Close to the bone: current studies in bone technologies
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Editor:
Selena Vitezović

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INTRODUCTION

Studies of worked osseous materials were neglected for a long time, but in the past two decades they are on the rise. In recent years, numerous methodological and theoretical innovations were introduced and the quantity and quality of publications increased, including numerous individual articles, PhD thesis, monographs. Particularly important were several conferences and thematic sessions held in Europe, North America and Asia, devoted to the problems of worked bone. As a result, several edited volumes appeared, with high quality and diverse papers – for example, those edited by H. Luik et al. (2005), Ch. Gates-St-Pierre and R. Walker (2007), A. Legrand-Pineau & I. Sidéra et al. (2010), J. Baron and B. Kufel-Diakowska (2011), F. Lang (2013), A. Choyke and S. O’Connor (2013), Mărgărit et al 2014, to mention just a few.

Osseous materials began to be recognized as an important part of the archaeological finds first by the French school, and the most important theoretical and methodological work was done by French researchers. The most significant was the work by H. Camps-Fabrer, who initiated a large research program on bone industry, La Commission de Nomenclature sur l’Industrie de l’Os Préhistorique, later continued by other researchers. Work organized by M. Patou-Mathis on the industrie osseuse peu élaboré should also be mentioned. However, the most important role in spreading and promoting the research on bone artefacts and its importance in the past few decades has been that of the Worked bone research group (WBRG), formed almost 30 years ago, and one of the official working groups of the International Council for Archaeozoology (ICAZ) since 2000. The main role of the WBRG is to improve communication between individuals studying worked animal hard tissues (especially bone, antler, and ivory) with a special emphasis on archaeological finds. A broad diachronic and multidisciplinary approach is emphasized in order to promote the exchange of ideas concerning attitudes towards and procurement of raw materials, technology, and cognitive aspects of bone working.

Since the first meeting, held in London in 1997, eight other meetings took place and in 2014 Belgrade was the host of the jubilee 10th Meeting of the WBRG (for more information, see www.wbrg.net).

Over sixty oral and poster presentations were held during the five conference days, contributed by 100 authors. Thirty-nine papers were selected for this volume, and I. Riddler, the organiser of the very first meeting in London, also contributed a paper with N. Trzaska-Nartowski.

Selected papers encompass the wide chronological and geographical range – from the Mesolithic period to the 18th century AD, from South America to the Eurasia and South Africa. Selected case studies do not simply present interesting archaeological material, but they also cover a wide range of topics – methodological issues, in particular traceoical investigations, reconstructions of technological procedures, problems related to the interpretation of functions, problems of the identification of workshops, and also symbolic use of osseous raw materials in both prehistoric and historic times. Papers are organised by alphabetical order, since the topics overlap and it was not possible to create distinctive thematic groups.

Such a variety in topics, as well as an increasing number of researchers focusing on studies of osseous raw materials, clearly shows that these studies have an important potential to contribute to the more general archaeological studies. Osseous artefacts are no longer disregarded, but are slowly gaining more and more space and are slowly taking place alongside with lithic industries and other classes of raw materials. However, there is still much work to be done, and bone tool studies still have to show all the potential they have.

Last but not least, I would like to thank all the people who helped during the conference and afterwards, during the preparation of the book. Special thanks to all the colleagues from the Institute of Archaeology and to all the colleagues and staff from the National museum in Belgrade, which generously offered the room for the conference and also helped with the lovely post-conference excursion to the Lepenski Vir. I would also like to thank for the hospitality to Dragan Janković, curator of the City museum, who welcomed us at the site of Vinča-Belo Brdo, and to dr Mira Ružić, who welcomed us at the Archaeological collection of the Faculty of Philosophy.

Finally, special thanks to the reviewers, who helped to enhance the scientific value of this volume.

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Close to the bone...


Selena Vitezović
BONE AND ANTLER ARTEFACTS FROM AN 8–5TH CENTURY BC SETTLEMENT AT GRZYBIANY, SOUTH-WESTERN POLAND

Justyna Baron
Marcin Diakowski
Tomasz Stolarczyk

Abstract: The paper presents the general results of studies on 75 bone, antler and horn artefacts produced by the excavations of a late Bronze Age and early Iron Age lake settlement at Grzybiany, in present-day south-west Poland. The site is unique due to its wet environment that resulted in the preservation of organic materials ranging from massive breakwater constructions and wooden trackways to small objects made of antler, bone, horn and wood. Our aim is to present the collection of worked bone and antler objects, which is one of the largest Bronze and Iron Age assemblages in Poland.

