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An Early Neolithic Bone and Antler Industry of Rakushechny Yar on the Lower Don: Technological Strategies and Functional Context

The Early Neolithic site of Rakushechny Yar on the Lower Don evidences successive peopling of the coastal zone in the 6th millennium BC. Analysis of faunal remains, toolkit, and limited technological contexts suggest seasonal orientation of the site shown at least at the early stages. We present the results of the analysis of the Early Neolithic bone tools from Rakushechny Yar layers 23–11 of excavation I, and assess their place in the context of bone industries of the contemporaneous archaeological cultures. The collection is dominated by points. Despite the variable morphology, their preforms and manufacturing techniques are rather standard. Apart from points, two spatula-like tools and two specimens with beveled edges, made from red-deer antler, were found. A limited typological and functional set reveals a peculiar subsistence activity. The traceological analysis has highlighted a stable series of tools for working skins and processing coarse vegetable materials (possibly for basket weaving). Spatula-shaped tools were likely destined for processing mineral materials such as ceramics. Certain typological and technological parallels are found in the Northern Caspian and the Lower Volga regions, but especially in the Southern Caucasian Neolithic (Aratashen-Shulaveri-Shomutepe) traditions possibly originating from those of the Levant and Zagros.

Keywords: *Early Neolithic, bone industry, Rakushechny Yar, technological traditions, functional context, traceology.*

Introduction

Rakushechny Yar, in the Lower Don region, is a multilayered Neolithic site showing a unique preservation of Early Neolithic complexes. From the 1960 to 1970s, several trenches and excavations I–V were established; of these, excavation I is the most representative for studying the Early Neolithic layers 23–11 (Fig. 1) (Belanovskaya, 1995), dating back to ca 5600–5400 BC (Bondetti et al., 2021).

Spatial distribution analysis shows a change in the structure of the site from seasonal settlements of the coastal zone with small household areas, sometimes paved with shell valves (layers 23–18), to residential structures with clay paved floors, ground hearths, and plastered walls/roofs, as well as utility structures (layers 17–11) (Dolbunova et al., 2021). The Neolithic collection contains a functionally limited and rather uniform set of bone and stone implements and pottery. Stone items are dominated by blanks and ready-made tools brought to the site. Clay vessels were probably made *in situ*, some of which were used for processing products of aquatic origin, possibly for preparing fish glue (Bondetti et al., 2021; Dolbunova et al., 2020).

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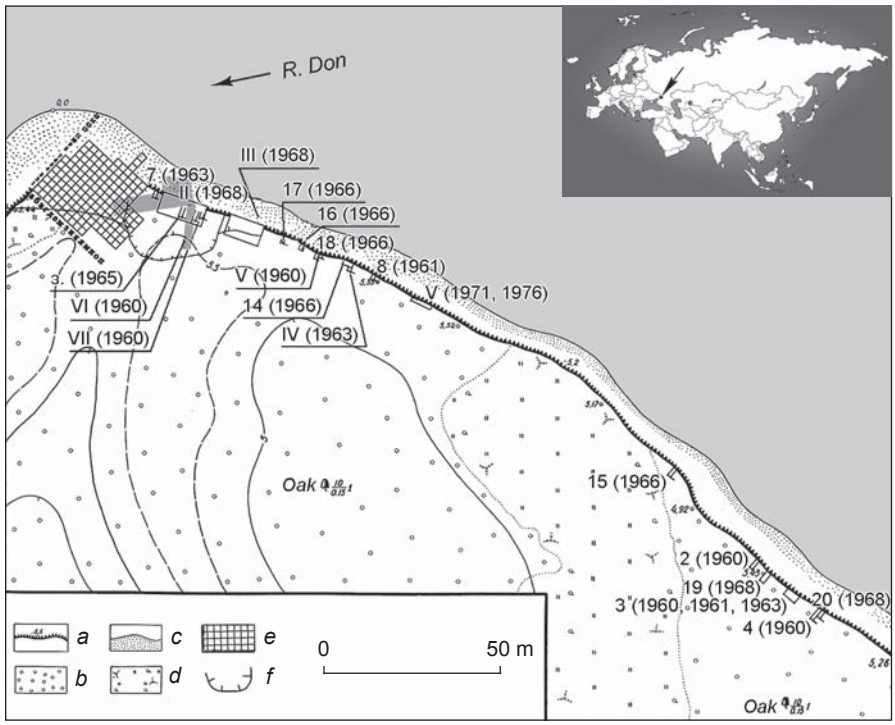

Fig. 1. Location of Rakushechny Yar, with excavations and clearings indicated (numbering after (Belanovskaya, 1960, 1962, 1965, 1977, 1995)).
a – coastline in the 1960s; *b* – forest; *c* – sand; *d* – meadow; *e* – excavation I (1012 m^2); *f* – trench in the area of excavations I and II.

We present the analytical data on the technology, morphology, and functions of bone and antler items from the Early Neolithic layers 23–11 of excavation I, and the possible influence of the highly specialized orientation of the site on the toolset. These materials are considered to be of particular value for understanding the processes of distribution of the most ancient Early Neolithic cultures in the south of Eastern Europe and identification of their origins.

Materials and study methods

The collection of bone items includes 40 tools, six waste products, and three blanks; that of antler items, three tools. The largest number of bone implements was found in layers 13 and 11 (see *Table*). The tools were manufactured on long bones, mainly metapodia and ribs of small ruminants and large ungulates (mostly red deer). One tool is made from a bird bone. Faunal remains from excavation I show the same set of animal species (Belanovskaya, 1995: 151).

Technological and functional analyzes were based on the principles developed by S.A. Semenov. The functions of tools are reconstructed on the basis of traceology—the study of macro- and microtraces resulting from the use of tools, and comparing them with traces on experimental specimens (Semenov, 1964). The surfaces of the products were examined using a Leica EZ4 binocular and an Olympus BHMJ microscope with ×10 / 0.30 UMPlanFI, ×20 / 0.40 LMPlanFI lenses and additional LED lighting, based on the analysis of acetate imprints of the objects. The photographs were taken with a Canon EOS 550D and processed by Helicon Focus 7.6.3 software.

Description of tools: manufacturing technology and morphology

Bone tools. The majority of the bone tools are points (Fig. 2); more than 80 % of the assemblage (*n*=39). Many points are fragmented; only their distal ends have survived. The dimensions of complete points range from 4 to 12 cm. On the basis of technological (for a description of the blank preparation technique, see: (Maigrot, 2003: 79–83)) and morphometric criteria (shape and cross-section), the points have been classified into six groups (see *Table*).

