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A CLASSIFICATION OF OBJECTS MADE OF BONE, ANTLER, TOOTH AND HORN FROM THE EARLY BRONZE AGE FORTIFIED SETTLEMENT IN MASZKOWICE

ABSTRACT

Przybyła M.S. and Jędrysik J. 2018. A classification of objects made of bone, antler, tooth and horn from the Early Bronze Age fortified settlement in Maszkowice. *Sprawozdania Archeologiczne* 70, 269-296.

Excavations at the Early Bronze Age fortified settlement in Maszkowice (Western Carpathians) carried out in 1959-1975 and 2010-2017 produced, among other finds, a collection of 56 artifacts made of bone, antler, teeth and horn. They were classified using formal criteria (size, shape, decoration), as well as character of use-wear traces into four types of ornaments (plaque, pendants, pins, dress items made of long bones) and seven types of tools (awls, perforators, spatulas, tanning tool, polishers, antler picks and hafted chopping tools). In the description of each type, we focus on its functional interpretation, discussing some opinions already existing in the literature. In the final section of the paper, we also analyze the frequency of each type in different contexts, as well as on the site in general.

Keywords: Early Bronze Age, Maszkowice, bone and antler industry, traseology, functional analysis
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1. INTRODUCTION

Objects made of raw materials of animal origin such as bone, tooth, horn, and antler constituted an important part of material culture in prehistory. However, due to their limited preservation, this group of artefacts is much less represented in archaeological records

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than objects made of stone or ceramics. The aim of this study is to present a rich collection of objects made of bone, tooth, horn, and antler discovered in the prehistoric fortified settlement on Zyndram's Hill in Maszkowice, in the valley of the upper Dunajec River. A significant part of the paper is devoted to the discussion of different criteria of classification of the artefacts in question. The classification system proposed here combines formal criteria with metric attributes, raw material characteristics, and, above all, the presence and type of use-wear traces. The resulting information is then analysed with regard to the archaeological context in which particular types of bone, tooth, and antler objects were discovered. It is also important to note that the study is focused on the classification and functional analysis of finished objects; issues pertaining to the processes of their manufacture remain beyond the scope of our interest.

2. MATERIAL AND METHODS

The archaeological site on Zyndram's Hill in Maszkowice has a long record of human occupation, in which six main stages can be distinguished. The oldest one is represented by single Neolithic artefacts discovered in secondary contexts. During the next stage, a highly fortified settlement functioned on Zyndram's Hill, whose duration can be estimated, mainly based on radiocarbon dates, as being between 1750 and 1500 BC – in other words, at the turn of the Early and Middle Bronze Ages (Przybyła and Skoneczna 2011; Przybyła 2016). After a gap of over 500 years, the hill was settled again around 900 BC. A vast settlement established at that time encompassed the top of Zyndram's Hill as well as its gentler slopes, and lasted until about 400 BC (Przybyła and Skoneczna 2014; Przybyła and Jędrysik 2017). The fourth stage of occupation is marked by relatively sparse artefacts dating to the late La Tène Period (ca 200-50 BC), which appear to constitute the remains of a few households – or possibly a single household – scattered over the hilltop (Madyda-Legutko 1996, 22; Przybyła and Jędrysik 2017, 107-108). The last occupational episodes are represented by Late Roman Period pottery and Late Medieval and Post-Medieval materials, which reflect the site's use as a farming field after the village of Maszkowice was founded at the end of the 13th century AD.

The prehistoric site on Zyndram's Hill was the subject of research excavations in 1959-1975, which resulted in the discovery of relics connected mainly with the younger stages of the site's occupation (e.g. Cabalska 1977). A new field research project was begun in 2010, and among its major results are the discovery of well-preserved remains from the Early Bronze Age settlement, as well as relics of a complex system of stone fortifications dating to the same period.

The collection of bone, antler, and tooth artefacts presented in this paper originates solely from the second stage of the site development, i.e. from the Early Bronze Age settlement (Fig. 1). In that time, the 0.5 ha plateau on top of Zyndram's Hill was surrounded on

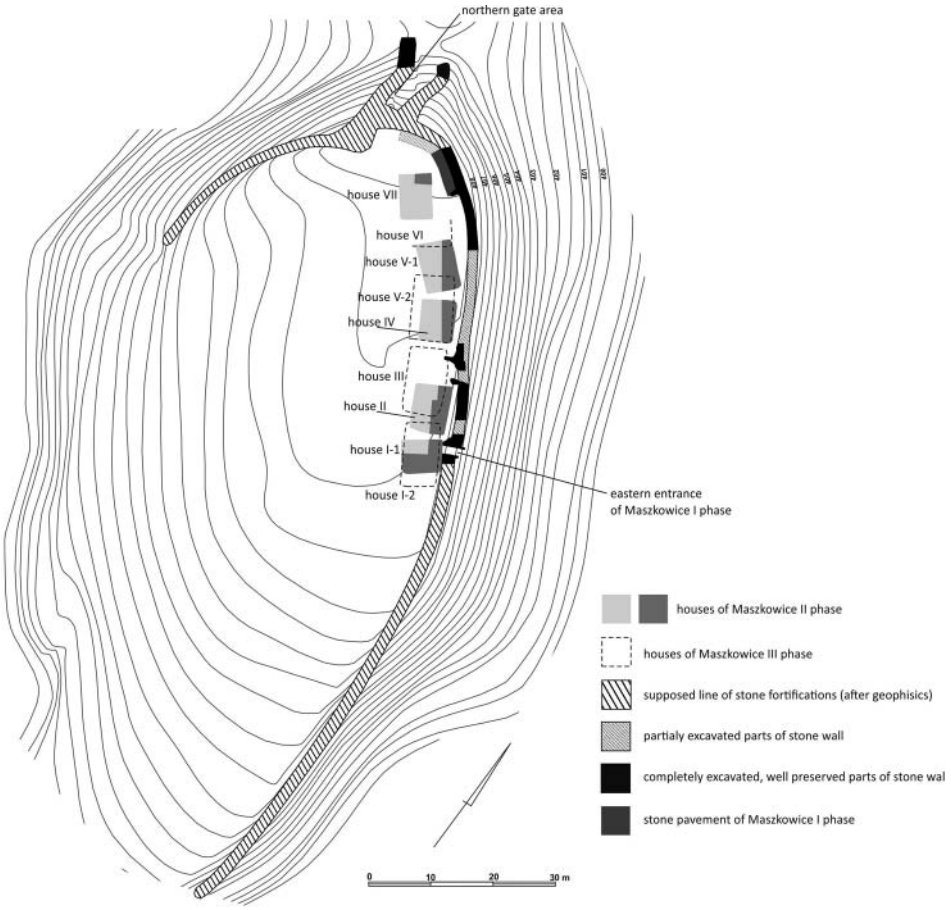

Fig. 1. The schematic plan of the Early Bronze Age fortified settlement at Maszkowice (state of excavation after the 2017 season)

the east and north by massive stone walls, which also partially retained a terrace on which houses were built. The wall, which has survived until today up to a height of 1.5 m, had at least two entrances: a small passage from the east and a sophisticated gateway from the north (Przybyła 2016). In the course of the research of 2010-2017, several houses were identified, forming a row along the eastern section of the fortifications. Five of them, houses I-1, II, IV, V-1, and VII, represent the older building phase of (Maszkowice II), radiocarbon dated to 1700-1650 BC, while slightly larger houses I-2, III, V-2, and VI belong to the last stage of the Early Bronze Age settlement (phase Maszkowice III), which dates to 1650-1500 BC (Przybyła and Skoneczna 2011; Przybyła 2016). All of the pottery recovered from the Early Bronze Age houses represents classic and post-classic phases of the Otomani-

Füzesabony culture. The southern connections, or possibly even southern origins, of the settlement's founders are additionally indicated by certain features of its stone architecture, as well as the characteristics of some artefacts other than ceramic vessels (Przybyła and Skoneczna 2011; 2014; Przybyła 2016a).

The position of every single artefact, including those discovered within the layers of the Early Bronze Age houses, was recorded during the exploration. This allows for a precise analysis of the spatial distribution of particular categories of objects. Nevertheless, this paper will be limited to presenting general tendencies in the occurrence of certain groups of bone, antler, and tooth artefacts within particular houses. It should also be noted that the houses' fills have been sieved only in part, and the methodology of the research has undoubtedly affected the detectability and numerical proportions of tiny (up to 2-3 cm long) objects considerably. With respect to larger artefacts, it can be assumed that their numbers in particular contexts reflect the original proportions quite faithfully, since the method by which such deposits have been explored has remained consistent and unchanged from the beginning of the current research project.

The artefacts presented here come from several different contexts, including from the houses uncovered between 2010-2017. Single specimens were found outside the buildings, especially within the fortifications and their remains, including the eastern wicket gate. Furthermore, a considerable collection of artefacts made of bone, antler, and tooth also comes from the previous excavations of 1959-1975. The methodology of this older research (with only very general descriptions of the artefacts' contexts) significantly hampers the interpretation of this group of finds. Among them, objects retrieved from the fill of a deep storage pit discovered in 1971 deserve particular attention (Cabalska 1974). The artefacts should no doubt be linked with the Early Bronze Age, and their original context – judging from the location of the pit – was most likely within the floor layer of house I-1 or II, which was partially damaged when the pit's walls collapsed (Przybyła and Skoneczna 2011, 11; Przybyła 2016, 300). The chronology of a group of artefacts recovered from trenches situated by the northern section of the fortifications (the research of 1960-1961 and 1967) cannot be established to the same degree of precision. These artefacts could originate from Early Bronze Age houses (Przybyła and Skoneczna 2011, 11-12), but may also have been found in Late Bronze/Early Iron Age pits dug into the layer of the earlier houses. Therefore, this group of sources will be regarded with certain reservations.

