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Early and Middle Holocene Antler Tools With Holes From the Gravel Pits of the Smarhon Area, North-Western Belarus[1]

Abstract

The present article focuses on artefacts made of antlers with holes drilled for the haft, both those available in physical collections and those known only from archaeological literature. This category of items is held by a number of central and regional museums in Belarus, as well as in private collections. Such 'dispersion' of the items makes their study problematic. Until now, no comprehensive study of antler artefacts with drilled holes from gravel pits located in Smarhon has been conducted. Publications have so far considered only the specimens that are most representative from the point of view of comparative typology. Michal Chernyavskiy and Piotr Kalinovskiy invariably associated tools with drilled holes with the Mesolithic period. However, this group of tools is more diverse and chronologically complicated than previously thought.

The authors of the present article propose a new typological scheme for this item category which is part of a pan-European cultural and chronological context based on a complex analysis of antler artefacts with drilled holes.

Keywords: Early and Middle Holocene, antler, red deer, elk, technology, typology, north-western Belarus

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1. History of discovery and archaeological context

The faunistic complex found in the Smarhon gravel pits (north-western Belarus) is the largest in the territory of western Belarus and quite well-represented in scholarly literature.[2] To date, more than seven thousand mammal bones were found at the location, some of which bear traces of processing and are represented by whole instruments.[3]

The Smarhon findspot is located to the south-east of Smarhon city (Hrodna region) on the left bank of the Vilija river (right-bank tributary of the Neman river), in the area of the villages of Michnievichy, Belaja and Klidzianiaty, where three large pits for the extraction of a sand-gravel mixture are now located (Fig. 1). The first bone and antler artefacts were discovered in the summer of 1971, in a pit near the village of Michnievichy.[4] According to P. F. Kalinovskiy, the archeozoological findings were confined to the gravel deposits, the depth of which is ca. 13 metres at this site.[5] Tools with drilled holes were also present among the discovered artefacts. The unearthing of material from the pits near Michnievichy continued between the 1970s and 1990s, until the quarrying stopped. Today, more than one hundred bone and antler artefacts, as well as individual flint items are known from the site at the village of Michnievichy.

The gravel pit located near the village of Klidzianiaty began to be developed in the early 2000s which means it is relatively new. Moreover, it still occupies a fairly small area (Fig. 1). In 2013, several antler artefacts with drilled holes were identified in sediments in the southern part of the pit.[6] One of the clean-ups carried out at the artefact findspot revealed a thick layer of buried sapropel at a depth of three metres, in which remains of wood were recorded.[7] Perhaps the antler finds should be associated with this particular layer. Taking into account the active development of the pit, it is quite possible that the number of bone and antler artefacts from this location will further increase in the future.

In the materials from the Michnievichy and Klidzianiaty pits, thirty tools with drilled holes and one preform for this type of item were identified. The collection also includes technologically determinable post-production waste related to drilled tools (9 examples).

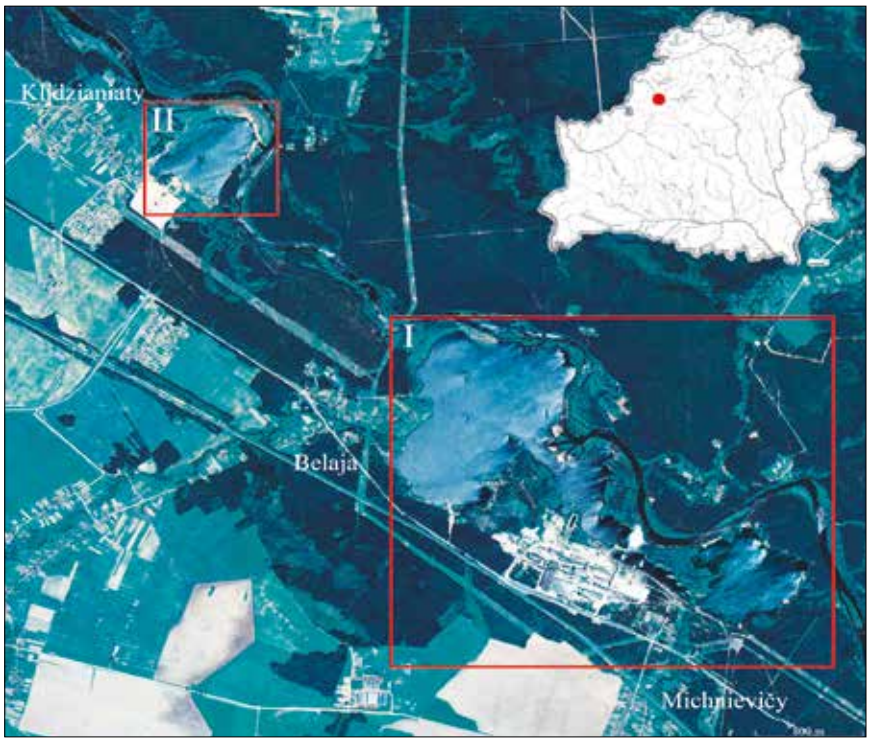

Fig. 1. Map of the Smarhon area with the Michnievichy and Klidzianiaty gravel pits.

[2] Kalinovskiy 1983, 36–39; 1995, 47–57; 1999, 36–41; Chernyavskiy, Kalinovskiy 1972, 26–32.
[3] Kalinovskiy 1995, 47–57; Chernyavskiy, Kalinovskiy 1972, 26–32; Chernyavskiy 1992, 116–120; 2006, 5–10.
[4] Chernyavskiy, Kalinovskiy 1972.
[5] Kalinovskiy 1983, 37.
[6] Chernyavskiy 2015.

2. Research methodology

2.1. Use-wear analysis

The technical and functional study of the antler items with drilled holes from the Smarhon findspot is based on the method of experimental traceology as applied to archaeological artefacts.[8]

The use-wear analysis of the material was performed with an MBS-9 binocular microscope (indirect lighting, magnification up to 98 times) and Olympus metallographic microscope (built-in lighting, magnification up to 500 times). Multifocal photofixation of traces of production and use was performed with the help of the CANON EOS Utility program, with further processing of frames in the Helicon Focus 5.2 program.

Due to the specific conditions of occurrence, detection, extraction, and further storage of archaeological materials from the Smarhon gravel pits, the preservation of antler items is, in most cases, poor. Mainly, there was a significant loss of the original surface of the items most exposed to external natural factors. Consequently, the features necessary for use-wear analysis such as macro- and micro-traces of manufacture disappeared. We have at our disposal only one antler object with a hole on the working end on which traces of use are preserved satisfactorily enough to enable microanalysis; this issue will be discussed in more detail later. However, macro marks such as the partially or completely preserved shape of the items, together with functional elements such as working blades, drilled and cut holes, hollows, or specially formed ends, have allowed us to establish the type of raw material and the technology used for preforms made from various parts, as well as the techniques of their secondary treatment.

2.2. Typology

Red deer antler items with a drilled hole are widely distributed geographically and temporally. At different times, different researchers have put forward typological schemes aimed at generalising and organising the available material. For example, mattocks made of red deer antlers from sites in northern Belgium were divided into five main types and nine subtypes.[9] The typology is based on the choice of a particular part of the deer antler (basal, medial, or distal – crown) and the location of the drilled hole. Similar features (the part of the antler and the location of the hole) have been used to create a typology of red deer antler mattocks from settlements in Great Britain, among which the so-called 'unbalanced' type of mattock is particularly notable, where the drilled hole is offset to the end part of the item.[10] Also noteworthy are the regional typologies developed for the finds from the Baltic coast in north-western Poland.[11] The principles used for this typology are similar to those used for classifying products with drilled holes from Belgium and the UK, in addition to the use of a combination of 'morphological' and 'functional' components in the names of types.