Group 1 (*n*=9; layers 21, 20, 12, and 11). The points were made on bone flakes—diaphyseal fragments of long bones or fragments of ribs of small ruminants (Fig. 3, *12*, *16*; 4, *8*, *10*, *12*; 5, *7*, *9*, *11*, *14*). The blanks were produced through percussion flaking; the lateral edges were processed by grinding covering a part of the

surface. The outlines are often uneven, without any specific cross-sectional standard.

Group 2 (*n*=4; layers 14, 13, and 11). The points were made on halves of the ribs of small ruminants (see Fig. 3, *1*; 4, *6*, *9*; 5, *15*). They show symmetrical edges and flattened cross-section. Ribs were grooved; the resulting blanks were ground all over the length.

Group 3. Large points (two pieces from layer 13; one piece from layer 12) were made from red-deer metapodium, divided lengthwise into two parts by grooves (see Fig. 3, *8*, *10*; 4, *7*). The points were processed by grinding. One point is complete, with preserved epiphysis.

Group 4 (*n*=7; layers 13 and 11). The large points were made on wide blanks from metapodia split along cut grooves, and completely processed by grinding. The points are symmetrical; their cross-sections are oval or rectangular (see Fig. 3, *9*, *11*; 4, *3*, *4*; 5, *2–4*).

Two fragments of pointed tools cannot be precisely attributed to group 3 or 4 owing to the lack of a sufficient number of distinctive features (see Fig. 4, *1*; 5, *6*). These tools were fashioned on a diaphysis divided lengthwise into two parts along the prepared grooves.

Group 5. Thin points on long blanks extracted from the diaphyses of long bones. Specimens of this typological group were recovered throughout the profile (layers 20, 16, 14, 13, 11; see *Table*). The points have sub-square or sub-circular cross-sections, ranging in size from 0.4 to 0.8 cm (see Fig. 3, *2*, *3*, *6*, *14*, *17*; 4, *2*; 5, *5*, *8*, *10*, *12*, *13*, *17*). They show thorough preparation and complete modification, so that in most cases it is difficult to identify the bone used and the manufacturing technique. However, the features of some specimens (see Fig. 5, *1*) suggest that the blank could have been produced from a large ruminant (probably, a red deer) metapodium, divided longitudinally into several parts (four or more). The bone was then subjected to flat abrasive processing until the medullary canal disappeared and a solid cortical rod with epiphysis (see Fig. 3, *3*, *6*; 4, *2*; 5, *5*, *8*, *10*, *12*) or without it (see Fig. 3, *2*, *14*, *17*; 5, 17) was produced. Epiphysis may have been removed by cutting or sawing, as evidenced by some of the waste products. The proximal part was completely ground to produce a rounded shape. Three points (layer 11) were decorated (see Fig. 5, *5*, *10*, *12*) by a zigzag, or parallel or intersecting lines made by a flint tool.

Group 6. The points were produced on complete bones (*n*=2): on a long bone of a bird (layer 13; see Fig. 4, *5*) and on a rib of a small ruminant, possibly a roe deer (layer 11; see Fig. 5, *16*). The working edge was shaped through longitudinal scraping.

The only beveled piece is represented by a distal fragment (layer 14; see Fig. 3, *5*). The tool was made

Distribution of morphological/technological and functional groups of bone tools in layers 21–11 (excavation I)

Layer	Points							Waste products	Tool blanks	Beveled tool
	Groups						Undeterminable			
	1	2	3	4	5	6				
21	1	–	–	–	–	–	–	–	–	–
20	1	–	–	–	1 (processing of plant materials)	–	–	1	1	–
16	–	–	–	–	1	–	–	–	–	–
14	–	1	–	–	2 (1 – skin processing)	–	–	–	–	Distal fragment (woodworking)
13	–	1	2 (1 – skin processing)	4 (1 – processing of plant materials)	2	1 (skin processing)	1	4	–	–
12	1	–	1	–	–	–	–	–	–	–
11	6 (1 – skin processing, 1 – processing of plant materials)	2	–	3	6 (2 – skin processing)	1 (processing of plant materials)	1	1	2	–

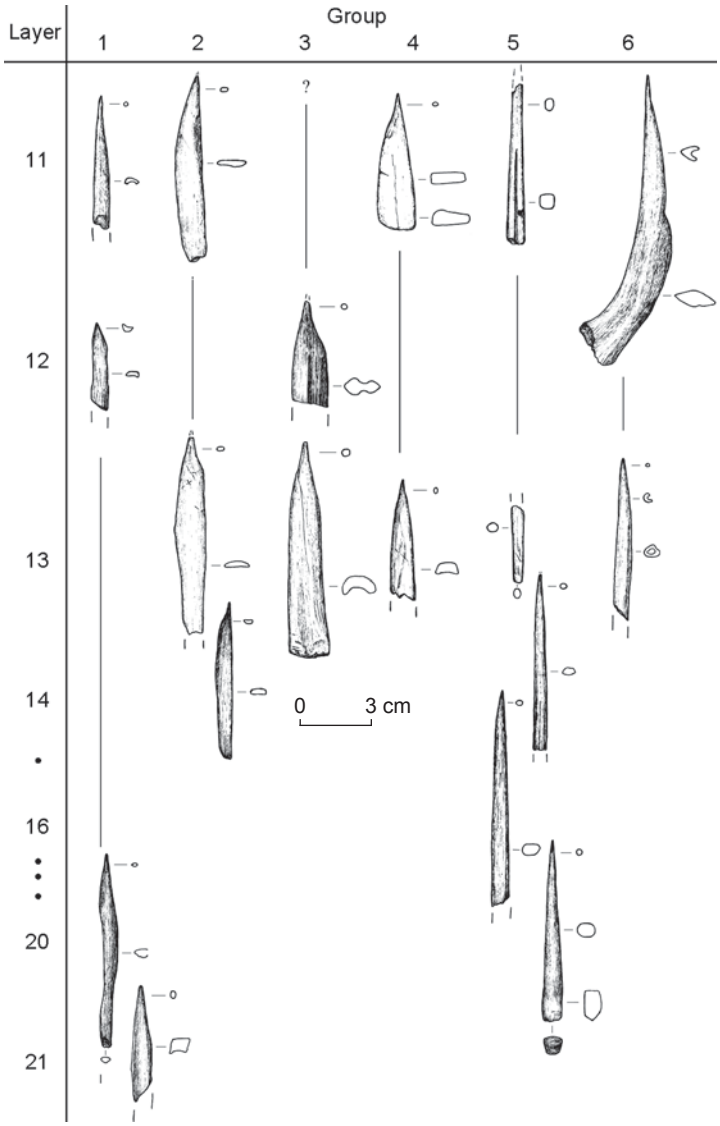

Fig. 2. Morphological groups of bone points.

from the diaphysis of a red deer's metapodium (the technique is undeterminable). The cutting edge was prepared through double-sided grinding. It is straight in side view, reaching 1.5 cm.