INTRODUCTION

In the vicinity of the present-day town of Legnica is the only area in Lower Silesia (an historical land covering more or less SW Poland) where natural lakelands survived. This is called Legnica Lakelands or Kunice Lakelands with origins in a melted glacier. The lakes are usually irregular and relatively shallow, with a maximal depth reaching 10 m. Due to intense drainage works starting from 18th cent. AD, Koskowice Lake is one of few surviving lakes of this type.

Prehistoric sites located both on the lake promontory and in its vicinity (Fig. 1), were known as early as from the 1930s, but regular excavations of a settlement site located on the promontory started in 1959 and continued to 1962 (Siedlak 1964; Marek and Siedlak 1972). The most intense survey including interdisciplinary research and underwater prospection was undertaken between 1970–1980, but the results, although widely known and considered an archaeological 'sensation' in some brief general papers (e.g. Bukowski 1982, 1985), have never been fully published. Recently, three small trenches were opened in 2010 and 2011 to verify former data on the site’s stratigraphy (Baron and Stolarczyk 2012). In the last two years, a project has been run to prepare both documentation and collections for a complete final publication (Stolarczyk and Baron 2014).

The site is unique for two reasons: one is that the wet environment resulted in the preservation of organic materials including massive constructions such as trackways and breakwater constructions. The second is a long-lasting settlement producing thick occupational layers, reaching 1 metre in some parts. This enabled observation on changing trends in farming structure and production strategies. Artefact studies, stratigraphy analysis and 14C dating – however
the last must be considered as only supporting artefact chronology as they belong to the ‘Hallstatt’ plateau of the calibration curve (Becker and Kromer 1993) – proved the existence of three settlement stages covering a period from 9/8th cent. to the end of 5th cent. BC. Placing this in the relative chronology of this part of Poland, the site was inhabited from the late Bronze to the early Iron Age (Baron 2014). It is worth noting that the oldest settlement stage (layer III) is clearly separated with sterile soil from two subsequent stages (layers II and I, Fig. 2) confirming the temporary flooding of the site area.

The total number of artefacts is unknown as some part of the documentation has been lost (mostly from the earlier excavations), but one can estimate over 130,000 pottery shards (Żur 2014), and many artefacts made of metal, stone, wood, bone, antler and glass. The picture is completed with over 11,000 animal bones, plant remains, daub lumps with construction imprints, charcoals etc. Despite the many large sites excavated recently in the course of rescue work, Grzybiany settlement remains unique even if, according to our estimations, only 14% of the site area was recorded.

The paper presents the general results of studies on 75 bone, antler and horn artefacts produced by the excavations (Fig. 3) and analysed together (without dividing them into settlement stages). Although the state of preservation varied for particular objects, for most of them it was possible to carry out material, technological and typological analysis. A full study of the collection, including archaeozoological, functional analysis and detailed production techniques is included in the site monograph (Diakowski 2014; Diakowski and Zych 2014).

Most of the finds have analogies from large well-excavated and frequently fortified settlements located mostly on lake promontories in present-day north-central Poland. Excavations of early Iron Age sites such as Biskupin (Łukasiewicz and Rajewski 1938; Drzewicz 2004), Smuszewo (Durbaczewski 1985), Sobiejuchy (Harding et al. 2004) and Jankowo (Ostoja-Zagórski 1978) produced hundreds of objects made of organic materials, including bone and antler. Although obtained at remote locations, they are a good point of reference in our studies since such sites in south-western Poland are rare.

METHODS

In the first stage of research to identify various types of traces (natural vs. anthropogenic ones), macroscopic observation was undertaken. Then, microscopic observation was involved with the use of a stereoscopic microscope, an Olympus SZX9 (up to 57×) and a metallographic microscope, a Nikon ECLIPSE LV100 (50–500×).
On many bone fragments natural traces were identified which, in some cases, might imitate working traces. Particular attention was paid to the degree of fragmentation and breakage patterns in bone material. Some researchers consider them as the remains of deliberate activities (e.g. Romanow 2011, pp. 154-155). Most of them, however, are of natural origin (Binford 1981; Lyman 1994; Marciniak 1996 with further references therein). Such transformations include a variety of exfoliation and cracking resulting from weathering (Behrensmeyer 1978), breakage resulting from depositional and post depositional factors and trampling (Behrensmeyer et al. 1986). Moreover, canine bite marks (e.g. dog, wolf and fox) and imprints of plant roots were observed.

