SIBERIAN BRANCH OF THE RUSSIAN ACADEMY OF SCIENCES
INSTITUTE OF ARCHAEOLOGY AND ETHNOGRAPHY

ARCHAEOLOGY, ETHNOLOGY & ANTHROPOLOGY OF EURASIA

Volume 51, No. 4, 2023

doi:10.17746/1563-0110.2023.51.4 *Published in Russian and English*

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ARCHAEOLOGY, ETHNOLOGY & ANTHROPOLOGY OF EURASIA

Volume 51, No. 4, 2023

Founded in January, 2000
A quarterly journal in Russian and English

Founders

Siberian Branch of the Russian Academy of Sciences

Institute of Archaeology and Ethnography of the Siberian Branch of the Russian Academy of Sciences

IAET SB RAS Editorial Office and Publishing House
Postal address:
Institute of Archaeology and Ethnography
Pr. Akademika Lavrentieva 17,
Novosibirsk, 630090, Russia
Tel.: (383) 330-83-66
E-mail: eurasia@archaeology.nsc.ru
http://journal.archaeology.nsc.ru

Editors of the original Russian texts
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Russian texts translated by
V.A. Baranov
A.G. Kozintsev
E.Y. Pankeyeva
E. Winslow

English texts revised by
L. Baranova
P. Magnussen

The journal is registered in the State Press Committee of the Russian Federation

Mass media registration certificate No. 018782 issued May 11, 1999

Passed for printing December 22, 2023
Appearance December 28, 2023
Format 60×84/8. Conv. print. sh. 18.83. Publ. sh. 20.5
Order No. 598. Circulation 100 copies
Open price

IAET SB RAS Printing House
Pr. Akademika Lavrentieva 17,
Novosibirsk, 630090, Russia
http://archaeology.nsc.ru

doi:10.17746/1563-0110.2023.51.4.003-014

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Early Upper Paleolithic Tubular Beads from the Main Chamber of Denisova Cave

The authors present the results of a technological and functional analysis of bone tubular beads from the Upper Paleolithic layer 11 in the Main Chamber of Denisova Cave, northwestern Altai. Tubular beads are among the most widespread categories of Early Upper Paleolithic ornaments from the cave. The technological sequence of operations has been reconstructed. It included several stages: selection of blank, planing, manufacture of preform by truncating the epiphyses, ornamenting the preform, marking preforms for fracturing into short tubes, sawing or cutting, fragmentation by cuts, removal of cancellous bone, and smoothing the fracture surfaces. Prepared blanks and diagnostic production waste were not noted in the technological context of the complex; this indicates that the tubular beads were probably manufactured outside the excavated area of the Main Chamber. The analyses revealed traces of wear caused by contact with clothing or human skin and by threading on a string or thin strap. Tubular beads were used by the Upper Paleolithic inhabitants of the cave as elements of clothing, necklaces, and probably bracelets. The closest but still considerably distant parallels to the tubular beads from the Altai are Aurignacian ornaments of a similar age from Western, Central, and Eastern Europe.

Keywords: *Altai Mountains, Denisova Cave, Early Upper Paleolithic, tubular beads, traceological and technological analysis.*

Introduction

Beads in the form of hollow items of elongated cylindrical shape, usually made from the diaphyses of tubular bones of mammals and birds, less often from mammoth ivory, sea-mollusk shells, or semi-precious stones, constitute one of the most noticeable groups of Upper Paleolithic non-utilitarian products (Abramova, 1962; Averbouh, 1993; Vanhaeren, d'Errico, 2006; Wright et al., 2014). These items are often called "cylindrical beads", "threaded beads", and in English and French publications, "tubular beads" and "perles tubulaires" (Vanhaeren, d'Errico, 2011; Rigaud et al., 2014). Tubular beads differ from other hollow items made of bone (such as needle cases or handles, which had a utilitarian purpose) primarily in size—their lengths rarely exceed 40 mm (Averbouh, 1993). Bone tubular beads often bear ornaments and traces of intense contact with soft organic material, which allows for their interpretation as personal ornaments (Gerasimov, 1941), buttons (Khlopachev, 2011), or musical instruments (Lbova, Kozhevnikova, 2016). Owing to their specific appearance, ornamented cylindrical beads are often considered as specific cultural elements and chronological markers of various Upper Paleolithic complexes of Eurasia (Vanhaeren, d'Errico, 2006; Rybin, 2014).

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In Northern Asia, bone tubular beads were widespread over vast regions already in the early stages of the Upper Paleolithic—from the Altai in the west to Transbaikalia in the east, from the Yana-Indigirka lowland in the north to Central China in the south (Abramova, 1962, 1979; Lbova, 2000; Derevianko, Shunkov, 2004; Pitulko, Pavlova, Ivanova, 2014; d'Errico et al., 2021). In the Upper Paleolithic assemblages from this vast area, they usually occur as solitary pieces or small series. The exception is the collection from the Yana site, which contains the largest set in Siberia of cylindrical beads made of tubular bones, approx. 300 specimens (Pitulko, Pavlova, Ivanova, 2014). The second largest and one of the most ancient sets of bone cylindrical beads, including more than 50 specimens, comes from Upper Paleolithic assemblages of Denisova Cave in the Altai Mountains (Fig. 1) (Derevianko, Shunkov, Kozlikin, 2020; Shunkov et al., 2020).

Cylindrical bone beads have been recovered from the Upper Paleolithic layers in all main sections of Denisova Cave. Currently, the beads from the East (Shunkov et al., 2020) and South (Shunkov, Fedorchenko, Kozlikin, 2019) Chambers of the cave have been most comprehensively studied. Previously published works provide the data on the tubular beads from the Main Chamber (excavations of 1984, 1993–1995, 1997, and 2016) (Shunkov, Krivoshapkin, Anoikin, 1995; Prirodnaya sreda…, 2003; Derevianko, Shunkov, 2004; Shunkov et al., 2016). Information about cylindrical beads from Denisova Cave is presented in review papers addressing the emergence of symbolic behavior and the spread of ancient personal ornaments in Eurasia (Sinitsyn, 2005; d'Errico, Vanhaeren, 2009; Wright et al., 2014). However, most of the Upper Paleolithic tubular beads from Denisova Cave remain outside the focus of special research addressing the production technology and methods of use, while the previously presented reconstructions were based on small samples and require verification (Shunkov et al., 2016; Shunkov, Fedorchenko, Kozlikin, 2017; Shunkov et al., 2020).

Layer 11 in the Main Chamber of the cave yielded the most representative collection of the Early Upper Paleolithic tubular beads in Siberia.

Here, we present the results of a detailed analysis of the entire collection of bone tubular beads from the Main Chamber. The excellent state of preservation and considerable quantity of the recovered beads make it possible to consider these items as the basis for reconstruction of the production technologies and use patterns of ancient Siberian tubular beads.

Materials and study methods

The Early Upper Paleolithic collection of artifacts from the Main Chamber of Denisova Cave comprises 28 specimens related to the manufacture of bone tubular beads (see *Table*): 27 specimens are finished beads of two types—with (*n*=19; Fig. 2, *3*) and without ornaments, or simple (*n*=8; Fig. 4); and one item is a longitudinally split fragment of a preform (Fig. 5, *1*). Among these, 16 beads were intact, seven artifacts show signs of longitudinal fracture, and four beads show traces of transverse and longitudinal fragmentation.

All the tubular beads were found in 1984–2018, in the excavation with an area of 21 m^2. Most of the beads (*n*=21) concentrated in sq. Д–Ж/6–8, in layers 11.2, 11.4, and 11.5 (see *Table*). Six items were recovered

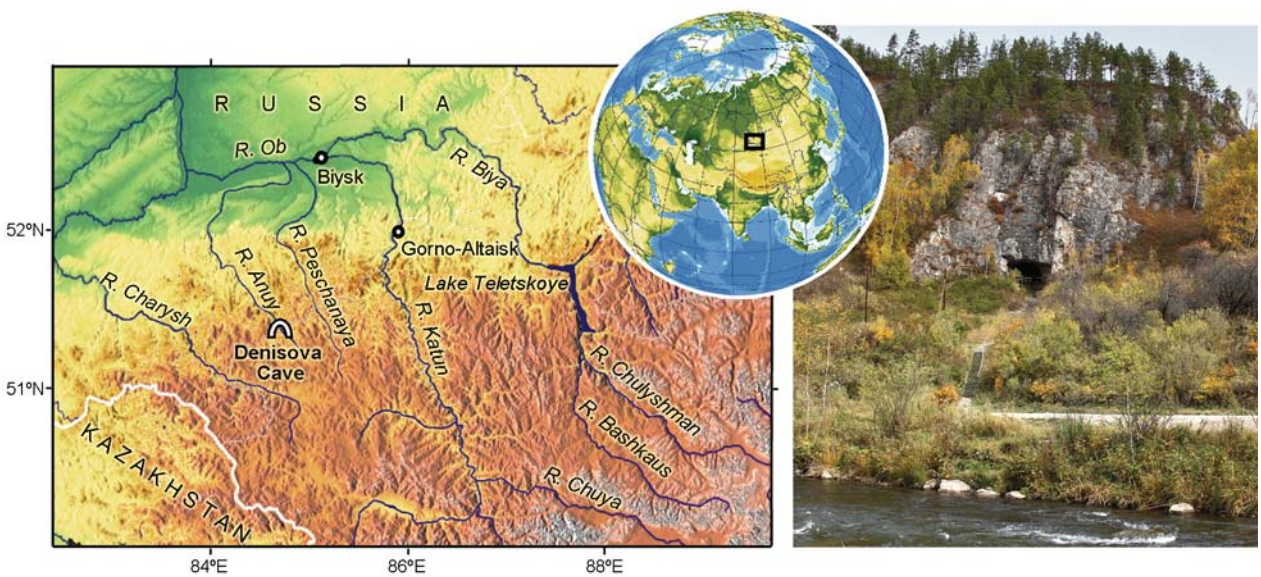


Fig. 1. Location of Denisova Cave.

from sq. Ж/7–8 and Е–8, lithological unit 11.2. Another six beads were found in the filling of two artificial depressions/pits noted in the 1984 excavation area in sq. Д/6–7 and stratigraphically related to the upper part of layer 11 (Prirodnaya sreda…, 2003: 132). Eight beads were recovered from the low part of layer 11: six items in sq. Е–Ж/6, Ж–7, and Е–Ж/8, layer 11.4, two items in sq. Е–Ж/7, layer 11.5. Eight beads were identified during the sorting of the faunal collection and wet-sieving of the sediments of layer 11 collapsed from the excavation's walls.

The available biostratigraphy data and absolute dates indicate that the deposits of layer 11 in the Main Chamber accumulated during the period corresponding to the

Bone tubular beads of the Initial Upper Paleolithic from the Main Chamber of Denisova Cave

No.	Year	Layer	Sq.	Type	Fragmentation	Length, mm	Width, mm	Thickness, mm	Fig.
1	1995	11.2	Е-8	Ornamented	Longitudinal and transversal	7.53	4.84	1.57	2, *1*
2	1997	11.2	Ж-7	"	None	17.72	8.75	6.25	2, *6*
3	1997	11.2	Ж-8	"	Longitudinal	31.03	6.02	1.88	3, *9*
4	2016	11.2	Ж-8	"	None	22.71	10.22	8.55	2, *9*
5	2016	11.2	Ж-8	Unornamented	"	22.43	4.36	3.67	4, *2*
6	2019	11.2	Ж-8	Ornamented	"	4.62	4.01	3.57	2, *5*
7	1984	11 pit	Д-7	"	"	34.33	13.70	12.56	3, *8*
8	1984	11 pit	Д-7	"	"	14.46	7.11	5.99	2, *10*
9	1984	11 pit	Д-6	Unornamented	"	36.05	4.70	4.09	4, *1*
10	1984	11 pit	Д-7	"	"	17.39	4.18	3.81	4, *3*
11	1984	11 pit	Д-7	Ornamented	Longitudinal	10.98	4.59	2.10	2, *4*
12	1984	11 pit	Д-6	Unornamented	None	23.69	13.95	12.56	4, *7*
13	1995	11.4	–	Ornamented	"	29.97	5.86	3.86	3, *4*
14	1995	11.4	Е-6	"	"	21.54	5.75	4.76	3, *1*
15	1995	11.4	Е-8	"	Longitudinal and transversal	21.12	6.66	2.00	3, *5*
16	1997	11.4	Ж-8	"	"	24.47	7.30	3.22	3, *7*
17	1997	11.4	Ж-7	"	Longitudinal	29.62	5.22	1.92	3, *6*
18	2016	11.4	Ж-6	Unornamented	None	18.49	11.83	11.31	4, *8*
19	1994	11.5	Е-7	Ornamented	Longitudinal	23.60	8.19	3.65	3, *3*
20	1997	11.5	Ж-7	"	None	20.16	4.26	3.48	3, *2*
21	1984	11	Д-8	Unornamented	"	9.62	9.30	6.99	4, *6*
22	1992	11	Г-5	Ornamented	Longitudinal and transversal	8.54	5.29	2.40	2, *2*
23	1992	11	Д-5	Preform	Longitudinal	34.89	11.93	5.83	5, *1*
24	1993	11	В/Д-5	Ornamented	"	10.30	8.58	5.34	2, *3*
25	1993	11	В-5	Unornamented	"	30.77	9.39	4.48	4, *4*
26	1994	11	Е-6	"	None	17.41	12.16	12.05	4, *5*
27	1994	11	Б-8	Ornamented	Longitudinal	13.21	7.69	2.74	2, *8*
28	2018	11	Б-8/9	"	None	16.49	8.75	7.26	2, *7*

Fig. 2. Ornamented tubular beads from layer 11 in the Main Chamber of Denisova Cave.

Fig. 3. Ornamented tubular beads from layer 11 in the Main Chamber of Denisova Cave.

first half of MIS 3 (Ibid.). The earliest radiocarbon dates for lithological unit 11.4 were established through direct dating of two artifacts—a bone point and an awl: 39,300 ± 1200 (OxA-34877) and 41,200 ± 1400 (Ox-A30271) / 42,900 ± ± 2000 BP (OxA-29872) (Douka et al., 2019). A younger age was determined by AMS-dating of bone remains with traces of butchering and a piece of charcoal—in the range from 32,150 ± 450 (OxA-34725) to 34,990 ± 340 BP (OxA-34722); similar data were generated for layer 11.2—from 33,900 ± 380 (OxA-X-2696-40) to 34,600 ± 600 BP (OxA-34919). These radiocarbon determinations correspond to calendar dates in the range of 38,000–40,000 BP, which is consistent with OSL-dating results (Jacobs et al., 2019).

The processes of bone working were reconstructed through the analysis of technological context, morphology of artifacts, and production sequence (Crémades, 1994; Teyssandier, Liolios, 2003; Laroulandie, d'Errico, 2004). Published experimental data were used in verification of the derived results (Buc, 2011; Buc, Acosta, Mucciolo, 2014; Orłowska, Ćwiek, Osipowicz, 2022). The ways of using the ornaments were determined by experimental and traceological analysis (Álvarez, Mansur, Pal, 2014; Bradfield, 2015; Osipowicz

Fig. 4. Unornamented tubular beads from layer 11 in the Main Chamber of Denisova Cave.

et al., 2020). The primary examination of artifacts was carried out at ×7.5–×45 magnification, using an Altami CM0745-T microscope; microscopic examination (×100–×500) was carried out using an Olympus VNM microscope. Photographic recording of the use-wear traces was made with a Canon EOS 5D Mark IV camera, EF 100mm f/2.8 Macro USM and MP-E 65mm F2.8 1-5X Macro lenses, and a tripod, with manual focusing. The images of use-wear traces with focusing over the entire area of one frame were obtained with the aid of Helicon Focus software.

Identification of the species of animals whose bones were selected for making the ornaments was based on determinations of the dimensions (length, diameter, and thickness) of the artifacts' walls. Faunal identifications were made by A.K. Agadjanian (Palaeontological Institute, Russian Academy of Sciences) and S.K. Vasiliev (Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences).

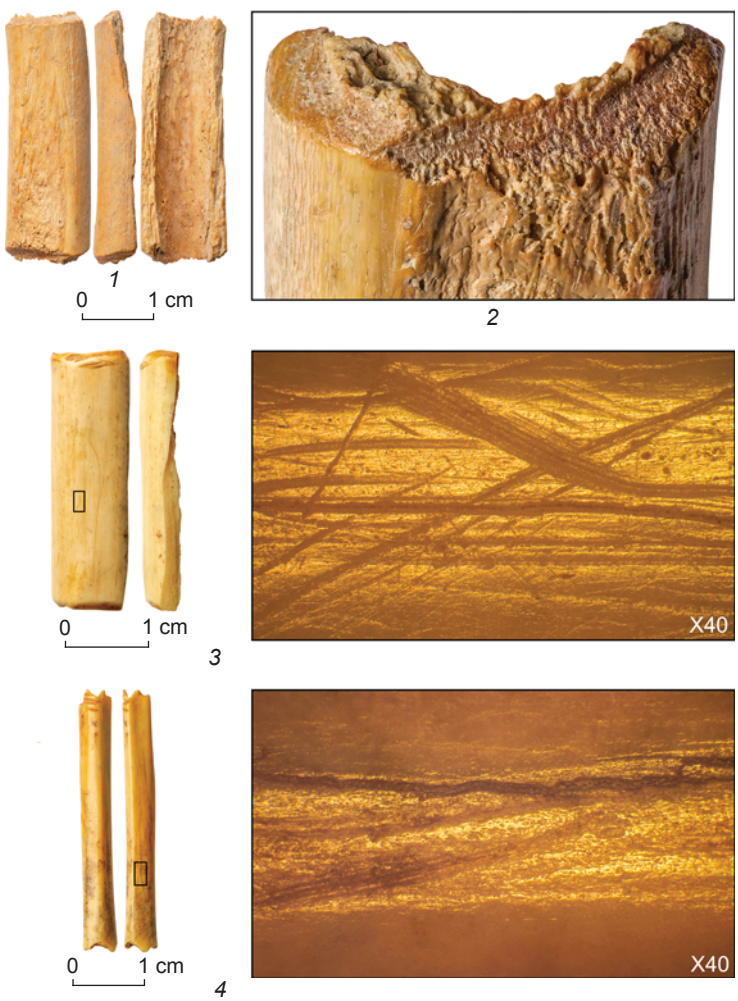


Fig. 5. Fragment of a preform of unornamented beads (*1*); fragment bearing traces of sawing off the diaphysis (*2*); fragments of ready-made beads bearing traces of planing (*3*, *4*) from layer 11 in the Main Chamber of Denisova Cave.

Study results

Technological context. Our results have shown that the technological context of the production of bone tubular beads in layer 11 of the Main Chamber was incomplete. Analysis of the archaeological and faunal collections led to one artifact being interpreted as a preform; however, no blanks or diagnostic technological waste were found. The absence of the latter suggests that the ornaments were made either in the unexplored areas of the cave, or beyond the site. Traces of wear on all the beads from the Main Chamber may indicate that these were delivered to the site as finished products. Refitting analysis did not show any correspondence between the finished products and/or the bead fragments.

Blank selection. The initial stage of the manufacture of tubular beads was the selection of blanks. The Upper Paleolithic inhabitants of the cave used tubular bones from mammals and birds of various sizes to make cylindrical beads. The blanks were dominated by ulna and humerus bones from birds of the size of a black grouse *Tetrao tetrix* or wood grouse *Tetrao urogallus* (*n*=12), and also from representatives of smaller species of the size of a thrush *Turdus philomelos/ruficlollis* or jackdaw *Corvus monedula* (*n*=7). Less common were the bones of the limbs of large mammals of the size of a roe deer *Capreolus pygargus* or red wolf *Cuon alpinus* (*n*=5), and smaller animals of the size of a marmot *Marmota* sp. or hare *Lepus* sp. (*n*=4). The incompleteness of the technological context, together with considerable modification and wear of finished products, make it impossible, in most cases, to identify accurately the animal species whose bones were used as raw material.

Preform preparation. The next stage in the technological sequence was processing of blanks by planing, followed by the removal of one or both epiphyses to obtain the required preforms. Five tubular beads show extended linear marks in certain parts of the surfaces; the marks are located parallel or subparallel to the long axis of the blank, and run over the entire lengths of the products (Fig. 5, *3*, *4*). The planing marks are partially covered by subsequent polishing during wear. The least deformed linear marks are observed on the preform. Most of the finished beads have no visible planing marks. The beads were probably planed situationally to flatten or smooth the surface of the blanks. The main shaping technique in the manufacture of preforms was the truncation of one or both epiphyses of the bone by cutting or sawing (Fig. 5, *2*), which was performed by reciprocal movements of a stone tool with a straight blade all around the blank (Buc et al., 2014).

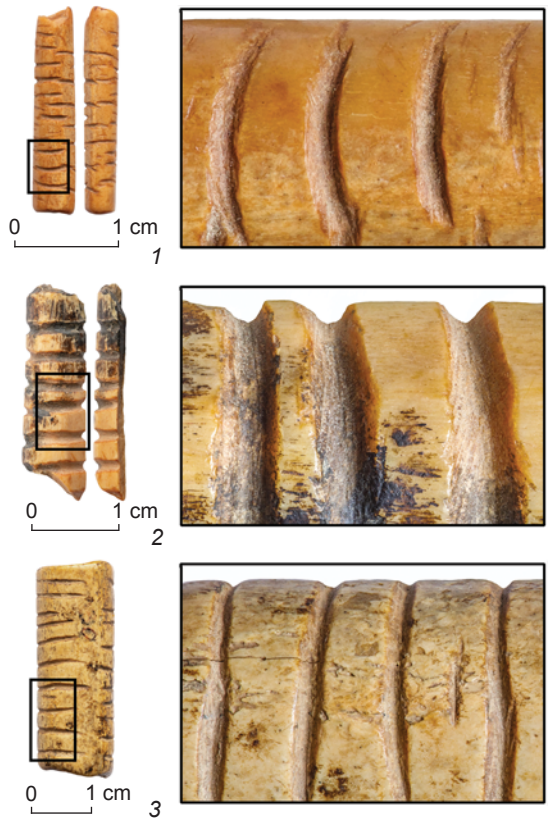
Ornamentation. Marks of shape-forming cutting or sawing at the ends of most finished ornamented beads overlap the traces of notching, suggesting that the stage of decorating the surfaces of artifacts with ornamentation preceded the segmentation of preforms*. This chaîne opératoire probably ensured the convenience and ease of ornamentation of a larger item, which was the preform, as compared to small, sometimes miniature, ready-made beads. The peculiarities of the technique of decorating preforms were reconstructed based on of the analysis of finished beads. Engraving of the artifacts was executed with a stone tool with a thin V-shaped blade by means of reciprocating movements (Fig. 6). In almost all cases, the notches on the products were located across the long axis. On one longitudinally fragmented bead, the notches slant at an angle of 70°.

Finishing stage. The preforms, starting from the ends freed from the epiphyses, were marked out for the subsequent division into segments. Ten beads from the collection show single, less often grouped, short and thin notches on their surfaces, close to the cut-off ends (Fig. 7, *1*, *2*), which might be interpreted as traces of preliminary marking. The subsequent division of the preform into short tubes was carried out by the technique of circular sawing or cutting with the above-mentioned stone tool (Laroulandie, d'Errico, 2004). Judging by the number and position of the grooves at the end zones of the beads (Fig. 7, *2*), the preform was successively rotated 3–5 times during the sawing process (see Fig. 5, *2*). The sawn grooves were mostly uneven, but closed down; only one third of the products show the grooves forming a relatively regular circle at their ends. In almost half of the finished beads, the cut does not run perpendicular to the long axis of the product. Only a quarter of all the beads were cut off from the preform at a right angle. For the fragmented items, making up 1/3 of the collection, it was impossible to determine the position of the tool during sawing.

The next stage of processing was the fragmentation of products along cuts by breaking; this is confirmed by the impressive traces of transverse fracture at one or two ends of the vast majority of intact tubular beads (see Fig. 7, *3*, *4*). One of the techniques used at the finishing stage of manufacturing beads was the removal of cancellous tissue. This operation was carried out to form and widen the hole in the bead by a tool with a thin and sharp cutting edge. Traces of the use of this technique were recorded on three tubular beads that were cut from epiphyseal fragments of long bone (see Fig. 2, *3*, *5*, *8*). After the hollow sections had been obtained, fragmentation zones were additionally processed, probably by planing or grinding, to remove or

*The finished preforms of cylindrical beads with notches resembled an ornamented product, with deep circular cuts and an unseparated epiphysis, from cultural layer II at Kostenki-14 (Sinitsyn, 2016: 322–323, fig. 10, *10*). Materials from the East Chamber of Denisova Cave contain a piece interpreted as a preform of ornamented tubular beads (Shunkov et al., 2020: Fig. 7, *1*).

Fig. 6. Ornaments on bone tubular beads from layer 11 in the Main Chamber of Denisova Cave.



smooth out the protrusions (Orłowska, Ćwiek, Osipowicz, 2022). The cut ends of half of the items show traces of deliberate smoothing (see Fig. 7, *5*, *6*).

Finished tubular beads are short or slightly longer straight tubes, with or without ornamentation. The length of the intact beads (n=16) varies from 4.6 to 36.5 mm, with a median of 19.3 mm (see *Table*). Enlarging the sample to include the longitudinally fragmented beads (n=7) doesn't change the extreme length values and doesn't significantly affect the median value, which is 20.2 mm in this case. The maximum diameter of intact tubular beads ranges from 4 to 14 mm, with a median of 11 mm.

The original feature of the finished beads is the ornamentation in the form of straight short notches or elongated lines. The incisions on intact beads are usually short (90 %); their length does not exceed 10 mm. The other incised lines reach 10–25 mm. The depth of the cuts varies from 0.2 to 1.4 mm, the width is from 0.2 to 1.6 mm. The intact beads show notches and lines grouped into three (n=5), two (n=3), or six (n=1) blocks. A total of 27 blocks were identified, including from 1 to 16 notches: 37 % of the examined blocks consisted of 1–5 lines, 37 %

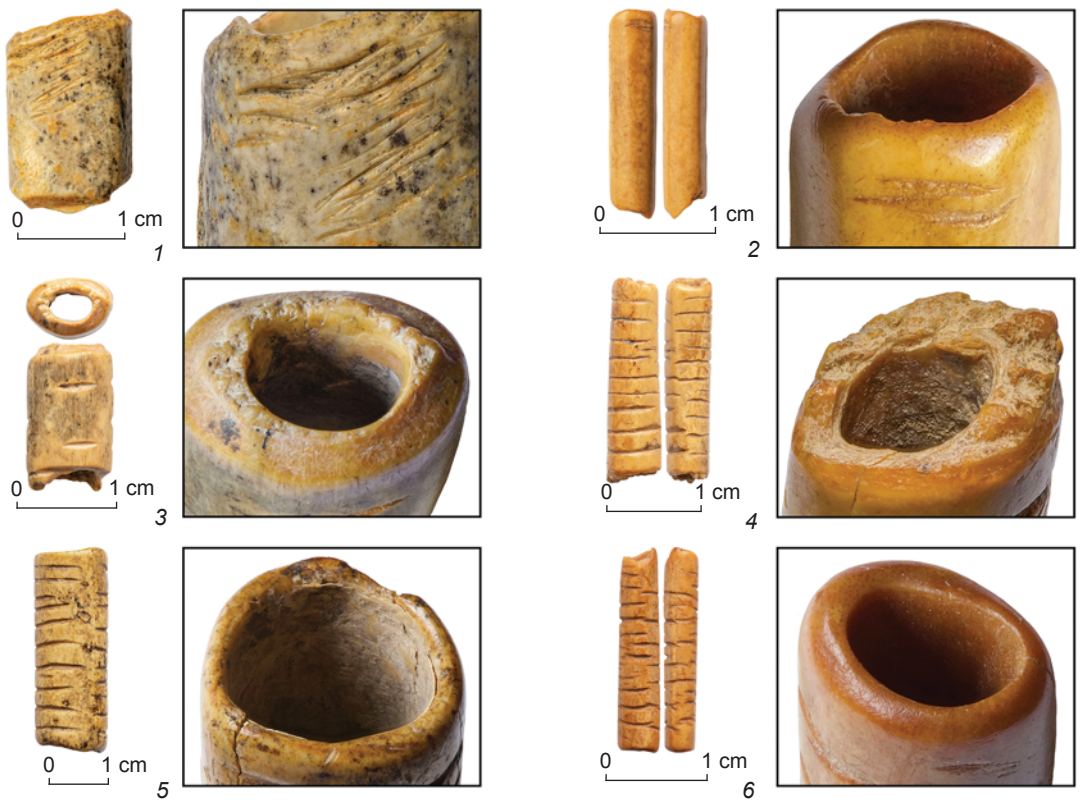


Fig. 7. Test incisions (*1*, *2*); traces of deliberate breaking at the ends of tubular beads (*3*, *4*); traces of deliberate leveling of surface at the ends of tubular beads (*5*, *6*) from layer 11 in the Main Chamber of Denisova Cave.

of 6–10 lines, 22 % of 11–15 lines, and 4 % of more than 15 lines. The number of notches grouped in blocks on each bead is rarely the same.

The noted morphometric parameters, the number and features of the arrangement of notches on intact and fragmented beads (*n*=19) reveal several ornamental patterns differing in the degree of concentration on the beads' surfaces. Variant 1 includes beads (one intact and five fragments) with relatively sparse, short, mostly narrow and shallow notches. Each block shows from two to four notches on average, which are usually not connected with one another. Variant 2 includes two intact beads with more regular (from 7 to 15 per block) short cut marks similar in size and morphology. On the surfaces of these beads, the notches in adjacent blocks often overlap and intersect one another. Variant 3 comprises beads (three intact ones and two fragments) bearing elongated, thin, and shallow lines. Each block contains from six to nine lines, which are rarely interconnected. Variant 4 includes ornaments (two intact beads and three fragments) with elongated, wide, and deep lines often connecting one another.

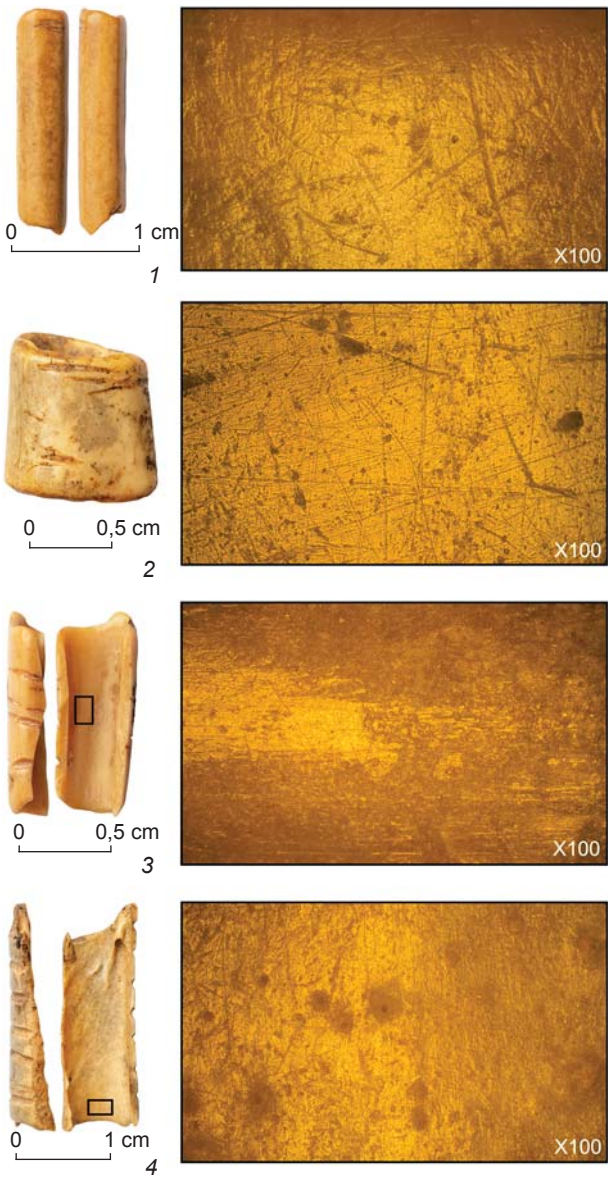


Fig. 8. Use-wear traces on the surfaces of tubular beads from layer 11 in the Main Chamber of Denisova Cave.

Use of tubular beads. The traceological analysis of all the ready-made beads revealed various types of wear traces, representing the features of human use of the products. At ×40 to ×200 magnification, thin elongated or short multidirectional incisions and larger rectangular dents were identified on the beads' surfaces, covered with glossy polishing (Fig. 8, *1*, *2*). This type of wear suggests the intense contact between the bone and a soft organic material (Buc, 2011; Bradfield, 2015; Osipowicz et al., 2020). The cut surfaces resulting from sawing and cutting at the ends of the beads are smoothed, rounded, and polished (see Fig. 7, *2*, *5*, *6*), most likely due to contacts with clothing and human skin. On the interior surface of longitudinally fragmented items (*n*=11), there are extended areas of dull and matte polishing, stretched parallel to the long axis of the item (see Fig. 8, *3*, *4*). Such wear traces occur on bone ornaments as a result of friction during prolonged wear on a thread or thin strap (Shunkov et al., 2020).

Discussion

At present, in the Altai, cylindrical beads made of tubular bone have been found only in Denisova Cave. The closest parallels to these artifacts have been recorded thousands of kilometers away from this site. In North Asia, outside the Altai region, the oldest ornamented tubular beads have been reported from the Early Upper Paleolithic collection from Kamenka in Transbaikalia (44.9–41.4 ka cal BP) (Lbova, 2000; Zwyns, Lbova, 2019). The collection from this site contains three small beads with traces of circular cutting at the ends, decorated with single and paired cut marks. Two large bird bone beads were made using similar technique: one item shows two rows of notches, the other, three blocks of three or four short lines. All the artifacts were polished during use (Lbova, Kozhevnikova, 2016). The other closest parallel to the beads from the Main Chamber of Denisova Cave are the ornaments from the Upper Zhoukoudian Cave in Central China (35.1–33.5 ka cal BP) (d'Errico et al., 2021). Here, four cylindrical beads made of tubular bone, decorated with blocks of one, two, or three short notches, were discovered. Unfortunately, the state of preservation of these beads makes it impossible to reconstruct reliably the technology of their manufacture.

The largest collection of Upper Paleolithic tubular beads in Northern Eurasia has been found at the site of

Yana, located in eastern Yakutia (33.2–31.0 ka cal BP) (Pitulko, Pavlova, Ivanova, 2014). More than 300 small cylindrical beads were discovered at this site; the beads were made from the bones of hare limbs through the technique of sequential truncation of diaphysis. Most of the beads show continuous or partially closed circular incisions in the medial part. Despite some differences in the morphology of the ready-made beads, the technology of their manufacture generally corresponds to that of the tubular beads from Denisova Cave.

A few beads in the form of elongated hollow cylinders from the tubular bones of birds and arctic foxes, as well as blanks and waste products, have been reported from the Middle Upper Paleolithic assemblage from the site of Malta in the Angara region (Gerasimov, 1941). Small series of bone tubular beads were noted in the Late Upper Paleolithic assemblages from Kokorevo II, Afontova Gora II and III on the Yenisei (Abramova, 1979; Astakhov, 1999), as well as from Krasny Yar in the Angara region (Abramova, 1962). The majority of these beads do not show any ornamentation; some pieces has one or two circular incisions in the medial part. The Upper Paleolithic tubular beads from the sites of the Angara region and the Yenisei valley have close parallels among typologically and technologically similar artifacts from the Yana collection.

The Upper Paleolithic tubular beads of Western Europe are traditionally associated with the spread of the Aurignacian technocomplex about 41–35 ka cal BP (Teyssandier, Liolios, 2003; Vanhaeren, d'Errico, 2006). The most expressive personal ornaments of this type were found at the cave sites of Le Côte and Isturitz in southwestern France (Rigaud et al., 2014; White, Normand, 2015), Spy in Belgium (Khlopachev, 2011), Geißenklösterle and Hohle Fels in southern Germany (Bolus, 2015; Dutkiewicz, Wolf, Conard, 2018), and Bombrini in Italy (Arrighi et al., 2020). Numerous short and elongated cylindrical beads from Aurignacian sites were made by dividing the tubular bones of mammals and birds or carved from mammoth ivory. Aurignacian beads show a variety of ornamentation—zigzags and oblique lines, transverse circular carving, short longitudinal and transverse notches, and lines twisted in spirals over the beads' axes. In Aurignacian assemblages, small tubular beads are often found in association with elongated "tubes", often ornamented in the same way as other bone items (Tartar, 2015).

In Central Europe, the technology of making ornamented bone beads was used since the Aurignacian period. In Pod Hradem Cave in the Czech Republic (41.7–39.2 ka cal BP), a cylindrical bead made from a small carnivore bone by planing and subsequent truncation of epiphyses was found; the bead was ornamented with three groups of seven, five, and four short and deep cuts (Wright et al., 2014). Later, cylindrical beads made of bone and tusk became widespread in the Gravettian complexes—Dolní Věstonice I, Klimăutsi II, and others (31.0–23.8 ka cal BP) (Cârciumaru, 2019; Láznicková-Galetová, 2021). The cylindrical beads from these sites are characterized by an ornament that combines transverse circular cuts, rounded dots, and short longitudinal lines, or a simpler motif in the form of rows of short notches similar to that on the ornaments from Denisova Cave.

In contrast to the beads from Western and Central Europe, the oldest Upper Paleolithic bone beads from the Russian Plain are very diverse. One of the earliest finds comes from cultural layer II of Kostenki-17, dated to 41–40 ka cal BP, which industry is considered to be a local variant of the Proto-Aurignacian (Stepanova et al., 2022). Made of mammoth ivory, this cylindrical item has no ornamentation. Its manufacturing technique is similar to a more recent technology reconstructed from the ornaments of Dolní Věstonice I. Expressive tubular beads, similar to the items from Denisova Cave, occur in non-contemporaneous complexes at Kostenki-14 (Sinitsyn, 2015). The oldest of these were discovered in the Aurignacian industry from the volcanic ash horizon, dated to 40.1 ka cal BP. The beads are made from arctic-fox bone using the technique of sequential separation of the epiphyses; the beads bear elongated, often interconnected notches, sometimes twisted into spirals. Younger, unornamented elongated beads come from layer III at Kostenki-17, dated to 35.2–33.8 ka cal BP.

Elongated-narrow and short-wide hollow cylinders, similar in age and technology, have been reported from the Sungir collection, most likely associated with the Streletskaya culture (34.6–33.7 ka cal BP) (Bader, 1973; Sinitsyn, 2016). A number of cylindrical beads of the Gorodtsov culture were recovered from layer II at Kostenki-14 (34.0–33.0 ka cal BP). These items were cut from rodent bones and decorated with two or three rows of transverse, short, and parallel notches. Elongated beads ornamented with rows of short notches located parallel or obliquely to the long axis of each bead were discovered in the younger Early Gravettian complex of cultural layer II at Kostenki-8 (Sinitsyn, 2016).

In general, the tubular beads from the Upper Paleolithic complexes of Eurasia are similar to the ornaments from layer 11 in the Main Chamber of Denisova Cave in shape, manufacturing technology, ornamentation techniques, and probable use patterns. In this case, the ornamented items offer the greatest potential for comparison. The Eurasian context provides a great variety of geographical and chronological affiliations of short and long cylindrical beads decorated with rows of parallel notches. The Altai tubular beads demonstrate the greatest similarity to Aurignacian items from the chronologically close, but geographically distant complexes of Western, Central, and Eastern Europe. Notably, the assemblages of Eastern European and especially North Asian sites with

the oldest artifacts of this type often do not show direct similarities with each other, in contrast to the probably monocultural Aurignacian earliest tubular beads from the sites in Western Europe.

Conclusions

The analytical data obtained of the artifact collection from layer 11 of the Main Chamber of Denisova Cave suggest that the production of tubular beads followed a standardized technological sequence: selection of blanks of the required configuration—tubular bones of birds, small and medium-sized mammals; leveling and smoothing of blank surfaces by planing; shaping of preforms by truncation of one or both epiphyses; ornamentation of the preform with short notches or lines grouped in separate rows or closed in a ring; marking of preforms into short tubes; dividing of preforms by sawing or cutting, fragmentation by cuts; removal of cancellous tissue and smoothing of fragmentation surfaces. The absence of blanks and production waste suggests that tubular beads were most likely made outside the excavated area of the Main Chamber of Denisova Cave.

The analysis of the chaîne opératoire showed that the ornamentation by groups of short or long notches of the surface was carried out at the stage of preparing preforms, rather than at the very end; when ornamentation was ready, the preform was cut into smaller fragments. The diverse morphometric characteristics and arrangement of lines indicate that the ornamentation did not have any "utilitarian" purpose, but was likely of certain cultural or symbolic character. Ornamentation with short notches and lines has been recorded not only on beads, but also on other products of the Early Upper Paleolithic from Denisova Cave—tools and non-utilitarian items made of bone, tusk, and horn: on points, needle cases, awls, buttons, plaques, and unique zoomorphic figurine.

Complete tubular beads from the Main Chamber demonstrate considerable variations in metric characteristics and proportions, suggesting their division into several size classes. This variability may be due to preferences in the choice of initial blanks, as well as to cultural norms determining the look of non-utilitarian products. Tubular beads are one of the most widespread categories of personal adornment in the Denisova Cave collections. Together with perforated pendants of mammalian teeth and flat beads of soft stone, bone, ivory, and shell, tubular beads were widely used by the Upper Paleolithic cave inhabitants as elements of clothing decoration, personal necklaces, and probably bracelets.

Bone tubular beads are a specific category of personal ornament broadly distributed over Eurasia since the Early Upper Paleolithic. Their manufacturing technique was relatively simple, as the raw materials used were the most accessible tubular bones of mammals and birds. At the same time, the choice of ornamentation techniques did not seem to be really strict; ornamentation determined the symbolic content of personal ornaments in accordance with existing cultural canons. According to the results of the analysis of the chronology and geography of cylindrical beads in Eurasia, products with identical ornaments and morphometric characteristics, close in age and similar in manufacturing technology, differed in cultural affiliation and were often found in regions hundreds and thousands of kilometers apart. The spread of ornamented tubular beads in Eurasia during the Early Upper Paleolithic was probably due to the transfer of their production technology in a ready-made form during migrations or intercultural contacts. The possibility of the convergent emergence, extinction, and reappearance of this technology in different parts of Eurasia at various stages of the Upper Paleolithic cannot be ruled out either. These processes were most likely facilitated by the special demand for these ornaments, the availability of raw materials, and the relative ease of their manufacture.

Acknowledgements

This study was supported by the Russian Science Foundation (Project No. 20-78-10125).

References

Abramova Z.A. 1962
Paleoliticheskoye iskusstvo na territorii SSSR. Moscow: Izd. AN SSSR.

Abramova Z.A. 1979
Paleolit Yeniseya. Afontovskaya kultura. Novosibirsk: Nauka.

Álvarez M., Mansur E., Pal N. 2014
Experiments in bone technology: A methodological approach to functional analysis on bone tools. In *Traceology Today. Methodological Issues in the Old World and the Americas*. Oxford: Archaeopress, pp. 19–26.

Arrighi S., Moroni A., Tassoni L., Boschin F., Badino F., Bortolini E., Boscato P., Crezzini J., Figus C., Forte M., Lugli F., Marciani G., Oxilia G., Negrino F., Riel-Salvatore J., Romandini M., Peresani M., Spinapolice E.E., Ronchitelli A., Benazzi S. 2020
Bone tools, ornaments and other unusual objects during the Middle to Upper Palaeolithic transition in Italy. *Quaternary International*, vol. 551: 169–187.

Astakhov S.N. 1999
Paleolit Yeniseya. Paleoliticheskiye stoyanki na Afontovoy gore v g. Krasnoyarske. St. Petersburg: Yevrop. dom.

Averbouh A. 1993
Fiches tubes et étuis. In *Fiches typologiques de l`industrie osseuse préhistorique*. Cah. VI: Éléments récepteurs. Treignes: CEDARC Publ., pp. 99–113.

Bader O.N. 1973
Vtoraya paleoliticheskaya mogila na Sungire (Verkhneye pogrebeniye). *Sovetskaya arkheologiya*, No. 3: 133–145.

Bolus M. 2015
The transition from the Middle to the Upper Paleolithic in the Swabian Jura, Southwestern Germany. *Anthropology*, vol. LIII/1-2: 167–179.

Bradfield J. 2015
Use-wear analysis of bone tools: A brief overview of four methodological approaches. *South African Archaeological Bulletin*, vol. 70 (201): 3–14.

Buc N. 2011
Experimental series and use-wear in bone tools. *Journal of Archaeological Science*, vol. 38: 546–557.

Buc N., Acosta A., Mucciolo L. 2014
Blank extraction techniques in bone technology. *P@lethnology*, vol. 3: 568.

Cârciumaru M., Nițu E.-C., Obadă T., Cîrstina O., Covalenco S., Lupu F.I., Leu M., Nicole A. 2019
Personal ornaments in the Mid Upper Palaeolithic East of the Carpathians. *PALEO*, vol. 30-1: 80–97.

Crémades M. 1994
L'art mobilier Paléolithique: Analyse des Procédés Technologiques. *Complutum*, vol. 5: 369–384.

Derevianko A.P., Shunkov M.V. 2004
Formation of the Upper Paleolithic traditions in the Altai. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 3: 12–40.

Derevianko A.P., Shunkov M.V., Kozlikin M.B. 2020
Who Were the Denisovans? *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 48 (3): 3–32.

d'Errico F., Pitarch Martí A., Wei Y., Gao X., Vanhaeren M., Doyon L. 2021
Zhoukoudian Upper Cave personal ornaments and ochre: Rediscovery and reevaluation. *Journal of Human Evolution*, vol. 161, Art. No. 103088: 1–27.

d'Errico F., Vanhaeren M. 2009
Earliest personal ornaments and their significance for the origin of language debate. In *The Cradle of Language*. Oxford: Oxford Univ. Press, pp. 16–40.

Douka K., Slon V., Jacobs Z., Ramsey C.B., Shunkov M.V., Derevianko A.P., Mafessoni F., Kozlikin M.B., Li B., Grün R., Comeskey D., Devièse T., Brown S., Viola B., Kinsley L., Buckley M., Meyer M., Roberts R.G., Pääbo S., Kelso J., Higham T. 2019
Age estimates for hominin fossils and the onset of the Upper Palaeolithic at Denisova Cave. *Nature*, vol. 565 (7741): 640–644.

Dutkiewicz E., Wolf S., Conard N.J. 2018
Early symbolism in the Ach and the Lone valleys of southwestern Germany. *Quaternary International*, vol. 491: 30–45.

