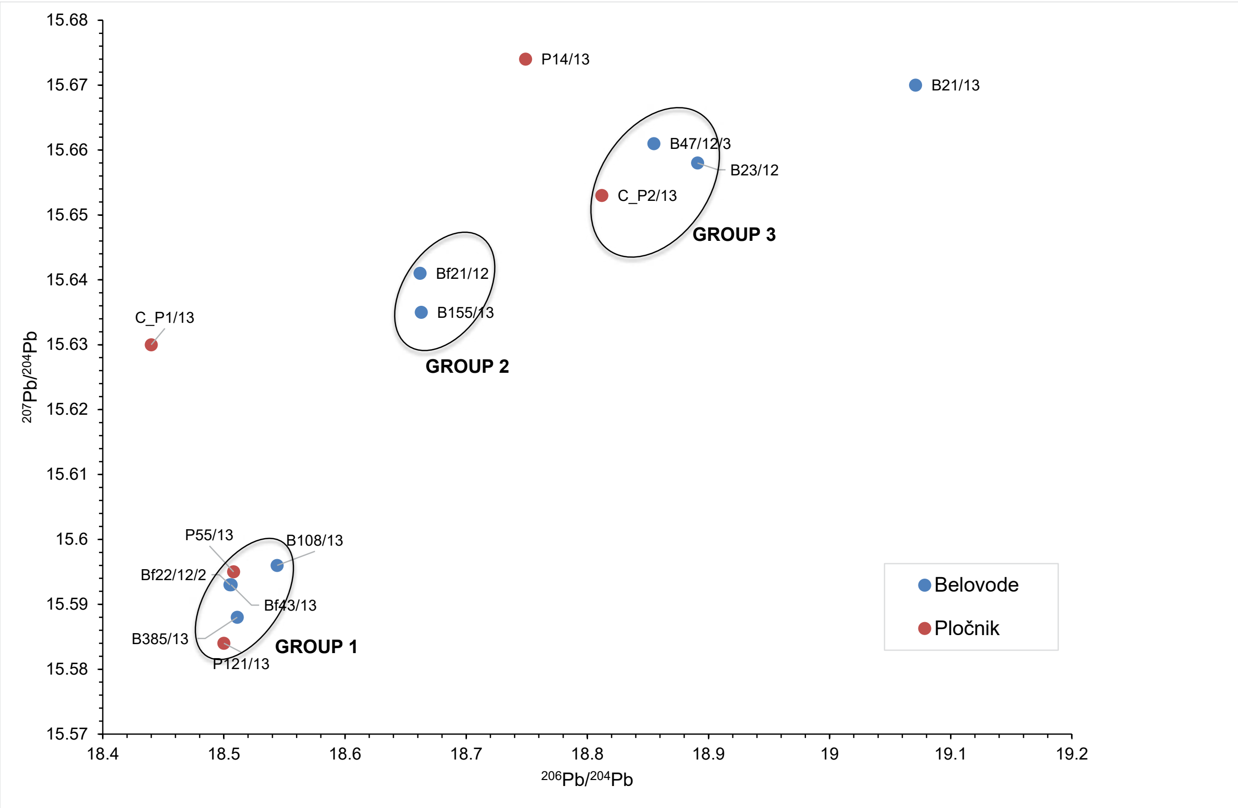


Figure 3. Lead isotope abundance ratios of Belovode and Pločnik artefacts presented in a $^{206}Pb/^{204}Pb$ vs $^{207}Pb/^{204}Pb$ diagram.

deposits database used for comparison, however only the sources consistent with the lead isotope abundance ratios in archaeological samples are included in the accompanying figures. The same applies to Tables 5–8 which, combined, include 177 copper-based archaeological artefacts (malachite, copper production and metal implements) from the Balkans, spanning the mid-6th to mid-4th millennium BC, with the largest concentration of items in the Early Chalcolithic (EC, 5000–4600 BC) and Middle Chalcolithic (MC, 4600–4450 BC). This unique dataset originated from the Curt-Engelhorn-Centre for Archaeometry in Mannheim, Germany. The additional dataset from Bulgaria (http://oxalid.arch.ox.ac.uk/Bulgaria/Bulgaria.html) was not used due to the difficulties in matching the exact level of contextual information available for the data in Tables 4–11.

From ore to metal: the pathways of lead isotope abundance ratios

A key feature of the tight clustering of copper minerals from Belovode (Bf22/12/2, B108/13, B385/13) and Pločnik (P55/13, P121/13) in *Group 1* is that these minerals come from top, middle and bottom spits, and have been chosen to check the consistency of ore choice from the beginning until the end of the occupation at both settlements. Interestingly, one of these (Bf22/12/2, from Belovode Horizon 1b), is an exact match for the earliest metal smelted at Belovode (Bf43/13, Belovode Horizon 2), while copper mineral B108/13 in this cluster originated from the same spit and horizon as Bf43/13 (see Table 2). The whole cluster shows more clearly that there was a consistent supply of copper minerals / ores from a source (or a group of sources) throughout the occupation of these two settlements, from *c.* 5200 BC until 4600 BC, or for *c.* 600 years. Looking at the direct dates provided (see Table 1, Chapter 37), both settlements joined the same supply network at almost the same time: the copper mineral from Belovode (B385/13) comes from spit 19, directly dated to the 51st century BC, which correlates well with the probability distribution of ^{14}C dates for P121/13 (associated with spit 21 and F30/F34), set also at around the 51st century BC. Also, the copper mineral samples B108/13, Bf43/13 and P55/13 show similar dating to the 49th century BC, which again reinforces the existence of the same supply networks between these sites and the ore deposits in eastern Serbia. This further supports the likely transmission of a shared metallurgical knowledge between the communities of Belovode and Pločnik, from the very beginning until the end of the Belovode occupation (46th century BC, see Chapter 37).

Table 4. Lead isotope abundance ratios of copper deposits in the Balkans. Regions are abbreviated as follows: BSC=Black Sea Coast, SRB = Serbia, W= West Bulgaria, STR= Strandza, THR = Thracia (data from Amov and Vǎkova 1994; Gale *et al.* 1991; Kunze and Pernicka 2020; Pernicka *et al.* 1993, 1997). Ore minerals are abbreviated as follows: chalc=chalcocite, cov=covelline, pyr=pyrite, enarg=enargite, chpyr=chalcopyrite, born=bornite, gal=galena, sphal=sphalerite, mal=malachite, fahl=fahlore, magn=magnetite.

Label	Sample	Location	Region	description	^{208}Pb/^{206}Pb	^{207}Pb/^{206}Pb	^{204}Pb/^{206}Pb	^{208}Pb/^{204}Pb	^{207}Pb/^{204}Pb	^{206}Pb/^{204}Pb
HDM	TG 197	Bor	SRB	Cu ore (chalc)	2.0900	0.85100	0.054820	38.127	15.524	18.242
HDM	TG 197 A	Bor	SRB	Cu ore (cov, pyr, enarg)	2.0866	0.84910	0.054680	38.158	15.528	18.288
HDM	TG 197 B	Bor	SRB	Cu ore (chalc)	2.0915	0.85050	0.054750	38.203	15.536	18.266
HDM	TG 197 C	Bor	SRB	Cu ore (cov, pyr, enarg)	2.0864	0.84930	0.054720	38.128	15.520	18.275
HDM	TG 197 E	Bor	SRB	Cu ore (enarg, pyr, cov)	2.0895	0.84930	0.054650	38.234	15.541	18.298
HDM	TG 197 F	Bor	SRB	Cu ore (chpyr, pyr)	2.0882	0.84990	0.054750	38.137	15.522	18.263
HDM	TG 197 G	Bor	SRB	Cu ore (cov, pyr, enarg)	2.0891	0.84980	0.054660	38.217	15.546	18.294
HDM	TG 197 I	Bor	SRB	Cu ore (cov, pyr)	2.0887	0.84970	0.054730	38.163	15.525	18.271
HDM	TG 197 J	Bor	SRB	Cu ore (enarg, pyr, cov)	2.0909	0.85050	0.054710	38.219	15.547	18.279
HDM	TG 197 K-1	Bor	SRB	Cu ore (born, pyr, chpyr)	2.0894	0.85070	0.054790	38.138	15.527	18.253
HDM	TG 197 K-4	Bor	SRB	Cu ore (cov, pyr)	2.0920	0.85120	0.054730	38.222	15.552	18.271
HDM	TG 197 L	Bor	SRB	Cu ore (gal, pyr, cov)	2.0915	0.85090	0.054760	38.193	15.538	18.261

Table 4 continued. Lead isotope abundance ratios of copper deposits in the Balkans. Regions are abbreviated as follows: BSC=Black Sea Coast, SRB = Serbia, W= West Bulgaria, STR= Strandza, THR = Thracia (data from Amov and Vǎkova 1994; Gale *et al.* 1991; Kunze and Pernicka 2020; Pernicka *et al.* 1993, 1997). Ore minerals are abbreviated as follows: chalc=chalcocite, cov=covelline, pyr=pyrite, enarg=enargite, chpyr=chalcopyrite, born=bornite, gal=galena, sphal=sphalerite, mal=malachite, fahl=fahlore, magn=magnetite.

Label	**Sample**	**Location**	**Region**	**description**	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$	$^{204}Pb/^{206}Pb$	$^{208}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{206}Pb/^{204}Pb$
HDM	TG 197 COV	Bor	SRB	Cu ore (cov)	2.0873	0.84930	0.054660	38.185	15.537	18.294
HDM	TG 197 ENARG	Bor	SRB	Cu ore (enarg)	2.0854	0.84880	0.054710	38.115	15.515	18.278
HDM	HDM 1395	Bor	SRB	native copper	2.0860	0.84540	0.054030	38.608	15.646	18.508
HDM	HDM 1396	Bor	SRB	native Cu	2.0901	0.85040	0.054770	38.160	15.526	18.258
HDM	TG 240	Velika Brestovica (near RG)	SRB	Cu slag	2.0587	0.83200	0.053140	38.742	15.656	18.818
HDM	TG 253 A-1	Majdanpek	SRB	Cu slag, metallic Cu	2.0783	0.84400	0.054170	38.367	15.581	18.461
HDM	TG 253 A-2	Majdanpek	SRB	oxidic Cu ore	2.0753	0.84430	0.054170	38.310	15.567	18.460
HDM	TG 253 B	Majdanpek	SRB	Cu slag, met. Cu	2.0763	0.84430	0.054140	38.349	15.576	18.470
HDM	TG 253 C	Majdanpek	SRB	Cu slag	2.0781	0.84370	0.054080	38.425	15.601	18.491
HDM	TG 253 E-1	Majdanpek	SRB	native Cu	2.0832	0.84510	0.054140	38.478	15.609	18.470
HDM	TG 253 E-2	Majdanpek	SRB	Cu ore (cupr)	2.0750	0.84280	0.054100	38.351	15.578	18.483
HDM	TG 253 F	Majdanpek	SRB	Cu ore (mal, azur)	2.0780	0.84400	0.054250	38.306	15.560	18.435
HDM	TG 253 G	Majdanpek	SRB	Cu ore (chpyr)	2.0752	0.84270	0.054150	38.326	15.563	18.489
AMOV	/	Majdanpek	SRB	Cu ore	2.0807	0.84440	2.464000	38.511	15.629	18.509
HDM	BG-17	Ai Bunar	THR	malachite	2.0829	0.84410	0.054000	38.572	15.631	18.519
HDM	BG-17e	Ai Bunar	THR	malachite	2.0836	0.84440	0.053980	38.599	15.643	18.525
HDM	BG-17f	Ai Bunar	THR	malachite	2.0836	0.84450	0.054000	38.585	15.639	18.519
HDM	BG-17g	Ai Bunar	THR	malachite	2.0823	0.84420	0.053990	38.568	15.636	18.522
HDM	BG-17h	Ai Bunar	THR	malachite	2.0830	0.84420	0.054000	38.574	15.633	18.519
HDM	BG-17i	Ai Bunar	THR	malachite	2.0824	0.84410	0.054030	38.542	15.623	18.508
CEZA	MA-14991	Ai Bunar	THR	malachite	2.0819	0.84380	0.054018	38.541	15.621	18.512
GALE	AB1	Ai Bunar	THR	malachite	2.0811	0.84831	0.054051	38.502	15.695	18.501
GALE	AB1a	Ai Bunar	THR	malachite	2.0871	0.84597	0.054086	38.589	15.641	18.489
GALE	AB2	Ai Bunar	THR	malachite	2.0791	0.84368	0.054115	38.419	15.590	18.479
GALE	AB2a	Ai Bunar	THR	malachite	2.0797	0.84360	0.054022	38.496	15.616	18.511
GALE	AB4	Ai Bunar	THR	malachite	2.0805	0.84398	0.054051	38.492	15.614	18.501
GALE	AB5	Ai Bunar	THR	malachite	2.0812	0.84396	0.054075	38.487	15.607	18.493

Table 4 continued. Lead isotope abundance ratios of copper deposits in the Balkans. Regions are abbreviated as follows: BSC=Black Sea Coast, SRB = Serbia, W= West Bulgaria, STR= Strandza, THR = Thracia (data from Amov and Văkova 1994; Gale *et al.* 1991; Kunze and Pernicka 2020; Pernicka *et al.* 1993, 1997). Ore minerals are abbreviated as follows: chalc=chalcocite, cov=covelline, pyr=pyrite, enarg=enargite, chpyr=chalcopyrite, born=bornite, gal=galena, sphal=sphalerite, mal=malachite, fahl=fahlore, magn=magnetite.

Label	**Sample**	**Location**	**Region**	**description**	^{208}Pb/^{206}Pb	^{207}Pb/^{206}Pb	^{204}Pb/^{206}Pb	^{208}Pb/^{204}Pb	^{207}Pb/^{204}Pb	^{206}Pb/^{204}Pb
GALE	AB5a	Ai Bunar	THR	malachite	2.0819	0.84437	0.053990	38.561	15.639	18.522
GALE	75	Ai Bunar	THR	malachite	2.0811	0.84421	0.054133	38.443	15.595	18.473
GALE	77D	Ai Bunar	THR	malachite	2.0816	0.84391	0.054037	38.522	15.617	18.506
GALE	78C	Ai Bunar	THR	malachite	2.0813	0.84398	0.054133	38.449	15.591	18.473
GALE	79	Ai Bunar	THR	malachite	2.0857	0.84581	0.054198	38.483	15.606	18.451
HDM	BG-11a	Radka	W	native copper	2.0703	0.83660	0.053390	38.777	15.670	18.730
HDM	BG-11b	Radka	W	native copper	2.0819	0.84200	0.053760	38.726	15.662	18.601
HDM	BG-11c	Radka	W	chpyr, pyr, gal, fhl, born	2.0845	0.84470	0.054060	38.559	15.625	18.498
HDM	36	Radka-Panagjuriste	W	ore?	2.0866	0.84560				
HDM	BG-6a	Zidarovo	BSC	malachite	2.0664	0.83660	0.053320	38.755	15.690	18.755
HDM	BG-6b	Zidarovo	BSC	malachite	2.0754	0.84210	0.053950	38.469	15.609	18.536
HDM	BG-6c	Zidarovo	BSC	born, chpyr	2.0666	0.83770	0.053600	38.556	15.629	18.657
CEZA	MA-141987	Zidarovo	BSC	malachite	2.0656	0.83593	0.053427	38.662	15.646	18.717
A&V	42.1	Zidarovo, Urta	BSC	galena	2.0757	0.84110	0.053903	38.509	15.605	18.552
A&V	42.2	Zidarovo, Urta	BSC	galena	2.0677	0.83750	0.053671	38.525	15.605	18.632
A&V	42.3	Zidarovo, Urta	BSC	galena	2.0718	0.83850	0.053576	38.671	15.650	18.665
HDM	BG-12d	M. Tarnovo-Bradceto	STR	malachite	2.0646	0.83550	0.053360	38.692	15.658	18.741
HDM	BG-12a	M. Tarnovo-Bradceto	STR	native Cu	2.0733	0.83690	0.053410	38.819	15.669	18.723
HDM	BG-12b	M. Tarnovo-Bradceto	STR	native Cu	2.0689	0.83600	0.053540	38.642	15.614	18.678
HDM	BG-12c	M. Tarnovo-Bradceto	STR	native Cu	2.0671	0.83410	0.053160	38.884	15.690	18.811
HDM	BG-12e	M. Tarnovo-Bradceto	STR	native Cu	2.0731	0.83510	0.053330	38.873	15.659	18.751
HDM	ZDRelo 1 C1	Ždrelo	SRB	malachite	2.0735	0.83991	0.053706	38.601	15.639	18.620
HDM	ZDRelo 1 C2	Ždrelo	SRB	malachite	2.0713	0.83931	0.053714	38.602	15.625	18.617
HDM	ZDRelo 2	Ždrelo	SRB	malachite	2.0730	0.83988	0.053697	38.574	15.641	18.623
HDM	Mali Sturac 152	Mali Sturac	SRB	malachite	2.0810	0.83903	0.053565	38.701	15.664	18.669
HDM	TG196	Rudna Glava	SRB	Cu ore mal	2.0374	0.83190	0.053250	38.261	15.622	18.780
HDM	TG196-1	Rudna Glava	SRB	Cu ore (magn, chalc, mal)	1.5448	0.63460	0.039670	38.937	15.996	25.206

Table 4 continued. Lead isotope abundance ratios of copper deposits in the Balkans. Regions are abbreviated as follows: BSC=Black Sea Coast, SRB = Serbia, W= West Bulgaria, STR= Strandza, THR = Thracia (data from Amov and Văkova 1994; Gale *et al.* 1991; Kunze and Pernicka 2020; Pernicka *et al.* 1993, 1997). Ore minerals are abbreviated as follows: chalc=chalcocite, cov=covelline, pyr=pyrite, enarg=enargite, chpyr=chalcopyrite, born=bornite, gal=galena, sphal=sphalerite, mal=malachite, fahl=fahlore, magn=magnetite.

Label	Sample	Location	Region	description	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$	$^{204}Pb/^{206}Pb$	$^{208}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{206}Pb/^{204}Pb$
HDM	TG 196-2	Rudna Glava	SRB	Cu ore mal	2.0466	0.83720	0.053590	38.190	15.623	18.660
HDM	TG 196-2g-1	Rudna Glava	SRB	Cu ore (mal, azur)	1.0507	0.45250	0.027300	38.493	16.578	36.635
HDM	TG 196-2g-2	Rudna Glava	SRB	Cu ore (chalc, mal)	1.9548	0.79740	0.050840	38.447	15.684	19.669
HDM	TG 196-2g-3	Rudna Glava	SRB	Cu ore (mal)	1.5461	0.60670	0.037920	40.774	15.999	26.372
HDM	TG 196-2g-4	Rudna Glava	SRB	Cu ore (mal)	2.0493	0.83880	0.053590	38.239	15.652	18.660
HDM	TG 196-3	Rudna Glava	SRB	Cu ore (mal)	2.0409	0.83270	0.053220	38.345	15.646	18.789
HDM	TG 196-4	Rudna Glava	SRB	Cu ore (mal)	1.8599	0.75150	0.047640	39.039	15.774	20.990
HDM	TG 196-4.3	Rudna Glava	SRB	Cu ore (chpyr, mal, azur)	1.8791	0.75520	0.047930	39.207	15.756	20.864
HDM	TG 196 A	Rudna Glava	SRB	Cu ore (chpyr, mal, azur)	1.6961	0.68300	0.042970	39.469	15.895	23.271
HDM	TG 196 B	Rudna Glava	SRB	Cu ore (magn, chalc)	1.8239	0.74830	0.047490	38.410	15.758	21.059
HDM	RUDNA 1	Rudna Glava	SRB	Cu ore (mal)	1.8846	0.76650	0.048520	38.844	15.800	20.612
HDM	RUDNA 2	Rudna Glava	SRB	Cu ore (mal)	1.9339	0.78460	0.049970	38.703	15.701	20.013
HDM	RUDNA 3	Rudna Glava	SRB	Cu ore (mal)	1.9935	0.81190	0.051810	38.477	15.672	19.302
HDM	RUDNA 4	Rudna Glava	SRB	Cu ore (mal)	0.6723	0.30890	0.017500	38.425	17.655	57.156
HDM	RUDNA 5	Rudna Glava	SRB	Cu ore (mal)	1.9535	0.78010	0.049710	39.300	15.693	20.118
GALE	RG1	RUDNA GLAVA 1	SRB	Cu ore	2.0757	0.84975	0.054526	38.069	15.584	18.340
GALE	RG2	RUDNA GLAVA 2	SRB	Cu ore	2.0780	0.85069	0.054564	38.084	15.591	18.327
GALE	RG3	RUDNA GLAVA 3	SRB	Cu ore	2.0835	0.85226	0.054576	38.175	15.616	18.323
GALE	RG4	RUDNA GLAVA 4	SRB	Cu ore	2.0795	0.85223	0.054538	38.130	15.626	18.336
HDM	TG 249 A	Rudnik	SRB	Cu ore (mal)	2.0770	0.83840	0.053550	38.784	15.655	18.673
HDM	TG 249 AA	Rudnik	SRB	Pb-Zn ore (gal, sphal, pyr, chpyr)	2.0783	0.83870	0.053520	38.834	15.671	18.686
HDM	TG 249 B	Rudnik	SRB	Cu slag	2.0783	0.83830	0.053560	38.806	15.652	18.672
HDM	TG 249 BB	Rudnik	SRB	Pb-Zn ore (gal, sphal, pyr, chpyr)	2.0793	0.83870	0.053510	38.861	15.674	18.689
HDM	TG 249 D	Rudnik	SRB	Cu slag	2.0788	0.83880	0.053520	38.843	15.674	18.685
HDM	TG 249 EE	Rudnik	SRB	Cu ore (chpyr)	2.0783	0.83870	0.053540	38.815	15.663	18.677
HDM	TG 249 F	Rudnik	SRB	Pb-Zn slag	2.0788	0.83840	0.053500	38.858	15.672	18.692
HDM	TG 249 FF	Rudnik	SRB	Pb-Zn ore (gal, sphal, pyr, chpyr)	2.0770	0.83850	0.053590	38.759	15.647	18.661

Table 4 continued. Lead isotope abundance ratios of copper deposits in the Balkans. Regions are abbreviated as follows: BSC=Black Sea Coast, SRB = Serbia, W= West Bulgaria, STR= Strandza, THR = Thracia (data from Amov and Vǎkova 1994; Gale *et al.* 1991; Kunze and Pernicka 2020; Pernicka *et al.* 1993, 1997). Ore minerals are abbreviated as follows: chalc=chalcocite, cov=covelline, pyr=pyrite, enarg=enargite, chpyr=chalcopyrite, born=bornite, gal=galena, sphal=sphalerite, mal=malachite, fahl=fahlore, magn=magnetite.

Label	**Sample**	**Location**	**Region**	**description**	^{208}Pb/^{206}Pb	^{207}Pb/^{206}Pb	^{204}Pb/^{206}Pb	^{208}Pb/^{204}Pb	^{207}Pb/^{204}Pb	^{206}Pb/^{204}Pb
HDM	TG 249 G	Rudnik	SRB	Pb-Zn slag	2.0796	0.83860	0.053520	38.853	15.668	18.683
HDM	TG 249 O-1	Rudnik	SRB	Cu ore (chpyr, mal)	2.0770	0.83830	0.053540	38.792	15.657	18.677
HDM	TG 249 O-2	Rudnik	SRB	Cu slag	2.0785	0.83880	0.053550	38.818	15.666	18.676
HDM	TG 249 T	Rudnik	SRB	Cu slag	2.0786	0.83870	0.053530	38.830	15.668	18.681
HDM	TG 249 Y	Rudnik	SRB	Cu slag	2.0801	0.83910	0.053450	38.919	15.699	18.710
HDM	Mali Sturac 152	Mali Sturac	SRB	malachite	2.0810	0.83903	0.053565	38.701	15.664	18.669
HDM	BG-1b	Medni Rid	BSC	chpyr, pyr	2.0645	0.83590	0.053410	38.654	15.651	18.723
HDM	BG-1c	Medni Rid	BSC	chpyr, born, mal, pyr, fhl	2.0745	0.84500	0.054110	38.339	15.616	18.481
CEZA	MA-135454	Rosen, Medni Rid region	BSC	malachite	1.8253	0.74540	0.047404	38.505	15.724	21.095
CEZA	MA-141990	Rosen, Medni Rid region	BSC	malachite	1.8196	0.73895	0.046903	38.795	15.754	21.320
CEZA	MA-145532	Rosen, Medni Rid region	BSC	malachite	1.8180	0.74178	0.047142	38.564	15.735	21.213
CEZA	MA-141989	Propadnala Voda, Medni Rid region	BSC	malachite	1.7136	0.68114	0.042754	40.080	15.932	23.390
CEZA	MA-145533	Propadnala Voda, Medni Rid region	BSC	malachite	1.8215	0.74430	0.047296	38.513	15.737	21.144
CEZA	MA-145534	Propadnala Voda, Medni Rid region	BSC	surface slag	1.5612	0.64458	0.040514	38.535	15.910	24.683
CEZA	MA-147718	Propadnala Voda, Medni Rid region	BSC	malachite	1.1363	0.48083	0.029397	38.654	16.356	34.017
CEZA	MA-152442	Propadnala Voda, Medni Rid region	BSC	malachite	1.6644	0.68392	0.043203	38.525	15.830	23.147
CEZA	MA-147715	Propadnala Voda, Medni Rid region	BSC	malachite	1.8286	0.74644	0.047415	38.566	15.743	21.090
CEZA	MA-147716	Propadnala Voda, Medni Rid region	BSC	malachite	2.0422	0.82842	0.052989	38.540	15.634	18.872
CEZA	MA-147722	Propadnala Voda, Medni Rid region	BSC	malachite	1.9733	0.80186	0.051187	38.551	15.666	19.536
CEZA	MA-147719	Kyumyur-lake, Medni Rid region	BSC	malachite	1.3509	0.56261	0.034962	38.639	16.092	28.603
CEZA	MA-147721	Kyumyur-lake, Medni Rid region	BSC	malachite	1.7921	0.72624	0.045977	38.978	15.795	21.750
CEZA	MA-147723	Surneshko Kladenche, Medni Rid region	BSC	malachite	2.0298	0.82333	0.052643	38.558	15.640	18.996
CEZA	MA-135453	Varli Brjag	BSC	malachite	2.0637	0.83611	0.053490	38.581	15.361	18.695
CEZA	MA-141988	Varli Brjag	BSC	malachite	2.0638	0.83396	0.053287	38.730	15.650	18.766
CEZA	MA-135455	Atiya	BSC	malachite	2.0394	0.82900	0.052948	38.517	15.657	18.886
CEZA	MA-141992	Zelenata Kanara	BSC	malachite	2.0613	0.81434	0.051801	39.793	15.721	19.305

Table 5. Lead isotope abundance ratios of Vinča culture malachite and copper metal implements (data from Pernicka *et al.* 1993; Radivojević *et al.* 2010a).

rel period	abs period	Cultural attribution	Site	Type	Region	^{208}Pb/^{206}Pb	^{207}Pb/^{206}Pb	^{204}Pb/^{206}Pb	^{208}Pb/^{204}Pb	^{207}Pb/^{204}Pb	^{206}Pb/^{204}Pb
EC	5000-4600 BC	Vinča culture	Medvednjak	malachite bead	SRB	2.0760	0.84290	0.054080	38.388	15.586	18.491
EC	5000-4600 BC	Vinča culture	Medvednjak	malachite bead	SRB	2.0554	0.83990	0.052940	38.825	15.865	18.889
EC	5000-4600 BC	Vinča culture	Selevac	malachite	SRB	2.0328	0.82360	0.052560	38.676	15.670	19.026
EC	5000-4600 BC	Vinča culture	Selevac	malachite	SRB	2.0552	0.83110	0.053290	38.566	15.596	18.765
EC	5000-4600 BC	Vinča culture	Selevac	malachite	SRB	2.0739	0.84200	0.054050	38.370	15.578	18.501
EC	5000-4600 BC	Vinča culture	Selevac	malachite	SRB	2.0749	0.84220	0.053990	38.431	15.599	18.522
EC	5000-4600 BC	Vinča culture	Selevac	malachite	SRB	2.0734	0.84200	0.053880	38.482	15.627	18.560
EC	5000-4600 BC	Vinča culture	Selevac	malachite	SRB	2.0762	0.84290	0.054070	38.398	15.589	18.495
EC	5000-4600 BC	Vinča culture	Selevac	malachite	SRB	2.0672	0.83400	0.053400	38.712	15.618	18.727
EC	5000-4600 BC	Vinča culture	Selevac	malachite	SRB	2.0735	0.84160	0.054010	38.391	15.582	18.515
EC	5000-4600 BC	Vinča culture	Selevac	malachite	SRB	2.0615	0.83320	0.053360	38.634	15.615	18.741
EC	5000-4600 BC	Vinča culture	Selevac	malachite	SRB	2.0731	0.84400	0.054010	38.384	15.627	18.515
EC	5000-4600 BC	Vinča culture	Selevac	malachite	SRB	2.0657	0.83500	0.053340	38.727	15.654	18.748
EC	5000-4600 BC	Vinča culture	Selevac	malachite	SRB	2.0681	0.83490	0.053330	38.779	15.655	18.751
EC	5000-4600 BC	Vinča culture	Selevac	malachite	SRB	2.0718	0.84010	0.053790	38.516	15.618	18.591
EC	5000-4600 BC	Vinča culture	Selevac	copper prill	SRB	2.0422	0.82440	0.052700	38.751	15.643	18.975
EC	5000-4600 BC	Vinča culture	Selevac	copper prill	SRB	2.0441	0.82530	0.052650	38.824	15.675	18.993
EC	5000-4600 BC	Vinca culture	Belovode	Belovode 12 mineral	SRB	2.0693	0.83947	0.053807	38.457	15.602	18.585
EC	5000-4600 BC	Vinca culture	Belovode	Belovode M13 mineral	SRB	2.0771	0.84338	0.054113	38.385	15.586	18.480
EC	5000-4600 BC	Vinca culture	Belovode	Belovode M17 mineral	SRB	2.0754	0.84249	0.054080	38.377	15.579	18.491
EC	5000-4600 BC	Vinca culture	Belovode	Belovode M20 slag	SRB	2.0610	0.83512	0.053548	38.490	15.596	18.675
EC	5000-4600 BC	Vinca culture	Belovode	Belovode M21 slag	SRB	2.0550	0.83089	0.053104	38.699	15.647	18.831
EC	5000-4600 BC	Vinca culture	Belovode	Belovode M22a slag	SRB	2.0546	0.83065	0.052994	38.769	15.675	18.870
EC	5000-4600 BC	Vinca culture	Belovode	Belovode M23 slag	SRB	2.0088	0.81254	0.051824	38.760	15.681	19.296
MC	4600-4450 BC	Vinča culture	Gomolava	bracelet	SRB	2.0777	0.84570	0.054150	38.369	15.618	18.467
MC	4600-4450 BC	Vinča culture	Pločnik	chisel	SRB	2.0812	0.84330	0.054000	38.541	15.617	18.519

Table 5 continued. Lead isotope abundance ratios of Vinča culture malachite and copper metal implements (data from Pernicka *et al.* 1993; Radivojević *et al.* 2010a).

rel period	abs period	Cultural attribution	Site	Type	Region	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$	$^{204}Pb/^{206}Pb$	$^{208}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{206}Pb/^{204}Pb$
MC	4600-4450 BC	Vinča culture	Pločnik	flat axe	SRB	2.0836	0.84420	0.054010	38.578	15.630	18.515
MC	4600-4450 BC	Vinča culture	Pločnik	flat axe	SRB	2.0825	0.84390	0.054020	38.551	15.622	18.512
MC	4600-4450 BC	Vinča culture	Pločnik	hammer axe	SRB	2.0518	0.82680	0.052890	38.794	15.632	18.907
MC	4600-4450 BC	Vinča culture	Pločnik	hammer axe	SRB	2.0574	0.83040	0.053050	38.782	15.653	18.850
MC	4600-4450 BC	Vinča culture	Pločnik	chisel	SRB	2.0657	0.83310	0.053320	38.742	15.625	18.755
MC	4600-4450 BC	Vinča culture	Pločnik	chisel	SRB	2.0629	0.83360	0.053330	38.682	15.631	18.751
MC	4600-4450 BC	Vinča culture	Pločnik	chisel	SRB	2.0775	0.84030	0.053650	38.723	15.663	18.639
MC	4600-4450 BC	Vinča culture	Pločnik	chisel	SRB	2.0748	0.83860	0.053510	38.774	15.672	18.688
MC	4600-4450 BC	Vinča culture	Pločnik	chisel	SRB	2.0840	0.84430	0.054020	38.578	15.629	18.512
MC	4600-4450 BC	Vinča culture	Pločnik	chisel	SRB	2.0844	0.84430	0.053980	38.614	15.641	18.525
MC	4600-4450 BC	Vinča culture	Pločnik	chisel	SRB	2.0751	0.84050	0.053720	38.628	15.646	18.615
MC	4600-4450 BC	Vinča culture	Pločnik	chisel	SRB	2.0836	0.84420	0.054010	38.578	15.630	18.515
MC	4600-4450 BC	Vinča culture	Pločnik	chisel	SRB	2.0585	0.83070	0.053040	38.810	15.662	18.854
MC	4600-4450 BC	Vinča culture	Pločnik	chisel	SRB	2.0831	0.84390	0.053990	38.583	15.631	18.522
MC	4600-4450 BC	Vinča culture	Pločnik	chisel	SRB	2.0650	0.83520	0.053330	38.721	15.661	18.751
MC	4600-4450 BC	Vinča culture	Pločnik	hammer axe	SRB	2.0824	0.84360	0.054010	38.556	15.619	18.515

Table 6. Lead isotope abundance ratios of 'Group of 16' artefacts (data from Pernicka *et al.* 1997).

Sample	rel period	abs period	Cultural attribution	Site	Type	Region	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$	$^{204}Pb/^{206}Pb$	$^{208}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{206}Pb/^{204}Pb$
HDM2004	EC	5000-4600 BC	Hamangia II	Durankulak	malachite bead	BSC	2.0513	0.82980	0.052990	38.711	15.660	18.871
HDM1559	MC	4600-4450 BC	Vinča culture	Pločnik	axe	SRB	2.0574	0.83040	0.053050	38.782	15.653	18.850
HDM1568	MC	4600-4450 BC	Vinča culture	Pločnik	axe	SRB	2.0585	0.83070	0.053040	38.810	15.662	18.854
HDM1982	MC	4600-4450 BC	Varna II	Durankulak	bracelet	BSC	2.0556	0.83060	0.053080	38.726	15.648	18.839
HDM1987	MC	4600-4450 BC	Varna I	Durankulak	bracelet	BSC	2.0567	0.83260	0.053140	38.703	15.668	18.818
HDM2016	MC	4600-4450 BC	Varna II	Durankulak	bracelet	BSC	2.0551	0.82960	0.053010	38.768	15.650	18.864
HDM1920	MC	4600-4450 BC	KGK VI?	Ruse	axe	NE	2.0538	0.83220	0.053210	38.598	15.640	18.793
HDM2043	MC	4600-4450 BC	KGK VI?	Ruse	borer	NE	2.0514	0.83010	0.053170	38.582	15.612	18.808
HDM2059	MC	4600-4450 BC	KGK VI?	Ruse	borer	NE	2.0581	0.83160	0.053020	38.817	15.685	18.861
HDM2068	MC	4600-4450 BC	KGK VI?	Ruse	borer	BSC	2.0510	0.83000	0.052920	38.757	15.684	18.896
HDM2089	LC	4450-4100 BC	KGK VI?	Ruse	pin	NE	2.0586	0.83170	0.053140	38.739	15.651	18.818
HDM2101	LC	4450-4100 BC	KGK VI?	Ruse	borer	NE	2.0529	0.82810	0.052920	38.793	15.648	18.896
HDM2102	LC	4450-4100 BC	KGK VI?	Ruse	borer	NE	2.0571	0.83190	0.053130	38.718	15.658	18.822
HDM2103	LC	4450-4100 BC	KGK VI?	Ruse	borer	NE	2.0598	0.83250	0.053060	38.820	15.690	18.847
HDM1303	FC	4100-3700 BC	Bodrogkeresztur	Urovica	axe	SRB	2.0551	0.83070	0.053120	38.688	15.638	18.825
HDM2736	PB	3700-3200 BC	KSBh IV?	Malorad	dagger	W	2.0610	0.83150	0.053010	38.879	15.686	18.864

Table 7. Lead isotope abundance ratios of Akladi Cheiri and related Middle to Late Chalcolithic sites on the Black Sea Coast (data from Kunze and Pernicka 2020; Rehren *et al.* 2020).

Sample	rel period	abs period	Cultural attribution	Site	Type	Region	208Pb/206Pb	207Pb/206Pb	204Pb/206Pb	208Pb/204Pb	207Pb/204Pb	206Pb/204Pb
MA-135452	LN	5500-5000 BC	Karanovo III/IV	Alepu	malachite	BSC	2.0137	0.81748	0.052293	38.508	15.633	19.123
MA-152458	LN	5500-5000 BC	Karanovo III/IV	Hadzidimitrovo	malachite	BSC	1.9778	0.79940	0.050966	38.806	15.685	19.621
MA-152459	LN	5500-5000 BC	Karanovo III/IV	Hadzidimitrovo	malachite	BSC	2.0640	0.83408	0.053309	38.718	15.647	18.759
MA-152460	LN	5500-5000 BC	Karanovo III/IV	Dana Bunar 2	malachite	BSC	2.0611	0.83394	0.053263	38.697	15.657	18.775
MA-133042	LN	5500-5000 BC	Karanovo III/IV	Akladi Cheiri	malachite	BSC	1.8394	0.75056	0.047712	38.552	15.731	20.959
MA-133043	LN	5500-5000 BC	Karanovo III/IV	Akladi Cheiri	malachite	BSC	1.4452	0.59936	0.054075	26.726	16.018	26.726
MA-133044	LN	5500-5000 BC	Karanovo III/IV	Akladi Cheiri	malachite	BSC	2.0196	0.81944	0.052367	38.566	15.648	19.096
MA-133045	LN	5500-5000 BC	Karanovo III/IV	Akladi Cheiri	malachite	BSC	2.0541	0.83240	0.053208	38.605	15.644	18.794
MA-133046	LC	4450-4100 BC	KGK VI	Akladi Cheiri	limonite/malachite	BSC	1.9520	0.79405	0.050682	38.515	15.667	19.731
MA-133047	LC	4450-4100 BC	KGK VI	Akladi Cheiri	limonite/malachite	BSC	2.0372	0.82633	0.052840	38.554	15.638	18.925
MA-133049	LC	4450-4100 BC	KGK VI	Akladi Cheiri	crucible/ceramic	BSC	2.0586	0.82916	0.052938	38.887	15.663	18.890
MA-135447	LC	4450-4100 BC	KGK VI	Akladi Cheiri	furnace wall with mal	BSC	2.0487	0.82598	0.052778	38.817	15.650	18.947
MA-151990	LC	4450-4100 BC	KGK VI	Akladi Cheiri	copper prill/crucible	BSC	2.0541	0.83184	0.053150	38.647	15.650	18.814
MA-133048	LC	4450-4100 BC	KGK VI	Akladi Cheiri	crucible/slag	BSC	2.0560	0.83383	0.053390	38.509	15.618	18.730
MA-151990	LC	4450-4100 BC	KGK VI	Akladi Cheiri	slag on pottery	BSC	2.0326	0.82476	0.052758	38.527	15.633	18.814
MA-151990	LC	4450-4100 BC	KGK VI	Akladi Cheiri	slag on pottery	BSC	2.0450	0.82926	0.053047	38.551	15.633	18.852
MA-151990	LC	4450-4100 BC	KGK VI	Akladi Cheiri	slag on pottery	BSC	2.0604	0.83429	0.053315	38.646	15.649	18.757
MA-151990	LC	4450-4100 BC	KGK VI	Akladi Cheiri	slag on pottery	BSC	2.0656	0.83695	0.053527	38.590	15.636	18.682
MA-135448	LC	4450-4100 BC	KGK VI	Akladi Cheiri	malachite	BSC	0.9262	0.40165	0.024028	38.546	16.715	41.616
MA-135449	LC	4450-4100 BC	KGK VI	Akladi Cheiri	malachite	BSC	2.0075	0.81549	0.052162	38.486	15.634	19.171
MA-135450	LC	4450-4100 BC	KGK VI	Akladi Cheiri	malachite	BSC	1.9927	0.80684	0.051556	38.651	15.650	19.396
MA-135451	LC	4450-4100 BC	KGK VI	Budzhaka	malachite	BSC	2.0457	0.83001	0.053128	38.505	15.622	18.822

Table 8. Lead isotope abundance ratios for EC and MC copper metal artefacts (data from Pernicka *et al.* 1993, 1997; Radivojević *et al.* 2010a).

LABEL	period	absolute dating	cultural attribution	Site	type of site/context	Region	Type	Axe type	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$
HDM 1904	EC	5000-4600 BC	Dikilitash Slatino Gradesnica	Slatino	settlement	W	chisel	unk	2.0835	0.84470
HDM 1912	EC	5000-4600 BC	Marica III	Marica	settlement	THR	heavy axe	unk	2.0714	0.83690
HDM 1975	EC	5000-4600 BC	Hamangia III	Durankulak	cemetery	BSC	finger ring	unk	2.0824	0.84400
HDM 2005	EC	5000-4600 BC	Hamangia III	Durankulak	cemetery	BSC	finger ring	unk	2.0339	0.82410
Belovode M34	MC	4600-4450 BC	Vinča culture	Belovode	settlement	SRB	copper ingot	unk	2.0773	0.84348
HDM 1308	MC	4600-4450 BC	KSBh / Vinča?	Sumrakovac	stray	SRB	hammer axe	Pločnik	2.0615	0.83390
HDM 1496	MC	4600-4450 BC	Vinča culture	Gomolava	cemetery	SRB	bracelet	unk	2.0777	0.84570
HDM 1555	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	chisel	unk	2.0812	0.84330
HDM 1556	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	flat axe	unk	2.0836	0.84420
HDM 1557	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	flat axe	unk	2.0825	0.84390
HDM 1558	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	hammer axe	Pločnik	2.0518	0.82680
HDM 1559	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	hammer axe	Pločnik	2.0574	0.83040
HDM 1560	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	chisel	unk	2.0657	0.83310
HDM 1561	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	chisel	unk	2.0629	0.83360
HDM 1562	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	chisel	unk	2.0775	0.84030
HDM 1563	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	chisel	unk	2.0748	0.83860
HDM 1564	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	chisel	unk	2.0840	0.84430
HDM 1565	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	chisel	unk	2.0844	0.84430
HDM 1566	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	chisel	unk	2.0751	0.84050
HDM 1567	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	chisel	unk	2.0836	0.84420
HDM 1568	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	chisel	unk	2.0585	0.83070
HDM 1569	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	chisel	unk	2.0831	0.84390
HDM 1570	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	chisel	unk	2.0650	0.83520
HDM 1571	MC	4600-4450 BC	Vinča culture	Pločnik	settlement/hoard?	SRB	hammer axe	Pločnik	2.0824	0.84360
HDM 1903	MC	4600-4450 BC	KSBh	Radlovci	stray	W	hammer axe	Pločnik	2.0770	0.84300
HDM 1910	MC	4600-4450 BC	KSBh	Dragoman	hoard	W	hammer axe	Pločnik	2.0771	0.84280
HDM 1911	MC	4600-4450 BC	KSBh	Dragoman	hoard	W	hammer axe	Pločnik	2.0751	0.84190

Table 8 continued. Lead isotope abundance ratios for EC and MC copper metal artefacts (data from Pernicka *et al.* 1993, 1997; Radivojević *et al.* 2010a).

LABEL	period	absolute dating	cultural attribution	Site	type of site/context	Region	Type	Axe type	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$
HDM 1940	MC	4600-4450 BC	Karanovo VI?	Ai Bunar	mine	THR	hammer axe	Pločnik	2.0795	0.83840
HDM 1976	MC	4600-4450 BC	Hamangia IV	Durankulak	cemetery	BSC	bracelet	unk	1.9927	0.80690
HDM 1977	MC	4600-4450 BC	Hamangia IV	Durankulak	cemetery	BSC	bracelet	unk	2.0825	0.84390
HDM 2011	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	bracelet	unk	2.0679	0.83250
HDM 2025	MC	4600-4450 BC	Hamangia IV	Durankulak	cemetery	BSC	bracelet	unk	2.0675	0.83250
HDM 2026	MC	4600-4450 BC	Hamangia IV	Durankulak	cemetery	BSC	bracelet	unk	2.0679	0.83250
HDM 2041	MC	4600-4450 BC	Boian-Spantov	Tell Ruse	settlement	NE	borer	unk	2.0786	0.84090
HDM 2049	MC	4600-4450 BC	Boian-Spantov	Tell Ruse	settlement	NE	borer	unk	2.0801	0.84150
HDM 2064	MC	4600-4450 BC	Boian-Spantov	Tell Ruse	settlement	NE	borer	unk	2.0776	0.84420
HDM 2080	MC	4600-4450 BC	Boian-Spantov	Tell Ruse	settlement	NE	borer	unk	2.0772	0.84280
HDM 2124	MC	4600-4450 BC	Sava IV (Hamangia IV)	Goljamo Delcevo	settlement	BSC	borer	unk	2.0772	0.84040
HDM 2702	MC	4600-4450 BC	KSBh	Darzhanitsa	hoard	W	heavy axe	Gumelnica	2.0447	0.82580
HDM 2703	MC	4600-4450 BC	KSBh	Darzhanitsa	hoard	W	Heavy axe	Salcuta	2.0777	0.84310
HDM 1422	MC	4600-4450 BC	KSBh I	Bubanj	settlement	SRB	Chisel	unk	2.0764	0.84250
HDM 1431	MC	4600-4450 BC	KSBh I?	Stari Kostolac	stray	SRB	chisel	unk	2.0763	0.84280
HDM 1905	MC	4600-4450 BC	KSBh I	Djakovo	settlement	W	flat axe	unk	2.0753	0.83910
HDM 1942	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	Finger ring	unk	2.0794	0.84150
HDM 1943	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	Finger ring	unk	2.0744	0.84490
HDM 1944	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0749	0.84480
HDM 1945	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0754	0.84490
HDM 1947	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0104	0.81540
HDM 1948	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0789	0.84670
HDM 1949	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0481	0.82760
HDM 1967	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	Finger ring	unk	2.0839	0.84410
HDM 1968	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	bracelet	unk	2.0191	0.81940
HDM 1972	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	bracelet	unk	2.0658	0.83260
HDM 1974	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	Finger ring	unk	1.8189	0.74210
HDM 1979	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0730	0.83820

Table 8 continued. Lead isotope abundance ratios for EC and MC copper metal artefacts (data from Pernicka *et al.* 1993, 1997; Radivojević *et al.* 2010a).

LABEL	period	absolute dating	cultural attribution	Site	type of site/context	Region	Type	Axe type	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$
HDM 1980	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	1.9644	0.79780
HDM 1981	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	bracelet	unk	2.0583	0.83440
HDM 1982	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0555	0.83060
HDM 1984	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0827	0.84350
HDM 1985	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0762	0.83810
HDM 1986	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	bracelet	unk	2.0766	0.84140
HDM 1987	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	bracelet	unk	2.0567	0.83260
HDM 1989	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	bracelet	unk	2.0833	0.84420
HDM 1991	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0831	0.84410
HDM 1992	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0819	0.84390
HDM 1993	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	1.9036	0.77490
HDM 1994	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0394	0.82480
HDM 1995	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0482	0.83030
HDM 1996	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	bracelet	unk	2.0833	0.84390
HDM 1998	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	bracelet	unk	2.0823	0.84410
HDM 2000	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	Finger ring	unk	1.7460	0.71350
HDM 2001	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	Finger ring	unk	2.0794	0.84270
HDM 2002	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	Finger ring	unk	2.0198	0.81920
HDM 2003	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	Finger ring	unk	2.0613	0.83900
HDM 2006	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	spiral ring	unk	2.0699	0.83520
HDM 2009	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	spiral ring	unk	2.0589	0.83630
HDM 2012	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	bracelet	unk	2.0795	0.84750
HDM 2013	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	finger ring	unk	2.0799	0.84120
HDM 2014	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	bracelet	unk	1.8107	0.73960
HDM 2015	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	bracelet	unk	2.0649	0.83470
HDM 2016	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0551	0.82960
HDM 2017	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0097	0.81680
HDM 2018	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	bracelet	unk	2.0428	0.82850

Table 8 continued. Lead isotope abundance ratios for EC and MC copper metal artefacts (data from Pernicka *et al.* 1993, 1997; Radivojević *et al.* 2010a).

LABEL	period	absolute dating	cultural attribution	Site	type of site/context	Region	Type	Axe type	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$
HDM 2019	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	2.0622	0.83860
HDM 2023	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	1.9966	0.81020
HDM 2024	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	bracelet	unk	1.9977	0.81030
HDM 2027	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	Finger ring	unk	2.0825	0.84410
HDM 2028	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	Finger ring	unk	2.0366	0.82870
HDM 2029	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	Finger ring	unk	2.0831	0.84410
HDM 2031	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	Finger ring	unk	1.7515	0.71690
HDM 2032	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	borer	unk	2.0818	0.84330
HDM 2034	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	pin	unk	2.0745	0.83900
HDM 2035	MC	4600-4450 BC	Varna II	Durankulak	cemetery	BSC	spiral ring	unk	2.0827	0.84420
HDM 2036	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	spiral ring	unk	2.0063	0.81450
HDM 2137	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	Finger ring	unk	2.0292	0.82300
HDM 2138	MC	4600-4450 BC	Varna I	Durankulak	cemetery	BSC	Finger ring	unk	2.0775	0.84610
HDM 1920	MC	4600-4450 BC	KGK VI?	Tell Ruse	settlement	NE	axe	Kamenar	2.0538	0.83220
HDM 1921	MC	4600-4450 BC	KGK VI?	Tell Ruse	settlement	NE	flat axe	Kamenar	2.0835	0.84430
HDM 1922	MC	4600-4450 BC	KGK VI?	Tell Ruse	settlement	NE	chisel	unk	1.9217	0.78140
HDM 1923	MC	4600-4450 BC	KGK VI	Tell Ruse	settlement	NE	axe	Gumelnica	2.0847	0.84460
HDM 2039	MC	4600-4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0794	0.84680
HDM 2040	MC	4600-4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0808	0.84150
HDM 2043	MC	4600-4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0514	0.83010
HDM 2044	MC	4600-4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0831	0.84420
HDM 2045	MC	4600-4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0831	0.84390
HDM 2047	MC	4600-4450 BC	KGK VI?	Tell Ruse	settlement	NE	double spiral headed pin	unk	2.0807	0.84500
HDM 2050	MC	4600-4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0774	0.84320
HDM 2051	MC	4600-4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0809	0.84690
HDM 2052	MC	4600-4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0814	0.84700
HDM 2053	MC	4600-4450 BC	KGK VI?	Tell Ruse	settlement	NE	chisel	unk	2.0829	0.84400

Table 8 continued. Lead isotope abundance ratios for EC and MC copper metal artefacts (data from Pernicka *et al.* 1993, 1997; Radivojević *et al.* 2010a).

LABEL	period	absolute dating	cultural attribution	Site	type of site/context	Region	Type	Axe type	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$
HDM 2054	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0786	0.83720
HDM 2055	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0800	0.84660
HDM 2056	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0732	0.84040
HDM 2057	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0817	0.84360
HDM 2058	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0782	0.84300
HDM 2059	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0581	0.83160
HDM 2060	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0667	0.83670
HDM 2061	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0628	0.83360
HDM 2063	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0465	0.82770
HDM 2065	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0760	0.84270
HDM 2067	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0838	0.84230
HDM 2068	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0510	0.83000
HDM 2070	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0849	0.84440
HDM 2071	MC	4600–4450 BC	KGK VI?	Tell Ruse	settlement	NE	borer	unk	2.0843	0.84420

The Group 1 cluster in both diagrams $^{207}Pb/^{206}Pb$ vs $^{208}Pb/^{206}Pb$ (Figure 4) and $^{206}Pb/^{204}Pb$ vs $^{207}Pb/^{204}Pb$ (Figure 5) implies strong consistency with Majdanpek, a large copper deposit in eastern Serbia (Figure 12), and to a lesser extent with Zidarovo, an ore field located on the western slope of the Medni Rid region in southeast Bulgaria. The partial overlap of Majdanpek with the mixed sulfide copper ores from Zidarovo has already been discussed by Pernicka *et al.* (1997: 139) in relation to the likely origins of the Serbian Chalcolithic copper metal artefacts. The authors argue that it is unlikely that Zidarovo was the source for the kind of copper metal that circulates only in Serbia and not anywhere in the Black Sea coast region. Further consistencies with the previously published copper minerals from Belovode (Figures 4 and 5) and Selevac (Figures 6 and 7) strengthen the argument that Majdanpek was one of the main copper deposits exploited during the Vinča culture (cf. Pernicka *et al.* 1993, 1997). Also, the Zidarovo lead isotope abundance field is clearly distinguished from Majdanpek in the $^{206}Pb/^{204}Pb$ vs $^{207}Pb/^{204}Pb$ diagram (see Figure 5, for instance).

A slight overlap of the Majdanpek field with the lead isotope abundance ratios of another prolific Chalcolithic copper deposit, Ai Bunar in Bulgaria, does not compromise the likelihood of Majdanpek being the major source for the mentioned artefacts (also easily distinguishable by their trace element patterns, see Table 12); Majdanpek is also consistent with a portion of the Selevac malachite assemblage and previously published copper metal implements from Pločnik (Figures 7–9, Tables 4 and 5), confirming arguments that Vinča culture communities were utilising copper ores from this mine towards the end of the Vinča culture, particularly at the prolonged end at Pločnik (Pernicka *et al.* 1993; Radivojević and Grujić 2018).

In Figure 11, a plot of Early Chalcolithic (EC) and Middle Chalcolithic (MC) metals from the Balkans shows a handful of objects with high consistency with the Majdanpek field, and an exact match with copper metal droplet Bf43/13 (such as a copper chisel HDM1422 from the MC period in Bubanj, Krivodol-Sălcuţa-Bubanj I culture, abbreviated as KSBh I/II, see Table 8). Further consistencies with copper implements from the MC occupation of the sites of Gomolava or Ruse (Figure 11, Table 8) indicate a wide network of copper supply that extended mainly along the lower Danube but also across eastern Serbia / western Bulgaria which, at the

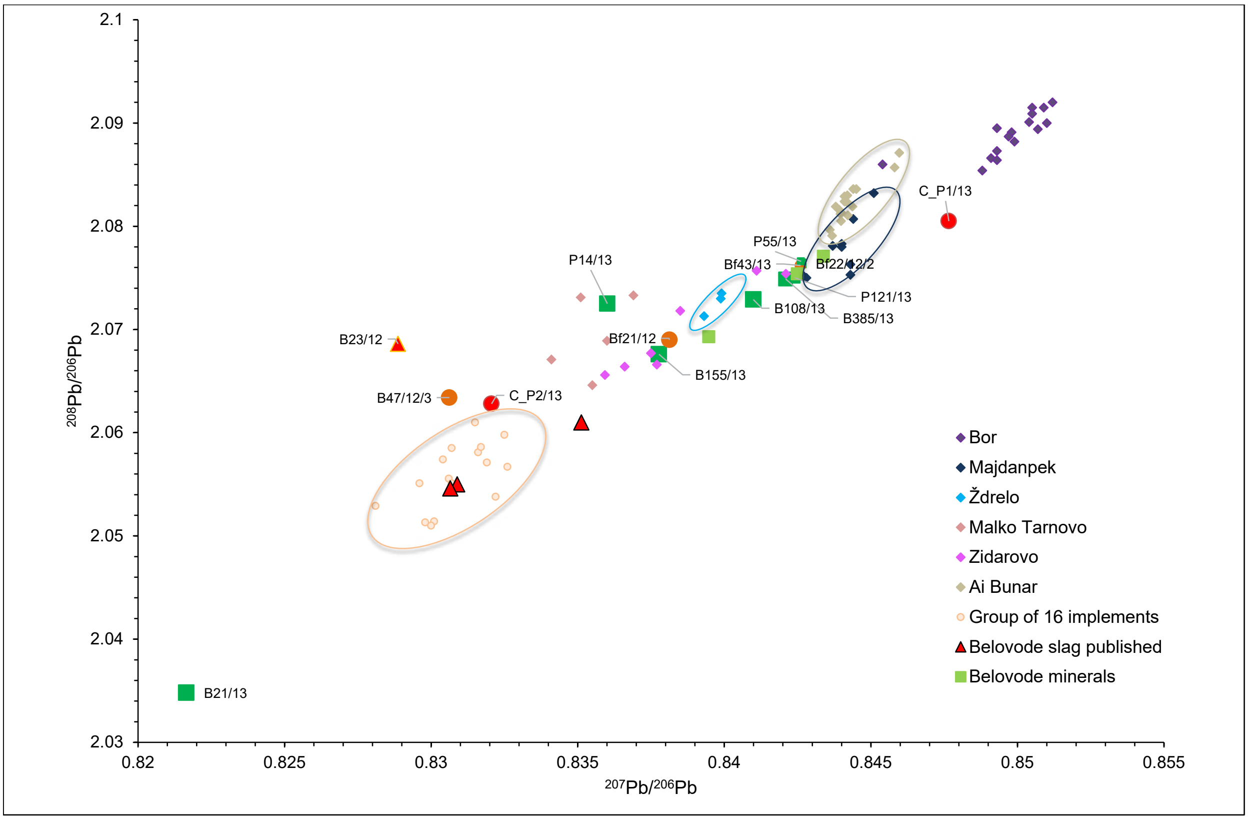


Figure 4. Lead isotope abundance ratios of Belovode and Pločnik artefacts presented in $^{207}Pb/^{206}Pb$ vs $^{208}Pb/^{206}Pb$ ratio against the published Belovode data and a selection of Balkan copper deposits and a group of artefacts (Group of 16). Error bars are smaller than symbols

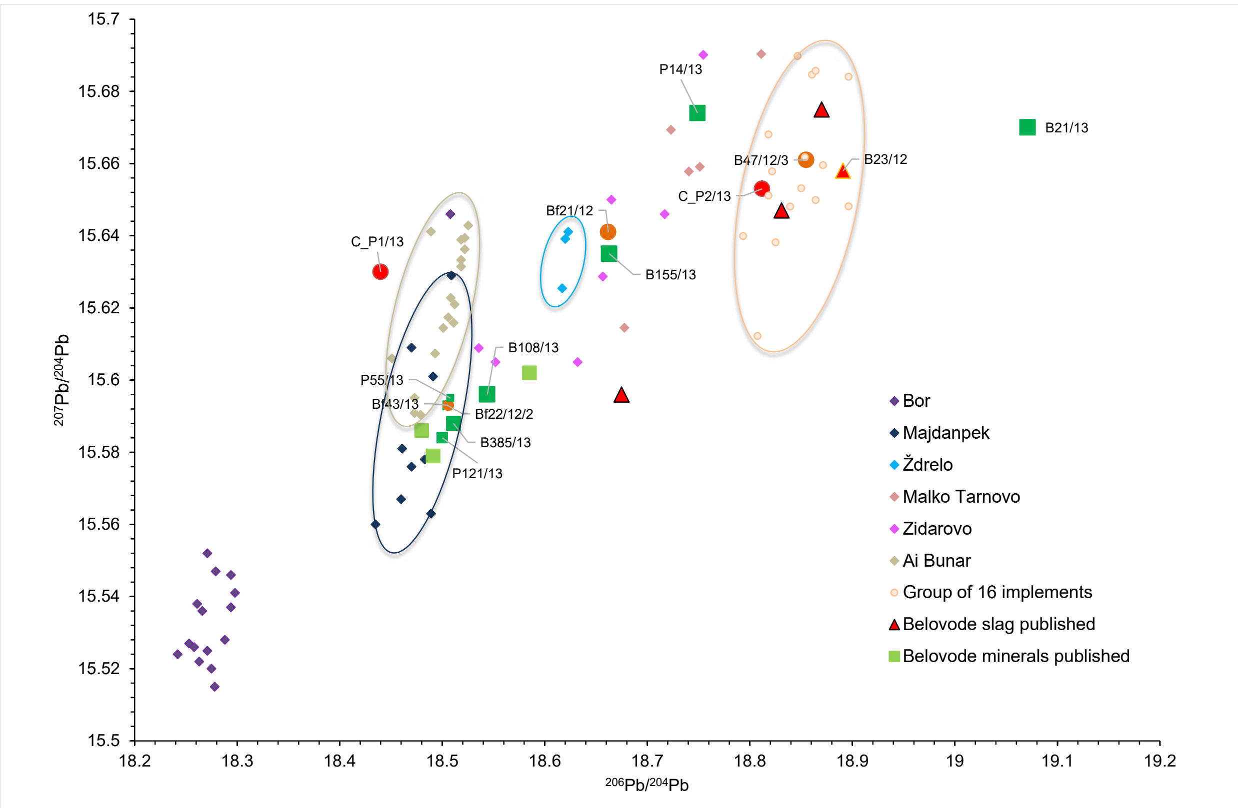


Figure 5. Lead isotope abundance ratios of Belovode and Pločnik artefacts presented in $^{206}Pb/^{204}Pb$ vs $^{207}Pb/^{204}Pb$ ratio ratio against the published Belovode data and a selection of Balkan copper deposits and a group of artefacts (Group of 16).