The analysis encompassed a total of 56 artefacts identified as finished ornaments, dress items, or tools, of which 35 originate from reliable contexts (their position was precisely recorded during the excavations of 2010-2017), while the rest were recovered during the previous excavations. Among the latter, 11 were discovered within the deep Early Bronze Age pit (feature 59) explored in 1971-1972, and the context and chronology of 10 are uncertain (Table 1).

The first step of our investigation was an archaeozoological analysis conducted on artefacts for the purpose of species (Fig. 2:a) and anatomical element identification (Fig. 2:b).

Table 1. Summary table of objects made of bone, antler, horn and tooth from the Early Bronze Age settlement at Maszkowice

No	ID nr	Season	Trench	Feature	Preserved length (mm)	Width, in the widest part (mm)	Width of the edge or diameter of the point (mm)	Type of use-wear traces (based on fig. 3)	Type of object	Anatomical part	Species	Figure nr
1	2	3	4	5	6	7	8	9	10	11	12	13
1	67/II/3/ 20-40 cm	1967	II/67, sq. 3	EBA house	48	22	?	/	1.1	canine tooth	*Sus* sp.	4:a
2	6/150/121	2012	6	house I-2	85	11	?	ABC	1.2	canine tooth	*Sus* sp.	4:c
3	15//10	2015	8	Maszkowice II - cultural layer	30	5	?	/	1.2	mandibular canine	*Sus* sp.	4:b
4	W2/65/120/81	2010	2	house I-2	97	13.5	?	ABC	1.3	long bone	Mammal of large dimensions	/
5	7/80/506	2014	7	house II	60	12.5	?	AC	1.3	long bone	Mammal of large dimensions	4:f
6	71/VI/1/230 cm	1971	line VI, sq. 1	pit (feat. 59)	87	15	?	B	1.4	metatarsus or metacarpus	*Ovies aries*/ *Capra hircus*	4:h
7	W2/65/I/225	2012	2	house I-2	91	7	?	AB	1.4	long bone	Mammal of large dimensions	4:d
8	8/110/105	2015	8	Maszkowice II - cultural layer	45	12	?	AB	1.4	long bone	Mammal of large dimensions	4:i
9	8/130/45	2015	8	Maszkowice II - cultural layer	59.5	10	2	AB	1.4	bone	Mammal of large dimensions	4:g

Table 1 cont.

1	2	3	4	5	6	7	8	9	10	11	12	13
10	8/110/5	2015	8	Maszkowice II - cultural layer	109.5	5.5	2	B	1.4	rib	Mammal of medium dimensions	4:e
11	11/80/194	2016	11	house V-1	72	7	2	AB	1.4	long bone	Mammal of medium dimensions	4:j
12	17//2	2017	11	house IV	20.5	7	1.5	AB	1.4 (?)	long bone (?)	Mammal of large dimensions	4:l
13	72/VI/1/ 180-200 cm	1972	line VI, sq. A	pit (feat. 59)	36	5	1.5	BC	2.1	long bone	Mammal of medium dimensions	6:b
14	6/140/ 220-6/150/92	2012	6	house I-1	101	7	2	AB	2.1	antler	*Cervus* sp.	6:a
15	10/110/82	2015	10	Maszkowice II - cultural layer	22	6	?	C	2.1	rib	Mammal of medium dimensions (?)	/
16	60/IA/ 140-160 cm	1960	sq. IA	EBA house	94	17	?	ABC	2.2	ulna	*Canis lupus* f. *familiaris*	/
17	67/I/2/3/ 100-120 cm	1967	line I, sq. 2/3	EBA house	67	26	4	ABC	2.2	antler	*Cervus* sp.	/
18	71/V/1/220 cm	1971	line VI, sq. 1	pit (feat. 59)	63	9	4	BC	2.2	long bone	Mammal of large or medium dimensions	6:c
19	7/150/148	2014	7	pit (feat. 59)	66	15	3	BC	2.2	metapodium	*Ovies aries*/ *Capra hircus*	6:d
20	11/90/5005	2017	11	house IV	67	10	3	BC	2.2	long bone	*Ovies aries*/ *Capra hircus*	/

21	14/50/112	2017	14	house VII	62.5	10	?	BC	2.2	long bone	*Ovies aries*/ *Capra hircus*	/
22	60/IB/ 120-140 cm	1960	sq. IB	EBA house	67.5	17	3	BD	3.1	long bone	Mammal of large dimensions	6:e
23	71/VI/1/220 cm	1971	line VI, sq. 1	pit (feat. 59)	73.5	15	1.5	BD	3.1	long bone	Mammal of large dimensions	/
24	W2/60/Q/40	2011	2	house I-2	59.5	10	3	D	3.1	long bone	*Ovies aries*/ *Capra hircus* (?)	6:f
25	7/130/108	2014	7	house I-2	63	9	3.5	BD	3.1	ulna	Mammal of large dimensions	/
26	7/160/49	2014	7	pit (feat. 59)	47	8	4	BD	3.1	long bone	Mammal of medium dimensions	/
27	7/180/48	2014	7	Maszkowice II - refuse layer inside the Eastern Gate	41	4.5	?	D	3.1	bone	Mammal of large dimensions	/
28	7/110/208	2014	7	house II	33	8.5	3.5	BCD	3.1	bone	Mammal of large dimensions	/
29	72/XI/1/ 230-250 cm	1972	line XI, sq. 1	pit (feat. 59)	101.5	20	3.5	D	3.2	long bone	Mammal of large dimensions	/
30	7/140/329	2014	7	pit (feat. 59)	91.5	23	5.5	BCD	3.2	tibia, right, distal part	*Sus scrofa* f. *domestica*	/
31	7/150/266	2014	7	house I-2	92	16.5	4	BD	3.2	long bone	Mammal of large dimensions	/

Table 1 cont.

1	2	3	4	5	6	7	8	9	10	11	12	13
32	7/110/480	2014	7	house II	96	29	2.5	D	3.2	long bone	Mammal of large dimensions	6:h
33	7/150/189	2014	7	house I-2	74	37	4.5	CD	3.2	fibula, right	*Ursus arctos*	6:g
34	14/30/244	2017	14	uncertain	74.5	30.5	5	BD	3.2	tibia	Mammal of large dimensions	/
35	67/I/2/4/ 100-120 cm	1967	line I, sq. 2/4	EBA house	79	16	6	BD	4.1	rib	Mammal of large dimensions	6:j
36	W2/60/I/19	2011	2	house I-2	52.5	11	7.5	BDF	4.1	rib	Mammal of large dimensions	/
37	6/120/4	2012	6	house I-2	89	11.5	11	DF	4.1	long bone	Mammal of medium dimensions	6:i
38	6/160/97	2012	6	house I-1	70	19	11.5	DEF	4.1	rib	Mammal of large dimensions	/
39	7/170/101	2014	7	house I-1	47	18	18	DF	4.2	long bone	Mammal of large dimensions	/
40	7/130/3	2014	7	Maszkowice II - clay embankment	59	19	16.5	BDF	4.2	horn	*Bos* sp.	7:a
41	72/XI/1/231	1972	XI/1	pit (feat. 59)	69	18	17	BDF	4.3	long bone	Mammal of large dimensions	7:b
42	71/VI/1/ 300-320 cm	1971	line VI, sq. 1	pit (feat. 59)	122	23	18.5, 16	BDEF	5	antler	*Cervus* sp.	7:g

43	61/III/E/ 50-70 cm	1961	sq. III, E side	EBA house	75	35	19.5	ABC	6	antler	*Cervus* sp.	7:d
44	71/VI/1/164	1971	VI/1	pit (feat. 59)	113	54.5	30	AB	6	antler	*Cervus* sp.	7:c
45	71/VI/1/140-160 cm	1971	line VI, sq. 1	pit (feat. 59)	80	21.5	7.5	G	7	antler	*Cervus* sp.	7:f
46	71/VI/1/210 cm	1971	line VI, sq. 1	pit (feat. 59)	182	23	7	BG	7	antler	*Cervus* sp.	7:e
47	71/VI/1/170 cm	1971	line VI, sq. 1	pit (feat. 59)	196	23	9	AG	7	antler	*Cervus* sp.	/
48	11/90/516	2016	11	house III	193.5	28	13.5	G	7	antler	*Cervus* sp.	/
49	67/V/2/3/ 130-140 cm	1967	line V, sq. 2/3	EBA house	160.5	73.5	?	A	8	antler	*Cervus* sp.	8:c
50	67/I/2/3/ 120-130 cm	1967	line I, sq. 2/3	EBA house	147.5	37.5	?	A	8	antler	*Cervus* sp.	8:g
51	67/I/2/2/ 80-100 cm	1967	line I, sq. 2, sq. 2	EBA house	191.5	103.5	?	AB	8	antler	*Cervus* sp.	8:a
52	W1/G/57	2011	1	house III	122.5	55	?	A	8	antler	*Cervus* sp.	8:b
53	14//88	2014	7	house II	117	59	?	AB	8	antler	*Cervus* sp.	8:d
54	11/60/498	2016	11	house V-2	82	32	?	AB	8	antler	*Cervus* sp.	8:e
55	14/50/142	2017	14	house VII	117.5	40.5	38.5	AB	8	antler	*Cervus* sp.	8:f
56	61/II/50-70 cm	1961	II	EBA house	141	59	40	ABG	8	antler	*Cervus* sp.	8:h