Items made of elk antler with drilled holes have not yet been subjected to any dedicated analysis as they are relatively few in number and do not have any clear type-forming features. For example, in the catalogue of bone and antler artefacts from the Lubana valley in eastern Latvia, all tools with holes made of elk antler and red deer antler were assigned to a single group of "antler axes and peaks with drilled holes", without any further division into types of antler raw materials.[12]

Judging from the results of the use-wear analysis of materials from the Smarhon pits, as well as taking into account the typological developments made for Western and Northern Europe, we offer our own typology of antler artefacts with drilled holes made of both red deer and elk antlers which is applicable to the territory of Belarus and Eastern Europe as a whole.

The scheme we propose is based on several characteristics (Table 1). The initial differentiation of the materials was based on the choice of raw material (I – *Cervus elaphus*; II – *Alces alces*). Further division is based on the choice of a certain part of the antler which served as a preform for the final implement (A – basal part; B – medial part; C – distal part; D – tines). Due to the specific nature of elk antler as raw material, two additional groups have been defined for it (AB – basal part passing into medial part; E – items with highly modified surfaces and/or ornamentation).

Depending on the location of the drilled hole, four groups were identified: 1 – frontal, centred; 2 – frontal, offset to one end of the preform; 3 – side, centred; 4 – side, offset to one end of the preform. Four variants of design and orientation of the working end of the item were also highlighted: a – hollow for inserting a stone or antler tool; b – blade oriented perpendicular to the attachment of the handle; c – blade parallel to the attachment of the handle; d (technical version) – missing working end. It is important to note that we are looking at the position of the antler tool and its handle in their

[7] Chernyavskiy 2015, 6–7.
[8] Semenov 1957; Peltier, Plisson 1986.
[9] Hurt 1982.
[10] Smith 1989.
[11] Ilkiewicz 2009/2010.
[12] Vankina 1999, 262–263.

Table 1. Typological classification of antler tools with holes. Key: I – raw material; A–C – antler parts (preforms); 1–4 – position of the hole (1 – frontally centred, 2 – frontal offset, 3 – lateral offset, 4 – laterally centred); a–d – position of the working end (a – hollow for inserting a stone or antler tool, b – blade is oriented perpendicularly towards the attachment of the handle, c – blade is oriented in parallel to the attachment of the handle, d (technical version) – missing working end.

	I (*Cervus elaphus*)															
	A (basal part)				B (medial part)				C (distal part)				D (tines)			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
a																
b																
c																
d																

Table 1. Typological classification of antler tools with holes (continued).

	II (*Alces alces*)															
	A (basal part)				B (medial part)				AB (basal part passing into medial part)				E (items with highly modified surfaces and/or ornamentation)			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
a																
b																
c																
d																

longitudinal plane. In contrast to the above-mentioned developments in other parts of Europe, our scheme may also be applicable to elk antler and can accommodate other antler products, the division of which may be based on the principle of raw material selection, preform orientation, and working blade arrangement.

Another difference in our typology is that we avoided using common terms that imply a precisely-defined scope and method of use (mattocks, picks, axes, adzes). During its 'life', an antler tool could go through a whole series of modifications as a result of the recycling process. Due to breakage, the dulling of the working blade, or complete unsuitability for its original function, the item could have been completely or partially modified. These actions may have resulted in a change in the functional purpose of the antler blade and thus in its 'functional' type (e.g. axe → sleeve; mattock ↔ axe, etc.). Among the findings from the Smarhon quarries were items which had undergone several stages of modification, most likely resulting in a change of function (Type I.A.2, 3b; Table 1). In cases where the items showed signs of use, we gave the tools a functional definition.

3. Chronology

When referring to the results of recent studies on the attribution of perforated antler tools from north-western European material, it is worth mentioning a generalising study of their relative chronology[13] as well as several works on radiocarbon dating of bone and antler artefacts.[14] According to these studies, antler tools with drilled holes can be attributed to the Early and Late Mesolithic, as well as the Early Neolithic.

M. M. Charniauski and P. F. Kalinovskiy have linked perforated tools with drilled holes with the Mesolithic period.[15] However, as it becomes apparent now, the Smarhon complex is chronologically more complicated and diverse.[16] In the nearest future, the initiated research will allow to obtain direct dating of selected finds from the collection, which will more accurately determine the existence of certain types of tools in the context of the site and the region as a whole.

4. Smarhon area. Choice of raw material

Elk antler (*Alces alces L.*) (n=7) and red deer antler (*Cervus elaphus*) (n=23) were used as materials for manufacturing the analysed items. Adult elk antlers consist of three parts: the main rod, the shovel, and a number of sharp tines (brow, bez and crown). At the base of the rod is a thickened bumpy ring – a socket. The length of the rod usually varies from 10 to 20 centimetres and its coverage, from 17 to 35 centimetres. Its section has an irregularly-rounded or slightly flattened shape. Its surface is covered by longitudinal grooves. The end of an elk antler rod expands into a slightly concave top shovel, studded on the front and outside edges with a number of sharp tines. The number of tines on antlers depends on the age of the animal and can reach up to twelve or thirteen. The structure of elk antlers is also distinguished into the front part, the back part, the palmation, and the posterior tine.[17] The antler of a red deer differs from the elk antler in shape, size and structure. Its structure also includes a main rod with a base in the form of a socket. A new tine (brow, bez, trez [third], terminal and crown) grows from the rod as the animal matures. The antler of a red deer also has a front and a back part, but there is no palmation and no posterior tine. Knowledge of these antler elements allows to determine the species even from small fragments. More schematically, in order to create convenient typological schemes, elk and red deer antlers are also divided into basal, medial and distal parts.[18]

During growth, the soft spongy tissue of the antlers is mineralized, i.e. the amount of the main element – calcium – increases. The cancellous bone contains bone-forming cells which deposit bone-forming lime on the frame.[19] The elk antler differs from the red deer antler not only in shape but also in inner structure: the elk antler has a thicker outer layer while the layer of the internal spongy material is thin, which is greatly reflected in its resistance to impact and fracture loads.

The structure of the red deer antler is such that it can be used almost entirely for a large number of *standardised* implements.[20] The selected area or antler fragment may be said to determine the morphometry of future products. The choice of antler fragment will determine the processing technology and, apparently, even the functional specification of the finished instrument. The situation is different with items made of elk antler, where, as a rule, the shovel (palmation along with the front and back parts) – a large and relatively flat part of the antler whose size, shape and relief will always be different – was used as a basis. Consequently, despite the tradition of making such tools with specific technological and functional parameters in mind (dedicated working and end parts, fixation of the handle by means of a hole), each of

[13] Pratsch 2011.
[14] Crombe *et al.* 1999; Meadows *et al.* 2019.
[15] Chernyavskiy, Kalinovskiy 1972.
[16] Kalinovskiy, Kavalyukh 1997.
[17] Schmidt 1972, 89, fig. 74.
[18] Hurt 1982; Smith 1989; Elliott 2012, 42, fig. 16.
[19] Schmidt 1972.
[20] Louwe Kooijmans *et al.* 2001, fig. 10.6.

these products is different in its own way.[21] We believe that this determines the peculiarities of the selection and subsequent processing of raw materials from elk or red deer antler.