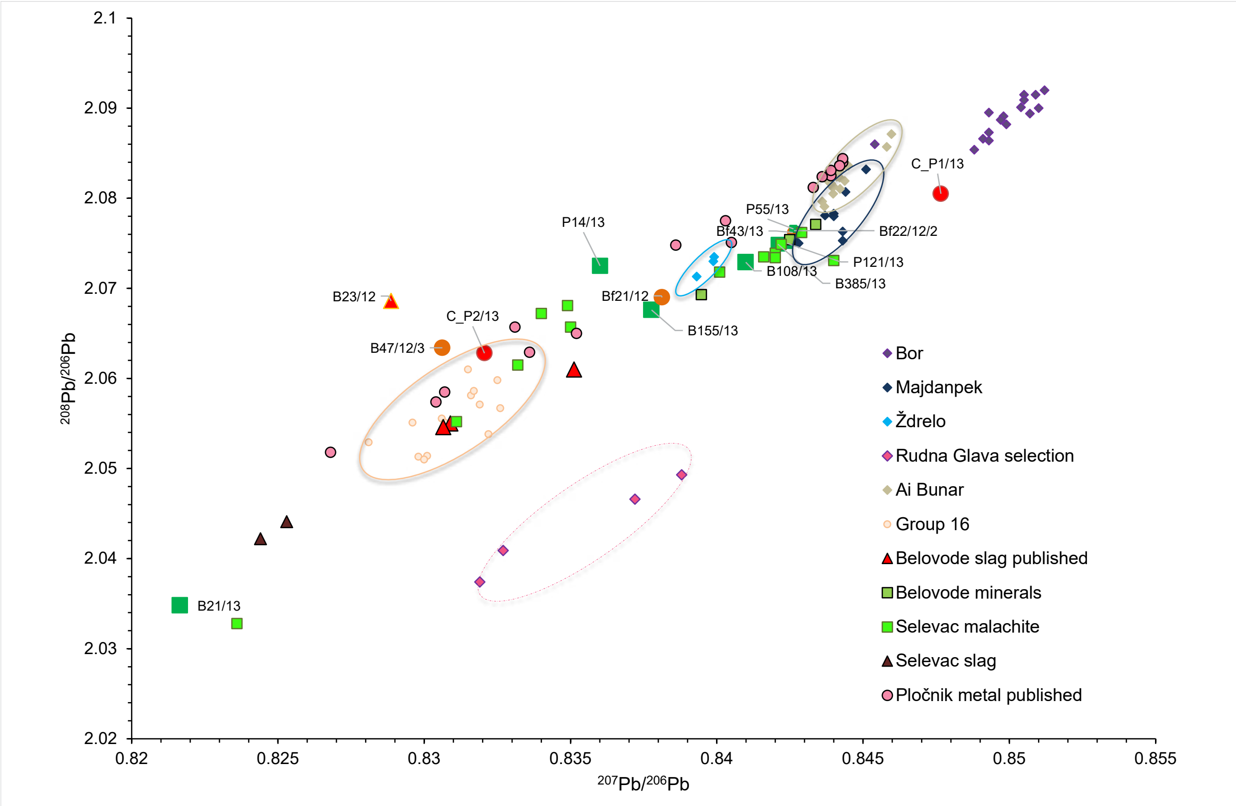


Figure 6. Lead isotope abundance ratios of Belovode and Pločnik artefacts presented in ^{207}Pb/^{206}Pb vs ^{208}Pb/^{206}Pb ratio against the published Belovode, Selevac and Pločnik data and a selection of Balkan copper deposits and a group of artefacts (Group of 16). Error bars are smaller than symbols.

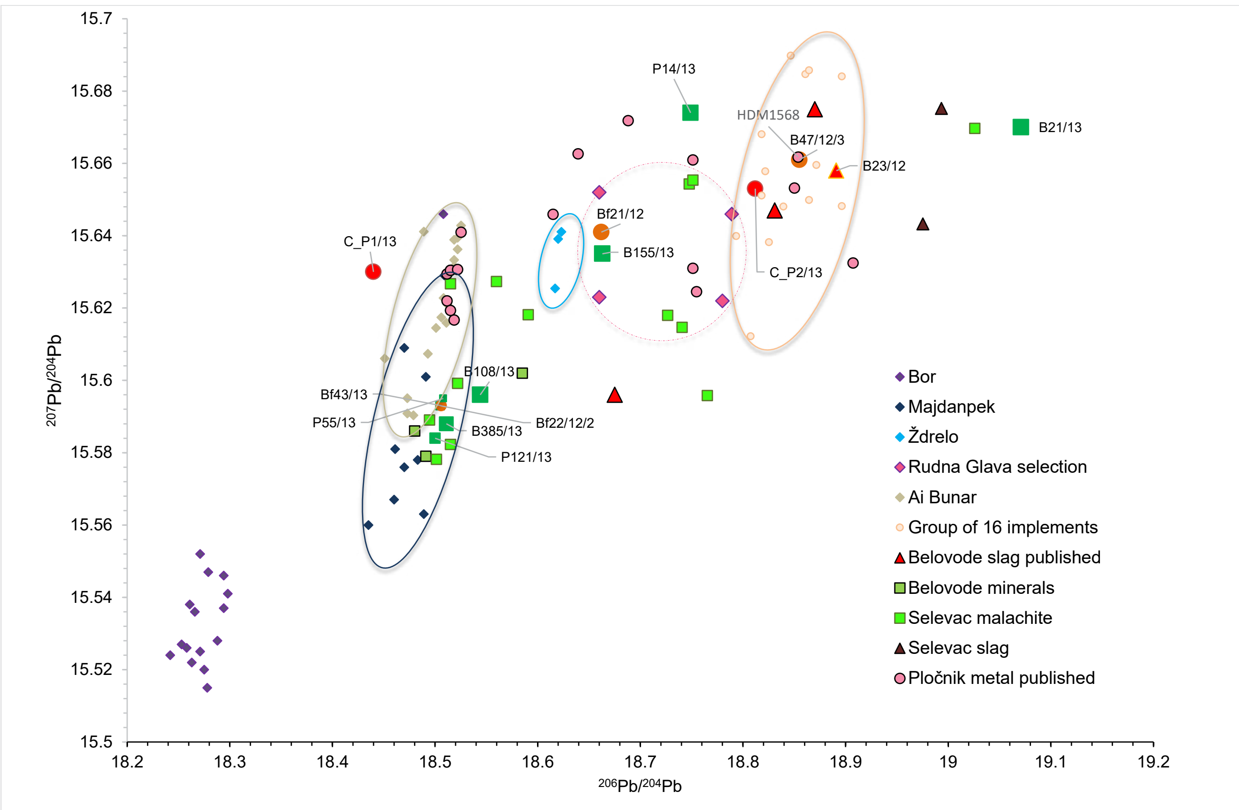


Figure 7. Lead isotope abundance ratios of Belovode and Pločnik artefacts presented in ^{206}Pb/^{204}Pb vs ^{207}Pb/^{204}Pb ratio against the published Belovode, Selevac and Pločnik data and a selection of Balkan copper deposits and a group of artefacts (Group of 16).

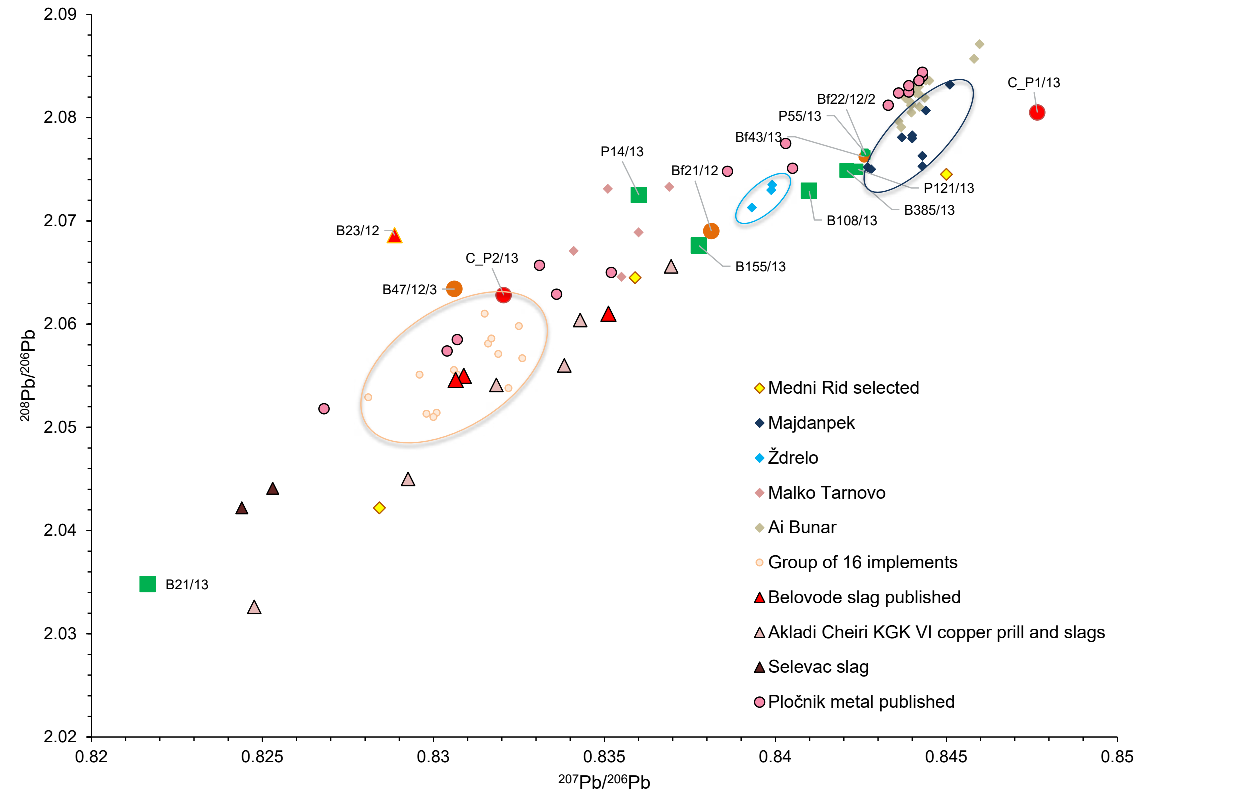


Figure 8. Lead isotope abundance ratios of Belovode and Pločnik artefacts presented in a $^{207}Pb/^{206}Pb$ vs $^{208}Pb/^{206}Pb$ diagram against the published Belovode, Selevac and Akladi Cheiri metal production data, Pločnik artefacts and a selection of Balkan copper deposits and a group of artefacts (Group of 16). Error bars are smaller than symbols.

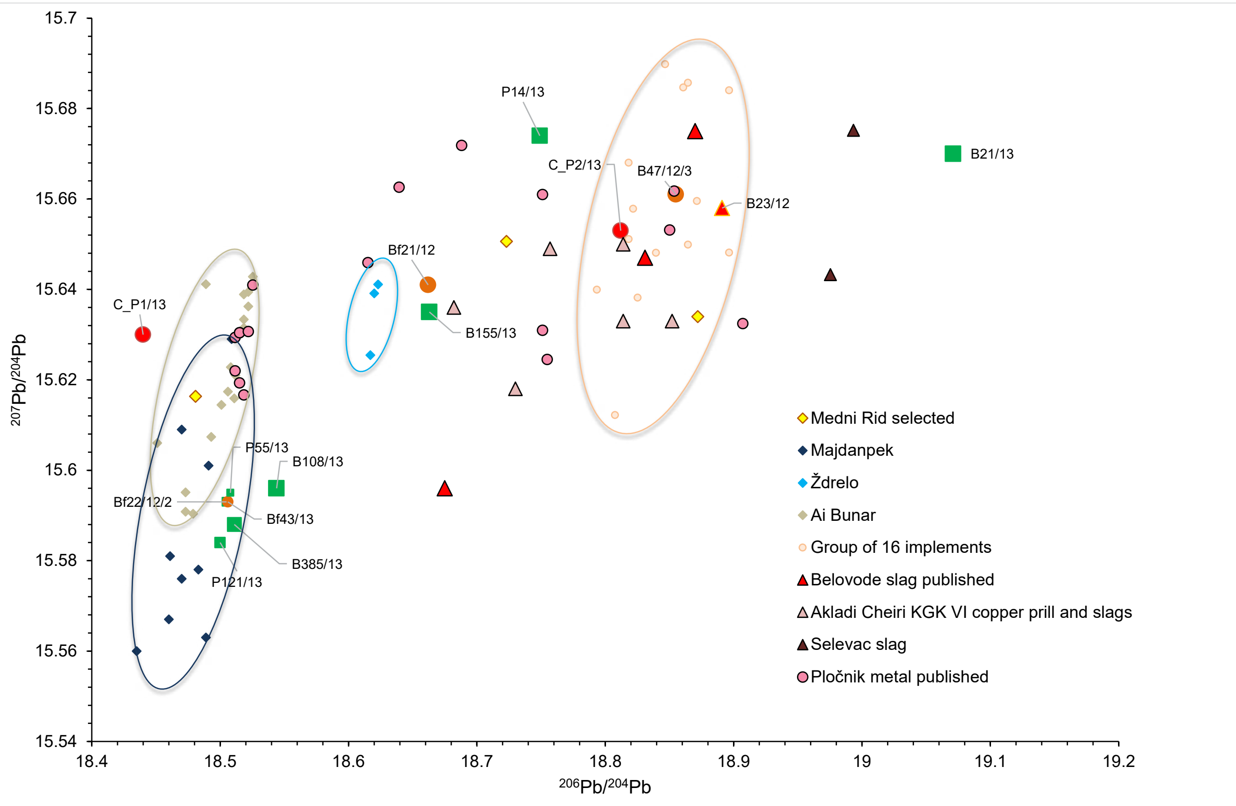


Figure 9. Lead isotope abundance ratios of Belovode and Pločnik artefacts presented in a $^{206}Pb/^{204}Pb$ vs $^{207}Pb/^{204}Pb$ diagram against the published Belovode, Selevac and Akladi Cheiri metal production data, Pločnik artefacts and a selection of Balkan copper deposits and a group of artefacts (Group of 16).

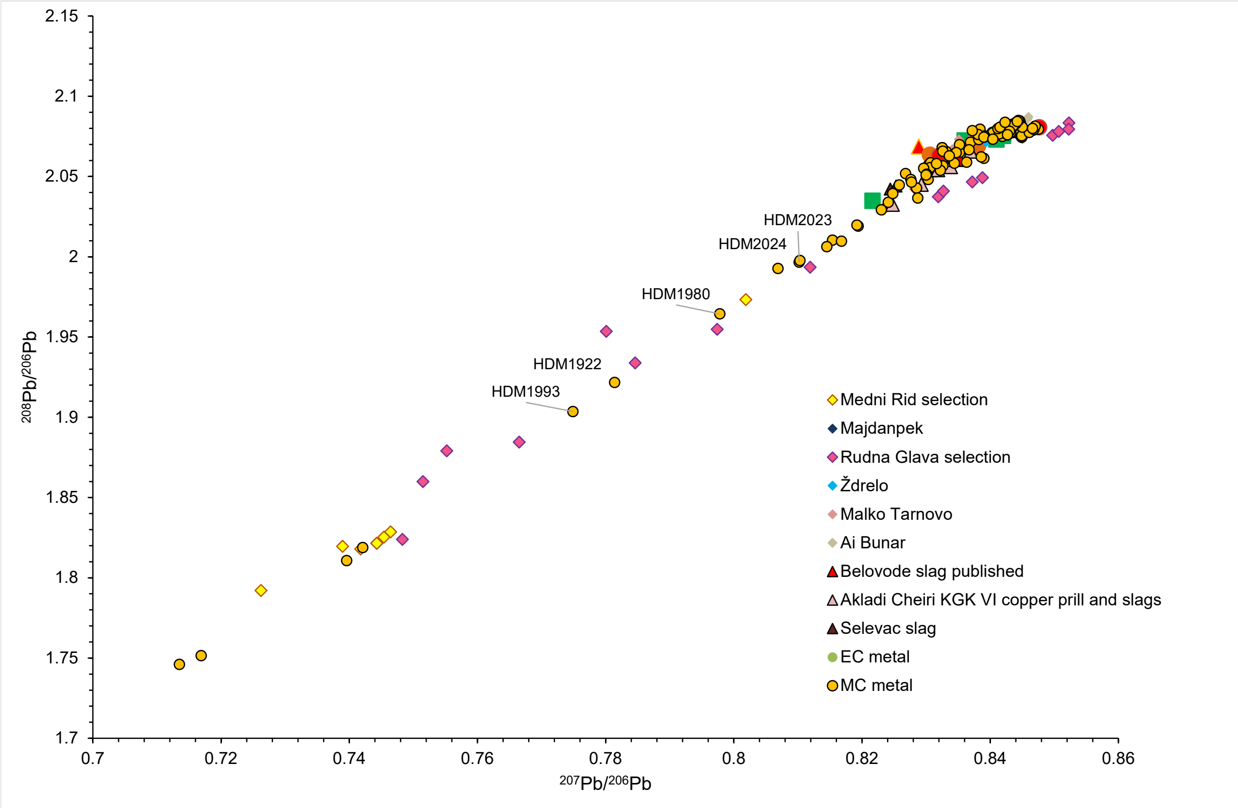


Figure 10. Lead isotope abundance ratios of Belovode and Pločnik artefacts presented in a $^{207}Pb/^{206}Pb$ vs $^{208}Pb/^{206}Pb$ diagram against the published Belovode, Selevac and Akladi Cheiri metal production data, EC/MC copper metal artefacts and a selection of Balkan copper deposits. Error bars are smaller than symbols.

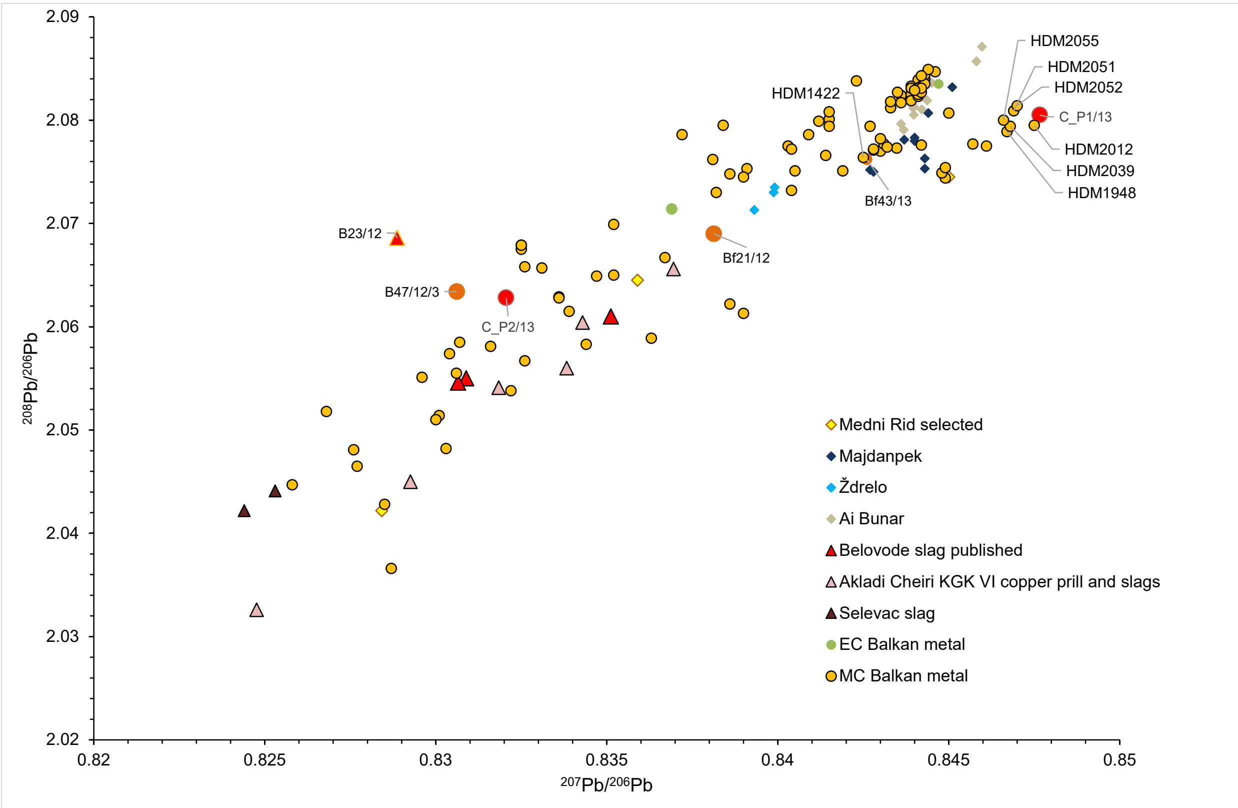


Figure 11. Lead isotope abundance ratios of Belovode and Pločnik artefacts presented in a $^{207}Pb/^{206}Pb$ vs $^{208}Pb/^{206}Pb$ diagram against the published Belovode, Selevac and Akladi Cheiri metal production data, EC/MC copper metal artefacts and a selection of Balkan copper deposits. This is an enlarged section of Fig. 10. Error bars are smaller than symbols.

time, was occupied by the Krivodol-Sălcuţa-Bubanj I communities. It is noteworthy that copper minerals in Group 1 are both pure green and black-and-green, hence could have been used for both smelting and malachite bead making (cf. Radivojević *et al.* 2010a). There is, however, no production evidence in this group of finds, barring the copper metal droplet (Bf43/13), which originated from a 'slag-less' process (Chapter 11, this volume).

Group 2 consists of a copper metal droplet (Bf21/12) and a mineral sample (B155/13) that come from Belovode Horizons 1b and 2 respectively (see Chapters 11 and 37). These further support the continuity of copper exploitation and production practices between these two horizons as indicated by the Group 1 artefacts. The ore field of Ždrelo, despite being currently defined by only three ore samples (Figures 4 and 5, and Table 4) appears to be more closely related to Bf21/12 and B155/13, particularly in the $^{206}Pb/^{204}Pb$ vs $^{207}Pb/^{204}Pb$ projection (Figure 5). The possible significance of this copper mine for metal production at Belovode has already been emphasised in Radivojević *et al.* (2010), particularly as it is less than 10 km away from the site, easily accessible on foot and visible from this settlement. These samples are also broadly consistent with malachite previously published from Belovode and Selevac (Figure 6 and Table 5). Although the latter appear to show relative consistency with the Rudna Glava ore field in the $^{206}Pb/^{204}Pb$ vs $^{207}Pb/^{204}Pb$ projection (Figure 7), including two more implements from Pločnik, the $^{207}Pb/^{206}Pb$ vs $^{208}Pb/^{206}Pb$ diagram excludes Rudna Glava as a possible source. Most data of this mineralisation are outside both diagrams, and two samples from Gale (1991) were excluded because they have model ages that are completely different from all the other samples from Rudna Glava and may have been contaminated as suggested by Pernicka *et al.* (1993).

Rudna Glava is a well-documented ancient mine that traditionally has been at the centre of discussions on the beginnings of metallurgy in southeastern Europe (Jovanović 1971; Jovanović and Ottaway 1976), most prominently in relation to the origins of copper for the Vinča culture metal artefacts (see opposing views in Pernicka *et al.* 1993; Jovanović 1993). However, lead isotope analysis produced a different conclusion. The radiogenic nature of lead from this copper mine clearly distinguishes it from Vinča culture archaeological ores and artefacts (see Pernicka *et al.* 1993: 31, Fig. 13, 14). This is despite the clear evidence for exploitation of Rudna Glava during the Vinča culture period, starting from *c.* 5500 BC and intensifying around the Gradac Phase (*c.* 5000 BC), which has been demonstrated both through material culture and direct ^{14}C dating (e.g. Jovanović 1971, 1995; Radivojević and Rehren 2016; Pernicka *et al.* 1993: 40).

The Group 3 artefacts are inconsistent with any currently identified copper deposits in the Balkans. However, they are consistent with the isotope field of sixteen 5th millennium BC copper artefacts (implements and a malachite bead), excavated mainly from the MC occupations at the sites of Pločnik, Durankulak and Ruse (Table 6). This assemblage of artefacts has been previously identified as Grouplet #7 (Pernicka *et al.* 1997: 112, Table 4), whose distinctive grouping outside the known Serbian and Bulgarian copper ore deposits (Pernicka *et al.* 1997: 106) indicates an independent assemblage with a source yet to be identified.

Figures 4 and 5 demonstrate the consistency of this 'Group of 16' with copper metal embedded in production evidence (B47/12/3, and previously published Belovode slag M21 and M22a, see Table 5), while Figures 6 and 7 show further variety in copper supply from this as yet unidentified source, adding a few Pločnik implements and Selevac malachite. Of note is the exact consistency (Figure 7) of two contemporaneous artefacts: production evidence (B/47/12/3, metal droplet) from the Belovode workshop and a copper metal chisel from Pločnik, HDM 1568, once again clearly demonstrating the consistent supply and cooperative links between these two communities. It is therefore reasonable to assume a scenario where copper metal produced in Belovode's workshop F6 ended up in the form of a copper chisel used at Pločnik.

Further comparisons with the copper production evidence from the site of Akladi Cheiri in Bulgaria reveal only a minor overlap with this 'Group of 16' artefacts field (Figure 9), while it has been convincingly shown that copper ores smelted at this site originate from the Medni Rid mining region (Rehren *et al.* 2020: 150–151, Figure 15). The ore samples from Akladi Cheiri show the same radiogenic lead 'wide' scatter as Medni Rid ores in southeast Bulgaria. Figure 10 shows only a selected reading of the lead isotope abundance ratios from Medni Rid, which largely matches Akladi Cheiri production, as well as good consistency with a selection of MC copper artefacts from Bulgaria. Another deposit with radiogenic lead is that at Rudna Glava, the wide scatter of which also appears consistent with several copper metal objects, such as bracelets and a chisel from the MC period in Durankulak (HDM 1980, 1993, 2023, 2024) and Ruse (HDM 1922) (Figure 10, Table 8). However, this impression could be due to the expanded scale of the diagram. Rudna Glava samples are systematically lower in the $^{208}Pb/^{206}Pb$ ratio and can thus be clearly distinguished in the upper right part of the diagram. This means that the Th/U ratios at Rudna Glava and at Medni Rid are different, which is only apparent at higher resolution. In the region of radiogenic lead isotope ratios this difference is less pronounced. There is also some similarity in the trace element signature of Medni Rid and Rudna Glava (cf. Kunze and Pernicka 2020: 416–417, Fig. 13 and 15), which will be discussed in more detail below.

The outliers, two minerals (B21/13 and P14/13) and a copper metal loop/ring (C_P1/13) do not appear consistent with any known lead isotope abundance ratios of Balkan copper deposits, although they are broadly consistent with other archaeological artefacts. Malachite sample B21/13 clusters closely with one of the Selevac malachite samples and one of the two slags from this settlement (Figure 7). Pločnik malachite (P14/13) is also broadly consistent with some of the Selevac malachite as well as Pločnik implements (Figure 7). The metal loop / ring from Pločnik (C_P1/13) groups well with six other copper metal implements (Figure 11) from the MC occupation (4600–4450 BC) of Durankulak (HDM: 1948, 2012) and Ruse (HDM: 2039, 2051, 2052, 2055). Incidentally, these two sites are in the lower Danube area (Figure 12), which features prominently in interpretations of the movement of ores or metals from the Vinča culture sites of Belovode and Pločnik.

Looking at the entire lead isotope abundance ratio range of all EC and MC Balkan metals analysed thus far (124 in total, Table 8 and Figure 10), a great majority of them (104 artefacts, Figure 11) are largely consistent with the copper deposits exploited by the Belovode and Pločnik communities. This applies equally to cases where the lead isotope abundance ratios of copper sources are known, as well as to cases where they are only indicated by a distinctive cluster of metal artefacts, as is the case with the 'Group of 16' (Figure 9) or an artefacts cluster surrounding C_P1/13 (Figure 11). It may also be assumed that the 'Group of 16' represents the exploitation of multiple copper deposits with similar lead isotope abundance ratios, or that a portion of these artefacts clustered closely due to the homogenisation effect resulting from mixing of different ore samples. Both scenarios could be equally probable in the absence of deposit(s) that are consistent with the 'Group of 16' artefacts range.

Overall, the lead isotope abundance ratios of Belovode and Pločnik artefacts investigated in detail here, together with the contemporary objects from across Serbia and Bulgaria (or Vinča culture and other coeval phenomena) reveal complex dynamics of copper exploitation between *c.* 5200 BC and *c.* 4450 BC in the Balkans. The earlier stages of copper mining activities (*c.* 5200–4600 BC) suggest the use of at least three major deposits: Majdanpek, Ždrelo and the 'Group of 16' source. In this context, the possibility of Rudna Glava exploitation (potentially limited to MC here, Figure 10) cannot be confirmed given the current state of assembled lead isotope abundance data. The *c.* 4600–4450 BC (MC) period introduces Ai Bunar and Medni Rid, with supply networks heavily entangled between all five (or six) major deposits by that time, as well as the main production / consumption sites, such as Pločnik, Belovode, Ruse and Durankulak. This hypothesis is further explored below with trace element analysis, which was conducted on largely the same set of samples (Table 9).

Acquisition and circulation of copper ores and artefacts: trace element analysis

Seventeen artefacts were analysed for their trace element contents (Tables 2 and 9) using the methodology reported by Kuleff and Pernicka (1995). The iron oxide sample P8/13 is excluded here from further consideration, as for the previous section.

Table 9 summarises results of NAA of the predominantly copper based objects, showing varying ranges of ten trace elements (As, Sb, Co, Ni, Ag, Au, Zn, Sn, Se, Te) and iron. All trace elements are in the lower range, with occasional spikes of Ni at 1600 ppm and Sn at 3800 ppm (metal artefact P13/13) and significant Zn readings at 1.2 wt% and 3 wt% in minerals P121/13 and B385/13, respectively, which happen to be the earliest copper minerals from both Belovode and Pločnik that belong to the distinctive Group 1 cluster in Figures 2 and 3. It is of note that other minerals from Group 1 (including the metal droplet Bf43/13) also present relatively high levels of Zn, varying between *c.* 1300 and 6000 ppm.

A comparison of seven trace elements commonly used for provenance analysis: As, Sb, Co, Ni, Ag, Au, Se (sensu Pernicka 1990) across the published dataset for the Chalcolithic copper artefacts (Tables 10 and 11) (Pernicka *et al.* 1993, 1997; Radivojević and Grujić 2018) and newly acquired data on copper metal (Table 9) offers a varied picture of the quality of copper ores used at Belovode and Pločnik, the Vinča culture in general and EC/MC copper metal in the Balkans more widely. The generally low values across the seven trace elements in metal production samples from Belovode (Bf43/13, B23/12, B47/12/3 and Bf21/12) (Table 9) are largely consistent with the readings of previously published similar samples from this site (Table 11), apart from the elevated Ni and Co readings (also see Table 1).

In contrast, the newly acquired dataset for Pločnik metal has a different trace element signature from the previously published data (Table 11). The contrasting values of As, Sb, Ag, Au and Se, albeit with huge fluctuations within the dataset, speaks to the use of different sources or different types of copper ores for producing metal artefacts from this settlement. This accords with the observation that Pločnik copper

Table 9. Trace element data for Belovode and Pločnik copper-based artefacts. Note seven trace elements used for provenance analysis as bold, and artefacts paired with either deposits or another cluster of Chalcolithic artefacts as shaded.

Site	Artefact type	Cu	Fe	As	Sb	Co	Ni	Ag	**Au**	**Zn**	**Sn**	**Se**	**Te**	**Au**	Zn	Sn	**Se**	Te
							%	%	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	**µg/g**	µg/g	µg/g	**µg/g**	µg/g
Belovode	Slagged sherd	1.61	2.30	9.9	1.16	55	47	2.1	**0.01**	**176**	**< 100**	**4.4**	**< 7**	**0.01**	176	< 100	**4.4**	< 7
Belovode	Malachite (black and green)	33.0	0.63	46.6	8.66	65	340	3.1	**0.071**	**5990**	**< 440**	**< 2**	**14.9**	**0.071**	5990	< 440	**< 2**	14.9
Belovode	Metal from slagged sherd	40.2	1.30	15.7	2.02	68	160	2.3	**0.012**	**145**	**< 75**	**2.1**	**< 11**	**0.012**	145	< 75	**2.1**	< 11
Belovode	Malachite (green)	46.2	1.26	14.1	0.84	5.8	69	0.8	**< 0.01**	**1330**	**< 49**	**< 0.7**	**< 4**	**< 0.01**	1330	< 49	**< 0.7**	< 4
Belovode	Copper mineral	35.1	2.70	530	12.2	4.0	61	< 1	**0.031**	**3060**	**< 110**	**0.78**	**14.4**	**0.031**	3060	< 110	**0.78**	14.4
Belovode	Malachite (green)	45.3	3.20	252	12.1	0.62	41	< 1	**0.271**	**555**	**< 90**	**< 1**	**4.1**	**0.271**	555	< 90	**< 1**	4.1
Belovode	Malachite (green)	47.1	0.53	30.5	1.37	2.98	100	< 2	**0.014**	**30800**	**< 140**	**0.97**	**3.3**	**0.014**	30800	< 140	**0.97**	3.3
Belovode	Metal droplet	103	0.04	4.0	0.2	15.5	180	9.9	**0.044**	**44**	**< 280**	**3.2**	**13**	**0.044**	44	< 280	**3.2**	13
Belovode	Malachite (green)	61.9	0.30	434	4.12	0.9	19	152	**0.103**	**1300**	**< 81**	**159**	**2.9**	**0.103**	1300	< 81	**159**	2.9
Belovode	Metal droplet	47.3	0.62	50.8	0.86	1.94	20	36.2	**0.085**	**6030**	**< 29**	**26.8**	**4.3**	**0.085**	6030	< 29	**26.8**	4.3
Pločnik	(magnetic) iron mineral	0.10	12.1	30.2	2.09	204	1870	< 2	**0.01**	**425**	**< 170**	**< 2**	**< 16**	**0.01**	425	< 170	**< 2**	< 16
Pločnik	metal foil/stock corroded	89.9	0.01	0.92	0.28	14.9	86	6.4	**0.079**	**25.8**	**19**	**0.8**	**< 6**	**0.079**	25.8	19	**0.8**	< 6
Pločnik	Metal wire/bracelet	46.3	2.20	38	7.3	64	1600	30	**0.7**	**1360**	**3800**	**53**	**290**	**0.7**	1360	3800	**53**	290
Pločnik	Malachite (green)	37.7	4.60	3360	172	48.7	303	21.3	**0.02**	**1150**	**58**	**20.1**	**36**	**0.02**	1150	58	**20.1**	36
Pločnik	Malachite (green)	21.9	7.50	513	25.1	3.3	121	< 2	**0.948**	**4810**	**< 150**	**2.9**	**2.5**	**0.948**	4810	< 150	**2.9**	2.5
Pločnik	Malachite (black and green)	25.2	2.50	228	12.3	25	214	11.7	**1.34**	**12300**	**< 160**	**< 2**	**7**	**1.34**	12300	< 160	**< 2**	7
Pločnik	Metal loop / ring	85.7	0.04	10.6	6.26	2.9	74	230	**0.41**	**61**	**< 280**	**6.2**	**15**	**0.41**	61	< 280	**6.2**	15

Table 10. Trace element data for EC and MC copper production and implements. Regions are abbreviated as follows: BSC=Black Sea Coast, SRB = Serbia, W= West Bulgaria, NE= Northeast Bulgaria, ROM = Romania, THR = Thracia. Data from Pernicka *et al.* 1993, 1997; Radivojević 2012; Radivojević and Grujić 2017.

LABEL analytical	relative period	absolute period	cultural attribution	Site	Sample label	Type of site/context	Region	Artefact type	Axe type	Category	Base	Cu (%)	As (µg/g)	Sb (µg/g)	Co (µg/g)	Ni (µg/g)	Ag (µg/g)	Au (µg/g)	Se (µg/g)
MA-110610	EC	5000-4600 BC	Vinča culture	Belovode	Belovode M6	settlement	SRB	copper metal droplet	unk	production	copper	55	9.4	1.83	0.68	40	58	0.089	270
MA-110620	EC	5000-4600 BC	Vinča culture	Belovode	Belovode M14	settlement	SRB	copper metal droplet	unk	production	copper	73	7.1	1.21	0.68	21	0.7	0.02	43
MA-071498	EC	5000-4600 BC	Vinča culture	Belovode	Belovode M21	settlement	SRB	copper slag	unk	production	copper	86	1.1	0.3	9.3	65	9.7	0.03	1.6
MA-071499	EC	5000-4600 BC	Vinča culture	Belovode	Belovode M22a	settlement	SRB	copper slag	unk	production	copper	94	1.6	0.2	5.4	22	6	0.03	1.3
MA-114275	EC	5000-4600 BC	Vinča culture	Pločnik	Pločnik145	settlement	SRB	copper chisel	unk	metal implement	copper	100	2	0.19	10.4	27	5.3	0.067	2.6
L 355	EC	5000-4600 BC	Vinča culture	Pločnik	Pločnik 217	settlement	SRB	copper ingot	unk	metal implement	copper	100	1	5.0	2.0	43.3	0.0	30.4	0.0
MA-110617	EC	5000-4600 BC	Vinča culture	Belovode	Belovode 131	settlement	SRB	copper slag	unk	production	copper	68	5.4	0.91	450	130	2.3	0.016	2.4
MA-110609	EC	5000-4600 BC	Vinča culture	Belovode	Belovode 134	settlement	SRB	copper slag	unk	production	copper	54	12.6	2	2990	580	4	0.039	9
L 354	EC	5000-4600 BC	Vinča culture	Pločnik	Pločnik 216	settlement	SRB	copper chisel	unk	metal implement	copper	100	1	1	7.4	29.1	0.0	0.1	0.0
MA-114274	EC	5000-4600 BC	Vinča culture	Pločnik	Pločnik 143	settlement	SRB	copper chisel	unk	metal implement	copper	100	3	0.68	8	83	7.9	0.3	6.3
MA-110622	EC	5000-4600 BC	Vinča culture	Vinča	Vinča 79	settlement	SRB	copper slag	unk	production	copper	76	12.2	2.74	62	51	3.9	0.037	2.5
MA-110616	EC	5000-4600 BC	Vinča culture	Vinča	Vinča 91	settlement	SRB	copper slag	unk	production	copper	49	16.3	3.7	860	320	2.6	0.04	4.3
HDM 1483	EC	5000-4600 BC	Vinča culture	Selevac	HDM 1483	settlement	SRB	copper prill	unk	production	copper	90	2	0.5	56	36	3.1	0.67	0.8
HDM 1494	EC	5000-4600 BC	Vinča culture	Selevac	HDM 1494	settlement	SRB	copper prill	unk	production	copper	97	1.1	0.3	61	108	5.8	0.019	1.9
HDM 1904	EC	5000-4600 BC	Dikilitash Slatino Gradesnica	Slatino	HDM 1904	settlement	W	chisel	unk	metal implement	copper	100	1	68	1	52	540	13.2	67
HDM 1912	EC	5000-4600 BC	Marica III	Marica	HDM 1912	settlement	THR	heavy axe	unk	metal implement	copper	100	2	14.7	1.5	130	530	10.2	70
HDM 1975	EC	5000-4600 BC	Hamangia III	Durankulak	HDM 1975	cemetery	BSC	Finger ring	unk	metal ornament	copper	100	770	770	2	39	420	8.1	83
HDM 2005	EC	5000-4600 BC	Hamangia III	Durankulak	HDM 2005	cemetery	BSC	Finger ring	unk	metal ornament	copper	88	6.3	0.44	11.1	20	370	4.6	27.8
MA-103713	MC	4600-4450 BC	Vinča culture	Gornja Tuzla	Gornja Tuzla 190	settlement	SRB	copper slag droplet	unk	production	copper	88	6	0.48	45	50	5.3	0.087	3.5
MA-103719	MC	4600-4450 BC	Vinča culture	Gornja Tuzla	Gornja Tuzla 183	settlement	SRB	copper awl	unk	metal implement	copper	94	8.7	1.93	10.8	130	11.2	2.28	19.3
MA-103721	MC	4600-4450 BC	Vinča culture	Gornja Tuzla	Gornja Tuzla 185	settlement	SRB	copper hook	unk	metal implement	copper	92	4.3	5.9	7.3	50	173	6.8	29.9
MA-103723	MC	4600-4450 BC	Vinča culture	Gornja Tuzla	Gornja Tuzla 195	settlement	SRB	copper bracelet	unk	metal ornament	copper	83	93.8	23.2	1.33	140	65	3.7	8.3
MA-103715	MC	4600-4450 BC	Vinča culture	Gornja Tuzla	Gornja Tuzla 193	settlement	SRB	copper wire	unk	metal implement	copper	94	5.7	0.85	18.2	240	10.3	1.16	9.8
MA-103716	MC	4600-4450 BC	Vinča culture	Gornja Tuzla	Gornja Tuzla 192a	settlement	SRB	metal droplet	unk	production	copper	85	2.25	0.33	4.2	50	3.5	0.097	1.8
MA-103718	MC	4600-4450 BC	Vinča culture	Gornja Tuzla	Gornja Tuzla 198a	settlement	SRB	copper awl	unk	metal implement	copper	88	4.6	0.43	5.9	45	6.3	0.16	5.2
MA-103720	MC	4600-4450 BC	Vinča culture	Gornja Tuzla	Gornja Tuzla 186	settlement	SRB	copper metal droplet	unk	production	copper	86	8	3.8	186	120	7.6	0.169	3.5
MA-103724	MC	4600-4450 BC	Vinča culture	Gornja Tuzla	Gornja Tuzla 196	settlement	SRB	copper wire	unk	metal implement	copper	89	4.1	1	13.8	150	8.1	0.37	6.4
HDM 1308	MC	4600-4450 BC	KSBh / Vinča?	Sumrakovac	HDM 1308	stray	SRB	hammer axe	Pločnik	metal implement	copper	100	4790	100	3.7	78	71	4.2	44
HDM 1496	MC	4600-4450 BC	Vinča culture	Gomolava	HDM 1496	cemetery	SRB	bracelet	unk	metal ornament	copper	100	1	0.1	3.2	33	13.8	0.07	6
HDM 1555	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1555	settlement/hoard?	SRB	chisel	unk	metal implement	copper	100	5.9	2.6	2.7	31	12.9	0.1	6.7
HDM 1556	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1556	settlement/hoard?	SRB	flat axe	unk	metal implement	copper	100	770	540	0.8	10	650	14	250
HDM 1557	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1557	settlement/hoard?	SRB	flat axe	unk	metal implement	copper	100	1120	730	0.9	11	610	10.6	175
HDM 1558	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1558	settlement/hoard?	SRB	hammer axe	Pločnik	metal implement	copper	100	0.5	0.06	13.4	42	4.9	0.058	4
HDM 1559	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1559	settlement/hoard?	SRB	hammer axe	Pločnik	metal implement	copper	100	0.4	0.05	42	30	5.5	0.017	3
HDM 1560	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1560	settlement/hoard?	SRB	chisel	unk	metal implement	copper	100	0.4	0.23	3	31	5.8	0.21	5.1
HDM 1561	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1561	settlement/hoard?	SRB	chisel	unk	metal implement	copper	100	0.4	0.18	42	32	5.4	0.019	2
HDM 1562	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1562	settlement/hoard?	SRB	chisel	unk	metal implement	copper	100	0.7	51	3.1	41	235	4.6	76
HDM 1563	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1563	settlement/hoard?	SRB	chisel	unk	metal implement	copper	100	2	52	4.2	26	800	15.9	64
HDM 1564	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1564	settlement/hoard?	SRB	chisel	unk	metal implement	copper	100	2	63	0.8	5	660	11.3	106
HDM 1565	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1565	settlement/hoard?	SRB	chisel	unk	metal implement	copper	97	3	400	0.3	16	700	10.8	128

Table 10 continued. Trace element data for EC and MC copper production and implements. Regions are abbreviated as follows: BSC=Black Sea Coast, SRB = Serbia, W= West Bulgaria, NE= Northeast Bulgaria, ROM = Romania, THR = Thracia. Data from Pernicka *et al.* 1993, 1997; Radivojević 2012; Radivojević and Grujić 2017.

LABEL analytical	relative period	absolute period	cultural attribution	Site	Sample label	Type of site/context	Region	Artefact type	Axe type	Category	Base	Cu (%)	As (µg/g)	Sb (µg/g)	Co (µg/g)	Ni (µg/g)	Ag (µg/g)	Au (µg/g)	Se (µg/g)
HDM 1566	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1566	settlement/hoard?	SRB	chisel	unk	metal implement	copper	100	0.6	15.4	1.7	10	450	7.1	44
HDM 1567	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1567	settlement/hoard?	SRB	chisel	unk	metal implement	copper	100	81	310	0.9	12	680	14.8	98
HDM 1568	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1568	settlement/hoard?	SRB	chisel	unk	metal implement	copper	100	0.6	0.1	16.3	20	2.9	0.02	1.7
HDM 1569	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1569	settlement/hoard?	SRB	chisel	unk	metal implement	copper	99	0.8	32	0.7	34	240	6.4	67
HDM 1570	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1570	settlement/hoard?	SRB	chisel	unk	metal implement	copper	100	17.3	12.7	1.2	44	155	11.9	33
HDM 1571	MC	4600-4450 BC	Vinča culture	Pločnik	HDM 1571	settlement/hoard?	SRB	hammer axe	Pločnik	metal implement	copper	100	840	160	2.8	36	240	5.9	35
HDM 1903	MC	4600-4450 BC	KSBh I	Radlovci	HDM 1903	stray	W	hammer axe	Pločnik	metal implement	copper	100	0.9	4.9	1	85	12	0.212	0.5
HDM 1910	MC	4600-4450 BC	KSBh I	Dragoman	HDM 1910	hoard	W	hammer axe	Pločnik	metal implement	copper	100	0.8	7.6	1.5	72	39	0.79	3.1
HDM 1911	MC	4600-4450 BC	KSBh I	Dragoman	HDM 1911	hoard	W	hammer axe	Pločnik	metal implement	copper	100	0.8	2.68	1	84	12	0.35	0.8
HDM 1940	MC	4600-4450 BC	Karanovo VI?	Ai Bunar	HDM 1940	mine	THR	hammer axe	Pločnik	metal implement	copper	100	1.3	1.55	1.5	41	850	12	320
HDM 1976	MC	4600-4450 BC	Hamangia IV	Durankulak	HDM 1976	cemetery	BSC	bracelet	unk	metal ornament	copper	100	1	29	5.6	150	150	29.2	38
HDM 1977	MC	4600-4450 BC	Hamangia IV	Durankulak	HDM 1977	cemetery	BSC	bracelet	unk	metal ornament	copper	99	2490	590	1	15	620	20.8	177
HDM 2011	MC	4600-4450 BC	Varna I	Durankulak	HDM 2011	cemetery	BSC	bracelet	unk	metal ornament	copper	98	3400	38	5	73	244	0.248	56
HDM 2025	MC	4600-4450 BC	Hamangia IV	Durankulak	HDM 2025	cemetery	BSC	bracelet	unk	metal ornament	copper	94	340	15.2	30	284	450	0.61	100
HDM 2026	MC	4600-4450 BC	Hamangia IV	Durankulak	HDM 2026	cemetery	BSC	bracelet	unk	metal ornament	copper	100	360	15.2	32	310	470	0.65	102
HDM 2041	MC	4600-4450 BC	Boian-Spantov	Tell Ruse	HDM 2041	settlement	NE	borer	unk	metal implement	copper	96	127	16.7	2	153	3400	53	204
HDM 2049	MC	4600-4450 BC	Boian-Spantov	Tell Ruse	HDM 2049	settlement	NE	borer	unk	metal implement	copper	83	15.3	6	5.5	23	147	14.8	135
HDM 2064	MC	4600-4450 BC	Boian-Spantov	Tell Ruse	HDM 2064	settlement	NE	borer	unk	metal implement	copper	100	2	1.8	3.5	125	54	0.83	42
HDM 2080	MC	4600-4450 BC	Boian-Spantov	Tell Ruse	HDM 2080	settlement	NE	borer	unk	metal implement	copper	100	10.9	3.1	39	890	11	0.46	1
HDM 2124	MC	4600-4450 BC	Sava IV (Hamangia IV)	Goljamo Delcevo	HDM 2124	settlement	BSC	borer	unk	metal implement	copper	100	92	2.75	11.2	67	360	2.94	274
HDM 2702	MC	4600-4450 BC	KSBh I	Darzhanitsa	HDM 2702	hoard	W	heavy axe	Gumelnica	metal implement	copper	103	0.8	0.11	12.6	34	9.3	0.083	2.5
HDM 2703	MC	4600-4450 BC	KSBh I	Darzhanitsa	HDM 2703	hoard	W	Heavy axe	Salcuta	metal implement	copper	102	10.9	2.15	0.1	52	11.9	0.275	1
MA-140926	MC	4600-4450 BC	KSBh I?	Kmpije Bor	Kmpije 2	settlement	SRB	Slagged sherd	unk	production	copper	4.76	53.8	2.36	30.1	123	2	0.033	3
MA-140927	MC	4600-4450 BC	KSBh I?	Kmpije Bor	Kmpije 3	settlement	SRB	metal	unk	metal implement	copper	84.9	2.9	1.13	1.34	66	7.6	0.215	2
MA-140929	MC	4600-4450 BC	Foeni Petresti (~ Late Vinča)	Foeni Cimitir Foeni	Foeni Petresti 6	settlement	ROM	Metal droplet?	unk	production	copper	46.5	964	42.7	5.2	105	666	3.87	42.3
HDM 1422	MC	4600-4450 BC	KSBh I	Bubanj	HDM 1422	settlement	SRB	Chisel	unk	metal implement	copper	98	3	8.9	1.9	90	129	0.69	45
HDM 1431	MC	4600-4450 BC	KSBh I?	Stari Kostolac	HDM 1431	stray	SRB	chisel	unk	metal implement	copper	100	3.5	4.5	0.7	94	12.8	0.26	1.6
HDM 1905	MC	4600-4450 BC	KSBh I	Djakovo	HDM 1905	settlement	W	flat axe	unk	metal implement	copper	100	2	4.9	1.5	104	1350	7.8	110
HDM 1942	MC	4600-4450 BC	Varna II	Durankulak	HDM 1942	cemetery	BSC	Finger ring	unk	metal ornament	copper	96	2.3	6.3	1.5	22	1210	2.26	750
HDM 1943	MC	4600-4450 BC	Varna I	Durankulak	HDM 1943	cemetery	BSC	Finger ring	unk	metal ornament	copper	82	39	5.8	9.9	77	19	44	32
HDM 1944	MC	4600-4450 BC	Varna II	Durankulak	HDM 1944	cemetery	BSC	bracelet	unk	metal ornament	copper	100	0.7	0.97	9.7	82	104	19.4	21.3
HDM 1945	MC	4600-4450 BC	Varna II	Durankulak	HDM 1945	cemetery	BSC	bracelet	unk	metal ornament	copper	100	0.6	1.1	8.6	71	111	20	26.4
HDM 1947	MC	4600-4450 BC	Varna II	Durankulak	HDM 1947	cemetery	BSC	bracelet	unk	metal ornament	copper	95	188	9.2	98	152	233	4.78	102
HDM 1948	MC	4600-4450 BC	Varna II	Durankulak	HDM 1948	cemetery	BSC	bracelet	unk	metal ornament	copper	100	5.9	5.7	15.3	162	191	10.3	27.6
HDM 1949	MC	4600-4450 BC	Varna II	Durankulak	HDM 1949	cemetery	BSC	bracelet	unk	metal ornament	copper	100	132	3.4	21	68	142	19.5	12.6
HDM 1967	MC	4600-4450 BC	Varna I	Durankulak	HDM 1967	cemetery	BSC	Finger ring	unk	metal ornament	copper	100	173	320	5.6	75	520	13.1	60
HDM 1968	MC	4600-4450 BC	Varna I	Durankulak	HDM 1968	cemetery	BSC	bracelet	unk	metal ornament	copper	100	5	1.96	90	2400	180	27.2	43
HDM 1972	MC	4600-4450 BC	Varna I	Durankulak	HDM 1972	cemetery	BSC	bracelet	unk	metal ornament	copper	100	2240	72	1	18	171	0.075	17.8
HDM 1974	MC	4600-4450 BC	Varna II	Durankulak	HDM 1974	cemetery	BSC	Finger ring	unk	metal ornament	copper	100	820	7.5	660	250	230	12.9	22.5

Table 10 continued. Trace element data for EC and MC copper production and implements. Regions are abbreviated as follows: BSC=Black Sea Coast, SRB = Serbia, W= West Bulgaria, NE= Northeast Bulgaria, ROM = Romania, THR = Thracia. Data from Pernicka *et al.* 1993, 1997; Radivojević 2012; Radivojević and Grujić 2017.

LABEL analytical	relative period	absolute period	cultural attribution	Site	Sample label	Type of site/context	Region	Artefact type	Axe type	Category	Base	Cu (%)	As (µg/g)	Sb (µg/g)	Co (µg/g)	Ni (µg/g)	Ag (µg/g)	Au (µg/g)	Se (µg/g)
HDM 1979	MC	4600-4450 BC	Varna II	Durankulak	HDM 1979	cemetery	BSC	bracelet	unk	metal ornament	copper	100	4	0.16	7.9	26	4	0.078	0.7
HDM 1980	MC	4600-4450 BC	Varna II	Durankulak	HDM 1980	cemetery	BSC	bracelet	unk	metal ornament	copper	98	5.4	4.8	12.5	82	330	6.8	68
HDM 1981	MC	4600-4450 BC	Varna I	Durankulak	HDM 1981	cemetery	BSC	bracelet	unk	metal ornament	copper	99	5	8	1	107	910	36	16
HDM 1982	MC	4600-4450 BC	Varna II	Durankulak	HDM 1982	cemetery	BSC	bracelet	unk	metal ornament	copper	100	4.4	7.1	1	26	640	9.5	40
HDM 1984	MC	4600-4450 BC	Varna II	Durankulak	HDM 1984	cemetery	BSC	bracelet	unk	metal ornament	copper	100	234	1550	3	47	880	20	310
HDM 1985	MC	4600-4450 BC	Varna II	Durankulak	HDM 1985	cemetery	BSC	bracelet	unk	metal ornament	copper	100	6	7.4	2.5	56	590	11.6	62
HDM 1986	MC	4600-4450 BC	Varna I	Durankulak	HDM 1986	cemetery	BSC	bracelet	unk	metal ornament	copper	97	66	120	7.5	57	330	100	50
HDM 1987	MC	4600-4450 BC	Varna I	Durankulak	HDM 1987	cemetery	BSC	bracelet	unk	metal ornament	copper	100	2.6	7.6	6.1	61	460	35	181
HDM 1989	MC	4600-4450 BC	Varna I	Durankulak	HDM 1989	cemetery	BSC	bracelet	unk	metal ornament	copper	100	3.9	122	0.5	41	440	3.4	235
HDM 1991	MC	4600-4450 BC	Varna II	Durankulak	HDM 1991	cemetery	BSC	bracelet	unk	metal ornament	copper	100	56	370	0.5	63	720	16.9	81
HDM 1992	MC	4600-4450 BC	Varna II	Durankulak	HDM 1992	cemetery	BSC	bracelet	unk	metal ornament	copper	100	5100	830	0.5	61	580	14.5	256
HDM 1993	MC	4600-4450 BC	Varna II	Durankulak	HDM 1993	cemetery	BSC	bracelet	unk	metal ornament	copper	100	12.8	3.4	35	350	144	56	11.8
HDM 1994	MC	4600-4450 BC	Varna II	Durankulak	HDM 1994	cemetery	BSC	bracelet	unk	metal ornament	copper	100	3	0.6	4	156	580	34	33
HDM 1995	MC	4600-4450 BC	Varna II	Durankulak	HDM 1995	cemetery	BSC	bracelet	unk	metal ornament	copper	100	53	7.8	107	64	180	3	96
HDM 1996	MC	4600-4450 BC	Varna I	Durankulak	HDM 1996	cemetery	BSC	bracelet	unk	metal ornament	copper	100	240	1500	2	105	650	7.9	78
HDM 1998	MC	4600-4450 BC	Varna I	Durankulak	HDM 1998	cemetery	BSC	bracelet	unk	metal ornament	copper	100	3.6	112	0.5	34	420	3	221
HDM 2000	MC	4600-4450 BC	Varna I	Durankulak	HDM 2000	cemetery	BSC	Finger ring	unk	metal ornament	copper	83	162	2.2	7.2	60	99	25	20.1
HDM 2001	MC	4600-4450 BC	Varna II	Durankulak	HDM 2001	cemetery	BSC	Finger ring	unk	metal ornament	copper	90	620	136	24.7	53	350	11.6	9.9
HDM 2002	MC	4600-4450 BC	Varna I	Durankulak	HDM 2002	cemetery	BSC	Finger ring	unk	metal ornament	copper	95	640	12.4	78	98	500	13.2	66
HDM 2003	MC	4600-4450 BC	Varna I	Durankulak	HDM 2003	cemetery	BSC	Finger ring	unk	metal ornament	copper	84	3.7	0.24	3	15	164	22.6	29
HDM 2006	MC	4600-4450 BC	Varna I	Durankulak	HDM 2006	cemetery	BSC	spiral ring	unk	metal ornament	copper	84	9	23.4	0.5	48	1640	12.9	33
HDM 2009	MC	4600-4450 BC	Varna II	Durankulak	HDM 2009	cemetery	BSC	spiral ring	unk	metal ornament	copper	92	1.3	2.91	1.5	96	240	33	47
HDM 2012	MC	4600-4450 BC	Varna I	Durankulak	HDM 2012	cemetery	BSC	bracelet	unk	metal ornament	copper	97	2.5	0.33	1.5	5	21	0.218	1.7
HDM 2013	MC	4600-4450 BC	Varna I	Durankulak	HDM 2013	cemetery	BSC	finger ring	unk	metal ornament	copper	95	1	0.21	1.5	27	720	2.63	400
HDM 2014	MC	4600-4450 BC	Varna I	Durankulak	HDM 2014	cemetery	BSC	bracelet	unk	metal ornament	copper	95	266	3.4	36	74	167	17.4	27.8
HDM 2015	MC	4600-4450 BC	Varna I	Durankulak	HDM 2015	cemetery	BSC	bracelet	unk	metal ornament	copper	100	13.5	11	2	27	600	7.7	53
HDM 2016	MC	4600-4450 BC	Varna II	Durankulak	HDM 2016	cemetery	BSC	bracelet	unk	metal ornament	copper	100	0.9	1.01	2	12	390	9.8	55
HDM 2017	MC	4600-4450 BC	Varna II	Durankulak	HDM 2017	cemetery	BSC	bracelet	unk	metal ornament	copper	100	0.9	0.44	2.5	33	181	11.4	31
HDM 2018	MC	4600-4450 BC	Varna I	Durankulak	HDM 2018	cemetery	BSC	bracelet	unk	metal ornament	copper	100	20.3	16.6	26.2	93	390	18.8	61
HDM 2019	MC	4600-4450 BC	Varna II	Durankulak	HDM 2019	cemetery	BSC	bracelet	unk	metal ornament	copper	100	1.1	2.73	1.5	152	350	27.1	37
HDM 2023	MC	4600-4450 BC	Varna II	Durankulak	HDM 2023	cemetery	BSC	bracelet	unk	metal ornament	copper	100	3	2.45	6.4	118	280	40	52
HDM 2024	MC	4600-4450 BC	Varna II	Durankulak	HDM 2024	cemetery	BSC	bracelet	unk	metal ornament	copper	100	2	2.31	3.5	100	276	37	55
HDM 2027	MC	4600-4450 BC	Varna II	Durankulak	HDM 2027	cemetery	BSC	Finger ring	unk	metal ornament	copper	100	6300	1310	1	25	860	9.8	279
HDM 2028	MC	4600-4450 BC	Varna I	Durankulak	HDM 2028	cemetery	BSC	Finger ring	unk	metal ornament	copper	88	9.2	1.89	10.3	174	158	39	63
HDM 2029	MC	4600-4450 BC	Varna I	Durankulak	HDM 2029	cemetery	BSC	Finger ring	unk	metal ornament	copper	100	1100	320	3.5	95	1980	15.4	33
HDM 2031	MC	4600-4450 BC	Varna I	Durankulak	HDM 2031	cemetery	BSC	Finger ring	unk	metal ornament	copper	95	22.6	1.21	5	105	205	55	26.8
HDM 2032	MC	4600-4450 BC	Varna II	Durankulak	HDM 2032	cemetery	BSC	borer	unk	metal implement	copper	98	2	5.5	1.5	294	630	7.9	80
HDM 2034	MC	4600-4450 BC	Varna II	Durankulak	HDM 2034	cemetery	BSC	pin	unk	metal ornament	copper	98	0.7	1.61	2	40	225	4.6	227
HDM 2035	MC	4600-4450 BC	Varna II	Durankulak	HDM 2035	cemetery	BSC	spiral ring	unk	metal ornament	copper	97	2	27.2	1	22	330	8.7	61
HDM 2036	MC	4600-4450 BC	Varna I	Durankulak	HDM 2036	cemetery	BSC	spiral ring	unk	metal ornament	copper	97	9.9	9.3	13	132	215	100	72

Table 10 continued. Trace element data for EC and MC copper production and implements. Regions are abbreviated as follows: BSC=Black Sea Coast, SRB = Serbia, W= West Bulgaria, NE= Northeast Bulgaria, ROM = Romania, THR = Thracia. Data from Pernicka *et al.* 1993, 1997; Radivojević 2012; Radivojević and Grujić 2017.