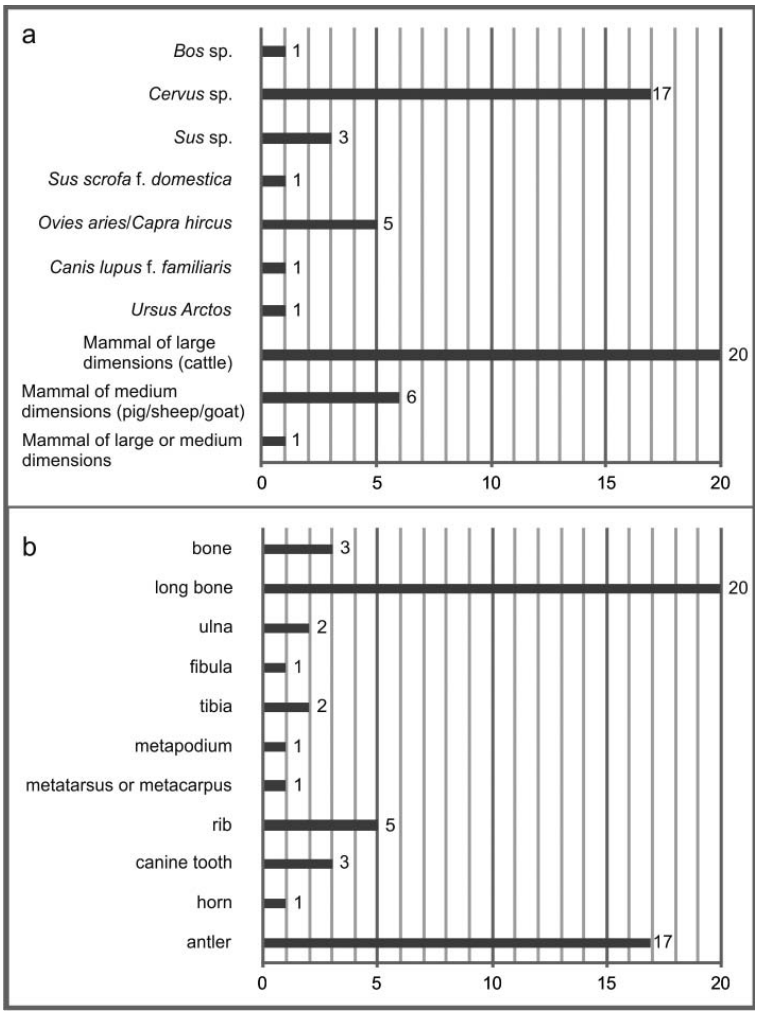

Fig. 2. Analysed artefacts from the Early Bronze Age settlement at Maszkowice: a – the distribution of species; b – anatomical parts

Next, all of those objects were subjected to the traseological analysis. As well as finished items, several dozen of the semi-finished products were investigated; however, the latter are not discussed in the current paper. Along with use-wear marks, various traces left by manufacturing processes were recorded, and the presence of the former was considered the basic criterion for distinguishing finished products from initially processed raw material.

Use-wear and manufacturing traces were analysed using a stereoscopic microscope with magnification up to 50x. All the observed alterations of object surfaces were photographed

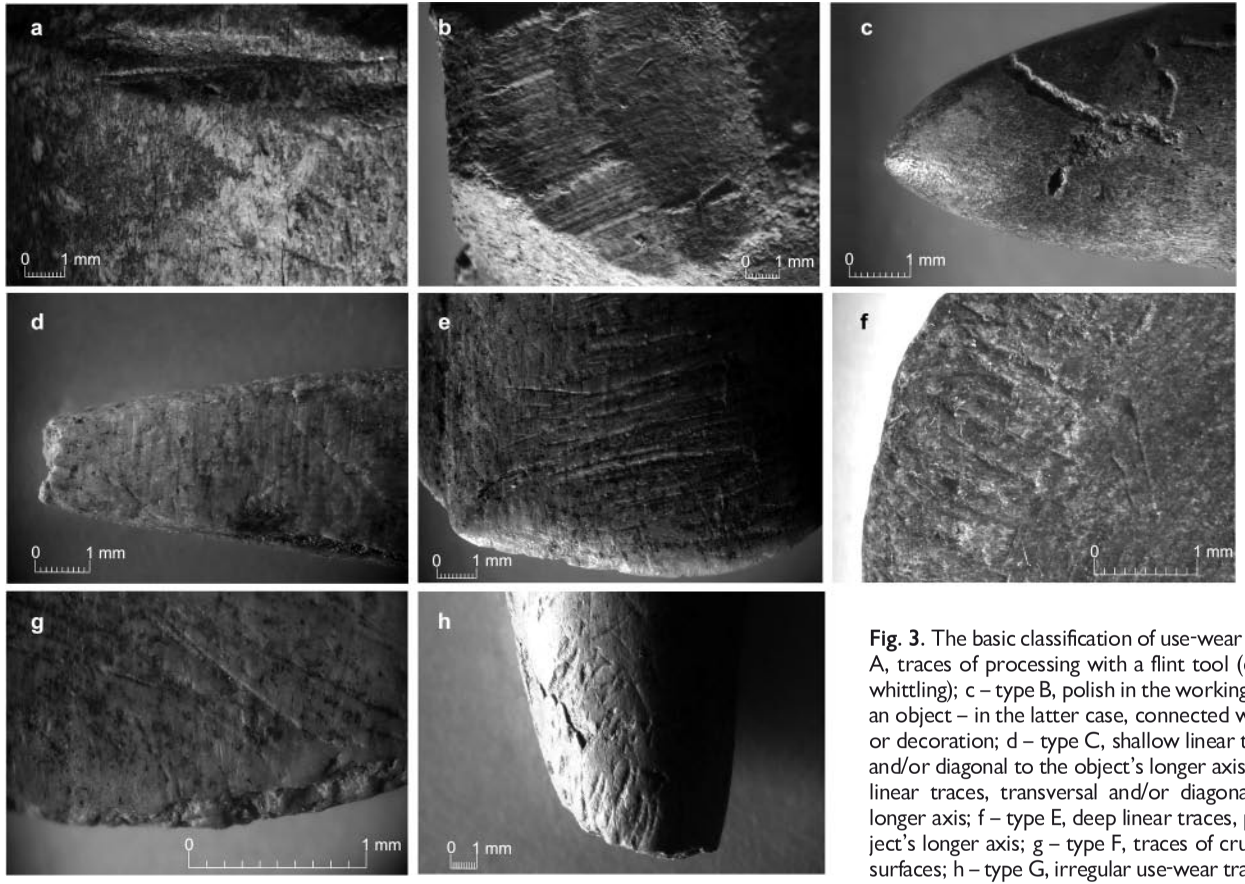

Fig. 3. The basic classification of use-wear traces: a, b – type A, traces of processing with a flint tool (cutting, chopping, whittling); c – type B, polish in the working or other parts of an object – in the latter case, connected with handling, haft, or decoration; d – type C, shallow linear traces, transversal and/or diagonal to the object's longer axis; e – type D, deep linear traces, transversal and/or diagonal to the object's longer axis; f – type E, deep linear traces, parallel to the object's longer axis; g – type F, traces of crushing on working surfaces; h – type G, irregular use-wear traces in the form of multidirectional damages to the object's surface, with rounded edges

and briefly described, which allowed for a preliminary classification of the use-wear traces (Fig. 3). The traseological analysis and its interpretation were based on the results of experimental research and studies on the function of prehistoric artefacts made of bone, antler, and tooth (Maigrot 2005; Buc 2011; Struckmeyer 2011; Diakowski 2014).

3. CLASSIFICATION OF ARTEFACTS MADE OF BONE, ANTLER, AND TOOTH

Type 1. Ornaments made of bone, antler, and tooth

The Early Bronze Age settlement in Maszkowice yielded 12 objects that had been used by its inhabitants as ornaments. Information on the function of these artefacts can be derived from cemeteries from the period. Three large and comprehensively published sepulchral sites – Iwanowice-Babia Góra (Kadrow *et al.* 1992), Jelšovce (Bátora 2000), and Nižná Myšľa (Olexa and Nováček 2013) – have been selected for comparison, and studied to supplement certain elements of analysis presented here.

Type 1.1. Plaque

This type is represented in Maszkowice by one applique/plaque made of the tusk of a pig or boar (Fig. 4:a). The object is leaf-shaped, 48×22 mm in size and D-shaped in cross section, and has four semi-circular indentations (two of them damaged) placed symmetrically on the edge of the broadest surface. Plaques of this type were most likely elements of dress; objects of similar form and manufacture are known, among other places, from several graves in the Nižná Myšľa cemetery in Slovakia (Olexa and Nováček 2013, 43, fig. 41:2, plate 11:3, 28:5, 48:1, 50:1, 64:1, 120:2).