CLASSIFICATION AND ARTEFACT ANALYSIS

The collection was divided into three main groups: half-products, waste, and finished objects of various types (Table 1) and using a variety of processing techniques (Table 2). They come mostly from layer II which is rich in artefacts and reflects site occupation in the 7th cent.-mid. 6th cent. BC (Fig. 2). In most publications, bone artefacts are divided into general categories (e.g. tools, weapons, elements of horse-harness and ornaments) and then into types (e.g. Drzewicz 2004). That however suggests a priori possible functions of the analysed objects and in this paper the labels are mostly used just to order the artefacts and do not have to reflect their original functions.

<table>
<thead>
<tr>
<th>type</th>
<th>layer III 8th c. BC</th>
<th>layer II 7-mid. 6th c. BC</th>
<th>layer I mid. 6-5th c. BC</th>
<th>undefined 8-5th c. BC</th>
<th>total</th>
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<td>7</td>
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<td>2</td>
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<td>pins</td>
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<td>handles</td>
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<td>tine tool</td>
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<td>total</td>
<td>13</td>
<td>44</td>
<td>6</td>
<td>12</td>
<td>75</td>
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</table>

Table 1. Bone and antler artefacts from the settlement at Grzybiany

Half-products

Table 2 contains 22 objects displaying various technological traces of manufacturing process. Bone objects were made of the long bones of large and medium-sized mammals (Plate 1). In one case, the bone was identified as belonging to a sheep or a goat. All the half-products were initially cleft with a stone pebble.

The shape of three artefacts suggests they might be the half-products of perforators (Plate 1:1-3), while another object seems to be a fragment of an unfinished bone point with traces of whittling made by a metal knife on its tip (Plate 1:4).

Most half-products were made from antler and represent three stages of processing:

1. Initial division of the raw material (Plate 2; Plate 3:2)
2. Advanced working process represented by blanks (Plates 3:1, 3:3, 3:4; Plate 4:1)
3. Items whose shapes allowed them to be identified as belonging to defined tool groups (Plates 4:2-5).

An initial division stage was identified on ten artefacts, of which one was made from the basal section of an antler, five were divided from the section between the base and the antler crown and contained tines. Chopping, breaking and splitting and - on one artefact - sawing traces were observed. Four tines were detached by chopping around the compact tissue while on one polishing was only noticed at the tip. Unfortunately, it remains unclear how the last one was cut off since only natural breakage was observed in the distal part.
More advanced treatment occurs on four blanks of cortical bone obtained from an antler beam (Plates 3:1, 3:3, 3:4; Plate 4:1). Their length is 10.4-11.3 cm is while their width is much less at 1.1-3.2 cm and the cross-sections are rectangular. They display traces of chopping, whittling and splitting with a wedge.

The third stage of the working process is represented by four artefacts of which three are half-products of leaf-shaped arrowheads (Plates 4:2-4). Their surfaces display traces of chopping, whittling and splitting with a wedge. The latter ones are displayed on core surfaces perpendicular to the long axis (Plate 5:1). In the case of two artefacts, sawing was observed as well as breakage on the surface (Plates 5:2, 5:3). Detailed analysis proved both were pieces of one horn (Plate 5:4). The high number of horn cores worked in this specific way reflects great interest in obtaining horn. However, it is not clear what this raw material was used for, because, due to the environmental conditions, the finished products did not survive. They might have been used as drinking horns, which are part of the Urnfield tradition, in particular in the early Iron Age period. In the Hallstatt culture, drinking horns were prestigious grave goods (e.g. Hochdorf burial – Biel 1978) and ceremonial accessories used in feasting, as is depicted on bronze situlae (e.g. from Vače – Kastelic 1956).

Moreover, two pieces of red deer antler were identified in the waste. One is a piece of a beam displaying chopping marks, the other one is part of a tine base with chopping marks caused by the detaching of the tine.