Gerasimov M.M. 1941
Obrabotka kosti na paleoliticheskoy stoyanke Malta. In *Paleolit i neolit SSSR*. Moscow, Leningrad: AN SSSR, pp. 65–85. (MIA; No. 2).

Jacobs Z., Li B., Shunkov M.V., Kozlikin M.B., Bolikhovskaya N.S., Agadjanian A.K., Uliyanov V.A., Vasiliev S.K., O'Gorman K., Derevianko A.P., Roberts R.G. 2019
Timing of archaic hominin occupation of Denisova Cave in Southern Siberia. *Nature*, vol. 565 (7741): 594–599.

Khlopachev G.A. 2011
Ukrasheniya i predmety vooruzheniya iz bivnya mamonta paleoliticheskoy stoyanki Spi (Belgiya): Kulturno-khronologicheskaya atributsiya. In *Predmety vooruzheniya i iskusstva iz kosti v drevnikh kulturakh Severnoy Yevrazii (tekhnologicheskiy i funktsionalniy aspekty)*. St. Petersburg: Nauka, pp. 3–26.

Laroulandie V., d'Errico F. 2004
Worked bones from Buran-Kaya III level C and their taphonomic context. In *The Paleolithic of Crimea*. Vol. III: The Middle Paleolithic and Early Upper Paleolithic of Eastern Crimea. Liège: Université de Liège publ., pp. 83–94.

Láznicková-Galetová M. 2021
Gravettian ivory ornaments in Central Europe, Moravia (Czech Republic). *L'anthropologie*, vol. 125: 2–15.

Lbova L.V. 2000
Paleolit severnoy zony Zapadnogo Zabaikalya. Ulan-Ude: Izd. BNC SO RAN.

Lbova L.V., Kozhevnikova D.V. 2016
Formy znakovogo povedeniya v paleolite: Muzykalnaya deyatelnost i fonoinstrumenty. Novosibirsk: Izd. Novosib. Gos. Univ.

Orłowska J., Ćwiek M., Osipowicz G. 2022
Was it ground? A closer look at various prehistoric bone grinding techniques – An experimental and traceological study. *Journal of Archaeological Science: Reports*, vol. 46.

Osipowicz G., Piličiauskienė G., Orłowska J. Piličiauskas G. 2020
An occasional ornament, part of clothes or just a gift for ancestors? The results of traceological studies of teeth pendants from the Subneolithic sites in Šventoji, Lithuania. *Journal of Archaeological Science: Reports*, vol. 29 (102130): 1–14.

Pitulko V.V., Pavlova E.Y., Ivanova V.V. 2014
Iskusstvo verkhnego paleolita Arkticheskoy Sibiri: Lichniye ukrasheniya iz raskopok Yanskoy stoyanki. *Uralskiy istoricheskiy vestnik*, No. 2 (43): 6–17.

Prirodnaya sreda i chelovek v paleolite Gornogo Altaya. 2003
A.P. Derevianko, M.V. Shunkov, A.K. Agadzhanyan, G.F. Baryshnikov, E.M. Malaeva, V.A. Ulyanov, N.A. Kulik, A.V. Postnov, A.A. Anoikin (eds.). Novosibirsk: Izd. IAET SO RAN.

Rigaud S., Roussel M., Rendu W., Primault J., Renou S., Hublin J.-J., Soressi M. 2014
Les pratiques ornementales à l'Aurignacien ancien dans le Centre-Ouest de la France. *Bulletin de la Société préhistorique française*, vol. 111: 19–38.

Rybin E.P. 2014
Tools, beads, and migrations: Specific cultural traits in the Initial Upper Paleolithic of southern Siberia and central Asia. *Quaternary International*, vol. 347: 39–52.

Shunkov M.V., Fedorchenko A.Y., Kozlikin M.B. 2017
Kostyaniye izdeliya verkhnego paleolita iz yuzhnoy galerei Denisovoy peshchery (kollektsiya 2017 goda). In *Problemy*

arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy, vol. XXIII. Novosibirsk: Izd. IAET SO RAN, pp. 259–262.

Shunkov M.V., Fedorchenko A.Y., Kozlikin M.B. 2019

Kostyaniye orudiya i personalniye ukrasheniya nachala verkhnego paleolita iz yuzhnoy galerei Denisovoy peshchery (kollektsiya 2019 goda). In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XXV. Novosibirsk: Izd. IAET SO RAN, pp. 306–314.

Shunkov M.V., Fedorchenko A.Y., Kozlikin M.B., Belousova N.E., Pavlenok G.D. 2016

Kostyaniye orudiya i ukrasheniya rannego verkhnego paleolita iz Tsentralnogo zala Denisovoy peshchery: Kollektsiya 2016 goda. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XXII. Novosibirsk: Izd. IAET SO RAN, pp. 221–224.

Shunkov M.V., Fedorchenko A.Y., Kozlikin M.B., Derevianko A.P. 2020

Initial Upper Palaeolithic ornaments and formal bone tools from the East Chamber of Denisova Cave in the Russian Altai. *Quaternary International*, vol. 559: 47–67.

Shunkov M.V., Krivoshapkin A.I., Anoikin A.A. 1995

Kostyaniye izdeliya pozdnego paleolita Denisovoy peshchery (kollektsiya 1992–1994 gg.). In *Problemy okhrany, izucheniya i ispolzovaniya kulturnogo naslediya Altaya*. Barnaul: Izd Alt. Gos. Univ., pp. 32–34.

Sinitsyn A.A. 2005

Skhodstvo i razlichiye kara-bomovskogo plasta i nachalnogo verkhnego paleolita Vostochnoy Yevropy. In *Aktualniye voprosy yevraziyskogo paleolitovedeniya*. Novosibirsk: Izd. IAET SO RAN, pp. 179–184.

Sinitsyn A.A. 2015

Kostenki 14 (Markina Gora) – opornaya kolonka kulturnykh i geologicheskikh otlozheniy paleolita Vostochnoy Yevropy dlya perioda 27–42 tys. let (GS-11–GI-3). In *Zamyatninskiy sbornik*, iss. 4. St. Petersburg: Izd. MAE RAN, pp. 40–59.

Sinitsyn A.A. 2016

Ranniy verkhniy paleolit Vostochnoy Yevropy: Ukrasheniya i voprosy estetiki. In *Verkhniy paleolit: Obrazy, simvoly, znaki*. St. Petersburg: Ekstraprint, pp. 320–337.

Stepanova K.N., Malyutina A.A., Bessudnov A.A., Girya E.Y. 2022

Ukrasheniya II sloya Kostenok 17: Osobennosti proizvodstva, ispolzovaniya i kontekst v ramkakh nachalnoy pory verkhnego paleolita Vostochnoy Yevropy. *Stratum plus*. *Arkheologiya i kulturnaya antropologiya*, No. 1: 193–220.

Tartar E. 2015

Origin and development of Aurignacian osseous technology in Western Europe: A review of current knowledge. In *Aurignacian Genius: Art, Technology and Society of the First Modern Humans in Europe*. New York: New York Univ. Press, pp. 33–55.

Teyssandier N., Liolios D. 2003

Defining the earliest Aurignacian in the Swabian Alp: The relevance of the technological study of the Geißenklösterle (Baden-Württemberg, Germany): Lithic and organic productions. In *The Chronology of the Aurignacian and of the Transitional Technocomplexes*. Lisboa: Inst. Português de Arqueologia, pp. 179–197.

Vanhaeren M., d'Errico F. 2006

Aurignacian ethno-linguistic geography of Europe revealed by personal ornaments. *Journal of Archaeological Science*, vol. 33: 105–128.

Vanhaeren M., d'Errico F. 2011

L'émergence du corps paré. Objets corporels paléolithiques. *Civilisations*, vol. 59-2: 59–86.

White R., Normand C. 2015

Early and archaic Aurignacian personal ornaments from Isturitz Cave: Technological and regional perspectives. *Palethnologie*, vol. 7: 138–164.

Wright D., Nejman L., d'Errico F., Králík M., Wood R., Ivanov M., Hladilová S. 2014

An Early Upper Palaeolithic decorated bone tubular rod from Pod Hradem Cave, Czech Republic. *Antiquity*, vol. 88: 30–46.

Zwyns N., Lbova L.V. 2019

The Initial Upper Paleolithic of Kamenka site, Zabaikal region (Siberia): A closer look at the blade technology. *Archaeological Research in Asia*, iss. 17: 24–49.

Received December 26, 2022.
Received in revised form May 19, 2023.

doi:10.17746/1563-0110.2023.51.4.015-024

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Stoilo—A Paleolithic Site in the Southern Angara Region, Siberia

On the basis of findings of the autumn 2021 field season, we present the first information on the Paleolithic site of Stoilo (Usolsky District of the Irkutsk Region). The site, located on the left bank of the Angara River, belongs to the Belaya geoarchaeological region. The complex is enclosed in pre-Holocene sediments relating to the residual grus-pebble crust, which overlies the soliflucion layer tentatively dating to the Late Karga–Early Sartan period. The analysis of the lithics, mostly made on siliceous rocks, indicates prismatic reduction resulting in small blades. The toolkit consists of small pieces, including various types of spurred tools, burins, knives on naturally backed blades, retouched blades and flakes with use-wear, and a heavy-duty pebble tool. A specific feature of the complex is that most artifacts reveal superficial traces of minor corrasion—a weak surface gloss. This and the fact that the material relates to the grus-pebble layer might be viewed as formal indicators of the "Makarovo Horizon". However, the totality of typological and technological features and the structure of the sediments suggest that Stoilo represents the middle stage of the Upper Paleolithic, dating to the Early Sartan stage. To confirm this assumption, further excavations are needed in order to augment the collection and obtain more environmental data.

Keywords: *Baikal Siberia, Southern Angara, Paleolithic, deflation, corrasion, Sartan stage, blade reduction.*

Introduction

The Belaya geoarchaeological region includes a 100-km stretch of the lower Belaya River with tentative bank boundaries, where the best-known key stratified geoarchaeological sites of Baikal Siberia (Georgievskoye I, Malta, Sosnovyi Bor, Ust-Belaya, Galashikha, and others), documenting the successive evolution of material culture from the Middle Paleolithic to the Nomadic Age, are situated (Fig. 1) (Problemy…, 1996; Kamennyi vek…, 2001). This region includes the site of Stoilo, where pilot excavations were conducted in the autumn of 2021. The site was discovered by the Angara Expedition from the State Academy of History of Material Culture in 1934. Archaeological mapping of the Usolsky District specified the geographical position of the site (Ukazatel…, 1991: 81–82). However, no excavations have been conducted there until recently.

The excavations of 2021 revealed the presence of Holocene archaeological remains recorded over a large area and resembling those described by the Angara Expedition. The lithic industry comprised prismatic and wedge-shaped cores, single end-scrapers, knives, prismatic blades, flakes, and fragments. Identifiable fauna remains included bones of Siberian roe deer (*Capreolus pygargus*). The archaeological materials were

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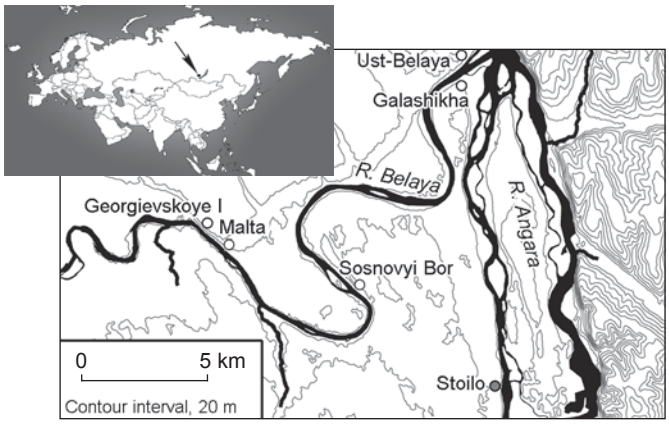

Fig. 1. Eastern part of the Belaya geoarchaeological region.

recovered from the lower part of the layer attributable to the Holocene Climatic Optimum (AT), whose upper face was partially destroyed and overlain by a humus-accumulating horizon of modern soil. One of the test pits contained fragments of plain pottery with imprints of retreating paddle, tentatively dating to the Late Neolithic/Bronze Age.

The most interesting results, however, were obtained from the northern part of the site. There, in a test pit, subsequently enlarged to a small trench (5 × 2 m), a lightly corraded lithic complex of Paleolithic appearance was recorded in the stratigraphic position. Here, we introduce new data on stratigraphy, deposit composition, and finds relating to this complex. Also, the first attempt is made at correlating these data with the available information on similar sites of the Belaya geoarchaeological region and Baikal Siberia in general.

Geomorphology and composition of Stoilo section

Geomorphologically, the study area is located on a gently sloping surface of the Angara left bank, at an elevation of 414–416 m (Baltic Height System). Relative height above the water's edge during the period of the present study was 14–16 m. However, according to A.P. Okladnikov, before the cascade of the Bratsk Hydroelectric Power Station on the Angara had been formed, the terrace was 18 m high (Sosnovskiy et al., 1934: 40).

The lower portion of the bank is composed of gray tabular dolomites of the Lower Cambrian Angara suite (Cm_1an), whose exposures are visible along the whole left bank of the Angara in that region (Geologicheskaya karta…, 1961: 14–16). They are overlain by boulders and pebbles tentatively attributable to the Zalari suite of the Lower Jurassic (J_1zl). Loose sediments from 0.5 to 2.3 m thick cover the upper portion of the bank.

In the northern part of the site (test pit 5, trench), where Paleolithic artifacts were discovered, the section revealed a complex structured sequence consisting of lithologically different sediments, including both subaerial layers (1–8) and an earlier subaqual layer 9 (Fig. 2). Each stratum records changes in conditions of sedimentation, and signals certain environmental and climate events. Below follows the interpretation of the section, including the age of some strata, in accordance with the regional climate-stratigraphic scheme (Vorobieva, 2010).

Layers 1–4 can be attributed to the Holocene. The upper portion of this sedimentary unit is severely disturbed by human activities. Okladnikov mentioned that the first finds from this site in the early 20th century were collected from the surface (Sosnovskiy et al., 1934: 42). Plowing reworked the Subboreal–Subatlantic sediments (SB–SA; up to ~4.6 ka uncal BP) into one humus-accumulative horizon. Judging by spots in the lower part of layer 2, the roof of layer 3, belonging to the Atlantic Climatic Optimum (AT; ~8–4.6 ka uncal BP) and possessing a diagnostic pale-yellow–brown coloration, was also destroyed in the process. Layer 4, tentatively attributed to the Early Holocene (PB–BO; ~10.3–8 ka uncal BP), is indistinct in the section; however, visible black spots therein may indicate the presence of derivatives of Early Holocene soils. Noteworthy is a network of small inserted cryogenic wedges of Middle and Early Holocene horizons. This can possibly be correlated with some cooling and decrease in humidity of the climate during the Boreal/Atlantic transition.

Layers 5–8 can be attributed to the Final Pleistocene. The Pleistocene to Holocene transition is distinctly traceable by diagnostic features such as carbonization of layer 5 (Sr^4; ~14–10.3 ka uncal BP) and a wavy boundary between layers 5 and 4, reflecting typical cryogenic "knolls" of thermo- and cryochrone contact. Layer 6 shows Sartan loess-like loams ($Sr^{3\text{-}2}$; ~18–14 ka uncal BP), pointing to periglacial subaerial conditions. The loams are more porous than the Holocene sediments.

Sediments of layer 7 and below are the most problematic in terms of origin and age. All subsequent statements about them are tentative. The lower portion of layer 7B possibly represents the Late Sartan solifluction (Sr^1_1 (sol); ~24–21 ka uncal BP) with fragments of Late Karga and presumably Early Karga formations (Kr; ~57–24 ka uncal BP). The surface of the solifluction-affected sediments is marked by residual deflation crust 7A, formed during the second half of the Early Sartan period (Sr^1_2; ~21–18 ka uncal BP). A similar sequence of events (cryogenesis (solifluction) → deflation) was recorded in several sections in the Angara basin, though there it was

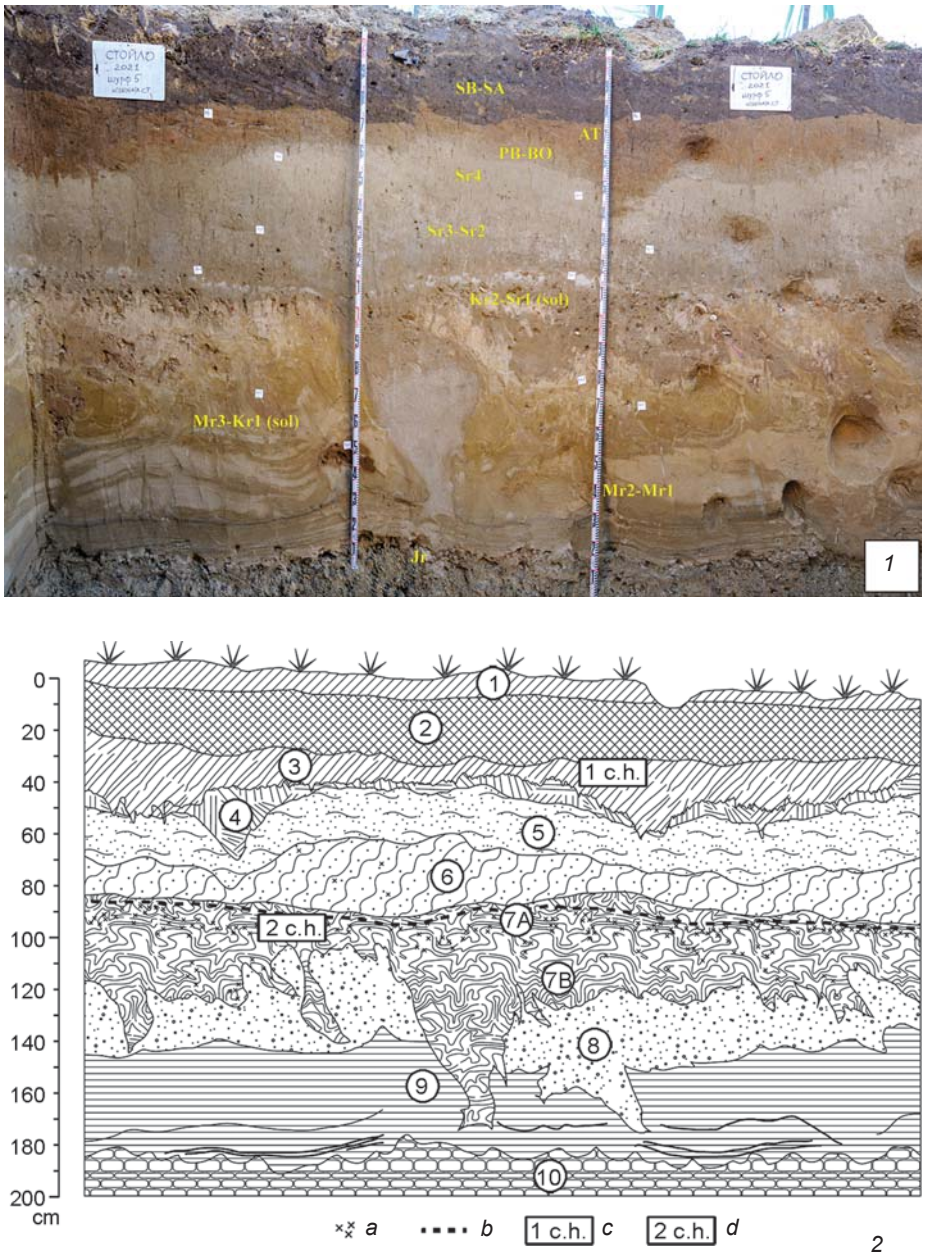

Fig. 2. Photograph (*1*) and drawing (*2*) of the stratigraphic section of the geoarchaeological site of Stoilo.
a – grus and pebbles; *b* – carbonate sublayer; *c* – Neolithic complex; *d* – Paleolithic complex.

attributed to the Murukta age (Vorobieva, Medvedev, 1984: 23). However, one and the same scheme, on the basis of cyclicity of environmental and climatic processes, can be applied to the Early Sartan period, too. Formation of the grus-pebble layer most probably was associated with transport of fine pebble and sand fractions down the slope. This movement was caused by aeolian processes, which involved pebbles of the Zalari suite. Pulling the grus-pebble lenses into "pockets" was connected with cryogenesis.

Maximal climate aridization during the subsequent period led to the formation of a carbonate sand layer: water flowing down the pebble crust and carrying suspended particles of silt rapidly evaporated, causing intense carbonization rather than overmoistening of the ground. The age of carbonates in the roof of layer 7 can be tentatively estimated by analogy with Early Sartan dates of carbonate cutans in Taiturki II section, located within the Belaya geoarchaeological region, 15 km in a straight line from the site of Stoilo (Golubtsov, Cherkashina, Snytko, 2019).

The question of filling the cryogenic wedges with fine washed sand in layer 7 remains open. It is possible that there occurred a short-term episode of flooding the surface

as a result of seismic-tectonic movements or a high water during the Late Karga period. In such a case, formation of the cryogenic wedges, which were subsequently covered by the solifluction flow, occurred during the Konoschel cooling (~33 ka uncal BP) (Vorobieva et al., 2010; Kind, 1974: 117).

Underlying layer 8 also has a complicated genesis. The reason for separating solifluction layers 7 and 8 was the change in composition and color of sediments, marking the transition to a new climatic stage. The preserved fragments of pink loams in the upper portion of layer 8 can be interpreted as remains of Early Karga (Kr^1) horizons of weathering. The rest of the layer consists of solifluction-affected sediments of the Late Murukta age (Mr^3 (sol); ? –57 ka uncal BP): sands and sandy loams of yellow hues. A rodent burrow filled with heavy brownish loam may contain the remains of Karga (?) soils. Layer 9, composed of sands and sandy loams, is interpreted as Middle Pleistocene (?) flood-plain facies reworked by Early Murukta ($Mr^{1–2}$; ~71–? ka uncal BP) aeolian processes. Underwater sediments have been preserved in their original horizontal thin-layered form only in the lowest part of the section.

Technical and morphological characteristics of the lithic industry

Archaeological assemblage from Stoilo comprises solely lithic artifacts (Table 1). Most of them (170 of 396 spec.) are debitage: shatters, chunks, and chips. Over 90 % of the artifacts were made of siliceous rocks. Sources of raw material most probably were exposures of siliceous concretions in dolomites of the Lower Cambrian Angara suite distributed throughout the Belaya geoarchaeological region in bank exposures of the Angara and its tributaries (Kamennyi vek…, 2001: 72). Quartzites of various grain sizes occur in small numbers. Most artifacts demonstrate traces of carbonization. These are chiefly small spots of carbonate crust; however, some pieces are completely covered with carbonates on one face or a margin.

Table 1. **Main categories of the lithic industry**

Category	Number	%
Core-like fragments	6	2.7
Core-trimming elements	81	35.8
Blades	43	19.8
Bladelets	10	4.4
Flakes	86	38.0
Debitage	170	42.9
Total	396	100

Note: Percentages of the first five categories refer to the total number excluding debitage (shatters, chunks, and chips). Percentage of debitage refers to the total number of lithic artifacts.

There are six core-like fragments in the collection, including a fragment of flaking surface of a core for blades (Fig. 3, *1*), a fragment with scars of blade removals on a narrow flaking surface, with a natural platform (Fig. 3, *2*), and a fragment of a lateral part of a core for blades with flake scars shaping an arris (Fig. 3, *3*). The industry of spalls numbers 220 spec. (Table 1). Fragmented pieces form a high percentage; unbroken items are 40 % only. Linear dimensions of the artifacts are small; maximal length of most of them does not exceed 70 mm.

Core-trimming elements are numerous; complete pieces number 51 spec. They reflect all stages of primary reduction, from decortication to rejuvenation of working faces and striking platforms (Table 2). The presence of items typical of prismatic reduction should be noted. These comprise semi-tablets (Fig. 3, *5*), including secondary flakes; a flake resulted from trimming of the flaking face (Fig. 3, *4*); longitudinal lateral flakes; and semi-crested blades. Preparation for detachment of core-trimming flakes was normally minimal; in most cases, the detachment was made from natural or plain surfaces. Striking platforms were mainly 4–9 mm deep. Two thirds of the flakes bear bulbs of percussion, whether distinct or blurred, in equal shares. Natural cortex is present on approximately 55 % of complete pieces (Fig. 3, *6*).

Among 86 flakes, 22 pieces are complete. Their length varies from 17 to 42 mm; the width falls within the range from 14 to 38 mm. The flakes exhibit dorsal treatment (45 %), unidentifiable (23 %), orthogonal (18 %), or bi-longitudinal (14 %). Natural cortex is present on 46 % of complete specimens. Platforms of the flakes are mainly natural (39 %) and plain (21 %); dihedral (11 %), polyhedral (7 %), facetted (4 %), and destroyed (18 %) platforms are also present. Seven flakes demonstrate platform rejuvenation by direct percussion. The depth of the platforms varies primarily from 3 to 7 mm. Bulbs of percussion are visible on 65 % of the flakes, 29 % of them are distinct, and 36 % are blurred.

Nine of 43 blades are complete. They are 33–56 mm long and 13–32 mm wide. Dorsal scar pattern on the blades is mostly longitudinal and unidirectional (44 %); semicortical, orthogonal, and unidentifiable varieties are less common. Remnants of natural cortex are present on 56 % of the complete specimens. Striking platform remnants are plain (43 %), destroyed (29 %), natural (14 %), or dihedral (14 %). Most of them are 2–5 mm deep. Eight specimens demonstrate rejuvenation of platforms performed by direct percussion. Bulbs of percussion are present on 47 % of proximal parts of the blades; 22 % are distinct and 25 % are blurred.

The majority of bladelets (seven of ten) are complete. Most of them measure within the range of 27 to

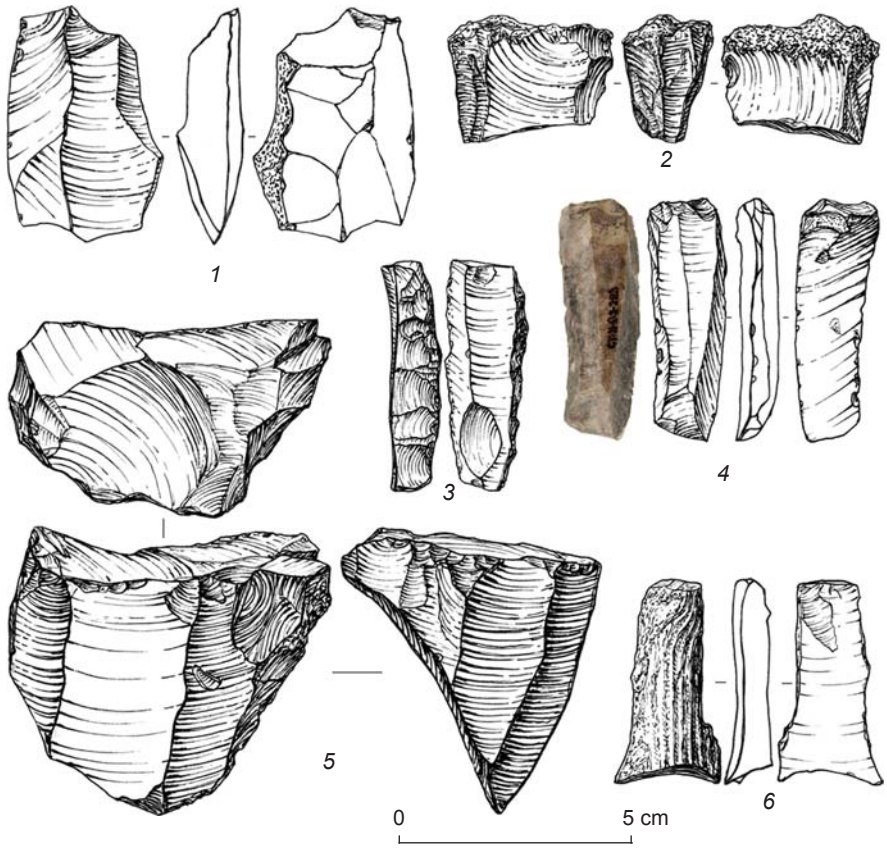

Fig. 3. Core-like fragments and core-trimming elements.

32 × 9 to 10 mm. Dorsal scar pattern is exclusively longitudinal; three bladelets retain cortex. Platforms are destroyed in half of the cases. Some of them are plain (25 %), natural or dihedral (12.5 % each). Two specimens show rejuvenation of platforms by direct reduction. In most cases, the platforms are 1–2 mm deep. Bulbs of percussion are present on 26 % of the bladelets, including 12 % distinct and 14 % blurred.

The toolkit consists of 43 items. Flakes and blades were used as blanks almost in equal shares; two tools were fashioned on bladelets. Complete specimens constitute 21 %.

Formal tools (25 spec.) are represented exclusively by Upper Paleolithic types. Spurred tools (points, according to the typological list of Malta site (Kamennyi vek…, 2001: 70)) are most numerous (9 spec.). Blades (Fig. 4, *3*, *4*), bladelets (Fig. 4, *9*), flakes (Fig. 4, *7*), and undiagnosable pieces (Fig. 4, *2*, *5*, *6*, *8*) were used as blanks. On most tools, a spur was fashioned by notches or fine marginal retouch.

There are five burins in the collection. All of them have a lateral working edge (Fig. 4, *10–12*). Burin spalls were struck from surfaces that were unprepared or prepared by one removal only. Knives on blades (4 spec.) have natural backs opposing the working edge with traces of retouch (Fig. 4, *13*, *14*; 5, *2*, *7*).

Table 2. **Core-trimming elements**

Variety	Number	%
Flaking surface rejuvenation flake	25	30.9
Decortication flake	19	23.5
Natural lateral flake	16	19.7
Debitage surface preparation flake	7	8.6
Semi-tablet flake	4	4.9
Longitudinal lateral flake	3	3.7
Semi-crested blade	2	2.5
Transverse lateral flake	2	2.5
Core convexity maintenance flake	1	1.2
Secondary semi-tablet flake	1	1.2
Plunging flake	1	1.2
Total	81	100

Two artifacts are retouched blades. In one case, the working element was formed by dorsal subparallel extensive retouch on the longitudinal edge (Fig. 5, *5*); on the second artifact, by dorsal marginal retouch on the longitudinal edge and by subparallel extensive retouch at the proximal end (Fig. 5, *8*). "Beaked" tools (2 spec.) are morphologically similar to the spurred tools, but have thicker distal parts ("beaks"), modified by retouch. On

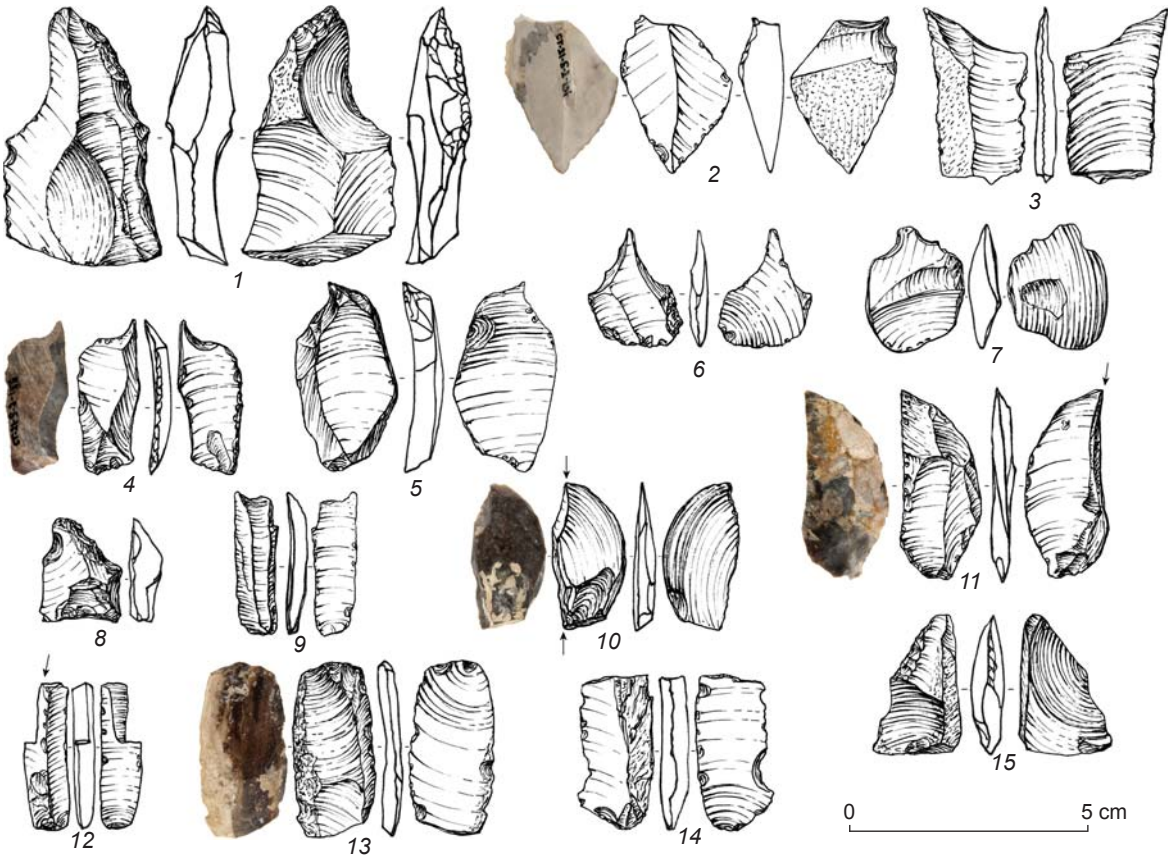

Fig. 4. Stone tools.
1 – "beaked"; *2–9* – spurred; *10–12* – burins; *13*, *14* – naturally backed knives; *15* – fragment of a tool.

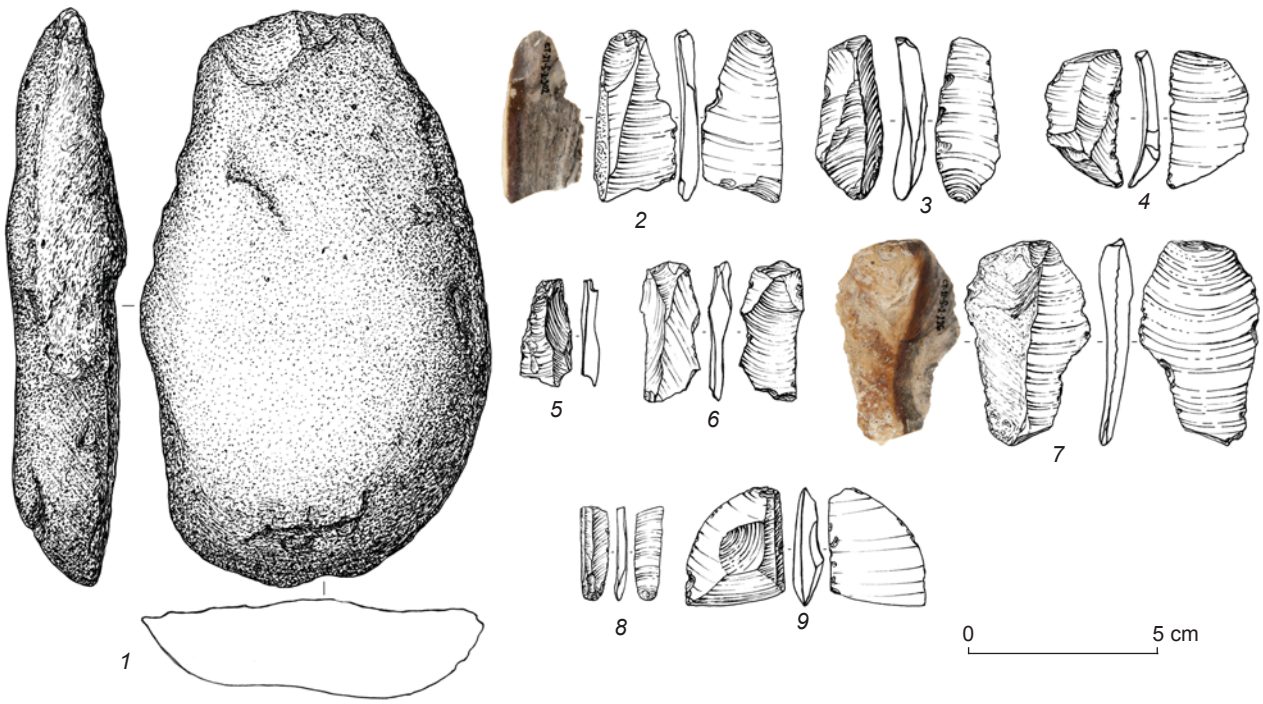

Fig. 5. Stone tools.
1 – tool on a cobble; *2*, *7* – naturally backed knives; *3* – blade with a distal working edge; *4*, *6*, *9* – flakes with utilization retouch; *5*, *8* – retouched blades.

one tool, extensive retouch covers the ventral face of the artifact; in the other case, it is located on the both faces (see Fig. 4, *1*).

The collection comprises one blade with a working edge located on the distal end. The working edge was shaped by crude abrupt retouch, and the cross-section of the blade is beveled from the right to the left margin (see Fig. 5, *3*). The only fragmented tool is an elongate flake with a functional element shaped by regular subparallel extensive retouch on the left margin (see Fig. 4, *15*). A massive tool, fashioned on a flat cobble, is also singular. Its working element was formed by a series of short removals from the dorsal face; its edge is blunted. The right edge has an area with intensive microflaking, occupying a half of the artifact's length (see Fig. 5, *1*). This piece can probably be attributed to the category of percussive-abrasive unmodified tools (Stepanova, 2015), and its edge was formed in the process of using the implement.

The category of non-formal tools comprises flakes, blades, and bladelets, without traces of intentional modification, but with use-wear marks such as weakly-modifying retouch, denticulate-notched areas, or a glossed edge (see Fig. 5, *4*, *6*, *9*). Such tools number 18 spec., including ten blades, seven flakes, and one bladelet. The separation of non-formal tools from flakes was motivated by the presence of tentative use-wear signs on some pieces. Most of them lack such traces, ruling out the effect of post-depositional processes on the artifacts' edges. Future work will either provide clearer criteria for separating this category of tentative tools, or exclude them from the toolkit.

The analysis of the industry has shown that primary reduction, manufacture, and utilization of tools proceeded at the site. Blocks of raw material had apparently been transported here, but final judgment must be postponed until the excavation area is widened and the collection enlarged. The dominance of siliceous rocks can be explained by utilization of local sources of raw material. The high percentage of dorsal faces with preserved cortex on all kinds of spalls (43–56 %) can be indicative of small sizes of raw material pieces.

Primary reduction was clearly aimed at the blade production. It can be assumed that prismatic technique was utilized to detach small blades and bladelets. Judging by dorsal scars, tool blanks were received mainly by unidirectional longitudinal technique; if necessary, striking platform and laterals of the core were trimmed.

The formal toolkit is rather specific: spurred tools, burin- and knife-like implements prevail, with the complete absence of any end-scrapers. A typical feature is small size of the tools; even flakes not exceeding 2 cm in length were used.

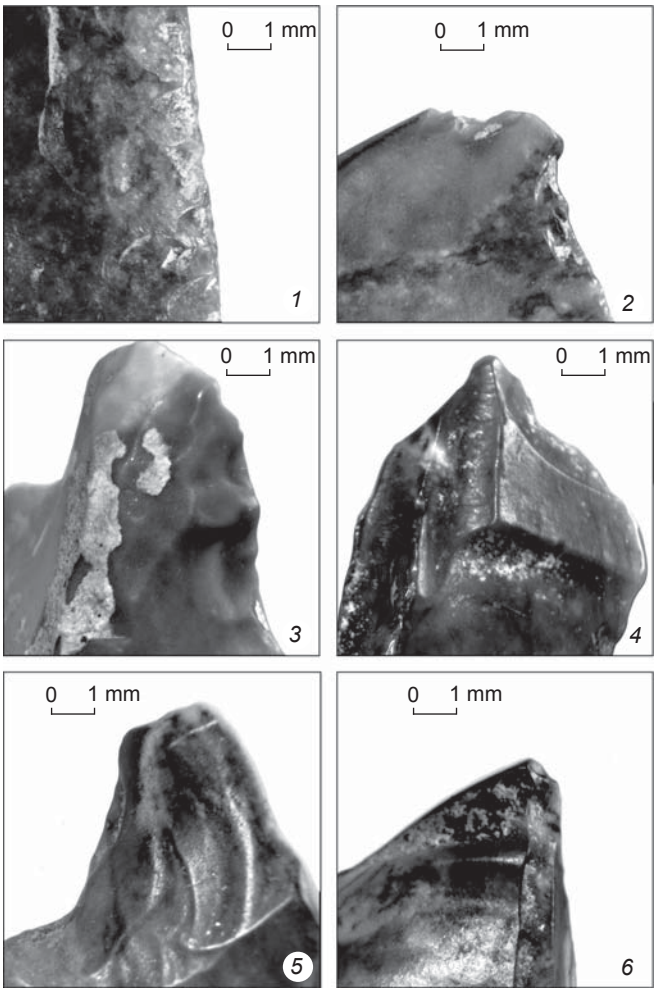

Fig. 6. Surfaces of working elements on stone tools.
1 – fragment of a tool (see Fig. 4, *15*); *2*, *6* – truncation burins (see Fig. 4, *10*, *11*); *3* – "beaked" tool (see Fig. 4, *1*); *4*, *5* – truncation burins.

Thus, the following characteristic features of the assemblage have been revealed: uniformity of raw material, high concentration of lithic artifacts, absence of typologically distinct cores, high percentages of core-trimming elements and tools. Accompanying features include traces of corrasion present on most complete artifacts as a weak surface gloss. At the micro level, signs of corrasion include flattened relief of surfaces and smoothed negative scars of microflaking on retouched implements (Fig. 6). According to the gradation suggested by G.I. Medvedev, artifacts of this complex demonstrate the second or third degree of corrasion (Medvedev, Sklyarevskiy, 1982).

Discussion

A specific feature of Stoilo Paleolithic complex is the evidence of corrasion on lithic artifacts. A related question concerns the age and origin of encompassing

sediments, marked by the residual grus-pebble crust. Corraded assemblages of "soft" rocks (not quartzite) in the Angara and Lena basins are traditionally attributed to the "Makarovo Horizon" (Makarovsky plast)—a conventional group of artifacts similar in terms of relative stratigraphy, degree of corrasion determined by aeolian processes, petrography, and morphology (Medvedev, 1983b; Medvedev, Sklyarevskiy, 1982).

In his doctoral dissertation on the Paleolithic of the Angara basin, Medvedev described the stratigraphic position of this group as a sand and pebble sublayer separating the lower and upper units of the Early Sartan solifluction deposits (1983a). Lithic assemblages of the "Makarovo Horizon" are considered as redeposited, while the period of aeolian activity that affected them is ascribed to a "short-term" episode of extreme deflation in the region in the conditions of paleo-desert environment during the Early Murukta age (70–60 ka uncal BP) (Medvedev, 2001). Technical and morphological characteristics of these assemblages are as follows: "week to moderate degree of corrasion of artifacts' surfaces; presence of cores of terminal-lateral technique of reduction for blades and bladelets; presence of bifacial technique; presence of burins and chisel-like tools; presence of points, convergent and déjeté scrapers" (Medvedev, Novoseltseva, 2011: 108–109). Proceeding from technological and morphological aspects of artifacts, degree of corrasion, and stratigraphic context, Medvedev referred complexes of the "Makarovo Horizon" (Gora Igetey I, horizon VI of Sosnovyi Bor, and Makarovo IV) to the Late Middle/Early Upper Paleolithic (Medvedev, Sklyarevskiy, 1982; Medvedev, 2001).

M.P. Aksenov had a somewhat different view on the age of Makarovo IV—a key site of the "Makarovo Horizon". He examined the depositional context of archaeological remains at the site and noted the presence of Mururkta horizons unaffected by denudation in the underlying sediments, and remains of Late Karga soil horizons in the overlying units. Thus, the grus-pebble sublayer with corraded artifacts at Makarovo IV was associated with the Early Karga formations affected by denudation during the Konoschel cooling; therefore, it could be dated to 50 (55) – 33 ka uncal BP (Aksenov, 2009: 198). The age of the archaeological material was the same: Aksenov believed that its redeposition occurred by a slight linear shift down the slope, whereby the cultural horizon was destroyed by aeolian processes, and the enclosed artifacts covered the deposits enforced by pebbles.

A different view of the "Makarovo Horizon" was expressed by E.P. Rybin and A.M. Khatsenovich (2020). Focusing on technological and morphological aspects, they note that the Makarovo IV industry contains both corraded and uncorraded artifacts, and that industries included in Makarovo IV (Gora Igetey I and Kolpakov Ruchey) lack common features. Makarovo IV, therefore, is an amalgam of Late Upper Paleolithic types (end-scrapers on blades, and carinate ones) and those of the Initial Upper Paleolithic (high frequency of small blades, trimmed and stemmed points, foliated points with bifacially thinned bases). Questioning the "Makarovo Horizon" as an umbrella term, Rybin and Khatsenovich believe that this industry was either a mixture or a highly unusual Baikal version of the blade complex dating to the Initial Upper Paleolithic. In the latter case, Makarovo IV dates to the Karga stage.

In this regard, the following points concerning the stratigraphy, corrasion, and technical and morphological characteristics of artifacts of Stoilo should be noted. A distinctive feature of Stoilo stratigraphic section is the evidence of solifluction processes in the sediments incorporating the grus-pebble sublayer. Taking into account the gap manifested by the change in composition of the solifluction sediments (loams–sandy loams), its upper section can be dated only to the Early Sartan period. Given that corrasion is weak, it is unlikely that artifacts had been repeatedly replaced over a prolonged period from other locations, where they could have been corraded during the Murukta stage. Chances are that Aksenov was right stating that redeposition at Makarovo IV occurred by an insignificant linear shift. Environmental processes, such as denudation, caused a mixture of grus and pebbles with artifacts in a subhorizontal rather than stratified manner, suggesting that periods of solifluction and deflation were partially separated in time (lithological layers 7A and 7B).

Notably, Stoilo industry is visually much less corraded than most artifacts from Gora Igetey, horizon VI of Sosnovyi Bor, and Makarovo IV. This can be indicative of a different environment during the formation of these complexes. Though G.I. Medvedev (2001: 271) denied the "success" of the Sartan desert invasion, which could have been manifested by the corrasion of lithics, S.M. Tseitlin, a geologist specializing in the Paleolithic, having studied the materials from horizon VI of Sosnovyi Bor, noted that pebbles and Paleolithic siliceous artifacts could have been affected by aeolian processes exactly during the culmination of the Sartan cooling, i.e. 19–16 ka uncal BP (1979: 169). A uniformly weak corrasion of Stoilo lithics, as compared to a wide range of its manifestations at Makarovo-type sites of the Belaya (horizon VI of Sosnovyi Bor) and Osa-Unga regions (Gora Igetey I), indirectly attests to various environments of those sites.