5. Characteristics of the artefact types

I. A. 1. a. The basal fragment of the antler rod was used as a preform for this type of instruments (n=1) (Fig. 2; Table 1). The protrusions of the socket rings were chopped off. A concentric groove was cut or notched out along the brow tine and the antler rod (there were no traces of this), which was then used to remove excess fragments. The location of the hole is frontal and centred. From the shape of the hole with straight, even walls we can conclude that the drilling was mechanical. The absence of drilling marks in the hole itself does not allow to determine the exact material (stone or bone) that was used to drill. On the rod side, the spongy substance was pushed out to create a cavity for inserting a stone or antler tool, which allows us to characterise this artefact as a sleeve. Artefacts of this type are known from the territories of Poland[22] and northern Germany.[23] One of the examples from Poland has an insert made of a wild boar tusk.

I. A. 2.-3. b. An instrument made of a red deer antler is also represented by a single example (n=1) (Fig. 3: 3; Table 1), which is similar to the type described above in its main distinctive features. The only differential characteristics are two holes – front and side – which are closer (offset) to the antler rod socket. The removed spongy substance of the antler at the opposite end, just as in the first case, suggests the fixation of a stone or antler instrument there. The presence of two holes indicates a possible change in the function of the tool during its lifespan. At the moment, the authors of this article are not aware of similar products with two holes.

I. A. 2. b. The next type of artefacts includes an instrument (n=1) made from the basal part of a red deer antler (Fig. 4.1, Table 1) with a frontal, mechanically drilled hole, offset towards the antler socket. In this case, both brow and bez tines had to be separated. The antler rod was separated at an angle, which made it easier to sharpen the future working blade. The working blade of the item is oriented perpendicularly to the handle attachment. Similar items (pick or adze) are known from sites in the Netherlands,[24] northern Germany,[25] Denmark,[26] Poland[27] and Lithuania.[28]

I. A. 2. d. Another item (n=1) is made from the basal part of a red deer antler (Fig. 4.2, Table 1). The hole is located in the frontal position with an offset towards the antler socket. The bez tine is absent which indicates that the individual was young. The brow tine was removed in a standard way (sawn off or chopped off). Unfortunately, the working edge is absent, which makes it difficult to classify the object by the blade orientation. A similar artefact with a preserved horizontally oriented blade and ornamented surface is known from the territory of Denmark.[29]

I. B. 1. a. One tool (n=1) with a frontal, centred hole (Fig. 3.2, Table 1) has been identified among the items for which the medial part of the red deer antler was used as a preform. The third tine is separated almost at the level of the antler rod. Both ends are sawn off or chopped off straight. There are no traces of removing the sponge mass of the antler at either end of the piece. The authors of this article are not aware of similar artefacts at the moment.

I. B. 2. a. Another object (n=1) is made of the medial part of a red deer antler (Fig. 5, Table 1). This item's distinctive feature is the location of the drilled hole in the front, but with an offset towards one end. The third tine is chopped off just below the antler rod. Both ends are separated at right angles. There are no traces of removing the sponge mass of the antler. On the end farther from the hole there is a large chipping, apparently associated with use. Artefacts of this type are known from the territory of the UK.[30]

I. B. 2. b. Another type of instrument (n=2), made from the medial part of a red deer antler (Figs 6.1,3; 7.1.a,b, Table 1), differs from the rest of the objects by its good surface preservation. The distinctive features include the frontal location of the hole, which is offset towards one end. The working blade is oriented perpendicularly to the attachment of the handle. The third tine is left at about a third of its length, which was probably a technological necessity required for better fixation of the tool. The bevelled working blade clearly shows traces of planing left by the sharpening (or resharpening) of the blade. Overlaying the planing marks, there is wear from use: intensive hammering of the sponge mass and the

[21] For example, see Clark 1954 or Louwe Kooijmans 1970, figs 18, 19.
[22] Okulicz 1973, 45, fig. 17.1e; Pratsch 2006, taf. 8.1; Ilkiewicz 2009/2010, 26, 27, fig. 6.5; Bagniewski 1990, photo 18.
[23] Pratsch 2011, fig. 5.3.
[24] Louwe Kooijmans 1970, 59, 60, fig. 17.
[25] Groß *et al.* 2019, 105, plate 8.ID1461, 107, plate 10.ID2112; Płonka 2003, 495, fig. 168.1.
[26] Płonka 2003, 443, fig. 116.
[27] Kabaciński *et al.* 2008, 257, 258: figs 7, 8.
[28] Rimantienė 1971, fig. 145.1,2.
[29] Płonka 2003, 490, fig. 163.
[30] Elliott 2015, fig. 6.92.244H.

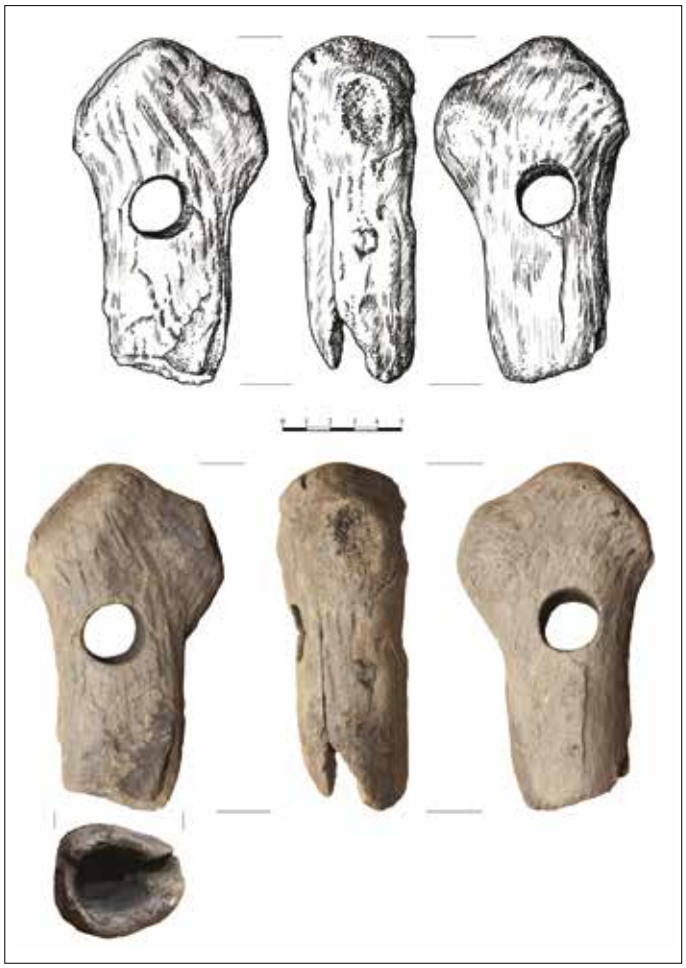

Fig. 2. Smarhon area. Klidzianiaty. Red deer antler tool with a hole. Type I. A. 1. a. (drawing by V. Petrushenka; photo by M. Chernyavskiy).