**Skates**

Excavations at Grzybiany produced five skates from various layers (Plate 6). They were made of radial bones belonging to red deer (Plate 6:1) domestic cattle (Plates 6:2, 6:5) and horse (Plates 6:3, 6:4). Such artefacts have

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**Table 2. Processing techniques on bone and antler artefacts from the settlement at Grzybiany**

<table>
<thead>
<tr>
<th></th>
<th>half-products</th>
<th>waste</th>
<th>skates</th>
<th>perforators</th>
<th>points</th>
<th>arrowheads</th>
<th>pins</th>
<th>rib tools</th>
<th>axes</th>
<th>hammers</th>
<th>picks</th>
<th>handles</th>
<th>lid</th>
<th>biscuit button</th>
<th>fitting</th>
<th>tine tool</th>
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On 18 objects from the middle settlement stage (layer II), working traces were so heavy that it excluded them from further use (Diakowski 2014: Tables 5-8). Most of them (16 items) are horn cores displaying sawing traces at their bases. These sawing marks are analogous to those caused by horn removal (Binford 1981). The horn cores belonged to domestic cattle (10) and goat (4). On some artefacts, traces of cleaving and sawing were observed. The latter ones are displayed on core surfaces perpendicular to the long axis (Plate 5:1). In the case of two artefacts, sawing was observed as well as breakage on the surface (Plates 5:2, 5:3). Detailed analysis proved both were pieces of one horn (Plate 5:4). The high number of horn cores worked in this specific way reflects great interest in obtaining horn. However, it is not clear what this raw material was used for, because, due to the environmental conditions, the finished products did not survive. They might have been used as drinking horns, which are part of the Urnfield tradition, in particular in the early Iron Age period. In the Hallstatt culture, drinking horns were prestigious grave goods (e.g. Hochdorf burial – Biel 1978) and ceremonial accessories used in feasting, as is depicted on bronze situlae (e.g. from Vače – Kastelic 1956).
been widely used across Europe from the Bronze Age to modern times (e.g. Küchelman and Zidarov 2005). Similar objects come from settlements dated to the late Bronze/early Iron Age from present-day Poland, e.g. from Biskupin (Drzewicz 2004: 19-20), Smuszewo (Durczewski 1985: 93-95), Jankowo (Ostoja-Zagórska 1978: fig. 10e, 12a). The high standardization of their manufacturing is a common feature of these objects. The posterior sides of the diaphysis displayed traces of detachment from the ulna while the anterior ones were partly ground to obtain a flattened facet. In the case of two skates, chopping marks resulting from the shaping of the distal epiphyses were observed as well (Plates 6:2, 6:4).

**Perforators**

Seven artefacts with pointed tips were assigned to this category, which are sometimes known as awls (Drzewicz 2004: 24). They were made of sheep or goat, pig, domestic cattle or horse bones. In addition, their shapes varied heavily depending on bone selection (Plates 7, 8:1, 8:2). In one perforator, a half of a distal part was originally a handle (Plate 7:1). A characteristic of two further items made from metapodial bones is the completely preserved distal part which was a handle as well (Plates 7:2, 7:3). The shape variability compared to other artefacts results from the application of different techniques of manufacturing. Two perforators were made from horse splint bones and two others from fragments of long bone diaphysis.

In the case of this category, the selection of raw material is interesting as bones of domestic cattle and red deer were used to produce the perforators, while examples from other sites were made mostly from goat or sheep bones (Drzewicz 2004). Such objects are common on settlements of the Urnfield culture and were recovered at Jankowo (Ostoja-Zagórska 1978: fig. 12:b-f), Smuszewo (Durczewski 1985: tablica 48-51:1-16), Sobiejuchy (Harding et al. 2004, 259, plate 30: 24-30; plate 31: 48-61), Wojkowice (Durczewski 1985: 81), double-ended awls (Łukasiewicz and Rajewski 1938: 47), hooks (Malinowski 1958: 32) or arrowheads (Fogel 1979: 120-121; Drzewicz 2004: 31-32). One item is a socketed point made from the metapodial bone of a sheep-sized animal. The socket was drilled into the bone at the proximal end, reaching the marrow cavity.

**Arrowheads**

This category includes two leaf-shaped tanged arrowheads made from red deer antler (Plates 10:1-2). The first arrowhead is elongated with a lozenge-shaped body and a tang on which whittled facets are present (Plate 10:1). The barsbs were shaped from the tang by sawing. The body has a flat oval cross-section, while the tang's cross-section is oval.