Type 1.2. Pendants from pig or boar tusk

Two objects discovered in Maszkowice belong to this group. They differ in size (with preserved lengths of 30 and 85 mm, respectively), but despite their poor preservation one can notice that each of them has a small aperture drilled through the central part (Fig. 4:b, c). During the time of the Early Bronze Age settlement in Maszkowice, pendants made of pig or boar tusks were elements of male costume. This is confirmed by the fact that in the cemeteries of the period such artefacts were found virtually only in male burials. However such pendants were relatively rare in grave inventories. For example, at the Iwanowice-Babia Góra cemetery they occurred in 8.64% of male burials (Kadrow *et al.* 1992), at Jelšovce, 9.71% (Bátora 2000), and at Nižná Myšľa, 22.02% (Olexa and Nováček 2013). Their occurrence was also chronologically limited, as the pendants occurred primarily in

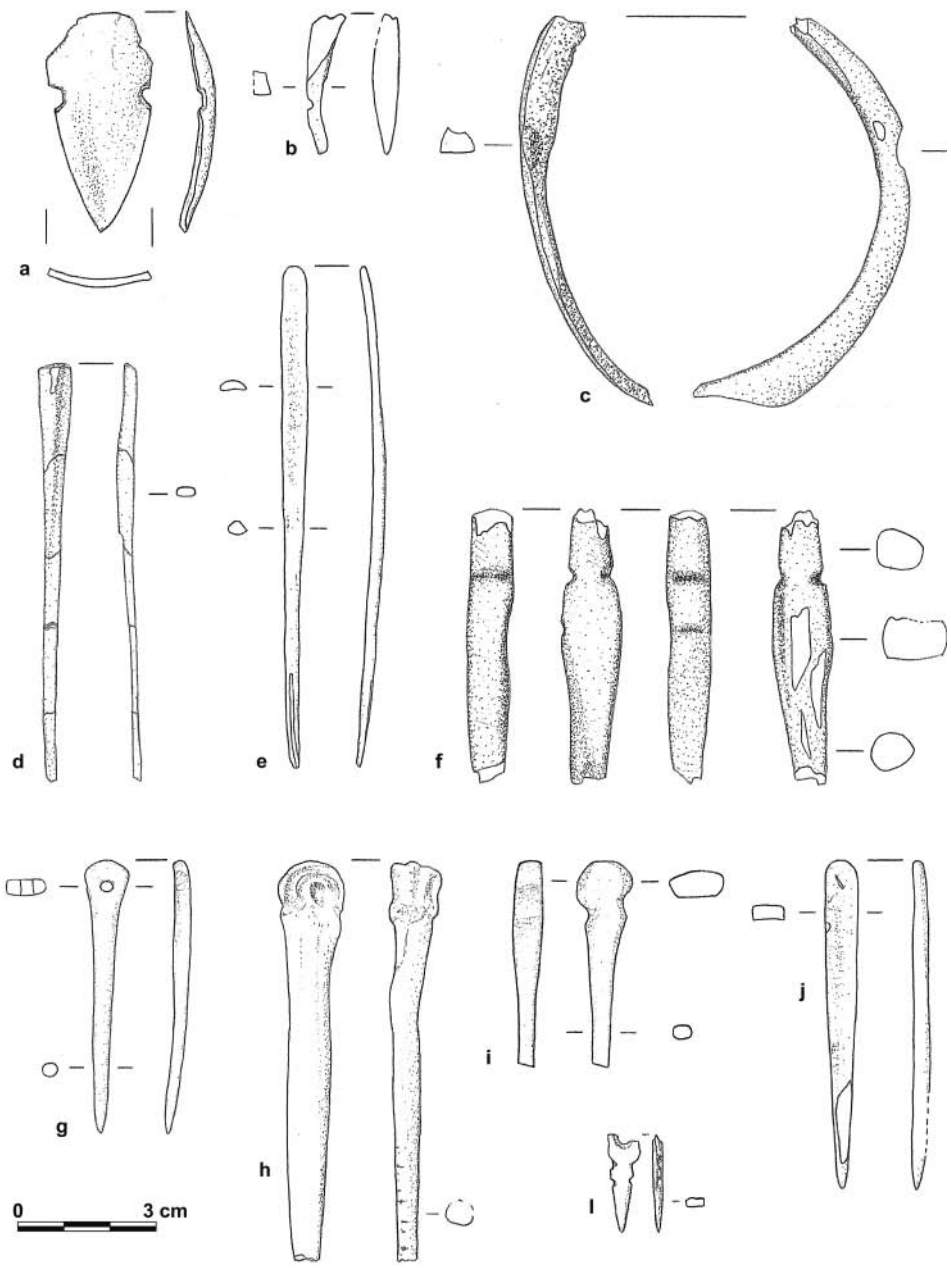

Fig. 4. Ornaments made of bone, antler, and tooth from the Maszkowice settlement:
a – plaque, type 1.1; b, c – pendants from pig or boar tusk, type 1.2; d, e – pins, type 1.4; f – ornament made of mammalian long bone, type 1.3; g-j – pins, type 1.4; l – miscellaneous artefact

graves belonging to older stages of the mentioned cemeteries, corresponding with phases BrA1 and BrA1/BrA2 (Kadrow *et al.* 1992; Bátora 2000; Olexa and Nováček 2013).

Type 1.3. Ornaments made of mammal long bone

To this category belong two poorly preserved artefacts made of long bones of large mammals, with preserved dimensions of 60×12.5 mm and 97×13.5 mm, respectively. Both bones were delicately worked into a cylindrical shape, in a manner that left marks over the entire surface. The more well-preserved object has two indentations made with a flint tool, forming a narrower neck in one place (Fig. 4:f). Shallow transversal and diagonal linear traces can be observed near and within the neck, which, given their location, can be interpreted as being made by a cord, strap, or other material tied around the neck. The function of these artefacts remains uncertain, although traseological analysis and formal criteria suggest that they may have been dress elements or ornaments.

Type 1.4. Pins

Six artefacts have been discovered in Maszkowice to date that can be described as bone pins. Except for one distinguished by its length (109.5 mm) and made of a rib of a middle-sized mammal (Fig. 4:e), all other pins were made of long bones of middle-sized or large mammals. Three objects have survived in full, while the rest are damaged on their upper portions. Two pins have distinct heads – one with a hole approximately 2 mm in diameter (Fig. 4:g), and the other formed into a trapezium with asymmetrically placed indentations (Fig. 4:i). In three cases, the pin's surface flares towards the top (Fig. 4:d, e, j), and one pin has an unworked epiphysis of a long bone belonging to a sheep or goat (Fig. 4:h; see also Cabalska 1972, fig. 2). Artefacts differ in terms of size and shape, but all were made with great care for detail.

The surfaces of all pins are polished to some degree. Such polishing forms due to the prolonged use of an object – by holding it frequently in hand, or by contact with textile or other soft material (Diakowski 2014, 356). Apart from the surface polish, the second criterion allowing us to distinguish pins from formally similar awls and perforators was microscopic analysis – as expected, pins did not show linear working traces typical of tools (Fig. 5).

This category also included a fragmentarily preserved object, which, although its function cannot be unambiguously determined, resembles a pin in terms of the character of its surface. The preserved fragment is 20 mm long, and on one side it terminates in a sharpened tip, while a hole was bored through the other side, along with two pairs of symmetrically arranged indentations; the entire surface is polished (Fig. 4:l). The object is formally similar to bone artefacts discovered at a tell site in Tószeg, Hungary, which were discussed as being possible elements of a horse bridle (Mozsolics 1953, 83-84, fig. 19, 20). However, the artefact from Maszkowice is very fragile, hence an interpretation as a bridle element, or an

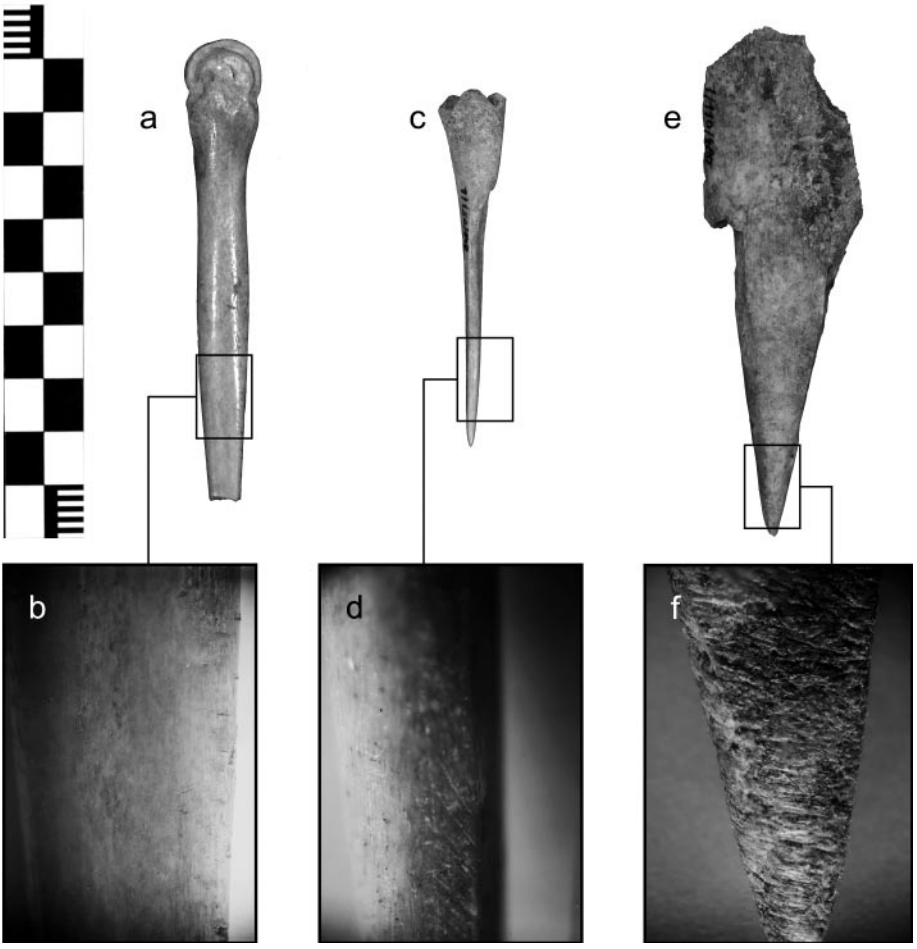

Fig. 5. Differences in use-wear traces observed on three kinds of morphologically similar items from the Maszkowice settlement: a – photography of pin; b – microphotography of polished area on pin; c – photography of awl; d – microphotography of linear use-wear traces on awl; e – photography of perforator; f – microphotography of deep linear use-wear traces on perforator

arrowhead, for example, seems unlikely. Due to its uncertain function, the object has not been included in the type frequency analysis.