LABEL analytical	relative period	absolute period	cultural attribution	Site	Sample label	Type of site/context	Region	Artefact type	Axe type	Category	Base	Cu (%)	As (µg/g)	Sb (µg/g)	Co (µg/g)	Ni (µg/g)	Ag (µg/g)	Au (µg/g)	Se (µg/g)
HDM 2137	MC	4600-4450 BC	Varna I	Durankulak	HDM 2137	cemetery	BSC	Finger ring	unk	metal ornament	copper	72	11.5	0.65	17.9	132	145	20.5	58
HDM 2138	MC	4600-4450 BC	Varna I	Durankulak	HDM 2138	cemetery	BSC	Finger ring	unk	metal ornament	copper	54	69	2.13	9.9	99	170	8.7	18
HDM 1920	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 1920	settlement	NE	axe	Kamenar	metal implement	copper	100	4.8	1.09	11.6	230	79	12.9	30
HDM 1921	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 1921	settlement	NE	flat axe	Kamenar	metal implement	copper	100	246	1210	1.5	19	690	14.2	430
HDM 1922	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 1922	settlement	NE	chisel	unk	metal implement	copper	100	4.5	1.12	19.9	93	141	20.2	14.6
HDM 1923	MC	4600-4450 BC	KGK VI	Tell Ruse	HDM 1923	settlement	NE	axe	Gumelnica	metal implement	copper	100	2	169	1	32	620	5.1	106
HDM 2039	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2039	settlement	NE	borer	unk	metal implement	copper	96	3500	870	3.5	58	5800	0.96	14.2
HDM 2040	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2040	settlement	NE	borer	unk	metal implement	copper	100	1	2.68	2.5	22	300	4.6	282
HDM 2043	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2043	settlement	NE	borer	unk	metal implement	copper	100	2	14.3	3	143	520	0.36	117
HDM 2044	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2044	settlement	NE	borer	unk	metal implement	copper	77	4	750	1.5	25	340	13.8	113
HDM 2045	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2045	settlement	NE	borer	unk	metal implement	copper	100	330	450	2.5	18	670	26.3	104
HDM 2047	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2047	settlement	NE	double spiral headed pin	unk	metal ornament	copper	100	4	6.8	1.5	154	2600	14.5	87
HDM 2050	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2050	settlement	NE	borer	unk	metal implement	copper	100	32	87	5.5	117	126	0.97	42
HDM 2051	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2051	settlement	NE	borer	unk	metal implement	copper	93	8600	197	2	214	2840	15.9	18.8
HDM 2052	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2052	settlement	NE	borer	unk	metal implement	copper	98	9400	236	3.5	271	2560	14.4	19.6
HDM 2053	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2053	settlement	NE	chisel	unk	metal implement	copper	99	117	440	2.5	17	430	9.6	490
HDM 2054	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2054	settlement	NE	borer	unk	metal implement	copper	100	5	3.1	1.5	81	600	17.8	59
HDM 2055	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2055	settlement	NE	borer	unk	metal implement	copper	100	12	860	1.5	510	13100	16.2	8.2
HDM 2056	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2056	settlement	NE	borer	unk	metal implement	copper	99	12.7	1.75	5.9	105	25	0.34	38
HDM 2057	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2057	settlement	NE	borer	unk	metal implement	copper	100	2430	197	3	17	650	9.2	140
HDM 2058	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2058	settlement	NE	borer	unk	metal implement	copper	100	1.3	3.1	2	64	11	0.29	0.7
HDM 2059	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2059	settlement	NE	borer	unk	metal implement	copper	99	4.1	0.78	1.5	41	64	1.15	152
HDM 2060	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2060	settlement	NE	borer	unk	metal implement	copper	100	2	1.53	2	17	852	5.3	15
HDM 2061	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2061	settlement	NE	borer	unk	metal implement	copper	100	3	0.63	7.3	204	42	0.67	38
HDM 2063	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2063	settlement	NE	borer	unk	metal implement	copper	98	4.5	0.58	16.4	210	22	0.04	94
HDM 2065	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2065	settlement	NE	borer	unk	metal implement	copper	100	138	19.6	18.7	109	39	1.4	92
HDM 2067	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2067	settlement	NE	borer	unk	metal implement	copper	100	1.4	2.92	1.5	57	2210	8.5	129
HDM 2068	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2068	settlement	NE	borer	unk	metal implement	copper	97	7.1	1.58	2	8	340	12.8	370
HDM 2070	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2070	settlement	NE	borer	unk	metal implement	copper	99	1.7	122	1.5	34	600	10.2	134
HDM 2071	MC	4600-4450 BC	KGK VI?	Tell Ruse	HDM 2071	settlement	NE	borer	unk	metal implement	copper	98	4.7	249	3.5	11	560	8.7	98

metal must have come from three, or possibly four, different deposits, most prominently from Ai Bunar (see Figures 6 and 7) and was possibly not directly produced on the site. The latter notion is based on the initial analysis of Belovode production evidence (slags M21 and M22a, see Table 10) showed that it matched the trace element pattern of copper implements from Pločnik (Radivojević *et al.* 2010a: 2785, Fig. 11), as well as the fact that the lead isotope abundance ratio of another sample of Belovode production evidence (B47/12/3) matched with one of the Pločnik copper chisels (HDM1568, see Figure 7). On the other hand, given that the same copper ores from identical sources in eastern Serbia were reaching both Belovode and Pločnik (e.g. Figures 4–9), and that copper smiths at both sites had equal opportunity and knowledge to extract metal (see for instance Radivojević *et al.* 2013), it is very likely that we may still discover a smelting workshop at Pločnik.

The variation in the trace element levels in the Vinča culture and EC / MC copper metal assemblages becomes

more evident as the number of artefacts analysed grows (Table 11). The greatest variations are in As, Sb, Co, Ni and Ag content, while Au remains at low levels overall. This complements the complex copper supply picture created by the lead isotope abundance ratios (Figure 11), indicating the exploitation of five (or six) major copper deposits at the time.

The immense work of building a trace element dataset for copper metal artefacts and main copper deposits in the Balkans conducted by Pernicka and collaborators (1993, 1997) laid the foundations for further comparisons. More recently, this dataset has been enriched with more samples that pushed the origins of metallurgy in the Balkans back to the beginning of the 5th millennium BC (Radivojević *et al.* 2010a; Radivojević 2012), which are also fully published as an open access document (Radivojević and Grujić 2017). Here, we use the nine chemical clusters of 335 copper based early metal artefacts from Serbia and Bulgaria, obtained through average-link cluster analysis (excluding malachite and samples younger than Proto Bronze Age)

Table 11. Trace element data comparison of newly analysed and previously published data for Belovode, Pločnik, Vinča culture, EC and MC copper metal, from production debris and implements.

label	period	description / number	As (ppm)	Sb (ppm)	Co (ppm)	Ni (ppm)	Ag (ppm)	Au (ppm)	Se (ppm)
Bf43/13	EC	Metal droplet	50.8	0.86	1.94	20	36.2	0.085	26.8
B23/12	MC	Slagged sherd (metal)	9.9	1.16	55	47	2.1	0.01	4.4
B47/12/3	MC	Slagged sherd (metal)	15.7	2.02	68	160	2.3	0.012	2.1
Bf21/12	MC	metal droplet	4	0.2	15.5	180	9.9	0.044	3.2
P10/13	MC	metal foil/stock corroded	0.92	0.28	14.9	86	6.4	0.079	0.8
P13/13	MC	metal wire/bracelet	38	7.3	64	1600	30	0.7	53
C_P1/13	MC	Metal loop / ring	10.6	6.26	2.9	74	230	0.41	6.2
Belovode average	EC/MC	n= 5 copper metal artefacts	**4.9**	**0.9**	**93.2**	**55.6**	**15.3**	**0.03**	**63.7**
Belovode min	EC/MC		1.1	0.2	0.68	21	0.7	0.000	1.3
Belovode max	EC/MC		9.4	1.83	450	130	58	0.089	270
stdev	EC/MC		*3.6*	*0.7*	*199.5*	*45.3*	*24.1*	*0.0*	*116.7*
Pločnik average	EC/MC	n= 21 copper metal artefacts	**135.8**	**113.2**	**7.8**	**29.2**	**260.5**	**6.9**	**52.7**
Pločnik min	EC/MC		0.4	0.05	0.3	5	0.000	0.017	0.000
Pločnik max	EC/MC		1120	730	42	83	800	30.4	250
stdev	EC/MC		*329.6*	*205.9*	*12.2*	*17.2*	*299.6*	*7.9*	*67.3*
Vinča culture average	EC/MC	n= 41 copper metal artefacts	**76.2**	**60.6**	**49.1**	**60.4**	**146.7**	**4.0**	**38.2**
Vinča culture min	EC/MC		0.4	0.05	0.3	5	0.000	0.000	0.000
Vinča culture max	EC/MC		1120	730	860	320	800	30.4	270
stdev	EC/MC		*244.8*	*157.7*	*151.7*	*64.3*	*248.0*	*6.5*	*65.4*
EC average	EC	n= 17 copper metal artefacts	**49.6**	**51.3**	**91.1**	**71.5**	**115.6**	**4**	**34.4**
EC min	EC		1.0	0.2	0.7	20.0	0.000	0.000	0.000
EC max	EC		770	770	860	320	540	30	270
stdev	EC		*185.7*	*185.9*	*225.3*	*73.5*	*203.4*	*8*	*67*
MC average	MC	n= 132 copper metal artefacts	**452**	**123.6**	**16.3**	**109.0**	**564.3**	**12.4**	**83.1**
MC min	MC		0.4	0.1	0.100	5	2	0.02	0.5
MC max	MC		9400	1550	660	2400	13100	100	750
stdev	MC		*1446.7*	*292.4*	*61.4*	*227.7*	*1329.7*	*16.3*	*112.0*

(Pernicka *et al.* 1997: 91, Table 2) as the comparative database for the newly analysed Belovode and Pločnik artefacts (Table 9). Importantly, the majority of artefacts analysed by Pernicka *et al.* (1993, 1997) are from Middle, Late and Final Chalcolithic, while only a handful represent the Early Chalcolithic period; the research presented here adds more artefacts to the EC period and takes the debate deeper into the beginnings of the 5th millennium BC.

The chemical clusters from Pernicka *et al.* (1997) are presented as the 10% percentile, median and 90% percentile of the distribution of elemental concentrations (Figures 12–14, see relevant selection in Table 12). The clusters of Ai Bunar, Majdanpek, Rudna Glava and Medni Rid in Table 12 are derived from analysis of copper ores, while clusters #8 and #2 come from cluster analyses of copper implements. For the comparison of metal objects with ore samples, the seven trace elements listed above were normalised to 100% copper based on the assumption that during smelting they behave in largely the same way as copper (Pernicka 1999) so that their ratios with respect to copper are not substantially altered. This approach was also used for the comparison of slag and copper ore samples from archaeological contexts with copper ore samples from mineralisations / deposits, because these are usually mixed with silicates that do not contain

Figure. 12. Map of sites and copper deposits mentioned in this chapter: 1.Tuzla; 2.Gomolava; 3.Vinča; 4.Selevac; 5.Belovode; 6.Ždrelo; 7.Majdanpek; 8.Rudna Glava; 9.Vlasac; 10.Lepenski Vir; 11.Pločnik; 12.Bubanj; 13.Ruse; 14.Durankulak; 15.Ai Bunar; 16.Zidarovo; 17.Akladi Cheiri; 18.Medni Rid.

those chalcophile and siderophile elements and thus function only as a diluent. A similar principle was previously applied to compare artefacts from Belovode and Pločnik against the trace element pattern of copper deposits, such as those from Ai Bunar, Majdanpek and Rudna Glava (Pernicka *et al.* 1993: 32–33 and Table 9, 1997: 158–160 and Tables A2 and A3a). These copper deposits, being confirmed as sites of ancient exploitation, were selected to test the assumptions derived from the discussion of the lead isotope data, although all chemical clusters and copper ore datasets published thus far were also probed for their consistency with the trace element data in Table 9.

Figure 13 presents the unique trace element pattern of the following copper minerals (malachite) from Belovode: B21/13, B108/13, B155/13, B385/13, and a copper metal wire / bracelet, P13/13 from Pločnik. This pattern is characterised by significant levels of Ni (up to 1600 ppm), Co (up to *c.* 60 ppm) and As (up to *c.* 150 ppm), while other values are much lower (e.g. Au). Since half of these artefacts fall into Group 1 (see Figure 3), this is consistent with the lead isotope abundance field for Majdanpek (e.g. Figures 4 and 5), the whole assemblage is plotted against the trace element signature of this copper ore field. While the consistency is not immediately apparent due to the prominent Ni peak that extends outside the Majdanpek ore trace element field, the rest of the trace element string is within the compositional envelope of this ore field. These artefacts are also consistent with previously published minerals and malachite beads from Lepenski Vir, Vlasac, Belovode, Pločnik and Gomolava (see Table 10) (Radivojević and Grujić 2017).

We deem these corresponding trace element patterns as indicative of the likely origins of this group of artefacts from Majdanpek, reinforcing the consistencies indicated in the discussion of the lead isotope data above. It is noteworthy that the trace element field for Majdanpek comes from 11 ore samples of native copper and copper ore, and from a deposit that has very poor preservation of ancient mining, being one of the largest Balkan copper deposits exploited in modern times. It seems very likely that the mineralisation that was exploited in the past could have been more enriched in Ni, however, it has long been bulldozed away and the opportunity to acquire more relevant samples has been lost.

The distinctive trace element pattern of a large body of metal production samples, including the freshly analysed B47/12/3 and B23/12, besides other Belovode, Vinča and Gornja Tuzla slags, resembles those of Rudna Glava ores (Figure 14, see Table 12 for data) but also those of the

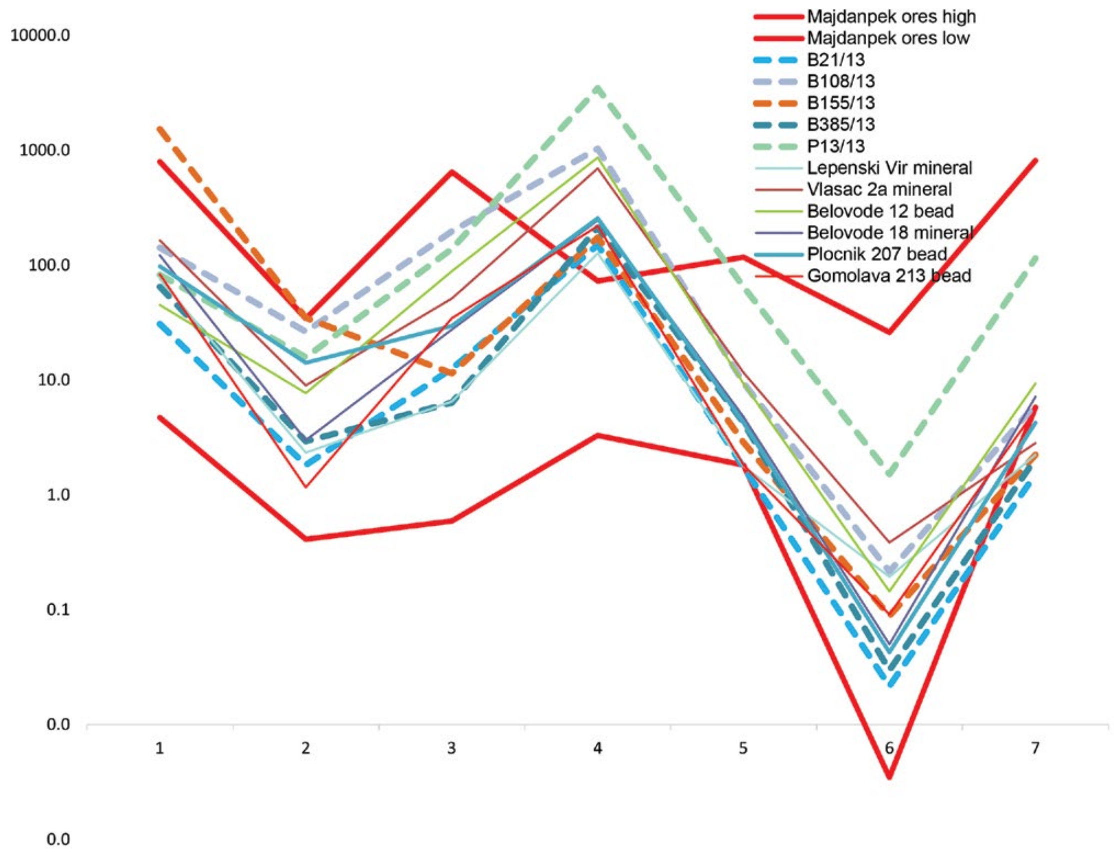


Figure 13. Trace element signature comparison of Late Neolithic, EC and MC artefacts against the signature of Majdanpek copper ore field.

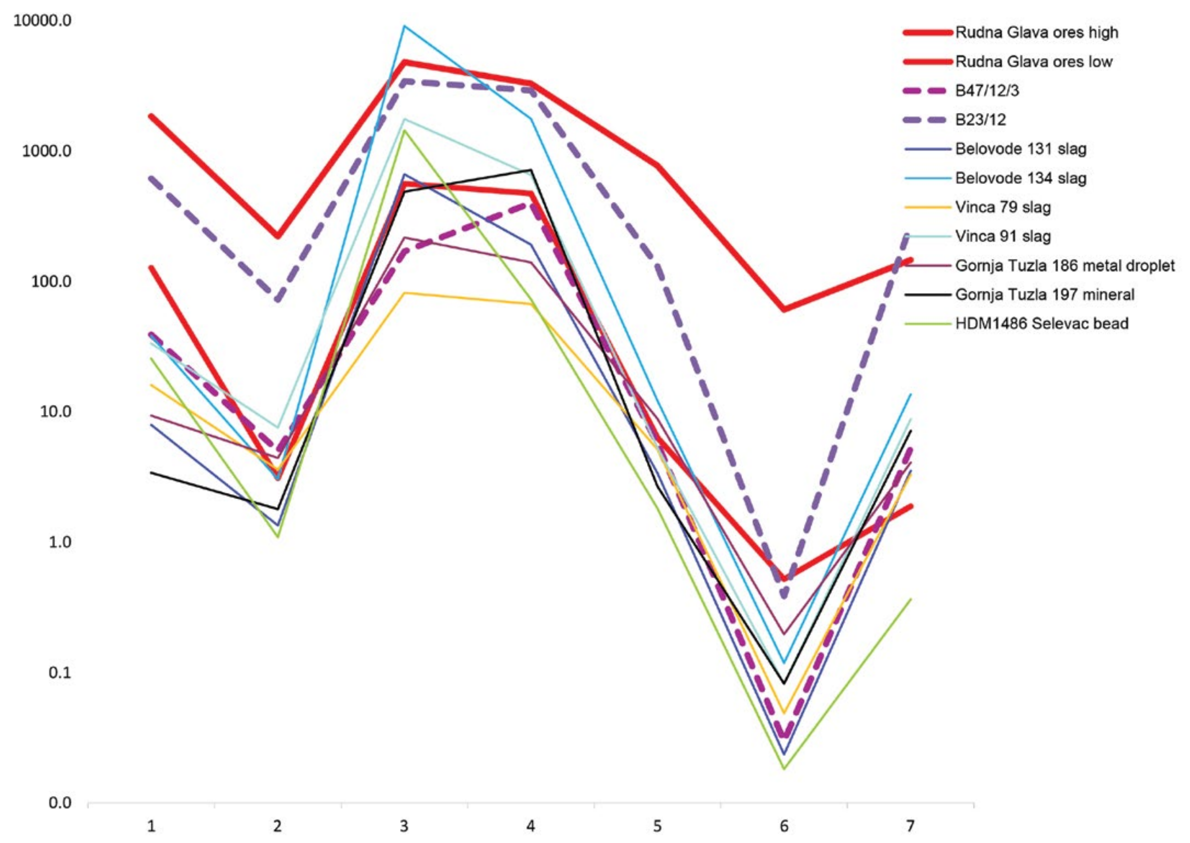


Figure 14. Trace element signature comparison of EC and MC artefacts against the signature of Rudna Glava copper ore field.

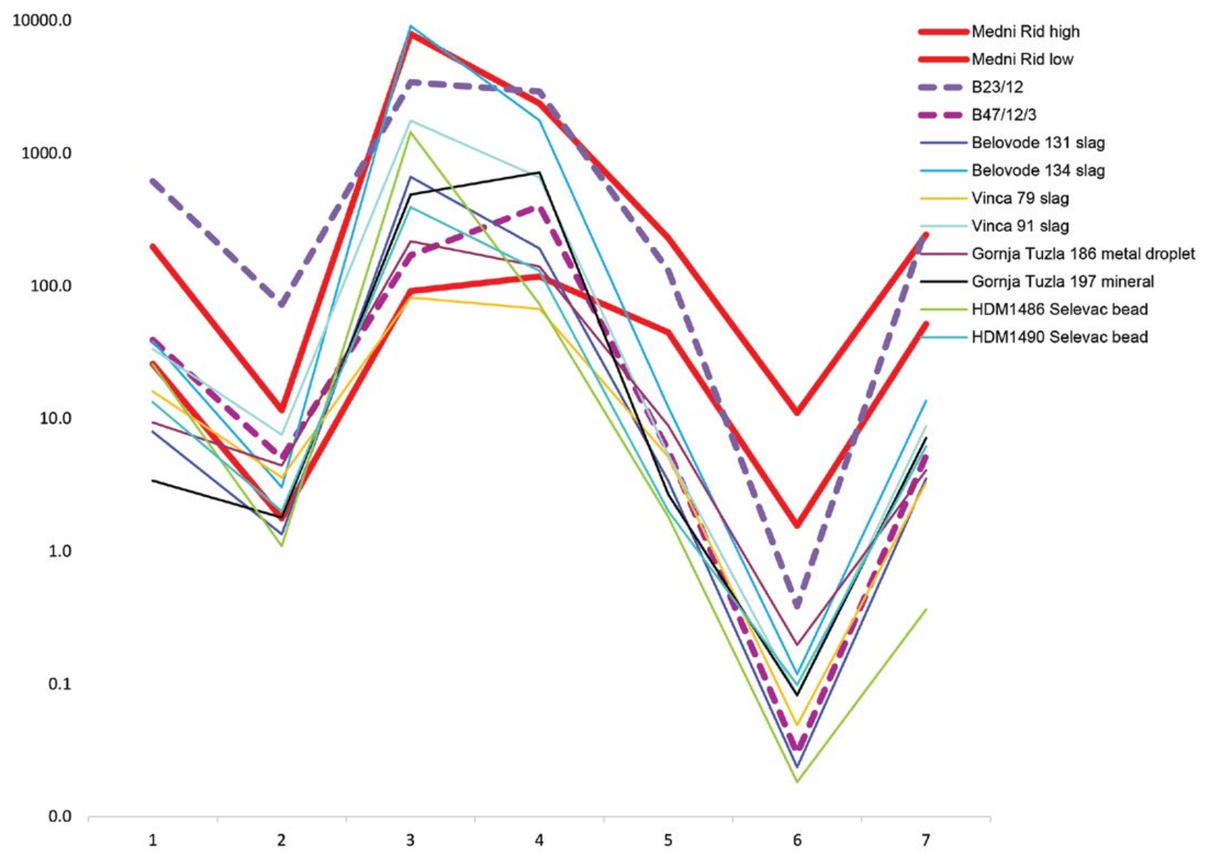


Figure 14a. Trace element signature comparison of EC and MC artefacts against the signature of Medni Rid ore field.

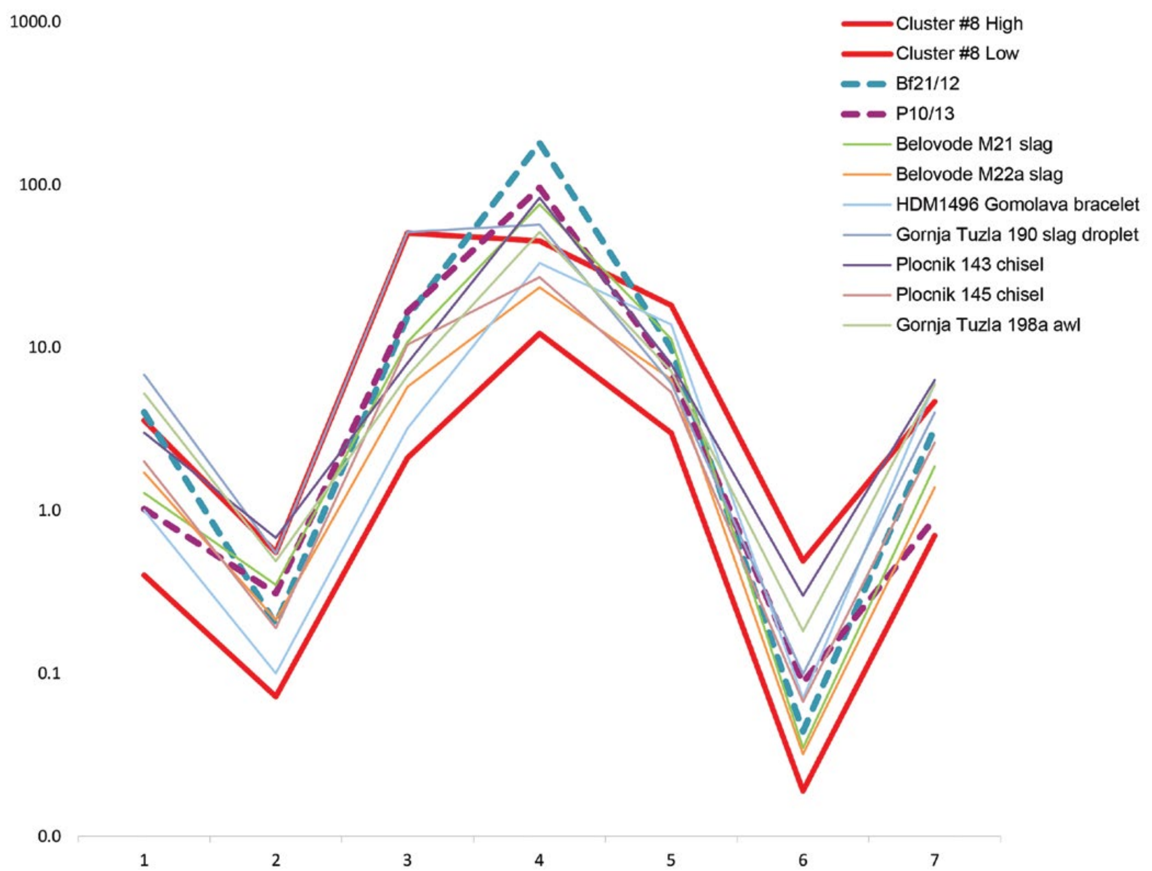


Figure 15. Trace element signature comparison of EC and MC artefacts against the signature of chemical cluster #8.

Medni Rid ore field in southeast Bulgaria (see Kunze and Pernicka 2020: 413–414, Table 3) (Figure 14a). The significant Co and Ni levels, as well as lower Sb and Au readings, characterise this group. The major difference is the lower Au concentrations in the ore samples but this may be due to the fact that the objects were most likely produced from ores originating from the oxidised zone of the copper deposits, which are usually somewhat enriched in Au. These parts of the ore deposits are no longer available; at least one of them, Medni Rid, was heavily worked in modern times. Both deposits also contain radiogenic lead (Figure 10) but so far, copper metal objects with such highly radiogenic signature have been identified only in eastern Bulgaria, from the Bulgarian MC period and later. This suggests that they may be related to the Medni Rid region, especially since the exploitation of these deposits in the later Chalcolithic is, at least indirectly, confirmed by the evidence for Chalcolithic copper smelting at nearby Akladi Cheiri (Rehren *et al.* 2020). Yet, no copper metal artefact analysed thus far from the EC or MC period from Serbia is isotopically consistent with Medni Rid. Rudna Glava, on the other hand, does not show optimal consistency with MC copper implements from Bulgaria (Figure 10); however, the samples in Figure 14 and 14a are largely a mix of EC/MC production evidence, or rather analyses of copper metal prills embedded in this material.

Seven out of 10 artefacts that produce this distinctive pattern are copper metal prills suspended in slag matrix, or droplets, and hence subjected to a set of variable conditions that would result in depletion of elements such as Ag, Au and Ni (depending on the copper ore content) (cf. Tylecote *et al.* 1977). The key to the provenance of these samples is their Co and Ni content, elaborated above, since Belovode production evidence (Table 11) exhibits increased readings of Co and Ni. In the extreme, the newly formed inclusions in Belovode slagged sherds and free slag samples (Tables 7 and 10, and Chapter 11 this volume) contain up to 60 wt% Co and a few percent of Ni, while EPMA analysis also points to high levels of Co and Ni in the previously published production data (Table 1). Co and Ni content are therefore crucial information for designating the provenance of ores used in copper smelting at the sites of Belovode, Vinča and Gornja Tuzla.

The Vinča culture metal producing sites are also geographically located within close reach of the river valleys of the Sava and the Danube, which (amongst others) possibly served as communication routes. Rudna Glava is a mining complex in the hinterlands of the Danube Gorges in eastern Serbia, with several shafts discovered during excavations by B. Jovanović in the 1960s (Jovanović 1971), and which also served

Table 12. A selection of chemical clusters made of Chalcolithic copper deposits and artefacts (data from Kunze and Pernicka 2020; Pernicka *et al.* 1993, 1997)

		As	Sb	Co	Ni	Ag	Au	Se
		µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Cluster #2 (58 samples)	median	15	5	1.2	53	19	0.4	1.4
	10% percentile	4	2	0.4	23	9	0.2	0.5
	90% percentile	99	14	4	94	59	0.8	5
Cluster #8 (15 samples)	median	1.1	0.18	13.4	32	5.5	0.07	1.7
	10% percentile	0.4	0.072	2.1	12.2	2.98	0.02	0.7
	90% percentile	3.56	0.554	50.4	45	18.1	0.5	4.7
Cluster Ai Bunar (9 samples)	median	50000	3500	37	192	458	6.3	193
	10% percentile	10053	1397	12	97	229	1.7	101
	90% percentile	90889	10691	60	407	2329	54.3	991
Cluster Majdanpek (11 samples)	median	39	3.7	21	22	10	0.08	19
	10% percentile	5	0.4	1	3	2	0.003	6
	90% percentile	793	34.3	645	73	117	25.91	810
Cluster Rudna Glava (19 samples)	median	525	27	2611	805	132	3.2	23
	10% percentile	127	3	560	472	6	0.5	2
	90% percentile	1846	221	4792	3280	768	60.6	146
Cluster Medni Rid region (13 samples)	median	74	6	1574	609	120	5	76
	10% percentile	26	2	91	117	45	2	52
	90% percentile	197	12	7897	2361	230	11	242

as an iron mine during Roman times, and into the 20th century (Pernicka *et al.* 1993: 41; Jovanović 2001), due to the abundance of magnetite ore besides malachite. Given the relatively small scope of this mining complex, it had been—unlike Majdanpek—mostly preserved at the time of excavation and is now part of the certified European Union Industrial Heritage Tour (Graf 2013; Muhi *et al.* 2018).

All of this is important in weighing the trace element consistency of the Vinča culture production evidence with Rudna Glava. The site has a confirmed activity from the mid-6th millennium BC and most notably around 5000 BC and could have been a larger complex in the past or included several adjacent outcrops. The most significant aspect is the compositional structure that bears a unique Co and Ni signature, found widely in metal production evidence dated between 5000 BC and 4400 BC (Radivojević and Rehren 2016). Crucially, Rudna Glava is only *c.* 100 km away from Belovode, a short distance in comparison to Medni Rid, which is *c.* 800 km away. Finally, a crucial to this discussion is the fact that the radiogenic lead contained in Rudna Glava ores contradicts the trace element consistency of this mine with Vinča culture metal production evidence (see example in Figure 7). On the other hand, not all Group 1 artefacts that are isotopically consistent with Majdanpek show the same consistency for trace elements. While pairing of both methods is clearly a more credible approach for designating the copper source, with the current state of the database we can consider Majdanpek as a major source of copper in the Chalcolithic but by no means the only one. Ideally, matching isotope and trace element patterns would be complemented by field observations of ancient mining activities combined with absolute dating. In this combination, a relationship with contemporary archaeological finds could be considered as proven.

Two of these three prerequisites (lead isotope and trace element consistencies in ore vs. artefacts comparisons) are presently fulfilled for Majdanpek, and possibly for

Ždrelo in the EC period, and Ai Bunar and Medni Rid for MC and later periods. The exploitation of the latter is at least indirectly indicated by a substantial number of artefacts that can be geochemically related. For Ždrelo, however, more field work and more geochemical analyses would be required to properly characterise this deposit. Rudna Glava remains as a special case where there is a copper mineralisation with abundant evidence for Chalcolithic mining but without matching archaeological artefacts that could be associated with the mine with high probability, especially with lead isotope analysis. It remains to be seen whether other mineralisations with radiogenic lead will be identified in eastern Serbia in the future that may match the Vinča culture assemblage better in their combination of lead isotope and trace element analysis. The possibility cannot, of course, be excluded that eventually, Chalcolithic copper artefacts may be found which are geochemically comparable with the ore samples from Rudna Glava, or that more ore samples from this mining complex may clarify this situation. Our assumption is that those artefacts that potentially came from the Rudna Glava ores are more likely to belong to the period between *c.* 5500–4600 BC.

The final group of artefacts with a particular trace element pattern in Figure 15 represents two artefacts analysed here, a metal droplet from Belovode (Bf21/12) and a metal foil from Pločnik (P10/13). Their patterns are very similar to those of two published slag samples from Belovode, to production evidence from Gornja Tuzla and to a handful of copper metal artefacts from Belovode, Pločnik and Gomolava. This is a purely production / artefact cluster and is highly consistent with cluster no. 8 identified by Pernicka *et al.* (1997: 89), formed by 13 copper metal implements and two malachite beads from the sites of Selevac, Pločnik, Durankulak, Gomolava, Daržanica, Hotnica and Zlotska pecina. It had been recognised earlier as the only trace element pattern to match the Belovode slags M21 and M22a (Radivojević *et al.* 2010a: 2785, Fig. 11), as well as yet another (in addition to 'Group of 16' or grouplet #7) to indicate an as yet unidentified copper deposit (Pernicka *et al.* 1997: 89). Spikes in Ni content in Bf21/12 and P10/13 again show that this deposit was rich in Ni and, as such, could also have been located in eastern Serbia, possibly even in the vicinity of Majdanpek or Rudna Glava (which are only about 24 km apart).

While this will form part of future research, the main outcome of the trace element comparison is that it indicates that at least three different copper deposits were exploited during the Vinča culture period (Figures 13–15), most likely located in the same geographic area, eastern Serbia. Importantly, these were not the only sources used by the Belovode and Pločnik communities, as further corroborated by the remaining seven artefacts (out of 16, see Table 9), which individually display a unique trace element signature that is yet to match a deposit or a published artefact assemblage.

Discussion and conclusion

The detailed analysis of technology and provenance data highlight the most important aspect of Belovode and Pločnik metallurgy in the wider context: its super-connectedness across the Vinča culture, as well as to important trade and exchange nodes along the known communication routes, such as the lower Danube. The shared access to copper sources and knowledge of metal making reveals a wide and complex network of interactions between metal producing and consuming communities in modern day Bosnia, Serbia and Bulgaria. While multiple datasets were employed to dissect this connectedness on a micro-level (e.g. engineering parameters for metal extraction, redox conditions, viscosity, close consistencies for individual mineral, slag and metal implements), a macro-level of data comparison was previously achieved using a robust approach stemming from complexity science (Radivojević and Grujić 2018). The research presented here not only underlines, but also complements the gaps in data and interpretations from the complex networks research, thereby opening avenues for more fine-grained research in the future.

In addition to providing direct absolute dates for metallurgical assemblages, the micro-level approach to data interpretation has both emphasised the connectedness of metal producing and consuming sites along important communication routes and highlighted the importance of several east Serbian copper deposits for the early phase of metallurgy evolution in the Balkans (Early Chalcolithic, *c.* 5000–4600 BC).

Direct ^{14}C dating of materials associated with metallurgical materials at Belovode and Pločnik provided, for the first time, high-resolution evidence of the beginning, evolution and end of metallurgy at these sites and, most importantly, data regarding the cooperation between these communities concerning access to copper ores. For example, the close consistency of Belovode production evidence with copper implements from Pločnik, and similar correspondence of copper minerals from the earliest levels at both sites, dated to the 51st century BC, reinforces assumptions about their close connectedness and involvement in metallurgical knowledge sharing. Equally, the matching data from smelted copper in one horizon and malachite associated with another at Belovode implies consistent supply networks throughout the occupation of this settlement. Pločnik, on the other hand, exhibits a tight connection with Ai Bunar copper supply shortly after 4600 BC, based on information drawn from both provenance and complex networks data (see also Figure 9, Chapter 3 this volume).

The consistency of copper supply links between Belovode, Pločnik, Gornja Tuzla, Gomolava, Selevac, Vinča, Ruse and Durankulak also accords with the conclusions of the complex networks approach and underlines the super-connectedness of these nodes and their likely communication routes. Direct dating again offers a clearer picture of the development of these relationships, placing Belovode, Vinča and Pločnik at the heart of these links, having early communication with the population buried in Durankulak, and potentially being the community who migrated to Gornja Tuzla, a settlement which demonstrates the same knowledge of supply and technology as held by the Vinča and Belovode communities, soon after their villages were abandoned in haste. While the current state of information for the latter is limited, our hope is that the analysis of metal making practices and supply networks presented here opens more avenues for research into the lives of Vinča communities after most of the villages disappeared in around 4600 BC.

Finally, the complex debate on the origins of copper ores used for metal making in the Vinča culture and beyond shows the limitations of the current approach and the available datasets, despite the fact that this is currently one of the richest in the field of early metallurgy. Our hope is that new perspectives for more research and analysis will open, based on the directions we offer in this interpretation.

Overall, the Balkan Chalcolithic communities were utilising copper from at least six (or seven) copper deposits, two of which remain unidentified. These are: Majdanpek, Ždrelo, Ai Bunar, Medni Rid, 'Group of 16', 'Cluster #8' and potentially Rudna Glava (or an associated Co/Ni rich mineralisation). Of these, Vinča culture communities were not using metal from Medni Rid, while copper from Ai Bunar was only used during the extended occupation of Pločnik, or beyond *c.* 4600 BC. This list of deposits is based on the analysis of consistency of studied artefacts with known copper resources; it is important to emphasise that it is not exhaustive. Further, it appears that consistencies based on trace element analysis for two deposits, Rudna Glava and 'Cluster #8', are not reflected in the lead isotope abundance ratio plots, which may point to the need to obtain more samples, identify novel deposits, or look for alternative explanations. It would be interesting to see whether the trace element field of Ždrelo, or lead isotope analysis of an expanded sample set, if and when available, could potentially offer additional explanations for some of the sampled artefacts.

Another important point is that the set of data presented here adds *c.* 500 years to the age of previously analysed artefacts (Pernicka *et al.* 1993, 1997), which brings the analysed assemblage closer to the date of established activity at the ancient mine of Rudna Glava (*c.* 5000 BC). This site has been the subject of contentious debates, mainly revolving around the radiogenic lead in the isotope signature and the lack of metallurgical materials that show consistency with this source. The newly acquired trace element data from the unique set of Serbian copper slags dating between *c.* 5000 and 4400 BC might now have filled this gap (Figure 14), although the question remains of why this Co and Ni abundant source shows good consistency in the trace element and not on the lead isotope analysis front.

The current consensus is that Rudna Glava provides the closest elemental match with the most important metal production evidence, which, given the unpredictable nature of early copper smelting (and hence varied depletion / enrichment patterns in the newly formed slag phases), and taken alongside corresponding ^{14}C dates and, most notably, spatial proximity to the metal production sites, makes it (or an associated Co/Ni rich mineralisation) a potential candidate for copper exploitation from the beginning of the Vinča culture until its end. However, the radiogenic lead isotope abundance ratios of Rudna Glava will continue to present a problem for linking the deposit to any Chalcolithic metallurgical artefacts. The most important point is that confirmation of the exploitation of copper ores with elevated Co and Ni levels gives direction for further research for more ancient copper deposits in eastern Serbia, which might potentially bear a signature that exhibits stronger consistency with the archaeological artefacts analysed here. The abundance of copper mineralisations in this region was mentioned at the beginning of this chapter, and is reinforced here once again, particularly as the next chemically corresponding mining region (that is rich in Co and Ni), Medni Rid, lies between 800 and 1000 km away from the Vinča culture metal producing sites in Serbia.

Our research is far from complete and opens more questions than it provides answers, despite the enlarged dataset since the research in the 1990s. Our hope, however, is to inspire future investigations in this region that will help us understand the intricate web of connectedness of the world's first metal making communities.

Appendix B_Ch41

Appendix avaliable online as part of Appendix B at https://doi.org/10.32028/9781803270425/AppendixB_Ch41

The bibliographic reference for this chapter is:

Radivojević, M., Rehren, Th. and Pernicka, E. 2021. Metallurgical knowledge and networks of supply in the 5th millennium BC Balkans: Belovode and Pločnik in their regional context, in Radivojević, M., Roberts, B. W., Marić, M., Kuzmanović Cvetković, J., and Rehren, Th. (eds) *The Rise of Metallurgy in Eurasia*: 484–527. Oxford: Archaeopress.

Bibliography

A

Adams, J.L. 1988. Use-wear analyses on manos and hide-processing stones. *Journal of Field Archaeology* 15(3): 307–315.

Adams, J.L. 1989. Experimental replication of the use of ground stone tools. *Kiva* 54 (3): 261–273.

Adams, J.L. 2002. *Ground Stone Analysis: A Technological Approach*. Salt Lake City: The University of Utah Press.

Adams, J., S. Delgado, L. Dubreuil, C. Hamon, H. Plisson and R. Risch. 2009. Functional analysis of macro-lithic artefacts: a focus of working surfaces, in F. Sternke, L. Eigeland and K.-J. Costa (eds) *Non-Flint Raw Material Use in Prehistory: Old Prejudices and New Directions*: 48–50. Proceedings of the XV World Congress of the International Union for Prehistoric and Protohistoric Sciences, Vol. 11, Session C77. (British Archaeological Reports International Series S1939): 43–66. Oxford: Archaeopress.

Albarella, U. 1995. Depressions on sheep horncores. *Journal of Archaeological Science* 22: 699–704.

Alberti, G. 2013a. An R script to facilitate correspondence analysis. A guide to the use and the interpretation of results from an archaeological perspective. *Archaeologia e Calcolatori* 24: 25–53.

Alberti, G. 2013b. Making sense of contingency tables in archaeology: the aid of correspondence analysis to intra-site activity areas research. *Journal of Data Science* 11: 479–499.

Alberti, G. 2014. Modeling group size and scalar stress by logistic regression from an archaeological perspective. *PLoS ONE* 9, e91510.

Alberti, G. 2015. CAinterprTools: An R package to help interpreting Correspondence Analysis results. *Software* X(1–2): 26–31.

Altmaier, A. and C. Kany. 2002. Digital surface model generation from CORONA satellite images. *Journal of Photogrammetry and Remote Sensing* 56: 221–235.

Alimov, K., N. Boroffka, M. Bubnova, J. Burjakov, J. Cierny, J. Jakubov, J. Lutz, H. Parzinger, E. Pernicka, V. Radililovskij, V. Ruzanov, T. Sirinov, D. Starsinin, and G. Weisgerber 1998. Zinnbergbau in Mittelasien. *Eurasia Antiqua* 3: 137-199.

American Society for Metals. 1979. *Source Book on Copper and Copper Alloys: A Comprehensive Collection of Outstanding Articles from the Periodical and Reference Literature*. Metals Park (OH): American Society for Metals.

Amicone, S. 2017. Pottery Technology in the Vinča Culture at the Dawn of Metal Age. A View from Pločnik and Belovode. Unpublished PhD dissertation, University College London.

Amicone, S., P. Quinn, N. Mirković-Marić, M. Marić, and M. Radivojević (eds). 2019. *Tracing Pottery Making Recipes in the Balkans, 6th–4th Millennia BC*. Oxford: Oxbow Books.

Amicone, S., A.R. Mathur, R.D. Pavitra, N. Mirković-Marić, I. Pantović and J. Kuzmanović Cvetković. 2020a. Beneath the surface: Exploring variability in pottery paste recipes within Vinča culture. *Quaternary International* 560–561: 86-101. DOI: https://doi.org/10.1016/j.quaint.2020.04.017.

Amicone, S., M. Radivojević, P.S. Quinn, C. Berthold and Th. Rehren. 2020b. Pyrotechnological connections? Re-investigating the link between pottery firing technology and the origins of metallurgy in the Vinča culture, Serbia. *Journal of Archaeological Science* 118: 105-123. DOI: https://doi.org/10.1016/j.jas.2020.105123.

Ammerman, A.J. and L.L. Cavalli-Sforza. 1971. Measuring the rate of spread of early farming in Europe. *Man* 6: 674–688.

Amov, B.G. 1999. Lead isotope data for ore deposits from Bulgaria and the possibility for their use in archaeometry. *Berliner Beiträge zur Archäometrie* 16: 5–19.

Amov, B.G. and V.N. Văkova. 1994. A summary of lead isotope data for ore deposits in Bulgaria, in H. Todorova and P. Popov (eds) *Проблеми на найранната металургия*. Sofia: Трудове на Минно-геоложкия университе.

Andel, K. 1958. Pohrebisko z doby medenej v Tibave na Vychodnom Slovensku. *Slovenská Archeologia* 6: 39–49.

Antonijević, I. and P. Mijatović. 2014. The copper deposits of Bor, eastern Serbia: Geology and Origin of the Deposits. *Annales Géologiques de la Péninsule Balkanique* 75: 59–74.

Antonović, D. 1992. *Predmeti od glačanog kamena iz Vinče*. Beograd: Filozofski fakultet, Cenar za arheološka istraživanja.

Antonović, D. 1997. Use of light white stone in the Central Balkans Neolithic. *Starinar* 48: 33–40.

Antonović, D. 2000. Predmeti od glačanog kamena sa Belovoda. *Viminacium* 11: 23–34.

Antonović, D. 2002. Copper processing in Vinča: new contributions to the thesis about metallurgical character of the Vinča culture. *Starinar* 52: 27–45.

Antonović, D. 2003. *Neolitska industrija glačanog kamena u Srbiji*. Beograd: Arheološki institute. Posebna izdanja 37.

Antonović, D. 2011. Industrija glačanog kamena na lokalitetu Crkvine: primer sonde 5, in M. Blagojević (ed.) *Kolubara* 5: 195–212. Beograd: Republički zavod za zaštitu spomenika kulture.

Antonović, D. 2013. Predmeti od glačanog kamena sa lokaliteta Livade u Kaleniću, in M. Blagojević (ed.) *Kolubara* 6: 23–36. Beograd: Republički zavod za zaštitu spomenika kulture.

Antonović, D. 2014a. *Kupferzeitlichen Äxte und Beile in Serbien.* (Prähistorische Bronzefunde, Vol 9, Band 27). Mainz: Akademie der Wissenschaften und der Literatur.

Antonović, D. 2014b. Manufacturing of stone axes and adzes in Vinča culture, in S. Vitezović and D. Antonović (eds) *Archaeotechnology: studying technology from prehistory to the Middle Ages*: 77–88. Belgrade: Srpsko arheološko društvo.

Antonović, D. 2014c. Examination methodology for ground stone artefacts, in S. Vitezović and D. Antonović (eds) *Archaeotechnology: studying technology from prehistory to the Middle Ages*: 13–27. Belgrade: Srpsko arheološko društvo.

Antonović, D., K. Resimić-Šarić and V. Cvetković. 2005. Stone raw materials in the Vinča culture: petrographic analysis of assemblage from Vinča and Belovode. *Starinar* 55: 53–66.

Antonović, D. and J. Šarić 2011. Kameno oruđe sa lokaliteta Crkvine u Stublinama, *Starinar* 61: 7–22.

Antonović, D. and M. Vukadinović. 2012. Eneolithic mine Prljuša – Mali Šturac: archaeological and geophysical investigations. *Starinar* 62: 95–106.

Antonović, D., M. Vukadinović and A. Cicović. 2014. Praistorijski rudnik na lokalitetu Prljuša, Mali Šturac istraživanje 2012, in D. Antonović, S. Golubović and V. Bikić (eds) *Arheologija u Srbiji. Projekti Arheološkog Instituta u 2012*: 28–31. Beograd: Arheološki Institut.

Arnold, D.E. 1985. *Ceramic Theory and Cultural Process*. Cambridge: Cambridge University Press.

Arnold, D.E. 1993. *Ecology and Ceramic Production in an Andean Community*. Cambridge: Cambridge University Press.

Arnold, D.E. 2000. Does the standardization of ceramic pastes really mean specialization? *Journal of Archaeological Method and Theory* 7/4: 333–375.

Arnold, E. and H. Greenfield. 2006. *The Origins of Transhumant Pastoralism in Temperate South Eastern Europe: A Zooarchaeological Perspective from the Central Balkans* (British Archaeological Reports International Series 1538). Archaeopress: Oxford.

Arsenijević, M. and J. Živković. 1998. Methodology and the results of statistical-typological analysis of pottery from the Vinča culture settlement of Belovode, near Petrovac-upon-Mlava. *Journal of Serbian Archaeological Society* 14: 281–291.

Arsić, R., J. Miletić and V. Miletić. 2010. Žaštitna istraživanja na lokalitetu Crkvine, Mali Borak. *Kolubara* 5: 55–67.

Averbouh, A. 2000. Technologie de la Matière Osseuse Travaillée et Implications Palethnologiques. Unpublished PhD dissertation, Université de Paris I.

Avramova, M. 2002. Der Schmuck aus den Gräbern von Durankulak, in H. Todorova (ed.) *Durankulak, Band II - Die prähistorischen Gräberfelder von Durankulak, Teil 1*: 191–206. Sofia: Publishing House Anubis Ltd.

B

Babović, Lj. 1986. Zbradila – Korbovo: compte-rendu des fouilles en 1981, Đerdapske Sveske 3: 95–115. Belgrade: Archaeological Institute.

Бабовић, М. 1992. Могућност примене аероархеолошких метода, in Д. Срејовић (ed.) *Археологија и природне науке*: 181–189. Beograd: Srpska akademija nauka i umetnosti

Bachmann, H.-G. 1980. Early copper smelting techniques in Sinai and in the Negev as deduced from slag investigations, in P.T. Craddock (ed.) *Scientific Studies in Early Mining and Extractive Metallurgy*: 103–134. London: The British Museum Press.

Bachmann, H.-G. 1982. *The Identification of Slags from Archaeological Sites* (Institute of Archaeology Occasional Publication 6). London: Institute of Archaeology.

Bačkalov, A. 1979. *Predmeti od kosti i roga u predneolitu i neolitu Srbije*. Beograd: Savez arheoloških društava Jugoslavije.

Bacvarov, K. and S. Vitezović. 2014. Objects of special use from Late Neolithic/Chalcolithic site of Voden, Thrace (SE Bulgaria). Poster presented at 10th Meeting of the Worked Bone Research Group of the ICAZ, Belgrade, Serbia, 25–30 Aug 2014.

Bailey, D.W. 2000. *Balkan Prehistory: Exclusion, Incorporation and Identity*. London, New York: Routledge.

Bailey, D.W. 2005. *Prehistoric Figurines: Representation and Corporeality in the Neolithic*. London: Routledge.

Bailey, D.W. 2014. Touch and cheirotic apprehension of prehistoric figurines, in P. Dent (ed.) *Sculpture and Touch*: 17–43. London: Ashgate.

Bajnóczi, B., G. Schöll-Barna, N. Kalicz, Z. Siklósi, G.H. Hourmouziadis, F. Ifantidis, A. Kyparissi-Apostolika, M. Pappa, R. Veropoulidou and C. Ziota. 2013. Tracing the source of Late Neolithic spondylus shell ornaments by stable isotope geochemistry and cathodoluminescence microscopy. *Journal of Archaeological Science* 40: 874–882.

Baker, P. and F. Worley. 2014. *Animal Bones and Archaeology: Guidelines for Best Practice.* Swindon: English Heritage.

Balasescu, A., D. Moise and V. Radu. 2006. Une utilisation des bovins pour la traction pendant le Chalcolithique en Roumanie? In P. Pétrequin, R.-M. Arbogast, A.-M. Pétrequin, S. van Willigen and M. Bailly (eds) *Premiers chariots, premiers araires. La diffusion de la traction animale en Europe pendant les IVe et IIIe millénaires avant notre* ère. (CRA Monograph 29): 269–273. Paris: CNRS.

Balasse, M., A. Evin, C. Tornero, V. Radu, D. Fiorillo, D. Popovici, R. Andreescu, K. Dobney, T. Cucchi and A. Bălăşescu. 2016. Wild, domestic and feral? Investigating the status of suids in the Romanian Gumelniţa (5th mil. cal BC) with biogeochemistry and geometric morphometrics. *Journal of Anthropological Archaeology* 42: 27–36.

Bánffy, E. and P. Sümegi. 2011. The [environ-]mental contexts of earliest Neolithic settlement and architecture in western Hungary, in A. Hadjikoumis, E. Robinson and S. Viner (eds) *The Dynamics of Neolithisation in Europe*: 231–265. Oxford: Oxbow Books.

Bankoff, H. and F. Winter. 1990. The later Aeneolithic in southeastern Europe. *American Journal of Archaeology* 94: 175–191.

Bartosiewicz, L., V. Boronean, C. Bonsall and S. Stallibrass. 2001. New data on the prehistoric fauna of the Iron Gates: a case study from Schela Cladovei, Romania, in R. Kertesz and J. Makkay (eds) *From the Mesolithic to the Neolithic*: 15–22. Budapest: Archaeolingua.

Bar-Yosef, O. and M.P. Deborah. 2008. ASIA, WEST | Palaeolithic Cultures, in D.M. Pearsall (ed.) *Encyclopedia of Archaeology* : 865–875. New York: Academic Press.

Bar-Yosef, O., D.E. Mayer and N. Porat. 2008. Green stone beads at the dawn of agriculture. *Proceedings of the National Academy of Sciences* 105: 8548–8551.

Bar-Yosef, O. and P. Van Peer. 2009. The chaine opératoire approach in Middle Paleolithic archaeology. *Current Anthropology* 50(1): 103–131. DOI: https://doi.org/10.1086/592234.

Barge-Mahieu, H. and Y. Taborin. 1991. Fiche canines residuelles de cerf (appelées craches), in H. Camps-Fabrer (ed.) *Fiches typologiques de l'industrie osseuse préhistorique.Cahier IV. Objets de parure*. Aix-en-Provence: Université de Provence.

Bartelheim, M. 2007. *Die Rolle der Metallurgie in vorgeschichtlichen Gesellschaften*, Forschungen zur Archäometrie und Altertumswissenschaft 2. Rahden/Westf: Marie Leidorf.

Basalla, G. 1988. *The Evolution of Technology.* Cambridge: Cambridge University Press.

Bastert-Lamprichs, K., N. Benecke, S. Hansen and R. Neef. 2012. *Der Beginn der Landwirtschaftim Sudkaukasus. Die Ausgrabungen in Aruchlo in Georgien*. Berlin: DAI Eurasien Abteilung.

Baxter, M.J. and H.E.M. Cool. 2010. Correspondence analysis in R for archaeologists: an educational account. *Archeologia e Calcolatori* 21: 211–228.

Beck, A.R. and G. Philip. 2012. The archaeological exploitation of declassified satellite photography in semi-arid environments, in W.S. Hanson and I.A. Oltean (eds) *Archaeology from Historical Aerial and Satellite Archives*: 261–278. New York: Springer.

Beeston, R.F., J. Palatinus, C. Beck and E.C. Stout. 2006. Organic residue analysis of pottery sherds from Chrysokamino. *Hesperia Supplements* 36: 413–428.