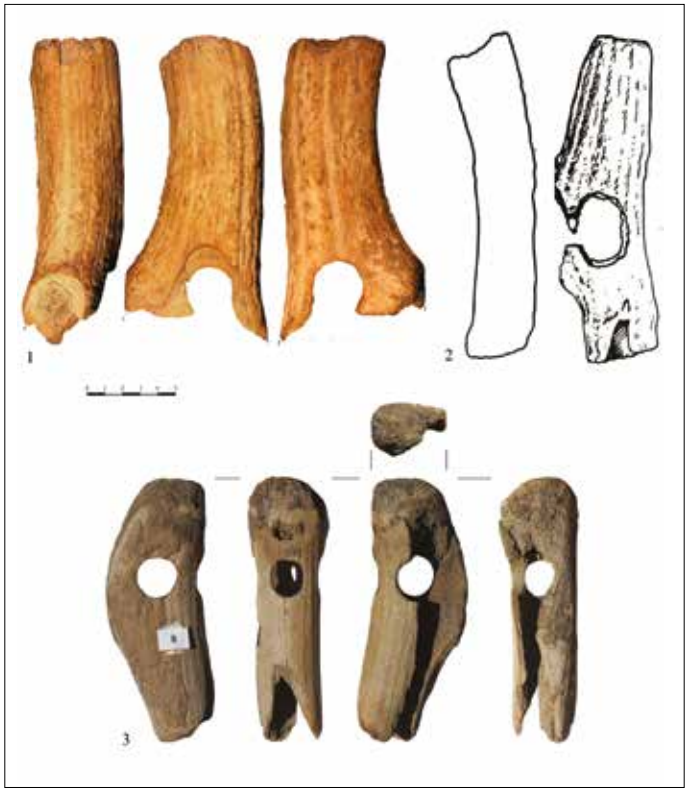

Fig. 3. Smarhon area. Michnievichy. Red deer antler tools with holes. 1 – Type I. B. 2. d.; 2 – Type I. B. 1. a.; 3 – Type I. A. 2.-3. b. (drawings by M. Chernyavskiy (Chernyavskiy 1992); photos by A. Vashanau, A. Malyutina and M. Tkachova).

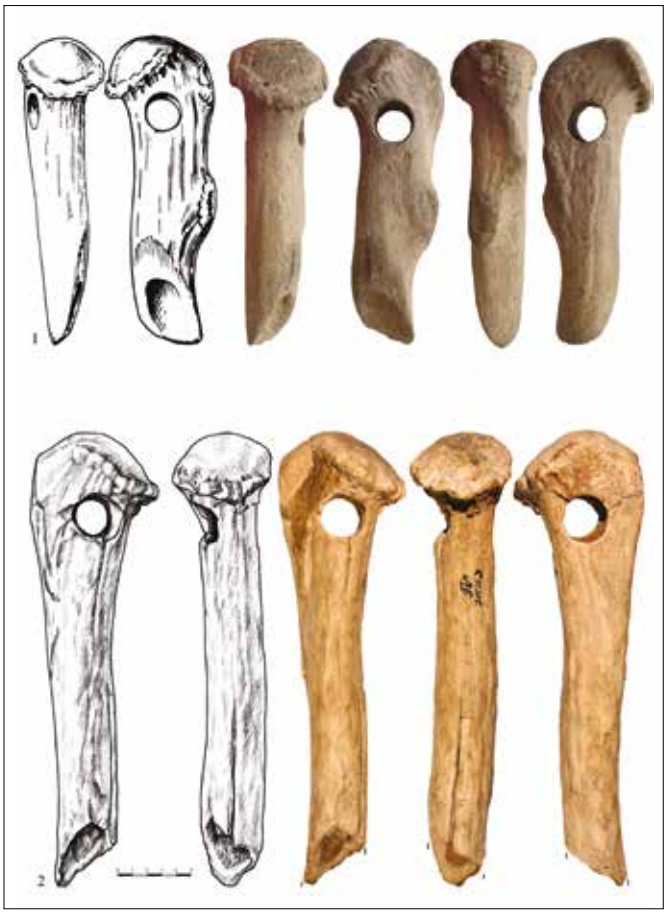

Fig. 4. Smarhon area. Michnievichy. Red deer antler tools with holes. 1 – Type I. A. 2. b.; 2 – Type I. A. 2. d. (drawings by M. Chernyavskiy (Chernyavskiy 1992) – 1, V. Petrushenka – 2; photos by N. Kiziukievich – 1, A. Vashanau, A. Malyutina and M. Tkachova – 2).

Fig. 5. Smarhon area. Klidzianiaty. Red deer antler tool with a hole. Type I. B. 2. a. (drawing by V. Petrushenka; photo by M. Chernyavskiy).

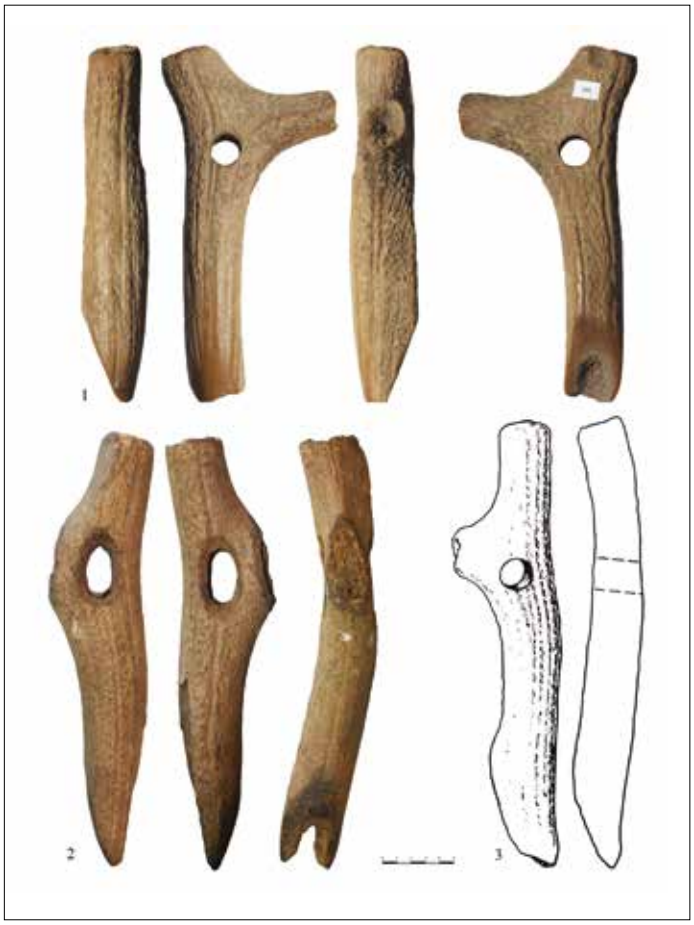

Fig. 6. Smarhon area. Michnievichy. Red deer antler tools with holes. 1 – Type I. B. 2. b.; 2, 3 – Type I. B. 2. c. (drawings by M. Chernyavskiy (Chernyavskiy 1992); photos by A. Vashanau and M. Tkachova).