Antler tools. Two spatula-shaped items are oval decorated blades (layer 14, 11; see Fig. 3, *4*; 4, *11*). Shaping eliminated traces of primary manufacturing. The ornament consists of lines or small rounded indentations arranged in rows or groups, which run parallel at the ends and middle parts of the exterior surfaces of the items. Sets of shorter notches occur on the side edges. The lines were made with a flint tool. The interior surfaces of the indentations shows concentric circles, indicating the use of a bow-drilling technique with an inserted flint tip (see Fig. 4, *11*).

The item with a beveled edge was made from the basal part of a red deer's antler (layer 11). This tool was produced on shed antlers that fell during molting. The antler beam was cut crosswise (the technique is undeterminable), and a round hole was made in it, probably for a handle. The beveled edge was formed in the course of the tool's use.

Functions of the tools

Most of the tools have not retained their working surfaces; many of them are eroded, which may be due to unstable burial conditions—recurrent drainage of the layers (Dolbunova et al., 2020). Therefore, it was possible to analyze only a small number of the recovered tools (n=20); the functional category was identified for only 11 of them (see *Table*).

Skin processing. Use-wear traces typical of skin working have been noted on six points: four of them were used for piercing (see Fig. 3, *10*; 4, *5*; 5, *8*), and two, for perforation (reciprocating movement) (see Fig. 3, *2*; 5, *10*; 6, *1*, *4*). The length of the working part, which determines the tool's movement, does not exceed 1 cm. This assumes working on skin that was not too thick. Three such tools belong to group 5, the others, to groups 1, 3, and 6 (see *Table*).

Processing of plant materials. This category includes four points (groups 1, 4–6) and a single tool with a beveled working edge (see *Table*). The points bear traces characteristic of working with medium-rigid plants: for example, for weaving baskets (see Fig. 4, *4*; 5, *14*, *16*; 6, *2*, *5*). These tools are flat in cross-section and much larger than those used for skin processing. Use-wear traces cover the entire surfaces of some of these tools, which suggests long-term and extensive use of the points.

Woodworking. A bone tool with a beveled front edge was used for woodworking (Fig. 6, *3*). Its proximal part shows a fracture resulting from bending, which may indicate the presence of a handle.

It was impossible to establish use-wear traces on the deer-antler item because of the poor preservation of its surface. However, the presence of a blunt cutting edge with slight chipping and depressions in the spongy tissue, associated with removals from the inner side of the working surface, and comparison of these signs with the results of traceological analysis of similar tools from other collections (Jensen, 1991, 2001; Maigrot, 2003: 150–154; 2004) suggest its use as an adze for woodworking.

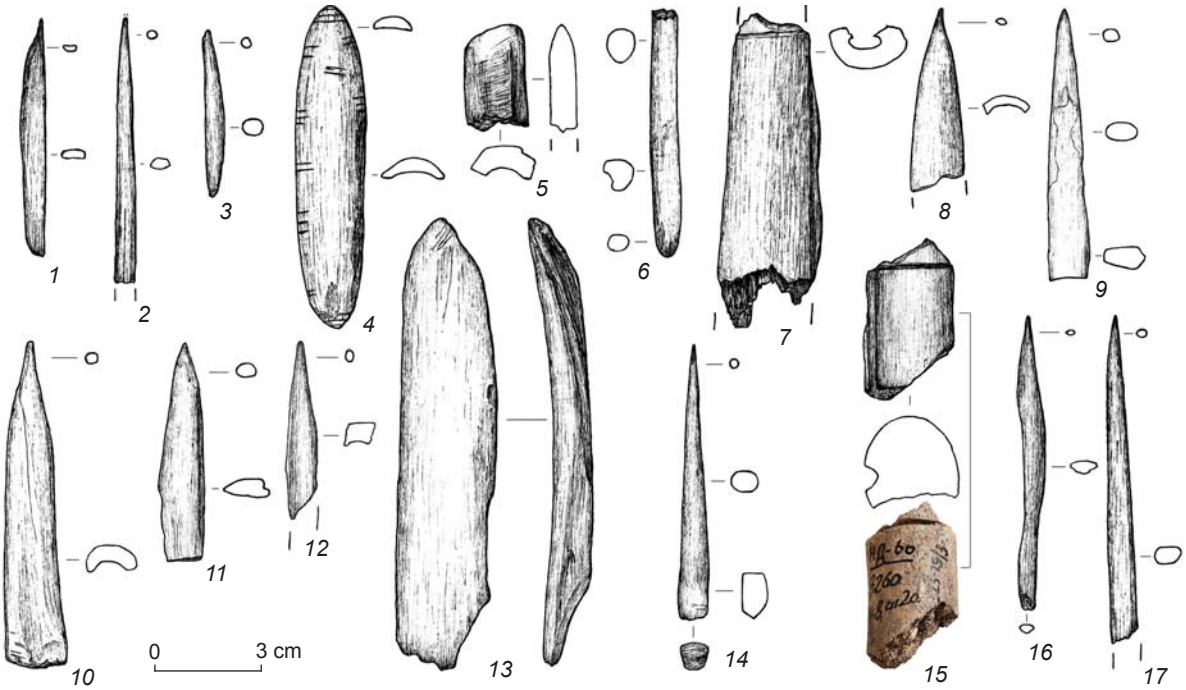

Fig. 3. Bone and antler items.
1 – point from a half rib (group 2); *2*, *3*, *6*, *14*, *17* – thin points made from cortical blank (group 5); *4* – spatula-shaped tool; *5* – beveled tool; *7*, *15* – metapodium fragments bearing traces of transversal sawing; *8*, *10* – points from metapodium halves (group 3); *9*, *11* – points from cortical blank (group 4); *12*, *16* – points on flakes (group 1); *13* – blank of an undeterminable tool from a long diaphyseal fragment. *1–5* – layer 14; *6–11* – layer 13; *12* – layer 21; *13–16* – layer 20; *17* – layer 16.