Behre, K.E. 2008. Collected seeds and fruits from herbs as prehistoric food. *Vegetation History and Archaeobotany* 17: 65–73.

Beijerinck, W. 1947. *Zadenatlas der Nederlandsche flora*. Wageningen: E. Veenman and Zonen.

Beldiman, C. 2007. *Industria materiilor dure animale în preistoria României. Resurse naturale, comunităţi umane şi tehnologie din paleoliticul superior până în neoliticul timpuriu.* Bucureşti: Asociaţia Română de Arheologie, Studii de Preistorie, Supplementum 2, Editura Pro Universitaria.

Beldiman, C., D.-M. Sztancs and C. Ilie. 2012. *Artefacte din materii dure animale* în *colecţia Muzeului de Istorie Galaţi. Eneolitic (Osseous materials artefacts in the collection of History museum of Galaţi. Aeneolithic).* Cluj Napoca: Editura Mega.

Benac, A. 1961. Neolitski telovi u sjeveroistočnoj Bosni i neki problemi bosanskog neolita. *Glasnik Zemaljskog Muzeja u Sarajevu* 15–16: 39–78.

Bendixen, M. 1995. Compositional perceptual mapping using Chi-squared Tree Analysis and Correspondence Analysis. *Journal of Marketing Management* 11: 571–581.

Benecke, N. 2009. Arheozoološka istraživanja. *Glasnik Zemaljskog Muzeja Bosne i Hercegovine u Sarajevu* 50–51: 124–126.

Benecke, N., S. Hansen, D. Nowacki, A. Reingruber, K. Ritchie and J. Wunderlich. 2013. Pietrele in the lower Danube region: integrating archaeological, faunal and environmental investigations. *Documenta Praehistorica* 40: 175–193.

Bentley, R.A., T.D. Price, J. Lüning, D. Gronenborn, J. Wahl and P.D. Fullagar. 2002. Human migration in early Neolithic Europe. *Current Anthropology* 43: 799–804.

Bentsen, S.E. 2013. Using pyrotechnology: Fire-related features and activities with a focus on the African Middle Stone Age. *Journal of Archaeological Research* 22: 1–35.

Bebber, M.R. 2021. The Role of Functional Efficiency in the Decline of North America's Copper Culture (8000–3000 BP): An Experimental, Ecological, and Evolutionary Approach. *Journal of Archaeological Method and Theory*. DOI: https://doi.org/10.1007/s10816-020-09497-0

Berciu, D. 1961. *Contribuţii la problemele neoliticului* în *Romînia* în *lumina noilor cercetări*. Bucureşti: Editura Academiei Republicii Populare Romine.

Berciu, D. 1967. *Romania: Before Burebista*. London: Thames and Hudson.

Berdenov, S. 2008. Kazahstanskie mestorozhdeniya medi i olova i ih razrabotka v bronzovom veke (Kazakh sources of copper and tin and their processing in the Bronze Age, in Russian). *Izvestiya Natsionalnoy Akademii nauk Respubliki Kazahstana. Seriya obschestvennyih nauk* 1: 42-55.

Bibikov, S.N. 1953. Rannetripolskoe poselenie Lukavrublevetskaya na Dnestre. *Materialy i Issledovanija po Arkheologii SSR* 38.

Biehl, P. and A. Marciniak. 2000. The construction of hierarchy: rethinking the Copper Age in Southeastern Europe, in M. Diehl (ed.) *Hierarchies in*

Action: Cui Bono? :181–209. Carbondale (IL): Center for Archaeological Investigations, Southern Illinois University.

Birch, T., Th. Rehren and E. Pernicka. 2013. The metallic finds from Çatalhöyük: a review and preliminary new work, in I. Hodder (ed.) *Substantive Technologies at Çatalhöyük*: 307–316. London, Los Angeles (CA): British Institute at Ankara, Cotsen Institute of Archaeology.

Biró, K.T. 2014. Carpathian obsidians: state of art of Central European obsidian research, in M. Yamada and A. Ono (eds) *Lithic Raw Material Exploitation and Circulation in Préhistory. A Comparative Perspective in Diverse Palaeoenvironment. ERAUL* 138: 45–67.

Bitelli G. and V.A. Girelli. 2009. Metrical use of declassified satellite imagery for an area of archaeological interest in Turkey. *Journal of Cultural Heritage* 10, Supplement 1: 35–40.

Blagojević, M. 2005. Keramičke posude iz ranoeneolitske kuće sa lokaliteta Livade, Kalenić. *Kolubara* 4: 31–78.

Blažić, S. 1985. Prilog poznavanju ostataka faune sa arheološkog lokaliteta 'Golokut'. *Rad Vojvođanskih muzeja* 29: 33–35.

Blažić, S. 1995. Ostaci životinjskih vrsta sa lokaliteta na trasi auto-puta kroz Srem, in Z. Vapa (ed.) *Arheološka istraživanja duž auto-puta kroz Srem*: 331–346. Novi Sad: Pokrajinksi zavod za zaštitu spomenika kulture.

Blažić, S. 2005. The faunal assemblage, in S. Karmanski (ed.) *Donja Branjevina: a Neolithic Settlement near Deronje in the Vojvodina (Serbia)*: 74–76. Trieste: Societa per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia.

Blažić, S., and D. Radmanović. 2011. Fauna kasnovinčanskih staništa Crkvine i Belež. *Kolubara* 5: 239–250.

Bleed, P. 2008. Skill matters. *Journal of Archaeological Method and Theory* 15: 154–166.

Blondel, V.D., J.-L Guillaume, R. Lambiotte and E. Lefebvre. 2008. Fast unfolding of communities in large networks. *Journal of Statistical Mechanics: Theory and Experiment* 10: P10008.

Bloom, R., R. Crippen, C. Elachi, J. Zarins, N. Clapp and G.R. Hedges. 1997. Space technology and the discovery of lost city of Ubar. *IEEE Aerospace Conference Proceedings* 1: 19–28.

Boardman, S. and G. Jones. 1990. Experiments on the effects of charring on cereal plant components. *Journal of Archaeological Science* 17: 1–11.

Bocquet-Appel, J.-P. 2002. Paleoanthropological traces of a Neolithic demographic transition. *Current Anthropology* 43: 637–650.

Boëda, E. 1990. Identification de chaînes opératoires lithiques de paléolithique ancien et moyen. *Paléo* (2): 43–80.

Boessneck, J. 1969. Osteological differences between sheep (*Ovis aries* Linn.) and goat (*Capra hircus* Linn.), in D. Brotwell and E Higgs (eds) *Science in Archaeology*: 331–358. London: Thames and Hudson.

Boessneck, J., H.-H. Müller and M. Teichert. 1964. Osteologische Unterscheidungsmerkmale zwischen Schaf (*Ovis aries* Linné) und Ziege (*Capra hircus* Linné). *Kühn-Archiv* 78: 1–29.

Bogaard, A. 2004. *Neolithic Farming in Central Europe. An Archaeobotanical Study of Crop Husbandry Practices.* London: Routledge.

Bogaard, A., J. Bending and G. Jones. 2007. Archaeobotanical evidence for plant husbandry and use at Ecsegfalva 23, in A. Whittle (ed.) *The Early Neolithic on the Great Hungarian Plain: Investigations of the Körös Culture Site of Ecsegfalva 23, Co. Békés*: 421–445. Budapest: Institute of Archaeology, Hungarian Academy of Sciences.

Bogaard, A. and P. Halstead 2015. Subsistence practices and social routine in Neolithic southern Europe, in C. Fowler, J. Harding and D. Hofmann (eds) *The Oxford Handbook of Neolithic Europe*: 385–410. Oxford: Oxford University Press.

Bogdanov, B. 1982. Bulgaria, in F.W. Dunning, W. Mykura and D. Slater (eds) *Mineral Deposits of Europe. Volume 2: Southeast Europe*: 215–232. London: The Institute of Mining and Metallurgy and the Mineralogical Society.

Bogdanović, M. 1988. Architectural and Structural Features at Divostin, in A. McPherron and D. Srejović (eds) *Divostin and the Neolithic of Central Serbia*: 35–142. Pittsburgh: University of Pittsburgh. Kragujevac: Narodni muzej Kragujevac.

Bogdanović, M. 1990. Die Spätneolithischen Siedlüngen in Divostin, in D. Srejović and N. Tasić (eds) *Vinča and its World*: 99–106. Belgrade: Serbian Academy of Sciences and Arts, Centre for Archaeological Research, Faculty of Philosophy.

Bogdanović, M. 1992. Iskopavanja na neolitskom naselju Gruža u Grivcu. Glasnik Srpskog arheološkog društva 8: 41–45.

Bogdanović, M. 2004. Naselja Vinčanske kulture. Arhitektura, in M. Bogdanović (ed.) *Grivac. Naselje protostarčevačke i vinčanske kulture*: 157–204. Kragujevac: Centar za naučna istraživanja SANU i Univerziteta u Kragujevcu, Narodni Muzej Kragujevac.

Bognár-Kutzián, I. 1963. *The Copper Age Cemetery of Tiszapolgar-Basatanya*. Budapest: Akademiai Kiado.

Bognár-Kutzián, I. 1972. *The Early Copper Age Tiszapolgar Culture in the Carpathian Basin*. Budapest: Akademiai Kiado.

Bognár-Kutzián, I. 1976. On the origins of early copper-processing in Europe, in J.V.S. Megaw (ed.) *To Illustrate the Monuments. Essays on Archaeology Presented to Stuart Piggott*: 6–76. London: Thames and Hudson.

Bogosavljević, V. 1989. Uvod u rudarsku arheologiju na Kopaoniku (oblici starog rudarstva i metalurgije). *Journal of Serbian Archaeological Society* 9: 86–93.

Bogosavljević, V. 1995. Mining hammerstones of Prljuša-Mali Šturac site, in P. Petrović and S.

Đurđekanović (eds) *Ancient Mining and Metallurgy in Southeast Europe*: 37–44. Bor, Belgrade: Archaeological Institute Belgrade, Museum of Mining and Metallurgy Bor.

Bogosavljević, V., K. Penezić, J. Jovanović, and S. Stefanović. 2019. Human jaw bone from the Late Neolithic Pločnik site: A multidisciplinary approach. *Zbornik Narodnog Muzeja* (Belgrade) 24: 9–30.

Bogosavljević, V., D. Mrkobrad and D. Bogosavljević. 1988. Istraživanje srednjovekovnog rudarstva na zapadnom Kopaoniku (okolina Kiževaka). *Naša Prošlost (Kraljevo)* 3: 9–48.

Bogosavljević-Petrović, V. 1992. *Okresana kamena industrija sa neolitskog naselja Divlje Polje: katalog povodom izložbe 'Tehnologija obrade kamena u neolitu'*. Kraljvo: Narodoni muzej Kraljevo.

Bogosavljević-Petrović, V. 1995. Arheometalurški kompleksi na Kopaoniku (Archaeometallurgical complexes in Kopaonik, in Serbian). *Journal of Serbian Archaeological Society* 10: 58–71.

Bogosavljević-Petrović, V. 2011. Redukcija kamenih sirovina na lokalitetu Crkvine – sonda 5 sa arheološkim celinama, in M. Blagojević (ed.) *Kolubara* 5: 213–238. Beograd: Republički zavod za zaštitu spomenika kulture.

Bogosavljević-Petrović, V. and J. Marković. 2012. History and current studies of petroarcheological data from the Neolithic and Chalcolithic in Serbia *Bulgarian e-journal of Archaeology* 2(1): 51–66. http://be-ja.org/article/history-and-current-studies-of-petroarcheological-data-from-the-neolithic-and-eneolithic-in-serbia/

Bogosavljević-Petrović, V. and J. Marković. 2014. Raw material studies of West Central Serbia. *Journal of Lithic Studies* 1(1): 55–71. DOI: https://doi.org/10.2218/jls.v1i1.823.

Bogosavljević-Petrović, V., J. Marković and Lj. Rašković. 2012. Savremeni rudnik magnezita 'Lazac': izvor za arheološka proučavanja. *Naša prošlost* 13: 79–96.

Bogosavljević-Petrović, V. and A. Starović. 2013. Balkanski kremen iz zbirke za stariji neolit Narodnog muzeja u Beogradu. *Zbornik Narodnog muzeja, Serija: Arheologija* 21(1): 77–108.

Bogosavljević-Petrović, V. and M. Tomović. 1993. Kasnoantički rudarsko-metalurški kompleks na zapadnom Kopaoniku. *Journal of Serbian Archaeological Society* 9: 236–240.

Bogucki, P. 1982. *Early Neolithic Subsistence and Settlement in the Polish Lowlands.* (British Archaeological Reports International Series S150). Oxford: Archaeopress.

Boivin, N. and M.-A. Owoc. 2004. *Soil, Stones and Symbols: Cultural Perceptions of the Mineral World.* London: University College London.

Bojadžiev, J. 2002. Die absolute Datierung der neo- und äneolithischen Gräberfelder von Durankulak, in H. Todorova (ed.) *Durankulak, Band II - Die prähistorischen Gräberfelder von Durankulak, Teil 1*: 67–70. Sofia: Publishing House Anubis Ltd.

Bojňanský, V. and A. Fargašová. 2007. *Atlas of Seeds and Fruits of Central and East European Flora: the Carpathian Mountains Region*. Dordrecht: Springer.

Bökönyi, S. 1970. Animal remains from Lepenski Vir. *Science* 167: 1702–1704.

Bökönyi, S. 1974. The vertebrate fauna, in M. Gimbutas (ed.) *Obre I and II: Neolithic Sites in Bosnia*: 55–154. Wissenschaftliche Mitteilungen des Bosnisch-herzegowinischen Landesmuseums, Band 3, Heft B (Archäologie). Sarajevo: Zemaljski Muzej.

Bökönyi, S. 1976. The vertebrate fauna from Anza, in Gimbutas, M. (ed.) *Neolithic Macedonia*: 313–374. Los Angeles: University of California Press.

Bökönyi, S. 1988. The Neolithic fauna of Divostin, in A., McPherron and D. Srejović (eds) *Divostin and the Neolithic of Central Serbia*: 419–445. Pittsburgh: University of Pittsburgh:

Bökönyi, S. 1991. Prehistoric animal remains from Bubanj-Hum at Niš. *Starinar* 40–41: 89–94.

Bökönyi, S. 1992. Animal remains of Mihajlovac-Knjepište: an early Neolithic settlement of the Iron Gate Gorge. *Balcanica* 23: 77–87.

Bolomey, A. and S. Marinescu-Bîlcu. 1988. Industria osului în aşezarea cucuteniana de la Draguşeni-Ostrov. *Studii şi cercetari de istorie veche şi arheologie* 39/4: 331–353.

Bonga, L. 2013. Late Neolithic Pottery from Mainland Greece, ca., 5,300–4,300 BC. Unpublished PhD dissertation. Temple University, Philadelphia.

Bonnardin, S. 2008. From traces to function of ornaments: some Neolithic, in L. Longo and N. Skakun (eds) *Prehistoric Technology 40 Years Later: Functional Studied and the Russian Legacy*: 297–308. Oxford: Archeopress.

Bonsall, C., M. Gurova, C. Hayward, C. Nachev and N. Pearce. 2010. Characterization of 'Balkan flint' artefacts from Bulgaria and the Iron gates using LA-ICP-MS and EPMA. *Interdisciplinary Studies* 22–23: 9–18.

Borić, D., B. Hanks, D. Šljivar, M. Kočić, J. Bulatović, S. Griffiths, R. Doonan and D. Jacanović. 2018. Enclosing the Neolithic World: A Vinča Culture Enclosed and Fortified Settlement in the Balkans. *Current Anthropology* 59: 336-346.

Borojević, K. 1990. Analiza Paleobotaničkih Makroostataka sa Arheoloških Lokaliteta u Srbiji. Unpublished MA dissertation, Department of Archaeology, University of Belgrade, Serbia.

Borojević, K. 2006. *Terra and Silva in the Pannonian Plain: Opovo Agro-Gathering in the Late Neolithic* (British Archaeological Reports International Series 1563). Oxford: Archaeopress.

Borojević, K. 2013. *New plant evidence from the Middle and Late Neolithic in central Balkans.* Paper presented at the 16th Conference of the International Work

Group for Palaeoethnobotany, Thessaloniki, Greece. Abstract in *Book of Abstracts*: 99.

Borojević, K., D. Antonović, J. Vuković, V. Dimitrijević, D. Filipović, M. Marić, K. Penezić, B. Tripković, V. Bogosavljević-Petrović and N. Tasić. 2020. Use of space in a Late Neolithic/Early Eneolithic building at the site of Vinča-Belo Brdo in the Central Balkans, in N. Tasić, D. Urem-Kotsou and M. Burić (eds) *Making Spaces into Places. The North Aegean, the Balkans and Western Anatolia in the Neolithic.* (British Archaeological Reports International Series S3001): 157–168. Oxford: BAR Publishing.

Boroffka, N., Cierny, J., Lutz, J., Parzinger, H., Pernicka, E. and G. Weisgerber 2002. Bronze Age tin from Central Asia, in K. Boyle, C. Renfrew and M. Levine, M. (eds.) *Ancient Interactions: East and West in* Eurasia, 135-159. Cambridge: McDonald Institute Monographs.

Bourgarit, D. 2007. Chalcolithic copper smelting, in S. La Niece, D. Hook and P. Craddock (eds) *Metals and Mines: Studies in Archaeometallurgy*: 3–14. London: Archetype Publications.

Boyadžiev, Y. 1995. Chronology of prehistoric cultures in Bulgaria, in D.W. Bailey, I. Panayotov and S. Alexandrov (eds) *Prehistoric Bulgaria* (Vol. Monographs in World Archaeology No. 22): 149–192. Madison (WI): Prehistory Press.

Boyadžiev, Y. 2002. Die absolute Chronologie der neo- und äneolithischen Gräberfelder von Durankulak, in H. Todorova (ed.) *Durankulak- Die Prähistorischen Gräberfelder*: 67–70). Sofia: The Bulgarian Academy of Sciences.

Brami, M. 2017. *The diffusion of Neolithic practices from Anatolia to Europe. A contextual study of residential construction, 8,500-5,500 BC cal BC*. (British Archaeological Reports International Series S2838). Oxford: BAR Publishing.

Breunig, P. 1987. *14C-Chronologie des vorderasiatischen, südost- und mitteleuropäischen Neolithikums*. Wien: Fundamenta A/13, Böhlau Verlag, Köln.

Brochier, J.É. 2013. The use and abuse of culling profiles in recent zooarchaeological studies: some methodological comments on 'frequency correction' and its consequences. *Journal of Archaeological Science* 40: 1416–1420.

Bronk Ramsey, C. 2009. Bayesian analysis of radiocarbon dates. *Radiocarbon* 51: 37–60.

Brovkin, V., S. Lorenz, T. Raddatz, T. Ilyina, I. Stemmler, M. Toohey, and M. Claussen 2019. What was the source of the atmospheric CO2 increase during the Holocene? *Biogeosciences* 16: 2543-2555.

Brown, B.M. 1987. Population estimation from floor area: a restudy of 'Naroll's Constant' *Cross-Cultural Research* 21: 1–49.

Brukner, B. 1962. Praistorijsko naselje Beletinci kod Obreža. *Rad Vojvođanskih muzeja* 11: 89–122.

Brukner, B. 1977. Beitrag zur Feststellung des Beginns der Metallurgie und der Aeneolithisierung. *Archaeologia Iugoslavica* 18: 9–12.

Brukner, B. 1980. Naselje vinčanske grupe na Gomolavi (neolitski i ranoeneolitski sloj). Izveštaj sa iskopavanja 1967-1976. *Rad Vojvođanskih Muzeja* 26: 5–55.

Brukner, B. 1988. Die Siedlung der Vinča-Gruppe auf Gomolava (die Wohnschicht des spätneolithikums und frühäneolithikums – Gomolava Ia-b und Gomolava Ib) und der Wohnhorizont des äneolithischen Humus (Gomolava II), in N. Tasić and J. Petrović (eds) *Gomolava – Chronologie und Stratigraphie der vorgeschichtlichen und antiken Kulturen der Donauniederung und Südosteuropas. Internationales Symposium, Ruma, 1986*: 9–38. Novi Sad: Vojvođanski muzej.

Brukner, B. 2002. Die Vinča–Kultur in Raum und Zeit: 61–103. Sarajevo, Frankfurt A/M, Berlin, Heidelberg, Knj. 30: Godišnjak Akademije nauka i umetnosti Bosne i Hercegovine, Centar za balkanološka ispitivanja.

Brukner, B. 2003. Vinčanska kultura u prostoru i vremenu. *Rad Muzeja Vojvodine* 43–45: 7–28.

Brysbaert, A. and A. Gorgues (eds). 2017. *Artisans Versus Nobility? Multiple Identities of Elites and 'Commoners' Viewed through the Lens of Crafting from the Chalcolithic to the Iron Ages in Europe and the Mediterranean.* Leiden: Sidestone Press.

Buckley, M., S. Whitcher Kansa, S. Howard, S. Campbell, J. Thomas-Oates and M. Collins. 2010. Distinguishing between archaeological sheep and goat bones using a single collagen peptide. *Journal of Archaeological Science* 37: 13–20.

Budd, P. 1991. Eneolithic arsenical copper - heat-treatment and the metallographic interpretation of manufacturing processes, in E., Pernicka and G.A. Wagner (eds) *Archaeometry '90: International Symposium on Archaeometry*: 35–44. Heidelberg: Birkhäuser Verlag.

Budd, P. and B.S. Ottaway. 1991. The properties of arsenical copper alloys: implications for the development of eneolithic metallurgy, in P. Budd, B. Chapman, C. Jackson, R. Janaway and C.A. Ottaway (eds) *Archaeological Sciences 1989: Proceedings of a Conference on the Application of Scientific Techniques to Archaeology, Bradford, September 1989*: 132–142. Bradford: Oxbow Books.

Budd, P. and T. Taylor. 1995. The faerie-smith meets the bronze industry - magic versus science in the interpretation of prehistoric metal-making. *World Archaeology* 27: 133–143.

Budden, S. 2008. Skill amongst the sherds: understanding the role of skill in the early to late Middle Bronze Age in Hungary, in I. Berg (ed.) *Breaking the Mould: Challenging the Past through Pottery. Prehistoric Ceramics Research Group Occasional Paper 6* (British Archaeology Reports International Series S1861): 1–18. Oxford: Archaeopress.

Buder, I. 1984. Uticaj vojnih činilaca na razvoj fotogrametrije. *Zbornik radova, Vojnogeografski institut:* 89–99. Beograd.

Бугарски, И. and В. Иванишевић. 2014a. Оживљавање изгубљених крајолика. *Гласник Друштва конзерватора Србије* 38: 252–254. Београд.

Бугарски, И and В. Иванишевић. 2014b. Примена аерофотографије у српској археологији. *Саопштења* XLVI: 251–263. Београд.

Bulatović, A. 2003. *Nalazi vinčanske kulture sa Fafosa i Valača*. Vranje: Narodni Muzej.

Bulatović, A. 2007. Vranje: kulturna stratigrafija praistorijskih lokaliteta u Vranjskoj regiji. Beograd: Arheološki institut, Vranje: Narodni muzej.

Bulatović, A. 2015. The phenomenon of prehistoric ritual pits: several examples from the central Balkans (in Serbian). *Starinar* 65: 7–35. DOI: https://doi.org/10.2298/STA1565007B.

Bulatović, A. and C. Jović. 2009. Leskovac: kulturna stratigrafija praistorijskih lokaliteta u Leskovačkoj regiji. Beograd: Arheološki institut, Leskovac: Narodni muzej.

Bulatović, A. and D. Milanović. 2020. *Bubanj. The Eneolithic and the Early Bronze Age Tell in Southeastern Serbia*. (Mitteilungen der Prähistorischen Kommission, Band 90). Wien: VÖAW.

Bulatović, A., M. Vander Linden and M. Gori. 2018. New AMS dates as a contribution to the absolute chronology of the early Eneolithic in the central Balkans. *Starinar* 68: 19–32.

Bulatović, J. 2010. Ostaci faune iz zatvorenih eneolitskih celina na nalazištu Bubanj kod Niša. Unpublished MA dissertation, University of Belgrade.

Bulatović, J. 2011. Ostaci životinja iz kasnovinčanske jame na nalazištu Vitkovačko polje. *Kruševački Zbornik* 15: 237–272.

Bulatović, J. 2012. Eksploatacija domaćih životinja u kasnom neolitu i eneolitu na području centralnog Balkana. Studije slučaja: Vitkovo i Bubanj. *Glasnik Srpskog arheološkog društva* 28: 279–300.

Bulatović, J. 2018. Arheozoološki aspekti društvenih i kulturnih promena na centralnom Balkanu u petom milenijumu pre nove ere. Unpublished Ph.D. dissertation, University of Belgrade.

Bulatović, J. and S. Milošević. 2015. Životinjski ostaci iz potkapine Mokranjske Stene, in A. Kapuran and A. Bulatović (eds) *Mokranjske Stene: kulturno nasleđe Negotinske Krajine*: 41–55. Negotin: Muzej Krajine.

Bulatović, J. and M. Spasić. 2019. Životinjski ostaci sa neolitskog nalazišta Grabovac – Đurića vinogradi. *Zbornik Narodnog muzeja* 24–1 (arheologija): 63–84.

Bunardžić, R., M. Bunardžić, S. Derikonjić and P. Gavović. 2008. *Topography of Polimlje*. Belgrade: Republic Institute for Heritage Protection.

Burmeister, S., S. Hansen, M. Kunst and N. Müller-Scheeßel (eds). 2013. *Metal Matters. Innovative Technologies and Social Change in Prehistory and Antiquity* (Menschen - Kulturen - Traditionen 12, ForschungsCluster 2), Rahden/Westf: Leidorf.

Burton, J. 1984. Axe Makers of the Wahgi, Pre-Colonial Industrialists of the Papua New Guinea Highlands. Unpublished PhD dissertation, Australian National University.

C

Cameron, C.M. 1990. The effect of varying estimates of pit structure use-life on prehistoric population estimates in the American Southwest. *Kiva* 55: 155–166.

Campbell, G., L. Moffet and V. Straker. 2011. *Environmental Archaeology: A Guide to the Theory and Practice of Method, From Sampling and Recovery to Post-Excavation* (second edition). Swindon: English Heritage.

Camps-Fabrer, H. 1966. *Matière et art mobilier dans la préhistoire nord-africaine et saharienne.* Paris: Mémoires du Centre de recherches anthropologiques préhistoriques et ethnographiques.

Camps-Fabrer, H. 1979. Principes d'une classification de l'industrie osseuse néolithique et de l'âge des métaux dans le Midi méditerranéen, in H. Camps-Fabrer (ed.) *Industrie de l'os et bois de cervidé durant le néolithique et* âge *des métaux. Première réunion du groupe de travail no. 3 sur l'industrie de l'os préhistorique*: 17–26. Paris: Centre national de la recherche scientifique.

Cann, J.R. and C. Renfrew. 1964. The characterisation of obsidian and its application to the Mediterranean region. *Proceedings of the Prehistoric Society* 30: 111–133.

Cantacuzino, G. and S. Morintz. 1963. Die jungsteinzeitlichen Funde in Cernica (Bucureşti) *Dacia* 7.

Cantoro, G. 2012. A free set of tools for automated imagery rectification. *ISAP News* 30: 9–11.

Cantoro, G. 2015. Aerial reconnaissance in archaeology – from archives to digital photogrammetry, in A. Sarris (ed.) *Best Practices of Geoinformatic Technologies for the Mapping of Archaeolandscapes*: 103–114. Oxford: Archaeopress.

Cappers, R.T.J., R.M. Bekker and J.E.A. Jans. 2006. *Digital Seed Atlas of the Netherlands.* (Groningen Archaeological Studies 4). Eelde: Barkhuis Publishing.

Carneiro, R.L. 1986. On the relationship between size of population and complexity of social organization. *Journal of Anthropological Research* 42: 355–364.

Carneiro, R.L. 2000. The transition from quantity to quality: a neglected causal mechanism in accounting for social evolution. *Proceedings of the National Academy of Sciences of the United States of America* 97: 12926–12931.

Carter, T. 2009. L'obsidienne Égéenne: caractérisation, utilisation et culture, in M.-H. Moncel and F. Frohlich (eds) *L'Homme et Le Precieux. Matières Minérales Précieuses de La Préhistoire À Aujourd'hui*

(British Archaeological Reports International Series 1934): 199–212. Oxford: Archaeopress.

Carvajal-Ramírez, F., A.D. Navaro-Ortega and F. Agüera-Vega. 2019. Virtual reconstruction of damaged archaeological sites based on Unmanned Aerial Vehicle Photogrammetry and 3D modelling. Study case of a southeastern Iberia production area in the Bronze Age. *Measurement* 136: 225–236.

Cassana, J. and J. Cothren. 2008. Stereo analysis, DEM extraction and orthorectification of CORONA satellite imagery: archaeological applications from Near East. *Antiquity* 82(317): 732–49.

Cermanović-Kuzmanović, A. and D. Srejović. 1992. *Leksikon religija i mitova drevne Evrope.* Beograd: Savremena administracija.

Cessford, C. 2005. Absolute dating at Çatal Höyük, in I. Hodder (ed.) *Changing Materialities at Çatalhöyük: Reports from the 1995-99 Seasons*: 65–100. Cambridge: McDonald Institute Monographs, British Institute at Ankara.

Cevey, C., D. Günther, V. Hubert, K. Hunger, E. Hildbrand, M.-A. Kaeser, E. Lehmann, N. Müller-Scheessel, M. Wörle-Soares, C. Strahm and S. van Willigen. 2006. Neue archäometallurgische Untersuchungen zum Beginn der Kupferverarbeitung in der Schweiz. *Archäologie der Schweiz* 29: 24–33.

Çevik, Ö. 2018. What follows the Late Neolithic occupation in Central-Western Anatolia? A view from Ulucak, in S. Dietz, F. Mavridis, Ž. Tankosić and T. Takaoğlu (eds) *Communities in Transition: The Circum-Aegean Area in the 5th and 4th Millennia BC*: 506–512. Oxford: Oxbow.

Chapman, J. 1981. *Vinča Culture of South-East Europe: Studies in Chronology, Economy and Society* (British Archaeological Reports International Series S117). Oxford: Archaeopress.

Chapman. J. 1990. The Neolithic in the Morava-Danube confluence area: a regional assessment of settlement pattern, in D. Krstić and R. Tringham (eds) *Selevac. A Neolithic village in Yugoslavia* (Monumenta Archaeologica 15): 13–44. Los Angeles: University of California Press.

Chapman, J. 1991. The creation of social arenas in the Neolithic and Copper Age of South East Europe: the case of Varna, in P. Garwood, P. Jennings, R. Skeates and J.Toms (eds) *Sacred and Profane.* (Oxford Committee for Archaeology Monograph 32): 152–171. Oxford: Oxbow books.

Chapman, J. 1999a. The origins of warfare in the prehistory of central and eastern Europe, in J. Carman and A. Harding (eds) *Ancient Warfare: Archeological Perspectives*:101–142. Stroud: Sutton.

Chapman, J. 1999b. Deliberate house-burning in the prehistory of central and eastern Europe, in A. Gustafson and H. Karlsson (eds) *Glyfer och arkeologiska rum: En vänbok till Jarl Nordbladh*: 113–126. Göteborg: University of Göteborg Press.

Chapman, J. 2000. *Fragmentation in Archaeology. People, Places and Broken Objects in the Prehistory of South-Eastern Europe*. London and New York: Routledge.

Chapman, J. 2006. Dark burnished ware as a sign: ethnicity, aesthetics and categories in the later Neolithic of the central Balkans, in N. Tasić and C. Grozdanov (eds) *Homage to Milutin Garašanin*: 295–308. Belgrade: Serbian Academy of Sciences and Arts.

Chapman, J. 2007. The elaboration of an aesthetic of brilliance and colour in the climax Copper Age, in F. Lang, C. Reinholdt and J. Weilhartner (eds) *Stephanos Aristeios. Archäologische Forschungen zwischen Nil und Istros. Festschrift für Stefan Hiller zum 65. Geburtstag*: 64–74. Wien: Phoibos.

Chapman, J. 2010. Houses, households, villages and proto-cities in southeastern Europe, in D.W. Anthony and J.Y. Chi (eds) *The Lost World of Old Empire: The Danube Valley, 5000–3500 BC*: 74–89. Princeton (NJ): Institute for the Study of the Ancient World.

Chapman, J. 2011. Enchantment and enchainment in later Balkan prehistory: towards an aesthetic of precision and geometric order, in A. Hadjikoumis, E. Robinson and S. Viner (eds) *The Dynamics of Neolithisation in Europe. Studies in Honour of Andrew Sherratt*: 153–176. Oxford: Oxbow Books.

Chapman, J. 2013. From Varna to Brittany via Csõszhalom – Was there a «Varna Effect»? In A. Anders and V. Kulcsár (eds) *Moments in Time. Papers Presented to Pal Raczky on his 60th Birthday*: 323–335. Budapest: L'Harmattan.

Chapman, J. 2020a. *Forging Identities in Balkan Prehistory: Dividuals, Individuals and Communities, 7000–3000 BC*. Leiden: Sidestone.

Chapman, J. 2020b. The Vinča group – (Almost) 40 years on. *Quaternary International* 560–561: 5–19.

Chapman, J. and B. Gaydarska. 2007. *Parts and Wholes: Fragmentation in Prehistoric Context*. Oxford: Oxbow.

Chapman, J. and B. Gaydarska. 2020. The deposition of history in prehistory: copper objects on sites and in the landscape. *Proceedings of the Prehistoric Society* 86: 139–163.

Chapman, J. and E. Richter. 2009. Geometric order and scientific principles: a view from the Mesolithic, Neolithic and Chalcolithic of central and south east Europe, in G. Bodi (ed.) *In Medias Res Praehistorie. Miscellanea in Honorem Annos LXV Peragentis Professoris Dan Monah Oblata*: 21–58. Iaşi: Editura Universităţii 'Alexandru Ioan Cuza'.

Chapman, J. and S. Souvatzi. 2020. The Neolithic of Southeast Europe: recent trends. *Annual Review of Anthropology* 49(1): 123–140.

Chapman, J. and R.F. Tylecote. 1983. Early copper in the Balkans. *Proceedings of the Prehistoric Society* 49: 373–379.

Chapman, J., T. Higham, V. Slavchev, B. Gaydarska and N. Honch. 2006. The social context of the emergence, development and abandonment of the Varna cemetery, Bulgaria. *European Journal of Archaeology* 9: 159–183. DOI: https://doi.org/10.1177/1461957107086121.

Charles, J.A. 1969. Appendix I. A metallurgical examination of south-east European copper axes. *Proceedings of the Prehistoric Society* 35: 40–42.

Chataigner, C. 1998. Sources des artefacts Néolithiques, in M.-C. Cauvin, A. Gourgaud, B. Gratuze, N. Arnaud, P. Poupeau, J.L. Poidevin and C. Chataigner (eds) *L'Obsidienne Au Proche et Moyen Orient: Du Volcan À l'Outil* (British Archaeological Reports International Series 738: 273–324. Oxford: Archaeopress.

Chernykh, E.N. 1966. *Istorija Drevnejsej Metallurgii Vostocnoj Evropy (History of Ancient Metallurgy of Eastern Europe, in Russian)*. Moskva: Akademija Nauk SSSR.

Chernykh, E.N. 1978a. Aibunar - a Balkan copper mine of the fourth millennium BC. *Proceedings of the Prehistoric Society* 44: 203–217. DOI: https://doi.org/10.1017/S0079497X00010136.

Chernykh, E.N. 1978b. *Gornoe Delo i Metallurgiya v Dreivneishei Bolgarii*. Sofia: Bolgarskoi Akademii Nauk.

Chernykh, E.N. 1991. Frühestes Kupfer in der Steppen- und Waldsteppenkulturen Osteuropas, in J. Lichardus (ed.) *Die Kupferzeit als Historische Epoche*: 85–88. Bonn: Habelt.

Chernykh, E.N. 1992. *Ancient Metallurgy in the USSR: The Early Metal Age*. Cambridge: Cambridge University Press.

Chernykh, E.N. 1997. *Kargaly, Zabytyi mir (Kargaly, the Forgotten World, in Russian)*. Moscow: Izdatelstvo 'NOX'.

Chernykh, E.N. 2008a. Formation of the Eurasian 'steppe belt' of stockbreeding cultures: viewed through the prism of archaeometallurgy and radiocarbon dating. *Archaeology, Ethnology and Anthropology of Eurasia* 35: 36–53. DOI: http://dx.doi.org/10.1016/j.aeae.2008.11.003.

Chernykh, E.N. 2008b. The 'steppe belt' of stockbreeding cultures in Eurasia during the Early Metal Age. *Trabajos de Prehistoria* 65: 73–93.

Chernykh, E.N. 2013. *Nomadic Cultures in the Mega-Structure of Eurasian World.* Volume 1 (in Russian). Moscow: Jaziki Slavjanskoi Kulturi. Translation into English by Irina Savinetskaya and Peter N. Hommel and published also as Chernykh, E.N. 2017. Nomadic Cultures in the Mega-Structure of the Eurasian World. Boston, MA: Academic Studies Press with LRC Publishing House.

Chernykh, E.N. and S.V. Kuzminykh. 1989. *Ancient Metallurgy in the Northern Eurasia. Seyma-Turbino Phenomenon (in Russian)*. Moscow: Nauka.

Chernykh, E.N., S.V. Kuzminykh and L.B. Orlovskaya. 2004. Ancient metallurgy in northern Eurasia: from the Urals to the Sayano-Altai, in K.M. Linduff (ed.) *Metallurgy in Ancient Eastern Eurasia from the Urals to the Yellow River*: 15–36. Lewiston (NY): Edwin Mellen.

Chernykh, E. N. 2021. *The Cultures of Homo: Challenging essays about humankind's multi-million years history*. Moscow: TAUS.

Childe, V.G. 1930. *The Bronze Age*. Cambridge: Cambridge University Press.

Childe, V.G. 1929. *The Danube in Prehistory*. Oxford: Oxford University Press.

Childe, V.G. 1936. *Man Makes Himself.* London: Watts and Co.

Childe, V.G. 1936-37. Neolithic black ware in Greece and on the Danube. *The Annual of the British School at Athens* 37: 26–35.

Childe, V.G. 1944. Archaeological ages as technological stages. *Journal of the Royal Anthropological Institute of Great Britain and Ireland* 74: 7–24.

Childe, V.G. 1950. The urban revolution. *The Town Planning Review* 21: 3–17.

Childe, V.G. 1951. *Social Evolution*. London: Collins.

Chirikure, S. 2010. *Indigenous Mining and Metallurgy in Africa.* Cambridge, Cape Town: Cambridge University Press.

Chokhadzhiev, S. 2000. Development of the graphite ornamentation in the Copper Age (in the light of evidence from the Struma cultures), in L. Nikolova (ed.) *Technology, Style and Society. Contributions to the Innovations between the Alps and the Black Sea in Prehistory* (British Archaeological Reports International Series 854): 97–112. Oxford: Archaeopress.

Choyke, A. 1997. The bone tool manufacturing continuum. *Anthropozoologica* 25–26: 65–72.

Choyke, A. 2001. Late Neolithic red deer canine beads and their imitations, in A. Choyke and L. Bartosiewicz (eds) *Crafting Bone: Skeletal Technologies Through Time and Space. Proceedings of the 2nd Meeting of the (ICAZ) Worked Bone Research Group, Budapest, 31 August–5 September 1999*: 251–266. Oxford: Archaeopress.

Choyke, A. 2013. Hidden agendas: ancient raw material choice for worked osseous objects in Central Europe and beyond, in A. Choyke and S. O'Connor (eds) *From These Bare Bones: Raw Materials and the Study of Worked Osseous Objects*: 1–11. Oxford and Oakville: Oxbow Books.

Choyke, A. and J. Schibler. 2007. Prehistoric bone tools and the archaeozoological perspective: research in Central Europe, in C. Gates St-Pierre and R. Walker (eds) *Bones as Tools: Current Methods and Interpretations in Worked Bone Studies*: 51–65. Oxford: Archaeopress.

Christensen, M. 2004. Fiches caractères morphologiques, histologiques et mécaniques des matières dures d´origine animale, in D. Ramseyer (ed.) *Matières et Techniques. Fiches de la Commission de Nomenclature sur l'Industrie de l'Os Préhistorique. Cahier XI*: 17–27. Paris: Centre national de la recherche scientifique.

Christidou, R. 2001. Study of bone tools at three late/final Neolithic sites from Northern Greece, in A. Choyke and L. Bartosiewicz (eds) *Crafting Bone: Skeletal Technologies Through Time and Space – Proceedings of the 2nd Meeting of the (ICAZ) Worked Bone*

Research Group, Budapest, 31 August–5 September 1999: 41–47. Oxford: Archaeopress.
Clason, A. 1979. The farmers of Gomolava in the Vinča and La Tene period. *Palaeohistoria* 21: 42–81.
Clason, A. 1980. Padina and Starčevo: game, fish and cattle. *Palaeohistoria* 22: 142–173.
Collard, M., A. Ruttle, B. Buchananand M.J. O'Brien. 2013. Population size and cultural evolution in nonindustrial food-producing societies. *PLoS ONE* 8, e72628.
Colominas, L. 2013. Specialization or re-utilization? Study of the selection documented in a bone-working refuse. Assemblage from Roman Baetulo (Badalona, Spain), in A. Choyke and S. O'Connor (eds) *From These Bare Bones: Raw Materials and the Study of Worked Osseous Objects*: 88–95. Oxford and Oakville: Oxbow Books.
Comşa, E. 1973. Parures néolithiques en coquillages marins découvertes en territorie roumain. *Dacia* XVII: 61–76.
Comșa, E. 1990. Complexul neolitic de la Radovanu. *Cultură și civilizație la Dunărea de Jos* 8: 7–126.
Comşa, E. 1991. L'utilisation du cuivre en Roumanie pendent le néolithique moyen, in J.-P. Mohen and C. Éluère (eds) *Découverte du Métal*: 77–84. Paris: Picard.
Cook, S.F. 1972. *Prehistoric Demography.* Reading (MA): Addison-Wesley Publishing Company.
Corns, A. and R. Shaw. 2013. Lidar and World Heritage Sites in Ireland: Why was such a rich data source gathered, how is it being utilized, and what lessons have been learned? In R.S. Opitz and D.C. Cowley (eds) *Interpreting Archaeological Topography*: 146–160 Oxford: Oxbow Books.
Costin, C.L. 1991. Craft specialization: issues in defining, documenting and explaining the organization of production. *Archaeological Method and Theory* 3: 1–56.
Courcier, A. 2014. Ancient metallurgy in the Caucasus from the sixth to the third millennium BCE, in B.W. Roberts and C.P. Thornton (eds.) *Archaeometallurgy in Global Perspective*: 579–664. New York: Springer.
Craddock, P.T. 1995. *Early Metal Mining and Production*. Edinburgh: Edinburgh University Press.
Craddock, P.T. 2001. From hearth to furnace: evidences for the earliest metal smelting technologies in the eastern Mediterranean. *Paléorient* 26: 151–156.
Craddock, P.T. and N.D. Meeks. 1987. Iron in ancient copper. *Archaeometry* 29: 187–204.
Crnobrnja, A. 2009. *Neolitsko naselje na Crkvina u Stublinama*. Belgrade: Muzej grada Beograda.
Crnobrnja, A. 2011. Arrangement of Vinča culture figurines: a study of social structure and organisation. *Documenta Praehistorica* 38: 131–147.
Crnobrnja, A. 2012. Group identities in the Central Balkan Late Neolithic. *Documenta Praehistorica* 39: 155–165.
Crnobrnja, A. 2014. The (E)neolithic settlement Crkvine at Stubline, Serbia, in W. Schier and F. Draşovean (eds) *The Neolithic and Eneolithic in Southeast Europe: New Approaches to Dating and Cultural Dynamics in the 6th to 4th Millennium BC*: 173–186. Rahden: Leidorf.
Crnobrnja, A., Z. Simić and M. Janković. 2009. Late Vinča culture settlement at Crkvine in Stubline: household organisation and urbanisation in the late Vinča culture period. *Starinar* 59: 9–25.
Csányi, M., P. Raczky and J. Tárnoki. 2009. Preliminary report on the cemetery of the Bodrogkeresztúr culture excavated at Rákóczifalva-Bagi-föld. *Tisicum* 38: 13–34.
Cuénod, A., Bray, P., and A. Mark Pollard 2015. The "Tin Problem" in the Prehistoric Near East: Further Insights from a Study of Chemical Datasets on Copper Alloys from Iran and Mesopotamia. *Iran* 53: 29-48.
Čuljković, B., S. Stefanović and S. Romac. 2002. Upotreba PCR-a u fizičkoj antropologiji-utvrđivanje pola (The application of PCR in physical anthropology- determination of sex, in Serbian), in *Zbornik radova sa I simpozijuma antropologa Republike Srpske*: 23–31. Banja Luka: Društvo antropologa Republike Srpske.
Cuomo di Caprio, N. 2007. *Ceramica in Archeologia.* Roma: L'Erma Bretschneider.
Custer, J.F., T. Eveleigh, V. Klemas and I. Wells. 1986. Application of LANDSAT data and synoptic remote sensing to predictive models for prehistoric archaeological sites: An example from the Delaware coastal plain. *American Antiquity* 51(3): 572–588.
Cvetković, N. 2004. Motel Slatina – Paraćin Trench: Gasovod II, Analyses of the Neolithic Fauna, in M. Vasić, P. Vučković and B. Cvetković (eds) *The Central Pomoravlje in Neolithization of South East Europe*: 75–82. Belgrade: Archaeological Institute.

Č

Čađenović G., D. Rašković and M. Bugar. 2003. *Vitkovačko polje u praistorijskom periodu. Naselje vinčanske kulture*. Kruševac: Narodni muzej.
Čović, B. 1961. Rezultati sondiranja na preistorijskom naselju u Gornjoj Tuzli. *Glasnik Zemaljskog Muzeja (Sarajevo)* 15/16: 79–139.

D

Dammers, B., A. Franz, R.G. Sobott and K. Bente. 2012. Erste Ergebnisse archäometrischer Untersuchungen zur mittel- und spätneolithischen Keramik von Uivar (Rumänien) unter besonderer Berücksichtigung der 3D-µ-Röntgen-Computertomographie, in B. Ramminger and O. Stilborg (eds) *Naturwissenschaftliche Analysen vor- und frühgeschichtlicher Keramik II*: 33–57. Bonn: Habelt.
Darvill, T. 1987 *Ancient Monuments in the Countryside: An Archaeological Management Overview.* Swindon: English Heritage.
Davenport, W.G., M. King, M. Schlesinger and A.K. Biswas. 2002. *Extractive Metallurgy of Copper (4th Edition)*. Oxford: Pergamon.
Davies, O. 1937. Ancient mining in the central Balkans. *Revue Internationale des Etudes Balkaniques* 1: 405–418.

Deer, W.A., R.A. Howie and J. Zussman. 1992. *An Introduction to the Rock-Forming Minerals*. Harlow, London: Longman.

de Groot, B.G. 2019. A diachronic study of networks of ceramic assemblage similarity in Neolithic Western Anatolia, the Aegean and the Balkans (c. 6600–5500 bc). *Archaeometry* 61: 600–613. DOI: https://doi:10.1111/arcm.12450.

De Pascale, A. 2003. 'Hammerstones from early copper mines': Sintesi dei ritrovamenti nell'Europa e nel Mediterraneo orientale e prime considerazioni sui mazzuoli di Monte Loreto (IV millennio BC - Liguria). *Rivista di Studi Liguri* 69: 5–42.

Derex, M., M.-P. Beugin, B. Godelle and M. Raymond. 2013. Experimental evidence for the influence of group size on cultural complexity. *Nature* 503: 389–391.

Dergachev, V.A. 2004. Karbunskiy klad, in M. Videiko (ed.) *Encyclopedia Trypilskoi tsyvilizatsii. Volume 2.* : 213–214. Kyiv: Ukrpoligraphmedia.

Derikonjić, S. 1996. *Neolitske Zajednice Polimlja*. Proboj: Zavičajni muzej.

Derikonjić, S. 2010. *Tragom jarmovačkih rudara. Catalogue*. Priboj on Lim: Homeland Museum of Priboj.

Derikonjić, S., M. Radivojević, E. Pernicka and Th. Rehren. 2011. The Vinča culture mining complex in Jarmovac, southwest Serbia, in A. Hauptmann, D. Modarressi-Tehrani and M. Prange (eds) *Archaeometallurgy in Europe III: Proceedings of the 3rd International Conference, Deutsches Bergbau-Museum Bochum, June 29 – July 1, 2011*: 39. Bochum: Deutsches Bergbau-Museum.

Deroin, J.P., F. Téreygeol and J. Heckes. 2011. Evaluation of very high to medium resolution multispectral satellite imagery for geoarchaeology in arid regions – case study from Jabali, Yemen. *Journal of Archaeological Science* 38: 101–114.

d'Errico, F. 1993. Identification des traces de manipulation, suspension, polissage sur l'art mobilier en os, bois de cervidés, ivoire, in P. Anderson, S. Beyries, M. Otte and H. Plisson (eds) *Traces et Fonction: Les Gestes Retouvés. Actes du Colloque International de Liège*: 177–188. Liège: ERAUL.

d'Errico, F. and M. Vanhaeren. 2002. Criteria for identifying red deer (*Cervus elaphus*) age and sex from their canines. Application to the study of Upper Palaeolithic and Mesolithic Ornaments. *Journal of Archaeological Science* 29: 211–232.

Дероко, А. 1950. Кулич и Рам каструми на римском Дунавском лимесу. *Старинар* I: 169–173. Београд.

Дероко, А. 1951a. Смедеревски град. *Старинар* II: 59–98. Београд.

Дероко, А. 1951b. Град Голубац. *Старинар* II: 139–149. Београд.

Deschler-Erb, S., E. Marti-Grädel and J. Schibler. 2002. Die Knochen-, Zahn- und Geweihartefakte, in A. de Capitani, S. Deschler-Erb, U. Leuzinger, E. Marti-Grädel and J. Schibler (eds) *Die jungsteinzeitliche Seeufersiedlung Arbon / Bleiche 3: Funde*: 277–366. Archäologie im Thurgau, Band 11. Frauenfeld: Departement für Erziehung und Kultur des Kantons Thurgau.

Dewar, R.E. 1994. Contending with contemporaneity: a reply to Kintigh. *American Antiquity* 59: 149–152.

Diaconescu, D. 2014. New remarks about the typology and the chronology of the Pločnik and Čoka copper hammer-axes, in W. Schier and F. Draşovean (eds) *New Approaches to Dating and Cultural Dynamics in the 6th to 4th Millennium BC.* (Prähistorische Archäologie in Südosteuropa 28): 221–241. Rahden: Leidorf.

Díaz-Andreu, M. 2007. *A World History of Nineteenth-Century Archaeology Nationalism, Colonialism, and the Past.* Oxford: Oxford University Press.

Dimić, V. 2015**.** Traseological markers on ground stone cutting–implements from Lađarište site near Vrnjačka Banja. *Glasnik Srpskog arheološkog društva* 31: 39–73.

Dimić, V. 2013a Analiza glačanog i abrazivnog kamenog oruđa sa lokaliteta Lađarište kod Vrnjačke Banje. *Naša prošlost* 14: 31–56.

Dimić, V. 2013b Petrološka, trasološka i funkcionalno-tipološka studija glačanog i abrazivnog kamenog oruđa sa lokaliteta Lađarište kod Vrnjačke Banje, Odeljenje za arheologiju Filozofskog fakulteta, Univerzitet u Beogadu, Beograd.

Dimitrijević, S. 1968. *Sopotsko-Lenđelska kultura*. Zagreb: Archaeological Institute, Faculty of Philosophy.

Dimitrijević, S. 1974. Problem stupnjevanja starčevačke kulture s posebnim obzirom na doprinos južnopanonskih nalazišta rešavanju ovih problema. *Materijali* X: 59–122.

Dimitrijević, S. 1979. Sjeverna zona, in A. Benac (ed.) *Praistorija Jugoslovenskih Zemalja (Prehistory of Yugoslav Countries)*: 229–362. Sarajevo: Centar za balkanološka istraživanja Akademija nauka i umjetnosti Bosne i Hercegovine.

Dimitrijević, V. 2006. Vertebrate fauna of Vinča Belo Brdo (Excavation Campaigns 1998–2003). *Starinar* 56: 245–269.

Dimitrijević, V. and B. Tripković. 2002. New *Spondylus* findings at Vinča-Belo Brdo 1998–2001 campaigns and the regional approach to problem. *Starinar.* New series. LII: 48–62.

Dimitrijević, V. and B. Tripković. 2006. *Spondylus* and *Glycymeris* bracelets: trade reflections at Neolithic Vinča-Belo Brdo. *Documenta praehistorica* XXXIII: 237–252.

Dimitrov, K. 2002. Die Metallfunde aus den Gräberfeldern von Durankulak, in H. Todorova (ed.) *Durankulak, Band II – Die prähistorischen Gräberfelder von Durankulak, Teil 1*: 127–158. Berlin, Sofia: Publishing House Anubis.

Djurić, N. 1986. Nalazi sa neolitskog lokaliteta Kremen. *Zbornik 2*: 9–15

Dobney, K., and K. Reily. 1988. A method for recording archaeological animal bones: the use of diagnostic zones. *Cicaea* 5: 79–96.

Dobres, M.-A. and R. Hoffman. 1994. Social agency and the dynamics of prehistoric technology. *Journal of Archaeological Method and Theory* 1: 211–258.

Dobres, M.-A. and R. Hoffman (eds). 1999. *The Social Dynamics of Technology: Practice, Politics, and World Views.* Washington DC: Smithsonian Institution Press.

Dolfini, A. 2013. The emergence of metallurgy in the central Mediterranean region: a new model. *European Journal of Archaeology* 16: 21–62. DOI: https://doi.org/10.1179/1461957112Y.0000000023.

Dolfini, A. 2014. Early metallurgy in the central Mediterranean, in B.W. Roberts and C.P. Thornton (eds) *Archaeometallurgy in Global Perspective: Methods and Syntheses*: 473–506. New York: Springer.

Dolfini, A. and R.J. Crellin. 2016. Metalwork wear analysis: the loss of innocence. *Journal of Archaeological Science* 66: 78–87.

Dombay, J. 1939. *A Zengővárkonyi őskori Telep és Temető - The Prehistoric Settlement and Cemetery at Zengővárkony.* (Archaeologica Hungarica 23). Budapest: Magyar Történeti Múzeum.

Dombay, J. 1960. *Die Siedlung und das Graberfeld in Zengővárkony. Beitrage zur Kultur des Aeneolithikums in Ungarn* (Archeologica Hungarica 37). Budapest: Akadémiai Kiadó.

Draşovean, F. 2006. Nordgriechenland und der Mittlere Donauraum zum Ende des 6. und Beginn des 5. Jahrtausends v. Chr, in N. Tasić and C. Grozdanov (eds) *Homage to Milutin Garašanin*: 267–277. Belgrade: Serbian Academy of Sciences and Arts, Macedonian Academy of Sciences and Arts.

Draşovean, F. 2007. The Neolithic tells from Parţa and Uivar. Similarities and differences of the organization of the social space. *Analele Banatului* 15: 19–32.

Draşovean, F., W. Schier, A. Bayliss, B. Gaydarska and A. Whittle. 2017. The lives of houses: duration, context, and history at Neolithic Uivar, Romania. *European Journal of Archaeology* 20: 636–662. DOI: https://doi:10.1017/eaa.2017.37.

Draşovean, F., and W. Schier (eds). 2021. *Uivar "Gomila" A Prehistoric Settlement in the Romanian Banat. Vol. I: Site, Architecture, Stratigraphy and Dating.* (Prähistorische Archäologie in Südosteuropa 32). Rahden: Leidorf.

Dreibrodt, S., R. Hofmann, C. Lubos, S. Dazert, J. Zahrer, M. Fuchs and H.-R. Bork. 2013. Ergebnisse geomorphologisch-geoarchäologischer Begleituntersuchungen an den Siedlungen im Visokobecken (Bosnien-Herzegowina), in J. Müller, K. Rassmann and R . Hofmann (eds) *Okolište 1 - Untersuchungen einer spätneolithischen Siedlungskammer in Zentralbosnien*: 287–310. Bonn: Verlag Rudolf Habelt.

Drennan, R.D. 2009. *Statistics for Archaeologists. A Common Sense Approach*. New York: Springer.

Driehaus, J. 1952–55. Zur Datierung und Herkunft donauländischer Axttypen der frühen Kupferzeit. *Archaeologia Geographica* 2: 3–4: 1–8.

Dubbini, M., L.C. Curzio and A. Campedelli. 2016. Digital elevation models from unmanned aerial vehicle surveys for archaeological interpretation of terrain anomalies: case study of the Roman castrum of Burnum (Croatia). *Journal of Archaeological Science Reports* 8: 121–134.

Dubreuil, L. 2001. Functional studies of prehistoric grindingstones. A methodological research. *Bulletin du Centre de recherche français à Jérusalem* 9: 73–87.

Dumitrescu, H. 1961. Connections between the Cucuteni-Tripolie cultural complex and the neighbouring Eneolithic cultures in the light of the utilization of golden pendants. *Dacia* 5: 69–93.

Dunbar, R.I.M. 1993. Coevolution of neocortical size, group size and language in humans, *Behavioral and Brain Sciences* 16: 681–735.

E

Earle, T.K. 2018 Introduction: Artisans, technologies and consumers - a political economy approach to craft specialization, in I. Miloglav and J. Vuković (eds) *Artisans Rule: Product Standardization and Craft Specialization in Prehistoric Society*: 1–19. Newcastle upon Tyne: Cambridge Scholars Publishing.

Ecsedy, I. 1990. On the early development of prehistoric metallurgy in southern Transdanubia. *Godišnjak Akademije BiH 28. Centar za balkanološka ispitivanja (Sarajevo)* 26: 209–231.

Edwards, K.J., P. Halstead and M. Zvelebil. 1996. The Neolithic transition in the Balkans – archaeological perspectives and palaeoecological evidence: a comment on Willis and Bennet. *The Holocene* 6: 120–122.

Ehrhardt, K.L. 2014. Copper Working Technologies, Contexts of Use, and Social Complexity in the Eastern Woodlands of Native North America, in B.W. Roberts & C.P. Thornton (ed.) *Archaeometallurgy in Global Perspective: Methods and Syntheses*: 303-328. New York: Springer.

Ehrich, R.W. and H.A. Bankoff. 1992. East central and southeastern Europe, in R.W. Ehrich (ed.) *Chronologies in Old World Archaeology*: 31–375. Chicago: University of Chicago Press.

Eichler, A., G. Gramlich, T. Kellerhals, L. Tobler, Th. Rehren, and M. Schwikowski, 2017. Ice-core evidence of earliest extensive copper metallurgy in the Andes 2700 years ago. *Scientific Reports* 7: 41855.

Eliade, M. 1962. *The Forge and The Crucible.* London: Rider.

Elias, N. and N.J. Scotson. 1965. *The Established and the Outsider*. Lomdon: Frank Cass and Company Limited.

Ellenberg H., H.E. Weber, R. Düll, V. Wirth, W. Werner and D. Paulissen. 1992. Zeigerwerte von Pflanzen in Mitteleuropa. *Scripta Geobotanica* 18: 1–258.

Elliott, J.F. 1976. Phase relationships in the pyrometallurgy of copper. *Metallurgical and Materials Transactions B. Process Metallurgy and Materials Processing Science* 7: 17–33.