Technical and morphological aspects of Stoilo lithics are also indicative of the Early Sartan age of the industry. Though typologically distinct artifacts are not numerous, in our view, the available assemblage by its appearance resembles the Middle Upper Paleolithic of Baikal Siberia. Judging by core-trimming elements (tablets, lateral flakes, and semi-crested blades) and tool blanks, the main strategy of artifact production was prismatic blade

reduction. Small-sized implements fashioned primarily on blades of various kinds, in combination with a crudely worked pebble tool, link this complex with materials from "classic" horizons of Malta (Gerasimov, 1935). If separate artifacts are compared, parallels with Middle Upper Paleolithic industries become more distinct. Certain types of artifacts from Stoilo, such as spurred implements (points), "beaked" tools, and blades with distal working edge (Gerasimov, 1935: Fig. 22, 23; Akimova, 2021: Fig. 9; The Paleolithic…, 1998: Fig. 105–107, 113), resemble those of Malta, Ust-Kova, and Buret. Notably, the elevation marks of Makarovo IV, too, are close to those of Malta and Buret. However, no definite conclusions regarding the age of the industry can be drawn at present, as the collection is typologically incomplete.

Conclusions

The available materials from Stoilo can be summed up as follows. The Paleolithic complex is associated with the grus-pebble sublayer underlying the Sartan sediments. The age and genesis of the sedimentation units below are controversial. The complex has marks of redeposition. The finds represent the weakly corraded lithic industry of uniform raw material (Belaya flint), showing blade prismatic reduction. The toolkit consists of implements fashioned on blades and flakes in roughly equal parts. These are mainly spurred tools, burins, naturally backed knives, retouched blades, blades and flakes with traces of use.

The Paleolithic industry from Stoilo can tentatively be dated to the first half of Sr^1 to early Sr^2 (~21–18 ka uncal BP). This is evidenced by the totality of data regarding stratigraphy, technology, morphology, and corrasion. Nonetheless, given the scarcity of science-based findings, small size of the excavated area, and the composition of the industry, our preliminary conclusions should be viewed as an invitation to a discussion around the nature of the "Makarovo Horizon".

Excavations planned for the nearest future will hopefully help resolve certain issues primarily concerning the stratigraphy of cultural horizons and the nomenclature of the lithic industry. Another promising direction is to compare materials from Stoilo with aeolian-corraded lithics of the "Makarovo Horizon" in the Belaya and Osa-Unga geoarchaeological regions.

Acknowledgments

Technical and typological analysis of the artifacts was carried out by S.A. Kogai, under the Russian Science Foundation Project No. 21-78-10146. The authors are grateful to paleopedologist P.N. Rebrikov (Irkutsk State University) for his consultations on the description of the stratigraphic section.

References

Akimova E.V. 2021
Problemy izucheniya i interpretatsii paleolita Ust-Kovy. *Izvestiya laboratorii drevnikh tekhnologiy*, vol. 17 (1): 9–32.

Aksenov M.P. 2009
Paleolit i mezolit Verkhnei Leny. Irkutsk: Izd. Irkutsk. Gos. Tekhn. Univ.

Geologicheskaya karta SSSR. M: 1 : 200 000. Seriya Vostochno-Sayanskaya, list No. 48-XXVI: Obiyasnitelnaya zapiska. 1961
M.M. Ivanshina (comp.), Y.N. Deyev (ed.). Moscow: Gosgeoltekhizdat.

Gerasimov M.M. 1935
Raskopki paleoliticheskoi stoyanki v s. Malta. In *Paleolit SSSR: Materialy po istorii dorodovogo obschestva*. Moscow, Leningrad: Gos. sots.-ekon. izd., pp. 78–124. (Izvestiya GAIMK; iss. 118).

Golubtsov V.A., Cherkashina A.A., Snytko V.A. 2019
Pervye dannye o vozraste i usloviyakh formirovaniya karbonatnykh novoobrazovaniy v pozdnepleistotsenovykh i golotsenovykh pochvakh Verkhnego Priangariya. *DAN*, vol. 486, No. 6: 727–732. https://doi.org/10.31857/S0869-56524866727-732

Kamennyi vek Yuzhnogo Priangariya: Belskiy geoarkheologicheskiy raion: Putevoditel Mezhdunar. simp. "Sovremennye problemy paleolitovedeniya Evrazii", 1–9 avg. 2001 g., g. Irkutsk. 2001
G.I. Medvedev, E.A. Slagoda, E.A. Lipnina, N.E. Berdnikova, A.G. Generalov, E.O. Rogovskoy, E.B. Oschepkova, G.A. Vorobieva, P.E. Shmygun. Vol. 2. Irkutsk: Izd. Irkutsk. Gos. Univ.

Kind N.V. 1974
Geokhronologiya pozdnego antropogena po izotopnym dannym. Moscow: Nauka.

Medvedev G.I. 1983a
Paleolit Yuzhnogo Priangariya. D.Sc. (History) Dissertation. Novosibirsk.

Medvedev G.I. 1983b
Paleoliticheskiye obitateli yuga Sibirskogo ploskogoriya i drevniye kultury Severnoi Ameriki. In *Pozdnepleistotsenovye i rannegolotsenovye kulturnye svyazi Azii i Ameriki*. Novosibirsk: Nauka, pp. 36–41.

Medvedev G.I. 2001
O geostratigrafii ansamblei eolovo-korradirovannykh artefaktov Baikalskoi Sibiri. In *Sovremennye problemy Evraziiskogo paleolitovedeniya*. Novosibirsk: Izd. IAET SO RAN, pp. 267–272.

Medvedev G.I., Novoseltseva V.M. 2011
Khronologiya, stratigrafiya i tekhnomorfologiya kompleksa artefaktov geoarkheologicheskogo mestonakhozhdeniya Gora Igetei I. *Vestnik Novosibirskogo gosudarstvennogo universiteta*. Ser.: Istoriya, filologiya, vol. 10. Iss. 7: Arkheologiya i etnografiya: 100–110.

Medvedev G.I., Sklyarevskiy M.Y. 1982
Problemy izucheniya paleoliticheskikh izdeliy iz kamnya s eolovoi korraziey obrabotannykh poverkhnostei (vozrast – kultura – geografiya). In *Problemy arkheologii i etnografii Sibiri: Tezisy dokladov k region. konf*. Irkutsk: Irkutsk. Gos. Univ., pp. 41–43.

Problemy nauchnoi ekspertizy i praktiki izucheniya geoarkheologicheskikh obyektov Baikalskoi Sibiri. 1996

G.I. Medvedev, A.G. Generalov, N.I. Drozdov, L.V. Lbova, E.V. Akimova, N.E. Berdnikova, V.N. Vetrov, G.A. Vorobieva, O.I. Goryunova, A.L. Zaika, S.V. Lastochkin, E.A. Lipnina, V.I. Makulov, S.S. Osadchiy, E.B. Oschepkova, S.A. Saveliev, E.V. Tashak (comp.). Krasnoyarsk, Irkutsk, Ulan-Ude: Arkom.

Rybin E.P., Khatsenovich A.M. 2020

Makarovskaya zagadka: Samyi ranniy verkhniy paleolit Evrazii ili pribaikalskiy variant tekhnokompleksa nachalnogo verkhnego paleolita perioda MIS-3? *Stratum Plus*, No. 1: 279–303.

Sosnovskiy G.P., Petri B.E., Gerasimov M.M., Okladnikov A.P. 1934

Otchet nachalnikov otryadov o rabotakh Angarskoi ekspeditsii. *Archives LOIA AN SSSR 1934 god*. F. 42, w/o inv., D. 29, fol. 1-44.

Stepanova K.N. 2015

Nemodifitsirovannye kamennye orudiya verkhnego paleolita Vostochnoi Evropy. Cand. Sc. (History) Dissertation. St. Petersburg.

The Paleolithic of Siberia: New Discoveries and Interpretations. 1998

A.P. Derevianko, W.R. Powers, D.B. Shimkin (eds.). Novosibirsk, Chicago: Univ. of Illinois.

Tseitlin S.M. 1979

Geologiya paleolita Severnoi Azii. Moscow: Nauka.

Ukazatel arkheologicheskikh pamyatnikov Irkutskoi oblasti: Usolskiy raion: Materialy k svodu pamyatnikov istorii i kultury Irkutskoi oblasti. 1991

N.E. Berdnikova, I.L. Lezhnenko, N.A. Saveliev, G.I. Medvedev, G.M. Georgievskaya. Irkutsk: Uprpoligrafizdat.

Vorobieva G.A. 2010

Pochva kak letopis prirodnykh sobytiy Pribaikalya: Problemy evolyutsii i klassifikatsii pochv. Irkutsk: Izd. Irkutsk. Gos. Univ.

Vorobieva G.A., Berdnikova N.E., Vashukevich N.V., Kuklina S.L., Chaika N.V. 2010

Sledy karginskogo pochvoobrazovaniya v doline r. Beloi (Yuzhnoye Pribaikalye) i ikh vliyaniye na agroproizvodstvennye svoistva pochv. *Zemledeliye, pochvovedeniye i agrokhimiya*, No. 4: 32–38.

Vorobieva G.A., Medvedev G.I. 1984

Pleistotsen-golotsenovye otlozheniya i pochvy arkheologicheskikh pamyatnikov yuga Srednei Sibiri. Pt. I: Pleistotsen: Rukovodstvo. Irkutsk: Izd. Irkutsk. Gos. Univ.

Received June 1, 2022.
Received in revised form December 2, 2022.

doi:10.17746/1563-0110.2023.51.4.025-034

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Stone Age Ivory Points from the Arctic Zone of Northeast Asia

We give a technological and typological description of two well-preserved points (one fragmented rod-shaped, the other double-slotted), made of mammoth ivory and found in the Ust-Yansky District of Sakha-Yakutia in 2016. Traces evidencing various stages of manufacture are described in detail. A succession of technological operations is reconstructed, from the preparation of preforms and further processing by planing and abrasion to final polishing. Spall negatives on artifacts are interpreted as post-depositional damage that could have occurred from the effect of cryogenic processes in sediments. The slotted specimen is decorated with five finely engraved arrows. The discovery context and the morphology of the rod-shaped specimen are similar to those of ivory points from the Yana sites, whereas the slotted one resembles those from Zhokhovo and other Northeast Asian sites of the same age. Radiocarbon analysis of the points supports these findings. The following conclusions are reached: the rod-shaped point dates to MIS 3, and the slotted one, to MIS 2; such points evidence an elaborate technology of ivory processing during the Late Pleistocene and Early Holocene in the high latitudes of Northeast Asia and an adaptation to the scarcity of lithic raw material in the region.

Keywords: *Northeast Asia, Pleistocene, Holocene, mammoth ivory, ivory points, traceological analysis.*

Introduction

Mammoth tusks have been used as a raw material in the manufacture of tools, weapons, personal ornaments, and symbolic items since remote antiquity; this is one of the striking examples of human adaptation strategies, and one of the important components of the material culture of ancient humans. The manufacture of hunting tools from tusk points not only to the availability of bone resources, but also to the fact that this material was stronger than stone or wood, which were rare in the tundra-steppe landscapes of the Arctic zone of Northeast Asia (Albrecht, 1977; Basilyan et al., 2011). Among other ways, osseous raw materials were obtained through hunting (Nikolskiy, Pitulko, 2013). Getting mammoth ivory, which was used to make weapons, was one of the main goals of hunting (Pitulko, Pavlova, Nikolskiy, 2015). Therefore, the sites evidencing human habitation during the Paleolithic are usually associated with large clusters of faunal remains, the most famous of which are Berelekhskoye (Vereshchagin, 1977; Pitulko, Basilyan, Pavlova, 2014; Pitulko, Pavlova, Basilyan, 2014) and one of the localities of the Yana complex (Basilyan et al., 2011). In recent decades, several paleontological sites have been discovered, including those containing archaeological materials (Cheprasov et al., 2015; Dyakonov et al., 2020; Kandyba, Dyakonov, Pavlov et al., 2020; Kandyba, Zotkina, Pavlov et al., 2022; Pavlov, Suzuki, 2020). In general, in the Arctic zone of Northeast Asia, relatively few Stone Age sites of the Late Pleistocene and Early Holocene have been found (Pitulko et al., 2015; Pitulko, Pavlova, Nikolskiy, 2017; Pitulko, Pavlova, 2019). For that reason, isolated indicative finds from this region—animal bones with traces of anthropogenic impact—are important for science, and provide solid grounds for establishing the earliest evidence of ancient human habitation in this region (Pitulko et al., 2015; Pitulko, Pavlova, Nikolskiy, 2017; Pitulko, Pavlova, 2019); the same is true for solitary artifacts marking the zone of human activity in the region during the periods corresponding to MIS 3 and 2 (Kandyba, Grigoriev, Tikhonov et al., 2015; Kandyba, Fedorov, Dmitriev et al., 2015).

The technology of production of ivory implements is quite specific. S.A. Semenov (1957: 180–184, fig. 74–76), a Soviet scholar, was among the first archaeologists to pay special attention to this aspect. Experts studied the sequences of *chaîne opératoire* in preparing tool blanks (Gerasimov, 1941; Filippov, 1978; Khlopachev, 2006; Khlopachev, Girya, 2010; Tartar, White, 2013), and techniques of the manufacture of personal ornaments (Otte, 1974; Poplin, 1995; White, 1993, 1997). The most amazing collection of ivory artifacts from the Arctic zone of Northeast Asia has been reported from the Yana sites (Pitulko, Nikolskiy, Girya et al., 2004; Pitulko et al., 2012; Pitulko, Nikolskiy, Basilyan et al., 2013; Pitulko, Pavlova, Nikolskiy, 2015). Some objects discovered outside the stratigraphic context provide information about the cultural and chronological range of their manufacture and use. These artifacts are studied in terms of mammoth tusk processing techniques and use-wear.

The points found in 2016 in the Ust-Yansky District of the Republic of Sakha (Yakutia) (hereinafter RS(Y)) (Grigoriev et al., 2017) were subjected to use-wear analysis. A double-slotted point was discovered by local residents of the Tumat village, Ust-Yansky District RS(Y), in the tundra zone, on the bank of the Krestyakh River (a tributary of the Syalakh River) (71°14′10.86″ N, 140°1′39.68″ E). A fragmented rod-shaped point was found by local residents of the Kazachiye village, Ust-Yansky District RS(Y), at the Yana mammoth cemetery in the lower reaches of the Yana River (70°43′25.25″ N, 135°24′47.62″ E). In 2017, the artifacts were deposited at the Mammoth Museum of the Research Institute of Applied Ecology of the North of the Ammosov North-Eastern Federal University, where they are recorded as MM-A18 and MM-A19.

This article provides the results of the cultural and chronological attribution of the mammoth ivory artifacts found outside the stratigraphic context, carried out using an integrated approach.

Methods

The ivory points have been subjected to technical-typological, experimental-traceological*, and radiocarbon analyses. The manufacturing techniques and types of the items—the main characteristics for cultural attribution—have been analyzed by technical-typological methods. This reveals deviations in behavior and raw material selection that emerged during adaptation to a particular environment by convergence, or due to migration flows. Points with specific technical and typological characteristics should occur in stratified sites that are close (or supposedly close) in age and similar in cultural and technological features.

The basic technical operations involved in the manufacture of the items have been reconstructed by the experimental-traceological method (Semenov, 1957; Keeley, 1980).

The study of artifacts was carried out in stages and involved an assessment of the state of preservation of the items, a preliminary examination using a stereoscopic

**Traceology* includes analysis of not only functional (use-wear), but technological aspects of archaeological artifacts, including evidence of production and utilisation, and post-depositional or other natural alteration, among other parameters.

microscope to identify use-wear signs, their comparison with published data, and a small series of experiments aimed at identification of basic techniques of tusk processing with stone tools. The final stage of the work involved a detailed study of artifacts using a microscope at low (up to ×50) and high (from ×50 to ×300) magnifications in order to interpret the use-wear traces on the artifacts.

The analysis was carried out using an Olympus SZX7 stereoscopic microscope (×8 to ×56) and an Olympus BHMJ metallographic microscope (×50 to ×300). Photographic recording of artifacts and use-wear signs on their surfaces was carried out by a Nikon D750 full-matrix camera; macro- and microfeatures were recorded remotely from microscopes using Nikon Pro Camera Control software. To obtain the best resolution photographs, the stacking technique was used (taking multiple images at different focus distances); combining of stacks was carried out using the Helicon Focus software.

For a proper interpretation of the traces on the ivory points, we used the published findings (Villa, d'Errico, 2001; Maigrot, 2003; Mazza et al., 2014; Haynes, 2017; Augustin et al., 2019; Thun Hohenstein, Gargani, Bertolini, 2020). The monograph by G.A. Khlopachev and E.Y. Girya "Secrets of Ancient Bone Cutters of Eastern Europe and Siberia: Techniques for Processing Mammoth Tusk and Reindeer Antlers in the Stone Age (Based on Archaeological and Experimental Data)" (2010) was taken as a main reference publication.

Notably, the traces of processing can be reliably classified into three main categories (technological, functional, and post-depositional), but not on all the artifacts. This concerns the objects with an unknown context of occurrence. Therefore, the origins of some traces can only be hypothesized.

The chronological position was established through the radiocarbon analysis of the samples that were drilled out from the inside of the points. Chemical preparation of the samples was carried out in the Laboratory for Isotope Research of the Institute of Archaeology and Ethnography SB RAS. Fragments of bone samples were washed with distilled water, dried at room temperature, and ground into powder using a FreezerMill cryogenic homogenizer. After this, the powder of each sample was placed into the cell of an ASE350 automatic extractor, washed with methylene chloride at room temperature once, and then dried. At the following stage, the bone powder was demineralized by treating it with a 0.5 M aqueous solution of HCl at room temperature and washing with water up to pH = 7, then the powder was treated with a 0.05 M aqueous solution of NaOH at room temperature for 15 minutes, washed with distilled water up to pH = 7, and was re-treated with a 0.5 M HCl solution at room temperature for 30 min. After this, the powder was washed with distilled water up to pH = 3 and kept at this acidity and 70 °C for 12 hours. Then the solution was separated from the sediment by centrifugation on an LMC-3000 device at a speed of 3000 rpm for 3 minutes; the solution was placed into test tubes, centrifuged again at 14,500 rpm for 70 min, separated from the sediment, and dried at 70 °C to get collagen powder.

The next stage was the procedure of graphitization of collagen at AGE-3, pressing each 1 mg of carbon into targets, which were subjected to radiocarbon analysis at the unique scientific device "Accelerator Mass Spectrometer of the Institute of Nuclear Physics SB RAS". In addition to research samples, standard samples of oxalic acid OxI and sucrose ANU were also subjected to the graphitization procedure. The relative content of $^{14}C/^{13}C$ radiocarbon in research samples was calculated as the average of two parallel graphite targets, and normalized by the $^{14}C/^{13}C$ content in the standards.

Materials

Artifact 1 is a fragmented, slightly curved rod-shaped head of a spear or dart, with a total length of 75 cm. Three fragments of the item were found; two of them (2, 3) can be refitted (Fig. 1). The fragment between parts 1 and 2 is missing.

Fragment 1 (distal) (Fig. 1, *A*, *1*) is the largest (ca 39 cm) in the set. The tip is slightly damaged, possibly owing to post-depositional processes, because this is the most fragile part (Fig. 1, *B*, *a*). The proximal part is also damaged; the spalls are visible on both sides (Fig. 1, *B*, *e*). The surface of the cementum layer of the tusk is well preserved (Fig. 1, *B*, *b*).

Traces of planing are present on almost the entire surface of the fragment: long transverse, most often parallel or intersecting at an acute angle, overcuts of the tusk's surface (Fig. 1, *B*, *c*, *d*; 2, *a*, *b*). Moreover, these grooves are considerably long and continuous, which indicates the use of a tool with a handle, possibly a two-handed tool (Khlopachev, Girya, 2010: 104, fig. 130–131). Starting from the medial part, the surface is "stepped" and overlapped by planing marks. In the proximal part, there are series of transverse, oblique, linear parallel traces, concentrated on several surfaces that form the round shape of the item (see Fig. 1, *B*, *e*). This combination of signs suggests the hewing of small longitudinal sections and the subsequent abrasion of the surface. Since, near the proximal edge, there is an obvious overlap of these oblique marks by planing (see Fig. 1, *B*, *f*), it can be concluded that the preform was first hewn, then the resulting faces were flattened by abrasion (see Fig. Fig. 2, *c–f*); the final stage of smoothing involved planing (see Fig. 1, *B*, *f*, *g*; 2, *a*, *b*). Moreover, the final operation was carried out from the tip and continued in the medial part. The cementum layer shows planing marks mainly in the distal part, closer to the tip (see Fig. 1, *B*, *b*).

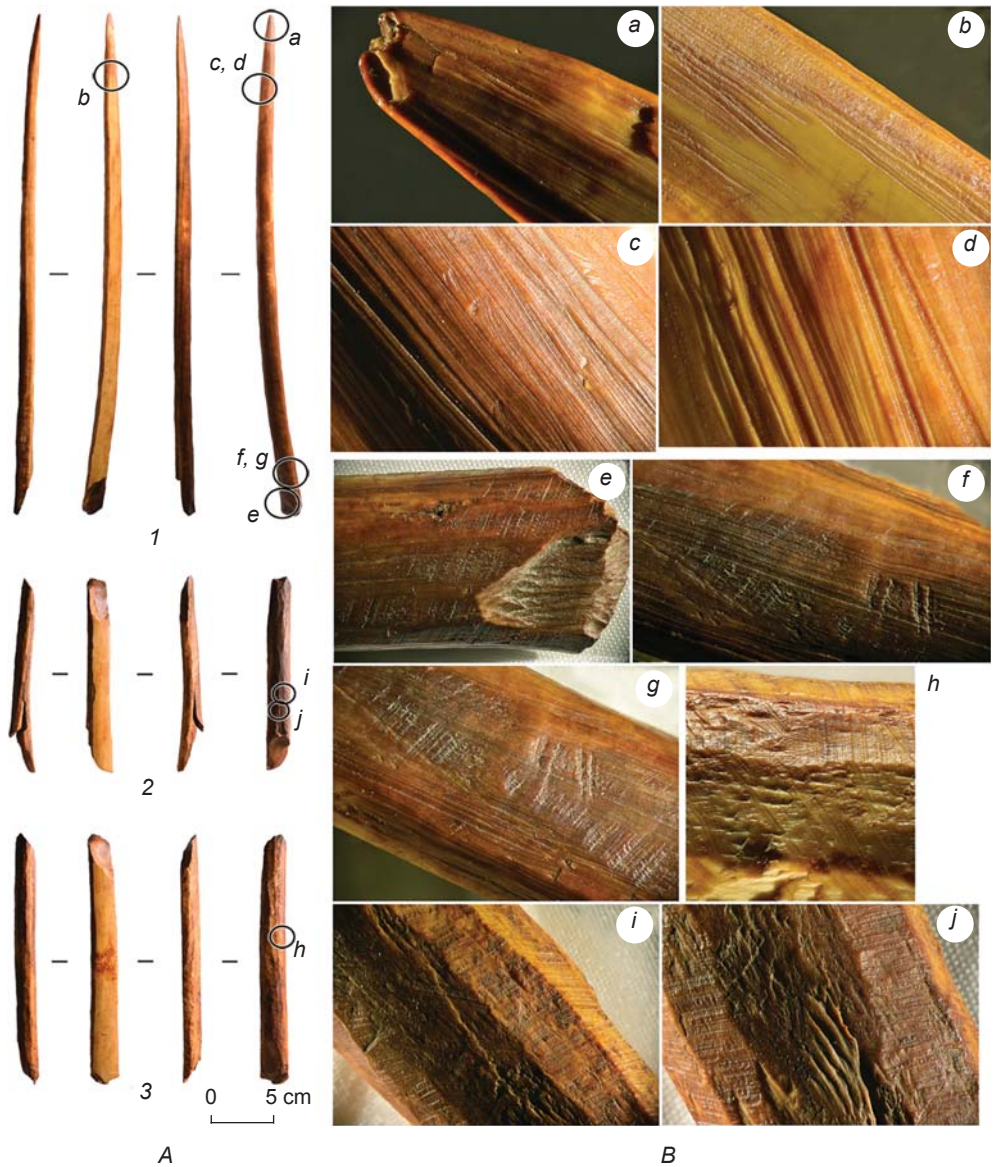

Fig. 1. Rod-shaped point.
A: *1–3* – general view of fragments; *B: a* – damage at the tip of fragment 1 (×20 magnification); *b* – traces of planing, partially extending to the area with cementum layer on fragment 1 (×20 magnification); *c*, *d* – traces of planing on fragment 1 (×20 and ×40 magnification, respectively); *e* – combination of traces of abrasion of the hewn surface and traces of planing, a negative scar in the proximal part of fragment 1 (×8 magnification); *f*, *g* – combination of traces of scraping and planing, including mutual overlaps in the proximal part of fragment 1 (×10 magnification), *h* – change in the orientation of traces of abrasion (scraping) of the hewn faces of fragment 3 due to a change in the position of the processed blank (×10 magnification); *i*, *j* – differently oriented traces of scraping of hewn sections of the blank on fragment 2 (×10 and ×20 magnification, respectively). *Photo by L.V. Zotkina*.

The boundaries of the cementum layer in other sections are very even and straight.

Fragment 2 (medial) (see Fig. 1, *A*, *2*). Negative scars in the distal part are on the side of the cementum layer (do not refit with fragment 1), those in the proximal part are on the side of the prepared surface (refit with fragment 3).

The boundaries of the cementum layer are quite distinct, with the exception of the left edge in the medial part, damaged by two removals. The prepared surface shows characteristic longitudinally oriented faces, forming a rounded shape. The boundaries of almost all the faces are uneven, but well-flattened by abrasion, which is suggested by the transversely and diagonally oriented short parallel linear marks. Thus, the preform was hewn and then subjected to abrasion in order to flatten and smooth the surface. Linear marks along the entire length of the fragment, on each surface, are almost always oriented in the same direction. A change in the orientation of abrasion (scraping) marks is noted only in areas where the artisan, having completed the cutting off of one face,

began to work on the other face; when the position of the item changed, the direction of the traces changed slightly (see Fig. 1, *B*, *i*, *j*). This suggests the use of a sufficiently large abrasive tool, which ensured contact of its active part with the processed surface along almost the entire length of each face, rather than along its particular parts.

Fragment 3 (proximal) (see Fig. 1, *A*, *3*). Negative scars are observed in the proximal and distal parts. The distal part refits with fragment 2, although even in the section where the edges of the two fragments fit one another, a small facet of removal is visible on the side of the cementum layer, whose negative is recorded lower in the same section. In the distal part, the removal facet is on the side of the cementum layer; in the proximal part, on the treated side.

Identical hewing scars flattened by scraping are noted. However, closer to the proximal end, more pronounced stepped effect and solitary negative hewing scars are recorded on the surface of the fragment (Ibid.: 119, fig. 153–155) (Fig. 1, *B*, *h*). In addition, the right edge (from the side of the cementum layer) shows a stepped surface caused by hewing; the tool moved from the tip to the proximal end. Closer to the proximal part, a large and deep dent is noted on the prepared surface, which covers the signs of working; its edges were not flattened or smoothed during scraping. The dent occurred most likely accidentally and was not associated with deliberate working, although the shape of the dent resembles the trace from a chopping tool.

Artifact 2 is a well-preserved slotted point, 56 cm long (Fig. 3, *A*, *1*). It shows rare and minor fresh scratches that may due to transportation. The proximal part is fragmented, a "tongued" negative scar is observed, which is most often interpreted as a breakage during tusk deposition in frozen soil (Ibid.: 96, fig. 115). The surface reveals a series of rather deep scratches, which may also be associated with post-depositional processes (Fig. 3, *B*, *g*, *h*). A bright polish with irregular linear traces of various sizes and directions (Fig. 4, *a*, *b*, *e*, *f*) is noted over almost the entire surface of the artifact and is a sign of intense polishing at the final stage of processing. An intense polish is also observed along the edges of the slots, but currently it is not possible to distinguish between the polishing at the final stage of the artifact's processing and the use-wear traces. Two zones of black deposit are visible in one section along the edge of the point (see Fig. 3, *B*, *c*, *d*); perhaps these are the areas bearing the remains of the adhesive substance that fastened the microliths constituting the working edge.

A small damage was noted at the tip of the point; the damaged area was polished in the same way (see Fig. 3, *B*, *b*) as the entire item (see Fig. 4). This slight unevenness could have appeared on the tip during manufacture or use.

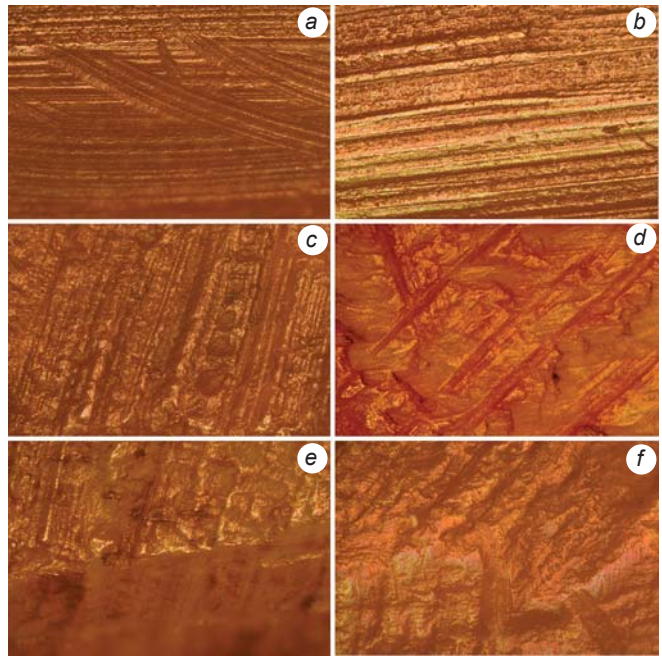

Fig. 2. Rod-shaped point.
a, *b* – traces of planing on fragment 1 (×50 magnification); *c*, *d* – traces of abrasion (scraping) of hewn sections on fragment 3 (×100 and ×50 magnification, respectively); *e*, *f* – traces of abrasion (scraping) of hewn sections on fragment 2 (×50 and ×100 magnification, respectively). *Photo by L.V. Zotkina*.

In addition to random minor scratches, there are some deliberate longitudinal engraved lines on the surface of the artifact (see Fig. 3, *B*, *a*). On the outer (convex) surface of the item, several thin lines made mostly with one reverse movement (cutting) are observed, forming an ornament of five "arrows" (Fig. 5, *B*); the arrows alternately extend to the right and left from the central line. In the area of "arrow" 4 (the second arrow from the tip), the central line turns into a crack (Fig. 5, *B*, 4*a*, 4*b*). Thus, the "arrow" closest to the tip runs from this crack rather than from the central line (Fig. 5, *B*, 5*a*, 5*b*). The "arrows" are formed by three lines (see, e.g., Fig. 5, 1*b*). First, a central line was engraved "running" from the main line stretching along the entire item; then two short notches were made, which were drawn from one point in opposite directions (longitudinally and transversely to the axis of the item), forming an arrow. The peculiarity of the ornament is due to the texture of the material. Longitudinal lines were drawn easily and did not change the trajectory planned by the artisan, because it followed the texture of the material. Transverse notches sometimes turned out with small fractures or parasite lines, which could occur owing to a greater resistance of the material, when the movement of the working part of the tool was directed against the fibers. This fine ornamentation was more visible on the fresh surface of the tusk than it is today.

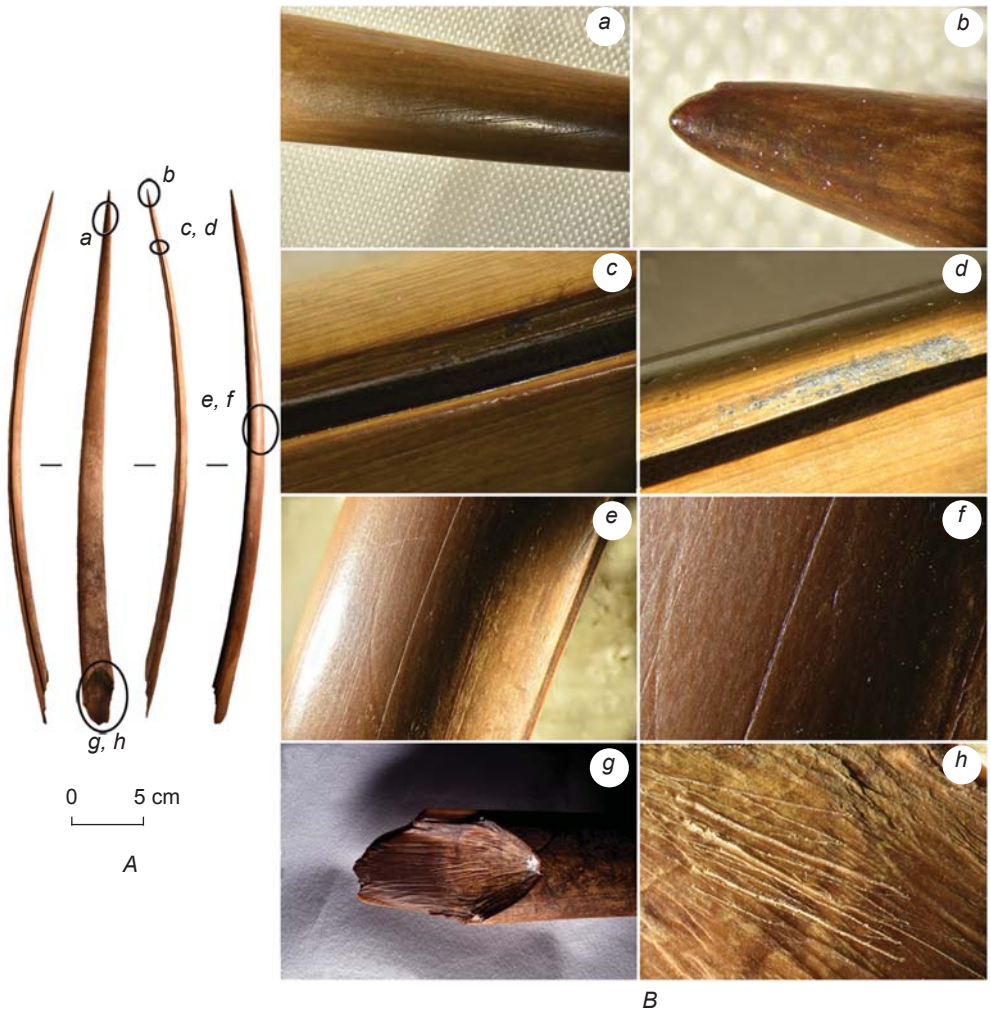

Fig. 3. Slotted point.
A – general view of the artifact in four projections; *B: a* – polishing and a series of longitudinal linear marks at the tip (×12.5 magnification); *b* – smoothed tip of the point (×56 magnification); *c*, *d* – slot retaining the remains of black presumably organic substance (×40 magnification); *e*, *f* – polished surface in the medial part, typical of the entire item, and fine engravings on the outer side (×10 and ×32 magnification, respectively); *g*, *h* – negative scar in the proximal part of the item and macrophoto of scratches on the negative scar (×16 magnification). Photo by *L.V. Zotkina.*

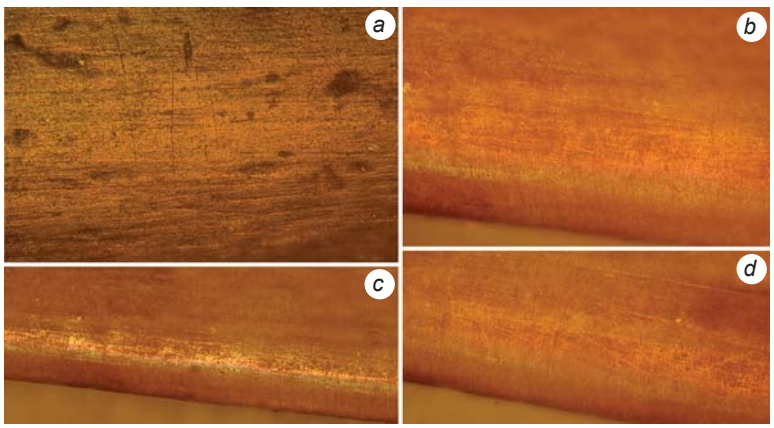

Fig. 4. Polished sections on the slotted point.
a – at the tip (×100 magnification); *b–d* – along the edges of the slots in various areas of the item, on the inner and outer sides of the slots (×100, ×50 and ×50 magnification, respectively). *Photo by L.V. Zotkina.*

Results

Technological characteristics

The technique of cutting slots made it possible to produce a long blank for the rod-shaped point and to retain the cementum layer surface (Ibid.: 120, fig. 97, 160); but in the region, the artisan most often used the wedging technique for such purpose (Pitulko, Pavlova, Nikolskiy, 2015). When the long longitudinal tusk-fragment was produced, the surface without a cementum layer was hewn out to round the shape in the cross-section; at that stage, a stepped relief was formed. To smooth it out, the surface was processed with an abrasive tool

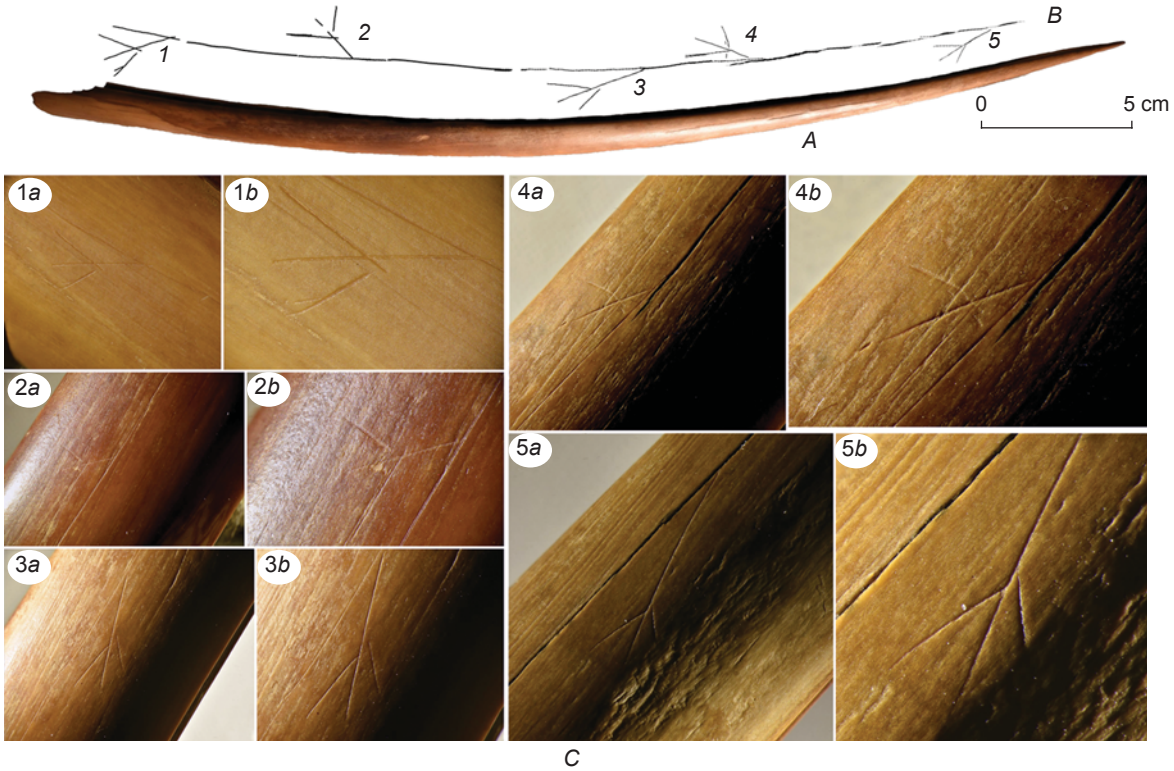

Fig. 5. Photo of slotted point (*A*), tracing of the ornament (*B*), photos of the elements (*C*).
1 a, *b* – the first "arrow" from the bottom, consisting of three fine engraved lines connected to a central longitudinal engraved line running along the entire outer side of the point (×10 and ×25 magnification, respectively); *2 a*, *b* – the second "arrow" from the bottom (×10 and ×25 magnification, respectively); *3 a*, *b* – the third "arrow" from the bottom (×10 and ×16 magnification, respectively); *4 a*, *b* – the fourth "arrow" from the bottom, connecting to the central engraved line running under the crack (×10 and ×25 magnification, respectively); *5 a*, *b* – the fifth "arrow" from the bottom, running under the crack (×10 and ×32 magnification, respectively). *Photo by L.V. Zotkina.*

(see Fig. 2, *c*–*f*). Grinding movements, most often oblique, were performed across the long axis of the workpiece. The abrasive surface was rather large, which ensured its contact with the treated faces simultaneously over almost the entire workpiece. The item was gradually rotated so as to smooth out each face. The final stage of processing was planing (see Fig. 2, *a*, *b*): it was presumably carried out with a two-handed tool, which made it possible to work out fairly extended areas of the surface, from the tip to the medial part. The cementum layer was planed only at the tip. Judging by the fact that smoothing by scraping and planing of the hewn areas was not completed, the item is an unfinished blank. The final stage of processing probably involved polishing. Fragmentation of the point could have occurred as a result of cryogenic deformations in sediments, which assumption is supported by the transverse fracture that separated fragments 2 and 3.

The morphological features of the slotted point suggest wedging of the tusk or sawing through the slots, with the subsequent separation of the longitudinal fragment from the main body of the tusk. It is possible that the item was not unbended, but was used in its original curved form. However, available parallels suggest that the blank was most likely undended by soaking and fastening it in a log groove under pressure*. After that, the blank was flattened by planing, and the entire surface was smoothed. Two slots were cut at the sides. Traces of planing and, especially, of primary fragmentation to get a blank have not been recorded, because these processes preceded the polishing. At the final production stage, the item was polished, probably with a soft material, such as leather/hide with addition of fat.

Radiocarbon age and available parallels

The radiocarbon age of the rod-shaped point is 32,858–32,143 BP (GV-03658), that of the slotted point, 14,236–14,094 BP (GV-03659)**, i.e., the items belong to the

*The descriptions of methods for unbending tusk blanks were suggested on the basis of experimental data (see (Filippov, 1978; Khlopachev, Girya, 2010: 82–89, fig. 96–109)).

**The initial radiocarbon values (28,363 ± 139 BP and 12,269 ± 36 BP, respectively) were calibrated in OxCal 4.4 software, IntCal20 calibration curve, 68.3 % confidence interval.

periods of MIS 3 and 2. Long ivory blanks, as well as the evidence of their production at that time, occur widely in Arctic Siberia (Pitulko, Pavlova, Nikolskiy, 2015; 2017: 134–135, fig. 7). Among the finds, the most noteworthy is a series of the Yana osseous items revealing the *chaîne opératoire* from the initial processing of raw material to the final stages of tool shaping. This technology involves longitudinal splitting and unbending of the tusk, processing of the resulting blanks, and production of rods with rectangular cross-sections. The method of longitudinal wedging and, probably, the technology of extraction (groove-and-splinter technique), used in production of long blanks, can be considered the main techniques of longitudinal splitting of complete tusks. Long blanks for the manufacture of rods for spears and darts produced by these techniques are typologically close to the Yana and Berelekh ivory artifacts (Vereshchagin, 1977; Pitulko, Pavlova, Nikolskiy, 2015). Evidence of the use of the longitudinal splitting technique in blank production is recorded at the sites dating to the turn of the Pleistocene and Holocene, such as Urez-22, Ozero Nikita, Ilin-Syalakh (Pitulko, Basilyan, Pavlova, 2014). Parallels to the slotted point are recorded among the finds from Zhokhovo (Pitulko, 1998), which are close to the artifacts in question in their radiocarbon age, although the ivory resource at this site was insufficient owing to the reduction of the mammoth steppe biome at the turn of the Pleistocene and Holocene (Pitulko, Kasparov, Pavlova, 2018). Notably, the ornament in the form of a series of "arrows" noted on the slotted point has not yet been recorded on any other finds from the region.

The extensive use of mammoth ivory in the Arctic zone of Northeast Asia is evidenced not only by the artifacts from archaeological sites, but also by isolated significant finds. These are the cores made of mammoth tusk from the Novaya Sibir Island; a mammoth ivory debitage discovered near the village of Zyryanka on the Kolyma River (Pitulko, Pavlova, Nikolskiy, 2015); and mammoth ivory debitage, as well as bones of mammoth, bison, and horse, fragmented by humans, at the Irelyakh-Siene site (Cheprasov et al., 2015). Thus, we assume the existence during the Late Pleistocene and Early Holocene in Northeast Asia of a vast territory inhabited by ancient populations having technologically and typologically similar osseous industries and common raw-material preferences.

Conclusions

Many Upper Paleolithic sites in Northern Eurasia contain hunting osseous tools that suggest the emergence of an effective technology of making tools from mammoth ivory and the adaptation of this technology to various climatic fluctuations. For the ancient hunters settling in the mammoth steppe, this animal was one of the main vital resources, the effective use of which is confirmed by finds—animal bones with fragments of ivory weapons stuck therein (Pitulko, Nikolskiy, Basilyan et al., 2013) and fragments of stone points presented in osteological collections (Nikolskiy, Pitulko, 2013). The Upper Paleolithic archaeological sites are often situated near concentrations of faunal remains. The evidence of the hunting practices of ancient populations provided at such localities as Sopochnaya Karga (Pitulko, 2016) and Lugovskoye (Zenin et al., 2006) indicates the effective development of hunting tactics based on the use of projectile weapons, ensuring successful exploitation of the fauna of open landscapes of the former Holarctic tundra-steppe zone. Other archaeological complexes—Malta (Sitlivy, Medvedev, Lipnina, 1997), Afontova Gora (Astakhov, 1999), and Sungir (Bader, 1998; Soldatova, 2014)—have no concentrations of paleontological material, although the remains of the mammoth fauna and hunting tools, personal ornaments, and symbolic items made from ivory were found at the sites. These finds suggest widespread technologies of processing ivory, as well as antler and bones from other mammoth fauna species. In fact, interaction between humans and mammoths is a fundamental characteristic of a great part of the Upper Paleolithic in northern Eurasia. Therefore, studies of the features of initial settlement and the history of human paleopopulations in the changing paleoecological conditions of North Asia in the Late Pleistocene, as well as the use of mammoth megafauna as a resource base by Paleolithic hunters, provide important information on the development of the early human populations of this region; the subsistence strategies of Northeastern Asian hunters can be considered an almost global example of human adaptation to extreme conditions.