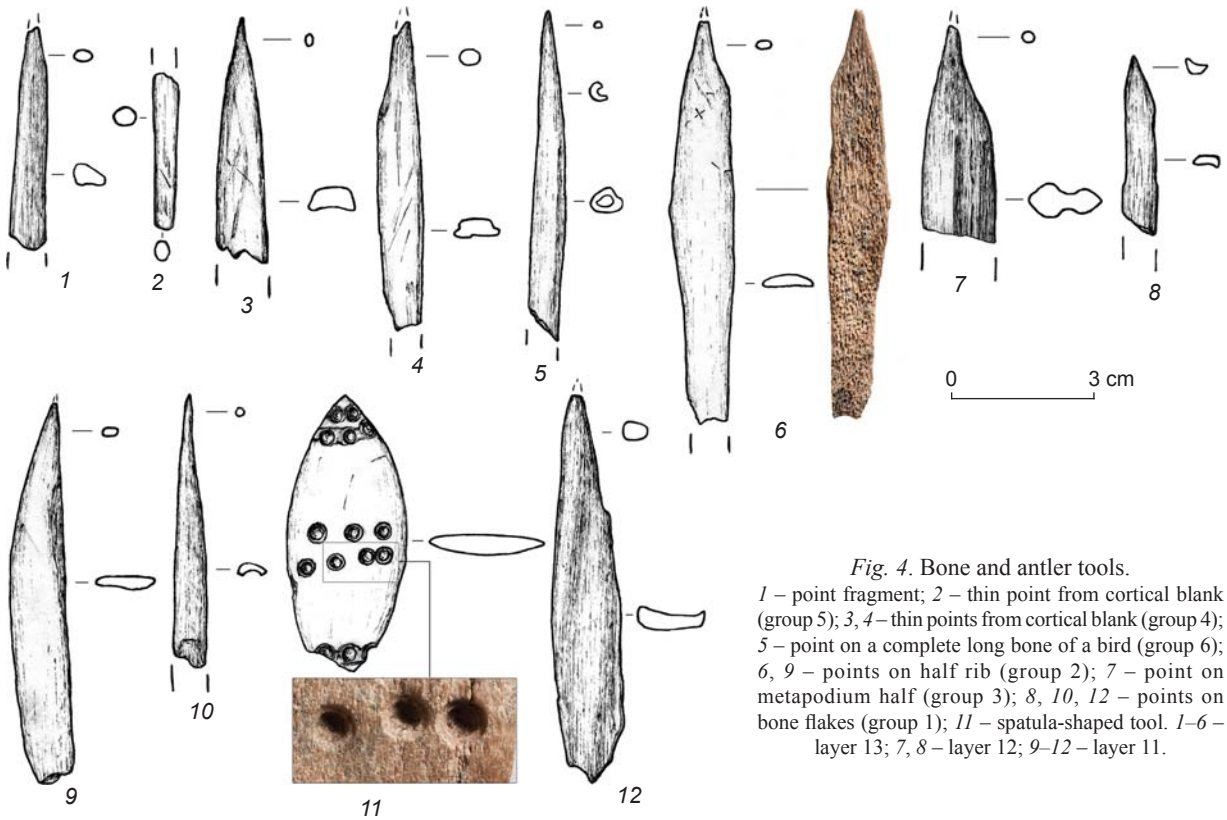

Fig. 4. Bone and antler tools.
1 – point fragment; *2* – thin point from cortical blank (group 5); *3*, *4* – thin points from cortical blank (group 4); *5* – point on a complete long bone of a bird (group 6); *6*, *9* – points on half rib (group 2); *7* – point on metapodium half (group 3); *8*, *10*, *12* – points on bone flakes (group 1); *11* – spatula-shaped tool. *1–6* – layer 13; *7*, *8* – layer 12; *9–12* – layer 11.