Elster, E. 2001. Middle Neolithic to Early Bronze Age bone tools from Sitagroi, Greece, in A. Choyke and L. Bartosiewicz (eds) *Crafting Bone: Skeletal Technologies through Time and Space – Proceedings of the 2nd Meeting of the (ICAZ) Worked Bone Research Group, Budapest, 31 August–5 September 1999*: 355–369. Oxford: Archaeopress.

El Susi, G. 2011. The management of livestock in the early Neolithic settlements (Starčevo Criş complex) from Transylvania and Banat, in S. Luca and C. Suciu (eds) *Early Neolithic (Starčevo Criş) Sites on the Territory of Romania*: 47–56. Oxford: Archaeopress.

Éluère, C. and C. J.Raub. 1991. Investigations on the gold coating technology of the great dish from Varna, in J.-P. Mohen and C. Éluère (eds) *Découverte du Métal*: 13–30. Paris: Picard.

Erkul E., D. Wilken, W. Rabbel, T. Yas, R. Hoffmann, N. Müller-Scheessel, K. Rassmann and J. Müller. 2013. Geoelektrische Untersuchugnen auf dem spätneolithischen Siedlungshügel von Okolište, in J. Müller, K. Rassmann and R. Hofmann (eds) *Okolište 1 - Untersuchungen einer spätneolithischen Siedlungskammer in Zentralbosnien. UPA 228*: 103–111. Bonn: Verlag Rudolf Habelt.

Evans, R. 1973. Craft Specialization in the Chalcolithic Period of the Eastern Portion of the Balkans Peninsula. Unpublished PhD dissertation, University of California.

Evin, A., L. Girdland Flink, A. Bălăşescu, D. Popovici, R. Andreescu, D. Bailey, P. Mirea, C. Lazăr, A. Boroneanţ, C. Bonsall, U. Strand Vidarsdottir, S. Brehard, A. Tresset, T. Cucchi, G. Larson and K. Dobney. 2015. Unravelling the complexity of domestication: a case study using morphometrics and ancient DNA analyses of archaeological pigs from Romania. *Philosophical Transactions of the Royal Society B* 370: 20130616.

F

Fagerberg, J. 2004. Innovation: a guide to the literature, in J. Fagerberg, J. Mowery and R. Nelson (eds) *The Oxford Handbook of Innovation*: 1–26. Oxford: Oxford University Press.

Feinman, G.M. 2011. Size, complexity, and organizational variation: a comparative approach. *Cross-Cultural Research* 45: 37–58.

Fewkes, V. 1936. Neolithic sites in the Morava-Danube area. *Bulletin of American School of Prehistoric Research* 12: 5–81.

Filipović, D. 2014. Southwest Asian founder and other crops at Neolithic sites in Serbia. *Bulgarian e-Journal of Archaeology* 4: 195–215.

Filipović, D., D. Challinor and M. Andrič. 2017. Vinča tell in southeast Europe: multi-proxy palaeobotanical evidence from Late Neolithic levels and the implications for the environment and economy. *Quaternary International* 429: 13–23. DOI: https://doi.org/10.1016/j.quaint.2014.09.059.

Filipović, D. and Đ. Obradović. 2013. Archaeobotany at Neolithic sites in Serbia: a critical overview of the methods and results, in N. Miladinović-Radmilović and S. Vitezović (eds) *Bioarheologija na Balkanu: bilans i perspektive*: 25–55. Beograd: Srpsko Arheološko Društvo.

Filipović, D. and N. Tasić. 2012. Vinča-Belo Brdo, a Late Neolithic site in Serbia: consideration of macro-botanical remains as indicators of dietary habits. *Balcanica* 43: 7–27.

Filipović, D., Đ. Obradović and B.Tripković. 2018. Plant storage in Neolithic southeast Europe: synthesis of the archaeological and archaeobotanical evidence from Serbia. *Vegetation History and Archaeobotany* 27: 31–44. DOI: https://doi.org/10.1007/s00334-017-0638-7.

Filipović, D., M. Marić, D. Challinor, J. Bulatović and N. Tasić. 2019. Natural environment and resources, and the long life of the Neolithic settlement at Vinča, southeast Europe. *Archaeological and Anthropological Sciences* 11: 1939-1960.

Filipovitch, L., I. Stefanova, M. Lazarova and M. Petrova. 1998. Holocene Vegetation in Stara Planina (the Balkan Range). *Phytologia Balcanica* 4/1–2: 13–25.

Fleming, L. and O. Sorenson. 2004. Science as a map in technological search. *Strategic Management Journal* 25: 909–928.

Fol, A. and J. Lichardus (eds). 1988. *Macht, Herrschaft und Gold: das Gräberfeld von Varna (Bulgarien) und die Anfänge einer neuen Europäischen Zivilisation.* Saarbrücken: Moderne Galerie des Saarland-Museums.

Food and Agriculture Organization of the UN. The Reference Soil Group of the Cambisols, viewed 05/12/2020, <http://www.fao.org/docrep/003/y1899e/y1899e08.htm>

Forenbaher, S. 1993. Radiocarbon dates and absolute chronology of the central European Early Bronze Age. *Antiquity* 67: 218–256.

Forte, V. 2019. Skilled people or specialists? Knowledge and expertise in Copper Age vessels from central Italy. *Journal of Anthropological Archaeology* 55: 1–20.

Forţiu, S. and A. Cîntar (eds). 2014. *ArheoVest, Nr. II: In Honorem Gheorghe Lazarovici. Interdisciplinaritate în Arheologie, Timișoara, 6 decembrie 2014, Volume 2: Metode Interdisciplinare, Asociația 'ArheoVest' Timișoara*. Szeged: JATEPress Kiadó.

Foster, G. 1965. The sociology of pottery: questions and hypothesis arising from contemporary Mexican work, in F. Matson (ed.) *Ceramics and Man* (Viking Fund Publications in Anthropology 4): 43–61. New York: Wenner-Gren Foundation for Anthropological Research Inc.

Fowler, M.J.F. 2012. Declassified intelligence satellite photographs, in S.W. Hanson and I.A. Oltean (eds) *Archaeology from Historical Aerial and Satellite Archives*: 47–65. New York: Springer.

Frame, L.D. 2012. Reconstructing ancient technologies: Chalcolithic crucible smelting at Tal-i Iblis, Iran, in P. Jett, B. McCarthy and J.G. Douglas (eds) *Scientific Research on Ancient Asian Metallurgy. Proceedings of the Fifth Forbes Symposium at the Freer Gallery of Art*: 183–204. Washington, DC: Archetype Publications in association with the Freer Gallery of Art, Smithsonian Institution.

Freudenberg, M. 2009. Steingerate zur Metallbearbeitung; Einige neue aspekte zum spatneolithichen und fruhbronzezeitlichen metallhanwerk von der hintergrund des Schleswig-Holsteinischen fundmaterials. Archaologisches Koresponedenzblatt 39(3): 341–359.

Frieman, C. 2021. *An archaeology of innovation: approaching social and technological change in human society*. Manchester: Manchester University Press.

Frierman, J. 1969. The Balkan graphite ware (Appendix II). *Proceedings of the Prehistoric Society* 35: 42–44.

Fuller, D.Q. and S.A. Weber. 2005. Formation processes and paleoethnobotanical interpretation in South Asia. *Journal of Interdisciplinary Studies in History and Archaeology* 2: 93–115.

Fuller, D.Q., C. Stevens and M. McClatchie. 2014. Routine activities, tertiary refuse, and labor organization. Social inferences from everyday archaeobotany, in M. Madella, C. Lancelotti and M. Savard (eds) *Ancient Plants and People: Contemporary Trends in Archaeobotany*: 174–217. Tucson: University of Arizona Press.

Fuller, D. Q., J. van Etten, K. Manning, C. Castillo, E. Kingwell-Banham, A. Weisskopf, A., L. Qin, Y-I. Sato and R.J. Hijmans, 2011. The contribution of rice agriculture and livestock pastoralism to prehistoric methane levels: An archaeological assessment. *The Holocene* 21: 743-759.

Furholt, M. 2012. Kundruci: Development of social space in a Late Neolithic tell-settlement in Central Bosnia, in R. Hofmann, F.-K. Moetz, and J. Müller (eds) *Tells: Social and Environmental Space. Proceedings of the International Workshop 'Socio-Environmental Dynamics over the Last 12,000 Years: The Creation of Landscapes II (14th–18th March 2011)' in Kiel, Vol. 3:* 203–219. Bonn: Habelt.

Furholt, M. 2013. Abseits des Weges – Prospektionen und Ausgrabungen in Kundruci, in J. Müller, K. Rassmann and R. Hofmann (eds) *Okolište I - Untersuchungen einer spätneolithischen Siedlungskammer in Zentralbosnien*: 173–206. Bonn: Habelt.

Furholt, M. 2017. *Das Ägäische Neolithikum und Chalkolithikum. Transformationen sozialer Handlungsmuster in Anatolien und Griechenland zwischen 6500 und 4000 v. Chr*, (Universitätsforschungen zur Prähistorischen Archäologie 304). Bonn: Habelt.

Furholt, M., J. Bátora, I. Cheben, H. Kroll, K. Rassmann and P. Tóth. 2014. Vráble – Veľké Lehemby: Eine Siedlungsgruppe der Linearkeramik in der Südwestslowakei. Vorbericht über die Untersuchungen der Jahre 2010 und 2012 und Deutungsansätze. *Slovenska Archaeologia* LXII(2): 227–266.

G

Gaastra, J.S., H.J. Greenfield and M.V. Linden. 2018. Gaining traction on cattle exploitation: zooarchaeological evidence from the Neolithic Western Balkans. *Antiquity* 92: 1462–1477. DOI: https://doi.org/10.15184/aqy.2018.178.

Gaastra, J.S., A. de Vareilles and M. Vander Linden. 2019. Bones and seeds: an integrated approach to understanding the spread of farming across the Western Balkans. *Environmental Archaeology:* 1–17. DOI: https://doi.org/10.1080/14614103.2019.1578016.

Gajić-Kvaščev, M., M.M.,Stojanović, Z. Šmit, V. Kantarelou, A.G. Karydas, D. Šljivar, D. Milovanović and V. Andrić. 2012. New evidence for the use of cinnabar as a colouring pigment in the Vinča culture. *Journal of Archaeological Science* 39: 1025–1033.

Gál, E. 2011. Prehistoric antler and bone tools from Kaposujlak-Vardomb (South-Western Hungary) with special regard to the Early Bronze Age implements, in J. Baron and B. Kufel-Diakowska (eds) *Written in Bones. Studies on Technological and Social Contexts of Past Faunal Skeletal Remains*: 137–164. Wrocław: Uniwersytet Wrocławski, Instytut Archeologii.

Gale, N.H., Z.A. Stos-Gale, P. Lilov, M. Dimitrov and T. Todorov. 1991. Recent studies of Eneolithic copper ores and artefacts in Bulgaria, in J.P. Mohen and C. Éluère (eds) *Découverte du Métal*: 49–76. Paris: Picard.

Gamble, C. 2007. *Origins and Revolutions: Human Identity in Earliest Prehistory*. Cambridge: Cambridge University Press.

Garašanin, D. 1961. Die Siedlung der Starčevokultur in Nosa bei Subotica und das Problem der neolitischen Lehmscheunen, in W. Dehn and G. Bersu (eds) *Bericht Uber Den V. Internationalen Kongress Fur Vor- und Fruhgeschichte Hamburg Vom 24. Bis 30. August*: 303–307. Berlin: Verlag Gebr. Mann.

Garašanin, M. 1951. Hronologija Vinčanske Grupe (Chronology of the Vinča Group, in Serbian). PhD dissertation, Univerza v Ljubljani.

Garašanin, M. 1954. Iz istorije mlađeg neolita u Srbiji i Bosni (History of the late Neolithic in Serbia and Bosnia). *Glasnik Zemaljskog Muzeja, Sarajevo* 9: 5–39.

Garašanin, M. 1973. *Praistorija na tlu Srbije (Prehistory in Serbia, in Serbian)*. Belgrade: Srpska Književna Zadruga.

Garašanin, M. 1979. Centralnobalkanska zona, in A. Benac (ed) *Praistorija jugoslavenskih zemalja* II: 144–212. Sarajevo: Svijetlost – Akademija nauka i umjetnosti Bosne i Hercegovine.

Garašanin, M. 1984. Vinča i vinčanska kultura u neolitu jugoistočne Evrope, in S. Ćelić (ed.) *Vinča u praistoriji i srednjem veku*: 42–57. Beograd: Galerija SANU.

Garašanin, M. 1990. Vinča und seine Stellung im Neolithikum Südosteuropa, in D. Srejović and N. Tasić (eds) *Vinča and Its World*: 11–16. Belgrade:

Serbian Academy of Sciences and Arts and Centre for Archaeological Research, Faculty of Philosophy.

Garašanin, M. 1991. Die Übergang vom Neolithikum zur frühen Bronzezeit auf dem Balkan und an der unteren Donau- ein Rückblick nach dreißig Jahren, in J. Lichardus (ed.) *Die Kupferzeit als Historische Epoche*: 205–216. Bonn: Dr. Rudolf Habelt Gmbh.

Garašanin, M. 1993. Zu den Problemen der Vinča-Gruppe in Rumänien. *Balcanica* 24: 7–20.

Garašanin, M. 1994/1995. Die Gradac-Stufe der Vinča-Gruppe und der Beginn des Aeneolithikums. *Dacia* 38/39: 9–17.

Garašanin, M. 1998 Vinčanska kultura i jadranski uticaji, in N. Tasić (ed.) *Arheološko blago Kosova i Metohije od neolita do ranog srednjeg veka*: 56–88. Beograd: Srpska akademija nauka i umetnosti.

Garašanin, M. and D. Garašanin. 1951. *Arheološki nalazi u Srbiji*. Beograd: Prosveta.

Garašanin, M. and D. Garašanin. 1958. Pavlovac kod Vranja – praistorijsko naselje. *Starinar* 7–8 (1956–1957).

Garašanin, M. and D. Garašanin. 1979. *Supska. 'Stublina' - praistorijsko naselje vinčanske grupe.* Beograd: Narodni muzej.

Gardner, E.J. 2003. Technical analysis of the ceramics / Appendix 7.1. Graphite-painted, in E.S. Elster and C. Renfrew (eds) *Excavations at Sitagroi, a Prehistoric Village in Northeast Greece: Vol. 2, The Final Report*: 283–298. Los Angeles: Cotsen Institute of Archaeology.

Garfinkel, Y., F. Klimscha, S. Shalev and D.Rosenberg. 2014. The beginning of metallurgy in the Southern Levant: a late 6th millennium Cal BC copper awl from Tel Tsaf, Israel. *PLoS ONE* 9: e92591. DOI: https://doi.org/10.1371/journal.pone.0092591.

Gatsov, I. 1993. *Neolithic Chipped Stone Industries in Western Bulgaria*. Krakow: Jagellonian University, Institute of Archaeology.

Gaul, J.H. 1948. The Neolithic period in Bulgaria. *Bulletin of the American Schools of Prehistoric Research* 16. Cambridge (MA).

Gauss, R. 2013. The development of metallurgy on the Iberian Peninsula: technological and social patterns of a long-term innovation process, in S. Burmeister, S. Hansen, M. Kunst and N. Müller-Scheeßel (eds) *Metal Matters. Innovative Technologies and Social Change in Prehistory and Antiquity*: 209–230. Rahden/Westf.: Marie Leidorf.

Găvan, A., 2015. *Metal and Metalworking in the Bronze Age Tell Settlements from the Carpathian Basin*. Cluj-Napoca: Mega Publishing House.

Gaydarska, B. 2017. Introduction: European prehistory and urban studies. *Journal of World Prehistory* 30: 177–188.

Gaydarska, B., M. Nebbia and J. Chapman. 2020. Trypillia megasites in context: independent urban development in Chalcolithic Eastern Europe. *Cambridge Archaeological Journal* 30(1): 97–121.

Georgieva, P. 2012. *The Neolithic and Eneolithic in Southeast Europe*. Sofia.University Press: 'St. Kliment Ohridski'.

Gerritsen, F. 2008. Domestic times: houses and temporalities in late prehistoric Europe, in A. Jones (ed.) *Prehistoric Europe: Theory and Practice*: 143–161. Oxford: Blackwell.

Gillis, R.E., J. Bulatović, K. Penezić, M. Spasić, N.N. Tasić and C.A. Makarewicz. 2020. Herding and hunting at Vinča-Belo Brdo and Stubline during the Late Neolithic, a stable isotopic perspective, in N. Marković and J. Bulatović (eds) *Animal Husbandry and Hunting in the Central and Western Balkans Through Time*: 19–39. Oxford: Archaeopress.

Gillis, R.E., J.S. Gaastra, M. Vander Linden and J.-D. Vigne. 2019. A species specific investigation into sheep and goat husbandry during the early European Neolithic. *Environmental Archaeology* DOI: https://doi.org/10.1080/14614103.2019.1615214.

Gimbutas, M. 1973. Old Europe c. 7000–3500 BC: the earliest European civilization before the infiltration of the Indo-European peoples. *Journal of Indo-European Studies* 1: 1–21.

Gimbutas, M. 1974. *The Goddesses and Gods of Old Europe: 6500-3500 BC. Myths and Cult Images.* London: Thames and Hudson.

Gimbutas, M. (ed.) 1976a. *Neolithic Macedonia as Reflected by Excavations at Anza*. Los Angeles (CA): Insitute of Archaeology, University of California

Gimbutas, M. 1976b. Ideograms and symbolic design on ritual objects of Old Europe (Neolithic and Chalcolithic south-east Europe), in J.V.S. Megaw (ed.) *To Illustrate the Monuments. Essays on Archaeology Presented to Stuart Piggott*: 78–98. London: Thames and Hudson.

Gimbutas, M. 1977. Varna: a sensationally rich cemetery of the Karanovo civilisation, about 4500 BC. *Expedition* 19: 39–47.

Gimbutas, M. (ed.) 1980. *The Transformation of European and Anatolian Culture, 4500-2500 BC and Its Legacy. Proceedings of the Multidisciplinary International Conference in Dubrovnik, 1979* (Vol. 17, Vol. 3). Washington DC: Journal of Indo-European Studies.

Gimbutas, M. 1982. *The Goddesses and Gods of Old Europe: 6500-3500 BC. Myths and Cult Images* (Second edition). London: Thames and Hudson.

Gläser, R. 1996. Zur absoluten Datierung der Vinča-Kultur anhand von 14C-Daten, in F. Draşovean, (ed.) *The Vinča Culture, its Role and Cultural Connections:* 141–162. Timisoara: The Museum of Banat.

Glišić, J. and B. Jovanović. 1960. Eneolitsko naselje na Kormadinu kod Jakova. *Starinar* XI: 113–139.

Glumac, P. 1988. Copper mineral finds from Divostin, in D., Srejović and A. McPherron (eds) *Divostin and the Neolithic of Central Serbia*: 457–462. Pittsburgh, Kragujevac: University of Pittsburgh, Narodni muzej Kragujevac.

Glumac, P. 1991. The Advent of Metallurgy in the Vinča Culture. Unpublished PhD dissertation. University of California.

Glumac, P. and J. Todd. 1987. New evidence for the use of lead in prehistoric south-east Europe. *Archeomaterials* 2: 123–145.

Glumac, P. and J.A.Todd. 1991. Early metallurgy in southeast Europe: the evidence for production, in P. Glumac (ed.) *Recent Trends in Archaeometallurgical Research* (MASCA Research Papers in Science and Archaeology Vol. 8/1): 9–19. Philadelphia (PA): University of Pennsylvania.

Glumac, P. and R.E. Tringham. 1990. The exploitation of copper minerals, in R.E. Tringham and D. Krstić (eds) *Selevac, A Neolithic Village in Yugoslavia*: 549–563. Los Angeles (CA): University of California Press.

Godin, B. 2015. *Innovation Contested: The Idea of Innovation over the Centuries.* London: Routledge.

Golden, J.M. 2010. *Dawn of the Metal Age: Technology and Society During the Levantine Chalcolithic*: London, Oakville (CT): Equinox Publications.

Goleanu, A., A. Marian, M. Gligor, C. Florescu and S. Varvara, S. 2005. Chemical and structural features of the Neolithic ceramics from Vinţa, Lumea Noua and Petresti cultures (Roumania). *Revue Roumaine De Chimie* 50: 939–949.

Goossens, R., A. De Wulf, J. Burgeois, W. Gheyle and T. Willems. 2006. Satellite imagery and archaeology: the example of CORONA in the Altai Mountains. *Journal of Archaeological Science* 33: 745–755.

Gopher, A. and T. Tsuk. 1996. *The Nahal Qanah Cave: Earliest Gold in the Southern Levant.* Tel Aviv: Tel Aviv University.

Gorelick, L. and A.J. Gwinnett. 1990. Innovative lapidary craft techniques in Neolithic Jarmo. *Archeomaterials* 4: 25–32.

Gori, M. and M. Ivanova (eds). 2017. *Balkan Dialogues: Negotiating Identity Between Prehistory and the Present.* New York: Routledge.

Görsdorf, J. and J. Bojadžiev. 1996. Zur absoluten Chronologie der bulgarischen Urgeschichte. *Eurasia Antiqua* 2: 105–173.

Gosselain, O.P. and D. Livingstone Smith. 2005. The source: clay selection and processing practices in Sub-Saharan Africa, in A. Livingstone Smith, D. Bosquet and R. Martineau (eds) *Pottery Manufacturing Process: Reconstruction and Interpretation* (British Archaeological Reports International Series 1349): 33–47. Oxford: Archaeopress.

Govedarica, B. 2001. Zur Typologie und Chronologie der Hammeräxte vom Typ Pločnik, in R.M. Boehmer and J. Maran (eds) *Lux Orientis: Archäologie zwischen Asien und Europa*: 153–164. Rahden: Leidorf.

Govedarica, B. 2016. Das Phänomen der balkanischen Kupferzeit, in V. Nikolov and W. Schier (eds) *Der Schwarzmeerraum vom Neolithikum bis in die Früheisenzeit (6000–600 v. Chr.). Kulturelle Interferenzen in der zirkumpontischen Zone und Kontakte mit ihren Nachbargebieten.* (Prähistorische Archäologie in Südosteuropa 30): 11–22. Rahden/Westf: Verlag Marie Leidorf GmbH.

Grabundžija, A., C. Schoch and A. Ulanowska. 2016. Bones for the loom. Weaving experiment with astragali weights. *Prilozi Instituta za arheologiju u Zagrebu* 33: 287–306.

Graeber, D. and D. Wengrow. 2021. *The Dawn of Everything. A New History of Humanity.* New York: Farrar, Straus and Giroux.

Graf, M. 2013. Industrijski putevi kulture (Industrial culture pathways, in Serbian) *Energija, ekonomija, ekologija,* 15: 328–335.

Grant, A. 1982. The use of tooth wear as a guide to the age of domestic ungulates, in B. Wilson, C. Grigson and S. Payne (eds) *Ageing and Sexing Animal Bones from Archaeological Sites* (British Archaeological Reports British Series 109): 91–108. Oxford: Archaeopress.

Gratuze, B. 1999. Obsidian characterization by laser ablation ICP-MS and its application to prehistoric trade in the Mediterranean and the Near East: sources and distribution of obsidian within the Aegean and Anatolia. *Journal of Archaeological Science* 26(8): 869–881. DOI: https://doi.org/10.1006/jasc.1999.0459.

Grbić, M. 1929. *Pločnik, eine Prähistorische Ansiedlung aus der Kupferzeit*. Belgrade: National Museum Belgrade.

Grbić, M. 1934. Neolitsko naselje u Botošu kod Velikog Bečkereka. *Starinar* 8–9: 40–58.

Грбић, М. 1936. Архитектура у Басијани (Сремски Петровци) I. Реконструкција места према ситуационом плану и авионском снимку. *Гласник Историског друштва* IX/1: 19–31. Нови Сад.

Грбић, М. 1950. Градиште код Кикинде. *Старинар* I: 113–118. Београд.

Грбић, М. 1951. Градиште код Кикинде.Наставак радова у 1948 години. *Старинар* II: 133–138. Београд.

Green, F.J. 1982. Problems of interpreting differentially preserved plant remains from excavations of medieval urban sites, in A.R. Hall and H.K. Kenward (eds) *Environmental Archaeology in the Urban Context* (Council for British Archaeology Research Report 23): 40–46. London: Council for British Archaeology.

Greenacre, M. 1988. Clustering the rows and columns of a contingency table. *Journal of Classification* 5: 39–51.

Greenacre M. 2007. *Correspondence Analysis in Practice*. Boca Raton-London-New York: Chapman and Hall/CRC.

Greenfield, H.J. 1986. *The Paleoeconomy of the Central Balkans (Serbia). A Zooarchaeological Perspective on the Late Neolithic and Bronze Age (ca. 4500–1000 B.C.)* (British Archaeological Reports International Series 304 (i, ii)). Oxford: Archaeopress.

Greenfield, H.J. 1994. Faunal remains from the Early Neolithic Starčevo settlement at Bukovačka Česma. *Starinar* 43–44: 103–113.

Greenfield, H.J. 2005. A reconsideration of the Secondary Products Revolution in south eastern Europe: on the origins and use of domestic animals for milk, wool and traction in the central Balkans, in J. Mulville and A. Outram (eds) *The Zooarchaeology of Fats, Oils, Milk and Dairying*: 14–31. Oxford: Oxford Books.

Greenfield, H.J. 2014. Zooarchaeology of the Late Neolithic, Eneolithic and Middle Bronze Ages at Vinča-Belo Brdo, Serbia: the 1982 excavations, in H.J. Greenfield (ed.) *Animal Secondary Products: Domestic Animal Exploitation in Prehistoric Europe, the Near East and the Far East*: 274–334. Oxford: Oxbow.

Greenfield, H.J. 2017. Hunting and herding in the Middle Neolithic of central Serbia: a zooarchaeological analysis of Stragari-Šljivik, Serbia, in P. Rowley-Conwy, D. Serjeantson and P. Halstead (eds) *Economic Zooarchaeology: Studies in Hunting, Herding and Early Agriculture:* 183–194. Oxford: Oxbow.

Greenfield, H.J. and E. Arnold. 2014. 'Crying over spilt milk': an evaluation of recent models, methods, and techniques on the origins of milking during the Neolithic of the Old World, in H.J. Greenfield (ed.) *Animal Secondary Products: Domestic Animal Exploitation in Prehistoric Europe, the Near East and the Far East*: 130–187. Oxford: Oxbow.

Greenfield, H.J. and E. Arnold. 2015. 'Go(a)t milk?' New perspectives on the zooarchaeological evidence for the earliest intensification of dairying in south eastern Europe. *World Archaeology* 47 (5): 792–818.

Greenfield, H.J. and T. Greenfield. 2014. Subsistence and settlement in the Early Neolithic of temperate SE Europe: a view from Blagotin, Serbia. *Archaeologia Bulgarica* 18(1): 1–33.

Greenfield, H.J. and T. Jongsma. 2008. Sedentary pastoral gatherers in the early Neolithic: architectural, botanical, and zoological evidence for mobile economies from Foeni-Salaş, south-west Romania, in D. Bailey, A. Whittle and D. Hofmann (eds) *Living Well Together? Settlement and Materiality in the Neolithic of South-East and Central Europe*: 108–130. Oxford: Oxbow.

Greenshaw, S.I. 2018. Structure from motion: origins and originality. *The Photogrammetric Record* 33: 7–10.

Grigson, C. 1982. Sex and age determination of some bones and teeth of domestic cattle: a review of the literature, in B. Wilson, C. Grigson and S. Payne (eds) *Ageing and Sexing Animal Bones from Archaeological Sites* (British Archaeological Reports British Series 109): 7–23. Oxford: Archaeopress.

Guerrero, E., S. Naji and J.-P. Bocquet-Appel. 2008. The signal of the Neolithic demographic transition in the Levant, in J.-P. Bocquet-Appel and O. Bar-Yosef (eds) *The Neolithic Demographic Transition and its Consequences*: 57–80. Berlin: Springer.

Gurova, M. 2012. 'Balkan flint'—fiction and/or trajectory to Neolithization: evidence from Bulgaria. *Bulgarian e-journal of Archaeology.*

Gurova, M. 2014. Neolithic flint assemblages from Bulgaria: an overview. *Самарский научный вестник* 3(8): 94–108.

Guthrie, D.R. 1983. Osseus projectile points: biological considerations affecting raw material selection and design among Paleolithic and Paleoindian peoples, in J. Clutton-Brock and C. Grigson (eds) *Animals and Archaeology 1: Hunters and Their Prey*: 273–294. Oxford: Archaeopress.

H

Hahn, H.P. 2012. Segmentary societies as alternatives to hierarchical order: sustainable social structures or organization of predatory violence? In T. Kienlin and A. Zimmermann (eds) *Beyond Elites: Alternatives to Hierarchical Systems in Modelling Social Formations: International Conference at the Ruhr-Universität Bochum, Germany, October 22-24, 2009.* (University Research on Prehistoric Archaeology 215): 33–40. Bonn: Habelt.

Hair J, F., W.C. Black, B.J. Babin and R.E. Anderson. 2009. *Multivariate Data Analysis* (Seventh edition). London: Prentice Hall.

Halstead, P. 1996. Pastoralism or household-herding? Problems of scale and specialization in early Greek animal husbandry. *World Archaeology* 28: 20–42.

Halstead, P. 1985. A study of mandibular teeth from Romano-British contexts at Maxey, in F. Pryor and C. French (eds) *The Fenland Project No. 1: Archaeology and Environment in the Lower Welland Valley* (East Anglian Archaeology 27): 219–24. Cambridge: Cambridgeshire Archaeological Committee.

Halstead, P., P. Collins and V. Isaakidou. 2002. Sorting sheep from goats: morphological distinctions between the mandibles and mandibular teeth of adult *Ovis* and *Capra*. *Journal of Archaeological Science* 29: 545–553.

Hambleton, E. 1999. *Animal Husbandry Regimes in Iron Age Britain.* (British Archaeological Reports British Series 282). Oxford: Archaeopress.

Hampton, O.W. 1999. *Culture of Stone: Sacred and Profane Uses of Stone Among the Dani.* College Station (TX): Texas A and M University Press.

Hansen, S. 2007. Bilder vom Menschen der Steinzeit. Untersuchungen zur anthropomorphen Plastik der Jungsteinzeit und Kupferzeit in Südosteuropa. *Archäologie in Eurasien* 20. Mainz: Deutsches Archäologisches Institut.

Hansen, S. 2009. Kupfer, Gold und Silber im Schwarzmeerraum während des 5. und 4. Jahrtausends v. Chr, in J. Apakidze, B. Govedarica and B. Hänsel (eds) *Der Schwarzmeerraum vom Äneolithikum bis in die Früheisenzeit (5000-500 v.Chr.). Kommunikationsebenen zwischen Kaukasus und Karpaten. Internationale Fachtagung von Humboldtianern für Humboldtianer im Humboldt-Kolleg* *in Tiflis - Georgien 17.- 20. Mai 2007.* (Prähistorische Archäologie in Südosteuropa, Band 25): 11–50. Rahden: Leidorf.

Hansen, S. 2012. The archaeology of power, in T.L. Kienlin and A. Zimmermann (eds) *Beyond Elites. Alternatives to Hierarchical Systems in Modelling Social Formations. International Conference at the Ruhr-Universität Bochum, Germany, October 22–24, 2009* (Universitätsforschungen zur Prähistorischen Archäologie 215): 213–223. Bonn: Habelt.

Hansen, S. 2013a. The birth of the hero. The emergence of a social type in the 4th millennium BC, in E. Starnini (ed.) *Unconformist Archaeology. Papers in Honour of Paolo Biagi* (British Archaeological Reports International Series 2528): 101–112. Oxford: Archaeopress.

Hansen, S. 2013b. Innovative metals: copper, gold and silver in the Black Sea region and the Carpathian Basin during the 5th and 4th Millennium BC, in S. Burmeister, S. Hansen, M. Kunst, and N. Müller-Scheeßel (eds) *Metal Matters. Innovative Technologies and Social Change in Prehistory and Antiquity*: 137–170. Rahden: Leidorf.

Hansen, S. and M. Toderaş 2012. The Copper Age settlement Pietrele on the Lower Danube River (Romania), in R. Hofmann, F.-K. Moetz and J. Müller (eds) *Tells: Social and Environmental Space. Proceedings of the International Workshop 'Socio-Environmental Dynamics over the Last 12,000 Years: The Creation of Landscapes II' in Kiel, 14th –18th March 2011. Volume 3*: 127–138. Bonn: Habelt.

Hansen, S., G. Mirtskhulava, K. Bastert-Lamprichs and M. Ullrich. 2012. Aruchlo– Eine Neolithische Siedlung im Sudkaukasus. *Altertum* 57: 81–106.

Hansen, S., P. Raczky, A. Anders and A. Reingruber (eds). 2015. *Neolithic and Copper Age between the Carpathians and the Aegean Sea: Chronologies and Technologies from the 6th to the 4th Millennium BCE. International Workshop Budapest, 30 March–1 April 2012*. Bonn: Habelt.

Hansen, S., I. Montero-Ruiz, S. Rovira, D. Steiniger and M. Toderaş. 2019. The earliest lead ore processing in Europe. 5th Millennium BC finds from Pietrele on the Lower Danube. *PLoS ONE* 14: e0214218. DOI: https://doi.org/10.1371/journal.pone.0214218.

Harris, E.C. 1989. *Principles of Archaeological Stratigraphy*. London: Academic Press.

Harris, E.C., M.R. Brown and G.J. Brown (eds). 1993. *Practices of Archaeological Stratigraphy.* London: Academic Press.

Hauptmann, A. 2000. *Zur frühen Metallurgie des Kupfers in Fenan/Jordanien, Der Anschnitt, Beiheft 11.* Bochum: Deutsches Bergbau-Museum.

Hauptmann, A. 2007. *The Archaeometallurgy of Copper: Evidence from Faynan, Jordan.* Berlin: Springer.

Hauptmann, A. 2014. The investigation of archaeometallurgical slag, in B.W. Roberts and C.P. Thornton (eds) *Archaeometallurgy in Global Perspective: Methods and Syntheses*: 91–105. New York: Springer.

Hauptmann, A. 2020. *Archaeometallurgy – Materials Science Aspects*. New York: Springer.

Hauptmann, A., J. Lutz, E. Pernicka and Ü.Yalçin. 1993. Zur Technologie der frühesten Kupferverhüttung im östlichen Mittelmeerraum, in M. Frangipane, A. Hauptmann, M. Liverani, P. Matthiae and M. Mellink (eds) *Between the Rivers and over the Mountains: Archaeologica Anatolica et Mesopotamica Alba Palmieri Dedicata*: 541–563. Roma: Dipartimento di Scienze Storiche Archeologiche e Antropologiche dell'Antichità, Università di Roma 'La Sapienza'.

Hauptmann, A., C. Bendall, G. Brey, I. Japariže, I. Gambašiže, S. Klein, M. Prange and T. Stöllner. 2010. Gold in Georgien. Analytische Untersuchungen an Goldartefakten und an Naturgold aus dem Kaukasus und dem Transkaukasus, in S., Hansen, A. Hauptmann, I. Motzenbäcker and E. Pernicka (eds.) *Von Majkop bis Trialeti. Gewinnungund Verbreitungvon Metallen und Obsidian in Kaukasien im 4.–2. Jt. v. Chr. Beiträge des Internationalen Symposiums in Berlin vom 1.–3. Juni 2006. Kolloquien zur Vor- und Frühgeschichte 13*: 139–160. Bonn: Habelt.

Healey J.F. 2013. *The Essentials of Statistics. A Tool for Social Research* (Third edition). Belmont (CA): Wadsworth.

Heeb, J. 2014. *Copper Shaft-Hole Axes and Early Metallurgy in South-Eastern Europe: An Integrated Approach.* Oxford: Archaeopress.

Heeb J., and B. Ottaway 2014. Experimental Archaeometallurgy, in B.W. Roberts and C.P. Thornton (eds) *Archaeometallurgy in Global Perspective: Methods and Syntheses*: 161-192. New York: Springer.

Helmer, D. 2000. Discrimination des genres *Ovis* at *Capra* à l'aide des prémolaires inférieures 3 et 4 et interprétation des âges d'abattage: l'example de Dikili Tash (Greece). *Anthropozoologica* 31: 29–38.

Helwing, B. 2013. Early metallurgy in Iran: An innovative region as seen from the inside, in S. Burmeister, S. Hansen, M. Kunst, and N. Muller-Scheessel (eds.) *Metal Matters: Innovative Technologies and Social Change in Prehistory and Antiquity*: 105–135. Rahden.: Leidorf.

Henrich, J. 2001. Cultural transmission and the diffusion of innovations: adoption dynamics indicate that biased cultural transmission is the predominate force in behavioral change. *American Anthropologist.* 103: 992–1013.

Henrich, J. 2004. Demography and cultural evolution: how adaptive cultural processes can produce maladaptive losses: the Tasmanian case. *American Antiquity* 69: 197–214.

Henrich, J. 2010. The evolution of innovation-enhancing institutions, in M.J. O'Brien and S.J. Shennan (eds) *Innovation in Cultural Systems. Contributions from Evolutionary Anthropology*: 99–120. Cambridge, MA: The MIT Press.

Hervella, M., M. Rotea, N. Izagirre, M. Constantinescu, S. Alonso, M. Ioana, C. Lazăr, F. Ridiche, A.D. Soficaru, M.G. Netea and C. de-la-Rua. 2015. Ancient DNA from South-East Europe reveals different events during Early and Middle Neolithic influencing the European genetic heritage. *Plos ONE* 10(6): e0128810.

Herzog, I. 2012. Aus Punkten werden Flächen: Vorschläge einer Methodik zur Abgrenzung von Gebieten mit hoher Funddichte. *Bericht der Römisch-Germanischen Kommission* 91: 197–215.

Higham, T., J. Chapman, B. Gaydarska, V. Slavchev, N. Honch, Y. Yordanov and B. Dimitrova. 2007. New perspectives on the Varna cemetery (Bulgaria) - AMS dates and social implications. *Antiquity* 81: 640–654.

Higham, T., V. Slavchev, B. Gaydarska and J. Chapman. 2018. AMS dating of the Late Copper Age Varna Cemetery, Bulgaria. *Radiocarbon* 60: 493–516. DOI: https://doi.org/10.1017/RDC.2018.9.

Hillier, B. and J. Hanson. 1984. *The Social Logic of Space.* Cambridge: Cambridge University Press.

Hillman, G.C. 1981. Reconstructing crop husbandry practices from the charred remains of crops, in R. Mercer (ed) *Farming Practice in British Prehistory*: 123–162. Edinburgh: Edinburgh University Press.

Hillman, G.C. 1984a. Interpretation of archaeological plant remains: application of ethnographic models from Turkey, in W.A. Casparie and W. van Zeist (eds) *Plants and Ancient Man*: *Studies in Palaeoethnobotany*: 1–41. Rotterdam: Balkema.

Hillman G.C. 1984b. Traditional husbandry and processing of archaic cereals in recent times: the operations, products and equipment which might feature in Sumerian Texts. Part I: the glume-wheats. *Bulletin on Sumerian Agriculture* 1: 114–52.

Hillman, G.C. 1985. Traditional husbandry and processing of archaic cereals in modern times. Part II, the free-threshing cereals. *Bulletin on Sumerian Agriculture* 2: 1–31.

Hofmann, R. 2013a. Okolište – Spätneolithische Keramik und Siedlungsentwicklung in Zentralbosnien: Ergebnisse und Interpretationen, *Godišnjak Centra za balkanološka ispitivanja Akademije nauka i umjetnosti Bosne i Hercegovine* 42: 23–44.

Hofmann, R. 2013b. *Okolište 2 – Spätneolithische Keramik und Siedlungsentwicklung in Zentralbosnien. Neolithikum und Chalkolithikum in Zentralnosnien 2.* (Universitätsforschungen zur prähistorischen Archäologie 234). Bonn: Verlag Rudolf Habelt.

Hofmann, R. and N. Müller-Scheeßel. 2013. Der spätneolithische Tell von Okolište im Visoko-Becken in Zentralbosnien: Ergebnisse der Grabungskampagne 2006 und 2007, in J. Müller, K. Rassmann and R. Hofmann (eds) *Okolište I - Untersuchungen einer spätneolithischen Siedlungskammer in Zentralbosnien*: 69–102. Bonn: Habelt.

Hofmann, R., and N. Müller-Scheeßel. 2020. Orientation of Neolithic dwellings in Central and Southeast Europe: Common denominator between the Vinča and Linearbandkeramik worlds. *Quaternary International*: 1–12. DOI: https://doi.org/10.1016/j.quaint.2020.05.006.

Hofmann, R., Z. Kujundzic-Vejzagić, J. Müller, N. Müller-Scheeßel and K. Rassmann. 2007. Prospektionen und Ausgrabungen in Okolište (Bosnien-Herzegowina). Siedlungsarchäologische Studien zum zentralbosnischen Spätneolithikum. *Berichte der Römisch-Germanischen Kommission* 87: 43–212.

Hofmann, R., Z. Kujundžić-Vejzagić, J. Müller, K. Rassmann and N. Müller-Scheessel. 2009. Rekonstrukcija procesa naseljavanja u kasnom neolitu na prostoru centralne Bosne. *Glasnik Zemaljskog Muzeja* 50/51: 11–177.

Holmberg, E.J. 1964. The appearance of Neolithic black burnished ware in mainland Greece. *American Journal of Archaeology* 68: 343–348.

Holste, F. 1939. Zur chronologischen Stellung der Vinča-Keramik, *Wiener prahistorische Zeitschrift XXVI*. Wien.

Hopf, M. 1974. Pflanzenreste aus Siedlungen der Vinča-Kultur in Jugoslawien. *Jahrbuch des Römisch-Germanisches Zentralmuseum* 21: 1–11.

Höppner, B., M. Bartelheim, M. Huijsmans, R. Krauss, K.P. Martinek, E. Pernicka and R. Schwab. 2005. Prehistoric copper production in the Inn Valley (Austria), and the earliest copper in central Europe. *Archaeometry* 47: 293–315.

Horedt, K. 1976. Die ältesten neolithischen Kupferfunde Rumäniens. *Jahresschrift für Mitteldeutsche Vorgeschichte* 60: 175–181.

Hosler, D. 2014. Mesoamerican metallurgy: the perspective from the west, in B.W. Roberts and C.P. Thornton (eds) *Archaeometallurgy in Global Perspective: Methods and Syntheses*: 329-359. New York: Springer.

Huebner, J. 1969. Stability relations of rodochrosite in the system manganese-carbon-oxygen. *American Mineralogist* 54: 457–481.

Humphris, J., M.F. Charlton, J. Keen, L. Sauder and F.Alshishani. 2018. Iron smelting in Sudan: Experimental archaeology at the royal city of Meroe. *Journal of Field Archaeology* 43: 399–416. DOI: https://doi.org/10.1080/00934690.2018.1479085.

Hüser, A. 2005. *Die Knochen- und Geweihartefakte der lieanrbandkeramischen Siedlung Bad Nnauheim-Nieder-Mörlen in der Wetterau*. (Kleine Schriften 55). Marburg: Phillips-Universität Marburg.

I

Ifantidis, F. and M. Nikolaidou (eds). 2011. *Spondylus in Prehistory: New Data and Approaches. Contributions to the Archaeology of Shell Technologies* (British Archaeological Reports International Series 2216). Oxford: Archaeopress.

Игњатовић, М. 2008. Каталог [Katalog], in Дубравка Николић [N. Dubravka] *Винча – праисторијска метропола. Истраживања 1908–2008. [Vinča, praistorijska nekropola. Istraživanja 1908–2008]*: 203–277. Beograd: Filozofski fakultet, Narodni muzej, Muzej grada Beograda, SANU.

Iles, L. 2018. Forging networks and mixing ores: Rethinking the social landscapes of iron metallurgy. *Journal of Anthropological Archaeology* 49: 88–99. DOI: https://doi.org/10.1016/j.jaa.2017.10.001.

Ingold, T. 2007. Materials against materiality. *Archaeological Dialogues* 14: 1–16.

Inizan, M.-L., M. Reduron-Ballinger, H. Roche and J. Féblot-Augustins. 1999. *Technology and Terminology of Knapped Stone.* Nanterre: Cercle de Recherches et d'Etudes Préhistoriques.

Inizan, M.-L., M. Reduron-Ballinger, H. Roche and J. Tixier. 1995. *Technologie de la Pierre Taillée.* Paris: CNRS.

Isaakidou, V. 2006. Ploughing with cows: Knossos and the 'secondary products revolution', in D. Serjeantson and D. Field (eds) *Animals in the Neolithic of Britain and Europe*: 95–112. Oxford: Oxbow Books.

Иванишевић, В. and И. Бугарски. 2015. Дигитална фотограметријска снимања античких и средњевековних локалитета у Србији. *Саопштења* XLVII: 165–180.

Ivanišević, V. and I. Bugarski. 2015. Landscape reconstruction in the Middle Danube Roman Limes: case studies from Lederata and Smorna, in V. Ivanišević, T. Veljanovski, D. Cowely, G. Kiarszys and I. Bugarski (eds) *Recovering Lost Landscapes* (Monographs, Volume 58): 57–65. Belgrade: Institute of Archaeology.

Ivanišević V., I. Bugarski and A. Stameković. 2018. Примена историјско – археолошког географског информационог система у истраживањима Царичиног града и околине. *Саопштења* L: 259–279. Beograd.

Ivanišević, V., T. Veljanovski, D. Cowely, G. Kiarszys and I. Bugarski. 2015. Recovering lost landscapes – introduction to an aerial perspective, in V. Ivanišević, T. Veljanovski, D. Cowely, G. Kiarszys and I. Bugarski (eds) *Recovering Lost Landscapes* (Monographs, Volume 58): 7–10. Belgrade: Institute of Archaeology.

Ivanov, I. 1978a. Rannokhalkolitni grobove do grad Varna. *Izvestiya na Narodniya Muzej Varna* 14: 81–93.

Ivanov, I. 1978b. Les fouilles archéologiques de la nécropole chalcolithique à Varna. *Studia Praehistorica* 1/2: 1–26.

Ivanov, I. 1988a. Das Gräberfelds von Varna: Katalog, in A. Fol and J. Lichardus (eds) *Macht, Herrschaft und Gold: Das Gräberfeld von Varna und die Anfänge einer Neuen Europäischen Zivilisation*: 183–208. Saarbrücken: Moderne Galerie des Saarland-Museums.

Ivanov, I. 1988b. Die Ausgrabungen des Gräberfeldes von Varna, in A. Fol and J. Lichardus (eds) *Macht, Herrschaft und Gold: Das Gräberfeld von Varna und die Anfänge einer Neuen Europäischen Zivilisation*: 49–66. Saarbrücken: Moderne Galerie des Saarland-Museums.

Ivanov, I. and M. Avramova. 2000. *Varna Necropolis. The Dawn of European Civilization. Treasures of Bulgaria 1.* Sofia: Agato.

Ivanova, M. 2007. Tells, invasion theories and warfare in fifth millennium BC north-eastern Bulgaria, in T. Pollard and I. Banks (eds) *War and Sacrifice: Studies in the Archaeology of Conflict*: 33–48. Leiden: Brill.

Ivanova, M. 2012. Perilous waters: Early maritime trade along the western coast of the Black Sea (fifth millennium BC). *Oxford Journal of Archaeology* 31: 339–365. DOI: https://doi.org/10.1111/j.1468-0092.2012.00392.x.

Ivanova, M. 2013. *The Black Sea and the Early Civilizations of Europe, the Near East and Asia*. Cambridge: Cambridge University Press.

Ivanova, M. 2020. Growing societies: An ecological perspective on the spread of crop cultivation and animal herding in Europe, in K. Gron, L. Sørensen and P. Rowley-Conwy P. (eds) *Farmers at the Frontier: A Pan European Perspective on Neolithisation*: 7–44. Oxford: Oxbow.

Ivanova, M., B. Athanassov, V. Petrova, D. Takorova and P.W. Stockhammer (eds). 2018. *Social Dimensions of Food in the Prehistoric Balkans*. Oxford: Oxbow.

J

Jacanović, D. 1985. *Požarevački kraj od najstarijih zemljoradnika do dolaska Rimljana*. Požarevac: Narodni Muzej.

Jacanović, D. 1988. Neolithic sites in the Danubian region from the mouth of the Velika Morava to Golubac, in D. Srejović (ed.) *The Neolithic of Serbia*: 111–119. Belgrade: University of Belgrade.

Jacanović, D. and D. Šljivar. 2001. Nalazi astragala sa neolitskog lokaliteta Belovode. *Zbornik Narodnog muzeja* XVII–1: 31–36.

Jacanović, D. and D. Šljivar. 2003. Preliminary reports on archaeological research from 1998 to 2002, Veliko Laole, Belovode (in Serbian). *Viminacium* 13–14: 297–302.

Jackson, C.M. and J.W. Smedley. 2004. Medieval and post-medieval glass technology: melting characteristics of some glasses melted from vegetable ash and sand mixtures. *Glass Technology* 45: 36–42.

Jacomet, S. and A. Kreuz. 1999. *Archäobotanik*. Stuttgart: Eugen Ulmer.

Jakucs J. and V. Voicsek. 2015. The northernmost distribution of the early Vinča culture in the Danube valley: a preliminary study from Szederkény-Kukorica-dűlő (Baranya County, southern Hungary). *Antaeus 33*: 13–54.

Jakucs J., E. Bánffy, K. Oross, V. Voicsek, C. Bronk Ramsey, E. Dunbar B. Kromer A. Bayliss, D. Hofmann, P.

Marshall and A. Whittle. 2016. Between the Vinča and Linearband-keramik worlds: the diversity of practices and identities in the 54th–53rd centuries cal BC in south-west Hungary and beyond. *Journal of World Prehistory 29*: 267–336.

Janković, S. 1967. *Ležišta Metaličnih Mineralnih Sirovina*. Belgrade: Mining and Geology Faculty, University of Belgrade.

Janković, S. 1977. The copper deposits and geotectonic setting of the Thethyan Eurasian Metallogenic Belt. *Mineralium Deposita* 12: 37–47. DOI: https://doi.org/10.1007/BF00204503.

Janković, S. 1982. Yugoslavia, in F.W. Dunning, W. Mykura and D. Slater (eds) *Mineral Deposits of Europe. Volume 2: Southeast Europe*: 143–202. London: The Institute of Mining and Metallurgy and the Mineralogical Society.

Jelenković, R. 1999. *Ležišta metaličnih mineralnih sirovina (Metallic Mineral Deposits, in Serbian)*. Belgrade: Mining and Geology Faculty, University of Belgrade.

Jevtić, M. 1986. Grobovi bakarnog doba iz Vinče. *Starinar* 37: 135–144.

Jochum, K.P., U. Weis, B. Stoll, D. Kuzmin, Q. Yang, I, Raczek, D.E. Jacob, A. Stracke, K. Birbaum, D.A. Frick, D. Günther and J. Enzweiler. 2011. Determination of reference values for NIST SRM 610-617 glasses following ISO Guidelines. *Geostandards and Geoanalytical Research* 35(4): 397–429. DOI: http://doi.wiley.com/10.1111/j.1751 908X.2011.00120.x

Jockenhövel, A. 2018. Alteuropäische Gräber der Kupferzeit, Bronzezeit und älteren Eisenzeit mit Beigaben aus dem Gießereiwesen (Gießformen, Düsen, Tiegel), in M. Overbeck (ed.) *Die Gießformen in West- und Süddeutschland (Saarland, Rheinland-Pfalz, Hessen, Baden-Württemberg, Bayern*: 213–317. Stuttgart: Franz Steiner.

Johnson, G.A. 1982. Organisational structure and scalar stress, in C. Renfrew, M.J. Rowlands and B. Segraves (eds) *Theory and Explanation in Archaeology*: 389–421. New York: Academic Press.

Jones, A. 2004. Archaeometry and materiality: materials-based analysis in theory and practice. *Archaeometry* 46: 327–338.

Jones, G. 1984. Interpretation of archaeological plant remains: ethnographic models from Greece, in W.A. Casparie and W. van Zeist (eds) *Plants and Ancient Man: Studies in Palaeoethnobotany*: 43–61. Rotterdam: Balkema.

Jones, G. 1987. A statistical approach to the archaeological identification of crop processing. *Journal of Archaeological Science* 14: 311–323.

Jones, G. 1990. The application of present-day cereal processing studies to charred archaeobotanical remains. *Circaea* 6(2): 91–96.

Jones, G. 1992. Weed phytosociology and crop husbandry: identifying a contrast between ancient and modern practice. *Review of Palaeobotany and Palynology* 73: 133–143.

Jones, G. and P. Halstead. 1995. Maslins, mixtures and monocrops: on the interpretation of archaeological crop samples of heterogenous composition. *Journal of Archaeological Science* 22: 103–114.

Jones, G., A. Bogaard, P. Halstead, M. Charles and H. Smith. 1999. Identifying the intensity of crop husbandry on the basis of weed floras. *Annual of the British School at Athens* 94: 167–89.

Jones, G., S. Valamoti and M. Charles. 2000. Early crop diversity: a 'new' glume wheat from northern Greece. *Vegetation History and Archaeobotany* 9: 133–146.

Jones, R.E. 1986. *Greek and Cypriot Pottery: A Review of Scientific Studies*. Athens: British School at Athens.

Jongsma, T. and H. Greenfield. 1996. The vertebrate fauna from middle and late Neolithic Sânandrei, in F. Draşovean (ed.) *The Vinča Culture: Its Role and Cultural Connection*: 295–308. Timişoara: Museum of Banat.

Jovanović, B. 1962. Postanak keramičkih tipova balkansko-podunavskog neolita i eneolita. *Starinar* 13–14: 9–25.

Jovanović, B. 1965. Starija vinčanska grupa u južnom Banatu. Rad vojvođanskih muzeja 14: 15–41.

Jovanović, B. 1971. *Metallurgy in the Eneolithic Period in Yugoslavia.* Belgrade: Archaeological Institute.

Jovanović, B. 1978. The oldest copper metallurgy in the Balkans. *Expedition* 21: 9–17.

Jovanović, B. 1979. Rudarstvo i metalurgija eneolitskog perioda Jugoslavije, in A. Benac (ed.) *Praistorija Jugoslavinskih Zemalja* 3: 27–85. Sarajevo: Svetlost.

Jovanović, B. 1980. The origins of copper mining in Europe. *Scientific American* 242: 152–167.

Jovanović, B. 1982. *Rudna Glava, najstarije rudarstvo bakra na centralnom Balkanu*. Belgrade: Arheološki Institut, Muzej rudarstva i metalurgije.

Jovanović, B. 1983. Mali Šturac, ein neues prähistorisches Kupferbergwerk in Zentralserbien. *Der Anschnitt* 4/5: 177–179.

Jovanović, B. 1993. Archaeological comment to E. Pernicka's et al. 'Eneolithic and Early Bronze Age copper artefacts from the Balkans and their relation to Serbian copper ores'. *Prähistorische Zeitschrift* 68: 55–57.

Jovanović, B. 1994. Gradac Phase in the relative chronology of the late Vinča culture. *Starinar (new series)* 43/44: 1–12.

Jovanović, B. (ed.) 1995. *Ancient Mining and Metallurgy in Southeast Europe.* Donji Milanovac: Archaeological Institute Belgrade and Museum of Mining and Metallurgy Bor.

Jovanović, B. 2006. Gradac Phase of the Vinča culture: origin of a typological innovation, in N. Tasić and C. Grozdanov (eds) *Homage to Milutin Garašanin*: 221–233. Belgrade: Serbian Academy of Sciences and Arts and Macedonian Academy of Sciences and Arts.

Jovanović, B. and B.S. Ottaway. 1976. Copper mining and metallurgy in the Vinča group. *Antiquity* 50: 104–113.

Jovanović, D. 2001. *Zlato i Bakar Istočne Srbije*, Belgrade: Srpsko društvo za istoriju nauke, Arheološki Institut Beograd.

Jovanović, M. 2011. *Gospodari gline i žita*. Novi Sad: Muzej Vojvodine.

Jovanović, S., M. Savić, R. Trailović, Z. Janković and D. Šljivar. 2003. Evaluations of the domestication process in Serbia: palaeozoological remnants at Neolithic settlement of Belovode. *Acta Veterinaria* 53: 427–434.

Jovanović, S., M. Savić, R. Trailović, Ž. Janković and D. Šljivar. 2004. Evaluation of the domestication process in Serbia – domestication of Neolithic cattle. *Acta Veterinaria* 54(5–6): 467–473.

Jović, V. 1996. Mineralogical study of malachite and azurite from the Belovode locality (Veliko Laole). *Préhistorie Européene* 8: 191–196.

Junghans, S., E. Sangmeister and M. Schröder. 1968. *Kupfer und Bronze in der frühen Metallzeit Europas.* (Studien zu den Anfängen der Metallurgie, 1-3). Berlin: Gebr. Mann.

Jurišić, A. 1959. Velika Gradina u Staparima, praistorijsko naselje. *Starinar* 9/10: 367–368.

K

Kaczankowska, M. and J. Kozlowski. 1990. Chipped stone industry of the Vinča culture, in D.Srejović and N. Tasić (eds) *Vinča and its World. International Symposium - The Danubian Region from 6000 to 3000 BC*: 35–47. Belgrade: Serbian Academy of Sciences and Arts and Centre for Archaeological Research.

Kaiser, T. 1984. Vinča Ceramics: Economic and Technological Aspects of Late Neolithic Pottery Production in Southeast Europe. Unpublished PhD dissertation, University of California.

Kaiser, T. 1989. Steatite-tempered pottery from Selevac, Yugoslavia: a Neolithic experiment in ceramic design. *Archeomaterials* 3/1: 1–10.

Kaiser, T. 1990. Ceramic technology, in R.E. Tringham and D. Krstiš (eds) *Selevac: a Neolithic Village in Yugoslavia*: 255–287. Los Angeles: University of California Press.

Kaiser, T. and B. Voytek. 1983. Sedentism and economic change in the Balkan Neolithic. *Journal of Anthropological Archaeology* 2: 323–353.

Kaiser, T., U.M. Franklin and V. Vitali. 1986. Pyrotechnology and pottery in the Late Neolithic of the Balkans, in J.S. Olin and M.J. Blackman (eds) *Proceedings of the 24th International Archaeometry Symposium*: 85–94. Washington DC: Smithsonian Institution.

Kapuran, A. and S. Milošević. 2013. Rockshelter Mokranjske Stene – a new late prehistoric site in eastern Serbia region. *Archaeologia Bulgarica* 17 (2): 17–37.

Kassebaum, T. 2019. Aggregation or Separation: (Re) considering Approaches Used in the Analysis of Sheep (*Ovis aries*) and Goat (*Capra hircus*) Faunal Remains. Unpublished MSc dissertation, University of York.

Kavtaradze, G.L. 1999. The importance of metallurgical data for the formation of Central Transcaucasian chronology, in A. Hauptmann, E. Pernicka, Th. Rehren and Ü. Yalçın (eds) *The Beginnings of Metallurgy* (Der Anschnitt, Beiheft 9): 67–102. Bochum: Deutsches Bergbau-Museum.

Kenoyer, J.M. and M.-L. Miller. 1999. Metal technologies of the Indus Valley tradition in Pakistan and western India, in V.C. Pigott (ed.) *The Archaeometallurgy of the Asian Old World*: 107-152. Philadelphia (PA): University of Pennsylvania Museum.

Kenoyer, J.M., M.Vidale and K.K. Bhan. 1991. Contemporary stone beadmaking in Khambhat, India: patterns of craft specialization and organization of production as reflected in the archaeological record. *World Archaeology* 23: 44–3.

Kienlin, T.L. 2010. *Traditions and Transformations: Approaches to Eneolithic (Copper Age) and Bronze Age Metalworking and Society in Eastern Central Europe and the Carphatian Basin* (British Archaeological Reports International Series 2184). Oxford: Archaeopress.