Acknowledgements

The study was carried out under State Assignment FWZG-2022-0003 "Northern Asia in the Stone Age: Cultural Dynamics and Environmental Context".

The authors are grateful to K.A. Kolobova, Professor at the Russian Academy of Sciences, for consultations.

References

Albrecht G. 1977

Testing of materials as used for bone points in the Upper Paleolithic. In *Méthodologie appliquée à l'industrie de l'os préhistorique*. Paris: CNRS, pp. 122–199.

Astakhov S.N. 1999

Paleolit Yeniseya. Paleoliticheskiye stoyanki Afontovoy Gory v g. Krasnoyarske. St. Petersburg.: Yevrop. Dom.

Augustin F.J., Matzke A.T., Csiki-Sava Z., Pfretzschner H.-U. 2019

Bioerosion on vertebrate remains from the Upper Cretaceous of the Haţeg Basin, Romania and its taphonomic implications. *Palaeogeography, Palaeoclimatology, Palaeoecology*, vol. 534 (109318).

Bader O.N. 1998

Sungir. Paleoliticheskiye pogrebeniya. In *Pozdnepaleoliticheskoye poseleniye Sungir (pogrebeniya i okruzhayushchaya sreda)*. Moscow: Nauch. mir, pp. 5–164.

Basilyan A.E., Anisimov M.A., Nikolskiy P.A., Pitulko V.V. 2011

Woolly mammoth mass accumulation next to the Palaeolithic Yana RHS site, Arctic Siberia: Its geology, age, and relation to past human activity. *Journal of Archaeological Science*, vol. 38: 2461–2474.

Cheprasov M.Y., Obade T.F., Grigoriev S.E., Novgorodov G.P., Marareskul V.A. 2015

Noviye mestonakhozhdeniya mamontovoy fauny i paleoliticheskiye stoyanki v basseyne srednego techeniya r. Kolyma. *Vestnik SVFU im. M.K. Ammosova*, No. 6 (50): 53–68.

Dyakonov V.M., Simokaytis T.B., Protopopov A.V., Pavlov I.S., Plotnikov V.V., Khlakhula I., Dolakova N. 2020

Noviye mestonakhozhdeniya i obyekty arkheologii na arkhipelage Novosibirskikh ostrovov. In *Mezhdistsiplinarniye arkheologicheskiye issledovaniya drevnikh kultur Yeniseiskoy Sibiri i sopredelnykh territoriy: Tezisy Mezhdunar. nauch. konf. (Krasnoyarsk, 20–22 oktyabrya 2020 g.)*. Krasnoyarsk: Sib. Feder. Univ., pp. 24–25.

Filippov A.K. 1978

Tekhnologiya izgotovleniya kostyanykh nakonechnikov v verkhnem paleolite. *Sovetskaya arkheologiya*, No. 2: 23–31.

Gerasimov M.M. 1941

Obrabotka kosti na paleoliticheskoy stoyanke Malta. In *Paleolit i neolit SSSR*. Moscow: Izd. AN SSSR, pp. 65–85. (MIA; No. 2).

Grigoriev S., Stepanov A., Kandyba A., Obada Th., Rodionov G., Vasilev S., Van der Plicht J., Protodiakonov K., Cheprasov M., Novgorodov G., Grigorieva L., Dyakonov A., Savvinov G. 2017

New findings of Stone Age bone tips in the Arctic zone of Yakutia. In *VII Intern. Conf. of Mammoths and Their Relatives*, *Taiwan, September 17–23*. Taichung: National Museum of Natural Sciences, pp. 1–2.

Haynes G. 2017

Taphonomy of the Inglewood mammoth (Mammuthus columbi) (Maryland, USA): Green-bone fracturing of fossil bones. *Quaternary International*, vol. 445: 171–183.

Kandyba A.V., Dyakonov V.M., Pavlov I.S., Zotkina L.V., Protopopov A.V., Simokaytis T.B. 2020

Poleviye issledovaniya na territorii Bulunskogo rayona (Respublika Sakha (Yakutiya)) v 2020 godu. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XXVI. Novosibirsk: Izd. IAET SO RAN, pp. 107–112.

Kandyba A.V., Fedorov S.E., Dmitriev A.I., Protodyakonov K.I. 2015

Mestonakhozhdeniye Syalakh – noviy arkheologicheskiy obyekt pozdnego neopleistotsena Sibirskoy Arktiki. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XXI. Novosibirsk: Izd. IAET SO RAN, pp. 90–93.

Kandyba A.V., Grigoriev S.E., Tikhonov A.N., Nikolskiy P.A., Obade T.F., Cheprasov M.Y., Makarov V.S., Novgorodov G.P. 2015

Poleviye issledovaniya na ostrove Bolshoy Lyakhovskiy (Rossiyskaya Vostochnaya Arktika). In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XXI. Novosibirsk: Izd. IAET SO RAN, pp. 82–85.

Kandyba A.V., Zotkina L.V., Pavlov I.S., Dyakonov V.M., Parkhomchuk V.V., Petrozhitskiy A.V., Kuleshov D.A., Pavlova N.I., Protopopov A.V. 2022

Kompleksnoye izucheniye paleoliticheskikh obyektov Arkticheskoy zony (mestonakhozhdeniye Muostakh, Bulunskiy rayon, Respublika Sakha (Yakutiya)). *Severo-Vostochniy gumanitarniy vestnik*, No. 2 (39): 24–34.

Keeley L.H. 1980

Experimental Determination of Stone Tool Uses: A Microwear Analysis. Chicago, London: Univ. of Chicago Press.

Khlopachev G.A. 2006

Bivneviye industrii verkhnego paleolita Vostochnoy Yevropy. St. Petersburg: Nauka.

Khlopachev G.A., Girya E.Y. 2010

Sekrety drevnikh kostorezov Vostochnoy Yevropy i Sibiri: Priemy obrabotki bivnya mamonta i roga severnogo olenya v kamennom veke (po arkheologicheskim i eksperimentalnym dannym). St. Petersburg: Nauka.

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. Paris: Univ. de Paris 1, Laboratoire de Chrono-écologie.

Mazza P.P.A., Stefaniak K., Capalbo C., Cyrek K., Czyzewski Ł., Kotowski A., Orłowska J., Marciszak A., Ratajczak-Skrzatek U., Savorelli A., Sudoł-Procyk M. 2014

Taphonomic analysis of the MIS 4–3 (Late Pleistocene) faunal assemblage of Bi´snik Cave, Southern Poland: Signs of a human-generated depot of naturally shed cervid antlers? *Quaternary International*, vol. 326–327: 20–63.

Nikolskiy P.A., Pitulko V.V. 2013

Evidence from the Yana Palaeolithic site, Arctic Siberia, yields clues to the riddle of mammoth hunting. *Journal of Archaeological Science*, vol. 40: 4189–4197.

Otte M. 1974

Observation sur le débitage et le faconnage de l'ivoire dans l'Aurignacien en Belgique. In *Actes du premier colloque international sur l'industrie de l'os dans la Prehistoire*. Aix-en-Provence: Abbaye de Sénanque, pp. 93–96.

Pavlov I.S., Suzuki N. 2020

Tabayuryakhskiy mamont (*Mammuthus primigenius* Blum., 1799) s ostrova Kotelniy, Novosibirskiy arkhipelag. *Prirodniye resursy Arktiki i Subarktiki*, vol. 25 (2): 56–66.

Pitulko V.V. 1998

Zhokhovskaya stoyanka. St. Petersburg: Dmitriy Bulanin.

Pitulko V.V. 2016

Svidetelstva rannego rasseleniya cheloveka v arkticheskoy oblasti Yevrazii: Noviye nakhodki i perspektivy issledovaniy. In *Arkheologiya Arktiki*, iss. 3. Kaliningrad: pp. 91–116.

Pitulko V.V., Basilyan A.E., Pavlova E.Y. 2014
The Berelekh mammoth graveyard: New chronological and stratigraphical data from the 2009 field season. *Geoarchaeology*, vol. 29: 277–299.

Pitulko V.V., Kasparov A.K., Pavlova E.Y. 2018
Sistema zhizneobespecheniya i godovoy khozyaistvenniy tsikl drevneishikh okhotnikov vysokoshirotnoy Arktiki (rannegolotsenovaya Zhokhovskaya stoyanka, Novosibirskiye ostrova). In *Arkheologiya Arktiki*, iss. 5. Omsk: pp. 39–62.

Pitulko V.V., Nikolskiy P.A., Basilyan A.Y., Pavlova E.Y. 2013
Human habitation in the Arctic Western Beringia prior the LGM. In *Paleoamerican Odyssey*. College Station: Texas A&M Univ. Press, pp. 13–44.

Pitulko V.V., Nikolskiy P.A., Girya E.Y., Basilyan A.E., Tumskoy V.E., Koulakov S.A., Astakhov S.N., Pavlova E.Y., Anisimov M.A. 2004
The Yana RHS site: Humans in the Arctic before the Last Glacial Maximum. *Science*, vol. 303: 52–56.

Pitulko V.V., Pavlova E.Y. 2019
Rasseleniye cheloveka v Arktike v pozdnem neopleistotsene – pervoy polovine golotsena: Osnovniye sobytiya i protsessy. In *Arkheologiya Arktiki*, iss. VI. Omsk: pp. 22–50.

Pitulko V.V., Pavlova E.Y., Basilyan A.E. 2014
Mammoth graveyards of the Northern Yana-Indighirka Lowland, Arctic Siberia. In *Abstract Book of the VIth International Conference on Mammoths and Their Relatives*, special vol. 102. Thessaloniki: S.A.S.G, p. 155.

Pitulko V.V., Pavlova E.Y., Nikolskiy P.A. 2015
Mammoth ivory technologies in the Upper Palaeolithic Arctic Siberia: A case study based on the materials from Yana RHS site. *World Archaeology*, vol. 47: 333–389.

Pitulko V.V., Pavlova E.Y., Nikolskiy P.A. 2017
Revising the archaeological record of the Upper Pleistocene Arctic Siberia: Human dispersal and adaptations in MIS 3 and 2. *Quaternary Science Review*, vol. 165: 127–148.

Pitulko V.V., Pavlova E.Y., Nikolskiy P.A., Ivanova V.V. 2012
Simvolicheskaya deyatelnost verkhnepaleoliticheskogo naseleniya Arkticheskoy Sibiri (busy i podveski Yanskoy stoyanki). In *Istoriko-kulturnoye naslediye i dukhovniye tsennosti Rossii*. Moscow: ROSSPEN, pp. 35–51.

Pitulko V.V., Pavlova E.Y., Nikolskiy P.A., Ivanova V.V., Basilyan A.E., Anisimov M.A., Remizov S.O. 2015
Rasseleniye cheloveka v Sibirskoy Arktike v pozdnem neopleistotsene i golotsene: Noviye materialy k arkheologicheskoy karte. In *IV Severniy arkheol. kongress: Doklad Khanty-Mansiysk. 19–23 oktyabrya 2015 g*. Yekaterinburg: Izd. Inst. istorii i arkheologii UrO RAN, pp. 152–176.

Poplin F. 1995
Débitage et débitage dans le travail de l'ivoire sur des examples du début du Paléolithique supérieur. In *Le Travail et l'Usage de l'ivoire au Paleolithique Supereiur. Actes de la Table Ronde*. Ravello: Centro Universitario Europeo per I Bene Culturali, pp. 17–27.

Semenov S.A. 1957
Pervobytnaya tekhnika (opyt izucheniya drevneishikh orudiy i izdeliy po sledam raboty). Moscow, Leningrad: Izd. AN SSSR. (MIA; No. 54).

Sitlivy V.I., Medvedev G.I., Lipnina E.A. 1997
Les civilisations préhistoriques d'Asie Centrale. 1. Le Paléolithique de la rive occidentale du lac Baikal. Bruxelles: Musées Royaux d'Art et d'Histoire.

Soldatova T.E. 2014
Obrabotka bivnya na paleoliticheskoy stoyanke Sungir. In *Kamenniy vek: Ot Atlantiki do Patsifiki*. St. Petersburg: Izd. MAE RAN: IIMK RAN, pp. 159–170. (Zamyatninskiy sbornik; iss. 3).

Tartar E., White R. 2013
The manufacture of Aurignacian split-based points: An experimental challenge. *Journal of Archaeological Science*, vol. 40: 2723–2745.

Thun Hohenstein U., Gargani E., Bertolini M. 2020
Use-wear analysis of bone and antler tools from Farneto (Bologna, Italy) and Sa Osa (Oristano, Italy) archaeological sites. *Journal of Archaeological Science: Reports*, vol. 32 (102386).

Vereshchagin N.K. 1977
Berelekhskoye "kladbishche" mamontov. *Trudy ZIN*, vol. 72: 5–50.

Villa P., d'Errico F. 2001
Bone and ivory points in the Lower and Middle Paleolithic of Europe. *Journal of Human Evolution*, vol. 41: 69–112.

White R. 1993
Technological and social dimensions of 'Aurignacian Age' body ornaments across Europe. In *Before Lascaux: The Complex Record of the Early Upper Paleolithic*. Boca Raton, FL: Chemical Rubber Comp. Press, pp. 277–300.

White R. 1997
Substantial acts: From materials to meaning in Upper Paleolithic Representation. In *Beyond Art: Pleistocene Image and Symbol*. San Francisco: California Academy of Sci., pp. 93–121.

Zenin V.N., Leshchinskiy S.V., Zolotarev K.V., Grootes P.M., Nadeau M.-J. 2006
Lugovskoye: Geoarcheology and culture of a Paleolithic site. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 1: 41–53.

Received July 27, 2022.
Received in revised form January 23, 2023.

doi:10.17746/1563-0110.2023.51.4.035-044

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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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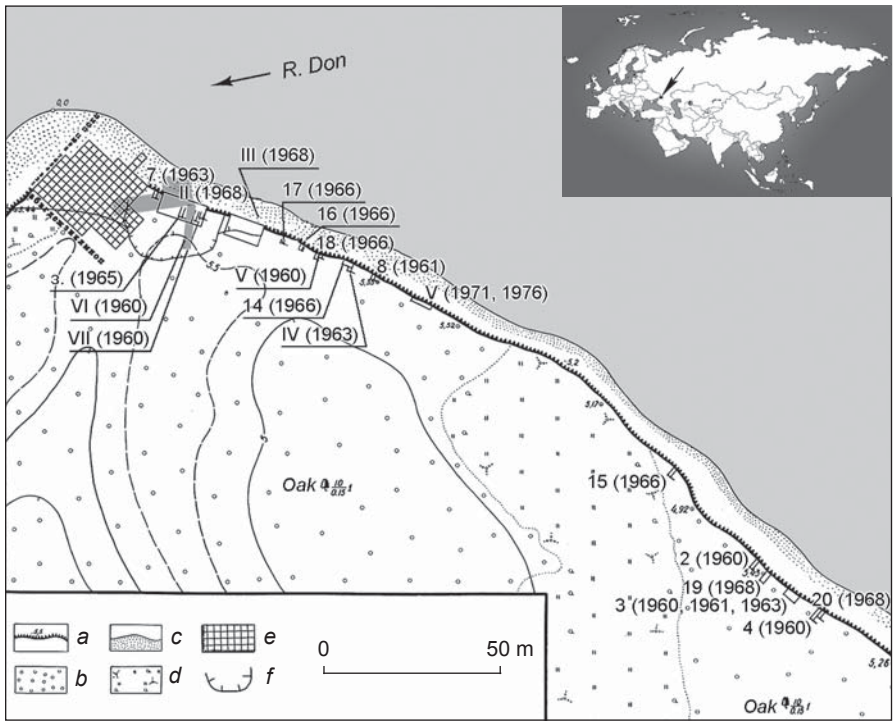

Fig. 1. Location of Rakushechny Yar, with excavations and clearings indicated (numbering after (Belanovskaya, 1960, 1962, 1965, 1977, 1995)).
a – coastline in the 1960s; *b* – forest; *c* – sand; *d* – meadow; *e* – excavation I (1012 m^2); *f* – trench in the area of excavations I and II.

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	–

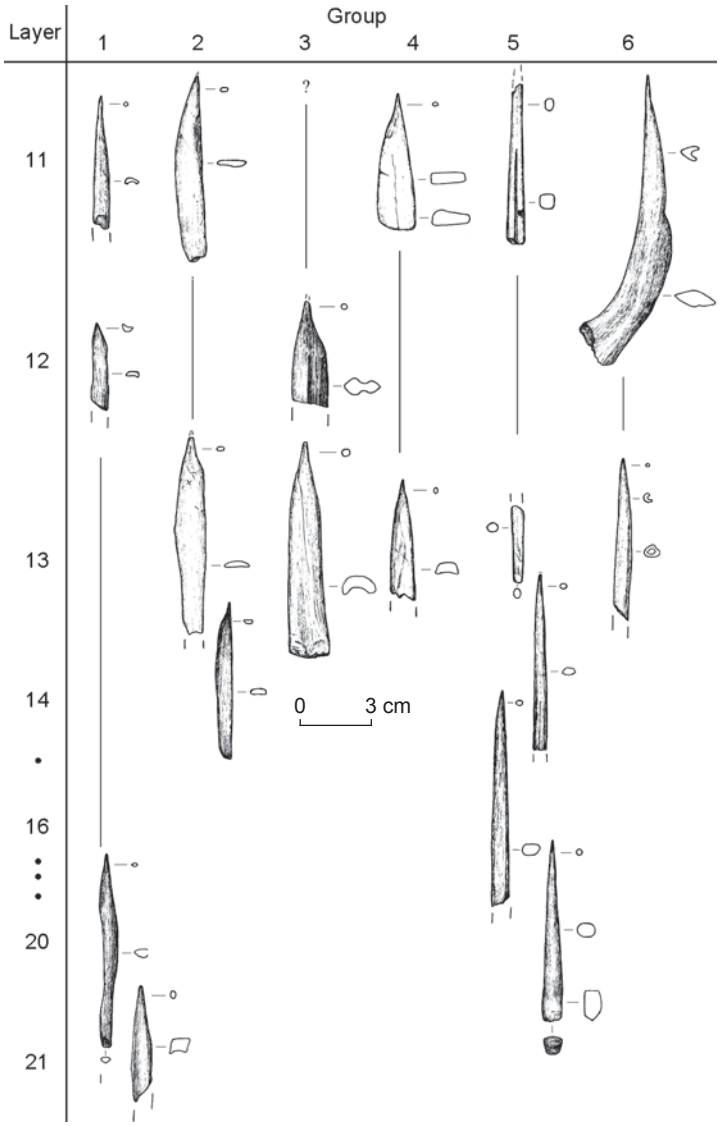

Fig. 2. Morphological groups of bone points.

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.

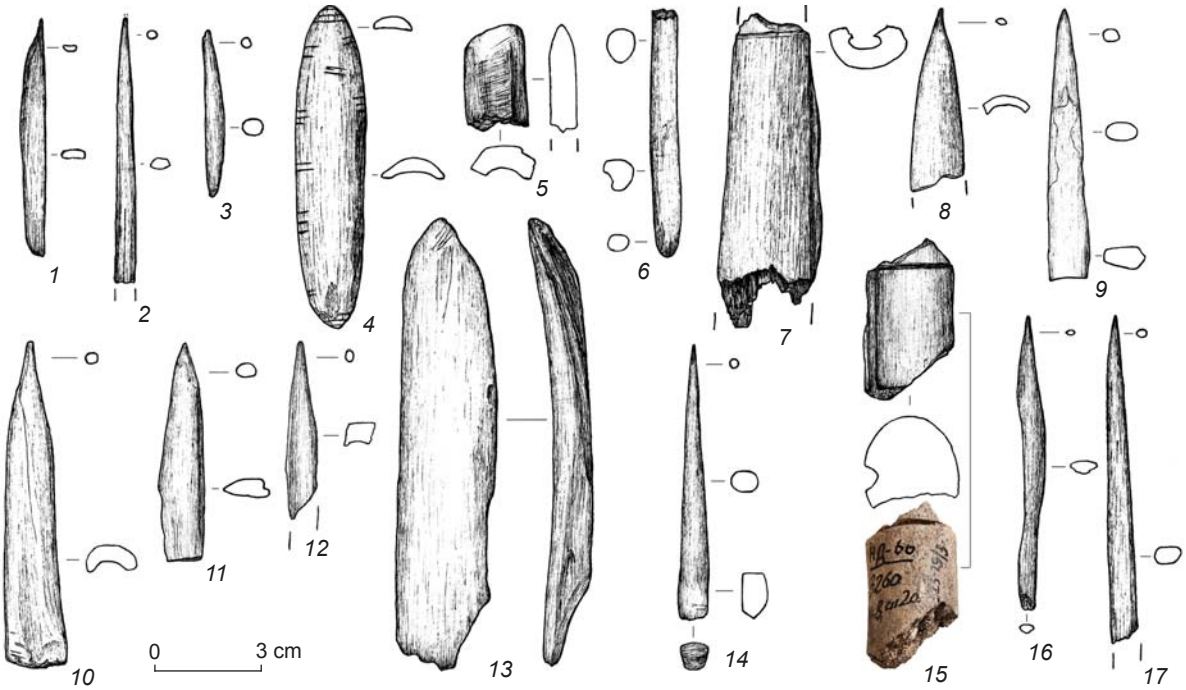

Fig. 3. Bone and antler items.
1 – point from a half rib (group 2); *2*, *3*, *6*, *14*, *17* – thin points made from cortical blank (group 5); *4* – spatula-shaped tool; *5* – beveled tool; *7*, *15* – metapodium fragments bearing traces of transversal sawing; *8*, *10* – points from metapodium halves (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.

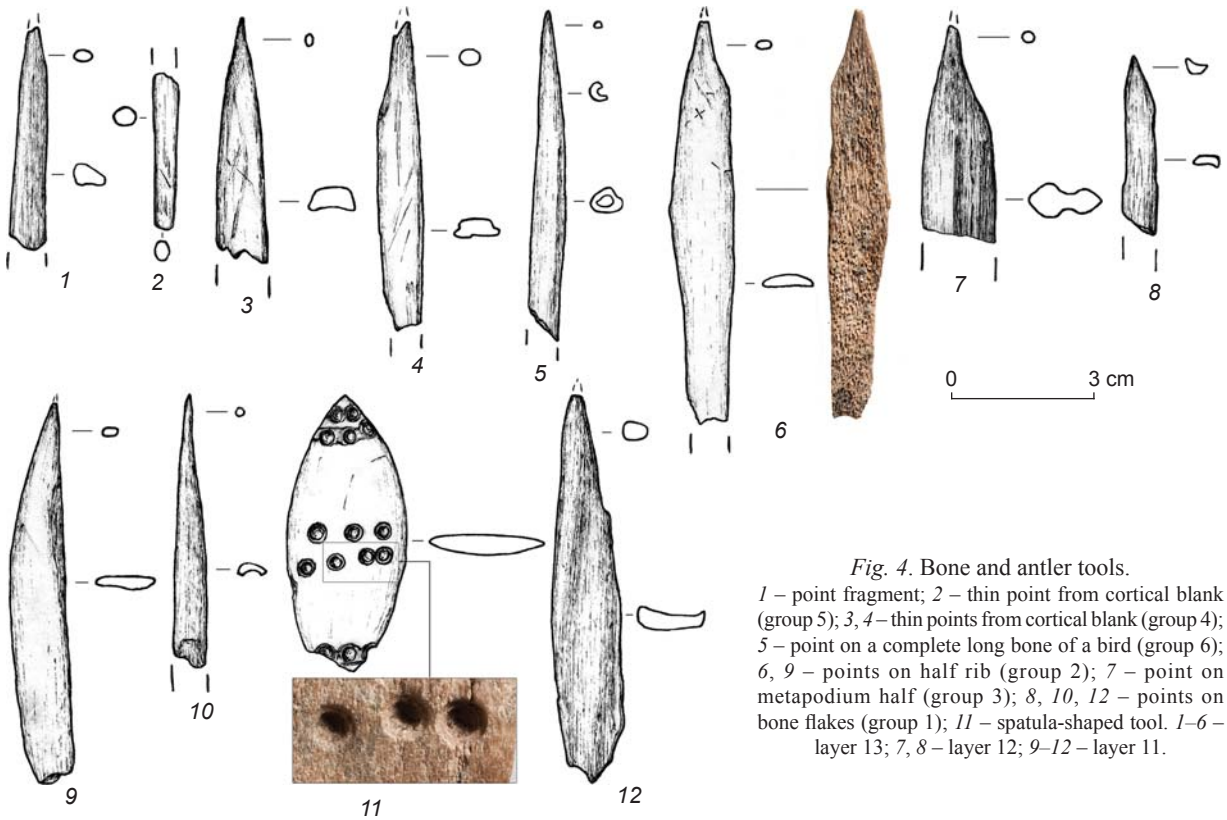

Fig. 4. Bone and antler tools.
1 – point fragment; *2* – thin point from cortical blank (group 5); *3*, *4* – thin points from cortical blank (group 4); *5* – point on a complete long bone of a bird (group 6); *6*, *9* – points on half rib (group 2); *7* – point on metapodium half (group 3); *8*, *10*,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

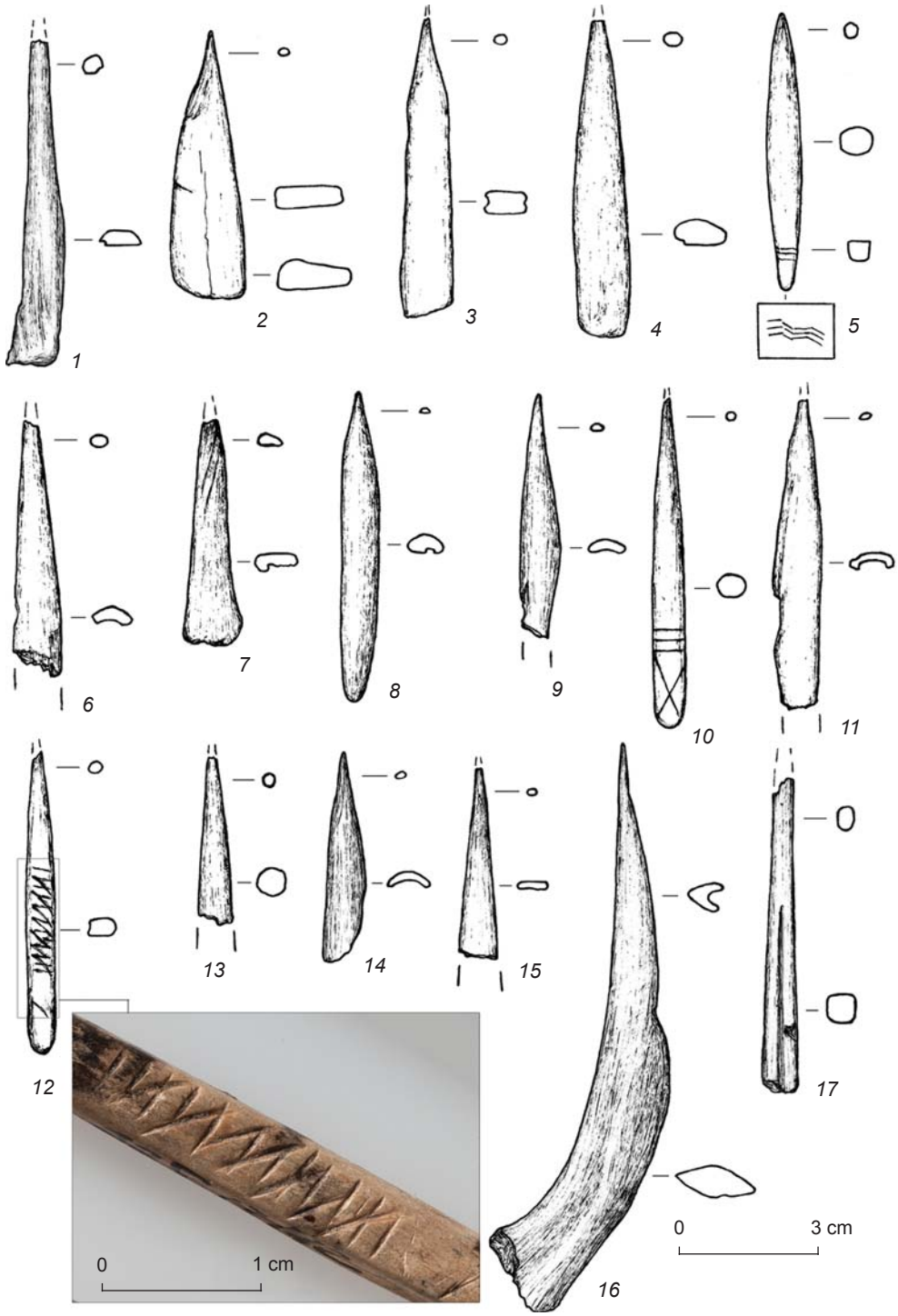

Fig. 5. Bone points (*1–16*) and an antler adze (*17*) from layer 11.
1, *5*, *8*, *10*, *12*, *13*, *17* – group 5 (*1* – preform); *2–4* – group 4; *6* – fragment (undeterminable group); *7*, *9*, *11*, *14* – group 1; *15* – group 2; *16* – group 6.

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).

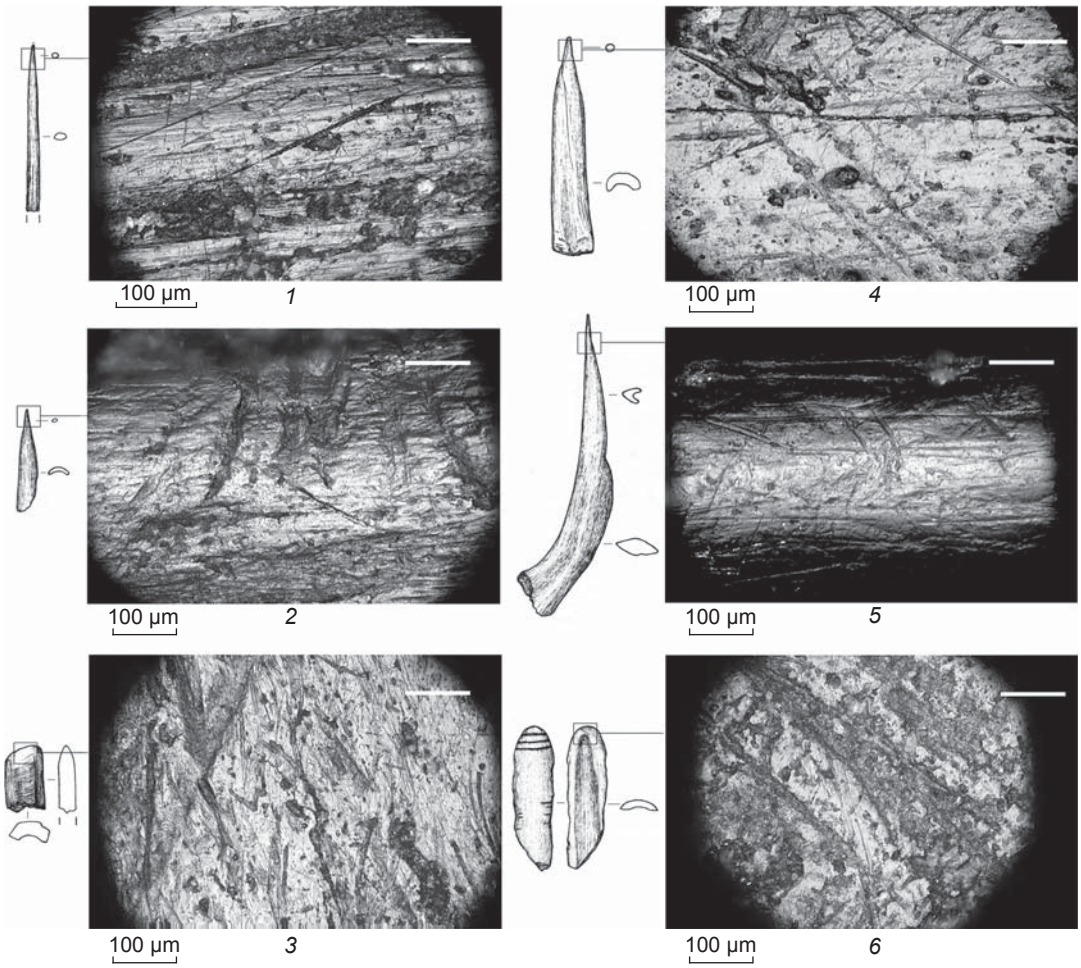

Fig. 6. Macroimages (×200) showing use-wear on artifacts.
1, *4* – skin perforation traces on the points from layers 14 and 13; *2*, *5* – plant-working traces on the points from layer 11; *3* – woodworking traces on the beveled tool from layer 14; *6* – clay burnishing traces on the ornamented spatula-shaped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

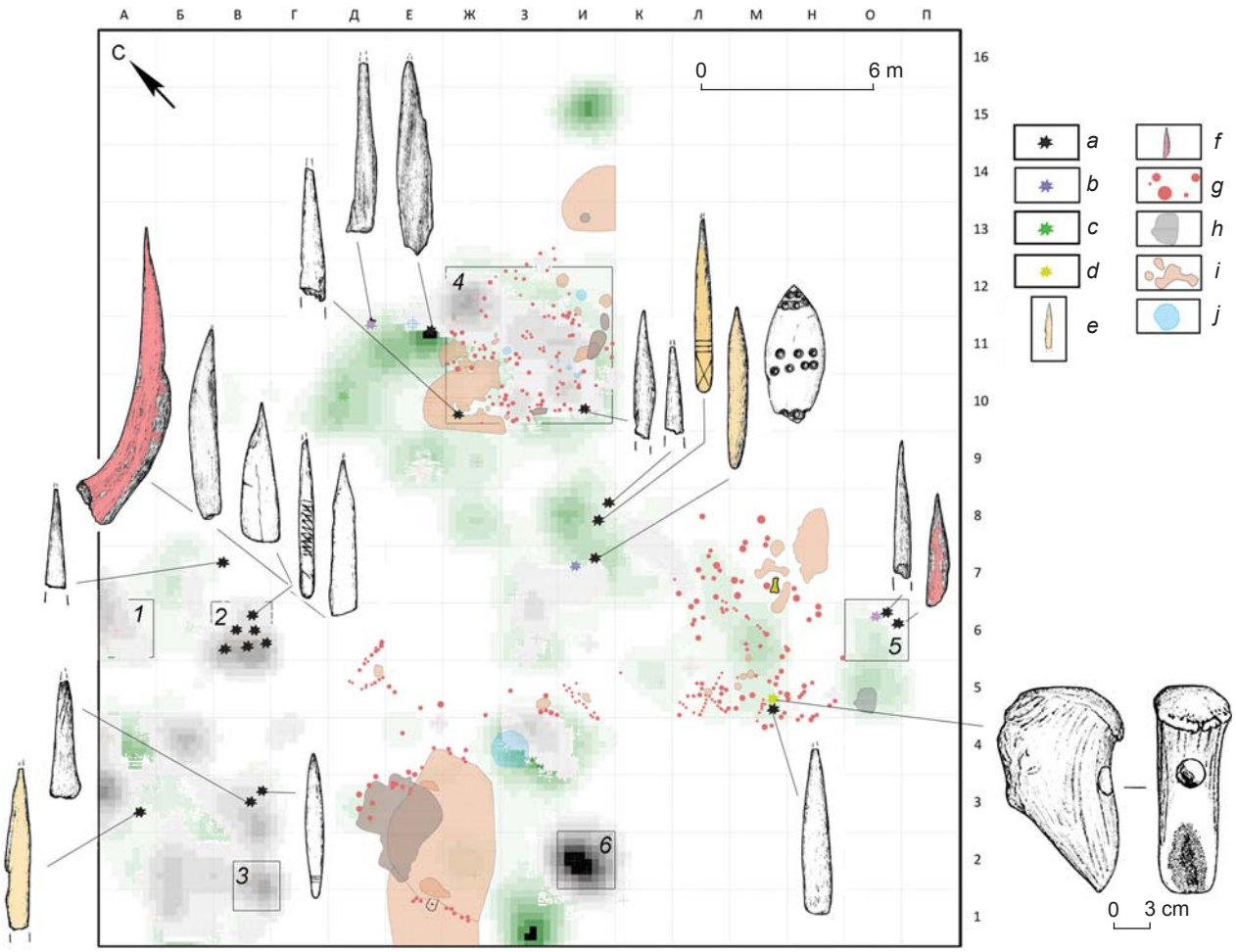

Fig. 7. Distribution of bone artifacts over the site, remains of constructions and objects in layer 11 (concentration of pottery fragments is marked green, that of flint artifacts is marked gray).

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.

Acknowledgements

The study of the bone artifacts collection and the functional context was supported by the Russian Foundation for Basic Research and the House of Human Sciences Foundation (FMSH), under the Scientific Project No. 21-59-22008. Traceological analysis was supported by IRP NORth (CNRS).

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.

Received May 23, 2022.
Received in revised form January 20, 2023.

doi:10.17746/1563-0110.2023.51.4.045-054

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Rock Art of the Ana Zaga Cave Shelter in the Archaeological Landscape of Gobustan, Azerbaijan

The Agisoft and 3D Studio Max software was used to study the petroglyphs of the Ana Zaga rock shelter, the largest in Gobustan. Stylistic features typical of various periods are described, and radiocarbon estimates for various cultural layers are given. Chronological stages in the evolution of rock art are defined. On the basis of geological data concerning transgressions and regressions of the Caspian Sea, the date of the first human settlement of the Ana Zaga shelter is estimated. The species composition of extinct faunas represented in rock art is assessed. It is concluded that in the Neolithic and Chalcolithic, following the rise of the sea level, the rock shelter became the principal habitat. In the Bronze Age, after the sea level had fallen, the middle and lower terraces became suitable for living. As new landscapes were settled, the themes of petroglyphs changed.

Keywords: *Gobustan, Ana Zaga rock shelter, Early Mesolithic, Mount Boyukdash, rock art, AMS-dating, 3D-modeling.*

Introduction

Gobustan is a geographical area on a plain between the southeastern slope of the Greater Caucasus Range and the Caspian Sea. Part of the archaeological landscape of Gobustan are rock carvings made at different times on the rocks of the Boyukdash, Kichikdash, and Jinghirdagh mountains. The archaeological complex includes about one thousand sites from different eras—from the Late Upper Paleolithic and Early Mesolithic to the turn of the 18th–19th centuries (Fig. 1). To date, more than 6 thousand rock images, 40 mounds, ca 20 shelter caves, ancient settlements and burials, and about 105 thousand pieces of material culture have been discovered on its territory. Since 1966, Gobustan has been a state historical and artistic reserve. In 2007, the cultural treasures of this site were added to UNESCO World Cultural Heritage List.

The first settlements of *Homo Sapiens* (Taglar, Damdzhyly, and Yatag Yeri) on the western coast of the Caspian Sea, appeared ~30–35 ka BP (Azərbaycan Arxeologiyası, 2008: 41–42, 44, 53), and the first rock paintings in Gobustan appeared more than 20 thousand years later. The sites of the first settlers of Gobustan (dated to 15 ka BP (Rustamov, 2000: 20)) are concentrated only on the upper terraces (127 m a.s.l.) (Farajova, 2011: 50–63; 2015b: 220). The petroglyphs on the ancient coast of the Caspian Sea determine the age of the earliest rock art in the region.

The figures executed on stones 29 and 42 (eastern side), as well as on the rocks on the upper terrace of Boyukdash and stone 49 on Kichikdash (eastern side), have both stylistic similarities and differences. The stones are natural walls, and the space between them is the habitat of ancient man, which can be defined as rock shelters or cave shelters.

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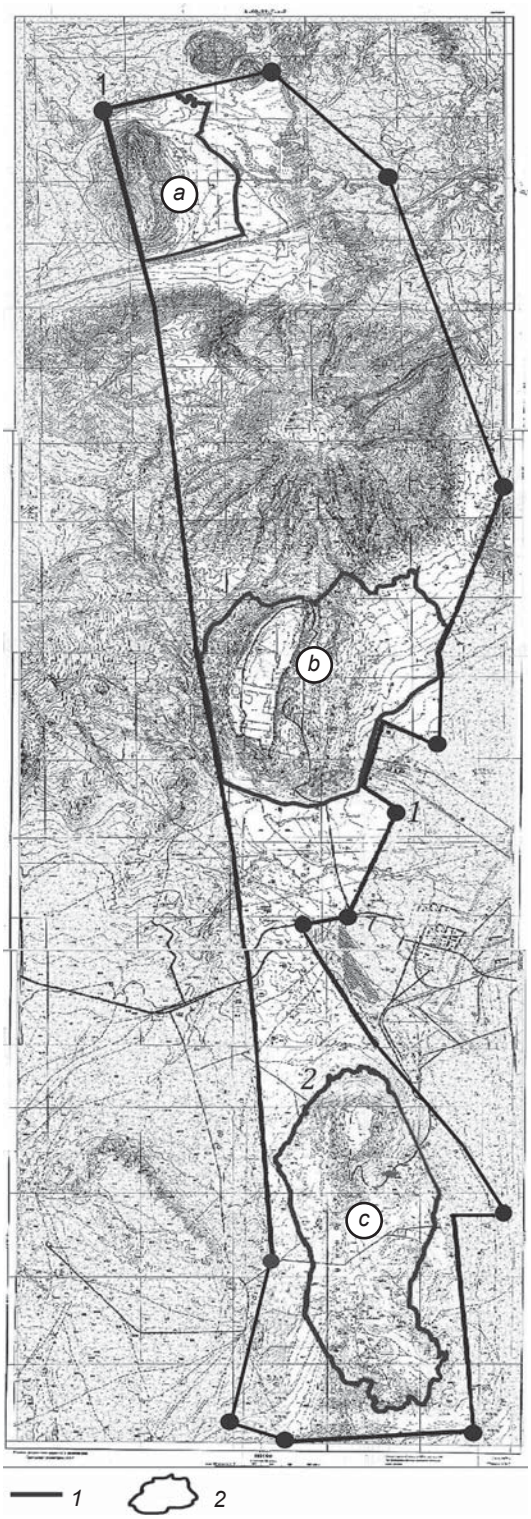

Fig. 1. Map of the Gobustan National Historical and Artistic Reserve.
a – Mount Jingirdag (coordinates 39T 360501 4449820); *b* – Mount Boyukdash (39T 361521 4441440); *c* – Mount Kichikdash (39T 361521 4441440).
1 – boundary of the reserve; *2* – boundary of the archaeological complex of rock art included in the UNESCO World Cultural Heritage List.

The rock art of Gobustan attracts the close attention of scholars: many science and popular-science works are devoted to it, and discussions on the dating and interpretation of individual plots and images continue. Recently, the petroglyphs of Gobustan have been studied using modern digital technologies and computer programs.

The most important problem of dating the Gobustan petroglyphs was raised in the works of the first researchers of the archaeological complex (Jafarzadeh, 1945, 1956, 1957, 1958, 1964, 1965a, b; 1973; Cəfərzadə, 1999; Rustamov, Muradova, 1974, 1975, 1976, 1984, 1986, 2003; Rustamov, 1984, 1986a, b; 1990, 2000, 2003). To determine the absolute age of the images, some experts tried to find stylistically similar analogs among rock paintings from other territories, often very distant (Formozov, 1969, 1980, 1987; Anati, 1994; Huyge, 2009, 2013; Huyge et al., 2011).

For a long time, it was believed that the petroglyphs of Gobustan had already been sufficiently studied (Cəfərzadə, 1999; Rustamov, Muradova, 2003). However, the publication of many new images (Fərəcova, 2007, 2018) led to a renewed focus on the problems of studying rock art in this area, and the use of advanced research methods for archaeological reconstructions, for example, AMS-dating (Farajova, 2011, 2012, 2015a, b, c).

The most significant results were obtained during the study of the multi-layered cave shelter of Ana Zaga, the largest in Gobustan. The surfaces of its stone slabs contain hundreds of overlapping petroglyphs, and in the space between these slabs, in the cultural layers, remains of extinct fauna have been identified.

The aim of this article is to introduce the latest materials—images and compositions identified and studied by the author at the Ana Zaga site, and the results of the analysis using advanced methods of rock-art study, which were unavailable half a century ago, when the main monographs on the topic were published.

Materials and methods

The Ana Zaga cave shelter, formed by almost vertically standing large blocks of limestone up to 15 m high, spaced up to 5 m from each other, is located on the upper terrace of the Boyukdash mountain, at an altitude of ca 130 m a.s.l. The lower layers of the cave, at depths of 5, 6, and 7 m, are composed of the sediments of Pleistocene marine basins.

In the Ana Zaga shelter, cultural layers dating back to the Mesolithic, Neolithic, and Chalcolithic were recorded in the central and southern parts of the human habitation area, at the foot of stone 30 (Azərbaycan Arxeologiyasi, 2008: 153–156). The cave shelter consists of several chambers, or compartments,

between stones with rock images. The first chamber is next to the cave's entrance, on the left, at the northern side of stone 29. On the southern side of the rock, 26 drawings were identified, and on the northern side, 77. Unfortunately, owing to the lack of appropriate conditions and equipment, the first researchers of the site did not make graphite impressions of some of the petroglyphs (Cəfərzadə, 1999: 201). The use of digital photography and the latest 3D-modeling techniques on stone 29 at Ana Zaga has allowed us to discover new rock images: 79 figures on the northern side, 40 on the eastern side, and 12 on the southern side.

New petroglyphs from various periods were found on the western side of stones 30 and 31. Using the Agisoft software, we were able to record and copy images on this panel, as well as to make estampages of the petroglyphs. The results of radiocarbon studies and the capabilities of the 3D StudioMax software made it possible to classify these petroglyphs by periods.

In 2015, the works on documenting the rock images of Gobustan began, using the Agisoft software and 3D-technologies. Copies of images on the planes of Boyukdash were created in the form of electronic 3D-models: Ana Zaga – stone 29 on the northern, southern, and eastern sides, Oküzler – stone 42 on the eastern and southern sides, as well as stones 65, 68 with figures of aurochs, hunters, and women to the east of Ana Zaga cave; Kichikdash: Gaya-Arasy – stones 9A, 9B, Jeyranlar – stone 49 on the southwestern side, Firuz – stone 19, etc.

In the process of digital documentation, on the northern side of stone 29 at Ana Zaga, a multi-figured composition was revealed: next to female silhouettes, there were previously unrecorded images of boats, aurochs, and hunters. Their photographs were taken with a Nikon 80D SLR camera. The Nikon 80D and Agisoft Photoscan, View MX2, and 3D Studio MAX software were used to obtain a 3D-model. When interpreting various categories of traces, we used the results of our own experimental observations (Ibid.).

To prepare the model, the panel was photographed in parts at a certain angle, and the images were processed in the View NX2 software; photos were converted into JPEG format. On the basis of these photographs, in the Agisoft Photoscan software, a model of the panel with drawings was built.