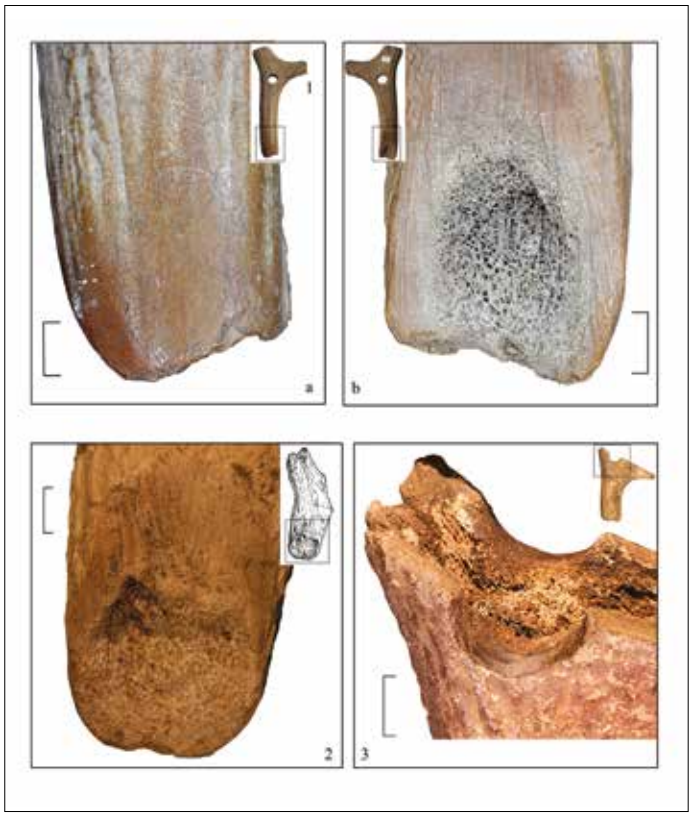

Fig. 7. Smarhon area. Michnievichy. Red deer antler tools with holes. 1: a, b – Type I. B. 2. b. Macrophotograph of traces of use; 2 – Type I. B. 4. c. Macrophotograph of working edge; 3 – Type I. B. 2. d. Macrophotograph of the hole with non-utilitarian traces of use (photo by A. Malyutina).

outer antler layer, large flakes on both planes of the blade, numerous large linear traces moving away from the blade edge, dense intensive polishing of protruding surface areas (Fig. 7.1.a,b). The asymmetry of the working end and the central maximum reduction of the blade edge caused by the usage of the tool are clearly visible. The character of the traces evidently points to a long use for work with hard materials (according to the experimental observations of this article's authors, such macro wear of the working blade occurs when cutting hard wood; the bevelled blade is placed upwards during work). In addition to the exploitation wear, traces of wear on the tool were recorded on the surface of the hole on all its sides, on the protruding sections of the end, which is associated with friction from the attachment of the tool in the handle. A similar item is known only from a publication.[31]

I. B. 2. c. The following type of item (n=1), made from the medial part of a red deer antler rod, differs from the previous type by the location of the working blade (Fig. 6.2, Table 1). A cut (not drilled) oblong hole positioned frontally is offset towards one end of the item. The third tine is chopped off almost at the level of the antler rod. The working end, asymmetrically bevelled, is parallel to the attachment of the handle. Another artefact of this type is known from the territory of the UK.[32]

I. B. 2. d. This type of artefacts includes fragmented items (Figs 3.1; 8, Table 1) (n=3). Distinctive features include the choice of the preform (medial part of a red deer antler rod) and the frontal location of the hole with a (likely) offset of its position closer to one end. On the surface of one fragmented piece, clear traces of hole drilling remained (Fig. 7.3) which were heavily smoothened by wear (as a result of the tool's attachment). Significant fragmentation of the item makes it difficult to find analogies for this artefact.

I. B. 4. c. The most numerous type of red deer antler tools discovered during the exploration of the Smarhon pit (n=7) (Figs 9–13, Table 1). Together with the finished tools of this type, we have at our disposal a considerable amount of waste from their production in the form of fragments of basal parts of the antler and rods with crowns (Figs 14–16). This allows us to reconstruct the technology of their production quite accurately. Thus, closer to the socket, on one side of the rod, a groove was cut which reached the spongy substance of the antler, and then the basal part of the antler was broken off. On the opposite end, a ring groove was chopped or sawn, along which the rod with the crown were removed. The third, central tine was sawn off or chopped off along the groove. The hole was then cut through it. Before drilling, the side

Fig. 8. Smarhon area. Michnievichy. Fragments of red deer antler tools with holes. Type I. B. 2. d. (photo by A. Malyutina, M. Tkachova).

[31] Chernyavskiy, Kalinovskiy 1972, fig. 6.3.

[32] Elliott 2015, fig. 4.60.176.299.

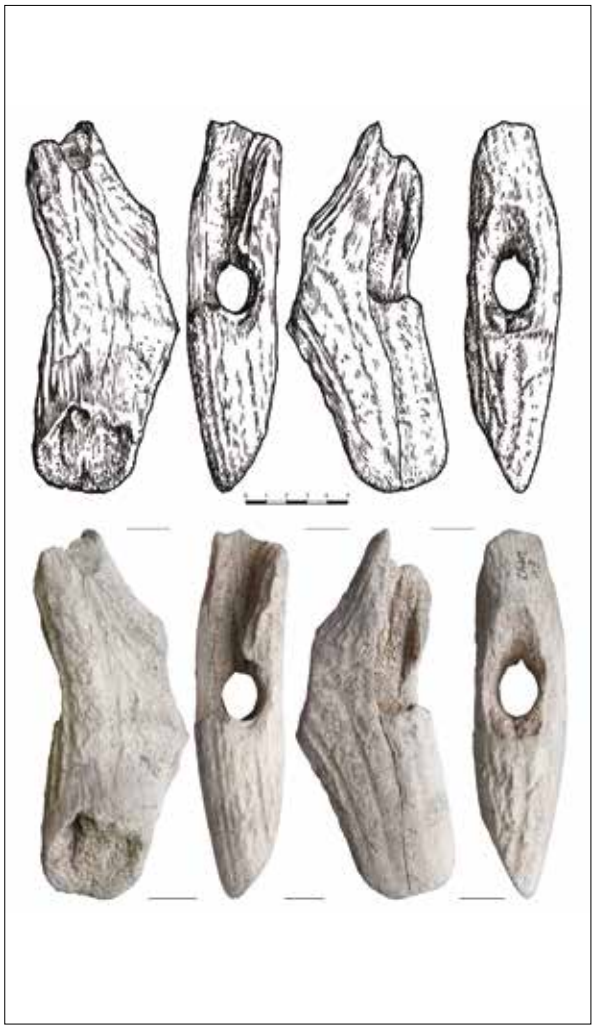

Fig. 9. Smarhon area. Michnievichy. Red deer antler tool with a hole. Type I. B. 4. c. (drawing by V. Petrushenka; photo by A. Vashanau).

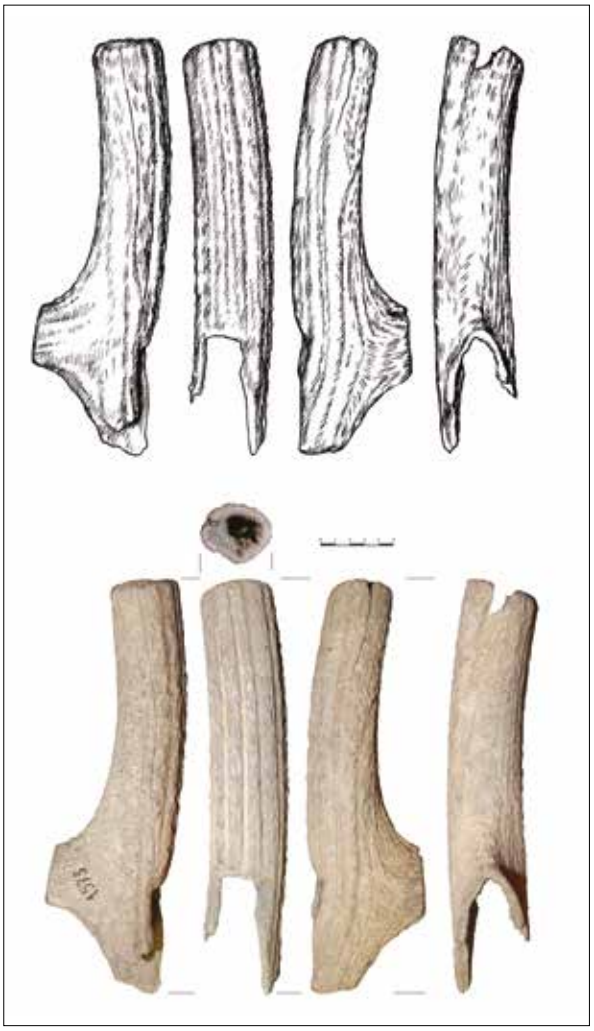

Fig. 10. Smarhon area. Michnievichy. Fragment of red deer antler tool with a hole. Type I. B. 4. c. (drawing by V. Petrushenka; photo by A. Vashanau).

face of the antler rod was flattened by means of scraping. Since the shapes of the holes are different in all cases – from round to elongated, we can assume that the technique of manufacturing the holes could combine both manual cutting of the antler sponge mass and mechanical drilling, if a pre-prepared flat surface was available.