Kienlin, T.L. 2014. Aspects of metalworking and society from the Black Sea to the Baltic Sea from the fifth to the second millennium BC, in B.W. Roberts and C.P. Thornton (eds) *Archaeometallurgy in Global Perspective: Methods and Syntheses*: 447–472. New York: Springer.

Kienlin, T.L. and A. Zimmermann (eds). 2012. *Beyond Elites. Alternatives to Hierarchical Systems in Modelling Social Formations. International Conference at the Ruhr-Universität Bochum, Germany, October 22–24, 2009* (Universitätsforschungen zur Prähistorischen Archäologie 215): 15–32. Bonn: Habelt.

Kilikoglou, V., Y. Bassiakos, A.P. Grimanis, K. Souvatzis, A. Pilali-Papasteriou and A. Papanthimou-Papaefthimiou. 1996. Carpathian Obsidian in Macedonia, Greece. *Journal of Archaeological Science* 23(3): 343–349.

Killick, D. 2014. From ores to metals, in B.W. Roberts and C.P. Thornton (eds) *Archaeometallurgy in Global Perspective: Methods and Syntheses*: 11–45). New York: Springer.

Killick, D. and T.R. Fenn 2012. Archaeometallurgy: the study of preindustrial mining and metallurgy. *Annual Review of Anthropology* 41: 559-575.

Kingery, W.D. and J.D. Frierman. 1974. The firing temperature of a Karanova sherd and inferences about south-east European Chalcolithic refractory technology. *Proceedings of the Prehistoric Society* 40: 204–205.

Kintigh, K.W. 1984. Measuring archaeological diversity by comparison with simulated assemblages. *American Antiquity* 49: 44–54.

Kintigh, K.W. 1994. Contending with contemporaneity in settlement-pattern studies. *American Antiquity* 59: 143–148.

Kjeld Jensen, C. and K. Høilund Nielsen. 1997. Burial data and correspondence analysis, in C. Kjeld Jensen and K. Høilund Nielsen (eds) *Burials and Society: The Chronological and Social Analysis of Archaeological Burial Data*: 29–61. Aarhus: Aarhus University Press.

Klassen, L. 2000. *Frühes Kupfer im Norden. Untersuchungen zu Chronologie, Herkunft und Bedeutung der Kupferfunde der Nordgruppe der Trichterbecherkultur* (Jutland Archaeological Society 36). Aarhus: Aarhus University Press.

Klimscha, F. 2013. Innovations in Chalcolithic metallurgy in the Southern Levant during the 5th and 4th millennium BC. Copper-production at Tall Hujayrat al-Ghuzlan and Tall al-Magass, Aqaba Area, Jordan, in S. Burmeister, S. Hansen, M. Kunst and N. Müller-Scheeßel (eds) *Metal Matters. Innovative Technologies and Social Change in Prehistory and Antiquity*: 31–64. Rahden/West: Leidorf.

Klimscha, F. 2014. Power and prestige in the Copper Age in the lower Danube, in C.-E. Stefan, M. Florea, S.-C. Ailincăi and C. Micu (eds) *Studii Privind Preistoria Sud-estului Europei: Volum Dedicat Memoriei lui Mihai Şimon. Studies in the prehistory of southeastern Europe: volume dedicated to the memory of Mihai Șimon.* (Biblioteca Istro-Pontica 10): 131–168. Brăila: Muzeul Brăilei, Editura Istros.

Klimscha, F. 2016. *Pietrele 1: Beile und Äxte aus Stein. Distinktion und Kommunikation während der Kupferzeit im östlichen Balkangebiet* (Archäologie in Eurasien 34). Bonn: Habelt.

Klimscha, F. 2020. New research on the 'Kings of Metal': Systems of social distinction in the Copper Age of Southeastern Europe. *Journal of Archaeological Research* 28, 99–138 . DOI: https://doi.org/10.1007/s10814-019-09132-x.

Kline, M.A. and R. Boyd. 2010. Population size predicts technological complexity in Oceania. *Proceedings of the Royal Society of London B: Biological Sciences* 277: 2559–2564.

Kogălniceanu, R., A. Ilie, M. Mărgărit, A. Simalcsik and V. Dumitraşcu. 2014. A hoard of astragals discovered in the Copper Age settlement at Iepureşti, Giurgiu County, Romania. *Documenta Praehistorica* XLI: 283–304

Kohl, P.L. 2007. *The Making of Bronze Age Eurasia*. Cambridge: Cambridge University Press.

Kohler-Schneider, M. 2003. Contents of a storage pit from late Bronze Age Stillfried, Austria: another record of the 'new' glume wheat. *Vegetation History and Archaeobotany* 12: 105–111.

Kokalj, Ž. and M. Somrak. 2019. Why not a single image? Combining visualizations to facilitate fieldwork and on-screen mapping. *Remote Sensing* 11: 747.

Koryakova, L. and A. Epimakhov. 2007. *The Urals and Western Siberia in the Bronze and Iron Ages*. Cambridge: Cambridge University Press.

Kosse, K. 1990. Group size and societal complexity: thresholds in the long-term memory. *Journal of Anthropological Archaeology* 9: 275–303.

Kostov, R.I. 2013. Nephrite-yielding prehistoric cultures and nephrite occurrences in Europe: Archaeomineralogical Review. *Haemus* 2: 11–30.

Kotsakis, K., A. Papanthimou-Papaefthimiou, A. Pilali-Papasteriou, T. Savopoulou, Y. Maniatis and B. Kromer. 1989. Carbon-14 dates from Mandalo, W. Macedonia, in Y. Maniatis (ed.) *Archaeometry, International Symposium on Archaeometry*: 679–85. Amsterdam: Elsevier.

Koukouli-Chryssanthaki, C., Todorova, H. Aslanis, I. Vajsov, I. and Valla, M. 2007. Promachon – Topolnica. A Greek-Bulgarian archaeological project, in Todorova, H. Stefanovich, M. and Ivanov, G. (eds.) *The Struma / Strymon Valley in Prehistory. Proceedings of the International Symposium 'Strymon Praehistoricus'. In The Steps of James Harvey Gaul*: Vol. 2: 43-78. Sofia: Gerda Henkel Stiftung.

Knipper, C., A. Mittnik, K. Massy, C. Kociumaka, I. Kucukkalipci, M. Maus, F. Wittenborn, S.E. Metz, A. Staskiewicz, J. Krause and P.W. Stockhammer. 2017. Female exogamy and gene pool diversification at the transition from the Final Neolithic to the Early Bronze Age in central Europe. *Proceedings of the Academy of Sciences* 114(38): 10083–10088.

Krajnović, D. and S. Janković. 1995. Copper mineralisation as potential raw material source of ancient copper metallurgy in Serbia, in B. Jovanović (ed.) *Ancient Mining and Metallurgy in Southeast Europe, 1995 Donji Milanovac, Srbija:* 21–28. Belgrade, Bor: Archaeological Institute, Museum of Mining and Metallurgy.

Krause, R. 1985. *The Clay Sleeps.* Tuscaloosa: University of Alabama Press.

Krause, R. 2003. *Studien zur kupfer- und frühbronzezeitlichen Metallurgie zwischen Karpatenbecken und Ostsee* (Vorgeschichtliche Forschungen 24). Rahden: Leidorf.

Krauss, R. 2008. Karanovo und das südosteuropäische Chronologiesystem aus heutiger Sicht *Eurasia Antiqua* 14: 117–149.

Krauss, R., S. Zäuner and E. Pernicka. 2014. Statistical and anthropological analyses of the Varna necropolis, in H. Meller, R. Risch and E. Pernicka (eds) *Metals of Power - Early Gold and Silver. 6th Archaeological Conference of Central Germany, October 17-19, 2013, Halle*: 371–387. Halle: Landesmuseum für Vorgeschichte.

Krauss, R., C. Schmid, D. Ciobotaru and V. Slavchev. 2016. Varna und die Folgen. Überlegungen zu den Ockergräbern zwischen Karpatenbecken und der nördlichen Ägäis, in M. Bartelheim, B. Horejs and R. Krauss (eds) *Von Baden bis Troja, Resourcennutzung, Metallurgie und Wissenstransfer. Eine Jubiläumsschrift für Ernst Pernicka.* (Oriental and European Archaeology, Volume 3): 273–315. Rahden: Leidorf.

Krauss, R., C. Schmid, D. Kirschenheuter, J. Abele, V. Slavchev and B. Weninger. 2017. Chronology and development of the Chalcolithic necropolis of Varna I. *Documenta Praehistorica* 44: 282–305. DOI: https://doi.org/10.4312/dp.44.17.

Krauss, R., J. Bofinger and B. Weninger. 2020. Formation and Transformation of Early Neolithic Lifestyles in Europe. *Quaternary International* 560–561: 1-286

Kreiter, A., Gy. Szakmány and M. Kázmér. 2009. Ceramic technology and social process in late Neolithic Hungary, in P. Quinn (ed.) *Interpreting Silent Artefacts: Petrographic Approaches to Archaeological Ceramics*: 101–119. Oxford: Archaeopress.

Kreiter, A., I. Azbej Havancsák, P. Sipos, M. Tóth and V. Orsolya. 2011. Maroslele–Panáról származó neolitikus kerámia töredékek petrográfiai, XRF és XRD vizsgálata. (The petrographic, XRF and XRD analyses of the Neolithic pottery from Maroslele-Pana), in T. Paluch (ed.) *Maroslele-Pana. Egy Középső Neolitkus Lelőhely a Kultúrák Határvidékén*: 303–326. Szeged: Móra Ferenc Múzeum.

Kreiter, A., Á. Pető and P. Pánczél. 2013. Materializing tradition: Ceramic production in Early and Middle Neolithic Hungary, in E. Bánffy (ed.) *The Early Neolithic of the Danube-Tisza Interfluve*: 127–140. Oxford: Archaeopress.

Kreiter, A., S. Czifra, Z. Bendő, J.E. Imre, P. Pánczél and G. Váczic. 2014. Shine like metal: an experimental approach to understand prehistoric graphite-coated pottery technology. *Journal of Archaeological Science* 52: 129–142.

Kreiter, A., T. Marton, L. Gomart, K. Oross and P. Pánczél. 2017a. Looking into houses: Analysis of LBK ceramic technological change on a household level, in L. Burnez-Lanotte (ed.) *Matières à Penser. Raw Materials Acquisition and Processing in Early Neolithic Pottery Productions*. Proceedings of the Workshop of Namur (Belgium), 29–30 May 2015: 111–132. Paris: Société Préhistorique Française.

Kreiter, A., N. Kalicz, K. Kovács, Zs. Siklósi and O. Viktorik. 2017b. Entangled traditions: Tisza and Lengyel ceramic technology in a Late Neolithic settlement in northern Hungary. *Journal of Archaeological Science Reports* 16: 285–295.

Kreiter, A., T. Marton, K. Oross and P. Pánczél. 2019. Looking into pots: Understanding Neolithic ceramic technological variability from Western Hungary, in S. Amicone, P.S. Quinn, M. Marić, N. Mirković-Marić and M. Radivojević (eds) *Tracing Pottery Making Recipes in the Balkans 6th-4th Millennia BC*: 65–77. Oxford: Archaeopress.

Kreuz, A. and N. Boenke. 2002. The presence of two-grained einkorn at the time of the Bandkeramik culture. *Vegetation History and Archaeobotany* 11: 233–240.

Kreuz, A., E. Marinova, E. Schäfer and J. Wiethold. 2005. A comparison of Early Neolithic crop and weed assemblages from the Linearbandkeramik and the Bulgarian Neolithic cultures: differences and similarities. *Vegetation History and Archaeobotany* 14: 237–258.

Kroll, H. 2013. Die Wirtschaft des Umfelds von Okolište: Zagrebnice, Kundruci und Donje Moštre, in J. Müller, K. Rassman and R. Hofmann (eds) *Okolište 1 – Untersuchungen einer spätneolithischen Siedlungskammer in Zentralbosnien. Neolithikum und Chalkolithikum in Zentralbosnien 1.* (Universitätsforschungen zur prähistorischen Archäologie 228): 231–238. Bonn: Habelt.

Kristiansen, K., T. Lindkvist, and J. Myrdal. (eds) 2018. *Trade and Civilisation: Economic Networks and Cultural Ties from Prehistory to the Early Modern Era*. Cambridge: Cambridge University Press.

Kuijpers, M.H.G. 2018. *An Archaeology of Skill. Metalworking Skill and Material Specialization in Early Bronze Age Central Europe.* London: Routledge.

Kuijpers M.H.G. and C.N. Popa 2021. The origins of money: Calculation of similarity indexes demonstrates the earliest development of commodity money in prehistoric Central Europe. *PLoS ONE* 16(1): e0240462. https://doi.org/10.1371/journal.pone.0240462

Kulbicki, G. 1958. High-temperature phases in montmorillonites. *Clays and Clay Minerals*: 144–158. National Academy of Sciences – National Research Council Publication 566.

Kuleff, I. and E. Pernicka. 1995. On the instrumental neutron activation analysis of native copper: some methodological considerations. *Journal of Radioanalytical and Nuclear Chemistry* 191: 145–161.

Kuna, M. 1981. Zur Neolithischen und Äneolithischen Kupferverarbeitung im Gebiet Jugoslawiens. *Godišnjak Akademije BiH 17. Centar za balkanološka ispitivanja (Sarajevo)* 19: 13–81.

Kunst, M. 2013. The innovation of copper metallurgy on the Iberian Peninsula: its significance for the development of social complexity in the 3rd millennium BC, in S. Burmeister, S. Hansen, M. Kunst and N. Müller-Scheeßel (eds) *Metal Matters. Innovative Technologies and Social Change in Prehistory and Antiquity*: 181–208. Rahden.: Leidorf.

Kunze, R. and E. Pernicka. 2020. Pre-industrial mining in the Medni Rid, in R. Krauss, E. Pernicka, R. Kunze, K. Dimitrov and P. Leshtakov (eds) *Prehistoric Mining and Metallurgy at the Southeast Bulgarian Black Sea Coast (RessourcenKulturen Band 10)*: 398–425. Tübingen: Tübingen University Press.

Kuzmanović Cvetković, J. 1998. *Prokuplje, grad sv. Prokopija*. Prokuplje: Narodni muzej Toplice.

Kuzmanović Cvetković, J., Z. Cvetković and B. Đevori. 1988. *Arheološka nalazišta opštine Prokuplje - katalog izložbe povodom 40 godina Muzeja Toplice*. Prokuplje: Narodni Muzej Toplice.

Kuzmanović Cvetković, J. and D. Šljivar. 1998. Die Göttin aus Pločnik. *Starinar* 49: 173–178.

Kuzmina, E.E. 2008. *The Prehistory of the Silk Road*. Philadelphia (PA): University of Pennsylvania Press.

L

Lang, F. 2005. Knochen- und Geweihobjekte, in S. Hiller and N. Vassil Nikolov (eds) *Karanovo. Die*

Ausgrabungen im Nordsüd-Schnitt, 1993–1999: 263–340. Sofia, Phoibos Verlag, Wien: Archäologisches Institut der Universität Salzburg, Archäologisches Institut mit Museum der Bulgarischen Akademie der Wissenschaften.

Lankton, J.W., J. Diamanti and J.M. Kenoyer. 2003. *A Bead Timeline: A Resource for Identification, Classification and Dating.* Washington, DC: The Bead Society of Greater Washington.

Larson, G., D.R. Piperno, R.G. Allaby, M.D. Purugganan, L. Andersson, M. Arroyo-Kalin, L. Barton, C. Climer Vigueira, T. Denham, K. Dobney, A.N. Doust, P. Gepts, M.T.P. Gilbert, K.J. Gremillion, L. Lucas, L. Lukens, F.B. Marshall, K.M. Olsen, J.C. Pires, P.J. Richerson, R. Rubio de Casas, O.I. Sanjur, M.G. Thomas and D.Q. Fuller. 2014. Current perspectives and the future of domestication studies. *Proceedings of the National Academy of Sciences* 111: 6139–6146.

Lasaponara, R. and N. Masini. 2011. Satellite remote sensing in archaeology: Past, present and future perspectives. *Journal of Archaeological Science* 38(9): 1995–2002.

Lazarovici, C.-M. 2006. Absolute chronology of the late Vinča culture in Romania and its role in the development of the Early Copper Age, in N. Tasić and C. Grozdanov (eds) *Homage to Milutin Garašanin*: 277–293. Belgrade: Serbian Academy of Sciences and Arts and Macedonian Academy of Sciences and Arts.

Lazarovici, G. 1970. Cultură Vinča A in Banat. *Acta Musei Napocensis (Romania)* 7: 475–488.

Lazarovici, G. 1979. *Naoliticul Banatului. Bibliotheca Musei Napocensis IV*. Cluj-Napoca: Bibliotheca Musei Napocensis.

Lazarovici, G. 1981. Die Periodisierung der Vinča-Kultur in Rumänien. *Prähistorische Zeitschrift* 56: 169–196.

Lazarovici, G. 2014. Beginning of the Copper Age in Transylvania and some data regarding the copper and gold metallurgy, in Schier, W. and F. Draşovean (eds) *New Approaches to Dating and Cultural Dynamics in the 6th to 4th Millennium BC*. (Prähistorische Archäologie in Südosteuropa 28): 243–271. Rahden/Westf: Verlag Marie Leidorf Gmbh.

Lazarovici, Gh., Fl. Draşovean and Z. Maxim. 2001. *Parta.* Timisoara: Museum Banaticum Temesiense.

Lazić, M. 1992. Doprinos arheozoologije u proučavanju ekonomije praistorijskih društvenih zajednica, in D. Srejović (ed.) *Arheologija i prirodne nauke*: 49–60. Beograd: SANU.

Lechtman, H. 1996. Arsenic bronze: dirty copper or chosen alloy? A view from the Americas. *Journal of Field Archaeology* 23: 477–514.

Lechtman, H. 2014. Andean metallurgy in prehistory, in B.W. Roberts and C.P. Thornton (eds) *Archaeometallurgy in Global Perspective: Methods and Syntheses*: 361–422. New York: Springer.

Legge, A. 1990. Animals, economy and environment, in R. Tringham and D. Krstić (eds) *Selevac: a Neolithic village in Yugoslavia*: 215–242. Los Angeles: University of California Press.

Legrand, A. 2007. *Fabrication et utilisation de l'outillage en matières osseuses du Néolithique de Chypre: Khirokitia et Cap Andreas -Kastros.* (British Archaeological Reports International Series 1678). Oxford: Archaeopress.

Lehner, J.W. and K.A. Yener. 2014. Organization and specialization of early mining and metal technologies in Anatolia, in B.W. Roberts and C.P. Thornton (eds) *Archaeometallurgy in Global Perspective. Methods and Syntheses*: 529–558. New York: Springer.

Leković, V. 1988. Zlatara-Ruma, in D. Srejović and V. Kostić (eds) *The Neolithic of Serbia*: 108–109. Belgrade: Centre for Archaeological Research, Faculty of Philosophy, the University of Belgrade.

Leković, V. 1990. The *vinčanization* of Starčevo culture, in D. Srejović and N. Tasić (eds) *Vinča and its World, International Symposium - The Danubian Region from 6000 to 3000 B.C., October 1988*: 67–74. Belgrade: Serbian Academy of Sciences and Arts – Centre for Archaeological research – Faculty of Philosophy.

Lemonnier, P. 1993. Introduction, in P. Lemmonier (ed.) *Technological Choices: Transformation in Material Cultures since the Neolithic*: 1–35. London: Routledge.

Lemonnier, P. 2012. *Mundane Objects: Materiality and Non-verbal Communication.* Walnut Creek, CA: Left Coast Press.

Lenneis, E. and P. Stadler. 1995. Zur Absolutchronologie der Linearbandkeramik aufgrund von ^{14}C-Daten. *Archäologie Österreichs* 6: 4–12.

Leshtakov, P. 2005. The sources and distribution of graphite as a means of decoration in the Bulgarian Chalcolithic, in G. Dumitroaia, J. Chapman, O. Weller, C. Preoteasa, R. Munteanu, D. Nicola and D. Monah (eds) *Cucuteni. 120 Years of Research. Time to Sum Up*: 293–296. Piatra-Neamţ: Constantin Matasă.

Leshtakov, P. 2013. Early copper metallurgy on the west Black Sea coast: archaeological evidence on prehistoric exploitation of the Rosen ore field, in *Where are the sites? Research, Protection and Management of Cultural Heritage, Ahtopol, Bulgaria, 2013*: 35–54. Sozopol: Centre for Underwater Archaeology, Bulgaria.

Letica, Z. 1964. The Neolithic figurines from Vinča. *Archaeology* 17(1): 26–32.

Letsch, J. and W. Noll. 1978. Material und Herstellung antiker C-Schwarz-Keramik, Teil I / Teil II. *Berichte der Deutschen Keramischen Gesellschaft* 55:163–168 and 259–261.

Letsch, J. and W. Noll. 1983. Phasenbildung in einigen keramischen Teilsystemen bei 600- 1000°C in Abhängigkeit von der Sauerstofffugazität. *Ceramic Forum International* 7: 259–267

Leusch, V., E. Pernicka and B. Armbruster. 2014. Chalcolithic gold from Varna – Provenance, circulation, processing, and function, in H. Meller, R. Risch and E. Pernicka (eds) *Metals of Power – Early*

Gold and Silver. 6th Archaeological Conference of Central Germany, October 17-19, 2013, Halle: 165–182. Halle: Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt/Landesmuseum für Vorgeschichte.

Leusch, V., B. Armbruster, E. Pernicka and V. Slavčev. 2015. On the invention of gold metallurgy: The gold objects from the Varna I cemetery (Bulgaria) – technological consequence and inventive creativity. *Cambridge Archaeological Journal* 25: 353–376. DOI: https://doi.org/10.1017/S0959774314001140.

Leusch, V., M. Brauns and E. Pernicka. 2016. Precise and accurate analysis of gold alloys: Varna, the earliest gold of mankind. A case study, in L. Dussubieux, M. Golitko and B. Gratuze (eds) *Recent Advances in Laser Ablation ICP-MS for Archaeology. Natural Science in Archaeology*: 95–113. Berlin, Heidelberg: Springer.

Leusch, V., S. Zäuner, V. Slavčev, R. Krauß, B. Armbruster and E. Pernicka. 2017. Rich metallurgists' (?) graves from the Varna I cemetery - Rediscussing the social role of the earliest metalworkers, in A. Brysbaert and A. Gorgues (eds) *Artisans versus Nobility? Multiple identities of Elites and 'Commoners' Viewed Through the Lens of Crafting from the Chalcolithic to the Iron Ages in Europe and the Mediterranean*: 101–124. Leiden: Sidestone Press.

Lichardus, J. 1988. Der Westpontische Raum und die Anfänge der kupferzeitlichen Zivilisation, in A. Fol and J. Lichardus (eds) *Macht, Herrschaft und Gold : das Graberfeld von Varna (Bulgarien) und die Anfänge einer neuen europäischen Zivilisation*: 79–130. Saarbrücken: Moderne Galerie des Saarland-Museums.

Lichardus, J. (ed.) 1991a. *Die Kupferzeit als Historische Epoche. Symposium Saarbrücken und Otzenhausen 6.-13.11.1988* (Saarbrücker Beiträge zur Altertumskunde 55). Bonn: Dr. Rudolf Habelt GmbH,

Lichardus, J. 1991b. Das Gräberfeld von Varna im Rahmen des Totenrituals des Kodžadermen-Gumelniţa-Karanovo VI-Komplexes, in J. Lichardus (ed.) *Die Kupferzeit als historische Epoche: Symposium Saarbrücken und Otzenhausen 6.-13.11.1988, Teil 1*: 167–194. Bonn: Habelt.

Lichardus, J. 1991c. Die Kupferzeit als historische Epoche. Versuch einer Deutung, in J. Lichardus (ed.) *Die Kupferzeit als Historische Epoche. Symposium Saarbrücken und Otzenhausen 6.-13.11.1988* (Saarbrücker Beiträge zur Altertumskunde 55) : 763–800). Bonn: Dr. Rudolf Habelt GmbH.

Lichter, C. 1993. Untersuchungen zu den Bauten des südosteuropäischen Neolithikums und Chalkolithikums. *Internationale Archäologie* 18. Leidorf: Buch am Erlbach.

Lichter, C. 2001. *Untersuchungen zu den Bestattungssitten des südosteuropäischen Neolithikums und Chalkolithikums* (Monographien 5). Zabern, Mainz: Heidelberger Akademie der Wissenschaften, Internationale Interakademische Kommission für die Erforschung der Vorgeschichte des Balkans.

Lichter, C. 2014. Temples in the Neolithic and Copper Age in southeast Europe. *Documenta Praehistorica* 41: 119–136.

Lichter, C. 2016. Burning down the house—Fakt oder Fiktion? In K. Bacvarov and R. Gleser (eds) *Southeast Europe and Anatolia in Prehistory: Essays in Honor of Vassil Nikolov on His 65th Anniversary*: 305–317. Bonn: Habelt.

Lienhard, J.H. 2006. *How Invention Begins.* Oxford: Oxford University Press.

Liu, R., G. Dong, M. Ma, and A.M. Pollard 2020a. Introduction to the Special Issue: Correlating changes for environmental, technological and societal transformation in prehistoric eastern Asia. *The Holocene* 31: 165-168.

Liu, X., D. Chen, T. Yang, F. Huang, S. Fu, and L. Li 2020b. Changes in soil labile and recalcitrant carbon pools after land-use change in a semi-arid agro-pastoral ecotone in Central Asia. *Ecological Indicators* 110: 105925.

Liritzis, I. 2008. Assessment of Aegean obsidian sources by a portable ED-XRF analyser: grouping, provenance and accuracy, in Y. Facorellis, N. Zacharias and K. Polikreti (eds) *Proceedings of the 4th Symposium of the Hellenic Society for Archaeometry* (British Archaeological Reports International Series S1746): 399–406. Oxford: Archaeopress.

Longman, J., D. Veres, W. Finsinger, and V. Ersek 2018. Exceptionally high levels of lead pollution in the Balkans from the Early Bronze Age to the Industrial Revolution. *Proceedings of the National Academy of Sciences* 115 (25): E5661-E5668. doi:10.1073/pnas.1721546115.

Lorenzo-Seva, U. 2011. Horn's Parallel Analysis for selecting the number of dimensions in Correspondence Analysis. *Methodology* 7: 96–102.

Lubbock, J. 1872. *Pre-Historic Times, as Illustrated by Ancient Remains, and the Manners and Customs of Modern Savages.* London: D. Appleton and Company.

Luca, S.A. 1999. *Sfârşitul eneoliticului pe teritoriul intracarpatic al României - cultura Bodrogkeresztúr* (Volume 11). Alba Iulia: Bibliotheca Musei Apulensis.

Luik, H. 2007. Dazzling white. Bone artefacts in Bronze Age society – some preliminary thoughts from Estonia, in A. Merkevičius (ed.) *Colours of Archaeology. Material Culture and Society. Papers from the Second Theoretical Seminar of the Baltic Archaeologists (BASE) Held at the University of Vilnius, Lithuania, October 21–22, 2005*: 49–64. Vilnius; Helsinki; Riga; Tartu: University of Vilnius, University of Helsinki, University of Latvia, University of Tartu. (Interarchaeologia; 2).

Lunardi, A. 2008. Experimental testing with polished green stone axes and adzes: technology of use, in L. Longo and N. Skakun (eds) *'Prehistoric Technology' 40 Years Later: Functional Studies and the Russian Legacy: Proceeding of the International Congress Verona (Italy), 20–23 April 2005.* (British Archaeological Reports

International Series S1783): 369–373. Oxford: Archaeopress.

Lyman, C.E. and M.J. O'Brien. 2003. Cultural traits: units of analysis in early twentieth-century anthropology. *Journal of Anthropological Research* 59: 225–250.

Lyneis, M.M. 1988. Antler and bone artifacts from Divostin, in A. McPherron and D. Srejović (eds) *Divostin and the Neolithic of Central Serbia* (Ethnology Monographs 10): 301–319. Pittsburgh: University of Pittsburgh.

M

Madas D. 1988. Ceramic vessels from Divostin II house floors, in A. McPherron and D. Srejović (eds) *Divostin and the Neolithic of Central Serbia*: 143–157. Pittsburgh: University of Pittsburgh.

Maddin, R., J.D. Muhly and T. Stech. 1999. Early metalworking at Çayönü, in A. Hauptmann, E. Pernicka, Th. Rehren and Ü. Yalçın (eds) *The Beginnings of Metallurgy, Der Anschnitt, Beiheft 9*: 37–44. Bochum: Deutsches Bergbau-Museum.

Maggetti, M. 1982. Phase analysis and its significance for technology and origin, in J.S. Olin and A.D. Franklin (eds) *Archaeological Ceramics*: 121–133. Washington DC: Smithsonian Institute Press.

Maggetti, M. 1994. Mineralogical and petrographical methods for the study of ancient pottery, in F. Buragato, O. Grubessi and L. Lazzarini (eds) *1st European Workshop on Archaeological Ceramics*: 23–35. Rome: Università degli Studi La Sapienza.

Maigrot, Y. 2003. Etude Technologique et Fonctionnelle de l'Outillage en Matières Dures Animales. La Station 4 de Chalain (Néolithique Final, Jura, France). Unpublished PhD dissertation, Université de Paris I.

Makkay, J. 1976. Problems concerning Copper Age chronology in the Carpathian Basin. *Acta Archaeologica Hungarica* 28: 251–300.

Makkay, J. 1989. *The Tiszaszőlős Treasure*l. Budapest: Akadémiai Kiadó.

Makkay, J. 1990. The Protovinča problem as seen from the northernmost frontier, in D. Srejović and N. Tasić (eds) *Vinča and Its World*: 113–122. Belgrade: Serbian Academy of Sciences and Arts.

Makkay, J. 1991. The most ancient gold and silver in central and south-east Europe, in J.-P. Mohen and C. Éluère (eds) *Découverte du Métal*: 119–128. Paris: Picard.

Makkay, J. 1995. The rise and fall of gold metallurgy in the Copper Age of the Carpathian Basin: the background of the change, in G. Morteani and J.P. Northover (eds) *Prehistoric Gold in Europe: Mines, Metallurgy and Manufacture*: 65–76. Dordrecht: Kluwer Academic Publishers.

Malafouris, L. 2013. *How Things Shape the Mind: A Theory of Material Engagement.* Cambridge, MA: MIT Press.

Malešević M., M. Vukanović, Z. Obradinović, M. Dimitrijević, T. Brković, M. Stefanović, R. Stanisavljević, O. Jovanović, S. Trifunović, Lj. Karajičić, M. Jovanović and Z. Pavlović. 1980. *Tumač za list Kuršumlija (K 34-31)*. Osnovna geološka karta. Beograd: Savezni geološki zavod.

Mallia, K. 2015. Evaluating Methodological Bias of Identification Rates of *Ovis* and *Capra* on Age-Profiles with the Aid of Zooms, using Çatalhöyük as a Test-Case. Unpublished MSc dissertation, University of York.

Maniatis, Y. and M.S. Tite. 1975. A scanning electron microscope examination of the bloating of fired clays. *Transactions and Journal of the British Ceramic Society* 74/8: 229–232.

Maniatis, Y. and M.S. Tite 1981. Technological examination of Neolithic and Bronze Age pottery from central and southeast Europe and from the Near East. *Journal of Archaeological Science* 8: 59–76.

Mantellini, S. and A.E. Berdimuradov. 2019. Evaluating the human impact on the archaeological landscape of Samarkand (Uzbekistan): a diachronic assessment of the Taylak district by remote sensing, field survey, and local knowledge. *Archaeological Research in Asia* 20: 1–11.

Maran, J. 2000. Das ägäische Chalkolithikum und das erste Silber in Europa, in C. Işık (ed.) *Studien zur Religion und Kultur Kleinasiens und des ägäischen Bereiches. Festschrift für Baki Ögün zum 75. Geburtstag*: 179–193. Bonn: Habelt.

Maran, J. and P.W. Stockhammer (eds). 2017. *Appropriating Innovations: Entangled Knowledge in Eurasia, 5000–1500 BCE*. Oxford: Oxbow.

Mareş, I. 2002. *Metallurgiei aramei în neo-eneoliticul României. The Metallurgy of Copper in the Romanian Neo- Eneolithic*. Suceava: Editura Bucovina Istorică.

Marić, M. 2011. Arhitektura i idealna rekonstrukcija objekata od lepa. *Kolubara* 5, 69–83. Beograd: Republički zavod za zaštitu spomenika kulture.

Marić, M. 2013a. The Vinča culture climate and environment in the Danube region in the 5th and 6th millennium BC, in L.Č. Popović, M. Vidaković and Đ.S. Kostić (eds) *Resources of Danubian Region: The Possibility of Cooperation and Utilization. Proceedings of the Humboldt Kolleg Belgrade 2013* :204-232. Belgrade: Humboldt-Club Serbien.

Marić, M. 2013b. Zaštitna arheološka istraživanja na lokalitetu Jaričište 1, in V. Filipović, R. Arsić and D. Antonović (eds) *Rezultati Novih Arheoloških Istraživanja u Severozapadnoj Srbiji i Susednim Teritorijama*: 17–31. Beograd: Srpsko Arheološkog Društvo. Valjevo: Zavod za zaštitu spomenika kulture.

Marić, M. 2015. Modelling obsidian trade routes during Late Neolithic in the South-East Banat region of Vršac using GIS. *Starinar* 65: 37–52.

Marić, M. 2017. Encircled in water: Modelling watercourses of the late Neolithic – early Copper Age Vinča culture sites in the Danube region (c. 5300 – 4500 BC). *Quaternary International* 429: 54–63. DOI: https://doi.org/10.1016/j.quaint.2014.06.030.

Marić, M. and N. Mirković-Marić. 2011. Obrenovac kod Dimitrovgrada, naselje vinčanske kulture. *Glasnik Društva Konzervatora Srbije* 35: 65–68.

Marić, R. 1951. Iskopavanja na Orašju, prethodni izveštaj o radovima u 1948/49. Godini. *Starinar new series* 2: 113.

Marinković, S. 2010. Arheološki materijal sa lokaliteta Živanićeva Dolja iz zbirke Narodnog muzeja u Zrenjaninu – vinčanska kultura. *Rad Muzeja Vojvodine* 52: 21–36.

Marinova, E. 2007. Archaeobotanical data from the early Neolithic of Bulgaria, in S. Colledge and J. Conolly (eds) *The Origins and Spread of Domestic Plants in Southwest Asia and Europe*: 93–109. London: Left Coast Press.

Marinova, E. and Tz. Popova. 2008. *Cicer arietinum* (chick pea) in the Neolithic and Chalcolithic of Bulgaria: implications for cultural contacts with the neighbouring regions? *Vegetation History and Archaeobotany* 17: 73–80.

Marinova, E. and S. Thiébault. 2008. Anthracological analysis from Kovačevo, southwest Bulgaria: woodland vegetation and its use during the earliest stages of the European Neolithic. *Vegetation History and Archaeobotany* 17: 223–231.

Marinova, E., S. Tonkov, E. Božilova and I. Vajsov. 2012. Holocene anthropogenic landscapes in the Balkans. The palaeobotanical evidence from Southwestern Bulgaria. *Vegetation History and Archaeobotany* 21: 413–427.

Marinova, E., D. Filipović, Đ. Obradović and E. Allué. 2013. Wild plant resources and land use in the Mesolithic and Early Neolithic southeast Europe: archaeobotanical evidence from the Danube catchment of Bulgaria and Serbia. *Offa* 69/70: 467–478.

Maritan, L. 2004. Archaeometric study of Etruscan-Padan type pottery from Veneto region: Petrographic, mineralogical and geochemical-physical characterisation. *European Journal of Mineralogy* 16: 297–307.

Markotić, V. 1984. *The Vinča Culture.* Calgary: Western Publishers.

Marković, N., J. Bulatović, J. Jovanović and V. Katić 2018. Bioarheološka perspektiva ranoneolitskog nalazišta Bataševo, in I. Todorović, G. Jošović, I. Becić and Lj. Vasiljević (eds) *Juhorski zapis – tematski zbornik*: 29–38. Svojnovo – Kruševac: Udruženje za kulturu i umetnost Logos – Istorijski Arhiv.

Martineau, R. 2010. Brussinage, polissage et degrés de séchage. *Les nouvelles de l'archéologie* 119: 13–19.

Martinon, S. 2017. Graphite-treated pottery in the northeastern Mediterranean from the Chalcolithic to the Bronze Age. *Near Eastern Archaeology* 80: 3–13.

Martinón-Torres, M. and Th. Rehren. 2008. *Archaeology, History and Science: Integrating Approaches to Ancient Materials*. Walnut Creek (CA). Left Coast Press.

Martinón-Torres, M. and Th. Rehren. 2014. Technical ceramics, in B.W. Roberts and C.P. Thornton (eds) *Archaeometallurgy in Global Perspective: Methods and Syntheses*: 107–131. New York: Springer.

Mathieson, I., S. Alpaslan-Roodenberg, C. Posth, A. Szécsényi-Nagy, N. Rohland, S. Mallick, I. Olalde, N. Broomandkhoshbacht, F. Candilio, O. Cheronet, D. Fernandes, M. Ferry, B. Gamarra, G.G. Fortes, W. Haak, E. Harney, E. Jones, D. Keating, B. Krause-Kyora, I. Kucukkalipci, M. Michel, A. Mittnik, K. Nägele, M. Novak, J. Oppenheimer, N. Patterson, S. Pfrengle, K. Sirak, K. Stewardson, S. Vai, S. Alexandrov, K.W. Alt, R. Andreescu, D. Antonović, A. Ash, N. Atanassova, K. Bacvarov, M.B. Gusztáv, H. Bocherens, M. Bolus, A. Boroneanţ, Y. Boyadzhiev, A. Budnik, J. Burmaz, S. Chohadzhiev, N.J. Conard, R. Cottiaux, M. Čuka, C. Cupillard, D.G. Drucker, N. Elenski, M. Francken, B. Galabova, G. Ganetsovski, B. Gély, T. Hajdu, V. Handzhyiska, K. Harvati, T. Higham, S. Iliev, I. Janković, I. Karavanić, D.J. Kennett, D. Komšo, A. Kozak, D. Labuda, M. Lari, C. Lazar, M. Leppek, K. Leshtakov, D.L. Vetro, D. Los, I. Lozanov, M. Malina, F. Martini, K. McSweeney, H. Meller, M. Menđušić, P. Mirea, V. Moiseyev, V. Petrova, T.D. Price, A. Simalcsik, L. Sineo, M. Šlaus, V. Slavchev, P. Stanev, A. Starović, T. Szeniczey, S. Talamo, M. Teschler-Nicola, C. Thevenet, I. Valchev, F. Valentin, S. Vasilyev, F. Veljanovska, S. Venelinova, E. Veselovskaya, B. Viola, C. Virag, J. Zaninović, S. Zäuner, P.W. Stockhammer, G. Catalano, R. Krauß, D. Caramelli, G. Zariņa, B. Gaydarska, M. Lillie, A.G. Nikitin, I. Potekhina, A. Papathanasiou, D. Borić, C. Bonsall, J. Krause, R. Pinhasi and D. Reich. 2018. The genomic history of southeastern Europe. *Nature* 555: 197. DOI: https://doi.org/10.1038/nature25778

McCarthy, J. 2014. Multi-image photogrammetry as a practical tool for cultural heritage survey and community engagement. *Journal of Archaeological Science* 43: 175–185.

McDonnell, J.G. 2001. Pyrotechnology, in D.R. Brothwell and M. Pollard (eds) *Handbook of Archaeological Science*: 493–506. London: Wiley.

McGeehan-Liritzis, V. and N.H. Gale. 1988. Chemical and lead isotope analysis of Greek Late Neolithic and Early Bronze Age Metals. *Archaeometry* 30: 199–225.

McLaren, F.S. and R.N.L.B Hubbard. 1990. The archaeobotanical remains, in R. Tringham, D. Krstić (eds) *Selevac, A Neolithic Village in Yugoslavia*: 247–254. Los Angeles: UCLA Institute of Archaeology Press.

McPherron, A. and D. Srejović (eds). 1988. *Divostin and the Neolithic of Central Serbia.* Pittsburgh (PA): University of Pittsburgh.

McPherron A., J. Rasson and B. Galdikas. 1988. Other artefact categories, in A. McPherron and D. Srejović (eds) *Divostin and the Neolithic of Central Serbia*: 325–343. Pittsburgh (PA): University of Pittsburgh.

Medović, A., R. Hofmann, T. Stanković-Pešterac, S. Dreibrodt, I. Medović and R. Pešterac. 2014. The

Late Neolithic settlement mound Borđoš near Novi Bečej, Serbian Banat, in a multiregional context – Preliminary results of geophysical, geoarchaeological and archaeological research. *Rada Muzeja Vojvodine* 56: 53–77.

Mehofer, M. 2014. Metallurgy during the Chalcolithic and the Beginning of the Early Bronze Age in Western Anatolia, in B. Horejs and M. Mehofer (eds) *Western Anatolia before Troy - Proto-Urbanisation in the 4th millennium BC*: 463–490. Vienna: OREA 1.

Meier, J. 2013. More than fun and games? An experimental study of worked bone astragali from two Middle Bronze Age Hungarian sites, in A. Choyke and S. O'Connor (eds) *From These Bare Bones: Raw Materials and the Study of Worked Osseous Objects*: 166–173. Oxford and Oakville: Oxbow Books.

Mellaart, J. 1964. Excavations at Çatalhöyük, 1963: third preliminary report. *Anatolian Studies* 14: 39–119.

Meller, H., R. Risch and E. Pernicka (eds). 2014. *Metalle der Macht - Frühes Gold und Silber. Metals of power - Early gold and silver.* Halle: Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt - Landesmuseum für Vorgeschichte Halle.

Menghin, O. 1931. *Weltgeschichte der Steinzeit.* Wien: Schroll.

Menze, B.H. and J.A. Ur. 2012. Mapping patterns of long-term settlement in Northern Mesopotamia at a large scale. *Proceedings of the National Academy of Sciences of the United States of America* 109(14): E778–E787.

Merkyte, I. 2005. *Lîga. Copper Age strategies in Bulgaria*. (Acta Archaeologica 76(1). Acta Archaeologica Supplementa VI, Centre of World Archaeology Publications 2). København: Blackwell Munksgaard.

Merlini, M. 2005. Semiotic approach to the features of the Danube script. *Documenta Praehistorica* 32: 233–251.

Merpert, N.J. and R.M. Munchaev. 1972. The early metallurgy in Mesopotamia (Древнейшая металлургия Месопотамии, in Russian), in R.M. Munchaev and N.J. Merpert (eds) *Early Agricultural Settlements in Northern Mesopotamia. The Investigations of Societ Expeditions in Iraq (Раннеземледельческие поселения северной Месопотамии. Иследования советской экспедиции в Ираке, in Russian)*: 307–316. Miami (FL). Field Research Projects.

Merpert, N.Y. and R.M. Muncaev. 1987. The earliest levels at Yarim Tepe I and Yarim Tepe II in northern Iraq. *Iraq* 49: 1–36.

Meskell, L. (ed.) 2005. *Archaeologies of Materiality.* Oxford: Blackwell.

Mesoudi, A. and J.M. O'Brien. 2008. The learning and transmission of hierarchical cultural recipes. *Biological Theory* 3: 63–72.

Michelaki, K. 2008. Making pots and potters in the Bronze Age Maros villages of Kiszombor-Új-Élet and Klárafalva-Hajdova. *Cambridge Archaeological Journal* 18: 355–380.

Michelaki, K.V., G. Braun and G.V. Hancock. 2014. Local clay sources as histories of human–landscape interactions: a ceramic taskscape perspective. *Journal of Archaeological Method and Theory* 22: 783–827.

Miculinić, K. and M. Mihaljević. 2003. Analiza faune prapovijesnog nalazišta Slavča-Nova Gradiška. *Opvscula Archaeologica* 27: 71–80.

Mihaylov, P. 2008. New evidence for the earliest copper yielding and processing in the Upper Struma Valley, in M. Čičikova and D. Gergova (eds) *Phosphorion. Studia in Honorem Mariae Čičikova*: 35–47. Sofia: Prof. Marin Drinov Academic Publishing House.

Milić, M. 2014. PXRF characterisation of obsidian from Central Anatolia, the Aegean and Central Europe. *Journal of Archaeological Science* 41: 285–296.

Milić, M. 2015. Obsidian Exchange and Societies in the Balkans and the Aegean from the Late 7th to 5th Millennia BC. Unpublished PhD dissertation, University College London.

Milić, M., K. Brown and T. Carter. 2013. A visual characterisation of the Çatalhöyük Obsidian (Appendix 21), in I. Hodder (ed.) *Substantive Technologies at Çatalhöyük Reports from the 2000–2008 Seasons*: 417–478. Los Angeles: Monographs of the Cotsen Institute of Archaeology, University of California at Los Angeles.

Milleker, F. 1938. Vorgeschichte des Banats: Neolithikum. *Starinar* 13: 102–166.

Miller, D. (ed). 2005. *Materiality*. Durham (NC): Duke University Press.

Miller, H. 2007. *Archaeological Approaches to Technology*. London, Amsterdam: Elsevier/Academic Press.

Milojčić, V. 1949. *Chronologie der Jungeren Steinzeit Mittel- und Sudosteuropas*. Berlin: Gebr. Mann.

Mineral Deposits of Serbia, n.d., Ore Deposit Database, viewed 18 June 2020, <https://bokisingl.files.wordpress.com/2011/04/serbia-mineral-deposits.pdf>

Mioč, U.B., P. Colomban, G. Sagon, M. Stojanović and A. Rosić. 2004. Ochre decor and cinnabar residues in Neolithic pottery from Vinča, Serbia. *Journal of Raman Spectroscopy* 35: 843–846. DOI: https://doi.org/10.1002/jrs.1221.

Mittnik, A., K. Massy, C. Knipper, F. Wittenborn, R. Friedrich, S. Pfrengle, M. Burri, N. Carlichi-Witjes, H. Deeg, A. Furtwängler, M. Harbeck, K. von Heyking, C. Kociumaka, I. Kucukkalipci, S. Lindauer, S. Metz, A. Staskiewicz, A. Thiel, J. Wahl, W. Haak, E. Pernicka, S. Schiffels, P.W. Stockhammer and J. Krause. 2019. Kinship-based social inequality in Bronze Age Europe. *Science* 366: 731–734.

Montero-Ruiz, I., M. Murillo-Barroso, and M. Ruiz-Taboada 2021. The beginning of the production and use of metal in Iberia: From independent invention to technological innovation. *Eurasia Antiqua* 23: 193–208.

Molloy, B. 2008. Martial arts and materiality: a combat archaeology perspective on Aegean swords of the fifteenth and fourteenth centuries BC. *World Archaeology* 40: 116–134.

Molloy, B. and M. Mödlinger. 2020. The organisation and practice of metal smithing in Later Bronze Age Europe. *Journal of World Prehistory* 33: 169–232.

Monah, D., G. Dumitroaia, F. Monah, C. Preoeasa, R. Munteanu and D. Nicola. 2002. *Poduri-Dealul Ghindaru: o troie în Subcarpații Moldovei* (Bibliotheca Memoriae Antiquitatis 13). Piatra Neamţ: Editura Constantin Matasa.

Montelius, O. 1899. *Der Orient und Europa: Einfluss der orientalischen Cultur auf Europa bis zur Mitte des letzten Jahrtausends v. Chr.* Stockholm: Königliche Akademie der schönen Wissenschaften, Geschichte und Alterthumskunde.

Monthel, J., P. Vadala, J.M. Leistel and F. Cottard. 2002. *Mineral Deposits and Mining Districts of Serbia*. Belgrade: Republic of Serbia Ministry of Mining and Energy, Geoinstitut Belgrade and Mining and Geology Faculty.

Montufo, A.M. 1997. The use of satellite imagery and digital image processing in landscape archaeology. A case study from the island of Mallorca, Spain. *Geoarchaeology: An International Journal* 12(1): 71–85.

Morgan, L.H. 1985 [1877]. *Ancient Society*. Tucson (AZ): University of Arizona Press.

Motolsci, J. 1970. Historische Erforschung der Körpergrösse des Rindes auf Grund von Ungarischem Knochenmaterial. *Zeitchr. f. Tierzüchtg. u. Züchtgsbiol.* 87 (2): 89–137.

Mrkobrad, D. 1989. Istraživanje rudarske topionice u Donjoj Zaplanini. *Glasnik Društva Konzervatora Srbije* 13: 91–92.

Mrkobrad, D., V. Bogosavljević and D. Bogosavljević. 1989. Prilog istraživanju kopaoničkog rudarstva. *Glasnik Društva Konzervatora Srbije* 13: 93–95.

Muhly, J.D. 1989. Çayönü Tepeşi and the beginnings of metallurgy in the Old World, in A. Hauptmann, E. Pernicka and G.A Wagner (eds) *Old World Archaeometallurgy* (Der Anschnitt, Beiheft 7): 1–13. Bochum: Deutsches Bergbau-Museum.

Muhly, J.D. 2002. Early metallurgy in Greece and Cyprus, in Ü. Yalçın (ed.) *Anatolian Metal II,* (Der Anschnitt, Beiheft 15): 77–82. Bochum: Deutsches Bergbau-Museum.

Muhi, B., D. Bugarin and J. Miloradić. 2018. Resursi i perspektive razvoja industrijskog i rudarskog turizma u Srbiji (Resources and perspectives of developing industrial and mining tourism in Serbia, in Serbian). *Business Economics* 23: 141–156.

Müller, J. 2006. Demographische Variablen des Bosnischen Spätneolithikums - zur Frage der Bevölkerungsrekonstruktion im Südosteuropäischen Neolithikum, in N. Tasić and C. Grozdanov (eds) *Homage to Milutin Garašanin:* 367–378. Belgrade: Serbian Academy of Sciences and Arts, Macedonian Academy of Sciences and Arts.

Müller, J. 2007. Demografski varijabiliteti u kasnom neolitu na području Bosne i pitanje gustine naseljenosti u neolitu jugoistočne Evrope, *Godišnjak Centra za balkanološka ispitivanja ANU BiH* 34: 17–33.

Müller, J. 2012. Tells, fire, and copper as social technologies, in R. Hofmann, F.-K. Moetz and J. Müller (eds) *Tells: Social and Environmental Space. Proceedings of the International Workshop 'Socio-Environmental Dynamics Over the Last 12,000 Years: The Creation of Landscapes II' in Kiel, 14th –18th March 2011. Volume 3* (Universitätsforschungen zur Prähistorischen Archäologie 207): 47–52. Bonn: Habelt.

Müller, J. 2017. Inheritance, population and social identities. Southeast Europe 5200-4300 BCE, in M. Gori and M. Ivanova (eds) *Balkan Dialogues. Negotiating Identity between Prehistory and the Present*: 156–168. London: Routledge.

Müller, R., Th. Rehren and S. Rovira. 2004. Almizaraque and the early copper metallurgy of southeast Spain: new data. *Madrider Mitteilungen* 45: 33–56.

Müller, J., K. Rassmann and R. Hofmann (eds). 2013a. *Okolište 1 – Untersuchungen einer spätneolithischen Siedlungskammer in Zentralbosnien* (Universitätsforschungen zur Prähistorischen Archäologie 228). Bonn: Verlag Rudolf Habelt

Müller, J., K., Rassmann and Z. Kujundžić-Vejzagić. 2013b. Okolište – Rekonstruktion spätneolithischer und frühchalkolithischer Siedlungsprozesse des zentralbosnischen Visokobeckens: Fragestellungen, Forschungsstrategien, Ergebnisse, in J. Müller, K. Rassmann, and R. Hofmann (eds) *Okolište 1 – Untersuchungen einer spätneolithischen Siedlungskammer in Zentralbosnien*: 11–68. Bonn: Habelt.

Müller, J., K. Rassmann and M. Videjko (eds). 2016. *Tripolye-Megasites and European Prehistory 4100-3400 BCE. Themes in Contemporary Archaeology*. London: Routledge and CRC Press.

Müller-Scheeßel, N., J. Bátora, S. Reiter, K. Radloff and P. Tóth. 2016. Joint prospections on Early Bronze Age site in the Žitava Valley by the Romano-German Commission, Frankfurt and the Archaeological Institute of the Slovak Academy of Sciences, Nitra and Comenius University, Bratislava. *Študijné Zvesti* 60: 79–96.

Müller-Scheeßel, N., J. Müller, I. Cheben, W. Mainusch, K. Rassmann, W. Rabbel, E. Corradini and M. Furholt. 2020. A new approach to the temporal significance of house orientation in European Early Neolithic settlements. *Plos One* 15(1): 1–18.

Murillo-Barroso, M. and I. Montero Ruiz. 2012. Copper ornaments in the Iberian Chalcolithic: technology versus social demand. *Journal of Mediterranean Archaeology* 25: 53–73.

N

Naumov, G., L. Fidanoski, I. Tolevski and A. Ivkovska. 2009. *Neolithic Communities in the Republic of Macedonia*. Skopje: Dante.

Neff, H. 1992. Ceramics and evolution. *Archaeological Method and Theory* 4: 141–193.

Neff, H. 1996. Ceramics and evolution, in M.J. O' Brian (ed.) *Evolutionary Archaeology: Theory and Application*: 244–269. Salt Lake City: University of Utah Press.

Nelson, R. and S. Winter. 1982. *An Evolutionary Theory of Economic Change.* Cambridge (MA): Belknap.

Nerantzis, N., Y. Bassiakos and S. Papadopoulos. 2016. Copper metallurgy of the Early Bronze Age in Thassos, north Aegean. *Journal of Archaeological Science Reports* 7: 574–580. DOI: http://dx.doi.org/10.1016/j.jasrep.2015.08.008.

Nessel, B. 2012. Metallurgen im Grab: Überlegungen zur sozialen Einstufung handwerklicher Spezialisten, in T.L. Kienlin and A. Zimmerman (eds) *Beyond Elites: Alternatives to Hierarchical Systems in Modelling Social Formations*: 423–432. Bonn: Habelt.

Nessel, B. 2013. The 'absence' of smiths and founders: Why tools are rare in Bronze Age burials, in B. Rezi, R.E. Németh and S. Berecki (eds) *Bronze Age Crafts and Craftsmen in the Carpathian Basin*: 139–148. Târgu Mureș: Editura MEGA.

Neubauer, F. and C. Heinrich. 2003. Late Cretaceous and Tertiary geodynamics and ore deposit evolution of the Alpine-Balkan-Dinaride orogen, in D. Eliopoulos (ed.) *Mineral Exploration and Sustainable Development. Proceedings of the Seventh Biennial SGA Meeting on Mineral Exploration and Sustainable Development, Athens, Greece, August 24-28, 2003*: 1133–1136. Athens: Millpress.

Neuninger, H., R. Pittioni and W. Siegl 1964. Frühkeramikzeitliche Kupfergewinnung in Anatolien. *Archaeologia Austriaca* 35: 98–110.

Nikolić, D. 2004. Keramičko posuđe, in M. Bogdanović (ed.) *Grivac. Naselja protostarčevačke i vinčanske kulture*: 203–315. Kragujevac: Narodni muzej.

Nikolić, D. (ed.). 2008. *Sto godina istraživanja arheološkog lokaliteta Vinča-Belo Brdo* (100 Years of archaeological research at Vinča- Belo Brdo, in Serbian). Belgrade: Faculty of Philosophy University of Belgrade, National Museum Belgrade, City Museum Belgrade, Serbian Academy of Arts and Sciences.

Nikolov, V. 1975. *Bogdan, Zaminec, praistorisko selishte*. Sofia.

Nikolov, V. 1984. *Krivodol-drevni kulturi*. Sofia.

Nodari, L., E. Marcuz, L. Maritan, C. Mazzoli and U. Russo. 2007. Hematite nucleation and growth in the firing of carbonate-rich clay for pottery production. *Journal of the European Ceramic Society* 27: 4665–4673.

Nørgaard, H.W., E. Pernicka and H. Vandkilde. 2019. On the trail of Scandinavia's early metallurgy: Provenance, transfer and mixing. *PLOS ONE* 14: e0219574.

Northover, J.P. 1989. Properties and use of arsenic-copper alloys, in A. Hauptmann, E. Pernicka and G.A. Wagner (eds) *Old World Archaeometallurgy*: 111–118. Bochum: Deutsches Bergbau-Museum.

Novotna, M. 1970. *Die Äxte und Beile in der Slowakei.* (Prähistorische Bronzefunde 9/3). München: Beck.

Novotný, B. 1958. *Die Slowakei in der Jungeren Steinzeit*. Bratislava: Archeologický ústav Slovenskej akadémie vied v Nitre.

O

Obelić, B., M. Krznarić-Škrivanko, B. Marijan and I. Krajcar-Bronić. 2004. Radiocarbon dating of Sopot culture sites (Late Neolithic) in eastern Croatia. *Radiocarbon* 46(1): 245–258.

Obradović, Đ. 2013. *New data on early agriculture in the Central Balkans: Archaeobotanical investigations at early and Late Neolithic sites in the Morava Valley, Serbia*. Poster presented at the 16th conference of the International Work Group for Palaeoethnobotany, Thessaloniki, Greece. Abstract in *Book of Abstracts*: 167.

Obradović, Đ. 2020. Arheobotanička istraživanja u kasnom neolitu Pomoravlja: društveno-ekonomski aspekti proizvodnje i pripreme hrane. Unpublished doctoral dissertation, University of Belgrade.

O'Brien, M.J. and S.J. Shennan (eds). 2010a. *Innovation in Cultural Systems. Contributions from Evolutionary Anthropology.* Cambridge, MA: The MIT Press.

O'Brien, M.J. and S.J. Shennan. 2010b. Issues in anthropological studies of innovation, in M.J. O'Brien and S.J. Shennan (eds) *Innovation in Cultural Systems. Contributions from Evolutionary Anthropology*: 3–17. Cambridge (MA): The MIT Press.

O'Brien, W. 2015. *Prehistoric Copper Mining in Europe: 5000-500 BC.* Oxford: Oxford University Press.

O'Connor, T. 2003. *The Analysis of Urban Animal Bone Assemblages*. York: Council for British Archaeology.

Olausson, D. 1980. Starting from scratch: the history of edge-wear research from 1838 to 1978. *Lithic Technology* 9(2): 48–60.

Olausson, D. 1983a. *Flint and groundstone axes in the Scanian Neolithic. An evaluation of raw materials based on experiment*. Lund: CWK Gleerup.

Olausson, D. 1983b. Tools and Technology: Lithic Technological Analysis of Neolithic Axe Morphology. Unpublished Phd Thesis, Lund University.

Olausson, D. 1990. Edge-wear analysis in archaeology. The current state of research. *Laborativ arkeologi* 4: 5–14.

Olofsson, A. and I. Rodushkin. 2011. Provenancing flint artefacts with ICP-MS using REE signatures and Pb isotopes as discriminants: preliminary results of a case study from Northern Sweden. *Archaeometry* 53: 1142–1170. DOI: https://doi.org/10.1111/j.1475-4754.2011.00605.x.

Orfanou, V. and Th. Rehren. 2015. A (not so) dangerous method: pXRF vs. EPMA-WDS analyses of copper-based artefacts. *Archaeological and Anthropological Sciences* 7: 387–397. DOI: https://doi.org/10.1007/s12520-014-0198-z.

Orton, C. and M. Hughes. 2013 *Pottery in Archaeology*. Cambridge: Cambridge University Press.

Orton, D.C. 2008. Beyond Hunting and Herding: Humans, Animals, and the Political Economy of the Vinča Period. Unpublished Ph.D. dissertation, University of Cambridge.

Orton, D. 2010. Both subject and object: Herding, inalienability and sentient property in prehistory. *World Archaeology* 42: 188–200. DOI: https://doi.org/10.1080/00438241003672773.