The experimental use of video technology and "animation" on stone 65 made it possible to identify, using the 3D Studio MAX software, a plot "narration": women run away from an aurochs, and a man tries to chase the aurochs away.

A detailed study of the Gobustan petroglyphs involves radiocarbon dating of cultural layers where fragments broken off from panels and individual stones with images occur. For this purpose, ca 50 samples from the cave shelters of Ana Zaga, Oküzler, Ovchular, Maral, and Daire on Mount Boyukdash, as well as Gaya-Arasy, Firuz 2 on Mount Kichikdash, were sent to the Laboratory for Radiation-Hygienic Monitoring of the Institute for Hygiene and Medical Ecology of the Academy of Medical Sciences of Ukraine (January 26, 2010), and to the laboratories of the University of Waikato, Hamilton, New Zealand (April 13, 2010, February 23, 2011) and BETA Analytic Inc., Miami, Florida, USA (September 1, 2011, September 23, 2011, July 30, 2014). On the basis of the radiocarbon dating data, rock art was differentiated by periods.

Calibrated dates of 10,430–10,240 cal BP were obtained for the cultural level of –270 cm in the Ana Zaga cave shelter.

To determine the age of the Gobustan petroglyphs, the remains of extinct Upper Pleistocene animals were studied, and geochronological data on the transgressions and regressions of the Caspian Sea were analyzed. Age estimates for bone fossils of animal species such as *Bos primigenius boj*, *Gazella subgutturoza, Equus hemionus Pallas, Sus. scrofa L., Capra aegagrus, Pantera pardus L.* from the cultural layers at Ana Zaga allowed us to determine the approximate date of some rock images.

According to the results of radiocarbon dating, the beginning of the Khvalynsk transgression dates back to the Terminal Late Pleistocene (almost 15–12 ka BP), and the end, to the Initial Holocene (9–7 ka BP), which coincides with the last glaciation (late stage of the Valdai glaciation, late stage of the Würm glaciation) of the East European Plain, as well as with the low level of the World Ocean, which was 25 m below the level of the modern sea (Svitoch, 2006: 22). The flourishing of the Gobustan rock art falls precisely within this period.

According to geochronological data, 14 ka BP, the level of the Caspian Sea was 22 m higher than the modern one (Arslanov et al., 2016); 14–12 ka BP, sea level ranged from 0 to -12 m (the modern sea level is 27 m, so the sea was higher by 27 and 15 m); 10 ka BP, a transgression occurred; 8 ka BP, the New Caspian regression began (Mamedov, 1997); 6 ka BP, sea level rose again by 25 m; 4 ka BP, by 23 m; 4–2 ka BP, a regression has begun (The Black Sea…, 2007: 144); 17 centuries ago, a major transgression happened owing to rapid warming, which caused the melting of continental ice and permafrost, as well as excessive flooding in river valleys; the level of the Caspian Sea rose so much that water cascaded onto the low-lying lands (Svitoch, 2006). As the sea receded, rocks were exposed, and the ancient inhabitants of the Caspian region began to create petroglyphs, first on the upper and then also on the lower terraces. Already 10 ka BP, when a major transgression occurred, the Ana Zaga cave shelter was the habitat of humans who left the first images on the walls.

The figures on the Ana Zaga walls (stones 29, 32, 39) correspond, both in style and application technique, to the images on the stones deposited in cultural layers. In 1977, in Ana Zaga Cave, at a depth of 255–270 cm, a piece of rock with petroglyphs was discovered (State National Historical and Artistic Reserve (GNIHZ), Inv. No. 2418) (for sediments at this depth, there is a calibrated radiocarbon date of 7500–7420 cal BP). On the edge of the rock, part of an anthropomorphic image carved in deep relief is visible. Hunters on stones 29 (northwestern side, figures 4, 5, 56, 57), 33 (figure 20) and 35 (figures 2, 3) were depicted in the same technique and stylistic manner. These figures are identical to those of hunters shown on a separate stone discovered at a depth of 255–265 cm at the Kyaniza site (GNIHZ, Inv. No. 1479), on stone 42 (northern side, figure 9), and on stone 68 on the upper terrace of Mount Boyukdash, as well as at the Jeyranlar site.

Research results

Among the Early Mesolithic petroglyphs on the northern side of stone 29 at Ana Zaga, images of aurochs at actual size predominate. The most ancient of them are probably associated with totemic beliefs. The cult of the aurochs was reflected in the epic of the Turkic-speaking Oghuz tribes. Images of aurochs are often accompanied by female figures in profile.

The aurochs depicted on the rocks of Gobustan is most often associated with the aurochs *Bos primigenius boj*. Some images of aurochs bear indentations—traces of magical actions performed by ancient people to ensure good luck in the hunt. The cult significance of this animal is evidenced by aurochs figurines deposited in cultural layers of various settlements on the territory of Azerbaijan. Several such artifacts were discovered in the lower layers of the Kura-Araxes culture at one of the ancient settlements in Geytepe (İsmayılova, 2006).

Female figures hold a special place in the repertoire of petroglyphs on the walls of the Ana Zaga cave shelter. Female images are among the most attractive in the rock art of Gobustan. Claviform female representations carved in deep relief on the northern side of stone 29 (Fig. 2; 3, *53*, *54*, *59–69*, *71–77*, *113*, *114*) belong mainly to the early period. Many of the figures obviously represent the image of a pregnant woman. Most often, such images occur in combination with a separate life-size figure of an aurochs. Female silhouettes and the figure of an aurochs (Fig. 4), depicted on stone 29A, as well as numerous images of boats and other characters made on the northern side of

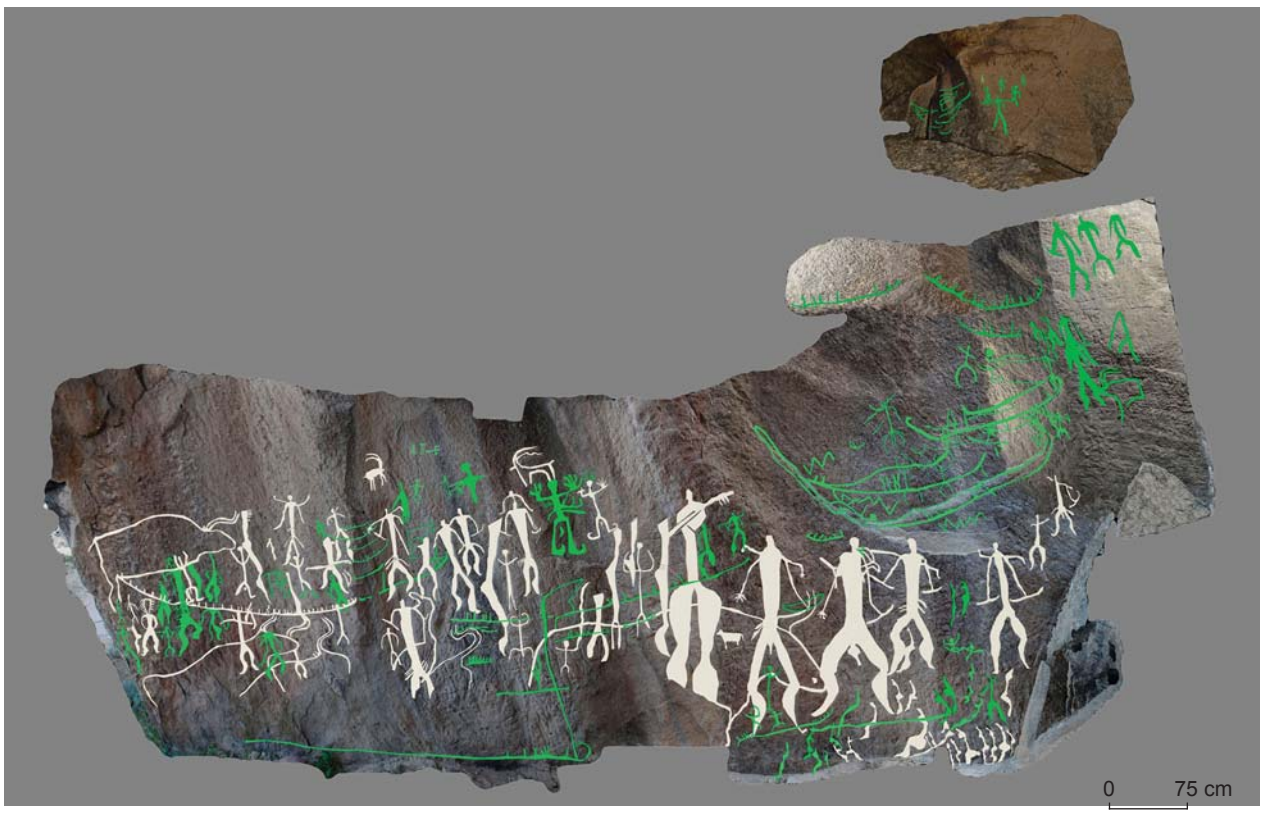

Fig. 2. Images (3D photography) on stone 29 (northern side) at Ana Zaga Cave (Farajova, 2016). Petroglyphs discovered by the author are highlighted in green.

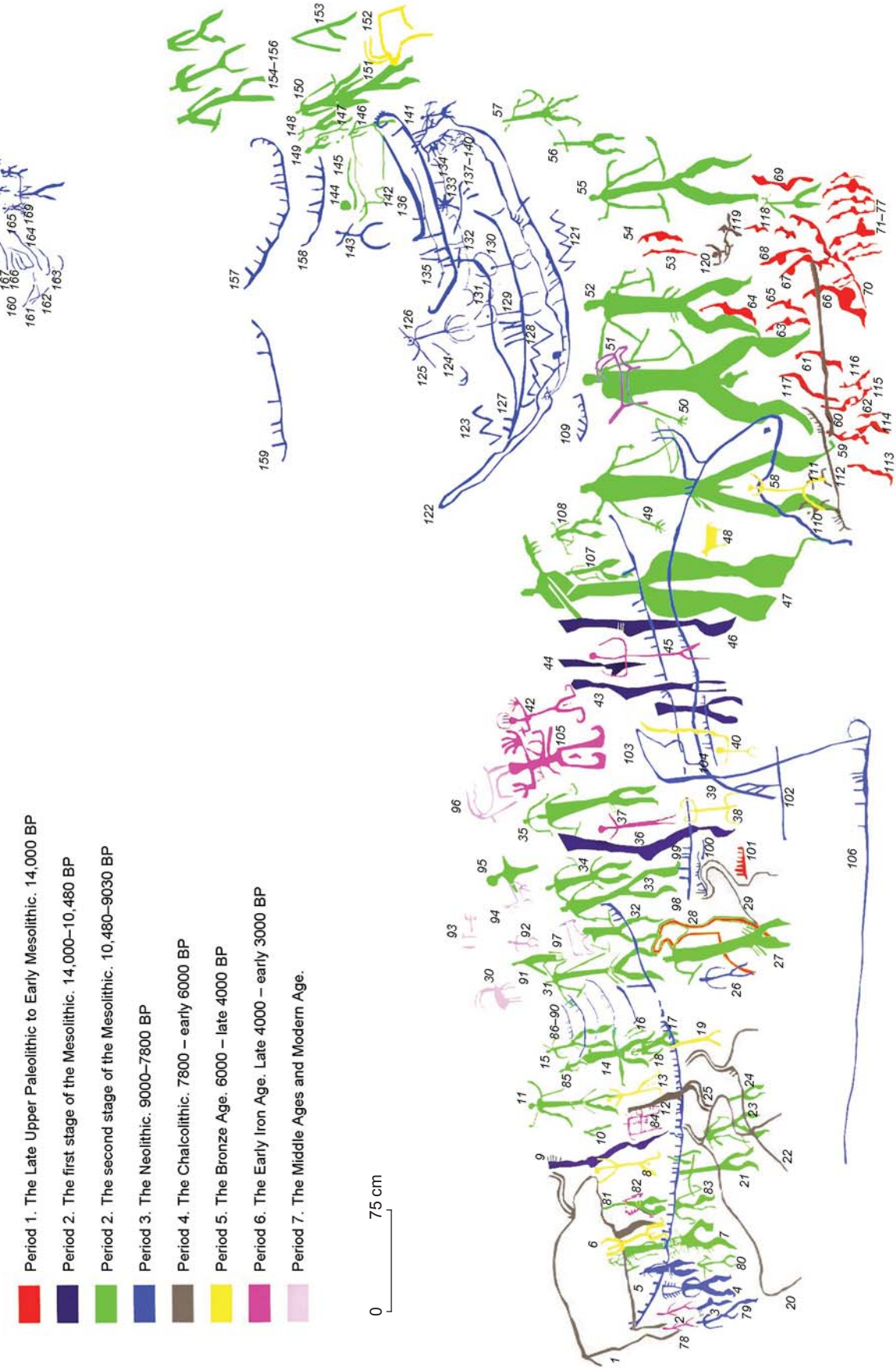

Fig. 3. Graphic trace-drawing of the images on stone 29 (northern side) at Ana Zaga Cave (Farajova, 2016).

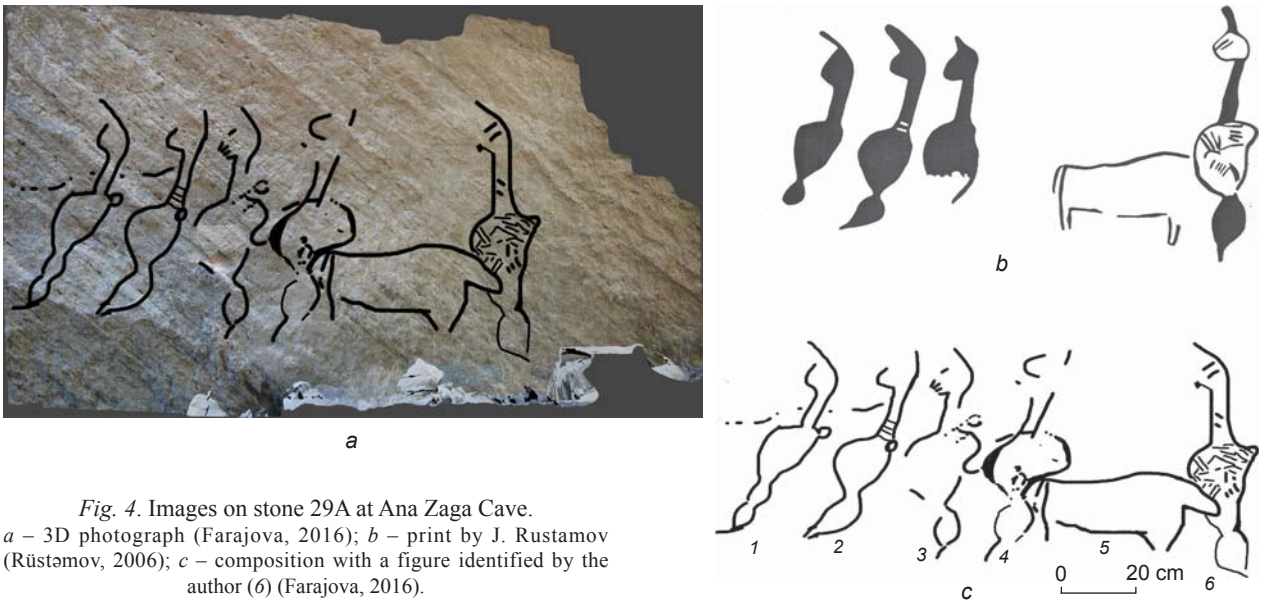

Fig. 4. Images on stone 29A at Ana Zaga Cave.
a – 3D photograph (Farajova, 2016); *b* – print by J. Rustamov (Rüstəmov, 2006); *c* – composition with a figure identified by the author (*6*) (Farajova, 2016).

stone 29 (see Fig. 3, *109*, *122–141*), harmonize with each other and form unified plots.

In the Late Mesolithic/Early Neolithic, the female image in petroglyphs changes—it begins to be conveyed in an increasingly schematic form. Some figures resemble Chalcolithic terracotta figurines from Gargalar Tepesi and Shulaverisgor (Central Transcaucasus). The women are depicted without heads and arms, in a semi-sitting position. Archaeologists associate the female figurine from Shulaverisgor with the idea of fertility (Fərəcova, 2009: 222–223). In Azerbaijan, images of women are found only in the southeastern part—in Gobustan. In other places of the periglacial zone of the country, no Stone Age rock art depicting human figures has been found.

A slightly different style is represented by life-size images of women with massive corpulent thighs, without arms, or with schematically rendered arms and legs, with prominent breasts and a large saggy belly (see Fig. 3, *28*). Such a figure, covered by images of hunters, is depicted in the lowest part of stone 29. The figure of a pregnant woman, in the upper area of its abdomen and chest, is covered with a zigzag or scaly ornament. On the same stone, another, probably female, figure with the same decoration was discovered (see Fig. 3, *103*). Both figures have lost their lower torsos owing to stone erosion.

Similar female figures are carved on the eastern side of stone 42 in Oküzler Cave. Of particular interest are the images of women at actual size on stone 29A in the southeastern sector of Ana Zaga Cave, which is considered one of the oldest human habitats in Gobustan. At this stone, the images of four women and one aurochs were recorded. And we were able to discover another life-size image of a woman. Thus, a whole composition is presented here, including the figures of four pregnant women following each other, and a separate tattooed woman. The latter covers the barely visible contours of the aurochs. The tattooed figures of Gobustan find parallels with similarly interpreted characters of Trypillian culture (Rybakov, 1981: 179, 189).

It can be assumed that in the earliest period, as symbols of fertility, heavy mature women with saggy bellies were depicted on the rocks, and at a later period, pregnant women (Ibid.: 189). The same semantic meaning have clay female figurines of naked goddesses found in the ancient settlements and necropolises of Mollaisakli, Mingachevir, Shamakhi, and Kabala. The waists of the goddesses are intercepted by belts, and their necks are decorated with several rows of necklaces (Fərəcova, 2009: 223).

It is quite likely that the most ancient means of transportation for the inhabitants of Gobustan were boats depicted 7800 years ago, which could accommodate more than 50 people. For the reconstruction of cultural-historical processes and spiritual-magical ideas of ancient hunter-gatherers on the territory of Azerbaijan, particularly Gobustan, the petroglyphs on the southern side of stone 29 on the upper terrace of Mount Boyukdash are very important. Of particular interest is the plot with boats, and hunters armed with bows and arrows. The use of 3D-modeling technologies has made it possible to discover 38 new images on this stone. I. Jafarzadeh recorded 20 images on the southern side of stone 29, and D. Rustamov, another 26 images, including two anthropomorphic figures and some indeterminate lines and marks under the image of a boat.

In 2007, we identified poorly-preserved figures of an aurochs, an anthropomorphic figure, and a fragment of a boat image (previously identified as a zoomorphic figure). The image of a boat crosses the anthropomorphic figure.

On the eastern side of stone 29, a complex composition is presented. 40 new images have been identified here: 9 anthropomorphic and 5 zoomorphic figures, 10 boats, 2 lines with cup-like depressions, and unidentifiable figures. Noteworthy are lines 14, 15, and 15a (Fig. 5), extending from cup-like depressions at the top of the rock. They split in two, pass through the figures of hunters 9 and 8, and, having come into contact with the

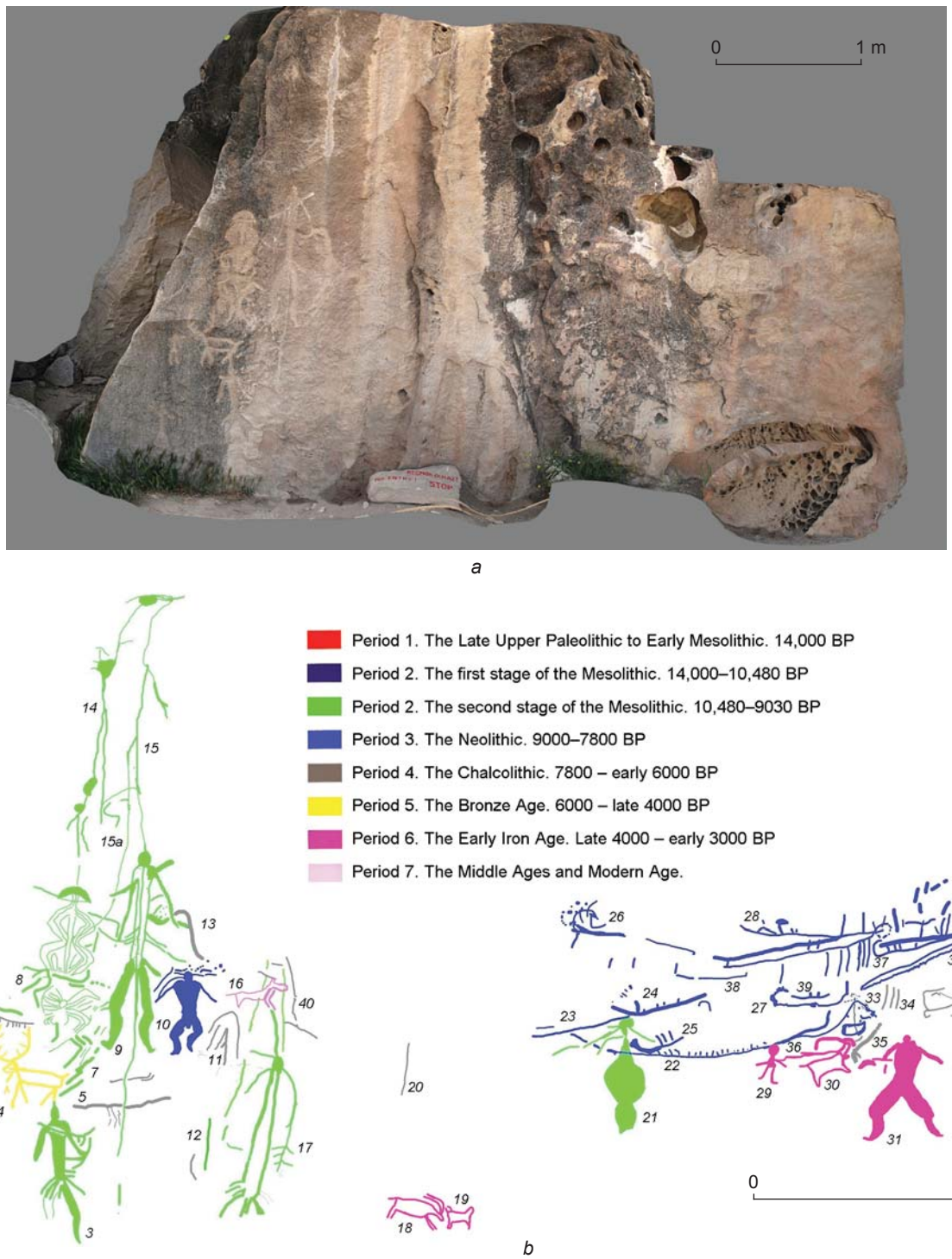

Fig. 5. Images on stone 29 (eastern side) at Ana Zaga Cave (Farajova, 2016).
a – 3D photography; *b* – graphic trace-drawing.

genital organs of the anthropomorphic characters, go down to the ground. Line 15a connects with the multi-tiered zigzag figure 8 at the level of the shoulder or elbow (?). Line 14 originates at the very top of the rock with a cup-shaped depression, passes through two other depressions, located one below the other, and through the mushroom-shaped decoration of multi-tiered figure 8 (Fig. 5). This figure connects with the lines extending from the cup-like depressions. A special feature of figure 8 is its mushroom-shaped headdress. Images of anthropomorphic characters in mushroom-shaped headdresses are widespread in the rock art of Mongolia, Altai, and Tuva (Devlet E.G., Devlet M.A., 2011: 79–80). Figure 8 is shown probably in ritual clothing or in a state of trance. Hunters 3, 9, 17 are depicted at actual size on the southeastern side of stone 29.

Conclusions

The uniqueness of the Gobustan archaeological complex lies in the fact that the cultural layers of its sites near the rocks with petroglyphs contain stones with their images identical to those presented on the caves' walls. Absolute dates obtained for the cultural layer where stones with petroglyphs were discovered suggest the age of the images on the walls of these cave shelters. If petroglyphs are associated with an archaeological layer, then their age can be determined quite accurately: rock carvings precede or are contemporaneous with this layer. A wide variety of data is taken into account when attributing the age of petroglyphs, such as style, imaging technique, and radiocarbon dating results.

Among the radiocarbon dates obtained for Gobustan, the oldest is ca 13,610 cal BP, corresponding to the Gayaarasy rock shelter (-350 cm) on Mount Kichikdash (Farajova, 2012, 2016, 2018a, b, c, 2021). The next oldest date is ca 10,600 cal BP, obtained for the cultural layer (-270 cm) of Ana Zaga Cave on Mount Boyukdash. Considering the fact that 14 thousand years ago the Late Khvalynian transgression occurred and the Khvalynian Sea waters washed the Boyukdash, Kichikdash, and Jingirdag mountains, the interval between these dates could have been due to the sea level rise.

Thus, the cumulative data suggest the following periods and stages in the rock art of Gobustan.

Period I. The Late Upper Paleolithic to Early Mesolithic. The most ancient period. 14,000 BP (12th millennium BC).

Period II. The Epipaleolithic to Mesolithic. 14,000–9030 BP (12th–8th millennia BC).

Stage I. Late 14,000 to 10,480 BP (12th–9th millennia BC).

Stage II. 10,480–9030 BP (9th–8th millennia BC).

Period III. The Neolithic. 9000–7800 BP (7th–6th millennia BC).

Period IV. The Chalcolithic. 7000–6000 BP (6th to the first half of the 4th millennia BC).

Period V. The Bronze Age. 4th to late 2nd millennia BC.

Period VI. The Early Iron Age. Late 2nd to early 1st millennia BC.

Period VII. The Middle Ages and Modern Age.

In the Late Upper Paleolithic to Early Mesolithic, settlements were most often located on the upper terraces. At such a height, the inhabitants of the caves could feel safe and control the surrounding areas. In the Neolithic and Chalcolithic, with the rise of the Caspian Sea's level, the Ana Zaga cave shelter was still a human habitat. In the Bronze Age, as sea level had fallen, the middle and lower coastal terraces also became populated. The themes of petroglyphs changed. During this period, the inhabitants of Gobustan, who were engaged in cattle breeding, depicted bezoar goats with large, curved horns. At the foot of the mountains, settlements circular in plan view appeared, and a tradition of burying the dead in mounds was developed.

Judging by the radiocarbon dating results, the Ana Zaga images can be divided into the following chronological groups: 1560 ± 55 BP; 4950 ± 200 to 5940 ± 40 BP (6880–6670 cal BP) to 6530 ± 40 BP (7500–7420 cal BP); 8670 ± 40 BP (9700–9540 cal BP) to 8996 ± 33 BP; 9170 ± 40 BP (10,480–10,460 cal BP).

These findings allow the conclusion to be made that in Ana Zaga Cave, whose walls contain more than 500 rock carvings, people lived for a very long time—from the Early Mesolithic to the Middle Ages.

References

Anati E. 1994
World Rock Art: The Primordial Language. Capo di Ponto: Centro Camuno di Studi Preistorici. (Studi Comuni; vol. XII).

Arslanov Kh.A., Yanina T.A., Chepalyga A.L., Svitoch A.A., Makshaev R.R., Maksimov F.E., Chernov S.B., Tertychniy N.I., Starikova A.A. 2016
On the age of the Khvalynian deposits of the Caspian Sea coasts according to ^{14}C and $^{230}Th/^{234}U$ methods. *Quaternary International*, vol. 409, pt. A: 81–87.

Azərbaycan Arxeologiyası: VI cilddə. 2008
1 cild: Daş dövrü. Bakı: Şərq-Qərb.

Cəfərzadə İ.M. 1999
Qobustan qayaüstü rəsmləri. Bakı: XXI.

Devlet E.G., Devlet M.A. 2011
Sokrovishcha naskalnogo iskusstva Severnoy i Vostochnoy Azii. Moscow: IA RAN.

Farajova M. 2011
Gobustan rock art cultural landscape. *Adoranten magazine*: 41–67.

Farajova M. 2012
Neolit Gobustana. In *Sbornik materialov mezhdunar. nauch. konf. "Rannezemledelcheskiye kultury Kavkaza"*. Azərbaycan

Milli Elmlər Akademiyası Arxeologiya və Etnoqrafiya İnstitutu. "Qafqazın Erkən Əkinçilik Mədəniyyətləri" (məqalələr toplusu) Beynəlxalq elmi konfrans. Bakı: pp. 62–68.

Farajova M. 2015a

Kulturno-istoricheskiy kontekst arkheologicheskogo kompleksa Gobustan. *Rossiykaya arkheologiya*, No. 4: 50–63.

Farajova M. 2015b

Reconstruction of the archaeological landscape of the western shore of the Caspian Sea at the end of Upper Pleistocene-Early Holocene. In *IGCP 610. Third Plenary Conference and Field Trip from the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary. Astrakhan, 22–30 Sept., 2015*, A. Gilbert, V. Yanko-Hombach, T. Yanina (eds.). Moscow: Moscow State Univ. Press.

Farajova M. 2015c

Reconstruction of the archaeological landscape of the western shore of the Caspian Sea at the end of Upper Pleistocene-Early Holocene. In *The International Geoscience Programme 610. Third Plenary Conference and Field Trip from the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary. Astrakhan, 22–30 Sept., 2015*. Moscow: Moscow State Univ. Press, pp. 75–76.

Farajova M. 2016

Rekonstruktsiya arkheologicheskogo landshafta Gobustana v epokhu neolita. Bakı*:* Azərbaycan Arxeologiyası və Etnoqrafiyası 2015в, pp. 20–30.

Farajova M. 2018a

Gaya arasy – samaya drevnyaya iz izvestnykh stoyanok Gobustana. *Dövlət İdarəçiliyi Nəzəriyyə və Təcrübə*, No. 4: 277–286.

Farajova M. 2018b

Noviye podkhody i metody v izuchenii naskalnogo iskusstva Gobustana. *Tarix və onun problemləri*, No. 2: 296–300.

Farajova M. 2018c

About specifics of rock art of Gobustan and some innovative approaches to its interpretation ("Firuz 2" shelter). *Quaternary International*, vol. 491: 78–98.

Farajova M. 2021

O datirovke naskalnykh izobrazheniy Gobustana (Azerbaidzhan). *Istoriya, arkheologiya i etnogrfiya Kavkaza*, vol. 17 (3): 657–682.

Fərəcova M. 2007

Qobustan çalaları. Bakı: CBS.

Fərəcova M. 2009

Azərbaycan qayaüstü incəsənəti. Bakı: Aspoliqraf.

Fərəcova M. 2018

Böyükdaş dağının yeni petroqlifləri haqqında (yuxarı səki, daş 29, şərq hissəsi). *H.Əliyev ad. Azərbaycan Ali Hərbi Məktəbi: Elmi Əsərlər Məcmuəsi*, No. 2 (31): 16–18.

Formozov A.A. 1969

Ocherki po pervobytnomu iskusstvu. Moscow: Nauka.

Formozov A.A. 1980

Pamyatniki naskalnogo iskusstva na territorii SSSR. Moscow: Nauka.

Formozov A.A. 1987

Naskalniye izobrazheniya i ikh izucheniye. Moscow: Nauka.

Huyge D. 2009

Late Paleolithic and Epipalaeolithic rock art in Egypt: Qurta and El-Hosh. *Archéo-Nil magazine*, No. 19: 108–120.

Huyge D. 2013

"Ice Age" art at Qurta. *Ancient Egypt*, No. 77: 32–41.

Huyge D., Vandenberghe D.A.G, De Dapper M., Mees F., Claes W., Darnell J.C. 2011

First evidence of Pleistocene rock art in North Africa: Securing the age of the Qurta petroglyphs (Egypt) through OSL dating. *Antiquity*, No. 85: 1184–1193.

İsmayılova Ş.H. 2006

Urmiyanın tunc dövrü gil fiqurları. In *Azərbaycan arxeologiyası və etnoqrafiyası*. Bakı: Nafta-Press, pp. 28–29.

Jafarzadeh I.M. 1945

Razvitiye arkheologicheskikh rabot v AzSSR. *Izvestiya AzFAN SSSR*, No. 6: 125–137.

Jafarzadeh I.M. 1956

Drevneishiy period istorii Azerbaidzhana. In *Ocherki po drevney istorii Azerbaidzhana*. Baku: Izd. AN AzSSR, pp. 51–61.

Jafarzadeh I.M. 1957

K voprosu drevney istorii Azerbaidzhana po arkheologicheskim dannym. In *10 let AN Azerbaidzhanskoy SSR: Sbornik dokl. nauch. sessii AN AzSSR*. Baku: Izd. AN AzSSR, pp. 608–622.

Jafarzadeh I.M. 1958

Naskalniye izobrazheniya Kobystana. In *Trudy Inst. istorii AzSSR*, vol. XIII. Baku: Izd. AN AzSSR, pp. 20–79.

Jafarzadeh I.M. 1964

Naskalniye izobrazheniya Gobustana. In *Sessiya, posvyashchennaya itogam arkheologicheskikh rabot 1963 g.: Tezisy dokl. i soobshch*. Baku: pp. 11–14.

Jafarzadeh I.M. 1965a

Petroglify Kobystana. In *Materialy sessii, posvyashchennoy itogam arkheologicheskikh i etnograficheskikh issledovaniy 1964 g. v SSSR: Tezisy dokl*. Baku: pp. 7–10.

Jafarzadeh I.M. 1965b

Naskalniye izobrazheniya Gobustana. In *Arkheologicheskiye issledovaniya v Azerbaidzhane*. Baku: Izd. AN AzSSR, pp. 15–28.

Jafarzadeh I.M. 1973

Gobustan. Baku: Elm.

Mamedov A.V. 1997

The Late Pleistocene – Holocene history of the Caspian Sea. *Quaternary International*, vol. 41/42: 161–166.

Rustamov D.N. 1984

Mezoliticheskaya stoyanka v Gobustane (Okyuzlyar-2). In *Kamenniy vek i eneolit v Azerbaidzhane*. Baku: Az. Gos. Univ., pp. 40–49.

Rustamov D.N. 1986a

Gaya arasy – stoyanka okhotnikov na dzheiranov. In *Arkheologichekiye i etnograficheskiye izyskaniya v Azerbaidzhane*. Baky: Elm, pp. 7–8.

Rustamov D.N. 1986b

Mezoliticheskiye zhenskiye statuetki Gobustana. In *Doklady AN AzSSR*, vol. XLII (3). Baku: Elm, pp. 92–95.

Rustamov D.N. 1990

Naskalniye izobrazheniya Gobustana. In *Problemy izucheniya naskalnykh izobrazheniy v SSSR*. Moscow: IA AN SSSR, pp. 99–103.

Rustamov D. 2000

Gobustan – ochag drevney kultury Azerbaidzhana. Baku: Nurlan.

Rustamov D. 2003

Petroglify Gobustana. Gobustan – ochag drevney kultury Azerbaidzhana, bk. I. Baku: Kooperatsiya.

Rustamov D.N., Muradova F.M. 1974
Arkheologicheskiye issledovaniya v Gobustane. In *Arkheologicheskiye i etnograficheskiye izyskaniya v Azerbaidzhane (1973 g.)*. Baku: Elm, pp. 8–11.

Rustamov D.N., Muradova F.M. 1975
Poleviye raboty v Gobustane. In *Arkheologicheskiye i etnograficheskiye izyskaniya v Azerbaidzhane (1974 g.)*. Baku: Elm, pp. 4–10.

Rustamov D.N., Muradova F. 1976
Raskopki na stoyanke Kyaniza v Gobustane. In *AO 1975 goda*. Moscow: Nauka, pp. 504–505.

Rustamov D.N., Muradova F.M. 1984
Gobustanskaya ekspeditsiya v 1979 godu. In *Arkheologicheskiye i etnograficheskiye izyskaniya v Azerbaidzhane (1979 g.)*. Baku: Elm, pp. 7–9.

Rustamov D.N., Muradova F.M. 1986
O rezultatakh arkheologicheskikh issledovaniy 1981 goda v Gobustane. In *Arkheologicheskiye i etnograficheskiye izyskaniya v Azerbaidzhane (1980–1981)*. Baku: Elm, pp. 92–94.

Rustamov D., Muradova F.M. 2003
Petroglify Gobustana. Naskalniye izobrazheniya Shongardaga i Shykhgaya, vol. I, bk. II. Baku: Kooperatsiya.

Rüstəmov C. 2006
Qobustan Azərbaycanın qədim mədəniyyət ocağı. Bakı: Nurlar.

Rybakov B.A. 1981
Yazychestvo drevnikh slavyan. Moscow: Nauka.

Svitoch A. 2006
Vsemirniy potop i velikaya khvalynskaya transgressiya Kaspiya. *Priroda*, No. 1: 20–24.

The Black Sea Flood Question Changes in Coastline, Climate and Human Settlement. 2007
V.Y. Hombach et al. (eds.). Dordrecht: Springer.

Received July 21, 2022.
Received in revised form May 4, 2023.

doi:10.17746/1563-0110.2023.51.4.055-064

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The Russian Archaeological Project in South America: Principal Findings and Prospects

This study outlines the findings of field and laboratory studies by the first Russian archaeological expedition to South America in 2014–2015 and 2017–2018 in collaboration with colleagues from Ecuador and Japan. The project focused on sites of the Archaic (10.8–6.6 ka BP) and Early Formative period (5.5–3.5 ka BP) in the coastal zone of Santa Elena Province, Ecuador. Excavations at Real Alto (Valdivia culture) and Loma Alto (Las Vegas culture) yielded representative archaeological, anthropological, and faunal samples and a large series of AMS dates, providing a basis for a number of novel proposals regarding the chronology and periodization of cultures, their origin, and early pottery-production in South America. Specifically, we have demonstrated that at the very beginning of the Formative period, two early ceramic traditions coexisted—Valdivia and "San Pedro". We have demonstrated the peculiarity of the "Tropical package" in the stone toolkit, and traced the previously unknown features of the funerary rites of the Las Vegas and Valdivia cultures. Radiocarbon analysis helped to correct the chronology of the late stage of the pre-ceramic Las Vegas culture (8.0–4.8 ka BP) and to estimate the tentative date of the earliest pottery manufacture at 4.8–4.7 ka BP. In conclusion, we outline the top priorities and prospects of Russian archaeological studies on the Pacific coast of South America, underscoring the importance of international cooperation.

Keywords: *South America, Ecuador, Pacific coast, Formative period, chronology, pottery-making.*

Introduction

The ancient cultures of South America began to attract especial interest with the expansion of the geography of Russian marine expeditions in the 19th century and the appearance of artifacts from that distant continent in private collections and capital museums. L.I. Schrenck visited Peru in 1854 and was among the first sponsors who donated their collections to the Kunstkamera (Yakovleva, 2010). Subsequently, Russian archaeologists repeatedly turned their attention to materials from South American cultures, several candidate and doctoral dissertations were defended, and a significant number of articles and monographs were published and received the highest appraisal from the international scientific community (see, e.g., (Bashilov, 1972; Berezkin, 1983)). However, despite a considerable number of planned projects, in the 19th–20th centuries it was impossible to carry out full-fledged expeditionary research on the territory of the South American continent.

Archaeology, Ethnology & Anthropology of Eurasia 51/4 (2023) 55–64 E-mail: Eurasia@archaeology.nsc.ru

The first archaeological excavations in South America were carried out by the Joint Russian-Ecuadorian expedition in 2014–2015 and 2017–2018; the project was realized by archaeologists from the Far Eastern Federal University (Vladivostok) and the Institute of Archaeology and Ethnography SB RAS (Novosibirsk). The research was focused on the Archaic and Early Formative periods in the coastal part of Ecuador (Tabarev, 2016) (Fig. 1). The Archaic period is represented in the project by the Las Vegas culture (10.8–6.6 ka BP); and the Early Formative period, by the Valdivia culture (5.5–3.5 ka BP) (Estrada, 1956; Evans, Meggers, 1958; Meggers, Evans, Estrada, 1965: 148–150). The chronological classification based on the dates derived in the 1960–1980s and the chronological gap between these cultures required correction and new solutions, which determined the special emphasis of the new project on the phenomenon of early pottery-making, its origins (local or foreign) and cultural background (hunter-gatherer-fisher community or the gradual transition to agriculture). In other words, our intention was to establish and analyze the Neolithization features in this part of the Pacific basin in the local and regional contexts (Tabarev, Popov, 2014).

As a result of the research works of the Russian expedition, representative archaeological, anthropological, and faunal materials were collected; some findings were published in Russian and foreign periodicals (Popov et al., 2016; Tabarev, Marcos, Popov, 2015; Kanomata, Marcos, Popov et al., 2019; Kanomata, Tabarev, Popov et al., 2019; Kanomata et al., 2021; Tabarev et al., 2019, 2021) and presented at international scientific conferences in Russia, Ecuador, Japan, Indonesia, the Philippines, and Poland (see, e.g., (Tabarev, Popov, Marcos, Kanomata, 2016)). Currently, it has become possible to summarize the main results, and outline the priorities and prospects for the next stage of field research by the Russian expedition on the Pacific coast of South America.

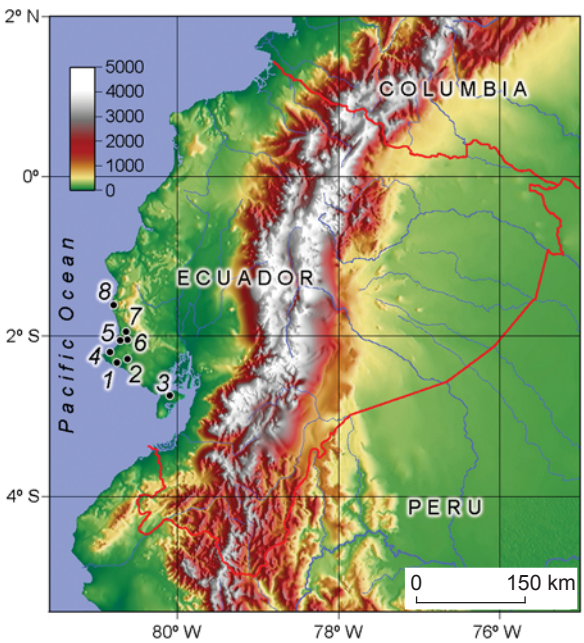

Fig. 1. Locations of the sites under discussion.
1 – Real Alto; *2* – Loma Atahualpa; *3* – El Encanto; *4* – No. 80; *5* – Valdivia; *6* – Loma Alta; *7* – Buen Suceso; *8* – Salango.

Research at the sites of Real Alto and Loma Atahualpa in 2014–2015 and 2017–2018

At first, the research was carried out at the site of Real Alto. The choice was determined by the large area of the site (ca 12 ha), its accessibility, preservation, and comfort (museum area with laboratory premises), the traces of almost all phases of the Valdivia culture, and the signs of an earlier, pre-ceramic horizon, which fully met the objectives of the project.

The area of a large settlement on a hill between the villages of El Real, Pechiche, and Manantial in the Río Verde River basin, in the southern part of the Santa Elena Peninsula (Santa Elena Province), was first examined in August 1971 by J.G. Marcos and was named Real Alto (GSECh-012) (Marcos, 2015: 35). In the 1970–1980s, several projects were implemented at the site, noteworthy among which are large-scale excavations by the University of Illinois (USA) expedition led by D. Lathrap in 1974–1975; the studies included topographic surveys and establishing a series of trenches (A, B, C). Trenches A and B revealed dwelling pits, a set of large earthen mounds with traces of ritual structures, more than 100 single burials, and a necropolis of the local elite. The artifact collection included thousands of stone and shell implements and a great amount of ceramics. In 1977, the expedition led by J. Damp continued excavations in trench C. It was determined that the northeastern section of the site belonged to the earliest period of human occupation at Real Alto—phases 1 and 2. This was evidenced by the thick cultural deposits (over 1 m) and the most ancient dates derived by the traditional method, on charcoal from lowermost horizons with ceramics: 6195 ± ± 215 (GX-5269), 5495 ± 200 (GX-5267), and 5260 ± ± 256 (ISGS-448) BP (Damp, Vargas, 1995) (hereinafter we present uncalibrated dates).

The results of research in the 1970–1980s showed eight successive phases and three main stages in the history of Real Alto: a settlement of early farmers, hunters, and gatherers; a major regional center; and a ceremonial center. According to the former researchers of the site, Real Alto became a large center at phase 3 (ca 4 ka BP) (Lathrap, Marcos, Zeidler, 1977; Marcos, 2015: 86). Russian specialists were familiar with this

assumption from the article by Marcos translated into Russian (1990).

An additional intrigue into the issues of the time of emergence of pottery-making in the coastal part of Ecuador was brought about by the excavations at the site of Loma Alta (10 km from Valdivia, 60 km from Real Alto) carried out by the expedition of the University of Calgary (Canada) in the early 1980s; the early age of Valdivian ceramics was confirmed by the derived dates: 5275 ± 175 (GX-7704), 5010 ± 120 (I-7076), and 5000 ± 190 (ISGS-142) BP (Raymond, 1993). In 2014, in the northeastern part of Real Alto, the Joint Russian-Ecuadorian expedition established an excavation (4 × 5 m); in 2015, two additional trenches—the northern (18 m) and the eastern (20 m)—were made; and in 2017, another 40 m^2 were excavated in addition to the main area. Thus, the total uncovered area over three seasons was 104 m^2 (Fig. 2). The resulting stratigraphic column (1.1 m) contained four cultural layers; their thickness varied from 0.4 m in the main excavation area to several centimeters in the outer squares of the trenches. In total, 10,426 lithic artifacts and 5721 ceramic fragments were recorded in the excavation (excluding trenches); abundant faunal material was also collected, gastropod shells (*Certhidea valida*) in layer 2 and bivalves (*Anadara similis*) in layer 3 predominating. The highest concentration of ceramics (more than 87% of the total amount) was recovered from layers 2 and 3; layer 4 yielded solitary fragments (less than 1%), which were redeposited from overlying horizons (Tabarev et al., 2021) (Fig. 3).

In 2014, three radiocarbon dates of 4450 ± 30 (IAAA-141115), 4490 ± 30 (AAA-141116), and 4620 ± ± 30 (IAAA-141114) BP were obtained for layer 3; these correspond to terminal phase 1 and initial phase 2 according to the periodization proposed by Marcos (Marcos, 2003; Tabarev, Kanomata, Marcos et al., 2016). The date of 5800 ± 30 (IAAA-151361) BP was derived from the medial portion of layer 4; we believe it corresponds to the pre-ceramic period in the history of the site (Popov et al., 2016).

The lower layers and horizon of the virgin land show numerous pits from pillar-type structures and several artifact concentrations with grinding stones and grinders (Fig. 4). Noteworthy is the discovery of four single male burials of a secondary type—almost 100 burials were previously found at Real Alto, but only one or two were attributed to the early phases of the culture (Fig. 5). In the immediate vicinity of the burials, various archaeological materials were recorded: anthropomorphic figurines made of stone and ceramics, tools made of stone, items made of shells, pieces of ocher and sea coral. The date of 4550 ± 20 BP (IAAA-170764) was generated on carbon deposits on a ceramic fragment from burial 2 (northern trench).