The analysis of the position of pins in graves in the selected cemeteries revealed that this group of artefacts were primarily placed near the arms and chest or feet of the deceased (Kadrow *et al.* 1992; Bátora 2000; Olexa and Nováček 2013). This suggests that pins served to fasten textiles for the needs of funeral practices, while their use as hair pins can be ruled out. In the context of cemeteries, one can assume that pins may have been

used for fastening burial shrouds. Two observations argue for such an interpretation: that many pins were found by the feet of the deceased, and that there was no observable pattern as regards the gender and age of the deceased furnished with pins.

Type 2. Awls

This category has been distinguished on the basis of traseological analysis and formal criteria. In terms of purely formal criteria, however, some of the objects included here would be described as pins. Artefacts interpreted as awls were those bearing traces of working in textile or other soft material. The traces in question include shallow linear marks situated near the tip and running transversally along the artefact's major axis, as well as polish on the working part of artefact (Fig. 3:c, d; Fig. 5:c, d). Differences in the width of the working parts allowed the awls from Maszkowice to be further sub-divided.

Type 2.1. Tiny awls

To this group belong three delicate artefacts, all of which have tips 1.5-2 mm wide and are oval or circular in cross section. One of them is very well-preserved (length of approx. 101 mm) and was made of antler (Fig. 6:a), while two others were made of bone – a long bone (preserved length of 36 mm) and a rib (preserved length of 22 mm) from a medium-sized mammal (Fig. 6:b). The item made of antler had a hole drilled through its head. Formally resembling a pin, the object was nevertheless most likely used as an awl or other tool of this type, as indicated by the polish covering only the tip, a few linear traces, and the manner of the artefact's manufacture; unlike with pins, the object was executed with little care for detail.

Type 2.2. Massive awls

This group includes six artefacts, distinctly more robust than those discussed above, with preserved lengths varying from 62.5 to 94 mm (Fig. 6:c, d). Five were made of long bones of medium-sized mammals (i.a. sheep/goat, dog), and one was made of antler from the brow tine of a deer. The working tips are approx. 3-4 mm wide.

Type 3. Perforators

Tools described as perforators were those bearing microscopically detectable traces of working in hard material, most likely left by piercing animal hides. Such traces were identified based on comparison with analogous artefacts and the results of experimental research (e.g. Maigrot 2005, 118, fig. 6:1; Buc 2011; Diakowski 2014, Plate 20:1, 2). All the

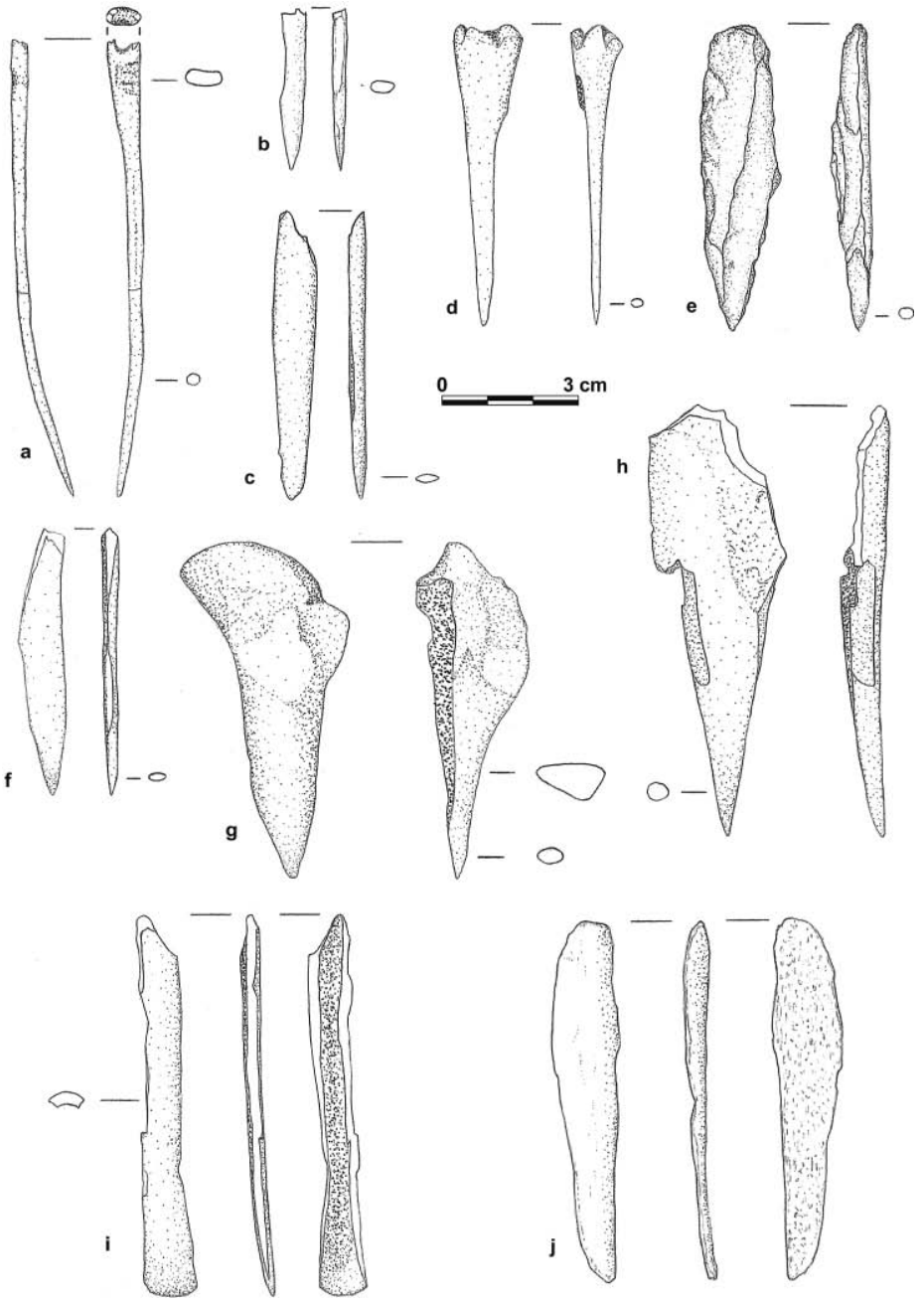

Fig. 6. Awls, perforators and spatulas made of bone and antler from the Maszkowice settlement: a, b – tiny awls, type 2.1; c, d – massive awls, type 2.2; e, f – tiny perforators, type 3.1; g, h – massive perforators, type 3.2; i, j – tiny spatulas, type 4.1

perforators from Maszkowice have deep linear traces near their tips, and less often further from the tip, usually showing no regular arrangement but most often transversal to the tool's major axis (Fig. 3:e; Fig. 5:e, f). The site yielded 13 tools identified as perforators, of which the majority (10 pcs.) were made of long bones of large mammals. The remaining three were from long bones of medium-sized mammals. Formal differences allowed two groups of perforators to be intuitively distinguished.

Type 3.1. Tiny perforators

To this group belong perforators that are no more than 17.5 mm wide in the widest place and with tips up to 4 mm wide (Fig. 6:e, f). Seven such tools have been found in Maszkowice.

Type 3.2. Massive perforators

The perforators of more massive construction are included here. These objects (six items) are 15 to 37 mm in maximum width and have working tips up to 5.5 mm wide. Most of them were made in a manner that precludes the identification of the species from which the bone came (e.g. Fig. 6:h), while in two cases epiphyses have survived. One of the latter seems particularly interesting, as it was made of the right fibular bone of a brown bear (Fig. 6:g). This is the first bone belonging to this species discovered in the Early Bronze Age settlement in Maszkowice (personal information from Dr. Jarosław Wilczyński).

Type 4. Spatulas

The site on Zyndram's Hill yielded a series of artefacts that, in terms of their formal parameters, represent tools described in the literature as spatulas (Buc *et al*. 2016, 82-83), scrapers (Drzewicz 2004, 20-22), and bevel-ended tools (Maigrot 2005, 117-118). Artefacts of this type are commonly assumed to have been connected with the processing of hide, wood, or bark, or possibly with the shaping of wet walls of clay vessels; such interpretations are supported by the results of experimental research (see: ibidem; Struckmeyer 2011, 190; Waszczuk 2014, 467-468). The spatulas from Maszkowice, however, bear use-wear traces different than those associated with these functions. They typically bear linear marks, relatively deep and short, diagonal or transversal to the artefact's longer axis (Fig. 3:e-g). Despite the relatively fragile construction of these tools, instances of crushing along their edges suggest intensive exploitation. In the case of two spatulas, such use has led to the polishing of the inner, spongy bone. The functions of the Maszkowice spatulas cannot as yet be precisely determined. However, their shape and the nature and direction of linear use-wear traces indicate that they may have been used for cutting hides or similar material, while their use in the process of pottery production can be ruled out. The objects from

this series represent two basic formal types, which is why they have been divided into two groups using the criterion of the width of the working edge; in addition, the collection also included one spatula-perforator.