The surface of the other arrowhead bears linear traces made by whittling with a metal knife. Its tip is broken as a result of impact. This artefact has no use-traces. Similar objects come mostly from fortified settlements from central-north Poland such as Biskupin (Drzewicz 2004, 113, tabl. 15), Smuszewo (Durczewski 1985, tabl. 55: 1-29) and Sobiejuchy (Harding et al. 2004, 259, plate 31:1-11).

**Object made from antler tine**

On this artefact made from red deer antler, traces of circumferential chopping with a metal axe at its base are evident (Plate 10:3). Spiral striations of various widths and depths surround the tip. A single object of this type comes from a fortified settlement at Smuszewo in Poland (Durczewski 1985: tabl. 59.3) while several others are known from Asva in Estonia (Luik 2010).

**Tine handle**

This object was made of red deer antler tine. In its base, a rectangular socket (i.e. a fixing hole) parallel to the object's long axis was drilled (Plate 10:4).

**Fitting**

Excavations at Grzybiany also produced a decorated red deer antler fragment – probably a fitting (Plate 10:5). It has the shape of a plaque and is 4 mm thick. On its upper surface, circle and dot decoration is evident. Such decoration required the use of metal tools and rarely occurs, however, some examples dated to the Bronze Age are known (e.g. Choyke 2005: plate V.8b).

**Button**
This elongated object was made from red deer antler tine, with a perforation in its central part (Plate 10:6). Similar button comes from the fortified settlement at Jankowo (Ostoja-Zagórski 1978, Fig. 10:g). This type of button commonly occurs on medieval sites, but they were made of pig metapodial bones instead of antler (Jaworski 1990).

Rib tools
Two artefacts made of the middle sections of domestic cattle ribs belong to this category (Plates 10:7-8). They are simple tools made mostly by chopping. In both cases, the outer surfaces displayed a concentration of overlapping linear traces, perpendicular or slightly oblique to the axis of the bones. They vary in shape and depth.

One rib tool has a shaped rounded end with a worn surface at its edge (Plate 10:8). Both side edges are heavily rounded and polished as well. Many similar objects come from Biskupin (Drzewicz 2004). In the case of these artefacts, it is not possible to identify traces of use from production. However, experimental work proves such clear linear striations derive from working raw wool. Similar objects were recovered at the Urnfield site of Wojkowice in south-western Poland (Gralak 2010: ryc. 103:2, 4; ryc. 104).

Axe
This category consists of only one object made from the basal part of a red deer antler (Plate 11). The working edge was oblique and the object surface displayed traces from the removal of pearling and an eye tine. Above the removed tine, a bilateral rectangular hafting hole was drilled.

Hammers
There are two examples of hammers – a complete and a fragmented one. A completely preserved object was manufactured from the base to eye tine segment of a red deer antler (Plate 12:1). Above the eye tine, a bilateral rectangular hole was drilled. In its distal part, on the spongy bone level, a hole parallel to the tool’s long axis was drilled.

The other hammer is fragmented and survives as a piece with a rectangular hole and four other small perforations (Plate 12:2).

Such objects are typical for the late Bronze and early Iron Age with many examples coming from Biskupin (Drzewicz 2004: tabl. 8: 6-11) and Smuszewo (Harding et al. 2004: tabl. 32:28).

Picks
Two artefacts were identified as picks, both made from red deer antler (Plates 12:4, 12:5). In one object, an eye tine is its working part and a beam piece acts as the haft (Plate 12:5). The other pick is made from tine. The spongy bone in the basal part was perforated parallel to the long axis. Unfortunately, due to the poor preservation (heavy exfoliation of the proximal part) and the lack of clear technological traces, we cannot say if the perforation is natural or deliberately made.

On both picks the tine tips show abrasion on both sides. Additionally, both objects display large chips making the edges concave. Similar implements from Biskupin are called picking tools or hoe-like tools (Drzewicz 2004: 16-19). Apart from Biskupin, picks come from Sobiejuchy (Harding et al. 2004: plate 32: 18, 22), Smuszewo (Durczewski 1985: tabl. 60: 1-4, 6) and Jankowo (Ostoja-Zagórski 1978: ryc. 12: n, 15: g, h).