Thus, the features that are common for all instruments of this type include the choice of the medial part of the antler for the preform, and the location of the hole in the side plane with an offset, usually towards one end. The working blade is oriented in parallel to the attachment of the handle. The existing examples bear no traces of use. All tools have a highly eroded surface (Fig. 7.2).

Among the materials from central and northern European archaeological sites, this type of item is known as a T-shaped axe, the manufacturing technology of which is clearly defined by standardisation. Similar tools were found in the territory of south-western Belarus,[33] Poland,[34] Lithuania,[35] Latvia,[36] Ukraine,[37] Russia,[38] France[39] and the UK.[40]

[33] Vashanau 2019.

[34] Wiślański 1979, fig. 135.22; Ilkiewicz 1989; Grygiel, Bogucki 1990; Pawlata 2006, 202, 203, table I.1, 4; 2008, 123, fig. 7.1; Ilkiewicz 2009/2010, 39, fig. 8.2-3; Kabaciński *et al*. 2014.

[35] Rimantienė 1971, 167, fig. 145.3; Girininkas 2015, 74, pav. 61; Piličiauskas *et al.* 2015.

[36] Bērziņš *et al.* 2016.

[37] Danilenko 1985, 123, fig. 31.7; Chernysh 1996a, 21, fig. 1.77; 1996b, 28, fig. 3.13; Tovkaylo 2005, 29, fig. 44.1.

[38] Timofeyev 1981.

[39] Ducrocq 2001, 196, 197, fig. 178.

[40] Smith 1989, 278, fig. 4b.

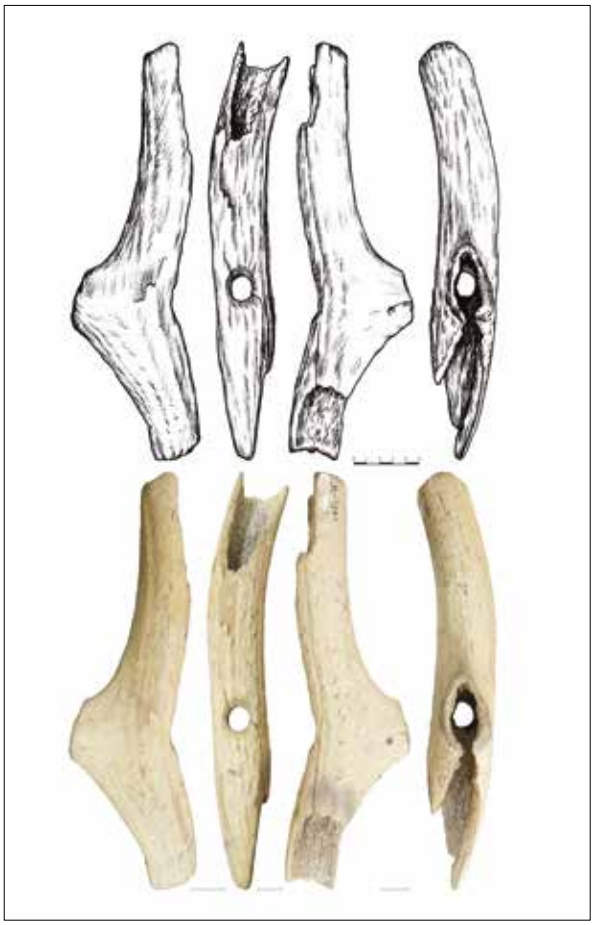

Fig. 11. Smarhon area. Michnievichy. Fragment of red deer antler tool with a hole. Type I. B. 4. c. (drawing by V. Petrushenka; photo by A. Vashanau).

Fig. 12. Smarhon area. Michnievichy. Red deer antler tools, fragments with holes. Type I. B. 4. c. (drawings by V. Petrushenka – 1, M. Chernyavskiy – 2, 3 (Chernyavskiy 1992); photos by A. Vashanau).

I. C. 2. b. A single object (n=1) (Fig. 17.1, Table 1) from the distal part of a red deer antler (the rod passing into the crown) unfortunately survived in a poor state of preservation. The drilled hole is located in the frontal position with an offset towards one end. The working end, asymmetrically bevelled, is oriented perpendicularly to the attachment of the handle. The fragmentation of the item makes it difficult to find analogies to this artefact.

I. C. 2. d. A single specimen (n=1) (Fig. 17.2, Table 1) represented by an item most likely made from the distal part of a red deer antler. The partially preserved hole is located in the front. The working end is missing.

I. D. 2. c. A group of items with a drilling, for which red deer antler tines were used as a preform, is represented by a single item (n=1) (Fig. 17.3, Table 1). The tine is separated from the rod by pre-chopped grooves. The hole is located in the frontal position with an offset towards one end. Before drilling, the plane of the antler was cut and flattened. The asymmetrically bevelled working blade is parallel to the attachment of the handle. Such artefacts are known from the territory of Denmark,[41] Ukraine,[42] Romania[43] and northern Belarus.[44]

Type **II** (Table 1) includes items with drilled holes for which elk antler served as raw material.

II. A. 1. b. One tool (n=1) was made from the basal part of an elk antler (Fig. 18, Table 1). A hole was drilled in the frontal plane of the antler. The hole is offset towards one end. The symmetrically bevelled working blade is oriented perpendicularly to the attachment of the handle. The item seems to have been used for a long

[41] Płonka 2003, 354, 356, figs 27.3, 29.
[42] Danilenko 1985, 120, fig. 30.11; Peleshchin 1985, 274, fig. 72.15; Sveshnikov 1985, 286, fig. 74.5.
[43] Płonka 2003, 355, fig. 28.2.
[44] Chernyavskiy 2007, 52, fig. 22.4.

Fig. 13. Smarhon area. Michnievichy. Red deer antler tool with a hole. Type I. B. 4. c. (drawing by V. Petrushenka; photo by A. Vashanau).

Fig. 14. Smarhon area. Michnievichy. Fragment of a preform of a red deer antler tool. Type I. B. 4. c. (drawing by V. Petrushenka; photo by A. Vashanau).

Fig. 15. Smarhon area. Michnievichy. 1 – Preform of a red deer antler tool; 2 – Red deer antler. Production waste (photos by A. Vashanau and A. Malyutina).

time and to have undergone a number of changes – on the wide butt end of the tool, a contour of the previous hole is clearly visible. Apparently, a part of the tool was lost in the course of its use. To avoid having to produce an entirely new one, the owner chose to drill a new hole in the existing fragment. Unfortunately, the traces of use on the bevelled working end were not preserved. The authors of this article are not aware of any similar artefacts at the moment.