Type 4.1. Tiny spatulas

The first group is characterised by the relatively narrow width of the working edge, ranging from 6 to 11.5 mm. Three artefacts made of ribs of large mammals and one from a long bone of a mid-sized mammal were included in this group. Each tool has one, thinner working edge on the shorter side (Fig. 6:i), while in one case the working edge additionally covers the longer side of the tool (Fig. 6:j). Working edges are either straight or rounded.

Type 4.2. Massive spatulas

The second group includes two larger specimens with working edges 16.5 and 18 mm wide. Although both tools are relatively poorly preserved, it was possible to establish that one was made of a long bone of a large mammal and the other from a horn-core of a cow or aurochs (Fig. 7:a).

Type 4.3. Spatula-perforator

This artefact has one straight working edge and a pointed tip on the opposite side (Fig. 7:b). The tip bears linear traces typical of massive awls (type 2.2), while use-wear marks on the slightly rounded working edge are the same as on other spatulas from Maszkowice. The tool was made of a long bone of a large mammal, is square in cross section, 69 x 18 mm in size, with the working edge approximately 17 mm wide. Analogous artefacts are known, among other places, from the Neolithic site in Drenovac (Serbia), and are believed to have been linked with the processing of soft organic material (Vitezović 2011, 126, fig. 18).

Type 5. Artefact bearing marks associated with tanning

This category has been distinguished because of the presence in the Maszkowice collection of an artefact that in all likelihood was used for working with hide, most probably for tanning. The tool is made of antler, is quite massive, oval in cross section, and 122 x 23 mm in size (Fig. 7:g). Its two rounded working edges bear deep, parallel, diagonal and transversal linear use-wear traces, detectable both micro- and macroscopically. In addition, crushing can be seen on both edges, which probably resulted from intensive use of the tool. Analogous linear marks are believed to be connected with hide processing, including tanning (Maigrot 2005, 118, fig. 5:3).

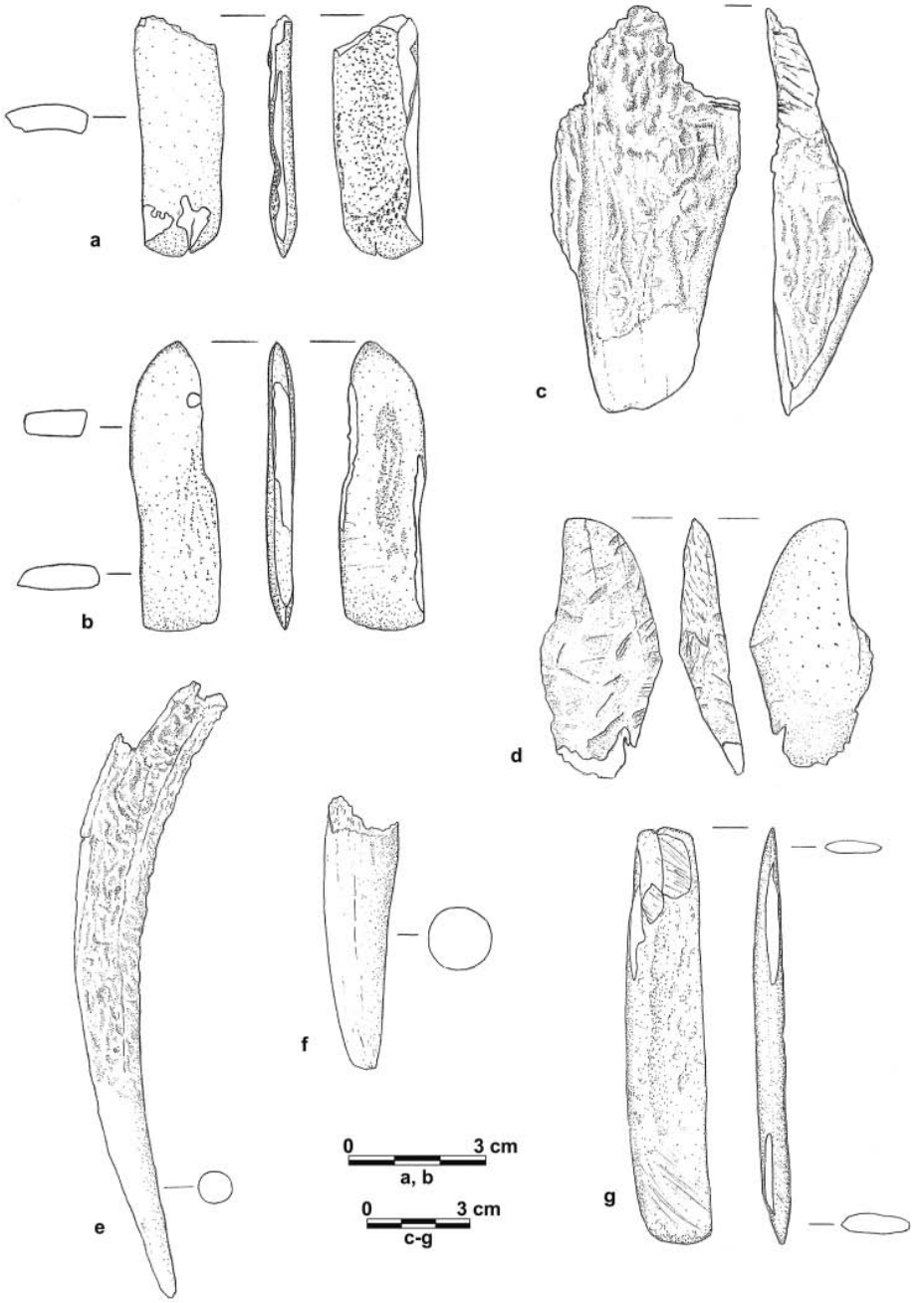

Fig. 7. Spatulas, polishers, antler picks, and a miscellaneous artefact bearing marks associated with tanning from the Maszkowice settlement: a – massive spatula (type 4.2); b – spatula-perforator (type 4.3); c, d – polishers (type 6); e, f – antler picks (type 7); g – artefact bearing marks associated with tanning (type 5)

Type 6. Polishers

Two of the artefacts discovered at the Early Bronze Age settlement in Maszkowice seem to bear marks suggesting they were used for polishing an undetermined material. Both are quite large, 113 x 54.5 mm and 75 x 35 mm in size, were made of antler, and each has a working edge as well as two working planes (upper and lower). Microscopic examination has revealed local polishing on both planes and the edge, as well as crushed indentations in the latter. The distal part of the larger of the two artefacts bears traces of whittling with a flint tool, perhaps reflecting an attempt to form a shaft (Fig. 7:c). The smaller of the polishers had its outer layer partly removed with a flint tool (Fig. 7:d). The artefacts in question may have been used for polishing some unidentified, probably soft, material. Objects of analogous form and function are known, for example, from the defensive settlement at Pákozdvár near Pákozd, Hungary, dated to the Middle Bronze Age (Choyke 1979, 14, fig. 6252).

Type 7. Antler picks

This category comprises artefacts made of brow tines of deer, which based on their morphological and formal attributes should be classed as digging tools or hoes (Drzewicz 2004, 16-19), and which also bear marks indicating their use in the loosening of soil (cf. Diakowski 2014, plate 22:4). In the collection retrieved from Maszkowice, there are four tools that meet both these criteria – one is fragmentarily preserved (80-mm long) and the lengths of the other three vary from 182 to 196 mm, with oval working tips ranging from 7 to 13 mm in width (Fig. 7: e, f). Apart from microscopically detectable multidirectional marks with rough edges, significant parts of the working planes also reveal macroscopically visible polish.

The entire collection of artefacts made of deer brow tines discovered in Maszkowice numbers more than a dozen objects. However, despite formal similarities, microscopic examination allowed the group described above to be distinguished from semi-products. Furthermore, one tool made from this raw material has been identified as having been used for working with a soft material, such as a textile fabric (see type 2.2).

Type 8. Hafted chopping tools

To this group belong eight artefacts made of antler, whose common features were the raw material and the presence of an aperture. Their manner of use is difficult to establish, mainly because of a lack of unambiguous use-wear traces in almost all cases, but also due to the poor preservation of potential working parts. The functional interpretation of these artefacts has been based on formal criteria alone, which is why we followed A.M. Choyke (1979, 12-16) in describing them as hafted chopping tools. We opted against distinguishing

any types, primarily due to significant metric differences. Therefore, each artefact is briefly discussed individually, along with speculation on its possible function.

The first sub-group includes five artefacts made of the basal part of deer antler, which can be described as axes. Three of them are large and heavy hafted chopping tools with oval apertures transversal to the working edge, shaped carelessly using a flint tool. The most well-preserved specimen, 191.5 x 103.5 mm in size, has survived in the form of a butt with a coronet, and part of a blade (Fig. 8:a). The latter was well shaped by means of cutting and then polishing the surface. The second object has only fragmentarily survived (160.5 x 73.5 mm), although it was possible to determine that it had a sub-rectangular butt formed using a flint tool (Fig. 8:c). In the case of the third one (141 x 59 mm), the blade is partially preserved, bearing marks indicating its use in the loosening of soil (Fig. 8:h).