Lid
This carefully executed object was made from the burl of a red deer antler and displays traces of sawing and intense scraping (Plate 12:3). At the edge of the upper (convex) facet, two pairs of holes were drilled. A flange of the lid was perforated as well – a single hole was located between the two pairs described above. A similar object comes from the site of Sobiejuchy (Harding et al. 2004: 64, 257, plate 29:18).

CONCLUSION

Faunal remains are usually the second most numerous artefact group (after pottery shards) obtained in course of archaeological excavations at settlements dated from the Neolithic onwards and the site of Grzybiany is not an exception with c. 11,000 animal bones, antler and horn pieces. This suggests that the animal raw material, even including the collection of antler sheds, was extremely easy to acquire and use. The relatively abundant artefact collection provides information on both raw material selection and the production of bone artefacts and antler processing on the site. The analysis proves that the objects under discussion played a constant and important role in the life of the people living in the settlement in Grzybiany for nearly four centuries. This is reflected in both the objects’ forms and possible functions covering most every-day activities including such essential ones as farming and the processing of various materials used for making shelters and clothes (perforators, points, axes, hammers and picks). Some objects prove the usage of faunal material in widely understood areas such as mobility (skates), hunting and warfare (arrowheads), clothing decoration (pins) or storage (a lid). Moreover, their manufacturing, most likely carried out on the site, as evidenced by waste and half-products, involved various techniques and tools – made both from stone and metal which also proves the high skill level of their makers.
Close to the bone...

Plate 1. Bone half-products. After Diakowski 2014, with modifications.
Plate 2. Antler half-products representing the initial division of the raw material. After Diakowski 2014, with modifications.
Close to the bone...

Plate 5. Production waste. After Diakowski 2014, with modifications.
Plate 8. Bone perforators (1-2) and pins (3-5). After Diakowski 2014, with modifications.
Plate 10. Bone and antler artefacts. 1, 2 – arrowheads; 3 – tine tool with spiral striations; 4 – tine handle; 5 – fitting; 6 – button; 7, 8 – rib tools.
After Diakowski 2014, with modifications.
REFERENCES