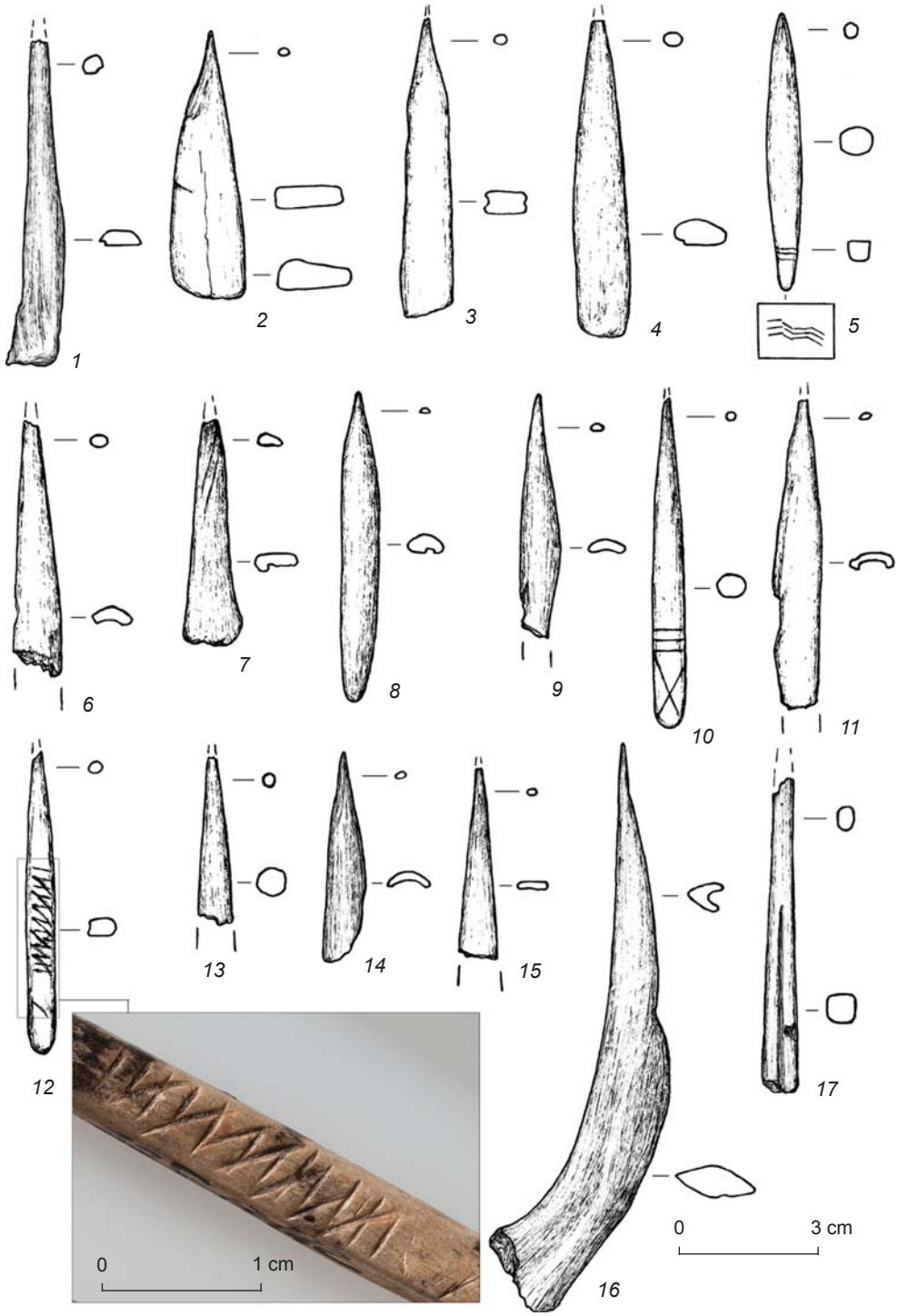

Fig. 5. Bone points (*1–16*) and an antler adze (*17*) from layer 11.
1, *5*, *8*, *10*, *12*, *13*, *17* – group 5 (*1* – preform); *2–4* – group 4; *6* – fragment (undeterminable group); *7*, *9*, *11*, *14* – group 1; *15* – group 2; *16* – group 6.

Functional context

In layers 23–18, few bone tools were found; they were located at some distance from the main accumulations of archaeological materials, or next to flint points (in layer 20). In layers 17–11, bone tools were associated with concentrations of flint tools and grinding plates. Accumulations of bone tools did not coincide with the zones of concentration of faunal remains and ceramic fragments (Dolbunova et al., 2021: Fig. 2–7).

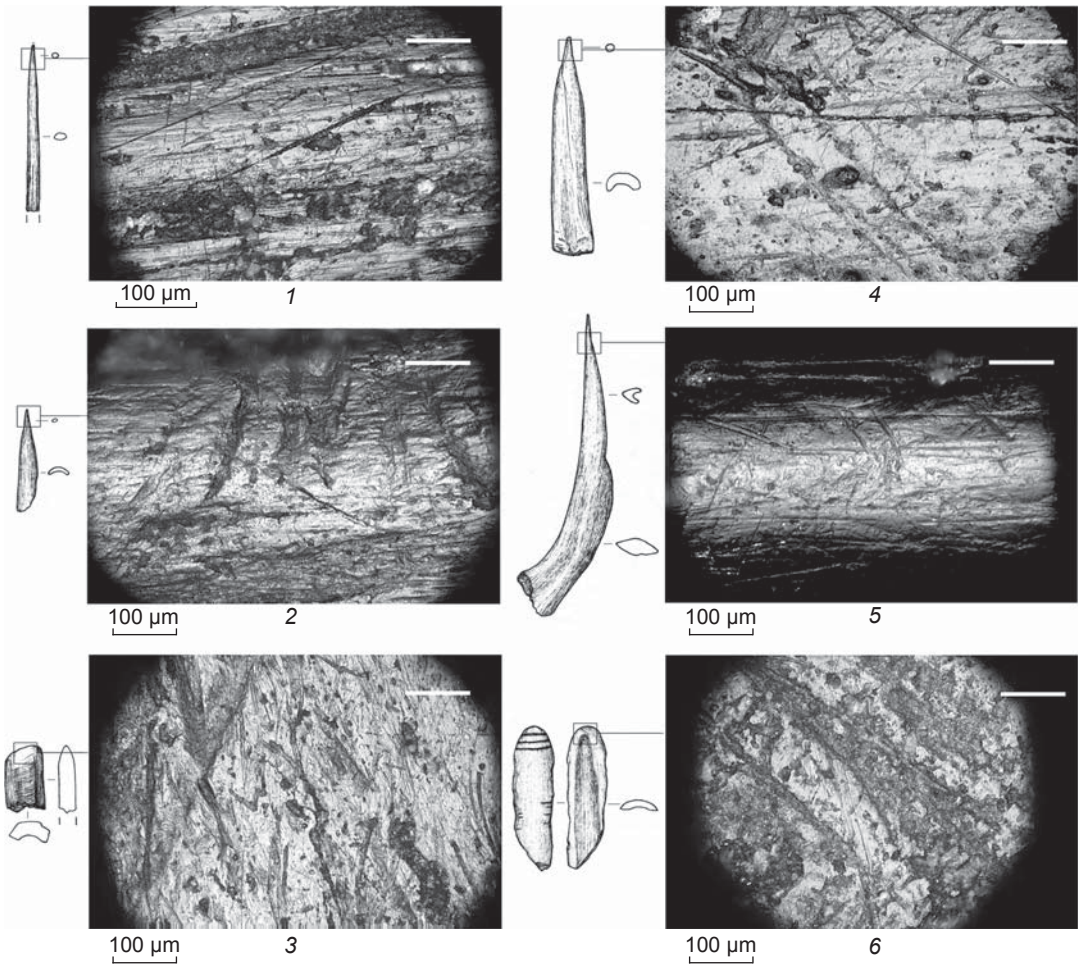

Fig. 6. Macroimages (×200) showing use-wear on artifacts.
1, *4* – skin perforation traces on the points from layers 14 and 13; *2*, *5* – plant-working traces on the points from layer 11; *3* – woodworking traces on the beveled tool from layer 14; *6* – clay burnishing traces on the ornamented spatula-shaped tool from layer 6.

In layer 11, bone points were located together with flint tools (in sq. B/6 and O/6; Fig. 7). Separate sets of bone artifacts were found near the remains of three different dwellings. The points were possibly straightened *in situ*, which is suggested by the tool made from petrified wood with a shallow groove, used to manufacture/modify bone items (Dolbunova et al., 2020: Fig. 11, *2*). A red-deer antler adze was found away from the main concentrations of flint and bone artifacts. During the recent excavations, adzes were also found at some distance from the tool concentrations, often in interlayers of alluvial sand. These may be single items left in the coastal line.