The finds from a small area in the northeastern extension to the main excavation are of exceptional importance. More than 50 fragments of vessels, belonging to another early ceramic tradition, "San Pedro" (Fig. 6, *1*), were recovered from the contact zone between layers 3 and 4 (depth 0.8–0.9 m). This culture was first identified by H. Bischof in the early 1970s at the Valdivia site (Bischof, Viteri, 1972) and attributed to the chronological range from 4495 ± 140 (Hv-4840) to 4260 ± 100 BP (Hv-4838), which dates were generated on charcoal samples from the layer (Bischof, Viteri, 2006). At the same time, fragments of ceramics other than Valdivian were found at El Encanto, in a layer with the dates of 4405 ± 90 (SI-1311) and 4370 ± 85 (SI-1184) BP (Porras, 1973: 159), and at Real Alto, in trench C, at a depth of 40–60 cm (between horizons with Valdivian ceramics typical of phases 1 and 2) (Damp, Vargas, 1995).

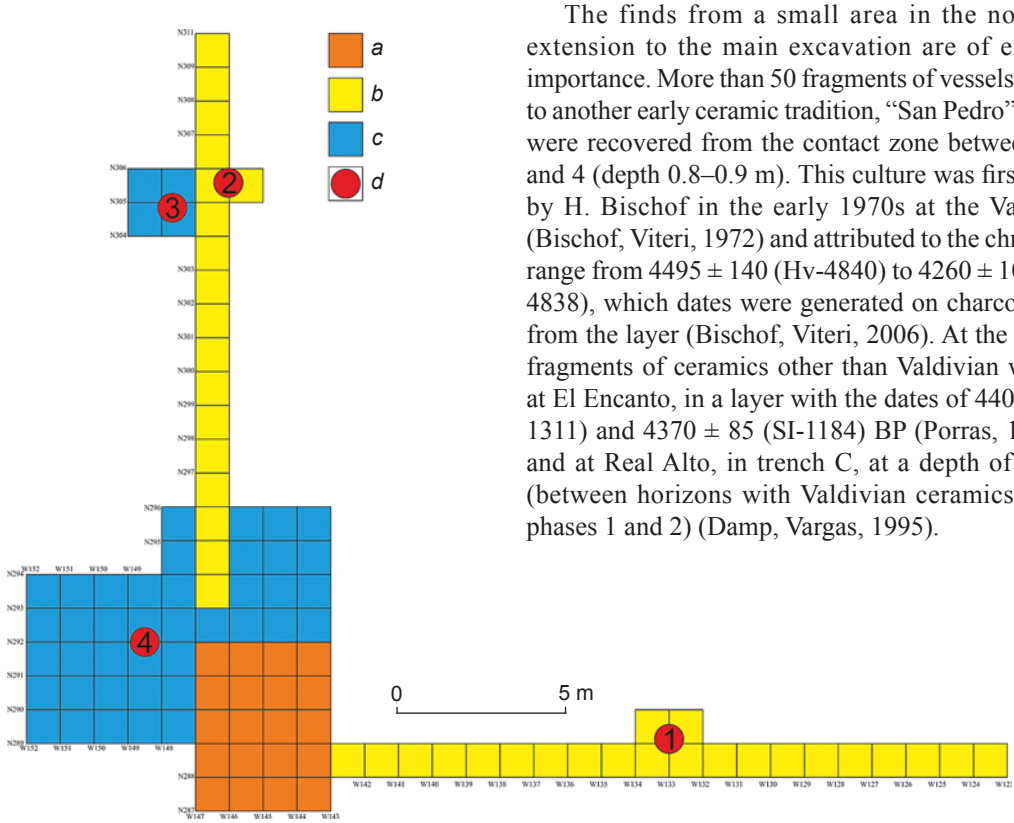

Fig. 2. Map of excavations and trenches at Real Alto.
a – excavation of 2014/15; *b* – trench of 2015; *c* – excavation of 2017; *d* – burials.

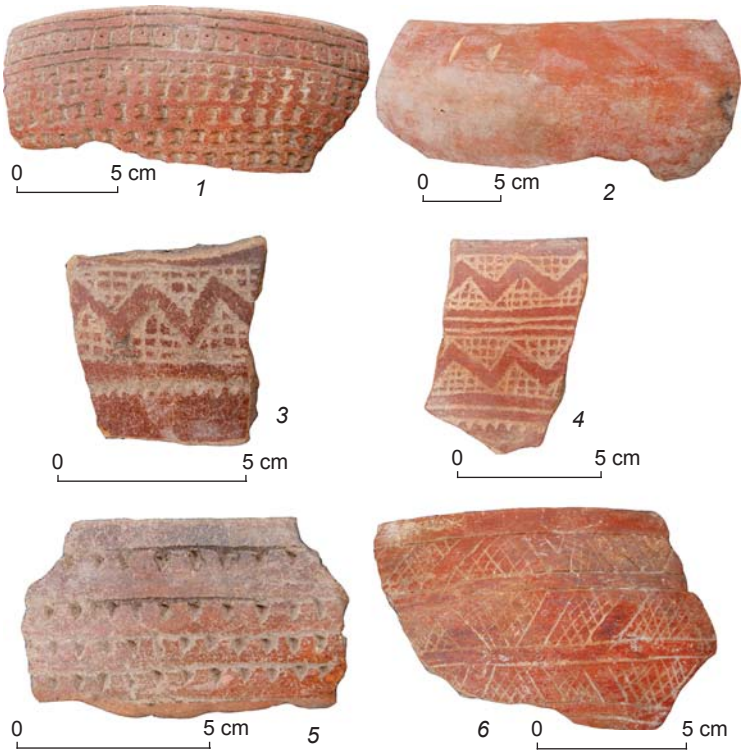

Fig. 3. Valdivia ceramics (phases 1 and 2) from Real Alto.

Fig. 4. Complexes with grinding stones and grinders. Real Alto, northern trench.

Fig. 5. Burial 1. Real Alto.

Researchers were not unanimous concerning the status of the "San Pedro" pottery: H. Bischof considered it as a "separate phase" preceding Valdivia phase 2 (Bischof, Viteri, 2006), while P. Porras and J. Damp believed that it was a variation of the Valdivia tradition. The most interesting hypothesis was proposed by D. Lathrap: "San Pedro" might have been an earlier ceramic tradition on the Ecuadorian coast than the Valdivian one, and "not been its technological predecessor" (Lathrap, Collier, Chandra, 1975: 27).

Charred deposits on the "San Pedro" ceramics provided the radiocarbon dates of 4640 ± 20 (IAAA-171318) and 4460 ± 30 (IAAA-181069) BP, which suggested that the "San Pedro complex" emerged in Real Alto somewhat earlier than Valdivia, the two traditions coexisted for some time, and then "San Pedro" disappeared (Kanomata, Marcos, Popov et al., 2019). Moreover, the publication of fragments of this pottery allowed researchers to identify it in a younger archaeological context at one of the sites in Salango Bay in the Manabi Province (Fig. 6, *2*), which significantly expanded the area of the tradition (Lunniss, Zeidler, Aguilú, 2021: 141, fig. 10, 11).

The results of three seasons of excavations at Real Alto determined the expansion of scope of research and focus on the archaic period preceding the Valdivia and represented by a series of Las Vegas sites. G. Bushnell was

Fig. 6. "San Pedro" ceramics (after (Lunniss, Zeidler, Aguilú, 2021), courtesy of R. Lunniss).
1 – Real Alto; *2* – Salango Bay, sector 141B.

one of the first scholars who reported lithic artifacts (split pebbles, flakes) not accompanied by ceramic fragments on the Santa Elena Peninsula, on the basis of the results of his survey works in the 1930s (1951: 123–124). In the 1960s, E. Lanning recorded a series of sites and proposed the name of "Las Vegas" for this culture (1967: 54–55). The most significant contribution to the study of the Las Vegas was made by the American researcher K. Stothert: she excavated several sites, mapped the distribution of sites, developed a representative database of radiocarbon dates, and proposed an internal periodization of the culture (1988: 56). Among the excavated sites, especially noteworthy is object No. 80 (OGSE-80), containing a series of burials (more than 200 individuals). In a later publication, Stothert mentioned another burial complex (No. 66/67), where she carried out small excavations in 2000 (Stothert, Piperno, Andres, 2003). The data from the excavation reports made it possible to clarify the history of its discovery: first, the site was identified, numbered (OGSEAt-66/67), and tested with pits by specialists from the Escuela Superior Politécnica del Litoral (ESPOL) university back in 1985 during a survey of the area for rescue excavations; in 1993, researchers from that university visited the site under the cultural heritage monitoring project.

In 2001, Stothert established a 5 × 2 m excavation area at OGSEAt-66/67, and at a depth from 0.7 to 1.3 m she discovered 15 secondary burials similar to those at object No. 80. She collected several samples of soil, charcoal, shells, and fragments of human bones for analysis, while the bulk of the finds were preserved *in situ*. This scholar published two dates of 7390 ± 60 (Beta-146982) and 7480 ± 70 (Beta-146983) BP, which she derived from the horizon with burials, and correlated these with the Late Las Vegas (Ibid.).

In 2017, the Russian expedition made an additional test pit at the site, and began full-fledged excavations in 2018. The site of Loma Atahualpa (OGSEAt-66/67) is located on the top of a hill on the watershed between the Tambo River and one of its left tributaries. Altitude above sea level is ca 72 m, and that above the Tambo bed is about 25 m. The area of distribution of the cultural layer is ca 700 m^2. In the middle part of the site (in accordance with the 2017 test pit), an excavation area of 28 m^2 was established; a trench (1 × 4 m) and a pit (1 × 2 m) were made to the south of the main area, and another four pits (1 × 1 m) were made along the boundaries of the site (Fig. 7). Notably, even after clearing the dense bushes, it was not possible to determine visually the location of the Stothert's excavation; during the works, it became clear that the original digging area was located approximately 8–10 m to the west of the 2018 excavation.

The total thickness of culture-bearing deposits (dense, differently colored sandy loam) at the site is about 1.2 m. The main part of the archaeological collection consists of lithic artifacts (almost 5000 spec.) and ceramics (259 spec.). The vast majority (90%) of pottery fragments were found in the upper horizons (0–0.6 m). Their morphological and technological features and ornamentation suggest their attribution to the Late Valdivia and the subsequent local cultures of Machalilla, Guangala, and Manteño. The minimum number (10%) of pottery fragments in the lower horizons was associated with rodent burrows.

The upper horizons yielded over three thousand lithic artifacts; 99% of them are products of knapping quartzite and chalcedony pebbles, nodules of chert and jasperoids. The collection of the morphologically distinct specimens comprises intact and fragmented hammerstones, tools on pebble spalls and flakes, fragments of abraders, two grinding stones, and solitary exhausted cores from chert and chalcedony. In general, the lithic assemblage is quite similar in its technical and typological features to the industry from the ceramic-free horizon and the overlying layer with Early Valdivia (phases 1 and 2) materials at Real Alto, which industry was identified during excavations by the Russian expedition in 2014–2015 and 2017.

The lithic industry of the lower horizons (1913 spec.) looks more homogenous: the pebble component is minor;

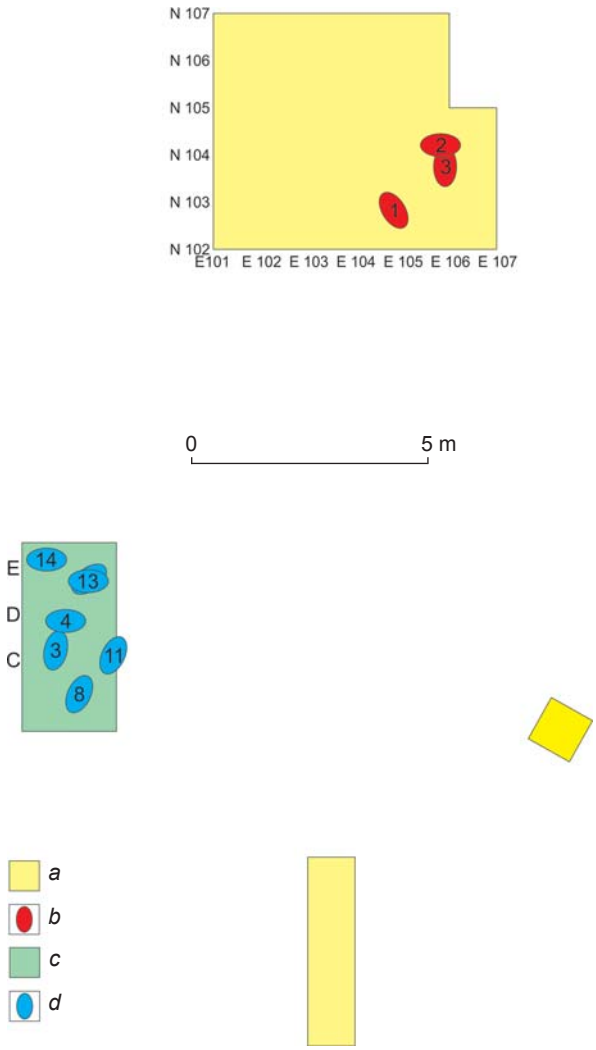

Fig. 7. Map of excavations at Loma Atahualpa.
a – excavation, trench, and test pit of 2018; *b* – burials in excavation 2018; *c* – Stothert's excavation of 2001; *d* – burials in the latter.

artifacts from light-colored chalcedony and black chert predominate; cream-colored and yellow jasperoids are rare. A series of exhausted cores (42 spec.), flakes with discontinuous marginal retouch, small hammerstones, colored pebbles without use-wear signs, and an impressive set of miniature (3–4 cm long) end-scrapers with transverse working edges were also recovered (Fig. 8).

In addition, three burials were found in the excavation.

Burial 2 (female over 50 years old) was uncovered at a depth of 80–100 cm, overlain by a layer of *Anadara similis* bivalves. Her skeleton was in a flexed position, oriented with her skull towards the northeast. A polished axe was placed at her feet (Fig. 9, *1*). The burial was located stratigraphically over burials 1 and 3 and belongs to a younger period.

Burial 1 (female 40–45 years old) was found at a depth of 1.0–1.2 m, practically on the virgin land surface, and was overlain by a layer of shells. The burial was discovered in the test pit in 2017. The skeleton was in the flexed position, oriented with the skull towards the northeast. A shell-pendant was found at the feet of the buried woman (Fig. 9, *2*); a pestle-burnisher was located under her skull.

Burial 3 (male 40–50 years old) was located under burial 2, on the virgin land, under the layer of shells. The pelvis and leg bones were well preserved; the upper part of the skeleton was partly missing: only arm long bones, some vertebrae, and solitary rib fragments survived. The skull was absent; a large sub-rectangular plate with abrasive surface, and a trihedral fragment of shell conglomerate were found in the place of the skull (Fig. 10).

The Loma Atahualpa archaeological assemblage can be correlated with the Las Vegas pre-ceramic culture, but it seems premature to draw more reasoned conclusions based on one field season and a comparatively small excavated area. The dates of 5340 ± 30 and 5710 ± 30 BP, derived from charcoal from a depth of 1 m, also require confirmation/correction.

Discussion: chronology, periodization and the origins of pottery-making

The materials obtained by the Russian expedition allow us to address several most important topics of the discussion, which have both local (Ecuador) and regional (South America) significance. The first topic is the chronology and periodization of cultures of the Archaic and Formative periods, which require clarification. The correctness of radiocarbon dates, most of which were generated on composite samples of charcoal or organic materials (shells, bone) from reference archaeological horizons through traditional technique in the 1960–1980s, needs evaluation. They have a significant error interval, and raise reasonable doubt among many experts. For example, dates for the Valdivia culture derived from samples from Real Alto (6195 ± 215, 5620 ± 250, and 5495 ± 200 BP) and Loma Alta (5275 ± 175 and 5240 ± 420 BP) (Lunniss, Zeidler, Aguilú, 2021) contrast with new AMS-data generated on charred deposits on ceramics from these sites (Real Alto – 4640 ± 20 BP (Kanomata, Marcos, Popov et al., 2019), Loma Alta – 4470 ± 40 BP (Zarrillo et al., 2008)) and with a recently published date of 4915 ± 15 BP for the Early Valdivian horizon at Buen Suceso (Rowe, Duke, 2020). In our opinion, the new data more accurately determine the time of emergence of pottery and, accordingly, the onset of the Formative period in the coastal part of Ecuador: 4.8–4.7 ka BP rather than 5.5 ka BP.

The periodization of the Las Vegas culture also requires correction. In Stothert's version, it was subdivided

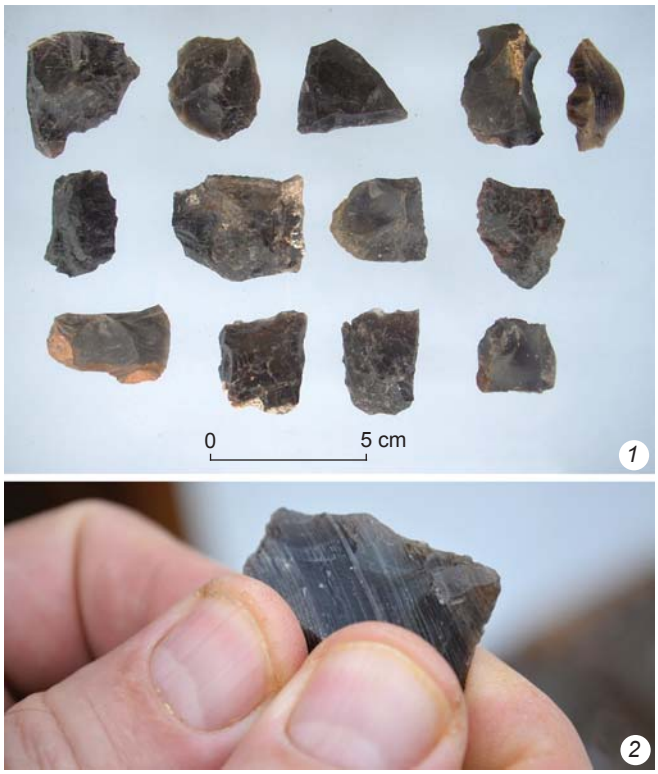

Fig. 8. Micro-end-scrapers with transverse working edges, Loma Atahualpa.

Fig. 9. Small stone axe (celt) from burial 2 (*1*) and bivalve pendant from burial 1 (*2*), Loma Atahualpa.

into the pre-Las Vegas (10.8–10.0 ka BP), early (10–8 ka BP) and late (8.0–6. 6 ka BP) stages; and several "younger" dates (for example, 5830 ± 80 and 5780 ± 60 BP) were associated with the "post-Las Vegas" phase (Stothert, Piperno, Andres, 2003). Taking into account the age assessments by the Russian expedition of the pre-ceramic period layer at Real Alto (5800 ± 30 BP) and Loma Atahualpa (5710 ± 30 and 5340 ± 30 BP), and a series of dates for the layer of the pre-ceramic period at Valdivia (from 4760 ± 80 to 4510 ± 95 BP) (Bischof, Viteri, 2006) it seems reasonable to attribute the Late Las Vegas to 8.0–4.8 ka BP.

Another issue is to determine the features of the transition from the Archaic to the Formative period. On the basis of analysis of phytoliths, Stothert and her colleagues proved that starting from 8–7 ka BP the Late Las Vegas people made the first attempts to cultivate plants: first, calabash (*Lagenaria siceraria*), Guinea arrowroot (*Calathea allouia*), squash (*Cucurbita* spp.), and then maize (*Zea mays*) (Stothert, Piperno, Andres, 2003). Taking into account the contemporaneous appearance of large necropolises (sites No. 66/67 and 80), the late phase of the Las Vegas culture can well be defined as both "Late Archaic" and "Pre-Ceramic Neolithic".

Fig. 10. Burial 3. Loma Atahualpa.

One more topic of the discussion concerns the most intriguing issue—the time and area/areas of emergence of the pottery production. The new data on "San Pedro" ceramics made it possible to identify and prove the fact of coexistence of at least two early ceramic traditions on the Ecuadorian coast during the Formative period. However, neither the "San Pedro" nor the Early Valdivian ceramics document the initial stage of pottery-making—their technological features, despite certain differences, demonstrate quite developed skills in the manufacture of pottery (Kanomata, Marcos, Popov et al., 2019). The authors suggest considering the version of local origin of the "San Pedro" pottery tradition (at the end of the Late Las Vegas), with the subsequent development in the coastal zone of the Early Valdivian tradition, which originated from the continental part. The latter assumption is supported, for example, by the available data on assemblages with early ceramics from Amazonia. This concerns not the rather controversial dating (7 ka BP) of Taperinha ceramics (Meggers, 1997; Roosevelt, 1995), but the archaeological materials from Mayo-Chinchipe sites in eastern Ecuador, which provided the dates of ca 5 ka BP for the early phase (Valdez, 2011), and especially the ceramics in southwestern Brazil (Monte Castelo) and Bolivia (Llanos de Mojos) (Pugliese, Neto, Neves, 2019). For example, at Monte Castelo, the earliest traces of pottery (older than 5200 BP) were recorded at the base of a thick (6.5 m) shell midden. The overlying horizons, dated back to 4.4–4.1 ka BP, yielded ceramics from the so-called Bacabal phase. It shows intriguing parallels in ornamentation with the earliest Valdivian pottery. The date based on carbon deposits on a fragment of a ceramic vessel from the site of Llanos de Mojos also looks promising: 6235 ± 62 BP (Ibid.).

The issue of the chronology and geography of pottery-production centers and the features of their mutual influence is undoubtedly a topic for a separate study. Essential to the subject of the present paper is the increasingly confirmed assumption that there is no evidence of a connection between the pottery's emergence and agriculture in Amazonia (Cerâmicas…, 2016: 32; Neves, 2020). Pottery appeared in semi-sedentary hunter-gatherer communities together with a focus on exploiting aquatic resources; this scenario is also probable for the late phase of the Las Vegas culture on the Ecuadorian coast.

Conclusions

The findings of the first Russian archaeological expedition were presented at international conferences and aroused interest among foreign colleagues. References to publications of the data have appeared in a number of recent generalizing collective monographs on the ancient cultures of pre-Columbian America (see, e.g., (Las Vegas…, 2020; Pre-Columbian Central America…, 2021)).

The achieved results not only expand the corpus of archaeological materials, but also newly formulate the questions about cultural genesis on the Pacific coast of Ecuador. Further development of this issue obviously requires an integrated approach in the form of long-term scientific projects or programs and a new level of international cooperation.

The priority task is to continue stationary archaeological research at the sites of Real Alto and Loma Atahualpa. At Real Alto, there is a need to clarify the chronology and interrelations between the early ceramic traditions of "San Pedro" and Valdivia, and to search for arguments in favor of the connection of "San Pedro" ceramics with other categories of artifacts and, possibly, burials. At Loma Atahualpa, to search for new burials of the Las Vegas culture, carry out a thorough analysis of grave goods aimed at the possible discovery of early ceramics, and obtain additional dates to determine the chronology of the necropolis. Detailed anthropological studies and, despite the characteristics of dry tropical soils, collection of soil samples for DNA extraction are also extremely relevant. Finally, the full-fledged continuation of archaeological research in South America implies the expansion of the geographical and chronological framework, addressing the full range of pre-Hispanic cultures on the Pacific coast of Ecuador, and considering prospects for work in neighboring countries.

Acknowledgements

This study was supported by the Russian Science Foundation, Project No. 22-28-00059. We thank Professor J.G. Marcos for his long-term and multidimensional cooperation (Escuela Superior Politécnica del Litoral, Guayaquil), Dr. R. Lunniss (Technical University of Manabi, Portoviejo), Prof. Y. Kanomata (Tohoku University, Sendai), and Prof. E. Neves (University of São Paulo), as well as all Russian and Ecuadorian participants of expeditions of 2014–2015 and 2017–2018. We express especial gratitude to the residents of the Pechiche commune (Santa Elena Province, Ecuador).

References

Bashilov V.A. 1972
Drevniye tsivilizatsii Peru i Bolivii. Moscow: Nauka.

Berezkin Y.E. 1983
Mochika: Tsivilizatsiya indeitsev severnogo poberezhya Peru v I–VII vv. Leningrad: Nauka.

Bischof H., Viteri J.G. 1972
Pre-Valdivia occupations on the southwest coast of Ecuador. *American Antiquity*, vol. 37: 548–551.

Bischof H., Viteri J.G. 2006
Entre Vegas y Valdivia: La fase San Pedro en el suroeste del Ecuador. *Bulletin de l'Institut Francais d'Etudes Andines*, vol. 35 (3): 361–376.

Bushnell G.H.S. 1951
The archaeology of the Santa Elena peninsula in South-West Ecuador. Cambridge: Cambridge Univ. Press.

Cerâmicas arqueológicas da Amazônia: Rumo a uma nova síntese. 2016
Belém: Instituto do Patrimônio Histórico e Artístico Nacional.

Damp J., Vargas L.P.S. 1995
The many faces of Early Valdivia ceramics. In *The Emergence of Pottery: Technology and Innovation in Ancient Societies*. Washington: Smithsonian Institution Press, pp. 157–168.

Estrada E. 1956
Valdivia: Un sitio arqueológico formative en la costa de la Provincia del Guayas, Ecuador. Guayaquil: Museo Victor Emilio Estrada.

Evans C., Meggers B.J. 1958
Valdivia: An Early Formative culture of Ecuador. *Archaeology*, vol. II (3): 175–182.

Kanomata Y., Marcos J., Popov A., Lazin B., Tabarev A. 2019
New data on early pottery traditions in South America: The San Pedro complex, Ecuador. *Antiquity*, vol. 93 (369): 1–6.

Kanomata Y., Tabarev A.V., Popov A.N., Lazin B.V., Gavrilina T.A., Rudenko M.K., Marcos J.G. 2021
Stone tool functions in the preceramic period at the Loma Atahualpa site in Ecuador. *Bulletin of Tohoku University Museum*, No. 20: 21–40.

Kanomata Y., Tabarev A.V., Popov A.N., Lazin B.V., Marcos J.G. 2019
Flake tool functions in early ceramic culture at the Real Alto site in Coastal Ecuador. *Bulletin of Tohoku University Museum*, No. 18: 11–29.

Lanning E. 1967
Peru before the Incas. Englewood Cliffs: Prentice Hall, Inc.

Las Vegas: The Early Holocene Archaeology of Human Occupation in Coastal Ecuador. 2020
Pittsburg: Univ. of Pittsburg Center for Comparative Archaeology. (Univ. of Pittsburgh Memoirs in Latin American Archaeology; No. 25).

Lathrap D.W., Collier D., Chandra H. 1975
Ancient Ecuador-Culture, Clay and Creativity, 3000–300 B.C. Chicago: Field Museum of Natural History.

Lathrap D.W., Marcos J.G., Zeidler J. 1977
Real Alto: An ancient ceremonial center. *Archaeology*, vol. 30: 2–13.

Lunniss R.M., Zeidler J., Aguilú J.J.O. 2021
La transición Arcaico Tardío – Valdivia: Una reevaluación en base a evidencias de los sitios Salango y Valdivia. In *Valdivia, una Sociedad Neolítica: Nuevos aportes a su conocimiento*. Portoviejo: Universidad Técnica de Manabí, pp. 120–158.

Marcos J.G. 1990
Poyavleniye rannezemledelcheskikh obshchestv v Severnykh Andakh, V.A. Bashilov (trans. from Spanish). In *Problemy arkheologii i drevney istorii stran Latinskoy Ameriki*. Moscow: Nauka, pp. 86–111.

Marcos J.G. 2003
A reassessment of the Ecuadorian Formative. In *Archaeology of Formative Ecuador*. Washington: Dumbarton Oaks Research Library and Collection, pp. 7–32.

Marcos J.G. 2015
Un sitio llamado Real Alto. Quito: Universidad Internacional del Ecuador.

Meggers B.J. 1997
La cerámica temprana en América del Sur: ¿Invención independiente or difusión? *Revista de Arqueologia Americana*, vol. 13: 7–40.

Meggers B., Evans C., Estrada E. 1965
The Early Formative Period of Coastal Ecuador: The Valdivia and Machalilla Phases. Washington: Smithsonian Inst. Press. (Smithsonian Contributions to Anthropology; vol. 1).

Neves E.G. 2020
Rethinking the role of agriculture and language expansion for ancient Amazonians. In *Rethinking the Andes–Amazonia Divide*. London: Univ. College London Press, pp. 211–220.

Popov A.N., Tabarev A.V., Marcos J.G., Lazin B.V., Vasilieva L.E. 2016
Arkheologicheskiye issledovaniya na pamyatnike Real-Alto v 2014–2015 gg. *Tikhookeanskaya arkheologiya*, iss. 38: 187–206.

Porras P. 1973
El Encanto – La Puna: Un sitio insular de la Fase Valdivia asociado a un conchero anular. Quito: Ediciones Huancavilca.

Pre-Columbian Central America, Colombia, and Ecuador: Toward an Integrated Approach. 2021
Washington: Dumbarton Oaks Research Library and Collection.

Pugliese F.A., Neto C.A.Z., Neves E.G. 2019
What do Amazonian shellmounds tell us about the long-term indigenous history of South America? In *Encyclopedia of Global Archaeology*. Cham: Springer. URL:https://doi.org/10.1007/978-3-319-51726-1_3030-2

Raymond S.J. 1993
Ceremonialism in the Early Formative of Ecuador. *Senri Ethnological Studies*, vol. 37: 25–43.

Roosevelt A.C. 1995
Early pottery in the Amazon: Twenty years of scholarly obscurity. In *The Emergence of Pottery: Technology and Innovation in Ancient Societies*. Washington: Smithsonian Inst. Press, pp. 115–131.

Rowe S.M., Duke G.S. 2020
Buen Suceso: A new multicomponent Valdivia site in Santa Elena, Ecuador. *Latin American Antiquity*, vol. 31: 639–645.

Stothert K.E. 1988
La Prehistoria Temprana de la Península de Santa Elena: Cultura Las Vegas. Guayaquil: Museos del Banco Central del Ecuador.

Stothert K.E., Piperno D.R., Andres T.C. 2003
Terminal Pleistocene/Early Holocene human adaptation in coastal Ecuador: The Las Vegas evidence. *Quaternary International*, vol. 109/110: 23–43.

Tabarev A.V. 2016
Formativniy period v arkheologii Ekvadora: Anatomiya termina i voprosy prakticheskogo primeneniya. *Teoriya i praktika arkheologicheskikh issledovaniy*, No. 1: 111–126.

Tabarev A.V., Kanomata Y., Marcos J.G., Popov A.N. Lazin B.V. 2016

Insights into the Earliest Formative Period of coastal Ecuador: New evidence and radiocarbon dates from the Real Alto site. *Radiocarbon*, vol. 58 (2): 323–330.

Tabarev A.V., Kanomata Y., Popov A.N., Poshekhonova O.E., Zubova A.V. 2021

Towards the characteristics of Early Formative, coastal Ecuador: Joint Russian-Japanese-Ecuadorian excavations at Real Alto site in 2014–2017. In *Valdivia, una Sociedad Neolítica: Nuevos aportes a su conocimiento*. Portoviejo: Universidad Técnica de Manabí, pp. 64–97.

Tabarev A.V., Marcos J.G., Popov A.N. 2015

Sovsem ne "pechalniye" tropiki: Rossiyskaya arkheologicheskaya ekspeditsiya v Ekvadore. *Nauka iz pervykh ruk*, No. 5/6: 156–171.

Tabarev A.V., Popov A.N. 2014

Vozvrashcheniye v Yuzhnuyu Ameriku: Nekotoriye itogi, problemy, perspektivy. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XX. Novosibirsk: Izd. IAET SO RAN, pp. 289–291.

Tabarev A., Popov A.N., Marcos J.G., Kanomata Y. 2016

New excavations at Real Alto site, Valdivia culture: Joint Russian-Japanese-Ecuadorian project, 2014–2015. In *The Latest Results of American Studies: II Intern. Symp. University of Wroclaw, Sept. 12–14*. Wroclaw: Univ. of Wroclaw, p. 44.

Tabarev A.V., Popov A.N., Marcos J.G., Kanomata Y. 2019

New excavations at Real Alto site, Valdivia culture: Joint Russian-Japanese-Ecuadorian project, 2014–2015. *The Latest Results of American Studies: Tambo*. Boletin de Arqueologia, No. 4: 247–272.

Valdez F. 2011

La cerámica Mayo Chinchipe, el Formativo Temprano de la Ceja de Selva Oriental. *Revista Nacional de Cultura*, vol. III: 685–705.

Yakovleva L.M. 2010

Keramika chimu iz kollektsii L.I. Shrenka v sobranii MAE. In *Etnografiya i arkheologiya korennogo naseleniya Ameriki*. St. Petersburg: MAE, pp. 176–186. (Sb. MAE; vol. LVI).

Zarrillo S., Pearsall D.M., Raymond S.J., Tisdale M.A., Quon D.J. 2008

Directly dated starch residues document Early Formative maize (*Zea mays L.*) in tropical Ecuador. *Proceedings of the National Academy of Sciences*, vol. 105 (13): 5006–5011.

Received February 17, 2022.
Receive in revised form March 3, 2022.

doi:10.17746/1563-0110.2023.51.4.065-077

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Chronology of Rock Art of the Russian and Mongolian Altai: From the Paleolithic to the Late Middle Ages

This study attempts to elaborate a chronology of rock art in the Russian and Mongolian part of the Altai Mountains, from the Paleolithic to the Late Middle Ages. We focus on the style and themes of rock art and on petroglyphic palimpsests. The earliest representations date to the Upper Paleolithic. On certain palimpsests, images of horses in the Kalguty style are overlaid by Bronze Age petroglyphs. The key challenge is to identify Neolithic petroglyphs. Among the huge number of Bronze Age representations, some follow the traditions peculiar to the Afanasyevo and Chemurchek cultures. The key feature of the latter is so-called "Chemurchek anthropomorphs". Bronze Age petroglyphs, representing animals, humans, weapons, wheeled vehicles, etc., are chronologically and culturally diverse and must be subdivided respectively. Early Iron Age ones require attribution to either the initial stage or to the mid-1st millennium BC. We discuss the difficulties of analyzing rock art of the Xiongnu-Sarmatian age, the expressive Turkic style, that of the early medieval rock art, and recent petroglyphs of the southern Russian Altai.

Keywords: Mongolian Altai, petroglyphs, palimpsests, Kalguty style, Chemurchek culture, Early Iron Age, Middle Ages.

Introduction

The Mongolian Altai is a real petroglyphic treasure, with many outstanding rock art sites (Fig. 1). As the most numerous archaeological objects in the region, petroglyphs have been systematically studied for decades, along with burials from various periods, commemorative complexes, and sculptures. In the late 20th to early 21st century, international expeditions extensively explored the valleys of the Baga-Oygur, Tsagaan Salaa, and Tsagaan Gol rivers in Northwestern Mongolia. During this time, they recorded and replicated thousands of rock compositions spanning various historical periods. The results of these works were published in monographs (see (Jacobson, Kubarev, Tseveendorj, 2001, 2006; Kubarev, Tseveendorj, Jacobson, 2005; Kubarev, 2009), which contain sections on the problems of periodization and chronology of petroglyphic sites in the Mongolian Altai studied by the co-authors. In his short article, N. Batbold outlined his point of view on the chronology of the petroglyphs in the Mongolian Altai (2018). A.N. Mukhareva and

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Fig. 1. Rock art sites in the Altai Mountains (Russian and Mongolian Altai).

1 – Chaganka; *2* – Elangash; *3* – Kalgutinskiy Rudnik; *4* – Muzdy-Bulak; *5* – Baga-Oygur; *6* – Tsagaan Salaa; *7* – petroglyphs from Baga-Oygur (right bank); *8* – Khar-Dzhamat-Gol; *9* – Khar-Salaa; *10* – Khar-Chuluu; *11* – Shiveet-Khairkhan.

N.N. Seregin chronicled the research history of the early medieval petroglyphs in the Mongolian Altai, and evaluated the findings of the studies (2021).

V.D. Kubarev, E. Jacobson, and D. Tseveendorj delved into the chronology of the petroglyphs, focusing on their cultural process dynamics and style, and drew conclusions regarding the parallels between representations and the material evidence uncovered in excavations. The examined complexes belonged to a wide chronological range, from the Stone Age to the ethnographically modern period. Scholars attributed the earliest rock art to the "Neolithic-Chalcolithic" (Kubarev, Tseveendorj, Jacobson, 2005: 54, 121) and distinguished two periods, early and late, in the set of petroglyphs from the Bronze Age (4th–1st millennia BC) (Ibid.: 55). The co-authors attributed the petroglyphs from the period of the "ancient nomads" of the Early Iron Age (Ibid.: 92–107), the Xiongnu-Sarmatian period, the "Middle Ages", and later time (Ibid.: 107–111). In the English-language studies published in France, the date of each rock composition or individual figure is provided (Jacobson, Kubarev, Tseveendorj, 2001, 2006).

The Kalgutinsky Rudnik site was explored on the Ukok plateau in the southern Russian Altai, which seems to constitute a single natural and cultural region with the Mongolian Altai. Some of the petroglyphs from that site have been identified as the earliest representations in the Altai, and were dated to the Upper Paleolithic (Molodin, Cheremisin, 1999). The concept of the historical and cultural development of local populations was formulated (Molodin, 1995).

The concept of the Central Asian center of prehistoric art, developed by A.P. Okladnikov (1972), has been further elaborated in later studies. In the recent decade, research in the Mongolian Altai by Russian, Mongolian and French scholars, aimed at identifying and studying the earliest petroglyphs, resulted in the discovery of a series of unique complexes (Tseveendorj et al., 2017; Cheremisin et al., 2018; Molodin, 2022; Molodin, Geneste, Zotkina et al., 2019; Molodin, Zotkina, Cretin et al., 2020; Molodin, Cheremisin, Nenakhova et al., 2022a; and others).

Study results

The study of the previously known and newly discovered representations involved the identification of their iconographies and stylistic features, reconstruction of techniques for making petroglyphs using traceological analysis, and interpretation of palimpsests. This provided new evidence supporting the Upper Paleolithic age of some petroglyphs in the Russian and Mongolian Altai. Figures of mammoths, rhinoceros (?), bulls, horses (Fig. 2, *1–5*; 3), deer (see Fig. 2, *6*), rams, and partial images pecked on slate rock surfaces were found in this region.

A serious argument for the early age of this group of petroglyphs was the results of the study of palimpsests containing pecked horse figures in the Kalguty style, overlapped by images of bulls and deer made in the Bronze Age style (compositions at the sites of Tsagaan Salaa IV and on the right bank of Baga-Oygur) (Molodin, 2022; Molodin, Geneste, Zotkina et al., 2019; Molodin, Zotkina, Cretin et al., 2020; Molodin, Cheremisin, Nenakhova et al., 2022a; Cheremisin et al., 2018; Tseveendorj et al., 2017; Batbold et al., 2019). It has been suggested to concentrate on the special "Kalguty style" of the earliest images (Molodin, Geneste, Zotkina et al., 2019).

Attribution of the Neolithic petroglyphs of the region under discussion is the most controversial area of chronological reconstructions. Identification of this group of rock art has been proposed in the works of Kubarev, Tseveendorj, and Jacobson (Jacobson, Kubarev, Tseveendorj, 2001: 64–66; Kubarev, Tseveendorj, Jacobson, 2005: 48–54). These scholars attributed a small number of rock representations to the Late Stone Age, relying upon stylistic features of pecked animal images, which to some extent were

similar to features typical of the Upper Paleolithic Kalguty style. A significant methodological issue arises from the fact that accepting this argument hinges on positing a connection between the Neolithic population of the region and the Paleolithic period. If, conversely, it is assumed that during the Neolithic the population changed, the rock art style may not necessarily show parallels with the previous tradition. Either way, identification of Neolithic petroglyphs in the region is currently the most difficult problem, for which no evidence is available.

According to the general principles of the chronology of Siberian petroglyphs, several single animal figures can still be safely attributed to the Neolithic. One of the reasons is a "scaly" technique of representation, probably with stone tools, which was noted by Kubarev, Tseveendorj, and Jacobson (2005: 49). Such figures included an image of an elk's head (see Fig. 2, *7*) and possibly several more large pecked animal figures (see Fig. 2, *8–10*), which, however, may well belong to an earlier period. Anthropomorphic figures did not yet appear during this period.

The Bronze Age was marked by flourishing of rock art traditions in the region. No other period is represented in the petroglyphs of the Mongolian Altai with so many images, such richness of plots, such variety of characters, and number of realities embodied in the art. This is also true for other regions of the mountain and steppe belt of Eurasia. However, the petroglyphs of the Mongolian Altai show completely unique motifs, compositions, and characters, which represent mythological subjects and ideological beliefs of the authors of this tremendous array of rock art imagery.

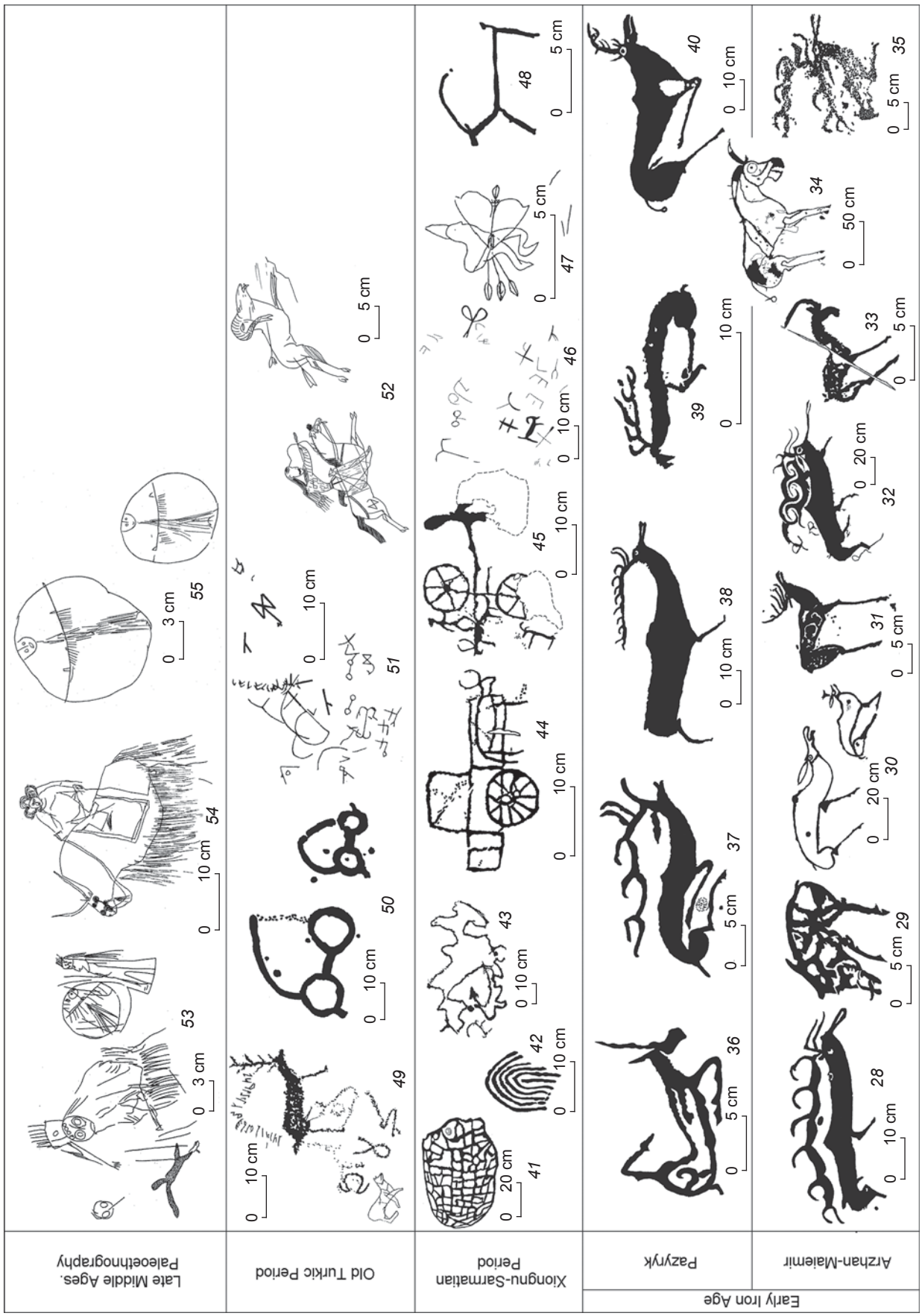
The characters include both domestic and wild animals repeatedly represented in hunting scenes (bulls, deer, mountain goats, camels, elks, wild boars; predators, such as felines, wolves, and rare bears, and various bird species). Domestic animals are horses and bulls. In the compositions, horses are harnessed to wheeled carts and chariots, bulls are loaded with luggage, are led by rein, and carry people on their backs. Stylized representations of dwellings, masks, and human footprints clearly go back to the Bronze Age. Anthropomorphic characters (in hunting scenes and military operations against each other), in different iconographies, with a variety of what seems to be ritual attributes and real weaponry, well-known from excavations, were most often depicted in the Bronze Age than in earlier periods. Various sexual practices were also represented. This subject was obviously related to the ritual aspect of culture of the local population.

It is indisputable that Bronze Age petroglyphs are not culturally and chronologically monolithic or homogeneous. The complexes related to the Early Bronze Age cultures may be distinguished from those left by the Late Bronze Age people.

Scholars have so far identified only a few examples of petroglyphs that can be associated with the Early Bronze Age. Some of these appear in a multi-figured palimpsest from Tsagaan Salaa IV. The Afanasyevo pictorial tradition identified by V.I. Molodin from the evidence discovered in the Russian Altai (Kucherla, Muzdy-Bulak, Uzungur) (1996) was also embodied in the rock art of the Minusinsk Basin (Esin, 2010). At the Muzdy-Bulak site on the Ukok plateau, a figure of deer was overlapped by other Bronze Age petroglyphs, while in Tsagaan Salaa (Mongolia), a similar image was superimposed on a figure of a horse in the Kalguty style (Molodin, Cheremisin, 2002; Molodin, Zotkina, Cretin et al., 2020). It is possible that the rich array of Bronze Age petroglyphs in the Mongolian Altai also includes other images associated with this developmental trend of the Early Bronze Age cultures of Southern Siberia and Central Asia (see Fig. 2, *11–13*).