Orton, D.C. 2012. Herding, settlement, and chronology in the Balkan Neolithic. *European Journal of Archaeology* 15 (1): 5–40. DOI: https://doi.org/10.1179/1461957112Y.0000000003.

Orton, D.C. 2014. Preliminary report on Neolithic animal bones from Kočićevo, in I. Pandžić and M. Vander Linden (eds) *The Neolithic Site of Kočićevo in the Lower Vrbas Valley (Republika Srpska, Bosnia and Herzegovina): Report of the 2009-2014 Field Seasons*: 97–120. Banja Luka: Philosophy Faculty, University of Banja Luka.

Orton, D., J. Gaastra and M. Vander Linden. 2016. Between the Danube and the deep blue sea: Zooarchaeological meta-analysis reveals variability in the spread and development of Neolithic farming across the Western Balkans. *Open Quaternary* 2: 1–26. DOI: http://doi.org/10.5334/oq.28.

Ottaway, B.S. 1979. Analysis of the earliest metal finds from Gomolava. *Rad Vojvođanskih muzeja* 25: 53–59.

Ottaway, B.S. 1989. Interaction of some of the earliest copper-using cultures in central Europe, in A. Hauptmann, E. Pernicka and G.A. Wagner (eds) *Old World Archaeometallurgy* (Der Anschnitt, Beiheft 7): 19–23. Bochum: Deutsches Bergbau-Museum.

Ottaway, B.S. 1994. *Prähistorische Archäometallurgie*. Espelkamp: Marie Leidorf.

Ottaway, B.S. 2001. Innovation, production and specialisation in early prehistoric copper metallurgy. *European Journal of Archaeology* 4: 87–112.

Ottaway, B.S. and B. Roberts. 2008. The emergence of metalworking, in A. Jones (ed.) *Prehistoric Europe: Theory and Practice*: 193–225. Chichester: Wiley-Blackwell.

Özdoğan, M. 2011 Archaeological evidence on the westward expansion of farming communities from Eastern Anatolia to the Aegean and the Balkans. *Current Anthropology* 52(S4): S415–S430.

Özdoğan, M. and N.O. Dede. 1989. Excavations at Toptepe in Eastern Thrace 1989. *Arkeoloji ve Sanat* 13(46–49): 3–23.

Özdoğan, M. and A. Özdoğan. 1999. Archaeological evidence on the early metallurgy at Çayönü Tepeşi, in A. Hauptmann, E. Pernicka, Th. Rehren and Ü. Yalçın (eds) *The Beginnings of Metallurgy* (Der Anschnitt, Beiheft 9): 13–22. Bochum: Deutsches Bergbau-Museum.

P

Pakkanen, J., A. Brysbaert, D. Turner, D. and Y. Boswinkel. 2020. Efficient three-dimensional field documentation methods for labour cost studies: Case studies from archaeological and heritage contexts. *Digital Applications in Archaeology and Cultural Heritage* 17: 1–10.

Palavestra, A., I. Bogdanović and A. Starović. 1993. Bodnjik-Družetić – eneolitsko gradinsko naselje. *Glasnik Srpskog arheološkog društva* 9: 186–191.

Palavestra A., I. Bogdanović and A. Starović. 1996. Bodnjik-Družetić, kampanja 1994. *Glasnik Srpskog arheološkog društva* 11: 190–197.

Paluch T. 2011. *Maroslele-Pana: egy középső neolitikus lelő hely a kultúrák határvidékén (Maroslele-Pana: A Middle Neolithic site at the frontier of cultures).* (Monographia Archaeologica 2). Szeged: Móra Ferenc Múzeum.

Pantović, I. 2014. *Vinčanski Amulet.* Vršac: Gradski muzej.

Papadopoulos, S. 2008. Silver and copper production practices in the prehistoric settlement at Limenaria, Thasos, in I. Tzachili (ed.) *Aegean Metallurgy in the Bronze Age. Proceedings of an International Symposium held at the University of Crete, Rethymnon, Greece, on November 19-21, 2004*: 59–67. Athens: Ta Pragmata Publications.

Papathanasiou, A., W. Parkinson, D. Pullen, M. Galaty and P. Karkanas (eds). 2018. *Neolithic Alepotrypa Cave in the Mani Greece*. Oxford: Oxbow.

Parcak, S. 2009. *Satellite Remote Sensing for Archaeology.* New York: Routledge.

Pare, C.F.E. 2000. Bronze and the Bronze Age, in C.F.E. Pare (ed.) *Metals Make the World go Round. The Supply and Circulation of Metals in Bronze Age Europe*: 1–38. Oxford: Oxbow Books.

Parkinson, W.A., R.W. Yerkes and A. Gyucha. 2004. The transition from the Neolithic to the Copper Age: excavations at Vésztı-Bikeri, Hungary, 2000–2002. *Journal of Field Archaeology* 29(1/2): 101–121.

Parzinger, H. 1993. *Studien zur Chronologie und Kulturgeschichte der Jungstein-, Kupfer- und Frühbronzezeit zwischen Karpaten und Mittlerem Taurus. Volume 52.* Mainz am Rhein: von Zabern.

Parzinger, H. 2005. Die mittel- und spätneolithische Keramik aus Aşağı Pınar Grabungen 1993–1998, in H. Parzinger and H. Schwarzberg (eds) *Aşağı Pınar II. Die mittel- und spätneolithische Keramik* (Archäologie in Eurasien 18 – Studien im Thrakien-Marmara Raum 2): 1–245. Mainz: Verlag Philipp von Zabern.

Patay, P. 1974. Die hochkupferzeitliche Bodrogkeresztúr-Kultur. *Bericht der Römisch Germanischen Komission* 55: 1–71.

Patay, P. 1984. *Kupferzeitliche Meißel, Beile und Äxte in Ungarn.* (Prähistorische Bronzefunde Volume 9, Band 15). München: C.H. Beck'sche Verlagsbuchhandlung.

Patterson, C.C. 1971. Native copper, silver, and gold accessible to early metallurgists. *American Antiquity* 36: 286–321. DOI: https://doi.org/10.2307/277716.

Park, J.-S., Voyakin, D. and A. Beisenov 2020. The implication of diachronic changes reflected in LBA bronze assemblages of Central Kazakhstan. *Archaeological and Anthropological Sciences,* 12 (7). DOI: https://doi.org/10.1007/s12520-019-00989-z.

Pascual Benito, J.L. 1998. *Utillaje* óseo, *adornos e* ídolos *neolíticos valencianos*. Valencia: Disputación provincial de Valencia. Servicio de investigación prehistórica. Serie de trabajos varios 95.

Pawlik, A.F. 2007. Analysis of two polished stone adzes from Ille Cave at El Nido, Palawan Island, Philippines. *Hukay: Journal of the University of the Philippines Archaeological Studies Program* 10: 38–59.

Payne, S. 1972. Partial recovery and sample bias: the results of some sieving experiments, in E. Higgs (ed.) *Papers in Economic Prehistory*: 49–64. Cambridge: Cambridge University Press.

Payne, S. 1973. Kill-off patterns in sheep and goats: the mandibles from Aşvan Kale. *Anatolian Studies* 23: 281–303.

Payne, S. 1985. Morphological distinctions between mandibular teeth of young sheep, *Ovis*, and goats, *Capra*. *Journal of Archaeological Science* 12: 139–147.

Pearce, M. 2015. The spread of early copper mining and metallurgy in Europe: An assessment of the diffusionist model, in A. Hauptmann, D. Modarressi-Tehrani and M. Prange (eds) *Archaeometallurgy in Europe III: Proceedings of the 3rd International Conference, Deutsches Bergbau-Museum Bochum, June 29 – July 1, 2011* (Der Anschnitt 26): 45–54. Bochum: Deutsches Bergbau-Museum.

Pearce, M. 2019. The 'Copper Age'– a history of the concept. *Journal of World Prehistory* 32: 229–250. DOI: https://doi.org/10.1007/s10963-019-09134-z.

Pearsall, M.D. 2000. *Paleoethnobotany. A Handbook of Procedures*. Orlando: Academic Press.

Pecikoza, V. 2011. Deposits of copper and Vinča sites in the area of Valjevo Mountains, in Blagojević, M. (ed.) *Kolubara 5*: 39–46. Belgrade: Republički zavod za zaštitu spomenika kulture

Pelegrin, J. 1988. Débitage expérimental par pression: du plus petit au plus grand, in *Technologie Préhistorique*. (Notes et Monographies Techniques du CRA 25): 37–53. Paris: Edition du CNRS.

Pelegrin, J. 2006. Long blade technology in the Old World: an experimental approach and some archaeological results, in J. Apel and K. Knutsson (eds) *Skilled Production and Social Reproduction – Aspects of Traditional Stone-Tool Technology*: 37–68. Upsalla: Societas Archeologica Upsaliensis.

Pentedeka, A. 2011. Links of clay in Neolithic Greece: the case of Platia Magoula Zarkou, in A. Brysbaert (ed.) *Tracing Prehistoric Social Networks through Technology: A Diachronic Perspective on the Aegean*: 106–125. London/New York: Routledge.

Perić, S. 2006. The Gradac period in the Neolithic settlements in the Morava valley, in N. Tasić and C. Grozdanov (eds) *Homage to Milutin Garašanin*: 235–250. Belgrade: Serbian Academy of Sciences and Arts.

Perić, S., C. Rummel, G. Schafferer, H. Wendling and D. Winger. 2016. Geomagnetic survey of Neolithic settlements in the Middle Morava Valley – preliminary results, in S. Perić (ed.) *The Neolithic in the Morava Valley. New Insights into Settlement and Economy*: 9–27. Belgrade: Institute of Archaeology.

Perišić, S. 1984. *Predmeti od kosti, roga i kamena iz Odseka za praistoriju Muzeja grada Beograda*. Beograd: Muzej grada Beograda.

Perišić, N., M. Marić-Stojanović, V. Andrić, U.B. Mioč and L. Damjanović. 2016. Physicochemical characterisation of pottery from Vinča culture, Serbia regarding the firing temperature and decoration technique. *Journal of the Serbian Chemical Society* 81/12: 1415–1426.

Pernicheva, L. 2004. Chalcolithic anthropomorphic figurines from Tell Kirilovo, Stara Zagora District, in V. Nikolov, K. Bachvarov, and P. Kalchev (eds) *Praistoričeska Trakija*. Sofia-Stara Zagora: Arheološki institut.

Pernicka, E. 1990. Gewinnung und Verbreitung der Metalle in prähistorischer Zeit. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz* 37: 21–129.

Pernicka, E. 1999. Trace element fingerprinting of ancient copper: a guide to technology or provenance? In S.M.M. Young, A.M. Pollard, P. Budd and R.A. Ixer (eds) *Metals in Antiquity*: 163–171. Oxford: Archaeopress.

Pernicka, E. 2020. Development of metallurgy in Eurasia. *Quaternary International* 560–561: 38–44. DOI: https://doi.org/10.1016/j.quaint.2020.03.057.

Pernicka, E., F. Begemann and S. Schmitt-Strecker. 1993. Eneolithic and Early Bronze Age copper artefacts from the Balkans and their relation to Serbian copper ores. *Prähistorische Zeitschrift* 68: 1–54.

Pernicka, E., F. Begemann, S. Schmitt-Strecker, H. Todorova and I. Kuleff. 1997. Prehistoric copper in Bulgaria. Its composition and provenance. *Eurasia Antiqua* 3: 41–180.

Pernicka, E., Lutz, J. and Stöllner, T. 2016. Bronze Age copper produced at Mitterberg, Austria, and its distribution. *Archaeologia Austriaca* 100: 19-55.

Perucchetti, L., Montero-Ruiz, I., and P. Bray 2020. Mapping archaeometallurgical data of the Iberian Copper Age: Different ways to look at a big picture. *Journal of Archaeological Science* 119: 105165. DOI: https://doi.org/10.1016/j.jas.2020.105165

Petrović, J. 1992. Архитектура куће 4 на Гомолави; насеље млађе винчанске културе, *Рад Војвођанских музеја* 34: 19–32.

Pétrequin P. and C. Jeunesse. 1995. La Hache de Pierre. *Carrières Vosgiennes et Éxchanges de Lames Polies pendant le Néolithique (5400-2100 avant J.-C.).* Paris: Editions Errance.

Pétrequin, P., S. Cassen, M. Errera, L. Klassen, A.M. Pétrequin and J.A. Sheridan. 2013. The value of things: the production and circulation of Alpine jade axes during the 5th–4th millennia in a European perspective, in *Economic Archaeology: From Structure to Performance in European Archaeology* (University Research on Prehistoric Archaeology 237): 65–82. Bonn: Habelt.

Petrović, J. 1999/2000. Građevinski objekti u naselju Starčevačke kulture na Golokutu. *Rad Muzeja Vojvodine* 41–42: 7–10.

Picon, M. 1995. Grises et grises: quelques réflexions sur les céramiques cuites en mode B, in Câmara Municipal de Tondela (ed.) *Actas das 1ªJornadas de Cerâmica Medieval e Pós Medieval, métodos e resultados para o seu estudo* (1992): 283–287. Tondela: Porto, Municipal de Tondela.

Pigott, V.C. 1999. The development of metal production on the Iranian Plateau: an archaeometallurgical perspective, in V.C. Pigott (ed.) *The Archaeometallurgy of the Asian World*: 73–106. Philadelphia (PA): University of Pennsylvania Museum.

Pigott, V.C. 2011. Sources of tin and the tin trade in southwest Asia: recent research and its relevance to current understanding, in P.P. Betancourt and S.C. Ferrence (eds) *Metallurgy: Understanding How, Learning Why. Studies in Honor of James D. Muhly*: 273–291. Philadelphia (PA): INSTAP Academic Press.

Pigott, V.C. 2021. The acquisition of tin in Bronze Age southwest Asia, in B. Lyonnet and N.A. Dubova (eds) *The World of the Oxus Civilization.* London: Routledge.

Pitblado, B.L., M.B. Cannon, H. Neff, C.M. Dehler and S.T. Nelson. 2013. LA-ICP-MS analysis of quartzite from the Upper Gunnison Basin, Colorado. *Journal of Archaeological Science* 40(4): 2196–2216. DOI: http://www.sciencedirect.com/science/article/pii/S0305440312005109

Plisson, H. and A. Lompré. 2008. Technician or researcher? A visual answer, in L. Longo and N. Skakun (eds) *'Prehistoric Technology' 40 Years Later: Functional Studies and the Russian Legacy: Proceedings of the International Congress Verona (Italy), 20-23 April 2005* (British Archaeological Reports International Series S1783): 497–501. Oxford: Archaeopress.

Pollard, A.M. and C. Heron. 2008. *Archaeological Chemistry.* Cambridge: The Royal Society of Chemistry.

Poplin F. 2004. Fiche éléments de nomenclature anatomique relative aux matères dures d´origine animale, in D. Ramseyer (ed.) *Matières et techniques. Fiches de la Commission de nomenclature sur l'industrie de l'os préhistorique. Cahier XI*: 11–15. Paris: CNRS.

Popova, Tz. 2014. Agriculture and subsistence economy in the territory of Bulgaria during Neo-Eneolithic, in C. Preoteasa and C.-D. Nicola (eds) *L'impact anthropique sur l'environnement durant le Néo-Énéolithique du Sud-Est de l'Europe: in honorem dr. Gheorghe Dumitroaia*: 37–47. Piatra-Neamţ: Editura 'Constantin Matasă'.

Porčić, M. 2009. Archaeology of Vinča Houses: Theoretical-Methodological Frameworks of Studying Demography and Social Structure. Unpublished PhD dissertation. Belgrade: University of Belgrade.

Porčić, M. 2011. An exercise in archaeological demography: estimating the population size of Late Neolithic settlements in the central Balkans. *Documenta Praehistorica* 38: 323–332.

Porčić, M. 2012a. Social complexity and inequality in the Late Neolithic of the Central Balkans: reviewing the evidence. *Documenta Praehistorica* 39: 167–183.

Porčić, M. 2012b. De facto refuse or structured deposition? House inventories of the Late Neolithic Vinča culture. *Starinar* 62: 19–43.

Porčić, M. 2012c. Effects of residential mobility on the ratio of average house floor area to average household size: implications for demographic reconstructions in archaeology. *Cross-Cultural Research* 46: 72–86.

Porčić, M. 2019a. Evaluating social complexity and inequality in the Balkans between 6500 and 4200 BC. *Journal of Archaeological Research*, doi:10.1007/s10814-018-9126-6.

Porčić, M. 2019b. Society and technology in the Neolithic and the Eneolithic of the Balkans, in J. Müller and S. Kadrow (eds) *Habitus? The Social Dimension of Technology and Transformation*:19–33. Leiden: Sidestone Press.

Porčić, M. 2020. Observations on the origin and demography of the Vinča culture. *Quaternary International* 560–561: 57–64. DOI: https://doi.org/10.1016/j.quaint.2020.04.012.

Porčić, M. and T. Blagojević. 2014. Fragmentation, context and spatial distribution of the Late Neolithic figurines from Divostin, Serbia, in C.E. Ursu and S. Terna (eds) *Anthropomorphism and Symbolic Behaviour in the Neolithic and Copper Age Communities of South-Eastern Europe*: 91–107. Suecedava: Editura karl A. Romstorfer.

Porčić, M., T. Blagojević and S. Stefanović. 2016. Demography of the Early Neolithic population in Central Balkans: Population dynamics reconstruction using summed radiocarbon probability distributions. *PLoS ONE* 11: e0160832. DOI: https://doi.org/10.1371/journal.pone.0160832.

Porčić, M. and M. Nikolić. 2016. The approximate Bayesian computation approach to reconstructing population dynamics and size from settlement data: demography of the Mesolithic-Neolithic transition at Lepenski Vir. *Archaeological and Anthropological Sciences* 8: 169–186.

Pottage, A. and B. Sherman. 2010. *Figures of Invention: A History of Modern Patent Law.* Oxford: Oxford University Press.

Poupeau, G., F.-X. Le Bourdonnec, T. Carter, S. Delerue, M.S. Shackley, J.-A. Barrat, S. Dubernet, P. Moretto, T. Calligaro, M. Milić and K. Kobayashi. 2010. The use of SEM-EDS, PIXE and EDXRF for obsidian provenance studies in the Near East: a case study from Neolithic Çatalhöyük (Central Anatolia). *Journal of Archaeological Science* 37(11): 2705–2720.

Powell, A., S. Shennan and M.G. Thomas. 2009. Late Pleistocene demography and the appearance of modern human behavior. *Science* 324: 1298–1301.

Pritchard-Parker, M.A. and J.A. Torres. 1998. Analysis of experimental debitage from hammerstone use and production: implications for ground stone use. *Lithic Technology* 23 (2): 139–146.

Prummel, W. 1988. Distinguishing features of postcranial skeletal elements of cattle, *Bos primigenius f. taurus*, and red deer, *Cervus elaphus*. *Schriftenaus der Archaologisch-Zoologishen Arbeitsgruppe Schleswig-Kiel* 12: 1–52.

Prummel, W. and H. Frisch, H. 1986. A guide for the distinction of species, sex and body size in bones of sheep and goats. *Journal of Archaeological Science* 13: 567–577.

Q

Quinn, P.S. 2013. *Ceramic Petrography: The Interpretation of Archaeological Pottery and Related Artefacts in Thin Section.* Oxford: Archaeopress.

Quinn, P.S., P. Day, V. Kilikoglou, E. Faber, S. Katsarou-Tzeveleki and A. Sampson. 2010. Keeping an eye on your pots: the provenance of Neolithic ceramics from the Cave of the Cyclops, Youra, Greece. *Journal of Archaeological Science* 37: 1042–1052.

Quitta, H. and G. Kol. 1969. Radiocarbondaten zum Neolithikum und zur frühen Bronzezeit Südosteuropas und der Sowietunion. *Zeitschrift für Archäologie* 3: 223–255.

R

Racimo, F., J. Woodbridge, R.M. Fyfe, M. Sikora, K.-G. Sjögren, K. Kristiansen and M.Vander Linden. 2020. The spatiotemporal spread of human migrations during the European Holocene. *Proceedings of the National Academy of Sciences* 117: 8989. DOI: https://doi.org/10.1073/pnas.1920051117.

Racky, P. and A. Anders. 2006. Social dimensions of the Late Neolithic settlement of Polgár-Csöszhalom (Eastern Hungary). *Acta Antiqua Academiae Scientiarum Hungaricae* 57: 17–3.

Radivojević, M. 1998. Field survey and topography of a Vinča culture settlement in Kremen- Mačina (in Serbian). *Papers from the Petnica Science Centre (Serbia)* 48: 316–340.

Radivojević, M. 2006. A contribution to the typology and distribution of hammer axes of Pločnik type in southeast Europe (in Serbian). *Journal of Serbian Archaeological Society* 22: 211–224.

Radivojević, M. 2007. Evidence for Early Copper Smelting in Belovode, a Vinča Culture Settlement in Eastern Serbia. Unpublished MSc dissertation, University College London.

Radivojević, M. 2012. On the Origins of Metallurgy in Europe: Metal Production in the Vinča Culture. Unpublished PhD dissertation, University College London.

Radivojević, M. 2013. Archaeometallurgy of the Vinča culture: a case study of the site of Belovode in eastern Serbia. *Historical Metallurgy* 47: 13–32.

Radivojević, M. 2015. Inventing metallurgy in western Eurasia: a look through the microscope lens. *Cambridge Archaeological Journal* 25: 321–338.

Radivojević, M., F. Draşovean, B. Gaydarska, J. Chapman and Th. Rehren (in preparation). Chalcolithic copper production at the Foeni-Petreşti culture site of Foeni, Romania. *Journal of Archaeological Science*.

Radivojević, M. and J. Grujić. 2017. Dataset for 'Community structure of copper supply networks in the prehistoric Balkans: An independent evaluation of the archaeological record from the 7th to the 4th millennium BC' (AHRC, Trans.). *Journal of Complex Networks* 6. DOI: https://doi.org/10.17863/CAM.9599.

Radivojević, M. and J. Grujić. 2018. Community structure of copper supply networks in the prehistoric Balkans: An independent evaluation of the archaeological record from the 7th to the 4th millennium BC. *Journal of Complex Networks* 6: 106–124. DOI https://doi.org/10.1093/comnet/cnx013.

Radivojević, M. and J. Kuzmanović Cvetković. 2014. Copper minerals and archaeometallurgical materials from the Vinča culture sites of Belovode and Pločnik: overview of the evidence and new data. *Starinar* 64: 7–30.

Radivojević, M. and Th. Rehren. 2016. Paint it black: the rise of metallurgy in the Balkans. *Journal of Archaeological Method and Theory* 23: 200–237. DOI: https://doi.org/10.1007/s10816-014-9238-3.

Radivojević, M., and Th. Rehren. 2019. *First to the finish line? Metallurgy of lead making in the 6th and 5th millennium BC Balkans.* Paper presented at the Archaeometallurgy in Europe, 5th International Conference, 19th-21st June 2019, Miskolc, Hungary.

Radivojević, M. and B.W. Roberts. 2013. *The Polychrome Beginnings of the Use of Metals and Alloys.* Paper presented at the Eighth International Conference on the Beginnings of the Use of Metals and Alloys, 10-15 September 2013, Nara, Japan.

Radivojević, M., Th. Rehren, E. Pernicka, D. Šljivar and M. Brauns and D. Borić. 2010a. On the origins of extractive metallurgy: new evidence from Europe.

Journal of Archaeological Science 37: 2775–2787: DOI: https://doi.org/10.1016/j.jas.2010.06.012.

Radivojević, M., Th. Rehren and M. Blagojević. 2010b *Arsenical Copper Smelting in Kolubara, western Serbia.* Paper presented at the 38th International Symposium on Archaeometry Abstract Handbook, Tampa, Florida.

Radivojević, M., Th. Rehren, J. Kuzmanović Cvetković, M. Jovanović and J.P. Northover. 2013. Tainted ores and the rise of tin bronze metallurgy, c. 6500 years ago. *Antiquity* 87: 1030–1045. DOI: https://doi.org/10.1017/S0003598X0004984.

Radivojević, M., Th. Rehren, J. Kuzmanović Cvetković and M. Jovanović. 2014a. Context is everything indeed: a response to Šljivar and Borić. *Antiquity* 88: 1315–1319.

Radivojević, M., Th. Rehren, J. Kuzmanović Cvetković and M. Jovanović. 2014b. Why are there tin bronzes in the 5th millennium BC Balkans? In S. Vitezović and D. Antonović (eds) *Archaeotechnology: Studying Technology from Prehistory to the Middle Ages*: 235–256). Belgrade: Srpsko Arheološko Društvo.

Radivojević, M., Th. Rehren, S. Farid, E. Pernicka and D.S. Camurcuoğlu. 2017. Repealing the Çatalhöyük extractive metallurgy: the green, the fire and the 'slag'. *Journal of Archaeological Science* 86: 101–122. DOI: https://doi.org/10.1016/j.jas.2017.07.001.

Radivojević, M., J. Pendić, A. Srejić, M. Korać, C. Davey, A. Benzonelli, M. Martinón-Torres, N. Jovanović and Ž. Kamberović. 2018. Experimental design of the Cu-As-Sn ternary colour diagram. *Journal of Archaeological Science* 90: 106–119. DOI: https://doi.org/10.1016/j.jas.2017.12.001.

Radivojević, M., B.W. Roberts, E. Pernicka, Z.A. Stos-Gale, M. Martinón-Torres, H. Vandkilde, J. Ling, D. Brandherm, P. Bray, J. Mei, K. Kristiansen, Th. Rehren, S. Shennan and C. Broodbank. 2019. The provenance, use and circulation of metals in the European Bronze Age: The state of debate. *Journal of Archaeological Research* 27: 131–185. DOI: https://doi.org/10.1007/s10814-018-9123-9.

Radimsky, W. and M. Hoernes. 1895. *Die neolithische Station von Butmir bei Sarajevo in Bosnien*. Wien: Holzhausen.

Radmanović, D., D. Kostić, J. Lujić and S. Blažić. 2014. Vertebrate fauna at the Neolithic and Eneolithic sites in Vojvodina (Serbia). *Zbornik Matice Srpske za prirodne nauke* 126: 75–86.

Radovanović, I. 1996. *The Iron Gates Mesolithic* (International Monographs in Prehistory. Archaeological Series 11). Ann Arbor (MI): Berghahn Books.

Radovanović, I., M. Kaczanowska, J.K. Kozlowski, M. Pawlikowski and B. Voytek. 1984. *The Chipped Stone Industry from Vinča*. Belgrade: Centar za arheološka istraživanja, Filozofski Fakultet.

Rahmstorf, L., 2011. Re-integrating 'diffusion': the spread of innovations among the Neolithic and Bronze Age societies of Europe and the Near East in T.C. Wilkinson, S. Sherratt and J. Bennet (eds) *Interweaving worlds: systemic interactions in Eurasia, 7th to the 1st millennia BC: 100-119. Oxford: Oxbow.*

Rahmstorf, L., 2019. Scales, weights and weight-regulated artefacts in Middle and Late Bronze Age Britain. *Antiquity* 93: 1197-1210.

Rahmstorf, L., G. Barjamović and N. Ialongo (eds) 2021. *Merchants, Measures and Money. Understanding Technologies of Early Trade in a Comparative Perspective*. Kiel/Hamburg: Wachholtz Verlag.

Rahmsdorf, L. and E.P. Stratford (eds) 2019. *Weights and Marketplaces from the Bronze Age to the Early Modern Period*. Kiel/Hamburg: Wachholtz Verlag.

Rapp, G. 2009. *Archaeomineralogy* (Second edition). Natural Science in Archaeology. Berlin, Heidelberg: Springer.

Rassmann, K., J. Ohlrau, C. Mischka, N.B. Burdo, M. Videjko and J. Müller. 2014. High precision Tripolye settlement plans, demographic estimations and settlement organization. *Journal of Neolithic Archaeology* 6: 63–95.

Rassmann, K., C. Mischka, M. Furholt, J. Ohlrau, K. Radloff, K. Winkelmann, G. Serlegi, T. Marton, A. Osztás, K. Oross and E. Bánffy. 2015. Large scale geomagnetic prospections on Neolithic sites in Hungary II. *Hungarian Archaeology Online* http://files.archaeolingua.hu/2015NY/eng_Rassmann_15S.pdf

Raub, C.J. 1995. The metallurgy of gold and silver in prehistoric times, in G. Morteani and J.P. Northover (eds) *Prehistoric Gold in Europe: Mines, Metallurgy and Manufacture*: 243–259. Dordrecht: Kluwer Academic Publishers.

Reddy, S.N. 2003. *Discerning Palates of the Past: An Ethnoarchaeological Study of Crop Cultivation and Plant Usage in India*. (International Monographs in Prehistory. Ethnoarchaeological Series 5). Ann Arbor (MI): Berghahn Books.

Reed, K. 2013. Farmers in Transition: The Archaeobotanical Analysis of the Carpathian Basin from the Late Neolithic to the Late Bronze Age (5000-900 BC). Unpublished PhD dissertation, University of Leicester.

Reed, K. 2015. From the field to the hearth: plant remains from Neolithic Croatia (ca. 6000–4000 cal BC). *Vegetation History and Archaeobotany* 24: 601–619.

Reed, W.P. 1992. Certificate of Analysis, Standard Reference Materials 612 and 613. Technical Report, National Institute of Standards and Technology.

Rehder, J.E. 1994. Blowpipes versus bellows in ancient metallurgy. *Journal of Field Archaeology* 21: 345–350.

Rehren, Th. 1997. Die Rolle des Kohlenstoffs in der Prähistorischen Metallurgie. *Stahl Und Eisen* 117: 87–92.

Rehren, Th. 2003. Crucibles as reaction vessels in ancient metallurgy, in P.T. Craddock, and J. Lang (eds) *Mining and Metal Production Through the Ages*: 207–215. London: The British Museum Press.

Rehren, Th. 2008. METALS, Primary Production Studies of, in M.P. Deborah (ed.) *Encyclopedia of Archaeology*: 1616–1620. New York: Academic Press.

Rehren, Th. 2014. Crossing boundaries, in P. Stone and Z. Hui (eds) *Sharing Archaeology: Academe, Practice and the Public*: 36–46. New York, London: Routledge.

Rehren, Th. and E. Pernicka. 2008. Coins, artefacts and isotopes-archaeometallurgy and Archaeometry. *Archaeometry* 50: 232–248. DOI: https://doi.org/10.1111/j.1475-4754.2008.00389.x.

Rehren, Th., M. Charlton, S. Chirikure, J. Humphris, A. Ige and H.A. Veldhuijzen. 2007. Decisions set in slag - the human factor in African iron smelting, in S. La Niece, D. Hook and P. Craddock (eds) *Metals and Mines: Studies in Archaeometallurgy*: 211–218. London: Archetype Publications.

Rehren, Th., Boscher, L. and E. Pernicka. 2012. Large scale smelting of speiss and arsenical copper at Early Bronze Age Arisman, Iran. *Journal of Archaeological Science* 39 (6): 717-1727. DOI:https:??doi.org/10.1016/j.jas.2012.01.009.

Rehren, Th., P. Leshtakov and P. Penkova. 2016. Reconstructing Chalcolithic copper smelting at Akladi Cheiri, Chernomorets, Bulgaria, in V. Nikolov and W. Schier (eds) *Der Schwarzmeerraum vom Neolithikum bis in die Früheisenzeit (6000-600 v.Chr.). Kulturelle Interferenzen in der zirkumpontischen Zone und Kontakte mit ihren Nachbargebieten*: 205–214. Rahden/Westf: Verlag Marie Leidorf GmbH.

Rehren, Th., P. Penkova and E. Pernicka. 2020. The Chalcolithic copper smelting at Akladi Cheiri, in R. Krauss, E. Pernicka, R. Kunze, K. Dimitrov and P. Leshtakov (eds) *Prehistoric Mining and Metallurgy at the Southeast Bulgarian Black Sea Coast.* (RessourcenKulturen Band 10): 137–156. Tübingen: Tübingen University Press.

Reimer, P.J., E. Bard, A. Bayliss, J.W. Beck, P.G. Blackwell, C. Bronk Ramsey, P.M. Grootes, T.P. Guilderson, H. Haflidason, I. Hajdas, C. Hatt, T.J. Heaton, D.L. Hoffmann, A.G. Hogg, K.A. Hughen, K.F. Kaiser, B. Kromer, S.W. Manning, M. Niu, R.W. Reimer, D.A. Richards, E.M. Scott, J.R. Southon, R.A. Staff, C.S.M. Turney and J. van der Plicht. 2013. IntCal13 and Marine13 radiocarbon age calibration curves 0-50,0000 years cal BP. *Radiocarbon* 55(4): 1869–1887.

Reingruber, A. 2014. The wealth of the tells: Complex settlement patterns and specialisations in the West Pontic between 4600 and 4250 cal BC, in B. Horejs and M. Mehofer (eds) *Western Anatolia before Troy: Proto-Urbanisation in the 4th millennium BC?*: 217–241. Vienna: Austrian Academy of Sciences Press.

Reitz, E. and E. Wing. 2008. *Zooarchaeology*. 2nd edition. Cambridge: Cambridge University Press.

Remondino, F. 2013. Worth a thousand words – Photogrammetry for archaeological 3D surveying, in R.S. Opitz and D.C. Cowley (eds) *Interpreting Archaeological Topography*: 115–122. Oxford: Oxbow Books.

Renfrew, C. 1969. The autonomy of the south-east European Copper Age. *Proceedings of the Prehistoric Society* 35: 12–47.

Renfrew, C. 1970. The place of Vinča culture in European prehistory. *Zbornik Radova Narodnog Muzeja (Belgrade)* 6: 45–57.

Renfrew, C. 1971. Sitagroi, radiocarbon and prehistory of south-east Europe. *Antiquity* 45(180): 275–282.

Renfrew, C. 1972. *The Emergence of Civilisation: the Cyclades and the Aegean in the Third Millennium B.C.* London: Methuen.

Renfrew, C. 1973. Sitagroi and the independent invention of metallurgy in Europe, in M. Garašanin, A. Benac and N. Tasić (eds) *Actes du VIIIe congrès international des sciences préhistoriques et protohistoriques: Belgrade, 9-15 septembre 1971* (Volume 2): 473–481. Belgrade: Union Internationale des Sciences Préhistoriques et Protohistoriques.

Renfrew, C. 1978b. The anatomy of innovation, in D. Green, C. Haselgrove and M. Spriggs (eds) *Social Organization and Settlement.* (British Archaeological Reports International Series 47/1): 89–117. Oxford: Archaeopress.

Renfrew, C. 1978a. Varna and the social context of early metallurgy. *Antiquity* 52: 199–203.

Renfrew, C. 1979. *Problems in European Prehistory*. Edinburgh: Edinburgh University Press.

Renfrew, C. 1986. Varna and the emergence of wealth in prehistoric Europe, in A. Appadurai (ed.) *The Social Life of Things: Commodities in Cultural Perspective*: 141–168. Cambridge: Cambridge University Press.

Renfrew, C. 1987. *Archaeology and Language: The Puzzle of Indo-European Origins*. London: Jonathan Cape.

Renfrew, C., J.E. Dixon and J.R. Cann. 1965. Obsidian in the Aegean. *Annual of the British School of Archaeology at Athens* 60: 225–247.

Renfrew, C., J.E. Dixon and J.R. Cann. 1966. Obsidian and early culture contact in the Near East. *Proceedings of the Prehistoric Society* 32: 30–72.

Renfrew, C., J.E. Dixon and J.R. Cann. 1968. Further analysis of Near Eastern obsidians. *Proceedings of the Prehistoric Society* 34: 319–331.

Renfrew, C. and E. Elster. 2003. Metal artifacts and metallurgy, in E. Elster and C. Renfrew (eds.), *Prehistoric Sitagroi: Excavations in northeast Greece, 1968–1970. Volume 2: The final report*: 301–324. Los Angeles: Cotsen Institute of Archaeology, University of California.

Renfrew, C., C. Gosden and L. DeMarrais (eds). 2005. *Rethinking Materiality.* Cambridge: McDonald Institute for Archaeology.

Renfrew, J.M. 1979. The first farmers in South East Europe, *in* U. Körber-Grohne (ed.) Festschrift Maria Hopf. *Archaeo-Physika* 8: 243–265.

Rice, P.M. 1981. Evolution of specialized pottery production: a trial model. *Current Anthropology* 22: 219–227.

Rice, P.M. 1991. Specialization, standardization, and diversity: a retrospective, in R.L. Bishop and F.W. Lange (eds) *The ceramic legacy of Anna O. Shepard*: 257–279. Niwot. Colorado: University Press of Colorado.

Rice, P.M. 2015. *Pottery Analysis: A Sourcebook*. Chicago: University of Chicago Press.

Ристић-Опачић, J. 2005. Топографско-хронолошке карактеристике насеља винчанске културе на територији Србије. Гласник Српског археолошког друштва 21: 71–112.

Roberts, B.W. and M. Vander Linden (eds). 2011. *Investigating Archaeological Cultures: Material Culture, Variability, and Transmission*. London: Springer.

Roberts, B.W. and C. Frieman. 2012. Drawing boundaries and drawing models: investigating the concept of the 'Chalcolithic frontier' in north-west Europe, in M.J. Allen, J. Gardiner, and A. Sheridan (eds) *Is there a British Chalcolithic? People, Place and Polity in the Late 3rd Millennium*: 27–39. Oxford: Oxbow.

Roberts, B.W. and C.P. Thornton (eds). 2014. *Archaeometallurgy in Global Perspective. Methods and Syntheses*. New York: Springer.

Roberts, B.W. and M. Radivojević. 2015. Invention as a process: pyrotechnologies in early societies. *Cambridge Archaeological Journal* 25: 299–306. DOI: https://doi.org/10.1017/S0959774314001188.

Roberts, B.W., C.P. Thornton and V.C. Pigott. 2009. Development of metallurgy in Eurasia. *Antiquity* 83: 1012–1022.

Rogers, E.M. 1962. *Diffusion of Innovations (1st edition)*. New York: Free Press of Glencoe.

Rogers, E.M. 2003. *Diffusion of Innovations (5th edition)*. New York: Simon and Schuster.

Rosenstock, E., S. Scharl and W Schier. 2016. Ex oriente lux? – Ein Diskussionsbeitrag zur Stellung der frühen Kupfermetallurgie Südosteuropas, in M. Bartelheim, B. Horejs and R. Krauss (eds) *Von Baden bis Troia: Resourcennutzung, Metallurgie und Wissenstransfer. Eine Jubiläumsschrift für Ernst Pernicka* (Oriental and European European Archaeology 3): 59–122. Rahden: Leidorf.

Rostoker, W. and J.R. Dvorak. 1990. *Interpretation of Metallographic Structures* (3rd Edition). San Diego, London: Academic Press Incorporated.

Rostoker, W., V.C. Pigott and J.R. Dvorak. 1989. Direct reduction to copper metal by oxide-sulfide mineral interaction. *Archeomaterials* 3: 69–87.

Rothermel M., K. Wenzel K., D. Fritsch D. and N. Haala. 2012. SURE: Photogrammetric surface reconstruction from imagery. *Proceedings, Low Cost 3D Workshop, Berlin, 01.12.2012*.

Rousseau, J.-J. 1761. *A discourse upon the origin and foundation of the inequality among Mankind*. London: R. & J. Dodsley.

Roux, V. 2003. Ceramic standardization and intensity of production: quantifying degrees of specialization. *American Antiquity* 68: 768–782.

Roux, V. 2008. Evolutionary trajectories of technological traits and cultural transmission, in M. Stark, B.J. Bowser and L. Horne (eds) *Cultural Transmission and Material Culture*: 82–104. Tucson: The University of Arizona Press.

Roux, V. 2010. Technological innovations and developmental trajectories: Social factors as evolutionary forces, in M. J. O'Brien and S. J. Shennan (eds) *Innovation in cultural systems. Contributions from Evolutionary Anthropology*: 217–234. Cambridge: The MIT Press.

Roux, V. 2017. *De Cramiques et des Hommes. Décoder les Assemblages Archéologiques*. Paris: Presses Universitaires de Paris Nanterre.

Roux, V. and D. Corbetta. 1989. *The Potter's Wheel: Craft Specialization and Technical Competence*. New Delhi/ Bombay/Calcutta: Oxford and IBH Publishing.

Roux, V., B. Bril and G. Dietrich. 1995. Skills and learning difficulties involved in stone knapping: the case of stone-bead knapping in Khambhat, India. *World Archaeology* 27 (1): 63-87.

Rovira, L.S. and I. Montero Ruiz. 2013. Iberia: technological development of prehistoric metallurgy, in S. Burmeister, S. Hansen, M. Kunst and N. Müller-Scheeßel (eds) *Metal Matters. Innovative Technologies and Social Change in Prehistory and Antiquity*: 231–239. Rahden/Westf.: Marie Leidorf.

Rowlands, M.J. 1971. The archaeological interpretation of prehistoric metalworking. *World Archaeology* 3: 210–224.

Rowley-Conwy, P. 2003. Early domestic animals in Europe: imported or locally domesticated? In A. Ammerman and P. Biagi (eds) *The Widening Harvest: the Neolithic Transition in Europe – Looking Back, Looking Forward*: 99–117. Boston: Archaeological Institute of America.

Rowley-Conwy, P. 2007. *From Genesis to Prehistory: The Archaeological Three Age System and its Contested Reception in Denmark, Britain and Ireland*. Oxford: Oxford University Press.

Roy, D.P., V. Kovalskyy, H.K. Zhang, E.F. Vermonte, L. Yan, S.S. Kumar and A. Egorov. 2016. Characterization of Landsat-7 to Landsat-8 reflective wavelength and normalized difference vegetation index continuity. *Remote Sensing of Environment* 185: 57–70.

Ruddiman, W. F. 2014. *Earth Transformed*. New York: W.H. Freeman & Co Ltd.

Ruíz Taboada, A. and I. Montero-Ruíz. 1999. The oldest metallurgy in Western Europe. *Antiquity* 73: 897–903.

Russell, N. 1990. The bone tools, in R. Tringham and D. Krstić (eds) *Selevac. A Neolithic village in Yugoslavia*: 521–548. Los Angeles: UCLA.

Russell, N. 1993. Hunting, Herding and Feasting: Human Use of Animals in Neolithic Southeast Europe. Unpublished PhD dissertation, University of California at Berkley.

Russell, N. 1998. Cattle as wealth in Neolithic Europe: Where's the beef? In D.W. Bailey (ed.) *The Archaeology of Value: Essays on Prestige and the Processes of Valuation* (British Archaeological Reports S730): 42–54. Oxford: Archaeopress.

Russell, N. 2001. The social life of bone: a preliminary assessment of bone tool manufacture and discard at

Çatalhöyük, in A. Choyke and L. Bartosiewicz (eds) *Crafting Bone: Skeletal Technologies Through Time and Space – Proceedings of the 2nd meeting of the (ICAZ) Worked Bone Research Group, Budapest, 31 August – 5 September 1999*: 241–250. Oxford: Archaeopress.

Russell, N., K. Twiss, D. Orton and A. Demirergi. 2013. More on the Çatalhöyük mammal remains, in I. Hodder (ed.) *Humans and Landscapes of Çatalhöyük: Reports from the 2000–2008 Seasons*: 213–258. Los Angeles: Cotsen Institute.

Ryndina, N. 2009. The potential of metallography in investigations of early objects made of copper and copper-based alloys. *Historical Metallurgy* 43: 1–18.

Ryndina, N.V. and I.J. Ravich. 2000. Eneolithic Balkan-Carpathian Metallurgical Province (BCMP) as a unique centre of the origin and development of the earliest metallurgical activity (Part I). *Bulletin of the Metals Museum* 32: 6–28.

Ryndina, N.V. and I.J. Ravich. 2001. Eneolithic Balkan-Carpathian Metallurgical Province (BCMP) as a unique centre of the origin and development of the earliest metallurgical activity (Part II). *Bulletin of the Metals Museum* 34: 1–21.

Ryndina, N.V. and I.J. Ravich. 2012. О металлопроизводстве майкопских племен Северного Кавказа (по данным химико-технологических исследований) (On Maikop metallurgy in the Northern Caucasus, in Russian). Вестник археологии, антропологии и этнографии (*Moscow)* 2: 4–20.

Ryndina, N., G. Indenbaum and V. Kolosova. 1999. Copper production from polymetallic sulphide ores in the northeastern Balkan Eneolithic culture. *Journal of Archaeological Science* 26: 1059–1068.

S

Saporta, G. 2006. *Probabilités, Analyse des Données et Statistique* (2nd Edition). Paris: Editions Technip.

Schachermeyr, F. 1955. *Die ältesten Kulturen Griechenlands.* Stuttgart: W. Kohlhammer.

Schacht, R.M. 1984. The contemporaneity problem. *American Antiquity* 49: 678–695.

Schalk, E. 1998. *Die Entwicklung der Prähistorischen Metallurgie im Nördlichen Karpatenbecken. Eine Typologische und Metallanalytische Untersuchung*. Rahden-Westfalen: Leidorf Verlag.

Scharl, S. 2016. Patterns of innovation transfer and the spread of copper metallurgy to Central Europe. *European Journal of Archaeology* 19: 215–244. DOI: https://doi.org/10.1080/14619571.2016.1147313.

Schauer, P., Shennan, S., Bevan, A., College, S., Edinborough, K., Kerig, T. and M. Parker Pearson, M. 2020. Cycles in Stone Mining and Copper Circulation in Europe 5500–2000 BC: A View from Space. *European Journal of Archaeology* 24(2), 204-225. DOI: https://doi.org/10.1017/eaa.2020.56.

Schibler, J. 1981. *Typologische Untersuchungen der cortaillodzeitlichen Knochenartefakte. Die neolithischen. Ufersiedlungen von Twann.* Bd.17. Bern: Staatlicher Lerhmittelverlag.

Schickler, H. 1981. Neolithische Zinnbronzen, in H. Lorenz (ed.) *Studien zur Bronzezeit: Festschrift für Wilhelm Albert v. Brunn*: 419–445. Mainz am Rhein: von Zabern.

Schier, W. 1991. Untersuchungen zur Keramik von Vinča-Belo Brdo. *Banatica* 10: 131–140.

Schier, W. 1995. Vinča Studien. Tradition und Innovation im Spätneolithikum des zentralen Balkanraumes am Beispiel der Gefäskeramik aus Vinča-Belo Brdo. Unpublished dissertation. Heidelberg: Heidelberg University.

Schier, W. 1996. The relative and absolute chronology of Vinča: new evidence from the type site, in F. Draşovean (ed.) *The Vinča Culture, its Role and Cultural Connections*: 141–162. Timişoara: National Museum,Timişoara.

Schier, W. 1997. Vin*č*a studies. Tradition and innovation in the Late Neolithic of the Central Balkan region: ceramic vessels from Vinča Belo Brdo. *Archaologisches Nachrichtenblatt* 2(1): 37–46.

Schier, W. 2000. Measuring change: the Neolithic pottery sequence of Vinča-Belo Brdo. *Documenta Praehistorica* 27: 187–197.

Schier, W. 2001. Tellstratigraphien als Zeitmasstab, in Lux Orientis. Archäologie zwischen Asien und Europa, in R. Boehmer and J. Maran (eds) *Festschrift für Harald Hauptmann zum 65.* Geburtstag (Rahden): 371–379.

Schier, W. 2014a. The Copper Age in southeastern Europe - historical epoch or typo-chronological construct? In W. Schier and F. Draşovean (eds) *New Approaches to Dating and Cultural Dynamics in the 6th to 4th Millennium BC.* (Prähistorische Archäologie in Südosteuropa 28): 419–435. Rahden: Leidorf.

Schier, W. 2014b. Der spätneolithisch-kupferzeitliche Tell von Uivar (Rumänien). Prospektionen und Grabungen 1998–2009, in W. Schier and M. Meyer (eds) *Vom Nil bis an die Elbe. Forschungen aus fünf Jahrzehnten am Institut für prähistorische Archäologie der Freien Universität Berlin*: 17–36. Rahden/Westf: Leidorf.

Schier, W. and F. Draşovean. 2004. Vorbericht über die rumänisch-deutschen Prospektionen und Ausgrabungen in der befestigten Teilsiedlung von Uivar, jud. Timiş, Rumänien (1998-2002). *Praehistorische Zeitschrift* 79(2): 145–230.

Schier, W. and F. Draşovean (eds). 2014. *New Approaches to Dating and Cultural Dynamics in the 6th to 4th Millennium BC* (Prähistorische Archäologie in Südosteuropa 28). Rahden/Westf: Verlag Marie Leidorf Gmbh.

Schier, W. and V. Nikolov (eds). 2016. *Der Schwarzmeerraum vom Neolithikum bis in die Früheisenzeit (6000–600* *v.Chr.). Kulturelle Interferenzen in der zirkumpontischen Zone und Kontakte mit ihren Nachbargebieten*. Rahden/ Westf: Leidorf.

Schiffer, M. (ed.) 2001. *Anthropological Perspectives on Technology.* Albuquerque: University of New Mexico Press.

Schiffer, M.B. 2005. The devil is in the details: the cascade model of invention processes. *American Antiquity* 70: 485–502.

Schiffer, M.B. 2010. Can archaeologists study processes of invention? In M.J. O'Brien and S.J. Shennan (eds) *Innovation in Cultural Systems. Contributions from Evolutionary Anthropology*: 235–250. Cambridge, MA: The MIT Press.

Schiffer, M.B. 2011. *Studying Technological Change: A Behavioral Approach.* Salt Lake City: University of Utah Press.

Schmid, E. 1972. *Atlas of Animal Bones: For Prehistorians, Archaeologists and Quaternary Geologists*. New York: Elsevier.

Schneider, G., H. Knoll, K. Gallis and J.P. Demoule. 1994. Production and circulation of Neolithic Thessalian pottery: chemical and mineralogical analyses, in J.-C. Decourt, B. Helly and K. Gallis (eds) *La Thessalie. Quinze Années de Recherches Archéologiques, 1975-1990: Bilans et Perspectives*: 61–70. Athens: Ministry of Culture.

Schoch, W.H., B. Pawlik and F.H. Schweingruber. 1988. *Botanische Makroreste: Ein Atlas Zur Bestimmung Häufig Gefundener und Ökologisch Wichtiger Pflanzensamen.* Bern: Paul Haupt.

Schroedter, T.M., R. Hofmann, M. Furholt, J. Müller and O. Nelle. 2011. Woodland and its use in central Bosnia during the late Neolithic. Results from anthracological investigations in the Visoko-basin. *Sagvntvum Extra* 11: 87–89.

Schubert, F. 1965. Zu den südosteuropäischen Kupferäxten. *Germania* 43: 274–295.

Schumpeter, J. 1939. *Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process.* New York: McGraw-Hill.

Sefériadès, M.L. 1992a. Le métal, in Treuil, R. (ed.) *Dikili Tash, Village Préhistorique de Macédoine Orientale*: 113–116. Athens: Ecole Française d'Athènes.

Séfériadès, M.L. 1992b. L'os et le bois de cervidé, in R. Treuil (ed.) *Dikili Tash. Village préhistorique de Macédoine orientale I. Fouilles de Jean Deshayes (1961–1975), Bulletin de correspondance hellénique, supplément XXIV, 1992*: 99–112.

Séfériadès, M.L. 2010. Spondylus and long-distance trade in prehistoric Europe, in D. Anthony (ed.) *The Lost World of Old Europe: The Danube Valley 5000–3500 BC*: 178–190. Princeton and Oxford: Princeton University Press.

Sekereš, L. 1967. Ludaš-Budžak, ranoneolitsko naselje. *Arheološki pregled* 9: 9–13.

Semenov, S.A. 1976. *Prehistoric Technology: An Experimental Study of the Oldest Tools and Artefacts from Traces of Manufactures and Wear.* Bradford-on-Avon. Wiltshire: Moonraker.

Sergeev, G.P. 1963. Rannetripolskii klad u s. Karbuna. *Sovetskaja Arheologija* 1: 135–151.

Shennan, S. 2000. Population, culture history and the dynamics of culture change. *Current* Anthropology 41: 811–835.

Shennan, S. 2001. Demography and cultural innovation: a model and its implications for the emergence of modern human culture. *Cambridge Archaeological Journal* 11: 5–16.

Shennan, S. 2013. Demographic continuities and discontinuities in Neolithic Europe: evidence, methods and implications. *Journal of Archaeological Method and Theory* 20: 300–311. DOI: https://doi.org/10.1007/s10816-012-9154-3.

Shennan, S. 2018. *The First Farmers of Europe: An Evolutionary Perspective*. Cambridge: Cambridge University Press.

Shennan, S. and J. Steele. 1999. Cultural learning in hominids: a behavioural ecological approach, in H.O. Box and K.R. Gibson (eds) *Mammalian Social Learning: Comparative and Ecological Perspectives*: 367–388. Cambridge: Cambridge University Press.

Shennan, S., S.S. Downey, A. Timpson, K., Edinborough, S. Colledge, T. Kerig, K. Manning and M.G. Thomas. 2013. Regional population collapse followed initial agriculture booms in mid-Holocene Europe. *Nature Communications* 4: 2486.

Shepard, A.O. 1980. *Ceramics for the Archaeologist*. Washington DC: Carnegie Institution.

Sherratt, A.G. 1981. Plough and pastoralism: aspects of the secondary products revolution, in I. Hodder, G. Isaac and N. Hammond (eds) *Pattern of the Past: Studies in Honour of David Clarke*: 261-306. Cambridge: Cambridge University Press.

Sherratt S. 2018. Why was (and is) silver sexy? Silver during the 4th-3rd millennia in the Near East and Mesopotamia, in X-L. Armada, M. Murillo-Barroso and M. Charlton (eds) *Metals, Minds and Mobility. Integrating Scientific Data with Archaeological Theory*: 97-106. Oxford: Oxbow.

Shimada, I. (ed.) 2007. *Craft Production in Complex Societies: Multi-Crafting, Sequential Production, and Producers.* Salt Lake City (UT): University of Utah Press.

Siklósi, Z. 2004. Prestige goods in the Neolithic of the Carpathian Basin. Material manifestations of social differentiation. *Acta Archaeologica Academiae Scientiarum Hungaricae* 55: 1–62. DOI: https://doi.org/10.1556/aarch.55.2004.1-2.1.

Siklósi, Z. 2013. *Traces of Social Inequality during the Late Neolithic in the Eastern Carpathian Basin. Dissertationes Pannonicae IV, 3.* Budapest: Eötvös Loránd University, Institute of Archaeological Sciences.

Siklósi Z., Prange M., Kalicz N. and P. Raczky 2015. New data on the provenance of Early Copper finds from the Great Hungarian Plain. In Hansen S., Raczky P., Anders A. and A. Reingruber (eds.) *Neolithic and*

Copper Age between the Carpathians and the Aegean Sea. Chronologies and Technologies from the 6th to the 4th Millennium BCE: 57-92. Archäologie in Eurasien 31. Bonn: Habelt.

Siklósi, Z. and M. Szilágyi 2019. New data on the provenance of copper finds from the Early-Middle Copper Age of the Great Hungarian Plain. *Archaeological and Anthropological Sciences* 11: 5275–5285. DOI: https://doi.org/10.1007/s12520-019-00867-8

Sillar, B. 2003. Technological choices and experimental archaeology, comments on M.S. Tite, V. Kilikoglou and G. Vekinis, 'Review Article: Strength, toughness and thermal shock resistance of technological choice'. *Archaeometry 43(3):* 301–324.

Sillitoe, R.H. 1983. Enargite-bearing massive sulfide deposits high in porphyry copper systems. *Economic Geology* 78: 348–352.

Silva, F. and M. Vander Linden. 2017. Amplitude of travelling front as inferred from 14C predicts levels of genetic admixture among European early farmers. *Scientific Reports* 7: 11985. DOI: https://doi.org/10.1038/s41598-017-12318-2.

Silver, I. 1969. The ageing of domestic animals, in D. Brothwell and E. Higgs (eds) *Science in Archaeology: A Survey of Progress and Research*: 283–302. London: Thames and Hudson.

Simonović, D. Č. 1967. Osnovne karakteristike jugoslovenske poljoprivredne proizvodnje, *Zbornik radova Pravno – Ekonomskog Fakulteta u Nišu* 6: 265–283.

Shott, M.J. 1996. Mortal pots: on use life and vessel size in the formation of ceramic assemblages. *American Antiquity* 61(3): 462–482.

Skakun, N. 1992. Evolution des techniques agricoles in Bulgarie chalcolithique (d'après les analyses tracéologiques), in P. Anderson (ed.) *Préhistoire de L'Agriculture: Nouvelles Approches Expérimentales et Ethnographiques* (Centre de Recherches Archéologiques Monograph 6): 289–303. Paris: Centre National de la Recherche Scientifique.

Skakun, N. 1993. Results of traseological examination of flint implements from Neolithic settlements in Western Bulgaria, in I. Gatsov (ed.) *Neolithic Chipped Stone Industries in Western Bulgaria*: 52–54. Kraków: Jagellonian University Press.

Скакун Н., Э. Ибрагимова and В.Терёхина. 2015. Некоторые результаты комплексного изучения материалов поселений Беловоде и Плочник, Неолитические культуры Восточной Европы: хронология, палеоэкология, традиции. Материалы Международной научной конференции, посвященной 75-летию Виктора Петровича Третьякова. Санкт-Петербург.

Skibo, J.M. 2013 *Understanding Pottery Function. Manuals in Archaeological Method, Theory and Technique.* New York: Springer.

Slavchev, V. (ed.) 2008. *The Varna Eneolithic Necropolis and Problems of Prehistory in Southeast Europe: Studia in Memoriam Ivan Ivanov.* (Acta Musei Varnensis 7). Varna: Regionalen Istoričeski Muzej, Varna.

Smith, C.S. 1981. On art, invention and technology, in C.S. Smith (ed.) *A Search for Structure*: 325–331. Cambridge (MA): The MIT Press.

Smith, K.Y. and F.D. Neiman. 2007. Frequency seriation, correspondence analysis, and Woodland period ceramic assemblage variation in the deep south. *Southeastern Archaeology* 26(1): 47–72.

Solecki, R.S., R.L. Solecki and A.P. Agelarakis. 2004. *The Proto-Neolithic Cemetery in Shanidar Cave.* Texas: Texas A&M University Press.

Sørensen, M.L.S. 2010. Households, in K. Kristiansen and T. Earle (eds) *Organizing Bronze Age Societies. The Mediterranean, Central Europe & Scandinavia compared:* 122–154. Cambridge: Cambridge University Press.

Spandl, K., A. Dain-Owens, C. Champness, M. Dresser, M. Hann, R. Godwin and P. Booth. 2010. Trials to identify soil cultivation practices to minimise the impact on archaeological sites. (Defra project number BD1705). *Effects of Arable Cultivation on Archaeology* (EH Project number 3874). Known collectively as: 'Trials' Appendix 3: Studying the effects of different cultivation systems on flat archaeological sites. Oxford Archaeology: 1–58.

Spasić, D. 1993. Dva neolitska lokaliteta u Pomoravlju. *Glasnik Srpskog Arheološkog Društva* 9: 180–185.

Spasić, M. 2011. Vinčanska keramika s lokaliteta Crkvine. *Kolubara* 5: 101–146.

Spataro, M. 2014. Continuity and change in pottery manufacture between the early and middle Neolithic of Romania. *Journal of Archaeological and Anthropological Sciences* 6(2): 175–197.

Spataro, M. 2017. Innovation and regionalism in the Middle/Late Neolithic of south and south-eastern Europe (ca. 5,500-4,500 cal. BC): A ceramic perspective, in L. Burnez-Lanotte (ed.) *Matières à Penser. Raw Materials Acquisition and Processing in Early Neolithic Pottery Productions*. Proceedings of the Workshop of Namur (Belgium), 29-30 May 2015: 61–72. Paris: Société Préhistorique Française.