The bone industry did not undergo significant changes over time; the same is true for the flint and ceramic complexes (Ibid.: 124–127). Possibly, this is due to the narrow chronological time period of the archaeological layers. The largest number of bone artifacts was found in the dwelling area of the site (layer 11). Their smallest number in layer 12 may be explained by the peculiarity of the studied area, most of which is occupied by the remains of stake structures (Dolbunova et al., 2021: Fig. 6).

Discussion

Categories of bone and antler items from the Early Neolithic layers 23–11, excavation I, at Rakushechny Yar, continued to exist up to the terminal stage of the Early Neolithic (layers 10–6, bottom of layer 5) (Belanovskaya, 1995: 89–92). The points form the most numerous group in the collection. Tools with beveled frontal edges are rare—even in the upper layers only a few such items were found (Ibid.: 129). Spatula-shaped tools made from animal bones were found in layer 6. Fragments of a tortoise shell from excavation I (layer 10) could have also been used by the ancient population, as indicated by a bowl made from a tortoise shell with a hole found during the recent excavations at Rakushechny Yar (Dolbunova et al., 2020).

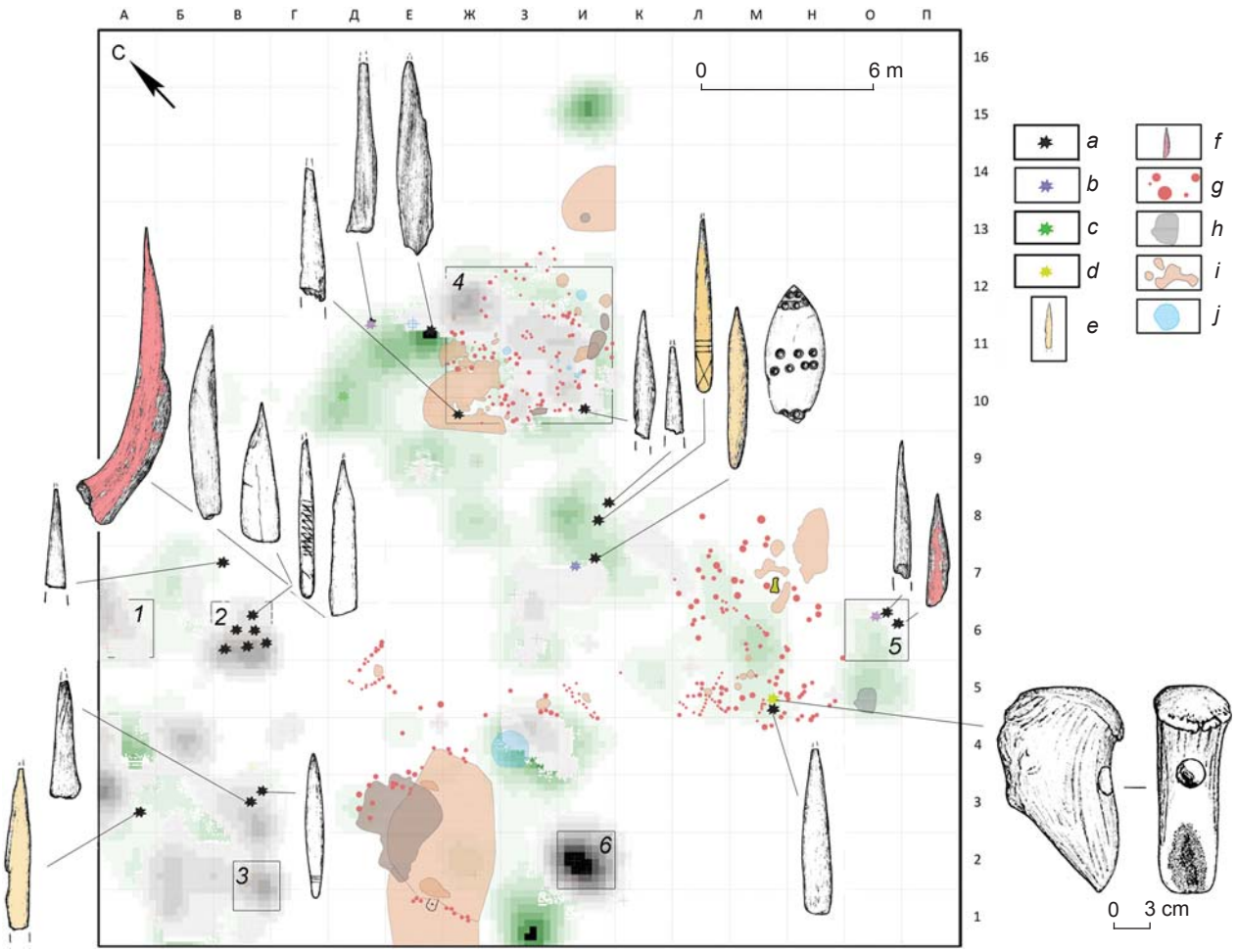

Fig. 7. Distribution of bone artifacts over the site, remains of constructions and objects in layer 11 (concentration of pottery fragments is marked green, that of flint artifacts is marked gray).

1 – concentration of fragments of grinding plates and plummets; *2–4* – grinding plates; *5*, *6* – grinding plates and flint drills. *a* – bone point; *b* – bone blade; *c* – bone flake; *d* – antler adze; *e* – bone point for skin processing; *f* – bone point for working with plant materials; *g* – stake and pole pits; *h* – charcoal pieces and ash concentrations; *i* – clay plastering; *j* – pit filled with shells.

The use-wear analysis revealed several tools for working with skin and rigid-medium plants. Points for skin processing have also been reported from the Northern Caspian and the Lower Volga regions, from the settlement of Baibek (Grechkina et al., 2020), and the site of Varfolomeevskaya (Yudin, 2004: 190). One of the spatula-shaped tools from layer 6 (see Fig. 6, *6*) showed traces suggesting clay working—a microsurface in a small flat area with smoothed high points, and significant linear depressions with a rough bottom (Maigrot, 2010). A similar item, ornamented with incised lines, was found at Varfolomeevskaya (Yudin, 2004: 101). Woodworking tools include an antler adze and a bone bevel.