Representations of anthropomorphic figures wearing distinctive clothing ("parabolic", "bell-shaped", "transparent capes", with weapons, "horns") appear widely on the rocks in the valleys of the Tsagaan Salaa and Baga-Oygur rivers. On the basis of complete iconographic parallels with scenes represented on ritual fences of the Chemurchek culture (Khar-Chuluut-1, Khulagash), these images can be considered the markers of the Chemurchek visual tradition identified by A.A. Kovalev (Kovalev, Munkhbayar, 2015, 2022; Molodin, Cheremisin, Nenakhova et al., 2022b; and others). The scholars have determined the circle of subjects associated with these characters and the pictorial context, which included animals in the scenes with the "Chemurchek anthropomorphs", such as bulls and horses, rendered using special iconography (Kovalev, Munkhbayar, 2022: 87). In addition, the depiction of a weapon, i.e. a bronze shaft-hole axe, makes it possible to date the figure represented on the right bank of the Baga-Oygur to the late 3rd millennium BC (Molodin, Cheremisin, Nenakhova et al., 2022b: 248) (see Fig. 2, *14–16*).

The variability of images, subjects, and iconographic solutions for representing zoo- and anthropomorphic characters, which go back to the Bronze Age, is clearly associated with their different chronology and cultural affiliation. For example, images of bulls are very diverse (a group of animals with massive rectangular bodies is clearly distinguishable (see Fig. 2, *18–20*), just as a group of more realistically depicted animals).


Late Middle Ages. Paleoethnography
Old Turkic Period
Xiongnu-Sarmatian Period
Early Iron Age
Pazyryk
Arzhan-Maiemir
0 3 cm
0 10 cm
0 20 cm
0 5 cm
0 50 cm
53
54
55
49
50
51
52
41
42
43
44
45
46
47
48
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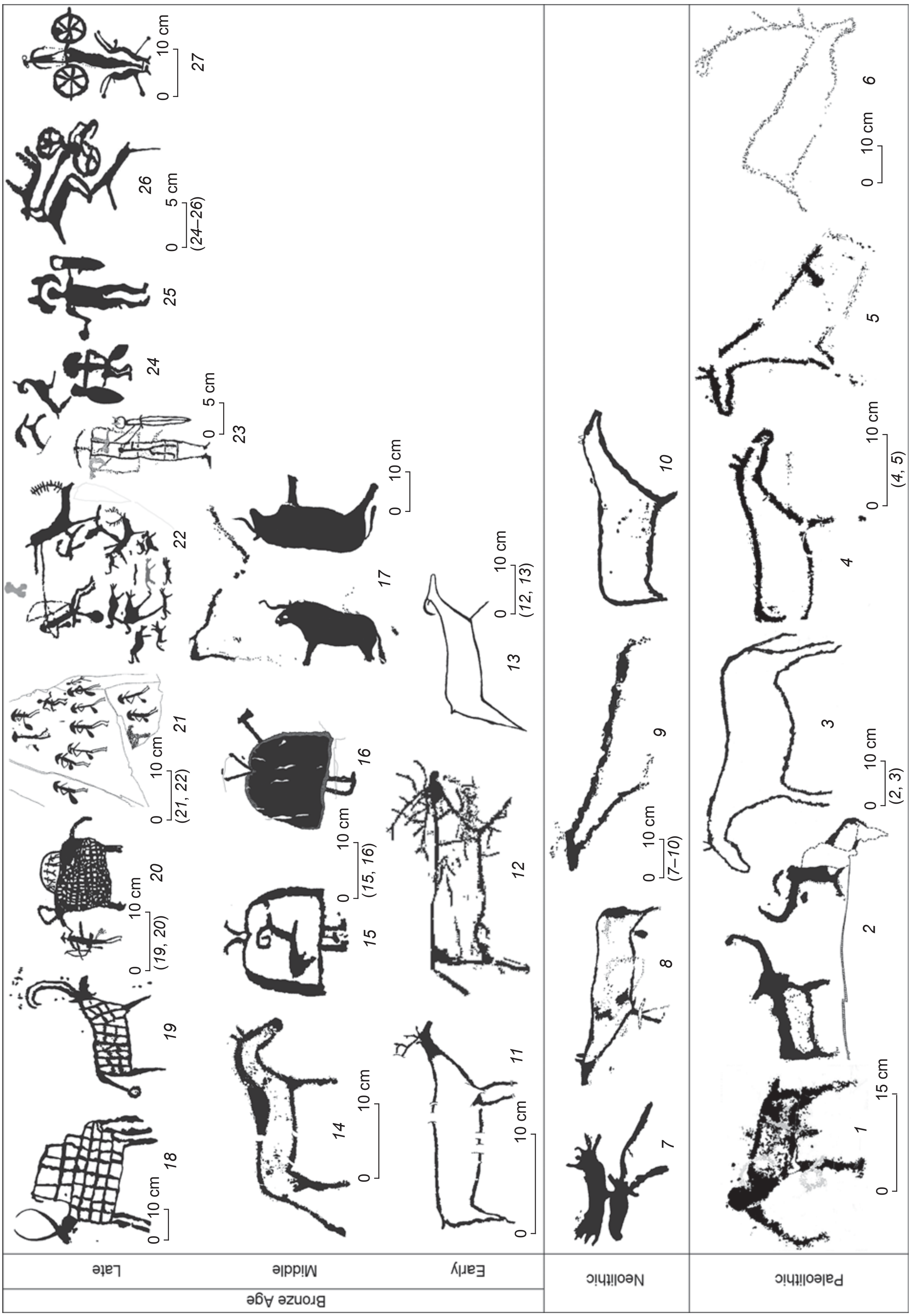
Bronze Age
Late
Middle
Early
Neolithic
Paleolithic

Human figures are often associated with the images of bulls: most often people lead these animals.

Kubarev identified several groups of images of bulls: made in different techniques, with different types of horns, "spotted" bulls, and bulls "in decorative style", riding and pack, in scenes with male and female characters (Kubarev, Tseveendorj, Jacobson, 2005: 523–535, 579–583). Domestic bulls were essential to the economy of the early cattle breeders, and this was reflected in their beliefs and art. It is still impossible to establish unambiguously the chronology of subjects associated with the depiction of domestic and wild (?) bulls, but note that in a number of compositions, the figures of bulls can be assigned to different groups. At the same time, they are associated with anthropomorphic characters in mushroom-shaped hats.

Anthropomorphic figures also differ in their iconography: the most numerous are male characters with weapons—bows and arrows, spears, daggers, and clubs. Figures depicted in a unique manner, i.e. on half-bent legs, wearing mushroom-shaped headdress, with tails or clubs, belong to the Advanced/ Late Bronze Age (Kubarev, 1987). Armed with bows and spears, they are often shown in hunting scenes, military confrontations, battle compositions, in the scenes of migrations with pack bulls, and in scenes with chariots (see Fig. 2, *20–25*).

The "Age of Chariots" (mid-second half of the 2nd millennium BC), related to the Late Bronze Age, is represented by lots of images of light wheeled carts drawn by horses. The Mongolian Altai is one of the regions where these images embodying the "Central Asian tradition" of depicting a chariot "in plan view", with horses located "back to back" and the charioteer on the platform, are most numerous (see Fig. 2, *26*, *27*). Anthropomorphic figures wearing mushroom-shaped hats, on half-bent legs, with daggers (Kubarev, Tseveendorj, Jacobson, 2005: 577, fig. 87, *20*) can be considered the dating evidence. These weapons correspond to solid cast daggers with handles, which have been found in the complexes of the Krotovo culture (Molodin, 2015) and occur as accidental finds from China to the Kazakhstan Irtysh region (Ibid.). They have been reliably dated to the Advanced Bronze Age. Judging by the parallels (Chlenova, 1976), images of anthropomorphic characters with daggers provided with ring pommels on their handles (Kubarev, Tseveendorj, Jacobson, 2005: 577, fig. 87, *19*) can be attributed to the Late Bronze Age.

The Early Iron Age petroglyph array, against other archaeological sites of this period in the region under discussion, would have been expected to feature no fewer images than that from the previous period. However, the situation is not as straightforward as it could have been. Indeed, very vivid, stylistically reliably identifiable, and very fully represented rock art at almost all significant sites in the Russian and Mongolian Altai consists of numerous petroglyphs in the "deer stone style" (Savinov, 1990) (see Fig. 2, *28*, *32*, *35*; 4). This is primarily an image of a "stylized" deer, which is widely reproduced not only on rock surfaces in vast areas of the region, but also

Fig. 2. Periodization of petroglyphs in the Mongolian Altai.

1 – Baga-Oygur III (Cheremisin et al., 2018: 67, fig. 15); *2* – Baga-Oygur II (Kubarev, Tseveendorj, Jacobson, 2005: 376, fig. 961); *3* – Kalgutinskiy Rudnik, section 1, representation 9 (Molodin, Cheremisin, 1999: 48, fig. 26); *4*, *5* – Tsagaan Salaa IV (Molodin, Zotkina, Cretin et al., 2020: 139, fig. 3); *6* – Kalgutinskiy Rudnik (Molodin, Cheremisin, 1999: 34, fig. 15); *7* – Tsagaan Salaa IV (Kubarev, Tseveendorj, Jacobson, 2005: 224, fig. 337); *8* – Baga-Oygur II (Ibid.: 377, fig. 962); *9* – Tsagaan Salaa IV (Ibid.: 223, fig. 332); *10* – Tsagaan Salaa II (Ibid.: 179, fig. 119); *11* – Muzdy-Bulak (Molodin, Cheremisin, 2002: 60, fig. 1); *12* – Tsagaan Salaa IV (Molodin, Zotkina, Cretin et al., 2020: 139, fig. 3); *13* – Baga-Oygur V (Kubarev, Tseveendorj, Jacobson, 2005: 477, fig. 1347); *14* – Tsagaan Salaa IV (Molodin, Zotkina, Cretin et al., 2020: 139, fig. 3); *15* – Baga-Oygur I (Kubarev, Tseveendorj, Jacobson, 2005: 348, fig. 847); *16*, *17* – Baga-Oygur-4 (right bank, field research of 2019, drawings by the authors); *18* – Tsagaan Salaa IV (Kubarev, Tseveendorj, Jacobson, 2005: 301, fig. 657); *19* – Khar-Chuluu (Kubarev, 2009: 338, fig. 1107); *20* – Baga-Oygur IV (Kubarev, Tseveendorj, Jacobson, 2005: 433, fig. 1182); *21* – Khar Salaa III (Kubarev, 2009: 122, fig. 275); *22* – Baga-Oygur-2 (right bank, field research of 2019, drawings by the authors); *23* – Khar Salaa II (Kubarev, 2009: 83, fig. 135); *24* – Baga-Oygur II (Kubarev, Tseveendorj, Jacobson, 2005: 352, fig. 862); *25* – Tsagaan Salaa IV (Ibid.: 241, fig. 405); *26* – Khara Dzhamat Gol-6 (field research of 2019, drawings by the authors); *27* – Tsagaan Salaa III (Kubarev, Tseveendorj, Jacobson, 2005: 206, fig. 244); *28* – Tsagaan Salaa I (Ibid.: 407, fig. 1086); *29* – Khar-Chuluu (Kubarev, 2009: 319, fig. 1033); *30* – Baga-Oygur III (Kubarev, Tseveendorj, Jacobson, 2005: 392, fig. 1026); *31* – Baga-Oygur V (Ibid.: 482, fig. 1362); *32* – Tsagaan-Salaa IV (Ibid.: 285, fig. 596); *33* – Tsagaan Salaa IV (Ibid.: 264, fig. 504); *34* – Shiveet-Khairkhan (Kubarev, 2009: 298, fig. 931); *35* – Baga-Oygur IV (Kubarev, Tseveendorj, Jacobson, 2005: 407, fig. 1086); *36* – Khar-Chuluu (Kubarev, 2009: 325, fig. 1060); *37* – Tsagaan Salaa IV (Kubarev, Tseveendorj, Jacobson, 2005: 217, fig. 310); *38* – Tsagaan Salaa I (Ibid.: 144, fig. 5); *39* – Tsagaan Salaa III (Ibid.: 210, fig. 266); *40* – Baga-Oygur III (Ibid.: 392, fig. 1028); *41* – Baga-Oygur IV (Ibid.: 435, fig. 1187); *42* – Baga-Oygur I (Ibid.: 340, fig. 820); *43* – Tsagaan Salaa IV (Ibid.: 285, fig. 597); *44* – Khar Salaa VII (Kubarev, 2009: 235, fig. 723); *45* – Khar Salaa VII (Ibid.: 235, fig. 725); *46* – Kalgutinskiy Rudnik (Molodin, Cheremisin, 1996: 48, figure); *47* – Tsagaan Salaa IV (Kubarev, Tseveendorj, Jacobson, 2005: 218, fig. 312); *48* – Tsagaan Salaa II (Ibid.: 171, fig. 93); *49* – Tsagaan Salaa IV (Ibid.: 235, fig. 379); *50* – Baga-Oygur II (Ibid.: 370, fig. 937); *51* – Baga-Oygur III (Ibid.: 397, fig. 1050); *52* – Chaganka (Cheremisin, 2004a: 44, fig. 7); *53–55* – Chaganka (field materials of D.V. Cheremisin).

Fig. 3. Image of a bull. Baga-Oygur-5 (right bank), Mongolian Altai.

Fig. 4. Stylized deer figure. Baga-Oygur-2 (right bank), Mongolian Altai.

on monumental stone sculptures and deer stones of the Mongolian-Transbaikal type.

As follows from the analysis of archaeological realities reproduced on deer stones of the Mongolian-Transbaikal type, this style can be dated to the initial stage of the Early Iron Age, although a much earlier date for the emergence of the image of a stylized deer has also been discussed (Kubarev, 2009: 22). The problem of the discrepancy between the areas of the highest concentration of such petroglyphs and stone sculptures

of the Mongolian-Transbaikal type with the figures of stylized deer has not yet been solved. For example, among a little over a hundred sculptures in the Russian Altai, only one sculpture with figures of stylized deer is known, and all other stelae are decorated with animal images in a different style. In the Mongolian Altai, sculptures with the image of a stylized deer are also much less common than such stelae in Central and Northern Mongolia.

In addition to distinctive figures of stylized deer, the "Early Scythian" period or the initial stage of the Early Iron Age in the Altai should include animal figures, such as deer, wild boars, predators, and mountain goats in the posture of "sudden stop", "on tiptoe", or with hanging limbs. These features correspond to the style of the Arzhan-Maiemir version of the animal style. Large numbers of engraved images of this period were discovered and studied during the work of E.A. Miklashevich at the sites of the Central Altai (2012). Images in this style are also known from the Russian and Mongolian part of the Altai Mountains (see Fig. 2, *29–31*, *33*, *34*; 5, 6).

Surprisingly, it is not easy to determine the rock art traditions of the next stage of the Early Iron Age in the Altai, in particular those associated with the Pazyryk culture, which was distinguished by the most vivid decorative and applied arts. Furthermore, these occur much more rarely than those belonging to the Initial Iron Age. Judging by the published materials, there are only a few rock art images in Northwestern Mongolia with the features of reliably identifiable Scythian-Siberian style of the Early Iron Age. There are also only few petroglyphs from this period in the Russian Altai: these are various animal images rendered in the classical style of the Scythian-Siberian pictorial tradition (see, e.g., (Kubarev, 1999)) (see Fig. 2, *36*).

Scenes of torment and images of griffins and other syncretic creatures are almost absent from the rock art of the region. The inhabitants of the Altai of the mid to second half of the 1st millennium BC were also quite rarely depicted in rock art, as opposed to, for example, their contemporaries, the carriers of the Tagar culture. Nevertheless, a significant part of the images of ungulates (primarily mountain goats and deer) obviously belonged to the advanced stage of the Early Iron Age, or 5th–3rd centuries BC (see Fig. 2, *37–40*). A vivid series of petroglyphs from Baga-Oygur III embody the "Scythian" tradition of combining and mutually inscribing animal figures, according to the principle of the "mysterious picture" typical of the Scythian toreutics (see (Kubarev, Tseveendorj, Jacobson, 2005: 400, No. 1056, 1057, 1059; 635, photo 55)).

A remarkable character associated with mythology and rituals of the Pazyryk people appears in the rock

Fig. 5. Image of a boar, the Early Iron Age. Chuy-Oozy, the Chuya River, Russian Altai.

Fig. 6. Images of a deer, mountain goat, and predator (?), Early Scythian period. Chagan River valley, Russian Altai.

art of the region. This is a fantastic image of a horse, with horns on its head, reproduced on the rocks at a number of locations in the valley of the Tsagaan Gol River (see, e.g., (Kubarev, 2009: 28–29, fig. 931)) (see Fig. 2, *34*). Indeed, the practice of "masking" or mythical "transforming" of a sacrificial horse into a deer or mountain goat in the funeral ritual of the Pazyryk people is known from the excavations of the "frozen" burial mounds in the Russian and Kazakhstan Altai (cemeteries of Pazyryk, Tuekta, Bashadar, Berel, etc.). This character clearly played an important role in the mythological bestiary of the Altai population in the Scythian period. The image of a horse with horns possessed a deep multi-layered meaning (for attempts at interpretation, see (Cheremisin, 2005)). It was used in the headdresses of the Pazyryk people and became perpetuated in the rock art of the region.

Identification of images from the subsequent Xiongnu-Sarmatian period in the region is complicated by several problems associated with a small amount of local rock art. Additionally, there are challenges in determining the stylistic and content-related features of these petroglyphs. First, the traditions of the previous period with the total domination of the Scythian-Siberian animal style survived in the rock art for a long time, just as in the decorative and applied art of Eurasia. Second, it is very difficult to consider such notions as "dynamism", "laconicism", and "schematism" to be proper scholarly definitions. These can be used to indicate the nature of only individual figures or compositions made by engraving or pecking, but not of any significant array of rock images with a statistically representative group of figures. Identification of the Xiongnu-Sarmatian or "post-Scythian" period in some studies shows that stylistic differences, which scholars discern in individual images, as well as style of petroglyphs from the neighboring regions (primarily, the similarities with the "Tashtyk style" on the Yenisei) (Miklashevich, 1996; Soenov, 2003; and others), have been most frequently used as a basis for attributing representations and their compositions to that period (see Fig. 2, *41–45*, *47*, *48*). E.A. Miklashevich noted new (as compared to the Scythian period) methods of rendering animal imagery in the transitional, "post-Scythian", period in the Altai, and pointed to elements of the Tashtyk style in the petroglyphs of the Ursul River valley in the Minusinsk Basin (1996: 40). V.I. Soenov also mentioned the appearance of features of the Tashtyk pictorial tradition in the rock art of the Altai, relying on the forms of bows and arrowheads represented in the Kalbak-Tash petroglyphs (2003).

An accumulation of tamgas, which differed from the Old Turkic ones, was discovered during the study of petroglyphs at the Kalgutinskiy Rudnik site in the mid-1990s. Two authors of the present article attributed them to the Xiongnu-Sarmatian period (Molodin,

Cheremisin, 1996) (see Fig. 2, *46*). Later, S.A. Yatsenko confirmed this attribution, based on the similarity of the Kalguty tagmas to those from Central Asia and Europe: "…in the Xiongnu-Sarmatian time in the Altai, an accumulation is known at the Kalguty mine… with signs that in almost all cases have parallels in tamgas of Central Asia and Sarmatia" (2001: 59, 106).

The rock art of the Old Turkic period of the Early Middle Ages, along with contemporaneous archaeological sites, such as burial mounds, commemorative complexes with fences, and monumental sculptures, is associated with the cultural traditions of the Old Turkic population of the region. Identification of the early medieval pictorial tradition with various stylistic groups is based on reliable determination of the original style of images represented on rocks using pecking or fine engraving techniques, which became widespread at that time in the vast spaces of the Altai-Sayan (see (Mukhareva, 2007)). It would not be an exaggeration to say that, during the Early Middle Ages, a style emerged as remarkable as that during the prominence of the "Scythian-Siberian" art.

Scholars linked the early medieval petroglyphs at the sites of the Russian Altai to the Old Turkic culture and mentioned the plot-oriented and stylistic features of petroglyphs, which find direct parallels in the evidence of the well-dated closed complexes. In terms of content, visual narrations on rocks apparently reflect the epic tradition of glorifying the chiefs, leaders of clans and military formations, invincible warriors, and unsurpassed hunters (see Fig. 2, *52*). A series of such scenes from the lives of the heroes of the time was reproduced using the technique of fine engraving on a rock in the valley of the Chagan River in the southern Russian Altai, showing a horseman with a bow and arrow who hunts and chases ungulates, as well as scenes of military duels (Cheremisin, 2004a). The technique of finest engraving allowed artisans to render the features of protagonists of their works, such as long flowing or braided hair, mustaches, and beards, and to depict armor, such as helmets, chain mail, bows, arrows, quivers, military belts, and the equipment of heroic horses, including real horse armor, in great detail (Fig. 7).

Fig. 7. Old Turkic mounted warrior, Shin-Oozy, Chagan River valley, Russian Altai.

Old Turkic petroglyphs created using the engraving technique are not so numerous in the Mongolian Altai. However, just as in the Russian Altai, these appear in the same rock complexes with runic inscriptions and tamgas, although in smaller quantities (see Fig. 2, *49–51*). Distinctive features of a representative series of petroglyphs at the Shiveet-Khairkhan site in the valley of the Tsagaan Gol River, which was executed in a technique of careful pecking (Kubarev, 2009: 123–124, fig. 278–280: 129, fig. 309; photos 11, 12), make it possible to speak about a special stylistic group within the Old Turkic petroglyphs of the region (Mukhareva, 2007: 195).

Thus, in the Early Middle Ages, there was a vibrant visual tradition with unique local stylistic groups in the region under study. Its chronological boundaries were the 6th to 9th centuries AD. The semantics of the plots appear to be related to visual expression of the Old Turkic epic tradition.

Unlike many regions of Eurasia where rock art developed only in antiquity and the Middle Ages and almost did not appear at later periods, in the southern Russian Altai, the traditions of rock art did not vanish, despite significant social and economic changes. For example, a special area of distinctive petroglyphs created in the Modern period and in contemporary times is located in the valleys of rivers flowing from the spurs of the South Chuya Range (see Fig. 2, *53–55*) (Cheremisin, 2004b; 2008). A completely different picture is observed in the neighboring regions of the Mongolian Altai with rare rock representations, which can be described as "paleoethnographic". This can be explained by the specific nature of the ethnic and religious situation in the region.

Almost all multi-layered petroglyphic sites in the central part of the Russian Altai (Bichiktu-Bom, sites of the Ursul River valley) and in Kosh-Agachsky District bordering Mongolia (Elangash, Chagan) display "popular drawings of the Altaians". In the south, the ancestors of the modern population, the Telengits of Kosh-Agach, who inherited—along with the landscape—all cultural, man-made objects from the previous generations of cattle breeders and hunters, continued the traditions of rock art, which were close and understandable to them. They often renewed ancient drawings, included ancient figures into their plots, modernizing them, and reproduced their multi-figured "canvases" next to or on top of the petroglyphs of the past centuries.

Along with depictions of nomadic life with large number of figures of horsemen, scenes of migrations with men and women dressed in traditional clothes, hunting scenes with guns and dogs, and compositions of herding livestock, completely new subjects appeared. These are realistic images of permanent and portable dwellings, including yurts with people inside, firearms (coulter multuk-guns), sleighs on runners, ornamented carpets, smoking pipes, and some other things taken from real life.

This art differs in its content from the traditional art of ancient times and Middle Ages, which focused on myths or epics. However, the religious and mythological component of rock art is manifested also in the Contemporary Period. The Altai shamanism is one of the most important subjects of petroglyphs in this period. Numerous figures of shamans are represented wearing special ritual clothing, headdresses with feathers, and holding tambourines. There are separate images of shamans' drums. These petroglyphs are usually made by the technique of fine engraving. Images are most often not carved, but simply scratched on ancient patina, and are distinguished by the almost complete absence of desert varnish. There are also polished figures and renovated ancient images.

Modern inscriptions on the Mongolian Altai rocks reflect a completely different tradition, focused on the word and text. Many of the newest figures are accompanied by inscriptions and texts. The nature and content of these images indicate a complete departure from the previous tradition, which was rich in content and included examples of the highest artistic skill.

Conclusions

Traditional stylistic analysis, the most recent studies of palimpsests, and comparative research on evidence from excavated closed complexes make it possible to establish a reliable periodization and chronology for various types of rock art in the Russian and Mongolian Altai. The suggestions about the content and chronological positions of the identified stages in the rock art of the region and in individual compositions and images will be supplemented and clarified with new research and new evidence, which is so abundant in this amazing region of North Asia.

Acknowledgment

The study was supported by the Russian Science Foundation, Project No. 23-18-00424.

References

Batbold N. 2018
Khronologiya petroglifov Mongolskogo Altaya. *Nauchnoye obozreniye Sayano-Altaya*, No. 1: 6–13.

Batbold N., Molodin V.I., Cheremisin D.V., Nenakhova Y.N. 2019
Mongolyn baruun khoid bus nutagt khiysen khadny zurgiyn sudalgaa. *Arkheologiynsudlal*, vol. XXXVIII: 190–199.

Cheremisin D.V. 2004a
Results of the most recent investigations into petroglyphs of the Ancient Turkic period in the Southeastern Russian Altai. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 1: 39–50.

Cheremisin D.V. 2004b
K izucheniyu petroglifov Altaya novogo i noveishego vremeni. In *Izobrazitelniye pamyatniki: Stil, epokha, kompozitsii: Materialy tematich. nauch. konf*. St. Petersburg: Ist. fak. SPbGU, pp. 346–349.

Cheremisin D.V. 2005
On the semantics of masked, horned horses from Pazyryk mounds. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 2: 129–140.

Cheremisin D.V. 2008
K izucheniyu noveishikh naskalnykh izobrazheniy Gornogo Altaya. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XIV. Novosibirsk: Izd. IAET SO RAN, pp. 269–274.

Cheremisin D.V., Molodin V.I., Zotkina L.V., Tseveendorj D., Cretin C. 2018
Noviye issledovaniya rannego plasta naskalnogo iskusstva Mongolskogo Altaya. *Vestnik Novosibirskogo gosudarstvennogo universiteta*. Ser.: Istoriya, filologiya. Vol. 17, iss. 3: Arkheologiya i etnografiya: 57–77.

Chlenova N.L. 1976
Karasukskiye kinzhaly. Moscow: Nauka.

Esin Y.N. 2010
Problemy vydeleniya afanasiyevskoy kultury v naskalnom iskusstve Minusinskoy kotloviny. In *Afanasiyevskiy sbornik*. Barnaul: Azbuka, pp. 53–73.

Jacobson E., Kubarev D.V., Tseveendorj D. 2001
Mongolie du Nord-Ouest: Tsagan Salaa/Baga Oigor: Textes et figures. Répertoire des petroglyphes d'Asie Centrale. Paris: De Boccard. (Mémoires de la Mission Archéologique Française en Asie Centrale; T. V, fasc. 6).

Jacobson E., Kubarev V., Tseveendorj D. 2006
Mongolie du Nord-Ouest. Haut Tsagaan Gol. Repertoire des petroglyphes d'Asie Centrale. Paris: De Boccard. (Mémoires de la Mission Archéologique Française en Asie Centrale; T. V, fasc. 7).

Kovalev A.A., Munkhbayar C. 2015
Chemurchekskiy ritualniy kompleks Khar Chuluut 1 v istokakh reki Khod (Kobdo) (predvaritelnoye soobshcheniye). In *Drevneishiye yevropeitsy v serdtse Azii: Chemurchekskiy kulturniy fenomen*. Vol. II, pt. II: Rezultaty issledovaniy v tsentralnoy chasti Mongolskogo Altaya i v istokakh Kobdo; pamyatniki Sintszyana i okrainnykh zemel. St. Petersburg: Muzey-institut semyi Rerikh, pp. 155–214.

Kovalev A.A., Munkhbayar C. 2022
Petroglify na chemurchekskikh ritualnykh ogradakh v vysokogorye Mongolskogo Altaya (III tys. do n.e.). In *Petroglyphs of Ancient Nomads from Central Asia*. Ulaanbaatar: pp. 84–93.

Kubarev V.D. 1987
Antropomorfniye khvostatiye sushchestva Altaiskikh gor. In *Pervobytnoye iskusstvo. Antropomorfniye izobrazheniya*. Novosibirsk: Nauka, pp. 150–167.

Kubarev V.D. 1999
Pazyrykskiye syuzhety v petroglifakh Altaya. In *Itogi izucheniya skifskoy epokhi Altaya i sopredelnykh territoriy*. Barnaul: Izd. Alt. Gos. Univ., pp. 84–92.

Kubarev V.D. 2009
Petroglify Shiveet-Khairkhana (Mongolskiy Altai). Novosibirsk: Izd. IAET SO RAN.

Kubarev V.D., Tseveendorj D., Jacobson E. 2005
Petroglify Tsagaan-Salaa i Baga-Oigura (Mongolskiy Altai). Novosibirsk, Ulan-Bator, Yudzhin: Izd. IAET SO RAN.

Miklashevich E.A. 1996
Petroglify doliny reki Ursul (nekotoriye rezultaty stilisticheskogo i khronologicheskogo analizov). In *Siberian Anthropological Review. Obozreniye rezultatov polevykh i laboratornykh issledovaniy arkheologov, etnografov i antropologov Sibiri i Dalnego Vostoka v 1994–96 gg*. Novosibirsk: Izd. IAET SO RAN, pp. 38–42.

Miklashevich E.A. 2012
Tekhnika gravirovki v naskalnom iskusstve skifskogo vremeni. In *Izobrazitelniye i tekhnologicheskiye traditsii v iskusstve Severnoy i Tsentralnoy Azii*. Moscow, Kemerovo: pp. 157–202. (Trudy SAIPI; iss. IX).

Molodin V.I. 1995
Perspectives and preliminary results of archaeological investigations of the South-Western Altai (the Ukok plateau). In *Science Policy: New Mechanisms for Scientific Collaboration between East and West*, vol. I. Dordrecht: pp. 215–222. (NATO ASI. Ser. 4. Science and Technology Policy).

Molodin V.I. 1996
Naskalniye izobrazheniya afanasiyevskoy kultury (k postanovke problemy). In *Noveishiye arkheologicheskiye i etnograficheskiye otkrytiya v Sibiri*, vol. II. Novosibirsk: Izd. IAET SO RAN, pp. 178–181.

Molodin V.I. 2015
Fenomen bronzovykh kinzhalov iz pogrebalnykh kompleksov krotovskoy kultury (khronologiya, territoriya rasprostraneniya, istoki). *Vestnik Kemerovskogo gosudarstvennogo universiteta*. Vol. 6: Arkheologiya, Istoriya, No. 2 (62): 97–107.

Molodin V.I. 2022
Drevneishiy plast naskalnogo iskusstva v Mongolii i Yuzhnoy Sibiri. In *Mir Tsentralnoy Azii-V*. Novosibirsk: SO RAN, pp. 3–7.

Molodin V.I., Cheremisin D.V. 1996
Kultury gunnskogo vremeni na ploskogorye Ukok (Yuzhniy Altay). In *100 let gunnskoy arkheologii. Nomadizm: Proshloye, nastoyashcheye v globalnom kontekste i istoricheskoy perspektive: Materialy Mezhdunar. konf*. Pt. 1: Gunnskiy fenomen. Ulan-Ude: pp. 47–49.

Molodin V.I., Cheremisin D.V. 1999
Drevneishiye naskalniye izobrazheniya ploskogorya Ukok. Novosibirsk: Nauka.

Molodin V.I., Cheremisin D.V. 2002
Palimpsest na valune s ozera Muzdy-Bulak (ploskogorye Ukok). In *Pervobytnaya arkheologiya. Chelovek i iskusstvo:*

Sbornik nauch. tr., posvyashch. 70-letiyu so dnya rozhdeniya Y.A. Shera. Novosibirsk: Izd. IAET SO RAN, pp. 59–62.

Molodin V.I., Cheremisin D.V., Nenakhova Y.N., Batbold N. 2022a

Palimpsesty kak klyuch k ponimaniyu vnutrenney khronologii petroglifov Altaya (na primerakh pamyatnikov Mongolskogo i Rossiyskogo Altaya). In *Petroglyphs of Ancient Nomads from Central Asia*. Ulaanbaatar: pp. 19–27.

Molodin V.I., Cheremisin D.V., Nenakhova Y.N., Nenakhov D.A., Batbold N. 2022b

Chemurchekskiye antropomorfy. *Stratum plus. Arkheologiya i kulturnaya antropologiya*, No. 2: 247–263.

Molodin V.I., Geneste J.-M., Zotkina L.V., Cheremisin D.V., Cretin C. 2019

The "Kalgutinsky" style in the rock art of Central Asia. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 47: 12–26.

Molodin V.I., Zotkina L.V., Cretin C., Cheremisin D.V., Batbold N., Tseveendorj D. 2020

Palimpsest s mestonakhozhdeniya Tsagaan-Salaa IV (Mongolskiy Altai): Otnositelnaya khronologiya izobrazheniy. *KSIA*, iss. 260: 134–150.

Mukhareva A.N. 2007

Rannesrednevekovaya izobrazitelnaya traditsiya v petroglifakh Sayano-Altaiskogo regiona i sopredelnykh territoriy. *Vestnik Novosibirskogo gosudarstvennogo universiteta*. Ser.: Istoriya, filologiya. Vol. 6, iss. 3: Arkheologiya, etnografiya: 189–198.

Mukhareva A.N., Seregin N.N. 2021

Petroglify rannego Srednevekovya na territorii Mongolii: Osnovniye etapy i rezultaty issledovaniy. *Teoriya i praktika arkheologicheskikh issledovaniy*, vol. 33 (1): 144–161.

Okladnikov A.P. 1972

Tsentralnoaziatskiy ochag pervobytnogo iskusstva (Peshcherniye rospisi Khoit-Tsenker Agui (Sengri-Agui), Zapadnaya Mongoliya). Novosibirsk: Nauka.

Savinov D.G. 1990

Petroglify v stile olennykh kamney. In *Problemy izucheniya naskalnogo iskusstva v SSSR*. Moscow: Nauka, pp. 174–181.

Soenov V.I. 2003

Petroglify Gornogo Altaya gunno-sarmatskogo vremeni. In *Drevnosti Altaya*, No. 10. Gorno-Altaisk: Izd. Gorno-Alt. Gos. Univ., pp. 100–107.

Tseveendorj D., Molodin V.I., Cheremisin D.V., Cretin C., Zotkina L.V., Batbold N., Nesterkina A.L. 2017

Izucheniye drevneishego plasta naskalnykh izobrazheniy Mongolii v 2017 godu: Pamyatniki Tsagaan-Salaa i Baga-Oygur. In *Problemy arkheologii, etnografii i antropologii Sibiri i sopredelnykh territoriy*, vol. XXIII. Novosibirsk: Izd. IAET SO RAN, pp. 231–234.

Yatsenko S.A. 2001

Znaki-tamgi iranoyazychnykh narodov Yevrazii drevnosti i rannego srednevekovya. Moscow: Vost. lit.

Received April 13, 2023.
Received in revised form August 28, 2023.

doi:10.17746/1563-0110.2023.51.4.078-085

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Lobed Ware in the Far East from the Neolithic to the Middle Ages

The study focuses on the origin and survival of the so-called lobed ware in the Far East. The term refers to vessels decorated with shallow vertical grooves, less often with deep, wide dents, either on the most convex part of the body or on the entire surface. Some vessels are covered with groups of vertical carved lines or burnished, less often painted bands imitating lobulation. Such ceramics are especially frequent at sites of the Jurchen era (7th–13th centuries) in the Amur basin. They are also found in Primorye, northeastern China, and in adjacent territories. The study of various sources shows that the lobed ware was made on the Lower Amur as early as the Neolithic (5th to late 2nd millennia BC), with the earliest samples relating to the Kondon culture. Typical lobed ceramics were also made by people of the Malyshevo and Voznesenovskoye cultures. It is hypothesized that the Jurchen-Bohai pottery, including the lobed ware, was directly influenced by Korean traditions of the first two or three quarters of the 1st millennium AD. Given the distinctness of the tradition, its reminiscences in the Amur region can be traced back to the Neolithic.

Keywords: *Amur region, Primorye, lobed vessels, Middle Ages, Jurchen culture, Neolithic cultures.*

Introduction

One of the frequently discussed issues in Eurasian archaeology (especially that of the Russian Far East) concerns the age of the so-called lobed (fluted) ware. This term refers to vessels of various shapes and sizes, with bodies decorated with shallow vertical grooves (commonly from four to eight) made by a narrow blunt tool (paddle or polisher). Less often they are decorated with deep, wide dents made by a pebble or a hummer, producing an effect of separate segments or bossed lobes. Such vessels are the most spectacular ones. Ancient artisans, possibly imitating lobulation, which, apart from elegance, was believed to strengthen the vessels, decorated them with groups of carved or incised lines, less often with burnished bands.

Ceramics of this kind are frequently encountered at numerous sites (flat-grave burial grounds, groups of mounds, fortified settlements, and villages) of the Jurchen era in the Russian part of the Amur region, Primorye, northeastern China, and in adjacent territories. In recent decades, I pointed to the existence of lobed ceramics in a number of Eurasian cultures, nearly all of them dating to the Early Iron Age and the Middle Ages. Nonetheless, noting the few then available indications of the existence of such ceramics in the Neolithic of the Lower Amur, I expressed hope to gain more evidence of their amazingly early origin. I also remarked on the extreme abundance and great variety of such ware on the Amur in the Middle Ages (Medvedev, 1986: 87). The revealed long traditions of the Amur Neolithic pottery-making were also taken into

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account. In the 1980s–1990s, for instance, ceramics of the Osipovka culture from the settlement of Gasya were considered the earliest known in the world. Specialists who claim that the medieval lobed ceramics have no apparent prototypes among the earlier Far Eastern pottery (Dyakova, Ivliev, 1985: 250) ignore these facts.

As was shown by recent studies of collections, other sources, and materials, ceramics with typical features of lobed vessels, which appeared on the Lower Amur in the Middle Neolithic (ca 5th–4th millennia BC) and existed there during the Late and Final Neolithic, later on, in the Early Bronze Age, actually disappeared from cultures of the region. At the same time, in some other cultural and historical provinces, it generally appeared in the Early Iron Age. This can be viewed as a discontinuity of cultural evolution and a revival of an earlier, evidently forgotten custom of decorating pottery. Such a reversal might have been triggered by an influence of a foreign cultural tradition.

I will now propose an interpretation of the available facts concerning the earliest examples of lobed ceramics in the Neolithic of the Amur and certain later instances, especially those relating to medieval traditions of this region.

The earliest vessels with elements of lobulation in the Neolithic cultures of the Amur region

There is now reason to say that lobed ware existed at least in three Middle and Late Neolithic cultures (Kondon, Malyshevo, and Voznesenovskoye) and in the Final Neolithic of the Lower Amur. Vessels with simplified elements of lobulation (or rather, pseudo-lobulation) in the form of groups of incised vertical lines or grooves mostly in the lower half of the body (their upper portions were primarily decorated with horizontal straight or wavy thin rolls, or less often with scaly impressions) were found in the early 1960s during the excavations of the Neolithic settlement of Kondon-Pochta (field studies of the site were completed in 1971–1972). As all Kondon vessels, these were hand-made, flat-bottomed, medium-sized (from 9–10 to 25 cm high) containers of a simple open shape. They lay in the ground mostly in crushed condition, but were completely reconstructed. By way of illustration, I will describe three typical vessels of this site, associated with two dwellings*. Notably, Far

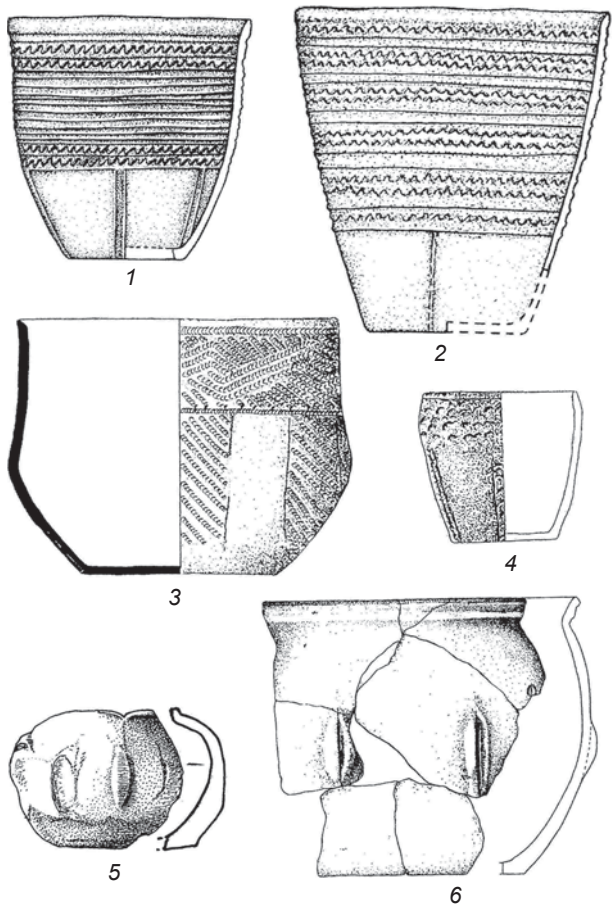

Fig. 1. Neolithic ware with elements of lobulation (*5*, *6*), and pseudo-lobed ware (*1–4*) from the Lower Amur.
1, *2*, *4* – Kondon (after (Okladnikov, 1984)); *3* – Malyshevo (after (Derevianko, Medvedev, 1994)); *5* – Voznesenovskoye (Museum for the History and Culture of Peoples of Siberia and the Far East IAET SB RAS); *6* – Final Neolithic (after (Medvedev, 2017)). Not to scale.

Eastern Neolithic ceramics, including Kondon ware, have not ever been examined before in the aspect considered in this article.

Vessel 1 (Fig. 1, *1*) was found in dwelling 8, together with other vessels of various kinds (Okladnikov, 1984: 105, pl. LII, *5*). All of them had broken bottoms. The vessel is 23 cm high, with gently curved profile, situla-shaped, with a barely distinct waist between the body and the slightly sharpened rim. The lower smooth surface, below the ornament composed of horizontal straight and wavy lines, has just six vertical grooves. The vessel can be regarded as pseudo-lobed; its lower portion resembles rather a segmented piece. This kind of decoration should probably be viewed as a precursor of embossed lobulation.

Vessel 2 (Fig. 1, *2*) was also found in dwelling 8. It is approximately 19 cm high. It has the shape of situla, with a gently narrowing lower part and the upper part

*All the ceramics described here, with the exception of one medieval vessel from Shuangchencun, China, are housed at the Institute of Archaeology and Ethnography SB RAS.

flaring out, without distinct neck. Under the embossed decoration composed of ten straight and ten wavy discontinuous rolls, there are four vertical shallow grooves apparently meant to divide the lower zone of the vessel into segments.

Vessel 3 (Fig. 1, *4*) was found in dwelling 9. The vessel is in the form of a small (9.5 cm high) situla or a jar, with a slightly convex body and a lip beveled inward. The upper third of the vessel bears ornamentation composed of three or four horizontal rows of arciform or scaled impressions. The lower part is decorated with narrow vertical grooves and adjacent bands of arciform dents. In addition to this piece with elements of pseudo-lobulation, three more small (from 5 to 10 cm high) pot-like vessels were found in the dwelling. Two of them are plain-walled, while the third bears linear figures against the background of vertical dotted zigzag (Ibid.: Pl. XLII, *2*, *3*, *11*).

The next group of pseudo-lobed or lobed ware consists of vessels of the Early Middle Neolithic Malyshevo culture. One vessel was found in 1986 in excavation II of the multilayered settlement of Gasya, on the right bank of the Amur, near the village of Sakachi-Alyan. It lay in the lower cultural horizon, on the bottom of a pit 120 cm deep in virgin loam, and was crashed into several parts. The vessel (Fig. 1, *3*) (Derevianko, Medvedev, 1994: 40, fig. 14, *4*) is flattened pot-like in shape. Its height is 14.5 cm; the body diameter is 19.5 cm. The lip is beveled inward; the straight neck is indistinct, smoothly transiting into the body. The largest portion of the outer surface is ornamented. Below the rim and in the upper part of the body, the vessel is encircled with rows of bracket-like impressions. A meander-shaped composition of similar rows lies between them. On the burnished surface of the body, vertical incised lines accentuate plain bands, interchanging with those ornamented by inclined rows of bracket-like impressions. Stratigraphic and other data make it possible to attribute this specimen to the 4th millennium BC and to consider it the earliest among the pseudo-lobed vessels.

Another Malyshevo vessel with elements of pseudo-lobulation was found in excavation I of the Ostrov Suchu site in 1975. The vessel is 32 cm high. It has a jug-amphoral shape, unusual for the Amur Neolithic (Fig. 2, *5*). The body is convex, with a maximum diameter of 31 cm. Rim with a rounded edge terminates the straight neck. Its diameter is 21 cm and the height is 15 cm. Almost the entire surface of the vessel is covered by mostly horizontal densely arranged rows of bracket-like angular impressions (upper part of the body) and roundish oval pits (neck and the lower part of the body). The ornamental zone between the neck and equator is separated by four narrow vertical stripes delimited by incised lines and painted with red ocher. A similar stripe runs along the edge of the orifice. The vessel is very elegant and was hardly destined for everyday use; more likely, it was related to ritual. Even if the red stripes are just a surface decoration, they might replicate lobes, as traditionally believed.

Another group of the most important Neolithic vessels was also discovered during the excavations at Ostrov Suchu. In 1974, a pot-shaped vessel 6.5 cm high with a short vertical rim painted with red ocher was found in the dwelling of the Malyshevo culture (Fig. 2, *1–4*). The entire surface of the vessel is covered with ornament, mostly in the form of inverted angles filled with oblique rows or small spirals of tiny angular or bracket-like impressions of retreating paddle. This specimen shows all the typical features of lobed vessels. Before decorating and firing the vessel, four deep vertical grooves resembling dents were made on its walls. Such a technique made the vessel similar to a four-lobed prototype.

A small vessel 3.5 cm high (see Fig. 1, *5*) of approximately similar shape was found in dwelling 2 of the Late Neolithic Voznesenovskoye culture (mid-2nd millennium BC) on Suchu Island (Medvedev, Filatova, 2021). It is light-brown and yellowish, with burnished outer surface. The most convex part of the body bears at least six vertical oval elongate dents rendering the vessel lobate. While the function of this tiny specimen cannot be assessed with certainty, it was hardly used for domestic purposes.

A half of a broken Final Neolithic vessel (late 2nd millennium BC) found in 1993 in excavation III of the Ostrov Suchu site is noteworthy. The vessel is flattened pot-like in shape, 19 cm high (see Fig. 1, *6*) (Medvedev, 2017: 157, fig. 2), with gray-brown engobe. At least five vertical rolls with sharpened ends, 1.0 cm thick and up to 5.0 cm long, were attached to the middle part of the body. These are transected with deep furrows along the ridge, making them similar to double ribs, again alluding to a lobate structure. What we deal with in this case are not "standard" lobed ceramics with various indentations in the walls. Such a ware, judging by the available finds, which are admittedly rare, was rather uncommon, but it did exist in the Neolithic and will hopefully draw the experts' attention.