Another two artefacts from this sub-group are marked by the very poor state of their preservation. Their original dimensions seem to have been much smaller than in the case of the artefacts presented above (with surviving dimensions of 122 x 55 mm and 117 x 59 mm, respectively), but their apertures were made in a similar manner. The polishing of the original antler structure over nearly the entire surface of both objects suggests their intensive exploitation (Fig. 8:b, d), which to some degree could explain the poor state of preservation.

As mentioned, the determination of the tools' function is made difficult because traseological analysis of the working parts could not be performed in all but one case. Nevertheless, such artefacts are generally believed to have been used in woodworking (Gál 2011, 144, fig. 10) or for digging (Choyke 1979, 12; Drzewicz 2004, 17). The latter explanation may be confirmed by analysis of the use-wear traces on the tool with the most well-preserved blade (Fig. 8:h).

A similar function can probably be ascribed to another object in this group, most likely made of a more distal part of deer antler. Unfortunately, the artefact has survived only fragmentarily (147.5 x 37.5 mm), and all that can be said is that it had a rectangular aperture approximately 30 mm wide (Fig. 8:g).

Among the artefacts made of distal parts of antler there were also two other hafted chopping tools, distinguished by much smaller dimensions and lighter construction. One has survived in about half of its original size (current dimensions: 82 x 32 mm); the part adjacent to the working edge was preserved, but the edge itself has been damaged (Fig. 8: e). The object tapers from the aperture towards the working edge, and much of its surface is polished, which argues for intensive or prolonged use. The last object from the discussed group was discovered in house VII in 2017. It has survived in excellent shape – from the blade to the butt (117.5 x 40.5 mm in size, with a 38.5 mm-wide blade) – and was manufactured with great attention to detail (Fig. 8:f). The care with which it was made is evidenced by the smoothing of the edges of apertures (made with a flint tool), a feature uncommon for the axe-like hafted chopping tools presented above. The artefact has one aperture (13.5-15.5 mm in diameter) transversal to the blade's edge, which joins with another, parallel

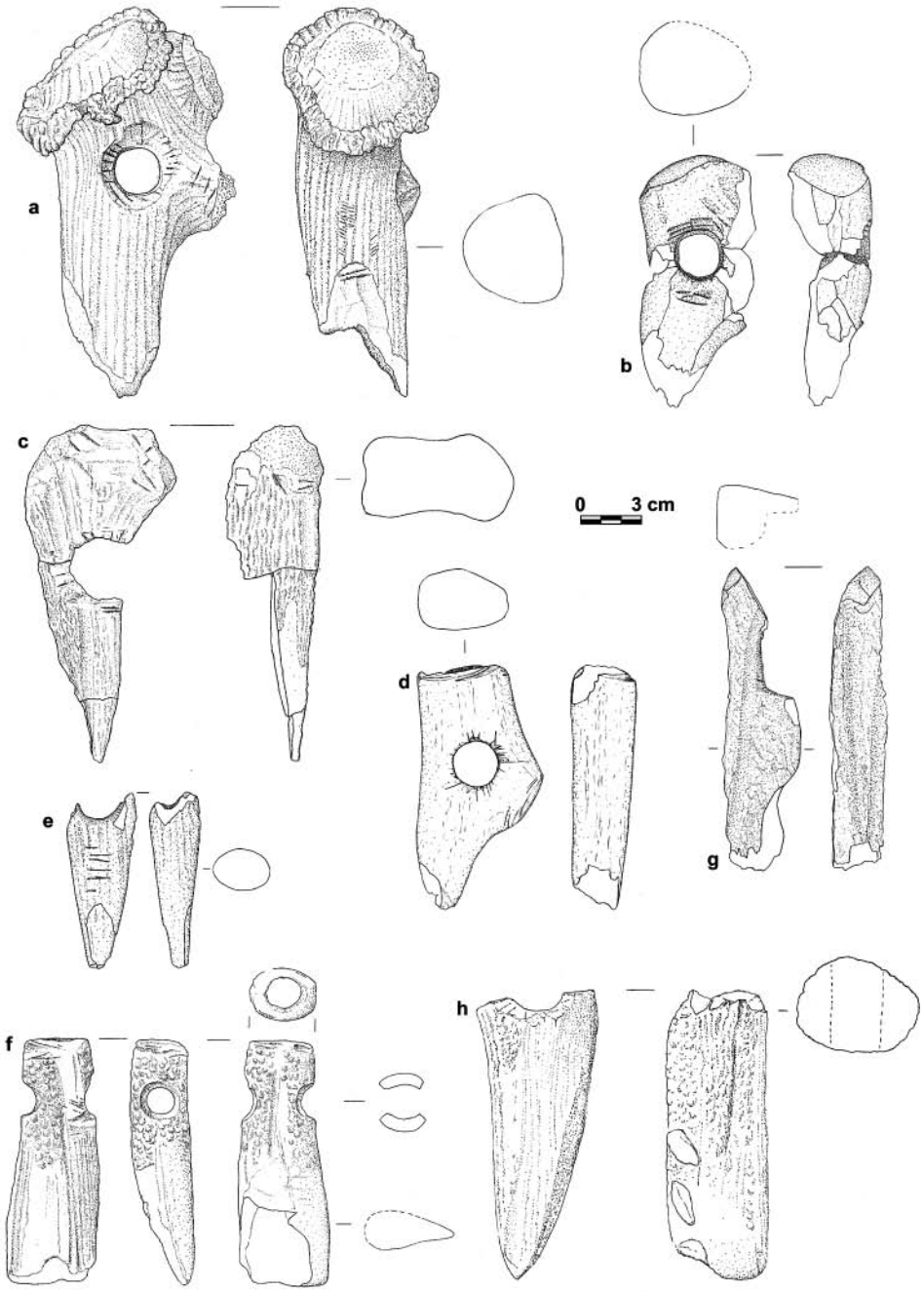

Fig. 8. Hafted chopping tools from the Maszkowice settlement: a-h type 8

one (14.5 mm in diameter) in the butt of the tool. Approximately half of one of the side surfaces was worked using a flint tool and then smoothed. Unfortunately, neither this surface nor the blade's edge bear any diagnostic use-wear marks. This observation, which applies to the last two of the discussed artefacts, as well as a lack of analogies, makes determination of the objects' function(s) impossible.

4. OCCURRENCE OF ARTEFACTS MADE OF BONE, TOOTH, HORN AND ANTLER IN ARCHAEOLOGICAL CONTEXTS

The very small size of the series of artefacts retrieved from particular houses hampers attempts to analyse their distribution pattern within the site. In houses V-1 and V-2 only single bone or antler objects were found, while the deposits associated with houses III, IV, and VII yielded two artefacts each. A higher number of classifiable artefacts made of bone, tooth, and antler were found in houses I-3 (3 pcs), II (4 pcs), in the house explored in 1967 and in a layer outside the houses dated to phase Maszkowice II (5 pcs each), in house I-2 (9 pcs), and in the pit explored in 1971-1972, which contained re-deposited sediments from nearby houses I-1 and II (14 pcs).

Despite these limitations, one can notice certain regularities. All the spatulas discovered in reliable contexts (5 pcs) were found in the two-phase house I (house I-1 and I-2) and in the nearby storage pit. Similarly, two neighbouring houses (I-2 and II) situated in the southern part of the explored area produced the same combinations of artefacts – an occurrence nearly unknown from other contexts – namely a pin (type 1.4) and tiny and massive perforators (types 3.1-3.2). In turn, the houses situated in the northern part of the explored area (houses IV, V, VII, and the house from 1967) produced the majority of antler axes (5 out of 7 discovered in reliable context) and half of the tools smaller than perforators, described here as awls (types 2.1-2.2, 4 out of 8 specimens with known context).

It is difficult to establish to what degree the patterns presented here reflect the spatial organization of activity (e.g., economic activity) within the Early Bronze Age settlement. It needs to be stressed once again that the analysed sample is too small for drawing any statistically reliable conclusions in this respect.

5. CONCLUSIONS

The fundamental problem we encountered while searching the literature for parallels to the artefacts discovered in Maszkowice was the lack of uniform classification criteria and the terminological diversity observed in the descriptions of objects made of bone, tooth, and antler. Such a state of affairs essentially precludes performing any comparative

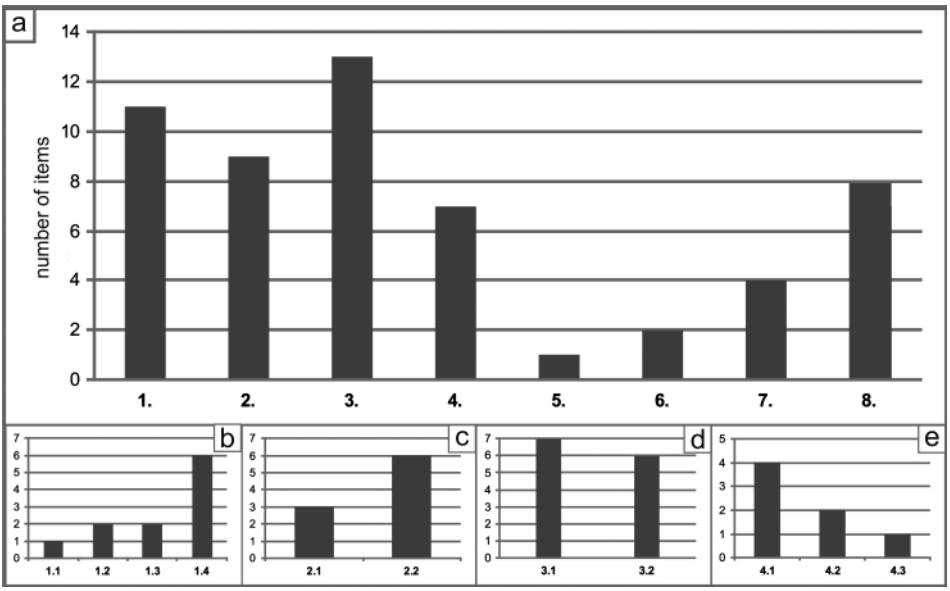

Fig. 9. Frequencies of different types of objects made of bone, antler, horn and tooth discovered in the Early Bronze Age settlement at Maszkowice; a – types in general; b – type 1, c – type 2; d – type 3; e – type 4

studies that could take into account the variations in frequencies of particular artefact types in subsequent chronological horizons or in different regions – all this despite a considerable degree of similarity of bone, tooth, and antler objects from the European Neolithic and Bronze Age.