Spataro, M. 2018. Origins of specialization: the ceramic chaîne opératoire and technological take-off at Vinča-Belo Brdo, Serbia. *Oxford Journal of Archaeology* 37: 247–265. DOI: https://doi.org/10.1111/ojoa.12140

Spataro, M. and M. Furholt (eds). 2020. *Detecting and Explaining Archaeological Innovation in Prehistory*. Leiden: Sidestone.

Spataro, M., M. Cubas, O.E. Craig, J.C. Chapman, A. Boroneanţ and C. Bonsall. 2019. Production and function of Neolithic black-painted pottery from Schela Cladovei (Iron Gates, Romania). *Archaeological and Anthropological Sciences* 11: 6287–6304. DOI: https://doi.org/10.1007/s12520-019-00918-0.

Spielmann, K.A. 2002. Feasting, craft specialization, and the ritual mode of production in small-scale societies. *American Anthropologist* 104: 195–207, DOI: https://doi.org/10.1525/aa.2002.104.1.195.

Srdoč, D., A. Sliepčević, B. Obelić and N. Horvatinčić. 1977. Rudjer-Boskovic Institute Radiocarbon Measurements IV. *Radiocarbon* 19(3): 465–475.

Srdoč, D., N, Horvatinčić, B. Obelić, I.K. Bronić and A. Sliepčević. 1987. Rudjer Bošković Institute Radiocarbon Measurements X. *Radiocarbon* 29(1): 135–147.

Srdoč, D., A. Sliepčević and J. Planinić 1975. Rudjer-Boskovic Institute Radiocarbon Measurements III. *Radiocarbon* 17(1): 149–155.

Srejović, D. 1963. Versuch einer historischen Wertung der Vinča-Gruppe. *Archaeologica Iugoslavica* 4: 5–18.

Srejović, D. 1968. Neolitska plastika centralnobalkanskog područja, in L. Trifunović (ed.) *Neolit centralnog Balkana*: 177–240. Beograd: Narodni muzej.

Srejović, D. 1969. *Lepenski Vir: Nova Praistorijska Kultura u Podunavlju*. Belgrade: Srpska književna Zadruga.

Srejović, D. 1972. *Europe's First Monumental Sculpture: New Discoveries at Lepenski Vir*. London: Thames and Hudson.

Srejović, D. (ed.). 1984a. *The Chipped Stone Industry from Vinča: Excavations 1929–1934.* Belgrade: Univerzitet u Beogradu, Centar za Arheološka Istraživanja.

Srejović, D. 1984b. Umetnost i religija, in S. Ćelić (ed.) *Vinča u praistoriji i srednjem veku*: 42–56. Beograd: Srpska akademija nauka i umetnosti.

Srejović, D. 1988. The Neolithic of Serbia: a review of research, in D. Srejović (ed.) *The Neolithic of Serbia: Archaeological Research 1948–1988*: 5–19. Belgrade: Faculty of Philosophy.

Srejović, D. 1997. *Arheološki leksikon.* Beograd: Savremena administracija.

Срејовић, Д. and **Б.** Јовановић. 1959. Оруђе и оружје од кости и накит из Винче [Utensils and weapons in bone and ornaments from Vinča]. *Starinar (new series)* 9-10: 181–190.

Srejović, D. and Z. Letica. 1978. *Vlasac: mezolitsko naselje u Djerdapu 2: Arheologija).* Belgrade: Srpska Akademija Nauka i Umetnosti.

Srejović, D. and N. Tasić (eds). 1990. *Vinča and its World.* Belgrade: Serbian Academy of Sciences and Arts.

Srejović, D., B. Stojanović, N. Tasić and Dušan Krstić. 1984. *Vinča u praistoriji i srednjem veku*. Beograd: Srpska Akademija Nauka i Umetnosti.

Stalio, B. 1960. Pločnik-Prokuplje-naselje. *Arheološki pregled (Belgrade)* 2: 33–36.

Stalio, B. 1962. Pločnik, Prokuplje- naselje vinčanske grupe. *Arheološki pregled (Belgrade)* 4: 19–25.

Stalio, B. 1964. Novi metalni nalaz iz Pločnika kod Prokuplja. *Zbornik Narodnog Muzeja (Belgrade)* 4: 35–41.

Stalio, B. 1972. *Gradac. Praistorijsko naselje.* Belgrade: Narodni Muzej.

Stalio, B. 1973. Četvrti nalaz bakarnog i kamenog oruđa sa Pločnika kod Prokuplja. *Zbornik Narodnog Muzeja* (Belgrade) 7: 157–161.

Starović, A. 2004. *Signs of Civilization: Exhibition Catalogue.* Novi Sad: Serbian Academy of Sciences and Arts.

Starović, A. 2005. If the Vinča script once really existed who could have written or read it? *Documenta Praehistorica* 32: 253–260.

Stefan, C.-E. 2018. Notă asupra unor materiale preistorice de la Romula (Reşca, judeţul Olt). *Buletinul Muzeului Judeţean Teleorman* 10: 109–130.

Stefanović, S. 2008. Late Neolithic boys at the Gomolava cemetery (Serbia), in L. Oosterbeek, (ed.) *Babies Reborn: Infant/Child Burials in Pre- and Protohistory. Proceedings of the XV World Congress of the International Union for Prehistoric and Protohistoric Sciences* (British Archaeological Reports International Series 1832): 95–100. Oxford: Archaeopress.

Stefanovich, M. and C. Angelova (eds). 2007. *PRAE: In honorem Henrieta Todorova*. Sofia: Bulgarian Academy of Sciences.

Sterud, E., R.K. Evans and J.A. Rasson. 1984. Part I: Ex Balcanis Lux? Recent Developments in Neolithic and Chalcolithic Research in Southeast Europe. *American Antiquity* 49: 713–741. DOI: https://doi.org/10.2307/279738.

Stevanović, M. 1997. The age of clay: the social dynamics of house destruction. *Journal of Anthropological Archaeology* 16: 334.

Stojanović, I. and J. Bulatović. 2013. Arheozoološka istraživanja mlađe praistorije na teritoriji Srbije, in N. Miladinović-Radmilović and S. Vitezović (eds) *Bioarheologija na Balkanu. Bilans i perspektive. Radovi Bioarheološke sekcije Srpskog arheološkog društva*: 13–24. Beograd: Srpsko Arheološko Društvo.

Stojanova-Kanzurova, E. and Z. Rujak. 2016. Food procurement, storage and preparation during the Neolithic in the Republic of Macedonia, in N. Miladinović-Radmilović and S. Vitezović (eds) *Bioarheologija na Balkanu 2: Metodološke, komparativne i rekonstruktivne studije* života u *prošlosti*: 69–79. Beograd: Srpsko Arheološko Društvo.

Stojić, M. and D. Jacanović. 2008. *Požarevac: kulturna stratigrafija praistorijskih lokaliteta u Braničevu.* Beograd: Arheološki Institut. Požarevac: Narodni muzej.

Stojić, M. and M. Jocić. 2006. *Niš. Arheološka građa Srbije.* Beograd, Niš: Arheološki Institut, Narodni muzej.

Stöllner, T., Samaschev, Z., Berdenov, S., Cierny, J., Doll, M., Garner, J., Gontscharov, A., Gorelik, A., Hauptmann, A., Rainer, H., Kusch, G. A., Merz, V., Riese, T., Sikorski, B. and Zickgraf, B. 2011. Tin from Kazakhstan - Steppe tin for the West? *In:* Yalçın, Ü. (ed.) *Anatolian Metal* V: 231-251. Bochum: Deutsches Bergbau-Museum.

Stout, D. 2002. Skill and cognition in stone tool production: an ethnographic case study from Irian Jaya. *Current Anthropology* 45(3): 693–722.

Stout, D. 2005. The social and cultural context of stone-knapping skill acquisition, in V. Roux and B. Bril (eds) *Stone Knapping: The Necessary Conditions for a Uniquely Hominin Behaviour*: 331–340. Cambridge: McDonald Institute for Archaeological Research.

Strahm, C. 1984. Die Anfänge der Metallurgie in Mitteleuropa. *Helvetica Archaeologica* 97: 1–39.

Stratouli, G. 1998. *Knochenartefakte aus dem Neolithikum und Chalkolithikum Nordgriechenlands*. Bonn: Rudolf Habelt.

Stratton, S., Griffiths, S., Kogălniceanu, R., Simalcsik, A., Morintz, A., Ştefan, C., Dumitraşcu, V., Bronk Ramsey, C., Nehlich, O., Beavan, N., Borić, D. and A. Whittle 2019. The Emergence of Extramural Cemeteries in Neolithic Southeast Europe: A Formally Modelled Chronology for Cernica, Romania. *Radiocarbon* 61: 319-346.

Struckmeyer, K. 2011. The bone tools from the dwelling mound Feddersen Wierde, Germany, and their functions, in J. Baron and B. Kufel-Diakowska (eds) *Written in Bones. Studies on Technological and Social Contexts of Past Faunal Skeletal Remains*: 187–195. Wrocław: Uniwersytet Wrocławski, Instytut Archeologii.

Stuiver, M. and H.A. Polach. 1977. Discussion: reporting of 14C data. *Radiocarbon* 19(3): 355–363.

Sümegi, P., G. Persaits and S. Gulyás. 2012. Woodland-grassland ecotonal shifts in environmental mosaics: lessons learnt from the environmental history of the Carpathian Basin (Central Europe) during the holocene and the last ice age based on investigation of paleobotanical and mollusk remains, in R.W. Myster (ed.) *Ecotones Between Forest and Grassland*: 17–57. New York: Springer-Verlag.

Svoboda, V., J. Vuković, S. Knežević, D. Izvonar and D. Kićević. 2004/2005. Experimental archaeology: traditional production of ceramics, presentation of phase I. *Diana* 10: 123–131.

Szakmány, Gy., K. Vanicsek, Z. Bendő, A, Kreiter, A. Pető, Z. Lisztes-Szabó and F. Horváth.

2019. Petrological analysis of late Neolithic ceramics from the tell settlement of Gorzsa (south-east Hungary), in S. Amicone, P.S. Quinn, M. Marić, N. Mirković-Marić and M. Radivojević (eds) *Tracing Pottery Making Recipes in the Balkans 6th-4th Millennia BC*: 156–171. Oxford: Archaeopress.

Š

Šarić, J. 2002. Stone as material for production of chipped artifacts in Early and Middle Neolithic of Serbia. *Starinar* 52: 11–26.

Šarić, J. 2006. Typology of chipped stone artefacts in the Early and Middle Neolithic in Serbia. *Starinar* 56: 9–45. DOI: https://doi.org/10.2298/STA0656009S.

Šarić, J. 2015. *Artefakti od okresanog kamena u starijem i srednjem neolitu na tlu Srbije*. Beograd: Arheološki institut.

Šarić, K. and V. Cvetković. 2013. Mineraloško-petrografska analiza uzoraka sa eneolitskog lokaliteta Crkvine u Malom Borku (Mineralogical-petrographical analyses of samples from Eneolithic locality Crkvine (Mali Borak)), in M. Blagojević (ed.) *Kolubara* 6: 37–43. Beograd: Republički zavod za zaštitu spomenika kulture.

Šiška, S. 1964. Gräberfeld der Tiszapolgár-Kultur in Tibava. *Slovenská Archeologia* 12: 293–356.

Šljivar, D. 1993–2009. *Belovode Field Excavation Diaries.* Belgrade: Project Archives, National Museum Belgrade.

Šljivar, D. 1996. The Eastern Settlement of the Vinča culture at Pločnik: a relationship of its stratigraphy to the hoards of copper objects. *Starinar* 47: 85–97

Šljivar, D. 1999. Pločnik, naselje vinčanske kulture i problem najranije metalurgije bakra, in D. Marinković (ed.) *Prokuplje u Praistoriji, Antici i Srednjem veku*: 31–44. Prokuplje: Archaeological Institute Belgrade and Museum of Toplica.

Šljivar, D. 2006. The earliest copper metallurgy in the Balkans. *Metalurgija-Journal of Metallurgy* 12: 93–104.

Šljivar, D. and D. Antonović. 1996. Mačina – naselje vinčanske kulture kod Prokuplja. *Zbornik Narodnog Muzeja* 16(1). *Arheologija*: 61–74.

Šljivar, D. and D. Jacanović. 1995. Rezultati arheoloških istraživanja neolitskog naselja Konjušnica u Viteževu. *Glasnik Srpskog Arheološkog Društva* 10: 181–185.

Šljivar, D. and D. Jacanović. 1996a. Veliko Laole – Belovode, naselje vinčanske kulture. *Glasnik Srpskog Arheološkog Društva* 12: 55–60.

Šljivar, D. and D. Jacanović. 1996b. Veliko Laole, Belovode-Vinča culture settlement in northeastern Serbia. *Préhistorie Européene* 8: 175–188.

Šljivar, D. and D. Jacanović. 1996c. Veliko Laole, 'Belovode' naselje vinčanske grupe. *Glasnik Srpskog Arheološkog Društva* 11: 185–189.

Šljivar, D. and D. Jacanović. 1997a. Veliko Laole-Belovode, the settlement of the Vinča culture. *Journal of Serbian Archaeological Society* 13: 115–125.

Šljivar, D. and D. Jacanović. 1997b. Veliko Laole-Belovode, istraživanja u 1997. *Glasnik Srpskog Arheološkog Društva* 14: 73–78.

Šljivar, D. and D. Jacanović. 1997c. Arheometalurgija bakra na naselju vinčanske culture Belovode kod Petrovca na Mlavi, in M. Lazić (ed.) *Arheologija istočne Srbije*: 189–195. Belgrade: Faculty of Philosophy, Centre for Archaeological Research.

Šljivar, D. and D. Jacanović. 2005. Zoomorphic figurines from Belovode. *Zbornik narodnog muzeja* 18(1): 69–78.

Šljivar, D. and J. Kuzmanović Cvetković. 1996-2009. *Pločnik Field Excavation Diaries*. Belgrade: National Museum Belgrade.

Šljivar, D. and J. Kuzmanović Cvetković. 1997a. Pločnik kod Prokuplja, naselje vinčanske kulture. *Glasnik Srpskog Arheološkog Društva* 13: 103–113.

Šljivar, D. and J. Kuzmanović Cvetković. 1997b. Pločnik kod Prokuplja, naselje vinčanske kulture. *Glasnik Srpskog Arheološkog Društva* 14: 79–85.

Šljivar, D. and J. Kuzmanović Cvetković. 1998a. Najstarija metalurgija bakra na Pločniku kod Prokuplja, naselju vinčanske kulture. *Arheometalurgija* (Belgrade) 6: 1–18.

Šljivar, D. and J. Kuzmanović Cvetković. 1998b. Pločnik near Prokuplje, excavation in 1997. *Journal of the Serbian Archaeological Society* 14: 79–85.

Šljivar, D. and J. Kuzmanović Cvetković. 2009a. Pločnik, archaeology and conservation. *Diana* (Belgrade) 13: 56–61.

Šljivar, D. and J. Kuzmanović Cvetković. 2009b. Pločnik 2008. Field Journal of Trench 21. September/ October. (Unpublished). Belgrade: National Museum in Belgrade.

Šljivar, D., D. Jacanović and J. Kuzmanović Cvetković. 2006. New contributions regarding the copper metallurgy in the Vinča culture, in N. Tasić and C. Grozdanov (eds) *Homage to Milutin Garašanin*: 251–266. Belgrade: Serbian Academy of Sciences and Arts and Macedonian Academy of Sciences and Arts.

Šljivar, D., J. Živković and D. Jacanović. 2011. *Belovode: naselje vinčanske kulture 5400-4600 g.p.n.e.* Petrovac na Mlavi: Zavičajni muzej.

Šljivar, D., J. Kuzmanović Cvetković and J. Živković. 2012. Belovode, Pločnik: on copper metallurgy in the Vinča culture. *Zbornik Narodnog Muzeja (Belgrade)* 20: 27–46.

Šljivar D., J.D. Živković and M.M. Svilar. 2015. Belovode, sonda XV. Prilozi stratigrafiji vinčanske kulture. *Zbornik Narodnog Muzeja* XXII-1: 9–27.

Šmilauer, P. 1992. *CanoDraw 3.0 User's Guide*. University College London: Environmental Change Research Centre.

Šumatić, N., J. Todorović, I. Komljenović and M. Marković. 1999. *Atlas korova*. Banja Luka: Glas Srpski, Šumarski fakultet, Poljoprivredni fakultet.

T

Taborin, Y. 1993. La parure en coquillage au paléolithique. *XIXe supplément à Gallia Préhistoire*. CNRS Editions.

Taborin, Y. 2004. *Langage Sans Parole. La Parure aux Temps Préhistoriques*. Paris: La Maison des roches.

Tasić, N. 1973. Neolitska Plastika. Beograd: Muzej grada Beograda.

Tasić, N. 1979. Tiszapolgar i Bodrogkeresztur kultura, in A. Benac (ed.) *Praistorija jugoslavenskih zemalja III – eneolitsko doba*: 55–85. Akademija nauka i umetnosti Bosne i Hercegovine.

Tasić, N. 1982. Naselje bakarnog doba u istočnoj Srbiji. *Zbornik radova Muzeja rudarstva i metalurgije u Boru (Serbia)* 2: 19–36.

Tasić, N. 1995. *Eneolithic Cultures of the Central and Western Balkans*. Belgrade: Institute for Balkan Studies.

Tasić, N. 2005. Vinča - the third glance, in L. Nikolova, J. Fritz and J. Higgins (eds) *Prehistoric Archaeology and Anthropological Theory and Education* (Reports of Prehistoric Research Projects 6–7): 1–8. Salt Lake City: Karlovo.

Tasić, N. 2007. Ritual pottery set from Vinča. *Glasnik Srpskog Arheološkog Društva* 23: 203–210.

Tasić, N. 2008a. Nemi svedoci jednog vremena: figuralna umetnost Vinče, in D. Nikolić (ed.) *Sto godina istraživanja arheološkog lokaliteta Vinča-Belo Brdo:* 139–163. Belgrade: Faculty of Philosophy University of Belgrade, National Museum Belgrade, City Museum Belgrade, Serbian Academy of Arts and Sciences.

Tasić, N. 2008b. *Vinča. Praistorijska metropola*. Beograd: Narodni muzej.

Tasić, N. 2015. *Metodologije i procedure na arheološkim istraživanjima u Vinči 1998-2015*. Beograd: Dosije Studio.

Tasić, N. and E. Tomić. 1969. *Crnokalačka bara – naselje starčevačke i vinčanske kulture*. Kruševac: Narodni muzej. Arheološko društvo Jugoslavije.

Tasić, N.N., M. Marić, K. Penezić, D. Filipović, K. Borojević, N. Russell, P. Reimer, A. Barclay, A. Bayliss, D. Borić, B. Gaydarska and A. Whittle. 2015. The end of the affair: formal chronological modelling for the top of the Neolithic tell of Vinča-Belo Brdo. *Antiquity* 89(347): 1064–1082. DOI: https://doi.org/10.15184/aqy.2015.101.

Tasić, N.N., M. Marić, D. Filipović, K. Penezić, E. Dunbar, P. Reimer, A. Barclay, A. Bayliss, B. Gaydarska and A. Whittle. 2016a. Interwoven strands for refining the chronology of the Neolithic tell of Vinča-Belo Brdo, Serbia. *Radiocarbon* 58: 795–831. DOI: https://doi.org/10.1017/RDC.2016.56.

Tasić, N., M. Marić, N. Bevan, C.B. Ramsey, B. Kromer, A. Barclay, A. Bayliss, B. Gaydarska and A. Whittle. 2016b. Vinča-Belo Brdo, Serbia: the times of a tell. *Germania* 93: 89–157.

Taylor, T. 1999. Envaluing metal: theorizing the Eneolithic 'hiatus', in S.M.M. Young, A.M. Pollard, P. Budd and R.A. Ixer (eds) *Metals in Antiquity* (British Archaeological Reports International Series 792): 22–32. Oxford: Archaeopress.

Teichert, M. 1969. Osteometrische Untersuchungen zur Berechnung der Widerristhöhe bei vor- und frühgeschichtlichen Schweinen. *Kühn Archiv* 83 (3): 237–292.

Teichert, M. 1975. Osteometrische Untersuchungen zur Berechnung der Widerristhöhe bei Schafen, in A. Clason (ed.) *Archaeozoological Studies*: 51–69. Amsterdam: North-Holland Publishing Company/ Elsevier.

ter Braak, C.F.J. and P. Šmilauer. 1997–1999. *CANOCO for Windows version 4.02.* Wageningen: Centre for Biometry.

Ţerna, S. and B. Govedarica (eds). 2016. *Interactions, Changes and Meanings. Essays in Honour of Igor Manzura on the Occasion of His 60th Birthday*. Kishniev: High Anthropological School University, Kishniev.

Thomas, J.T. 2011. Fashioning identities, forging inequalities: Late Neolithic/Copper Age personal ornaments of the Portuguese Estremadura. *European Journal of Archaeology* 14 (1–2): 29–59.

Thomas, R. and N. Johannsen. 2011. Articular depression in domestic cattle phalanges and their archaeological relevance. *International Journal of Paleopathology* 1: 43–54.

Thomas, P., M. Radivojević, S. Derikonjić, F. Schapals, J. Pendić, A. Jablanović, K. Kosczinski, N. Heil, B.W. Roberts, M. Marić, E. Pernicka, Th. Rehren and T. Stöllner. (In preparation). Jarmovac, a new prehistoric mine in the Balkans.

Thornton, C.P. 2001. The Domestication of Metal: A Reassessment of the Early Use of Copper Minerals and Metal in Anatolia and Southeastern Europe. Unpublished MPhil dissertation, University of Cambridge.

Thornton, C.P. 2007. Of brass and bronze in prehistoric southwest Asia, in S. La Niece, D. Hook, and P. Craddock (eds.) *Metals and Mines: Studies in Archaeometallurgy*: 123–135. London: Archetype Publications.

Thornton, C.P. 2009. The Emergence of complex metallurgy on the Iranian Plateau: escaping the Levantine Paradigm. *Journal of World Prehistory* 22: 301–327. DOI: https://doi.org/10.1007/s10963-009-9019-1.

Thornton, C.P. 2010. The Rise of Arsenical Copper in Southeastern Iran. *Iranica Antiqua* 45: 31–50.

Thornton, C.P. and B.W. Roberts. 2009. Introduction: The beginnings of metallurgy in global perspective. *Journal of World Prehistory* 22: 181–184.

Thoury, M., B. Mille, T. Séverin-Fabiani, L. Robbiola, M. Réfrégiers, J.F. Jarrige and L. Bertrand. 2016. High spatial dynamics-photoluminescence imaging reveals the metallurgy of the earliest lost-wax cast object. *Nature Communications* 7: 13356. DOI: https://doi.org/10.1038/ncomms13356.

Timberlake, S., 2007. The use of experimental archaeology/archaeometallurgy for the understanding and reconstruction of Early Bronze Age mining and smelting technologies, in S. La Niece, D. Hook and P. Craddock, (eds) *Metals and Mines. Studies in Archaeometallurgy*, 27-36. London: Archetype/British Museum.

Timpson, A., S. Colledge, E. Crema, K. Edinborough, T. Kerig, K. Manning, M.G. Thomas and S. Shennan. 2014. Reconstructing regional population fluctuations in the European Neolithic using radiocarbon dates: a new case-study using an improved method. *Journal of Archaeological Science* 52: 549–557.

Todorova, H. 1978. *The Eneolithic Period in Bulgaria in the Fifth Millennium B.C.* (British Archaeological Reports International Series 49). Oxford: Archaeopress.

Todorova, H. 1981. *Die kupferzeitlichen Äxte und Beile in Bulgarien.* (Prähistorische Bronzefunde, Volume 9, Band 14). München: C.H. Beck'sche Verlagsbuchhandlung.

Todorova, H. 1982. *Kupferzeitlische Siedlungen im Nordostbulgarien.* Munchen: C.H. Beck.

Todorova, H. 1986. *Kamenno-Mednata Epokha v Bulgariya. Peto Khilyadoletie predi Novata Era*. Sofia: Nauka i Izkustvo.

Todorova, H. 1995. The Neolithic, Eneolithic and Transitional Period in Bulgarian prehistory, in D.W. Bailey, I. Panayotov and S. Alexandrov (eds) *Prehistoric Bulgaria* (Monographs in World Archaeology 22): 79–98. Madison (WI): Prehistory Press.

Todorova, H. (ed.) 2002a. *Durankulak - Die Prähistorischen Gräberfelder.* Sofia: The Bulgarian Academy of Sciences.

Todorova, H. 2002b. Chronologie, horizontale Stratigraphie und Befunde, in H. Todorova (ed), *Durankulak, Die prähistorischen Gräberfelder,* band II: 35–52. Sofia: Anubis.

Todorova, H. and I. Vajsov. 1993. *Novo-Kamennata Epokha v Bulgariya.* Sofia: Nauka i Izkustvo.

Todorova, H. and I. Vajsov. 2001. *Der kupferzeitliche Schmuck Bulgariens.* (Prähistorische Bronzefunde, Vol. 20, Band 6). Stuttgart: Steiner.

Todorova, M. 1997. *Imagining the Balkans*. Oxford: Oxford University Press.

Todorova-Simeonova, H. 1971. Spätneolithisches Gräberfeld bei der Stadt Devnja. *Bulletin du Musée National à Varna* 7: 3–26.

Tomkins, P.D. and P.M. Day. 2001. Production and exchange of the earliest ceramic vessels in the Aegean: a view from early Neolithic Knossos, Crete. *Antiquity* 75: 259–260.

Trajković-Filipović, T., D. Milanović and A. Bulatović. 2008. Reviziona arheološka iskopavanja lokaliteta Bubanj kod Niša u 2008. godini. *Zbornik Narodnog muzeja u Nišu* 16–17: 309–318.

Trbojević, N. 2005. The possibility of reconstruction of the early Eneolithic house at the locality of Livade in the village of Kalenić. *Kolubara* 4: 79–88.

Trigger, B.G. 1986. The role of technology in V. Gordon Childe's archaeology. *Norwegian Archaeological Review* 19: 1–14.

Tringham, R. 1971. *Hunters, Fishers and Farmers of Eastern Europe, 6000-3000 B.C.* London: Hutchinson and Co. Ltd.

Tringham, R. 1992. Life after Selevac: Why and how a Neolithic settlement is abandoned. *Balcanica* 23: 133–145.

Tringham, R. and D.A Krstić. 1990a. Selevac and the transformation of southeast European Prehistory, in R. Tringham and D. Krstić (eds) *Selevac: a Neolithic Village in Yugoslavia*: 567–616. Los Angeles: University of California Press.

Tringham, R. and D.A. Krstić (eds). 1990b. *Selevac: A Prehistoric Village in Yugoslavia*. Los Angeles: University of California Press.

Tringham, R. and D. Krstić. 1990c. Conclusion: Selevac in the wider context of European prehistory, in

R. Tringham and D. Krstić (eds) *Selevac. A Neolithic Village in Yugoslavia*: 567–616. Los Angeles: UCLA.

Tringham, R. and M. Stevanović. 1990. Nonceramic uses of clay, in. R. Tringham and D. Krstić (eds) *Selevac, A Neolithic Village in Yugoslavia*: 328–388. Los Angeles: University of California Institute of Archaeology.

Tringham, R.E., B. Brukner and B. Voytek. 1985. The Opovo Project: a study of socio-economic change in the Balkan Neolithic. *Journal of Field Archaeology* 12: 425–44.

Tringham, R., A. McPherron, J. Gunn and G. Odell. 1988. The flaked stone industry from Divostin and Banja, in A. McPherron and D. Srejović (eds) *Divostin and Neolithic of Central Serbia*: 203–254. Pittsburgh, Kragujevac: University of Pittsburgh, Narodni muzej Kragujevac.

Tringham, R.E., B. Brukner, T. Kaiser, K. Borojević, L. Bukvić, P. Šteli, N. Russel, M. Stafanović and B. Voytek. 1992. Excavation at Opovo, 1985–1987: Socioeconomic change in the Balkans Neolithic. *Journal of Field Archaeology* 19(3): 351–386.

Tripković, B. 2003a. Obsidian deposits in the Central Balkans? Tested against archaeological evidence. *Starinar* 53–54: 163–79.

Tripković, B. 2003b. A dialogue between the household and community: a case study of Banjica, in L. Nikolova (ed.) *Early Symbolic Systems for Communication in Southeast Europe* (British Archaeological Reports International Series 1139): 447–457. Oxford: Archaeopress.

Tripković, B. 2007. *Domaćinstvo i prostor u kasnom neolitu. Vinčansko naselje na Banjici* (Household and Space in the Late Neolithic. Vinča Settlement at Banjica). Beograd: Srpsko Arheološko Društvo.

Tripković, B. 2009a. Domaćinstvo i zajednica u kasnom neolitu Zapadnog Balkana (Household and Community in the Late Neolithic of the Western Balkans, in Serbian). Unpublished PhD dissertaion, University of Belgrade.

Tripković, B. 2009b. House(hold) continuities in the central Balkans. *Opuscula Archaeologica* 33: 7–28.

Tripković, B. 2011. Containers and grains: food storage and symbolism in the Central Balkans (Vinča period). *Documenta Praehistorica* 38: 159–172.

Tripković, B. 2013. *Domaćinstvo i zajednica: kućne i naseobinske istorije u kasnom neolitu centralnog Balkana*. Beograd: Univerzitet u Beogradu, Filozofski fakultet.

Tripković, B. and M. Milić. 2008. The origin and exchange of Obsidian from Vinča – Belo Brdo. *Starinar* 58: 71–86.

Tripković, B., and K. Penezić. 2017. On-site and off-site in western Serbia: a geoarchaeological perspective on Obrovac-type settlements. *Quaternary International* 429: 35–44.

Trubitt, M. 2003. The production and exchange of marine shell prestige goods. *Journal of Archaeological Research* 11(3): 243–277.

Tsirtsoni, Z. 2016a. The end of the Balkan Chalcolithic: A viewpoint from the south, in V. Nikolov and W. Schier (eds) *Der Schwarzmeerraum vom Neolithikum bis in die Früheisenzeit (6000–600 v. Chr.). Kulturelle Interferenzen in der Zirkumpontischen Zone und Kontakte mit ihren Nachbargebieten. Proceedings of the Humboldt-Kolleg held at Varna, May 16–20, 2012* (Prähistorische Archäologie in Südosteuropa Band 30): 339–358. Rahden/Westf: Leidorf.

Tsirtsoni, Z. (ed.) 2016b. *The Human Face of Radiocarbon. Reassessing Chronology in Prehistoric Greece and Bulgaria, 5000–3000 cal BC* (Travaux de la Maison de l'Orient 69). Lyon: Maison de l'Orient et de la Méditerranée Jean Pouilloux.

Tucakov, J. 1986. *Lečenje biljem*. Beograd: Izdavačka radna organizacija 'Rad'.

Turck, R. 2010. *Die Metalle zur Zeit des Jungneolithikums in Mitteleuropa – Eine sozialarchäologische Untersuchung*. (Universitätsforschungen zur prähistorischen Archäologie 185). Bonn: Habelt.

Tutin, T.G., H.H. Vernon, N.A. Burges, D.H. Valentine, S.M. Walters and D.A. Webb. 1964–1980. *Flora Europaea*. Cambridge: Cambridge University Press.

Tykot, R.H. 2011. Obsidian finds on the fringes of the Central Mediterranean: exotic or eccentric exchange? In A. Vianello (ed.) *Exotica in the Prehistoric Mediterranean*: 33–44. Oxford: Oxbow Books.

Tylecote, R.F. 1962. *Metallurgy in Archaeology*. London: Edward Arnold.

Tylecote, R.F. 1976. *A History of Metallurgy*. London: The Metals Society.

Tylecote, R.F., H.A. Ghaznavi and P.J. Boydell. 1977. Partitioning of trace elements between the ores, fluxes, slags and metal during the smelting of copper. *Journal of Archaeological Science* 4: 305–333.

U

Ucko, P.J. 1969. Ethnography and archaeological interpretation of funerary remains. *World Archaeology* 1: 262–280.

Ur, J. 2003. CORONA satellite photography and ancient road networks: A northern Mesopotamian case study. *Antiquity* 77(295): 102–115.

Urem-Kotsou, D. 2016. Salting the roads: connectivity in the Neolithic Balkans, in B.P.C. Molloy (ed.) *Of Odysseys and Oddities: Scales and Modes of Interaction between Prehistoric Aegean Societies and Their Neighbours* (Sheffield Studies in Aegean Archaeology 10): 123–141. Oxford: Oxbow Books.

U.S. Geological Survey, 2008, Declassified intelligence satellite photographs: U.S. Geological Survey Fact Sheet 2008–3054, viewed 21.07.2020, https://pubs.usgs.gov/fs/2008/3054/pdf/fs2008-3054.pdf

U.S. Geological Survey, 2020a, Landsat Missions, viewed 20.06.2020, https://www.usgs.gov/

U.S. Geological Survey, 2020b, Earth Explorer, viewed 20.06.2020, https://earthexplorer.usgs.gov/

V

Vajsov, I. 2007. Promachon-Topolnica. A typology of painted decorations and its use as a chronological marker, in H. Todorova, M. Stefanovich and G. Ivanov (eds) *The Struma/Strymon River Valley in Prehistory. Proceedings of the International Symposium 'Strymon Praehistoricus'*: 79–120. Düsseldorf: Gerda Henkel Stiftung.

Valamoti, S.-M. 2004. *Plants and People in Late Neolithic and Early Bronze Age Northern Greece: an Archaeobotanical Investigation* (British Archaeological Reports International Series 1258). Oxford: Archaeopress.

Valamoti, S.-M. and K. Kotsakis. 2007. Transitions to agriculture in the Aegean: the archaeobotanical evidence, in S. Colledge and J. Conolly (eds) *The Origins and Spread of Domestic Plants in Southwest Asia and Europe*: 75–92. London: Left Coast Press.

Valamoti, S-M., A. Moniaki and A. Karathanou. 2011. An investigation of processing and consumption of pulses among prehistoric societies: archaeobotanical, experimental and ethnographic evidence from Greece. *Vegetation History and Archaeobotany* 20: 381–396.

van der Leeuw, S.E. and R. Torrence (eds). 1989. *What's New? A Closer Look at the Process of Innovation.* London: Unwin Hyman.

van der Veen, M. 2005. Gardens and fields: the intensity and scale of food production. *World Archaeology* 37: 157–163.

van der Veen, M. 2007. Formation processes of desiccated and carbonised plant remains - the identification of routine practice. *Journal of Archaeological Science* 34: 968–990.

van Zeist, W. 2002. Plant Husbandry and Vegetation of Tell Gomolava, Vojvodina, Yugoslavia. *Palaeohistoria* 43/44: 87–115.

Vander Linden, M., I. Pandžić and D. Orton. 2014. New radiocarbon dates for the Neolithic period in Bosnia & Herzegovina. *Godišnjak/Jahrbuck* 43:7–34.

Varvara, S., B. Fabbri, S. Gualtieri, P. Ricciardi and M. Gligor. 2008. Archaeometric characterisation of the Neolithic pottery discovered at Alba Iulia-Lumea Noua archaeological site (Romania). *Studia Universitatis Babes-Bolyai Chemia* 53(1): 5–13.

Васић, Ч. 1987. Релативни хронолошки односи између објеката на Акропољу Царичиног града. *Саопштења* XIX: 127–138. Београд.

Vasić, M. 1911. Gradac, preistorisko nalazište latenskog doba. *Glas Srpske Kraljevske Akademije* 86: 97–140.

Vasić, M. 1932-1936. *Preistoriska Vinča I-IV (Prehistoric Vinča, in Serbian)*. Belgrade: Državna štamparija.

Васић, М. 1932. Преисториска Винча I. Београд: Државна штампарија.

Vasić, M. 1936a. *Preistorijska Vinča II.* Beograd: Kraljevska državna štamparija.

Vasić, M. 1936b. *Preistorijska Vinča III. Plastika.* Beograd: Državna štamparija kraljevine Jugoslavije.

Vasić, M. 1936c. *Preistoriska Vinča IV. Keramika*. Belgrade: Državna Štamparija Kraljevine Jugoslavije.

Vetnić, S. 1974. Počeci rada na ispitivanju kulture prvih zemljoradnika u srednjem Pomoravlju. *Materijali* X: 123–168.

Vértes, L. 1965. The depot of silex blades from Boldogkőváralja. *Acta Archaeologica Hungarica* 17: 128–136.

Videiko, M. 2004. Absolute dating of Tripolye culture, in M. Videiko (ed.) *Encyclopedia Trypilskoi tsyvilizatsii. Volume 1*: 85–95. Kyiv: Ukrpoligraphmedia.

Vigne, J.-D. And D. Helmer. 2007. Was milk a 'secondary product' in the Old World Neolithisation process? Its role in the domestication of cattle, sheep and goats. *Anthropozoologica* 42(2): 9–40.

Virmani, S.M., K.L. Sahrawat and J.R. Burford. 1982. Physical and chemical properties of vertisols and their management, in *Proceedings of the 12th International Congress of Soil Science, 8-16 February 1982, New Delhi.* India: 80–93. New Delhi: Indian Society of Soil Science.

Vitezović, S. 2007. Koštana Industrija u Neolitu Srednjeg Pomoravlja. Unpublished MPhil dissertation, University of Belgrade.

Vitezović, S. 2011a. Koštana Industrija u Starijem i Srednjem Neolitu Centralnog Balkana. Unpublished PhD dissertation, University of Belgrade.

Vitezović, S. 2011b. The Neolithic bone industry from Drenovac, Serbia, in J. Baron and B. Kufel-Diakowska (eds) *Written in Bones. Studies on Technological and Social Contexts of Past Faunal Skeletal Remains*: 117–135. Wrocław: Uniwersytet Wrocławski, Instytut Archeologii.

Витезовић, С. 2012. Коштана индустрија са локалитета Витково-Трифуновићи (ископавања 2001. године) [Bone industry from the site Vitkovo-Trifunovići (excavation season 2001)], Крушевачки зборник *[Kruševac collection]* 15: 351–376.

Vitezović, S. 2012. The white beauty – Starčevo culture jewellery. *Documenta Praehistorica* XXXIX: 91–203

Vitezović, S. 2013a. Analiza praistorijskih koštanih predmeta – neka metodološka razmatranja, in N. Miladinović-Radmilović and S. Vitezović (eds) *Bioarheologija na Balkanu. Bilans i perspektive. Radovi bioarheološke sekcije Srpskog arheološkog društva*: 107–132. Beograd-Sremska Mitrovica: Srpsko arheološko društvo-Blago Sirmiuma.

Vitezović, S. 2013b. Osseous raw materials in the Vinča culture, in A. Choyke and S. O'Connor (eds) *From These Bare Bones: Raw Materials and the Study of Worked Osseous Objects*: 59–72. Oxford and Oakville: Oxbow Books.

Vitezović, S. 2013c. Personal ornaments in the Vinča culture: the case study of Vitkovo and Stragari, in I. Vasile Ferencz, N. Cătălin Rişcuţa and O. Tutilă Bărbat (eds) *Archaeological Small Finds and their Significance: Proceedings of the Symposium: Costume as an Identity Expression*: 9–20. Deva, Cluj-Napoca: Mega.

Vitezović, S. 2014. Pavlovac - Kovačke Njive: preliminarni izveštaj analize koštane industrije, in D. Antonović, S. Golubović and V. Bikić (eds) *Arheologija u Srbiji. Projekti Arheološkog instituta u 2012*: 16–19. Beograd: Arheološki institut.

Vitezović, S. 2016a. *Metodologija proučavanja praistorijskih koštanih industrija*. Beograd: Srpsko arheološko društvo.

Vitezović, S. 2016b. The sea within: the use of mollusc shells as ornaments in the central Balkans Neolithic, in C. Preoteasa, C.-D. Nicola (eds) *Cucuteni Culture within the European Neo-Eneolithic Context: Proceedings of the International Colloquium Cucuteni – 130. 15–17 October 2014, Piatra-Neamţ, Romania: In Memoriam Dr. Dan Monah, In Memoriam Dr. Gheorghe Dumitroaia*: 237256. Piatra-Neamţ: Editura 'Constantin Matasă'.

Vitezović, S. 2018. Managing raw materials in prehistory: the importance of studying osseus raw materials. *Opuscula Archaeologica* 29–40: 13–24.

Vitezović, S. and D. Antonović. 2020. Functional differentiation and possible regional specialisation of the Vinča culture settlements: viewpoint from osseous and lithic industries. *Quaternary International* 539: 39–48.

Vitezović, S., D. Antonović and V. Dimić. 2017. Life in white: symbolism and importance of the white colour in the Neolithic in the Balkans, in V.P. Sekulov (ed.) *Acta Musei Tiberiopolitani, Volume* 2: 26–37. Strumica: Institute for the Protection of Monuments of Culture and Museum Strumica.

Vitelli, K.D. 1993a. *Franchthi Neolithic Pottery, Volume 1. Classification and Ceramic Phases, 1 and 2*. Bloomington, Indiana: Indiana University Press.

Vitelli, K.D. 1993b. Power to the potters: comment on Perlés systems of exchange and organization of production in Neolithic Greece. *Journal of Mediterranean Archaeology* 6: 247–257.

Vlassa, N. 1967. Unele probleme ale neoliticuli Transilvaniei. *Acta Musei Napocensis (Romania)* 4: 403–423.

Vogel, J.C. and H.T. Waterbolk. 1963. Groningen radiocarbon dates IV. *Radiocarbon* 5: 163–202.

Vollmar, K. 2009. *Das grosse Buch der Farben*. Krummwisch: Königsfurt-Urania Verlag GmbH.

Von den Dreisch, A. 1976. *A Guide to the Measurements of Animal Bones from Archaeological Sites*. Cambridge (MA): Harvard University Peabody Museum.

Von de Pulsky, F. 1884. *Die Kupferzeit in Ungarn*. Budapest: Kessinger Publishing.

Vörös, I. 1980. Zoological and palaeoeconomical investigations of the Early Neolithic Körös culture. *Folia Archaeologica* 31: 3–64.

Voruz, J.-L. 1984. *Outillages Osseux et Dynamisme Industriel dans le Néolithique Jurassien.* Lausanne: Cahiers d'archéologie romande 29.

Voytek, B. 1985. The Exploitation of Lithic Resources in Neolithic Southeast Europe. Unpublished PhD Dissertion, University of Berkeley.

Voytek, B. 1988. Chipped stone industry of Selevac, Serbia, Yugoslavia, in T. Szelag (ed.) *Archaeologia Interregionali. Chipped Stone Industries of the Early Farming Cultures in Europe.* Warsaw: Warsaw University Press.

Vukanović, T. 1969. A Neolithic Janus from Kosovo, *Vranjski glasnik* 5: 112.

Vukmanović, M. and N. Radojčić. 1990. Quantitative analysis of the pottery, in R. Tringham and D. Krstić (eds) *Selevac: A Neolithic village in Yugoslavia*: 289–317. Los Angeles: The Institute of Archaeology, University of California.

Vuković, J. 2010. Neolithic fine pottery: properties, performance and function. *Glasnik Srpskog Arheološkog Društva 26*: 7–23.

Vuković, J. 2011. Late Neolithic pottery standardization. Application of statistical analysis. *Glasnik Srpskog archeološkog društva (Journal of the Serbian Archaeological Society)* 27: 81–101.

Vuković, J. 2013. Posude za pečenje u kasnom neolitu: đuveči iz Vinče. Zbornik Narodnog muzeja XXI/1: 129–144.

Vuković, J. 2015. Izgubljeni u tranziciji: problem prelaza ranog/srednjeg u kasni neolit centralnog Balkana u jugoslovenskoj/srpskoj arheologiji druge polovine XX veka. *Etnoantropološki problemi* 10(3): 651–673.

Vuković, J. 2018a. Erasing boundaries or changing identities? The transition from early/middle to late neolithic, new evidence from southern Serbia, in M. Gori and M. Ivanova (eds) *Balkan Dialogues: Negotiating Identity between Prehistory and the Present*: 240–253. London: Routledge.

Vuković, J. 2018b. Late Neolithic Vinča pottery firing procedure. *Opuscula Archaeologica* 39/40: 25–35.

Vuković, J. 2020. Technological innovation and social change. Early vs. Late Neolithic pottery production of the Central Balkans, in M. Spataro and M. Furholt (eds) *Detecting and Explaining Technological Innovation in Prehistory*: 135–150. Leiden: Sidestone

Vuković, J. and I. Miloglav. 2018. Part-time labor and household production: Emergence of specialized potters in the Late Neolithic Vinča (Serbia) and Late Eneolithic Vučedol (Croatia) Societies, in I. Miloglav and J. Vuković (eds) *Artisans Rule: Product Standardization and Craft Specialization in Prehistoric Society*: 120–136. Cambridge: Cambridge Scholar Publishing.

Vuković, S. and D. Marković. 2019. Ostaci životinja iz horizonta mlađe praistorije na lokalitetima Nad Klepečkom i Rit, in A. Kapuran, A. Bulatović, A. Golubović and V. Filipović (eds) *Viminacijum u praistoriji – iskopavanja 2005-2015*: 223–248. Beograd: Arheološki institut.

Vulpe, A. 1975. *Die Äxte und Beile in Rumänien.* (Prähistorische Bronzefunde Volume 9, Band 2). München: C. H. Beck'sche Verlagsbuchhandlun.

Vulpe, R. 1957. *Izvoare: Săpăturile din 1936-1948*. Bucharest: Editura Academiei Republicii Populare Romîne.

W

Wailes, B. (ed.) 1996. *Craft Specialization and Social Evolution: In Memory of V. Gordon Childe.* Philadelphia: University Museum of Archaeology and Anthropology, University of Pennsylvania.

Walker, A. and A. Bogaard. 2011. Preliminary archaeobotanical results from teleor 003/Măgura 'Buduiasca', in S. Mills and P. Mirea (eds) *The Lower Danube in Prehistory. Landscape Changes and Human-Environment Interactions*: 151–160. Bucureşti: Editura Renaissance.

Wallaert-Pêtre, H. 2001. Learning how to make the right pots: apprenticeship strategies and material culture, a case study in handmade pottery from Cameroon. *Journal of Anthropological Research* 57: 471–493.

Ward, G.K. and S.R. Wilson. 1978. Procedures for comparing and combining radiocarbon age determinations – critique. *Archaeometry* 20: 19–31.

Washburn, D. and D. Crowe (eds). 2004. *Symmetry Comes of Age.* Seattle (WA): University of Washington Press.

Watanabe, N., S. Nakamura, B. Liu and N. Wang. 2017. Utilization of structure from motion for processing CORONA satellite images: Application to mapping and interpretation of archaeological features in Liangzhu Culture, China. *Archaeological Research in Asia* 11: 38–50.

Watson, J. 1979. The estimation of relative frequencies of mammalian species: Khirokitia 1972. *Journal of Archaeological Science* 6: 127–137.

Weber, R.J., S. Dixon and A.M. Llorente. 1993. Studying invention: the hand tool as a model system. *Science, Technology, and Human Values* 18: 480–505.

Weninger, B., C. Lee, E. Rohling, O. Bar-Yosef, U. Böhner, M. Budja, M. Bundschuh, A. Feurdean, H.G. Gebe, O. Jöris, J. Linstädter, P. Mayewski, T. Mühlenbruch, A. Reingruber, G. Rollefson, D. Schyle, L. Thissen, H. Todorova and C. Zielhofer. 2009. The impact of rapid climate change on prehistoric societies during the Holocene in the Eastern Mediterranean. *Documenta Praehistorica* 36: 7–59.

Wertime, T.A. 1964. Man's first encounters with metallurgy. *Science* 146: 1257–1267.

Wertime, T.A. 1973. The beginnings of metallurgy: a new look. *Science* 182: 875–87.

White, L. 1959. *The Evolution of Culture: the Development of Civilization to the Fall of Rome*. New York: McGraw-Hill.

Whittle, A. 1996. *Europe in the Neolithic: The Creation of New Worlds*. Cambridge: Cambridge University Press.

Whittle, A. 2003. *The Archaeology of People: Dimensions of Neolithic Life*. London: Routledge.

Whittle, A. 2018. *The Times of their Lives: Hunting History in the Archaeology of Neolithic Europe*. Oxford: Oxbow.

Whittle, A., L. Bartosiewicz, D. Borić, P.B. Pettitt and M. Richards. 2002. In the beginning: new radiocarbon dates for the Early Neolithic in northern Serbia and south-east Hungary. *Antaeus (Budapest)* 25: 63–117.

Whittle, A., A. Bayliss, A. Barclay, B. Gaydarksa, E. Bánffy, D. Boric, F. Draşovean, J. Jakucs, M. Marić, D. Orton, I. Pantović, W. Schier, N. Tasić and M.Vander Linden. 2016. A Vinča potscape: formal chronological models for the use and development of Vinča ceramics in south-east Europe. *Documenta Praehistorica* 43: 1–60.

Wiener, N. 1993. *Invention. The Care and Feeding of Ideas.* Cambridge (MA): The MIT Press.

Wijnen, M. 1994. Neolithic pottery from Sesklo – technological aspects, in J.-C. Decourt, B. Helly and K. Gallis (eds) *La Thessalie. Quinze Années de Recherches Archéologiques, 1975-1990: Bilans et Perspectives*: 149–155. Athens: Ministry of Culture.

Wilkinson, T.C., Sherratt, S. and J. Bennet. (eds) 2011. *Interweaving Worlds: Systemic Interactions in Eurasia: 7th to the 1st Millennia BC*. Oxford: Oxbow.

Williams, M. 2006. *Deforesting the Earth: From Prehistory to Global Crisis, an Abridgement.* Dordrecht: Kluwer Academic Publishers.

Williams, R. A. and Le Carlier de Veslud, C. 2019. Boom and bust in Bronze Age Britain: major copper production from the Great Orme mine and European trade, c. 1600–1400 BC. *Antiquity,* 93, 1178-1196.

Williams-Thorpe, O., S.E. Warren and J.G. Nandris. 1984. The distribution and provenance of archaeological obsidian in Central and Eastern Europe. *Journal of Archaeological Science* 11: 183–212.

Willis, K.J. 1994. The vegetation history of the Balkans. *Quaternary Science Reviews* 13: 769–788.

Willis, K.J. and K.D. Bennett. 1994. The Neolithic transition – fact or fiction? Palaeoecological evidence from the Balkans. *The Holocene* 4: 326–330.

Willms, C. 1985. Neolitischer Spondylusschmuck. Hundert Jahre Forschung. *Germania* 63(2): 331–343.

Windler, A. 2018. *Der Austausch von Spondylus gaederopus in Europa zwischen 5.500 und 5.000 v. Chr. Eine ökonomische Analyse.* Rahden, Westfalen: Marie Leidorf.

Windler, A. 2019. The use of *Spondylus gaederopus* during the Neolithic of Europe. *Journal of Open Archaeology Data* 7: 7. DOI: http://doi.org/10.5334/joad.59

Winn, S. 1981. *Pre-Writing in South-eastern Europe: The Sign Systems of the Vinča Culture ca. 4000 BC*. Calgary: Western Publishers.

Wright, E. and S. Viner-Daniels. 2015. Geographical variation in the size and shape of the European aurochs (*Bos primigenius*). *Journal of Archaeological Science* 54: 8–22.

Wright, K., P., Critchley, A., Garrard, D., Baird, R., Bains and S. Groom. 2008. Stone bead technologies and early craft specialisation: insights from two Neolithic sites in eastern Jordan. *Levant* 40: 131–165.

Wright, K. and A. Garrard. 2003. Social identities and the expansion of stone bead-making in Neolithic Western Asia: new evidence from Jordan. *Antiquity* 77: 267–284.

Y

Yahalom-Mack, N., D. Langgut, O. Dvir, O. Tirosh, A. Eliyahu-Behar, Y. Erel, B. Langford, A. Frumkin, M. Ullman and U. Davidovich. 2015. The earliest lead object in the Levant. *PLoS ONE* 10(12): e0142948. DOI: https://doi.org/10.1371/journal.pone.0142948.

Yang, J., H. Shao and L.Pan. 2020. *The Metal Road of the Eastern Eurasian Steppe: The Formation of the Xiongnu Confederation and the Silk Road*. Singapore: Springer.

Yorston R.M., V.L. Gaffney and P. Reynolds. 1990. Simulation of artefact movement due to cultivation. *Journal of Archaeological Science* 17: 67–83.

Youni, P. 2000. Painted pottery from East Macedonia in North Greece: technological analysis of decorative techniques. *Documenta Praehistorica* 27: 198–214.

Yovchev, D. Native gold and platinum in stream sediments from Dvoynitsa River and right tributaries of Kamchia River, Bulgaria *'GEOSCIENCES 2014', Sofia, 2014*: 33–34. Bulgarian Geological Society.

Z

Zakšek, K., K. Oštir and Ž. Kokalj. 2011. Sky-view factor as a relief visualization technique. *Remote Sensing* 3: 398–415.

Zeder, M. 2006. Reconciling rates of long bone fusion and tooth eruption and wear in sheep (*Ovis*) and goat (*Capra*), in D. Ruscillo (ed.) *Recent Advances in Ageing and Sexing Animal Bones*: 87–118. Oxford: Oxbow.

Zeder, M. and H. Lapham. 2010. Assessing the reliability of criteria used to identify postcranial bones in sheep, *Ovis*, and goats, *Capra*. *Journal of Archaeological Science* 37: 2887–2905.

Zeder, M. and S. Pilaar. 2010. Assessing the reliability of criteria used to identify mandibles and mandibular teeth in sheep, *Ovis*, and goats, *Capra*. *International Journal of Archaeological Science* 37: 225–242.

Žeravica, Z. 1993. *Äxte und Beile aus Dalmatien und anderen Teilen Kroatiens, Montenegro, Bosnia und Herzegowina.* (Prähistorische Bronzefunde Volume 9, Band 8). Stuttgart: Steiner.

Zhang, Y., B. Guindon and J. Cihlar. 2002. An image transform to characterize and compensate for spatial variations in thin cloud contamination of Landsat images. *Remote Sensing of Environment* 82(2): 173–187.

Zhang, Y. 2002a. Problems in the fusion of commercial high-resolution satellite as well as Landsat 7 images and initial solutions, in C. Armenakis and Y.C. Lee (eds) *The International Society for Photogrammetry and Remote Sensing. Commission IV Symposium 'Geospatial Theory, Processing and Applications', 9–12 July 2002, Ottawa, Canada.* Vol. 34, Part 4.

Zhang, Y., 2002b. A new automatic approach for effectively fusing Landsat 7 as well as IKONOS images, *IEEE International Geoscience and Remote Sensing Symposium*, Vol. 4, Toronto, Ontario, Canada, 2002: 2429–2431.

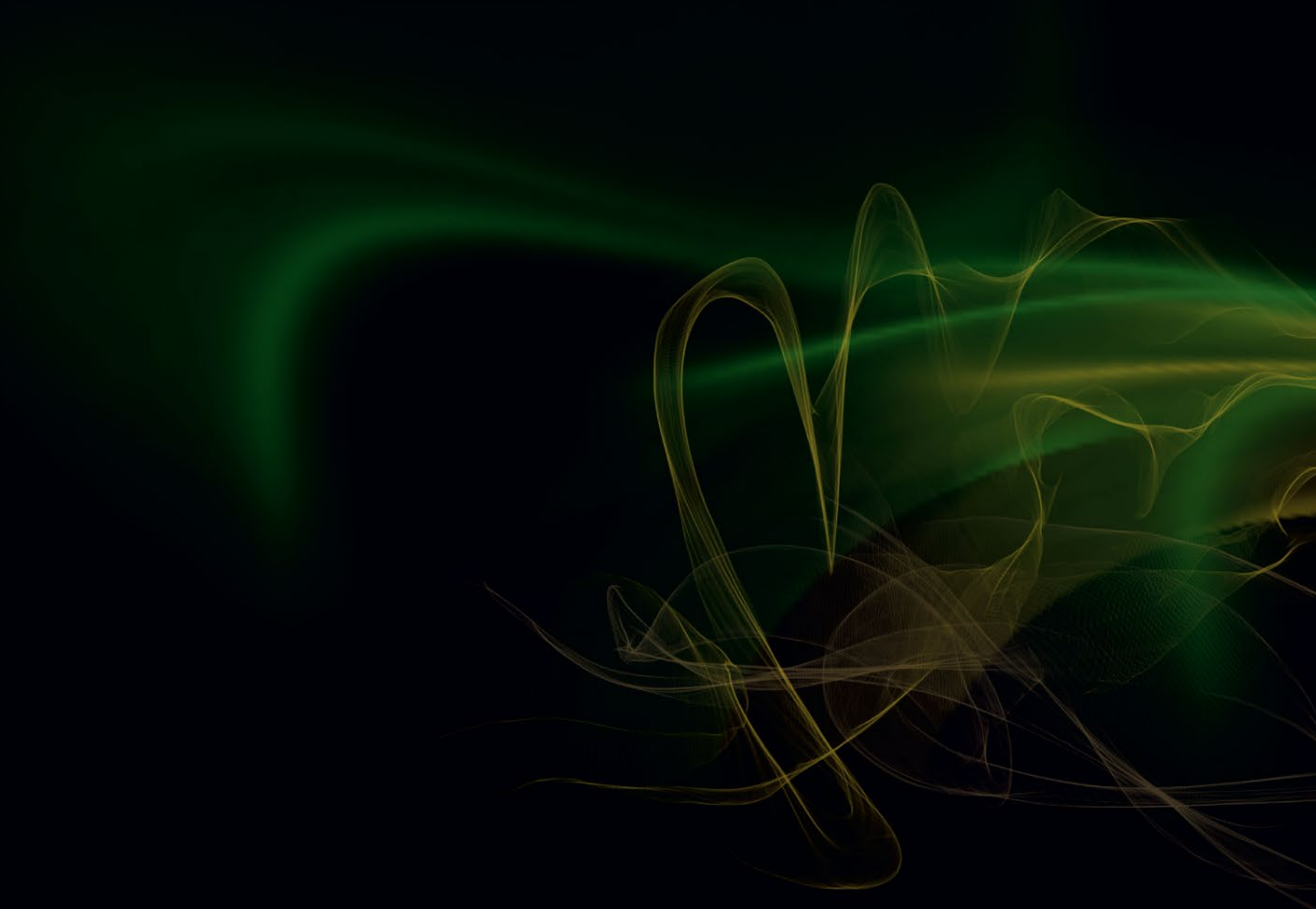
Zhu, Z., M.A. Wulder, D.P. Roy, C.E. Woodcock, M.C. Hansen, V.C. Radelod, S.P. Healey, C. Schaaf, P. Hostert, P., Strobl, J.-F. Pekel, L. Lymburner, N. Pahlevan and T.A. Scambos. 2019. Benefits of the free and open Landsat data policy. *Remote Sensing of Environment* 224: 382–385.

Zidarov, P. 2005. Bone artefacts. *Acta Archaeologica* 76(1), *Acta Archaeologica Supplement* 6. *Lîga. Copper Age Strategies in Bulgaria*: 124–131, 185–187.

Živanović, Z. 2013. *Eneolitska gradina Bodnjik*. Koceljeva: Zavičajni muzej Koceljeva.

Zohary, D., M. Hopf and E. Weiss. 2012. *Domestication of plants in the Old World*. Fourth edition. Oxford: Oxford University Press.

Zori, C. 2019. Extracting Insights from Prehistoric Andean Metallurgy: Political Organization, Interregional Connections, and Ritual Meanings. *Journal of Archaeological Research 27*: 501–556. DOI: https://doi.org/10.1007/s10814-019-09128-7.



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.

Archaeopress Archaeology **www.archaeopress.com**