II. B. 1. b. From the medial part, closer to the natural edge of the antler shovel, the preform for another special type (n=2) of tools (Fig. 19.1, Table 1) was cut or chopped (no traces of production were preserved). The hole is drilled in a wide, frontal plane, and offset towards one end. The asymmetrically bevelled working blade is sharpened at the opposite end. The blade is oriented perpendicularly to the attachment of the handle. The working blade was sharpened (or resharpened) by planing (barely visible traces remain on the artefact's surface). It is important to note the exceptional length and marked narrowing of the working end. Apparently, this form of working blade existed due to the specific use of

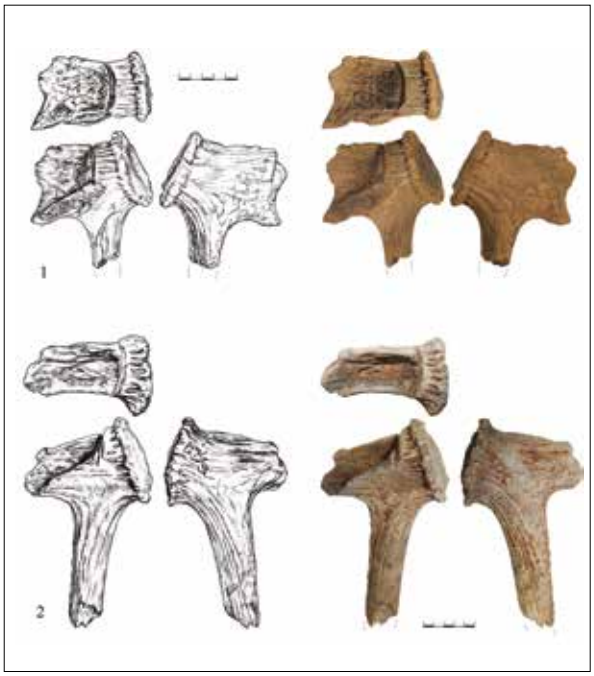

Fig. 16. Smarhon area. Michnievichy. Red deer antler. Production waste (drawing by V. Petrushenka; photo by A. Vashanau).

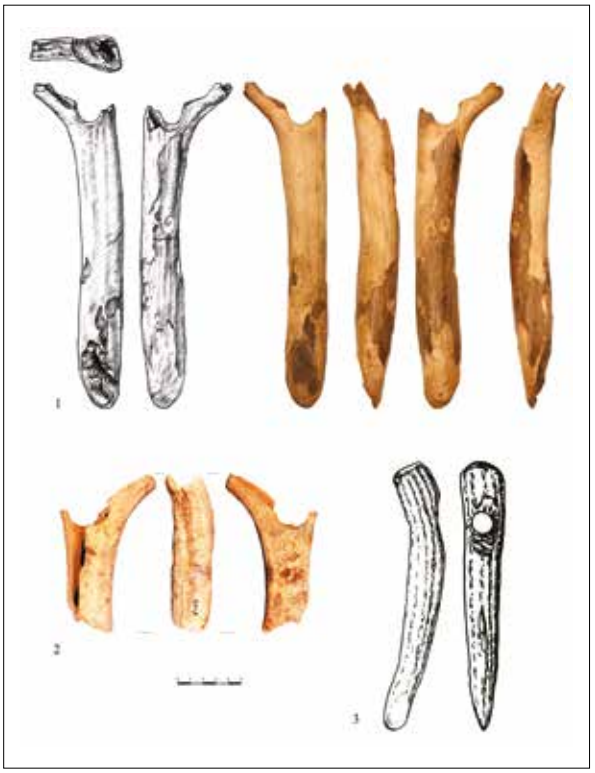

Fig. 17. Smarhon area. Michnievichy. Red deer antler tools, fragments with holes. 1 – Type I. C. 2. b.; 2 – Type I. C. 2. d.; 3 – Type I. D. 2. c. (drawings by V. Petrushenka – 1, M. Chernyavskiy (Chernyavskiy 1992) – 3; photos by A. Malyutina).

tools (possibly for digging, loosening, or breaking ice or soil). Unfortunately, a more detailed analysis of the function of this item is not possible due to its poor state of preservation. A heavily deformed object with a hole in the frontal plane is, probably, the same type of item (Fig. 19.2). Such artefacts are known from southern Belarus.[45]

II. B. 2. d. Among the remarkable items with drilled holes from an elk antler shovel, there is one object in the collection of artefacts from the Smarhon pit (n=1) which is difficult to attribute to any of the utilitarian instruments or their preforms, so we distinguish it in a separate subtype (Fig. 20; Table 1). Despite the artefact's poor state of preservation, there are slightly noticeable cut marks on its surface, on three sides. We can assume that this is a heavily modified artefact, which was reworked from what was originally a different type of object. No straight analogies have been found for this type of item. The antler artefacts from the Nizhneye Veretye site in north-western Russia are the closest morphologically.[46]

II. AB. 1. c. Another unique type of tool in which the drilled hole was chopped or cut (no traces of production have been preserved) from the basal, passing into the medial (shovel), part of an elk antler (Fig. 21, Table 1). This product's distinctive feature is the location of the hole – frontally, in the central part of the tool. As is the case with **type II. B. 1. b**., the working end of the product is elongated and narrowed. However, the asymmetrically bevelled blade remains parallel to the attachment of the handle. Unfortunately, the surface of the object is heavily eroded and no trace of use has been preserved.

Ornamented 'wands' (*bâton de commandement*) (Figs 22, 23; Table 1) which are also made of elk antler hold a special place in the collection. Due to the heavy processing of the items, it is difficult to say which part of the antler shovel was used as a preform, so we defined it as a separate **E** subtype.

II. E.3. b. The first 'wand' is preserved almost entirely and resembles a zoomorphic image of an elk's head (Fig. 22). The degree of the item's secondary treatment does not allow us to unequivocally describe the fragment of the antler shovel selected for the future preform (our version is shown in the scheme – Fig. 22.a). A hole for fixing it to a rod/shaft was cut out at one end, in the side face of the object (Fig. 22.e). The hole is offset towards one end of the item. A 'neck' was carved out of the antler

[45] Kryval´tsevich 1996, 158, 159, fig. 5.5; 2009, 137, fig. 1.

[46] Oshibkina 2006, 212, figs 7, 9.

Fig. 18. Smarhon area. Klidzianiaty. Elk antler tool with a hole. Type II. A. 1. b. (drawing by V. Petrushenka, M. Chernyavskiy (Chernyavskiy 1992)).

Fig. 19. Smarhon area. Michnievichy. Elk antler tool with a hole, fragment of tool. Type II. B. 1. b. (photo by A. Malyutina and M. Tkachova).

and then, at an angle to it, a 'muzzle' with a designated protrusion – 'ear'. The entire surface of the item was then polished and planed. The tip of the 'muzzle' was partially destroyed. Unlike the second 'wand' (Fig. 23), this item has no glossy shine, which is probably due to the acidic environment of the soil in which the item was found. The artefact is ornamented. Two parallel 'herringbone' or chevrons lines were carved on one of the wide sides using a stone cutter (Fig. 22.c) (Motive A5 after Płonka);[47] on the opposite side, two parallel blurred lines of zigzags were cut. Here, next to the 'ear', two triangles filled with parallel lines were placed (a schematic image of a building?) (Fig. 22.b) (Motive D2 after Płonka).[48] On the lower lateral edge, under the 'muzzle', there is one zigzag line with preserved black paint (Fig. 22.d) (Motive A24 after Płonka).[49] No traces of use were found on the object. An artefact very similar in morphology is known from the territory of Finland.[50]

II. E. 4. b. The second 'wand' (Fig. 23) is partially preserved. It appears that we have half of the item which was broken along a hollow cut out in its side. One end of the preserved fragment is rounded. The opposite end, on the side face, has a hollow cut (it could probably have been an inside-out hole, but the fracture that went through this part does not allow us to judge for sure). The entire surface of the object was polished (Fig. 23.b), giving the object even facets. The smooth, shiny surface was formed after polishing. It is possible that the object acquired its gloss after additional operations (e.g. soaking in fat or oils, a method which has been proven for Neolithic antler items from the settlement on Lake Zürich, Switzerland).[51] All faces of the object are decorated with geometric ornamentation. On the side faces, the ornament has a form of cuts (Fig. 23.c,d) (Motive A1 after Płonka)[52] and 'grids' of lines (Fig. 23.a) (Motive A1+G1 after

[47] Płonka 2003.
[48] Płonka 2003.
[49] Płonka 2003.
[50] Mannermaa 2016.
[51] Spangenberg *et al.* 2014.
[52] Płonka 2003.