The classification proposed in this paper does not aim to fill this gap. Our intention was rather to highlight the necessity of taking into account the results of traseological analyses – not only in the reconstruction of the manufacturing processes and the functions of previously classified artefacts, but also at the very stage of their classification. In this respect, particularly informative examples from this paper include the group of objects made of brow tines of deer (cf. type 7), and the classification of an object, which formally resembles a pin, as an awl instead, based on traces of its use as a tool (cf. type 2.1.). From the perspective of functional analysis, particularly interesting are the observations pertaining to the so-called 'spatulas' (cf. type 4). All the objects of this type discovered at Maszkowice bear traces suggesting they were used as cutting tools, and surely not for working the surfaces of clay vessels as has often been suggested in the literature (cf. Drzewicz 2004, 20-22).

As for the frequency of particular types in the Early Bronze Age settlement in Maszkowice, the predominant forms are perforators (type 3) and awls (type 2), which together make up nearly half (41.8%) of the analysed collection (Fig. 9). It is worth noting that in contemporary sites from the middle Danube basin the frequencies of these categories are

usually significantly lower (Choyke *et al.* 2004, fig. 8, 12). However, at the present stage of research, it is difficult to determine whether these differences should be attributed to considerations of local ecological conditions, or rather to peculiarities of cultural tradition. The next most numerous group of artifacts at Maszkowice comprises the so-called spatulas – artefacts that in light of traseological analysis should be interpreted as cutting tools. It needs to be emphasised that this category of bone artefacts is the only one at Maszkowice that seems clearly connected with a specific zone in the explored part of the settlement, namely with the two-phase house I. Further observations, based on comprehensive analyses of the distribution of various categories of artefacts within the lowermost levels of houses, can be expected to suggest a connection between these objects and specific forms of human activity.

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References

Bátora J. 2000. *Das Gräberfeld von Jelšovce/Slowakei. Ein Beitrag zur Frühbronzezeit im nordwestlichen Karpatenbecken* 2 (= *Prähistorische Archäologie in Südosteuropa* 16). Kiel: Verlag Oetker/Voges.

Buc N. 2011. Experimental series and use-wear in bone tools. *Journal of Archaeological Science* 38(3), 546-557.

Buc N., Rivero D. and Medina M. 2016. The late Holocene bone tools from Quebrada del Real 1 (Sierras of Córdoba, Argentina). In S. Vitezović (ed.), *Close to the bone: current studies in bone technologies*. Belgrade: Institute of Archaeology, 80-85.

Cabalska M. 1972. Maszkowice, district of Nowy Sącz (A fortified habitation site of the Lusatian culture – the Hallstatt and the Early and Middle La Tène period). *Recherches Archéologiques* de 1971, 15-20.

Cabalska M. 1974. Die Problematik der ältesten, mit Buckelornamentik verzierten Keramik aus dem Gebiete Kleinpolens, unter Berücksichtigung des Materials aus Maszkowice, Kreis Nowy Sącz. In M. Gedl (ed.) Studien zur Lausitzer Kultur (= *Prace Archeologiczne* 18. *Zeszyty Naukowe UJ* 352). Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego 57-92.

Cabalska M. 1977. Hillfort and fortified settlement of Lusatian Culture in Maszkowice, voivodship of Nowy Sącz. *Archaeologia Polona* 18, 107-136.

Choyke A. 1979. A classification of the bone and antler tools from the Bronze Age hill-fortress of Pákozdvár. *Alba Regia* 17, 9-21.

Choyke A., Vretemark M. and Sten S. 2004. Levels of social identity expressed in the refuse and worked

bone from Middle Bronze Age Százhalombatta-Földvár, Vatya culture, Hungary. In S. J. O'Day, W. Van Neer and A. Ervynck (eds.), *Behaviour Behind Bones. The zooarchaeology of ritual, religion, status and identity*. Oxford: Oxbow Books, 177-189.

Diakowski M. 2014. Przedmioty wykonane z kości i poroża. Badania technologiczne i analiza funkcji. In T. Stolarczyk and J. Baron (eds.), *Osada kultury pól popielnicowych w Grzybianach koło Legnicy*. Legnica-Wrocław: Muzeum Miedzi w Legnicy, 345-392.

Drzewicz A. 2004. *Wyroby z kości i poroża z osiedla obronnego ludności kultury łużyckiej w Biskupinie*. Warszawa: Wydawnictwo Naukowe "Semper".

Gál E. 2011. Prehistoric antler- and bone tools from Kaposújlak-Várdomb (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*. Wrocław: Instytut Archeologii Uniwersytet Wrocławski, 137-164.

Kadrow S., Machnik J. and Machnikowa A. 1992. *Iwanowice, stanowisko Babia Góra: Cmentarzysko z wczesnego okresu epoki brązu*. Kraków: Instytut Archeologii i Etnologii PAN.

Madyda-Legutko R. 1996. Zróżnicowanie kulturowe polskiej strefy beskidzkiej w okresie lateńskim i rzymskim. Rozprawy Habilitacyjne UJ, 304/1. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.

Maigrot Y. 2005. Ivory, bone and antler tools production systems at Chalain 4 (Jura, France): late Neolithic site, 3rd millenium. In H. Luik, A. Choyke, C. Batey and L. Lougas (eds.), *From Hooves to Horns, from Mollusc to Mammoth: Manufacture and Use of Bone Artefacts from Prehistoric Times to the Present. Proceedings of the 4th Meeting of the ICAZ Worked Bone Research Group at Tallinn, 26th-31st of August 2003*. Tallinn: Tallinn Book Printers Ltd, 113-126.

Mozsolics A. 1953. Mors en bois de cerf sur le territoire du bassin des Carpathes. *Acta Archaeologica Academiae Scientarum Hungaricae* 3, 69-204.

Olexa L. and Nováček T. 2013. Pohrebisko zo staršej dobry bronzovej v Nižnej Myšli. Katalóg (hroby 1-310). Nitra: Archeologický ústav SAV.

Przybyła M. S. 2016. Early Bronze Age stone architecture discovered in Polish Carpathians. *Archäologisches Korrespondenzblatt* 46(3), 291-308.

Przybyła M. S. 2016a. Middle Bronze Age social networks in the Carpathian Basin. *Recherches Archéologique* NS 8, 47-84.

Przybyła M. S. and Jędrysik J. 2017. Recycled fortifications: the Late Bronze and Iron Age settlement in Maszkowice (Western Carpathians). In B. Heeb, A. Szentmiklosi, R. Krause and M. Wemhoff (eds.), *Fortifcations: Rise and Fall of Defended Sites In Late Bronze and Early Iron Age Of South-East Europe. Internat. Conference in Timişoara, Romania from November 11th to 13th, 2015* (= *Berliner Beiträge zur Vor- und Frühgeschichte* 21). Berlin: Staatliche Museen zu Berlin, 91-106.

Przybyła M. S. and Skoneczna M. 2011. The fortified settlement from the Early and Middle Bronze Age at Maszkowice, Nowy Sącz district (Western Carpathians). Preliminary results of studies conducted in the years 2009-2012. *Recherches Archéologiques* NS 3, 5-66.

Przybyła M. S. and Skoneczna M. 2014. Bronze Age settlement in Maszkowice (Western Carpathians) – analyses and interpretations. In T. Kienlin, P. Valde-Nowak, M. Korczyńska, K. Cappenberg and J. Ociepka (eds.), *Settlement, Communication and Exchange around the Eastern Carpathians in European Context. International Workshop held at the Institute of Archaeology, Jagiellonian University, Kraków, October 27-28, 2012* (= *Archaeopress Archaeology*). Oxford: Archaeopress, 265-285.

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*. Wrocław: Instytut Archeologii Uniwersytet Wrocławski, 187-196.

Vitezović S. 2011. 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*. Wrocław: Instytut Archeologii Uniwersytet Wrocławski, 117-135.

Waszczuk K. 2014. Analiza narzędzi wykonanych z kości, zębów i poroża. In S. Rzepecki, *Wilkostowo 23/24. Neolityczny kompleks osadniczy* 1. *Tekst*. Łódź: Instytut Archeologii Uniwersytetu Łódzkiego, Fundacja Uniwersytetu Łódzkiego, 463-470.