The parallels to the typological composition of the points and the manufacturing techniques can be found in the archaeological materials from the Northern Caspian and the Lower Volga regions; some parallels can also be traced in the Early Neolithic ceramics of these regions. Points of morphological groups 1 and 2 were widespread in the Near East, Central Asia, and Europe (Le Dosseur, 2006; Stordeur, Christidou, 2008).

Despite the diversity in the morphology of the points, a certain similarity is noted in the types of blanks used and the manufacturing processes (breaking, grooving, extraction, bipartition, etc.). Shaping was carried out by abrading (longitudinal or oblique). The working parts of the points were recurrently sharpened by unifacial (rarely bifacial) scraping. These technological features are distinctive for bone points from the Early Neolithic sites of Transcaucasia (Aratashen-Shulaveri-Shomutepe culture, 6th millennium BC) (Badalyan et al., 2010; The Neolithic Settlement…, 2022: 196–199; Chataigner, 1995: 147–170; Lombard, Chataigner, 2004; Taha, Le Dosseur, 2017). These sites also yielded tools with beveled edges, made from basal parts of deer antlers (Chataigner, 1995: 147–170), which represent a specific

category in the Rakushechny Yar toolkit. Traceological studies showed that they were used in woodworking (The Neolithic Settlement…, 2022: 203; Stordeur, Christidou, 2008), as also similar tools of the Mesolithic and Neolithic of Central Europe (Jensen, 1991, 2001; Maigrot, 2003: 150–154; 2004; Gijn, 2005). Implements made from deer antler have also been reported from the sites of the Lower Volga and the Northern Caspian regions, but these belong to sleeves (Grechkina et al., 2020) or hammerstones (Yudin, 2004).

The ornamentation of bone items is quite simple. The motifs and techniques show parallels in the materials of the Neolithic sites of Transcaucasia (Badalyan et al., 2010) and the Lower Volga (Yudin, 2004: 101). The bone toolkit from Varfolomeevskaya, along with items decorated with notches and pits, contains implements with elaborated ornamental compositions, which are not represented in the Rakushechny Yar collection (Ibid.: 93–96, 100).

Conclusions

The collection of the Early Neolithic bone and antler implements from Rakushechny Yar is dominated by points; whereas spatula-shaped items, tools with beveled edges, and adzes made from red-deer antler are rare. Similar types of artifacts were recovered from different layers; this suggests a narrow chronological period of deposition. A limited typological and functional diversity of the recovered tools is a particularity of this site, and a peculiar technological strategy of the local hunter-gatherers (see also (Dobres, Hoffman, 1994)). Highly productive fishing over a short period of time and fish processing, which determined the local economic specificity, led to the highly specialized toolkits and the absence of a full cycle of manufacturing and secondary working of tools. The functional niche might have been occupied partially by shell tools (see also (Solana, Gutiérrez Zugasti, Conte, 2011)). Changes have been recorded with the emergence of residential contexts—the remains of clay pavements, associated with a more complex toolkit and a more complete technological cycle.

Several parallels to the Rakushechny Yar bone industry can be traced in the archaeological complexes of the Northern Caspian and Lower Volga regions. Noteworthy is the absence of common technological and morphological features with materials from the forest zone of Eastern Europe, which belong to a different typological and technological cultural unit (Miklyaev, 1995; Zhilin, 1994; Maigrot, 2014). The closest typological and technological parallels can be traced in the Early Neolithic of Transcaucasia, originated possibly from the cultures of the Levant and Zagros (Baudoin, Lyonnet, Hamon, 2018; Gorelik, Tsybriy A., Tsybriy V., 2021). These assumptions might indicate the origins of the Rakushechny Yar material culture, which emerged in the south of Eastern Europe in the middle of the 6th millennium BC.

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References

Badalyan R.S., Harutyunyan A.A., Chataigner C., Le Mort F., Chabot J., Brochier J.E., Lalasescu A., Radu V., Hovsepyan R. 2010
The settlement of Aknashen-Khatunarkh, a Neolithic site in the Ararat plain (Armenia): Excavation results 2004–2009. *Tüba-Ar*, No. 13: 185–218.

Baudoin E., Lyonnet B., Hamon C. 2018
Architectural techniques and cultural relationships between the Caucasus and Mesopotamia at the beginning of the sixth millennium B.C. In *From the Caucasus to the Arabian Peninsula: Domestic Spaces in the Neolithic: Proceeding of the International conference: Actes du Collogue international.* Paris: Routes de l'Orient, pp. 49–84.

Belanovskaya T.D. 1960
Otchet o raskopkakh neoliticheskoy stoyanki Rakushechniy Yar u stanitsy Razdorskoy i rabote po Rostovskoy oblasti Severo-Donetskogo arkheologicheskogo otryada v 1960 g. *Archives of the IA RAN*. R-1. 2139.

Belanovskaya T.D. 1962
Neoliticheskoye poseleniye Rakushechniy Yar u stanitsy Razdorskaya Rostovskoy oblasti (raskopki 1962 g.). *Archives of the IA RAN*. R-1. 2508.

Belanovskaya T.D. 1965
Otchet o rabote Nizhnedonskoy arkheologicheskoy ekspeditsii v 1965 g. *Archives of the IA RAN*. R-1. 2560.

Belanovskaya T.D. 1977
Otchet o rabote Razdorskogo arkheologicheskogo otryada v 1977 g. *Archives of the IA RAN*. R-1. 6998.

Belanovskaya T.D. 1995
Iz drevneishego proshlogo Nizhnego Podonya: Poseleniye vremeni neolita i eneolita Rakushechniy Yar. St. Petersburg: SPb. Gos. Univ.

Bondetti M., González Carretero L., Dolbunova E., McGrath K., Presslee S., Lucquin A., Tsybriy V., Mazurkevich A., Tsybriy A., Jordan P., Heron C., Meadows J., Craig O.E. 2021
Neolithic farmers or Neolithic foragers? Organic residue analysis of early pottery from Rakushechny Yar on the Lower Don (Russia). *Archaeological and Anthropological Science*, vol. 13 (8): 141–157.

Chataigner C. 1995
La Transcaucasie au Néolithique et au Chalcolithique. Oxford: Tempus reparatum. (BAR Int. Ser.; No. 624).

Dobres M.-A., Hoffman R.C. 1994
Social agency and the dynamics of prehistoric technology. *Journal of Archaeological Method and Theory*, vol. 1 (3): 211–258.