Fig. 20. Smarhon area. Michnievichy. Elk antler tool (?) with a hole. Type II. B. 2. d. (photo by A. Malyutina).

Płonka),[53] and on the wide sides it takes the form of zig-zag lines parallel to each other, echoed by a line of drilled recesses (Fig. 23.b) (Motive A24+H3 after Płonka).[54]

Summary

As a result of the traceological analysis of thirty antler tools with drilled holes, preforms, and production waste, the methods of processing red deer and elk antlers were determined. In the preserved tools, the red deer antler was used in its entirety – from the base to the tines. It is possible that the morphometry of future tools was predetermined by the selection of the part or fragment of the antler used for their production. The choice of antler fragment also dictated the technology of its processing and, most likely, even the functional specification of the finished product. The elk antler preforms were most commonly made of the broad medial part (shovel). The elk antler items at our disposal are singular, unique finds, some of which are heavily-worn, modified objects or items of non-utilitarian nature (*bâton de commandement*).

Following the traceological analysis of the materials from the Smarhon quarries, as well as typological sequences created by archaeologists for western and northern Europe, we have offered our own typology for perforated antler tools. According to this scheme, the entirety of the Smarhon complex of antler tools with drilled holes can be divided into thirteen types. Four more types are represented by heavily fragmented objects which cannot be matched with any other type. The original selection

Fig. 21. Smarhon area. Michnievichy. Elk antler tool with a hole. Type II. AB. 1. c. (photo by A. Malyutina and M. Tkachova).

of the type of raw material was used as the basis for the sequence proposed here. Further differentiation is based on the selection of the specific part of antler which was to be used as a preform for the final tool – basal, medial, distal, or tines. According to the location of the drilled hole and the working end, the objects were further classified as belonging to one of four groups. However, the

[53] Płonka 2003.

[54] Płonka 2003.

Fig. 22. Smarhon area. Klidzianiaty. Bâton de commandement. Type II. E. 3. b. (macrophotograph by A. Malyutina).

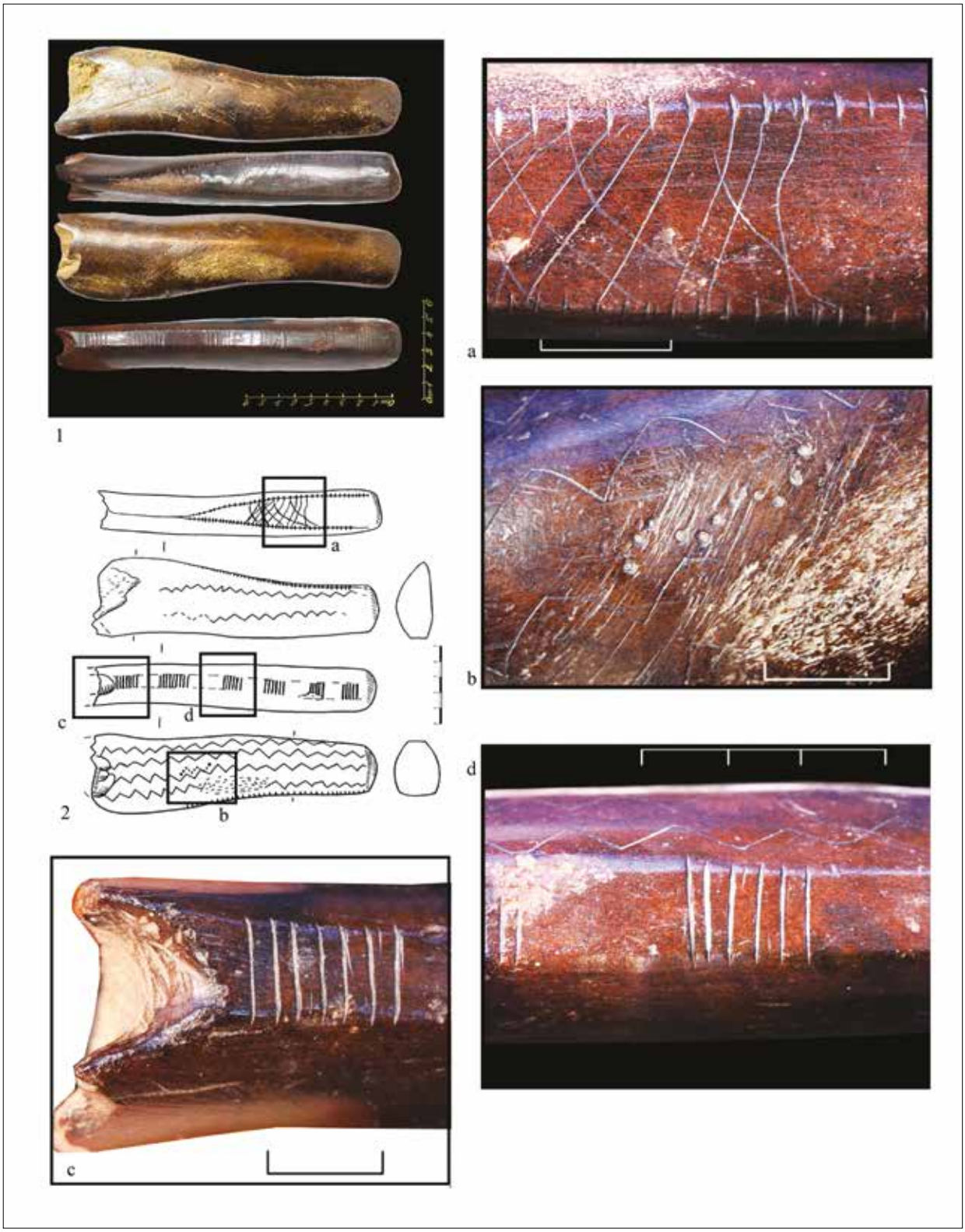

Fig. 23. Smarhon area. Michnievichy. Bâton de commandement. Type II. E. 4. b. (macrophotograph by A. Malyutina).

question of the relation between the type and function of a tool remains open. Out of the thirty tools, we were able to identify the function of only one (wood-cutting). It is obvious that to answer this question we must turn to analogous materials preserved in a better state and conduct further experimental investigations.

The analysis performed has revealed a significant typological diversity of the material. Some of its variations have close analogies in north-western and central parts of Europe, which can imply close contact between the ancient populations of these vast territories. The initiated direct dating of selected type-forming items from the Smarhon complex will allow more detailed analyses of the cultural and historical context of such relations and interactions.

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