LIST OF CONTRIBUTORS

Ariel Shatil, The Hebrew University in Jerusalem, Israel
Björn Briewig, German institute of Archaeology, Berlin, Germany
Christian Casseyas, Laboratoire d’archéologie expérimentale, Préhistomuseum, Flemalle, Belgium
Christopher Arabatzis, Institute of Archaeological Sciences, University of Bern, Switzerland
Corneliu Beldiman, University of Pitești, Faculty of Socio-Humanistic Sciences, Department of History, Pitești, Romania.
Dan Lucian Buzea, National Museum of the Eastern Carpathians, Sf. Gheorghe, Covasna County, Romania
Diana-Maria Sztancs, Central High School, Bucharest, Romania
Diego Rivero, CONICET – Área de Arqueología y Etnohistoria del Centro de Estudios Históricos “Prof. Carlos S. A. Segreti”, Córdoba, Argentina
Elisabetta Grassi, Dipartimento di Scienze della Natura e del Territorio, Università degli Studi di Sassari, Italia
Erik Hrnčiarik, Trnavská univerzita v Trnave, Filozofická fakulta, Katedra klasické archeologie, Trnava, Slovakia
Erika Gál, Institute of Archaeology, Research Centre for the Humanities, Hungarian Academy of Sciences, Budapest, Hungary
Éva David, CNRS Laboratoire Préhistoire et technologie, Maison Archéologie et Ethnologie, Université Paris Ouest Nanterre La Défense, France
Felix Lang, University of Salzburg, Department of Classical Studies / Archaeology, Salzburg, Austria
George Nuțu, Eco-Museum Research Institute, Târgu Mureș, Romania
Giedrė Piličiauskienė, Lithuanian Institute of History, Kražių 5, Vilnius, Lithuania
Gilberto Pérez-Roldan, Escuela de Ciencias Sociales y Humanidades, Universidad Autónoma de San Luis Potosí, Mexico
Grjegor Osipowicz, Institute of Archaeology, Nicolaus Copernicus University, Toruń, Poland
Heidi Luik, Institute of History, Tallinn University, Tallinn, Estonia
Hrvoje Kalafatić, Institute of Archaeology, Zagreb, Croatia
Ian Riddler, independent researcher, Stratton, Cornwall, UK
Isabelle Sidéra, CNRS, laboratoire Préhistoire et technologie, Maison Archéologie et Ethnologie, Université Paris Ouest Nanterre La défense, France
Ivan Bogdanović, Institute of Archaeology, Belgrade, Serbia
Ivan Bugarski, Institute of Archaeology, Belgrade, Serbia
Jean-Marc Léotard, Service Public de Wallonie, DG04 Direction de Liège 1, Service de l’Archéologie, Belgium
Justin Bradfield, Department of Anthropology and Development Studies, University of Johannesburg, Auckland Park Campus, Johannesburg, South Africa
Justyna Baron, Institute of Archaeology, Wrocław University, Wrocław, Poland
Justyna Orlowska, Institute of Archaeology, Nicolaus Copernicus University, Toruń, Poland
Kinga Winnicka, Institute of Archaeology, Wrocław University, Wrocław, Poland
Louisa Gidney, Archaeological Services, University of Durham, UK
Marcin Diakowski, Institute of Archaeology, Wrocław University, Wrocław, Poland
Marija Mihaljević, Municipal Museum Nova Gradiška, Croatia
Marina Kovač, Museum of Slavonia, Osijek, Croatia
Mario Novak, Institute for Anthropological Research, Zagreb, Croatia
Marius Gheorghe Barbu, Museum of Dacian and Roman Civilisation, Deva, Romania
Matías E. Medina, CONICET-Área de Arqueología y Etnohistoria del Centro de Estudios Históricos “Prof. Carlos S. A. Segreti”, Córdoba, Argentina
Mihaela Maria Barbu, Museum of Dacian and Roman Civilisation, Deva, Romania
Mira Ružić, Department of Archaeology, Faculty of Philosophy, University of Belgrade, Serbia
Miriam Selene Campos Martínez, Escuela de Ciencias Sociales y Humanidades, Universidad Autónoma de San Luis Potosí, Mexico
Mislaw Čavka, University Hospital Dubrava, Zagreb, Croatia
Monica Márgărit, Valahia University of Târgoviste, Romania
Natacha Buc, CONICET-Instituto Nacional de Antropología y Pensamiento Latinoamericano, Buenos Aires, Argentina
Nemanja Marković, Institute of Archaeology, Belgrade, Serbia
Nicola Trzaska-Nartowski, independent researcher, Stratton, Cornwall, UK
Paul Stokes, St. Cuthbert’s Society University of Durham, Durham, UK
Pierre de Maret, Université Libre de Bruxelles, Belgium
Pierre van der Sloot, Service Public de Wallonie, DG04 Direction de Liège 1, Service de l’Archéologie, Belgium
Christian Casseyas, Laboratoire d’archéologie expérimentale, Préhistomuseum, Flemalle, Belgium
Close to the bone...

Rajna Šošić Klindžić, University of Zagreb, Faculty of Humanities and Social Sciences, Zagreb, Croatia
Saša Redžić, Institute of Archaeology, Belgrade, Serbia
Selena Vitezović, Institute of Archaeology, Belgrade, Serbia
Simina Margareta Stanc, Faculty of Biology, Alexandru Ioan Cuza University, Iaşi, Romania
Siniša Radović, Croatian Academy of Sciences and Arts, Institute for Quaternary Paleontology and Geology, Zagreb, Croatia
Sofija Petković, Institute of Archaeology, Belgrade, Serbia
Sonja Stamenković, Institute of Archaeology, Belgrade, Serbia
Sonja Vuković-Bogdanović, Laboratory of Bioarchaeology, Faculty of Philosophy, Belgrade, University of Belgrade, Serbia

Steven P. Ashby, Department of Archaeology, University of York, York, UK
Tajana Sekelj Ivančan, Institute of Archaeology, Zagreb, Croatia
Tatjana Tkalčec, Institute of Archaeology, Zagreb, Croatia
Tomasz Stolarczyk, Copper Museum in Legnica, Poland
Toni Čerškov, Institute for the cultural heritage preservation, Niš, Serbia
Vesna Bikić, Institute of Archaeology, Belgrade, Serbia
Vesna Manojlović Nikolić, Faculty of Philosophy, Department of History, University of Novi Sad, Serbia
Vinayak, Centre for Historical Studies, School of Social Sciences, Jawaharlal Nehru University, Delhi, India
Zlatko Kovancaliev, NI Stobi, Archaeological site Stobi, Gradsko, FYR Macedonia