Dolbunova E.V., Mazurkevich A.N., Larionova A.V., Maigrot Y., Lozovsky V.M. 2021
Rakovinniye platformy i zhiliye konstruktsii: Planigrafiya kulturnogo sloya rannego neolita p. Rakushechniy Yar. *Universum Humanitarium*, No. 2: 58–84.

Dolbunova E.V., Tsybryi V.V., Mazurkevich A.N., Tsybryi A.V., Szmańda J., Kittel P., Zabilska-Kunek M., Sablin M.V., Gorodetskaya S.P., Hamon C., Meadows J. 2020
Subsistence strategies and the origin of Early Neolithic community in the lower Don River valley (Rakushechny Yar site, early/middle 6th millennium cal BC): First results. *Quaternary International*, vol. 541: 115–129.

Gijn A.L., van. 2005
A functional analysis of some Late Mesolithic bone and antler implements from the Dutch coastal zone. In *From Hooves to Horns, from Mollusc to Mammoth: Manufacture and Use of Bone Artefacts from Prehistoric Times to the Present: Poceed. of the 4th meeting of the ICAZ Worked Bone Research Group, Tallinn, 26–31 August 2003*. Tallinn: Tallinn Book Printers Ltd., pp. 47–66. (Muinasaja teadus; No. 15).

Gorelik A., Tsybriy A., Tsybriy V. 2021
The Caucasian route of Neolithization in the Pontic-Caspian region. In *Foraging Assemblages*, vol. 2. Belgrade, New York: Serbian Archaeological Society, The Italian Academy for Advanced Studies in America, Columbia Univ., pp. 720–726.

Grechkina T.Y., Malyutina A.A., Vybornov A.A., Lebedev Y.S. 2020
Kostyaniye izdeliya neoliticheskoy stoyanki Baibek. *Samarskiy nauchniy vestnik*, vol. 9 (2): 132–144.

Jensen G. 1991
Ubrugelige økser? Forsøg med Kongemose- og Ertebøllekulturens økser af hjortetak. In *Eksperimentel Arkaeologi*. No. 1: Studier i teknologi og Kultur. Lejre: Historisk-Arkaeologisk Forsøgscenter, pp. 10–21.

Jensen G. 2001
Macro wear patterns on Danish Late Mesolithic antler axes. In *Crafting Bone: Skeletal Technologies Through Time and Space: Proceedings of the 2nd Meeting of the ICAZ Worked Bone Research Group, Budapest, 31 August–5 September 1999*. Oxford: Archaeopress, pp. 165–170. (BAR Int. Ser.; No. 937).

Le Dosseur G. 2006
La néolithisation au Levant sud à travers l'exploitation des matières osseuses: Étude techno-économiques de onze séries d'industries osseuses du Natoufien au néolithique précéramique B recent: Thèse de doctorat. Université de Paris I. Paris.

Lombard P., Chataigner C. 2004
Le Néolithique et le Chalcolithique en Transcaucasie: L'exemple des bassins de la Kura et de l'Araxe. In *Aux marges des grands foyers du Néolithique: Périphéries débitrices ou créatrices? Séminaire du Collège de France*. Paris: Errance, pp. 63–84.

Maigrot Y. 2003
Etude technologique et fonctionnelle de l'outillage en matières dures animales: La station 4 de Chalain (Néolithique final, Jura, France): Thèse de doctorat. Université de Paris I. Paris.

Maigrot Y. 2004
Les outils en matières dures animales utilisés pour le travail du bois à Chalain station 4 (Néolithique final, Jura). In *Approches fonctionnelles en Préhistoire: Actes du XXV^{ème} Congrès Préhistorique de France, 24–26 novembre 2000, Nanterre*. Paris: Société préhistorique française, pp. 67–82.

Maigrot Y. 2010
Étude comparative de deux séries d'outils en os impliqués dans la production céramique néolithique du Jura: Clairvaux XIV (Néolithique moyen) et Chalain 4 (Néolithique final). *Bulletin de la Société Préhistorique Française*, vol. 107 (4): 737–754.

Maigrot Y. 2014
Kostyaniye orudiya neoliticheskogo svaynogo poseleniya Serteya II (Smolenskaya obl., Rossiya). In *Arkheologiya ozernykh poseleniy IV–II tys. do n.e.: Khronologiya kultur i prirodno-klimaticheskiye ritmy*. St. Petersburg: Periferiya, pp. 214–220.

Miklyaev A.M. 1995
Kamenniy – zheleznyi vek v mezhdurechye Zapadnoy Dviny i Lovati. *Peterburgskiy arkheologicheskiy vestnik*, No. 9: 7–39.

Semenov S.A. 1964
Prehistoric Technology. Bradford-on-Avon: Moonracker Press.

Solana D.C., Gutiérrez Zugasti I., Conte I.C. 2011
The use of mollusc shells as tools by coastal human groups: The contribution of ethnographical studies to research on Mesolithic and Early Neolithic technologies in Northern Spain. *Journal of Anthropological Research*, vol. 67 (1): 77–102.

Stordeur D., Christidou R. 2008
L'industrie de l'os. In *Le site néolithique de Tell Mureybet (Syrie du Nord): En hommage à Jacques Cauvin*. Oxford: BAR, pp. 439–537. (BAR Int. Ser.; No. 1843).

Taha B., Le Dosseur G. 2017
Bone tools as records of regional differences during the Neolithic: A preliminary comparative study between the bone industries at Mentesh Tepe and Kamiltepe sites. In *The Kura Projects: New Research on the Later Prehistory of the Southern Caucasus*. Berlin: Reimer, pp. 399–424. (Archäologie in Iran und Turan; Bd. 16).

The Neolithic Settlement of Aknashen (Ararat valley, Armenia): Excavation seasons 2004–2015. 2022
R. Badalyan, C. Chataigner, A. Harutyunyan (eds.). Oxford: Archaeopress.

Yudin A.I. 2004
Varfolomeyevskaya stoyanka i neolit stepnogo Povolzhya. Saratov: Izd. Sarat. Gos. Univ.

Zhilin M.G. 1994
Nekotoriye voprosy perekhoda ot mezolita k neolitu na Verkhney Volge. In *Problemy izucheniya epokhi pervobytnosti i rannego srednevekovya lesnoy zony Vostochnoy Yevropy*, iss. 1. Ivanovo: [Tip. GU KPK Mintopenergo], pp. 19–31.

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