So, on the basis of the materials from the Lower Amur, it can be stated that various kinds of lobed vessels were in use at least from the early stages of the Middle Neolithic to its final period.

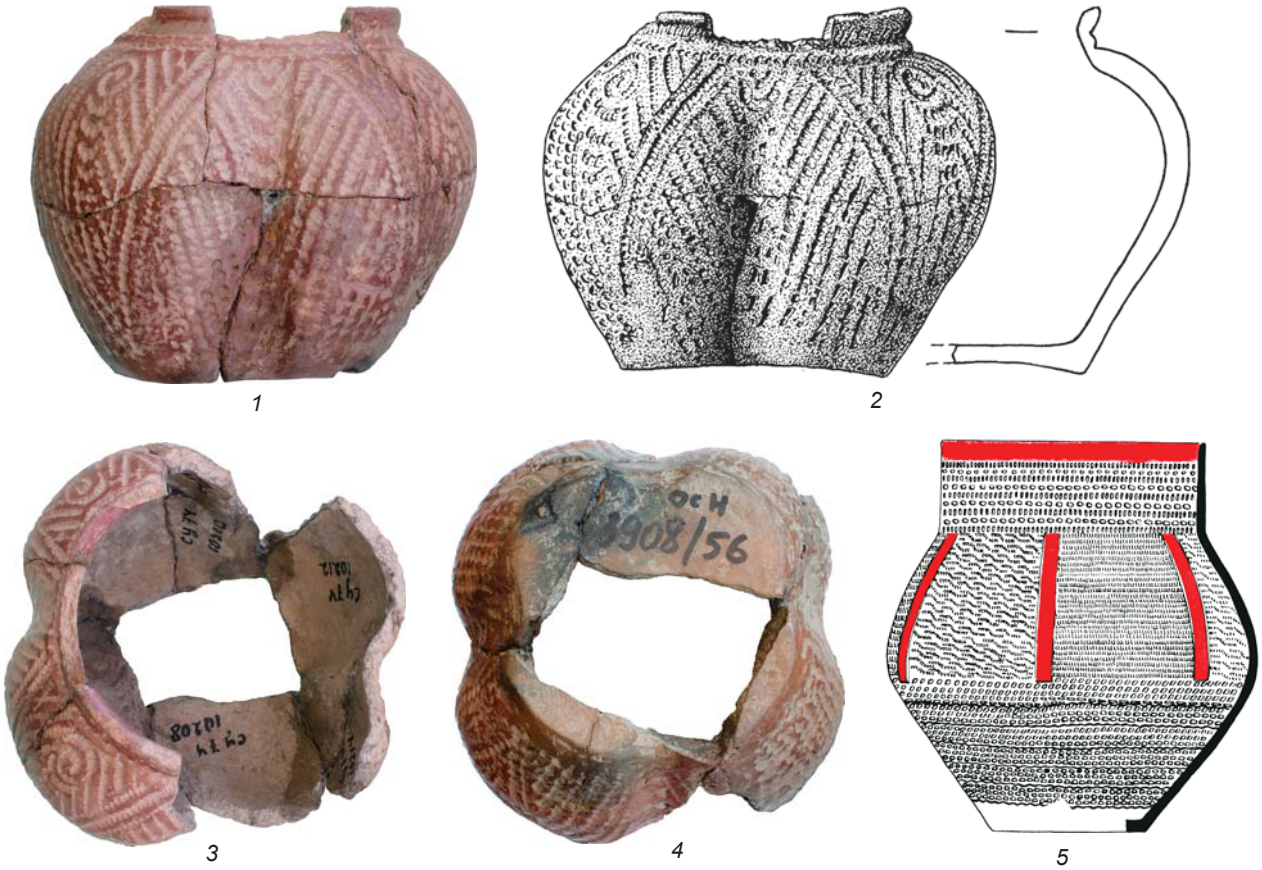

Fig. 2. Ceramics of the Malyshevo culture from Ostrov Suchu. Museum for the History and Culture of Peoples of Siberia and the Far East IAET SB RAS.
1–4 – lobed vessel from dwelling B: *1*, *2* – general view, *3* – upper view, *4* – view from the bottom; *5* – vessel with vertical stripes covered with red paint, from excavation I (1975). Not to scale.

Lobed ware in some Eurasian prehistoric and medieval cultures

Early examples of lobulation on vessels in Eastern European archaeological cultures can be judged from Chalcolithic Tripolye ceramics from Moldova. In particular, a vase from Druța I settlement, with a series of vertical and slightly inclined oblong dents on the body, possesses all the features of the lobed ware (Ryndina, 1984: Fig. on p. 415). There are reasons to consider vases and beakers of the Komarov culture (Upper and Middle Dniester regions), with series of vertical carved and incised lines on the body (Epokha…, 1987: 114, 212, fig. 53, *28*), as the examples of the Late Bronze Age pseudo-lobed ceramics.

In the Early Iron Age, lobed and pseudo-lobed ceramics became fairly widespread in Eurasian cultures. For instance, typical vessels of these kinds were encountered in burials of the Sarmatian Age (mid-1st millennium BC) in the Lower Volga region (Sinitsyn, 1960: Fig. 3, *10*; 5, *8*), Northern Caucasus (Korenyako, Naidenko, 1977: 235, fig. 4, *7*; 242, fig. 6, *4*), and at many other sites.

At medieval archaeological sites, the number of lobed ceramic vessels increases. For example, vessels with vertical dents were found during the excavations at Chersonesus. Such a ware became widespread in medieval Transcaucasia. Certain specialists argued that it was unique and imitated the decoration of metal ware (Jakobson, 1979: 82, fig. 50, *1–3*; p. 83). One could agree with this claim, were it not for much earlier clay prototypes. These, in fact, suggest the reverse, i.e., that metal vessels replicated those made of clay.

In the Asian part of Eurasia, in Central Asia and farther east, lobed-grooved ware appeared mostly in the Early Middle Ages. In particular, it was recorded at Qidan sites in Inner Mongolia (see, e.g., (Wang Yuping, 1956: 31, fig. 4)). Quite a lot of lobed vessels of the Jurchen culture (in China, Sanhao culture) was found in the Heilongjiang Province of China (Graves…, 1977: 51, fig. 4, *1*, *2*; p. 54, fig. 13).

Ceramics of this kind were found at Bohai settlements of the 8th–10th centuries in Primorye (Semenichenko, 1976: 89–90; and others).

Korean wheel-thrown lobed ware of the 1st millennium BC is also noteworthy. The earliest vessels of this series are attributable to the Mahan culture, which existed during the first centuries of the Common Era in the southern part of the Korean Peninsula. In particular, the collection of the Buyeo National Museum comprises a gray clay pot whose upper part is decorated with rectangular impressions of a stamp superimposed by stripes forming an oblique net. The surface of its body bears a series of shallow vertical grooves. The vessel is dated to the 2nd–3rd centuries. Later on, in the Goguryeo Kingdom (4th–6th centuries), wheel-thrown ware was manufactured that was virtually identical to the Bohai and Jurchen ceramics: gray burnished vase- or pot-like vessels, including those with applied band handles, and bowls. Goguryeo ceramics also include steamer pots and other types of cookware. In the 1990s, such utensils were represented in the exposition of the National Museum of Korea in Seoul. Among the contemporaneous lobed ceramics of the Early Koguryo, dating to the mid-1st millennium, there are hand-made vessels from certain Mohe sites on the Middle Amur. They are decorated in a pseudo-lobed fashion, with vertical incised lines on the body. A typical example is a complete vessel from the Poltse-Mohe burial ground of Amurzet (Fig. 3, *1*).

Noteworthy is ceramic ware of the 7th century from the Silla Kingdom, housed in the Seoul Museum. In distinction from the Goguryeo ceramics, it bears a weaker resemblance to the Bohai-Jurchen ceramics. Silla vessels were made more thoroughly; there is a visible difference in assortment of the ceramics, too. However, along with differences, the Bohai-Jurchen and Silla ceramics still show a substantial similarity. Small narrow-necked jars with typical vertical grooves, that is lobed, occur among Silla vessels. It is reasonable to assume that the Jurchen lobed-grooved, hand-made and wheel-fashioned ware appeared in the Amur basin somewhat later than that of Mahan, at about the same time as the similar wheel-thrown pottery of Silla, i.e., in the 7th century.

The view of the scholars who analyze the lobed vessels of the medieval Far Eastern cultures is essentially that such a tradition had no local roots and had allegedly been introduced from Central Asia, first to Qidan and then to Primorye-Amur. Another claim is that "the most likely time of contact between Qidan and the Primorye-Amur cultures was the late 8th to early 10th century AD" (Dyakova, 1993: 326). Such a view, reckoning without the presence of lobed vessels in the Amur Neolithic and later—in cultures of the first two or three quarters of the 1st millennium AD on the Korean Peninsula (note that the Amur ceramics are quite different from those of Qidan), is illogical and cannot be accepted (for more details, see (Medvedev, 1998: 453–458)).

Jurchen lobed ware

In the Far East, the highest number of various lobed ceramic vessels is known in the Jurchen culture, especially in its northern Amur area. The earliest samples—hand-made, wheel-adjusted, narrow-necked jars and pot-shaped vessels with vertical grooves and dents—were found at the Korsakovsky flat-grave burial ground on Ussuriysky Island (burials 44, 141, 346, and others). Because this is the key Far Eastern cemetery in terms of both the number of excavated graves (386) and the number of lobed vessels, it deserves a special attention. Among the 459 hand-made and wheel-thrown vessels, 47 are lobed, including singular pseudo-lobed specimens. The last-mentioned usually have an archaic amphoral shape and pairs of vertical curved lines on the body (Fig. 3, *2*). All other lobed vessels are decorated with dents and small grooves. They vary in shape and size, although most common are jar-shaped, with a narrow neck and a relatively wide body; pot-shaped vessels with rounded profile are also numerous (Fig. 3, *3–9*). The vessels actually lack traces of soot or smoke. They were mainly used as tableware or, in some cases, as funeral items. This cemetery provides a convincing proof that people who left it had manufactured and used lobed vessels from the 7th century until the first decades of the 12th century. This is the only cemetery in the entire Far East that was used for nearly half a millennium (with intervals).

At the next large Nadezhdinsky burial ground, 115 examined graves yielded not less than 14 vessels with pronounced elements of lobulation: vertical grooves or, in some cases, dents on the body. Such decorations are present on narrow-necked jars and more often on pot-shaped roundish vessels with a short neck (Fig. 3, *10–12*, *14*). Lobed ceramics were found at other Jurchen cemeteries, too: Dubovsky, Bolonsky, Molchanikhinsky (Fig. 3, *13*, *16*, *19*), Nazaichevsky, Kamenushka, and Protoka Bystraya.

Of great interest is lobed ware from Jurchen (Jin) cemeteries in adjacent Chinese territory, especially in the area where the center of Jurchen consolidation was located and where their state of Jin was formed with the first (main) capital—Shangjing (Huiningfu, modern Baicheng). In the vicinity of Baicheng,

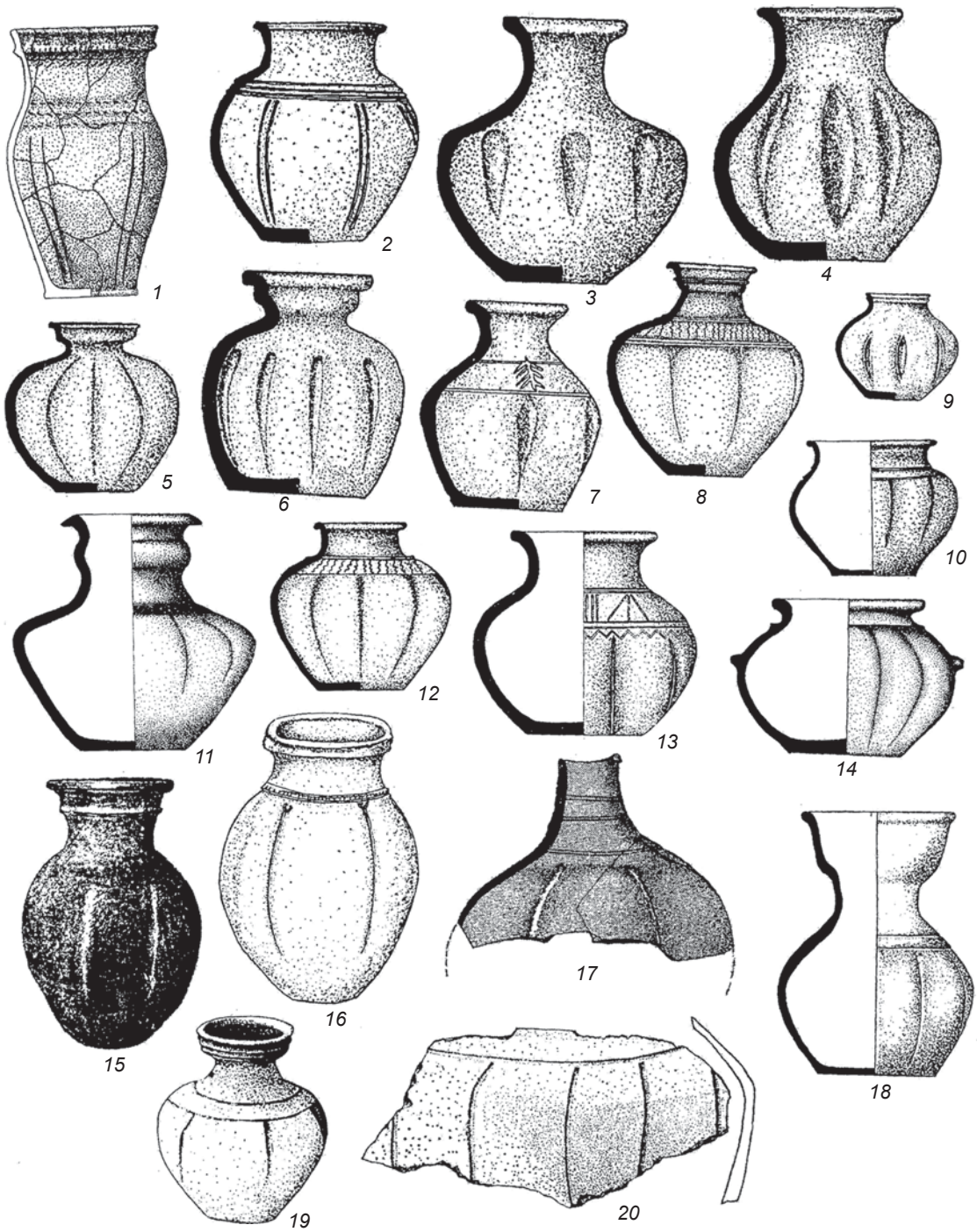

Fig. 3. Lobed ware of the Mohe (*1*) and Jurchen (*2–20*) cultures from cemeteries (*1–19*) and fortified settlement (*20*) (after (Medvedev, 1986, 2016, 2017)).
1 – Amurzet; *2–9* – Korsakovsky; *10–12*, *14* – Nadezhdinsky; *13* – Dubovsky *15* – Shuangchencun (China); *16* – Bolonsky Ostrov (Achan); *17* – Pervoye Ozero; *18* – Olsky; *19* – Molchanikhinsky; *20* – Djari. Not to scale.

Chinese archaeologists examined the burials possibly belonging to constructors or inhabitants of the capital. Grave goods included wheel-thrown burnished clay vessels. Among them, a jar 32.2 cm high (Fig. 3, *15*) is noteworthy (Medvedev, 2016). Its body is decorated with vertical grooves, with horizontal bands of stamped scaly ornamentation located in between. This vessel is a compelling evidence that lobed ware was manufactured by Jurchens during the Jin Empire, and this in its center. Ceramics of this sort are also present in the collection

from the contemporaneous fortified settlement of Djari in the Khabarovsk Territory (Fig. 3, *20*).

Dozens of lobed vessels were discovered during excavations of numerous kurgan cemeteries of the Jurchen epoch (8th–13th centuries) in the Russian Amur region: Pervoye Ozero, Olsky (Fig. 3, *17*, *18*), Venzelsky, Ludannikova Sopka, and others.

The totality of historic and archaeological facts shows the Jurchen culture to be the richest in diverse lobed ware in the Far East. Previously, before the evidence of such ceramics in earlier cultures of the region became available to me, I had suggested that they could have been invented *in situ* by medieval Tungus-Manchurian speaking Jurchen. As it turned out, however, the lobed ware in the region appeared in the Middle Neolithic.

Conclusions

The facts cited in the present paper leave no doubt that the ceramics known as lobed owing to its peculiar decoration was manufactured as early as the Middle and Final Neolithic (5th to late 2nd millennia BC). The earliest examples of such ware include vessels of the Kondon culture. These do not display clear features of lobulation—distinct vertical grooves. However, vertical curved or incised lines on the bodies give vessels the look of pseudo-lobulation.

In the Middle Neolithic (Malyshevo culture) though, along with pseudo-lobed ware (Gasya site), "classic" lobed vessels were manufactured. This allows us to make a conclusion about nearly synchronous evolution of these ceramic traditions on the Lower Amur. In the future, such ceramics will hopefully be also discovered at Neolithic sites elsewhere. Facts concerning the technology of Neolithic pottery are relevant to the study of Bronze Age ceramics as well (certain scholars attempt a chronological subdivision of such ware within a single culture, which would appear inexplicable).

It should be noted that one lobed vessel from Ostrov Suchu is attributable to the Late Neolithic, while another one, to the Final Neolithic (late 2nd millennium BC). Later on, prior to and at the beginning of the Early Middle Ages, pseudo-lobulation appeared on some Mohe and Poltse-Mohe clay vessels (Amurzet, Naifeld, Petrovskoye Ozero). Stages of spreading the lobed ware in the Amur region and Primorye were associated with the Bohai and especially the Jurchen cultures (7th to the first half of the 8th century). Their early pottery manufacture, including the production of lobed vessels, appears to have been directly influenced by ceramic traditions of Korea in the first three quarters of the 1st millennium AD. However, indirect reminiscences of the Neolithic tradition are likewise possible in later cultures of the Amur region.

I cannot accept that "lobulation (in fact, pseudo-lobulation – **V.M.**) was first rendered in the Amur-Primorye cultures on a typical Mohe vessel… in the 4th century AD" (Dyakova, 1993: 325), and that lobed ware, under the influence of Sogdian merchants, "became widespread approximately from the 8th–9th centuries in the Amur region and, to a certain degree, in Primorye", while "it was absolutely unknown in the Far East in the preceding time" (Shavkunov, 1985: 151). Judging by the available archaeological findings, lobed ceramics had very deep roots in the Far East, especially on the Amur. It had been manufactured and used in the region much earlier than the 1st millennium AD, specifically since the Neolithic.

Acknowledgment

The study was carried out under the Project "Diversity and Continuity in the Evolution of Cultures During the Stone Age, Bronze Age, Iron Age, and the Middle Ages in the Far Eastern and Pacific Regions of Eurasia" (FWZG-2022-0004).

References

Derevianko A.P., Medvedev V.E. 1994
Issledovaniye poseleniya Gasya: Predvaritelnye rezultaty, 1986–1987 gg. Novosibirsk: IAET SO RAN.

Dyakova O.V. 1993
Proiskhozhdeniye, formirovaniye i razvitiye srednevekovykh kultur Dalnego Vostoka (po materialam keramicheskogo proizvodstva), pt. 2. Vladivostok: Dalnauka, pp. 290–409.

Dyakova O.V., Ivliev A.L. 1985
O proiskhozhdenii dolchatogo dekora v srednevekovykh kulturakh Dalnego Vostoka SSSR. In *Rerikhovskie chteniya. 1984 god*. Novosibirsk: [s.n.], pp. 250–256.

Epokha bronzy lesnoi polosy SSSR. 1987
Moscow: Nauka. (Arkheologiya SSSR).

Graves of Common People of the Jin Epoch in Iungshen of Suibin County. 1977
Archaeological Team of the Heilongjiang Province. *Wenwu*, No. 4: 50–55. (In Chinese).

Jakobson A.L. 1979
Keramika i keramicheskoye proizvodstvo srednevekovoi Tavriki. Leningrad: Nauka.

Korenyako V.A., Naidenko A.V. 1977
Pogrebeniya rannego zheleznogo veka v kurganakh na r. Tomuzlovke (Stavropolskiy krai). *Sovetskaya arkheologiya*, No. 3: 230–248.

Medvedev V.E. 1986
Priamuriye v kontse I – nachale II tysyacheletiya (chzhurchzhenskaya epokha). Novosibirsk: Nauka.

Medvedev V.E. 1998

Bokhaiskaya kumirnya v Primoriye. Seul: Hakionmunhvasa. (In Russian and Korean).

Medvedev V.E. 2016

Korotko o chzhurchzhenyakh i ikh pervoi stolitse Shantszine (Baichene). In *Srednevekovye drevnosti Primoriya*, iss. 4. Vladivostok: Dalnauka, pp. 28–47.

Medvedev V.E. 2017

Ob osobennostyakh razvitiya srednego i pozdnego neolita na yuge Dalnego Vostoka (Nizhneye Priamuriye). In *Trudy V (XXI) Vserossiyskogo arkheologicheskogo syezda*, vol. I. Barnaul: Izd. Altai. Gos. Univ., pp. 155–158.

Medvedev V.E., Filatova I.V. 2021

Materials from dwelling 2 on Suchu Island, the Lower Amur (1977 season, excavation III). *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 49 (3): 13–23.

Okladnikov A.P. 1984

Keramika drevnego poseleniya Kondon (Priamurye). Novosibirsk: Nauka.

Ryndina N.V. 1984

Raskopki poseleniya razvitogo Tripoliya Drutsy I. In *Arkheologicheskiye otkrytiya 1982 goda*. Moscow: Nauka, pp. 415–416.

Semenichenko L.E. 1976

K voprosu ob etnokulturnykh svyazyakh mokhe-bokhaitsev (po materialam arkheologicheskikh issledovaniy). In *Noveishiye arkheologicheskiye issledovaniya na Dalnem Vostoke SSSR*. Vladivostok: [s.n.], pp. 88–111.

Shavkunov E.V. 1985

Sogdiysko-iranskiye elementy v kulture bokhaitsev i chzhurchzhenei. In *Problemy drevnikh kultur Sibiri*. Novosibirsk: IIFF SO AN SSSR, pp. 146–155.

Sinitsyn I.V. 1960

Drevniye pamyatniki v nizoviyakh Eruslana (po raskopkam 1954–1955 gg.). In *Drevnosti Nizhnego Povolzhya: Itogi rabot Stalingradskoi arheologicheskoi ekspeditsii*, vol. 2. Moscow: Izd. AN SSSR, pp. 10–168. (MIA; No. 78).

Wang Yuping. 1956

Ceramics from sites of the Liao Epoch on the slope of the Beitan Mountain in Lingdongjie of Bairin-Zozi hoshun, Dju-Ud aimag in Inner Mongolia. *Wenwu Cankao Ziliao*, No. 2: 29–33. (In Chinese).

Received May 17, 2023.

doi:10.17746/1563-0110.2023.51.4.086-095

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Wooden Paddles from the Nizhny Tagil Museum-Reserve of Mining and Metallurgy in the Urals

This article describes Early Metal Age wooden paddles from the Gorbunovo peat bog, kept by the Nizhny Tagil Museum-Reserve of Mining and Metallurgy in the Urals. Their morphology and manufacturing technology are analyzed. The archaeological context and new AMS-dates are introduced. This sample of early wooden paddles is the largest and the most representative in the world. The specimens are very standardized with regard to general proportions, shape of the blade and handle, and decoration of the handle. A distinctive feature of this sample is that the handle of certain specimens is composite. A comprehensive traceological and technological analysis of the paddles has revealed several aspects of their manufacture, and xylotomy has provided information about the species of wood (pine, cedar, and spruce). On the basis of the processing traces, a tentative toolkit was reconstructed. The paddles generally fall in two categories: most are one-piece, and a few are composite. During the Early Metal Age, woodworking was probably a traditional craft in the Trans-Urals, showing a number of customary techniques.

Keywords: *Gorbunovo peat bog, Early Metal Age, wooden paddles, morphology, processing traces, woodworking tools, manufacturing technology.*

Introduction

Over 160 wooden paddles and their fragments have been found at peat bog land sites of the Trans-Urals, such as Karasyeozerskoye IA and IIБ, Razboinichiy Ostrov, Karasyeozerskoye X, Shuvakish I, IA, VIB, VIIIГ, and XIД, Elnichnoye IA, as well as open mines VI and Dalniy of the Gorbunovo peat bog; the Staroye, Novoye, and Yazevskoye mines, second Kuryinsky mine, second Yazevskoye site, and the Shigirskoye A settlement at the Shigir peat bog. These items have been analyzed in a number of both general studies (Eding, 1940; Raushenbakh, 1956: 9, 23, 25, 30, 123; Chairkina, 2005: 215–216) and specialized ones (Pogorelov, 1998; Kashina, Chairkina, 2016, 2017). Wooden paddles have also been found at sites west of the Urals and from the Baltic Sea region (Hartz, Lübke, 2000; Vilkunan, 1986). Due to the

almost complete absence of absolute dates at the time of publication, the authors have dated almost all the paddles (simple and composite) to a fairly wide chronological period—the Early Metal Age. This article will analyze wooden paddles found at open mines VI and Dalniy of the Gorbunovo peat bog, which are now a part of the collection of the Nizhny Tagil Museum-Reserve of Mining and Metallurgy in the Urals (NTMR). These paddles have provided a series of AMS dates, and revealed their morphology and manufacturing techniques.

Sources

The set of sources for studying means of water transportation was developed in the 1920s as a result of excavations of peat bog sites, primarily mine VI of the Gorbunovo peat bog, located in the Sverdlovsk Region, 140 km north of the city of Yekaterinburg, in the area of the city of Nizhny Tagil (Fig. 1). In 1926–1929, 1931, and 1936, the site was explored by D.N. Eding; in 1948, by A.Y. Bryusov and V.M. Raushenbakh; in 1979–1980 and 1983, by V.F. Starkov; since 2007, by N.M. Chairkina; and since 2017, by the Integrated Russian-German Expedition. During the excavations, unique finds of organic materials and complexes of wooden structures have been found.

Judging by archaeological reports, as well as field and collection inventories, 86 whole paddles and fragments of their different parts were found in mine VI in the excavation pits of D.N. Eding and A.Y. Bryusov over an area of ca 1500 m^2 (Eding, 1928, 1929, 1936; Kashina, Chairkina, 2016). From these, 18 items extracted from the excavations of 1926–1928 and 1936 are kept at the NTMR. However, the designation of some of these items with labels "blade fragment of a paddle?" (No. 1034; TM-452/60, TM-452/63, and possibly TM-452/?) is questionable. The items transferred to the NTMR from the State Historical Museum are marked TM-452: whole paddles TM-?452/4 (6/150), TM-452/5, TM-452/6, TM-?452/8, TM-?452/21; their parts—blades TM-452/3, TM-452/20, TM-452/33, TM-?452/22, and TM-?452, and handles TM-452/11, TM-452/23, TM-452/24, TM-452/25, TM-452/26, TM-?, and TM-? (24/2). The NTMR collection also contains a blade fragment (TM-7002/58) and handle (TM-7285/1), discovered by Y.B. Serikov during exploration works in 1978. Three handles, including one from a composite paddle, two blade fragments, and three whole paddles (TM-22000/1, TM-22000/2, and TM-2000/133) were found in the excavation pits of V.F. Starkov (1979, 1980, 1983). Wooden paddles were also found at mine VI in subsequent years (Chairkina et al., 2019: Fig. 1, *6*).

Prior to the detailed radiocarbon analysis of the most typical items from various typological series, cultural and chronological attribution of these items was based on their stratigraphic occurrence and the accompanying finds, and was not always unambiguous. The site was investigated mainly in the first half of the 20th century. The exact location, depth of occurrence, and stratigraphic situation of the discoveries in some cases were not indicated in collection inventories, but even when such information was available, it did not serve as a clear chronological indicator. The problem is that all the excavations of Eding and Bryusov, with the exception of one (1936), were carried out on the northern side of mine VI, where peat was not extracted in the early 20th century. The excavation pit of 1936 was inside mine VI, where peat was extracted. Scholars established the depth of finds from the surface, which corresponded to the natural terrain (or was higher due to peat bricks stored for drying on the side) and was

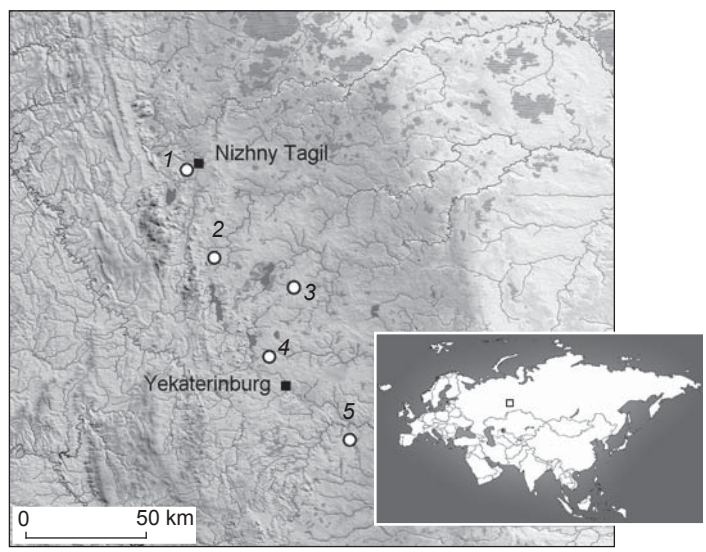


Fig. 1. Location of archaeological sites in the Trans-Urals, where the paddles were found.
1 – Mines VI and Dalniy at the Gorbunovo peat bog; *2* – Staroye, Novoye, Yazevskoye, and Second Kuryinsky mines, Yazevskoye site at the Shigir peat bog; *3* – Elnichnoye settlement IA; *4* – Shuvakish I, IA, VIB, VIIIГ, and XIД settlements; *5* – Karasyeozerskoye IA, IIБ, Razboinichiy Ostrov sites, Karasyeozerskoye X settlement.

clearly lower than the natural level in the mine, where peat had been removed to various depths. Therefore, this indicator was of little help for comparing the occurrence level of wooden structures and items marking cultural layers. Due to these circumstances, the cultural and chronological attribution of the items under discussion was not exhaustive in the previous studies. It was determined by a relatively sophisticated comparison of information from the reports and publications of Eding, modern research of the site analyzing the accompanying evidence from the collections of the State Historical Museum and NTMR, as well as several parallels with paddles found at other sites of the Trans-Urals.

The Dalniy mine is located in the western part of the Gorbunovo peat bog. In 1978, the site was examined by V.F. Starkov (1979). A fragment of wooden flooring made of wooden poles, marked by the Chalcolithic Lipchinskoye-type pottery, two handles (TM-6599/25), and a paddle fragment (TM-6599/24) were discovered.

Thus, currently, the NTMR collection contains seven whole or almost whole paddles, seven blade fragments, and ten handles, found at mines VI and Dalniy of the Gorbunovo peat bog.

Morphological description of the paddles

Wooden paddles discovered at the Ural peat sites can be divided into two categories: one-piece (over 150 fragments and fully preserved items), and composite (12–15 items) (Pogorelov, 1998; Kashina, Chairkina, 2016, 2017). Among one-piece items, those 120–130 cm long, with an oval blade 50–60 cm long and handle with a rounded end, were predominant. A blade design with a realistic or stylized waterfowl head, or rarely an animal head, were less common. According to the length of the handles, the paddles can be divided into very short (25–40 cm), short (51–62 cm), medium-sized (about 70–79 cm), and long (84–96 cm). The maximum length of the known paddles from the beginning of the blade to the end of the handle was 156 cm; the minimum length was 100 cm.

According to their length, paddle blades can be divided into long (61–75 cm), medium-sized (50–60 cm), and short (49 cm); according to width, into wide (10–16 cm) and narrow (4–10 cm). Their shape is varied: ellipsoid-shaped and wide; lanceolate-shaped and wide, with shoulders at the point of transition to the handle; oval- and suboval-shaped, which are both wide or narrow; and suboval short paddles (about 1/2 of the usual length of a large paddle). In cross-section, paddle blades can be divided into subtriangular and rhombic, rarely suboval. The paddle handles usually have an oval cross-section (3.5 × 2.5 cm), rarely round, subtriangular, or subrectangular (Pogorelov, 1998).

Paddles of the composite category consist of two parts—the blade with a short piece of the handle, and the handle itself. The handles are cut into a slanting wedge and equipped with grooves or notches used for attaching the parts together (Pogorelov, 1998; Kashina, Chairkina, 2016, 2017).

One-piece paddles with a blade and handle. TM-?452/8. The item is almost intact, only the end of the blade is broken off. This paddle is of medium length, with a wide, medium-sized, ellipsoid blade, and handle with curved thickening at the end (Fig. 2, *1*). The length of the surviving part of the blade is 53 cm; the width is 10 cm. A protruding sharp reinforcing rib is noticeable on the outer surface. The length of the handle is 67 cm. In cross-section, it is round (3 cm in diameter) near the blade and oval (2.0 × 1.2 cm) at the end near the thickening. The length of the thickening is 6.7 cm; the diameter is 3 cm. The paddle is carefully manufactured. The entire surface is polished as a result of secondary processing and long use. The item has a radiocarbon date of 4819 ± 23 BP (Table 1, No. 5)*.

TM-452/6. A short paddle with wide, oval blade of medium length, and a handle with rounded end (Fig. 2, *2*). The overall length is 114 cm. The length of the blade is 51.5 cm; the width is 11.7 cm. Its outer surface is convex; the inner (working) surface is flat. The diameter of the handle is 3 cm. Two triangular recesses were cut out at its end with a knife, probably for a better grip.

TM-?452/21. A short paddle with narrow, oval blade of medium length, and a handle with a straight end (Fig. 3, *1*), made of cedar (Table 2, No. 3). The total length is 105.3 cm. Its state of preservation is poor. Its flat blade is significantly broken on both sides. The length of the surviving part is 55.6 cm; the width is 8.5 cm. The handle is oval (3.5 × 2.5 cm) in cross-section. The end is flat; it was planed with a knife on both sides. This paddle gave a radiocarbon date of 3936 ± 21 BP (see Table 1, No. 3).

TM 2000/133. Probably a short paddle with long, wide, oval blade (Fig. 3, *2*). The end of the handle is broken off. The total length is 115.5 cm. The length of the blade is 64.3 cm; the width is 13.5 cm. The blade is

*All radiocarbon dates were obtained at the Curt Engelhorn Center of Archaeometry (Mannheim) and were calibrated using the Oxcal4.4 software and Intcal20 calibration curve (Reimer et al., 2020).

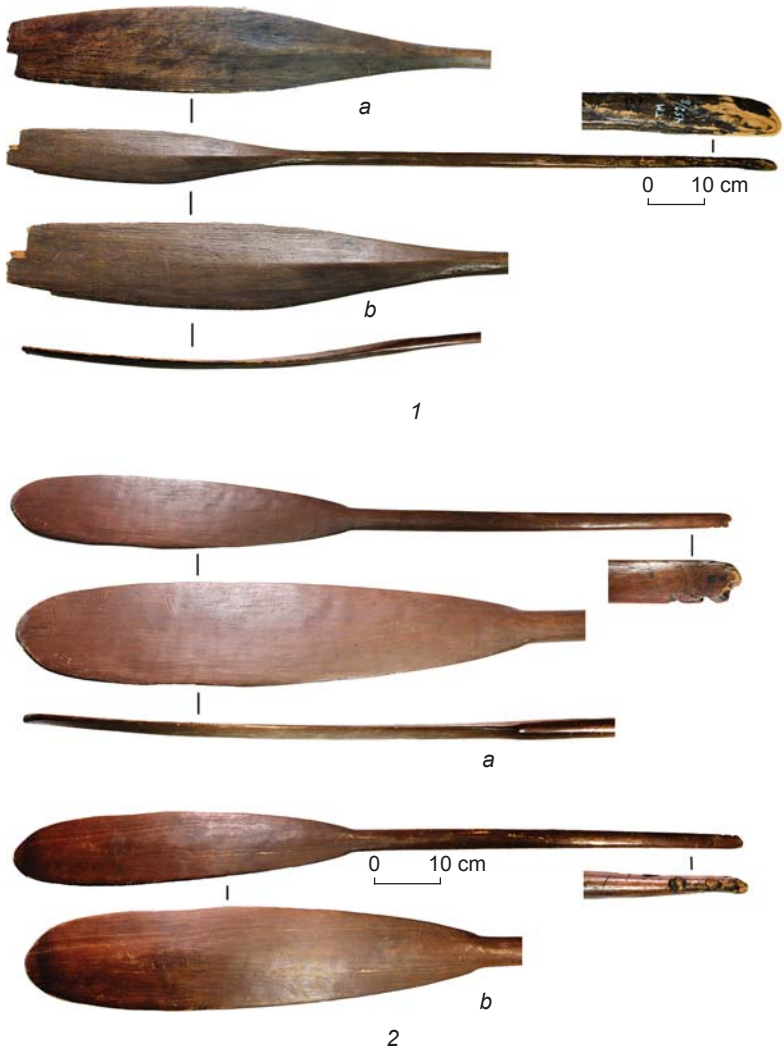


Fig. 2. Paddles TM-?452/8 (*1*) and TM-452/6 (*2*).
a – front; *b* – back.

curved, with an asymmetrical, rounded end. Its outer surface is slightly convex; the inner (working) surface is flat, with four round dark spots located at equal distance along the long axis. The diameter of the handle is 4.5 cm at the blade and 3 cm at the broken end. This item gave a radiocarbon date of 3822 ± 21 BP (see Table 1, No. 1).

TM-452/5. A very short paddle (children's?), with a short, narrow, suboval blade, and a handle with beveled end (Fig. 4, *1*), made of cedar (see Table 2, No. 7). The total length is 72.5 cm. The length of the slightly curved blade, which is flattened at the end, is 42 cm; the thickness is 3 cm at the beginning and 8 cm in the middle part. The diameter of the handle is 2.5 cm. Its end was asymmetrically rounded and trimmed with bilateral cuts. This paddle gave a radiocarbon date of 5044 ± 23 BP (see Table 1, No. 7).

TM-22000/1. A long paddle with short, wide, oval blade (Fig. 4, *2*, left). The total length is 135 cm; the length of the handle is 95 cm. The blade is 10 cm wide. Its end is worn and beveled. Initially, the blade had a symmetrical shape. The handle is bent, and becomes gradually thinner towards the end.

TM-22000/2. A long paddle with narrow, oval blade of medium length (Fig. 4, *2*, right). It is well preserved, with symmetrical shape, and is marked by a particular refinement. The length of the paddle is 135 cm. The length of the blade is 50 cm; the width is 8.1 cm. The handle ends with a straight cut.

Blades of one-piece paddles. TM-452/3. A wide (11.3 cm), oval blade of medium length (52.3 cm) (Fig. 5, *1*), made of pine (see Table 2, No. 8). Fractures are present on its rounded edges. On the outer surface, traces of secondary processing by a chisel with flat working surface have survived. The diameter of the remaining part of the handle is 3.2 cm; the length is 3 cm. It is almost flat, with rounded edges. This item gave a radiocarbon date of 5059 ± 23 BP (see Table 1, No. 6).

TM-6599/24. A shortened oval blade of medium width (Fig. 5, *2*). The end is broken off. The length of the preserved part is 47.5 cm; the width is 9.3 cm. The outer surface is convex, with a thickening along the longitudinal axis; the inner surface is flat. The diameter of the surviving fragment of the handle is 2.2 cm.

TM-452/20. Fragment of a very wide, oval blade of medium length, made of cedar (see Table 2, No. 4). The length of the preserved part is 52 cm; the width is 9 cm. The outer surface is convex, shaped as smooth oval, and shows clear traces of processing by a chisel with flat working surface. The inner surface is concave, shovel-shaped (Fig. 6, *1*).

TM-452, "a separate sample". A perfectly manufactured, narrow, oval blade, with pointed end (Fig. 6, *2*). The inner surface is flat; the outer surface has a weakly visible reinforcing rib. The total length is 85 cm; the length of the blade is 79 cm; the width in the middle is 11.8 cm; the thickness is 0.8–1.2 cm.

Table 1. **Radiocarbon dates of wooden paddles from mine VI of the Gorbunovo peat bog**

No.	Collection code	Item	Date, BP	Index	Calibrated date, yrs BC	
					±1σ	±2σ
1	TM-2000/133	Paddle	3822 ± 21	MAMS-53626	2293–2205	2397–2150
2	TM 452/24	Handle of the composite paddle	3924 ± 22	MAMS-53627	2467–2350	2471–2305
3	TM-?452/21	Paddle	3936 ± 21	MAMS-53628	2471–2350	2560–2343
4	TM-7285/1	Paddle handle	3946 ± 22	MAMS-49165	2557–2352	2565–2346
5	TM-?452/8	Paddle	4819 ± 23	MAMS-53625	3641–3536	3645–3529
6	TM-452/3	Paddle blade	5059 ± 23	MAMS-53629	3944–3800	3949–3793
7	TM-452/5	Paddle (children's?)	5044 ± 23	MAMS-53630	3940–3792	3948–3778
8	TM-452/23	Paddle handle	5090 ± 24	MAMS-53631	3954–3809	3961–3800

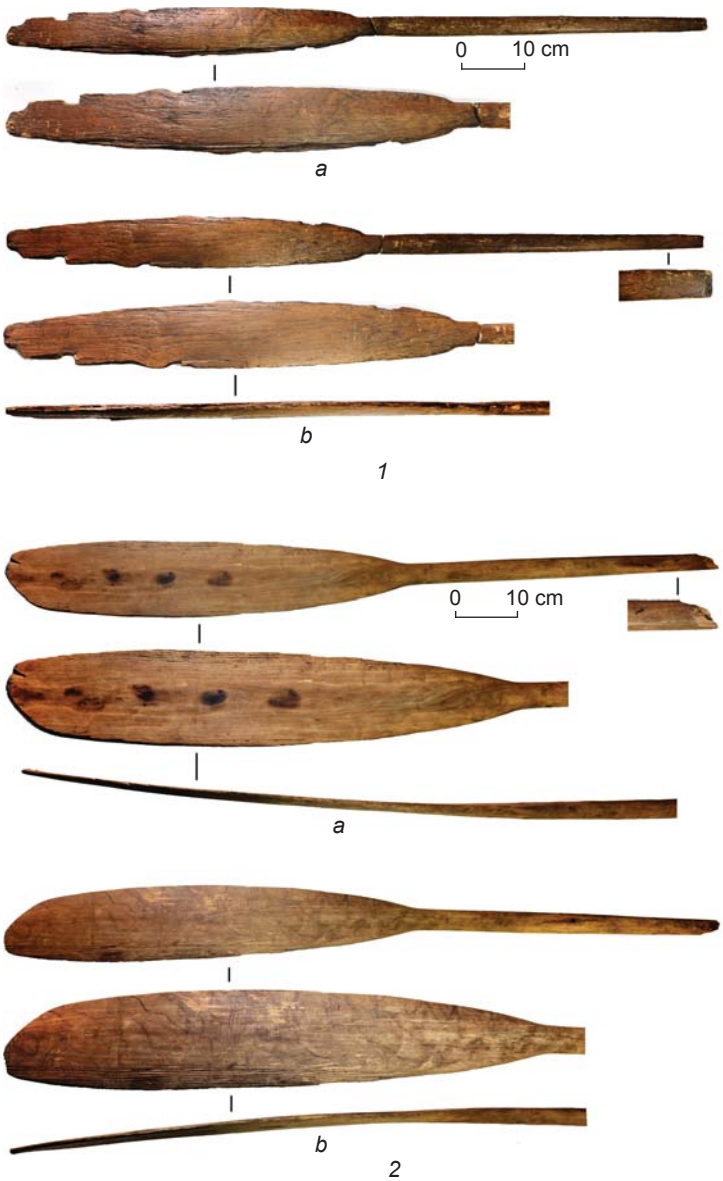


Fig. 3. Paddles TM-?452/21 (*1*) and TM-2000/133 (*2*).
a – front; *b* – back.

TM-452/33. Fragment of a paddle blade blank (Fig. 7, *1*), 48 cm long and 3.9 cm wide. The thickness of the rounded two-plane part is 2.7 cm. Traces of planing with a knife are well preserved on the blank.

TM-7002/58. Fragment of the middle part of a paddle blade, carefully processed and smoothed. Its length is 60.8 cm; the width in the middle is 6.5 cm. The thickness is 2.7 cm at the beginning of the handle, and 1 cm at the end of the rounded part. A thickened and pointed reinforcing rib passing into the handle is clearly visible on the outer surface (Fig. 7, *2*).

TM-?452/22. Fragment of a narrow paddle blade made of pine (see Table 2, No. 5). Its size is 34.0 × 7.0 × 0.8 cm. One side was processed very well; the other side was manufactured less carefully. The profile is slightly deformed; the cross-section is oval.

TM-11.8/4461-4468. Fragment (half) of a thin paddle blade. Its length is 57.8 cm; the width is 5.4; the thickness at the broken edge in the area of transition to the handle is 1 cm. A through hole was made on both sides with the thin tip of a sharpened knife, or was drilled with a pin-drill at the end of the blade, near the broken edge. This hole was possibly made for fastening two halves of the split blade.

Fragments of paddle handles with preserved ends. The length of the handles ranges from 36 to 61 cm. Their cross-section is oval (TM-452/24, TM-452/25, TM-?, TM-7285/1) or quadrangular (TM-452/23), from 1.5 to 2.5 cm at the end

Table 2. **Wood species of the items found during excavations at the Gorbunovo peat bog***

No.	Collection code	Item	Wood species
1	TM-452/23	Paddle handle	Pine
2	TM-452/26	"	"
3	TM-?452/21	Paddle	Siberian pine
4	TM-452/20	Paddle blade	"
5	TM-?452/22	"	Pine
6	TM-452/25	Paddle handle	Spruce
7	TM-452/5	Paddle	Siberian pine
8	TM-452/3	Paddle blade	Pine
9	TM-?452/4	Paddle	"

*Compiled using archival books of the Nizhny Tagil Museum-Reserve of Mining and Metallurgy in the Urals (F. 2, Inv. 1, D. 15, fols. 1, 2).

Fig. 4. Paddles TM-452/5 (*1*), TM-22000/1, and TM-22000/2 (after (Starkov, 1983: Fig. 16, *2*, *3*)) (*2*).
a – front; *b* – back.

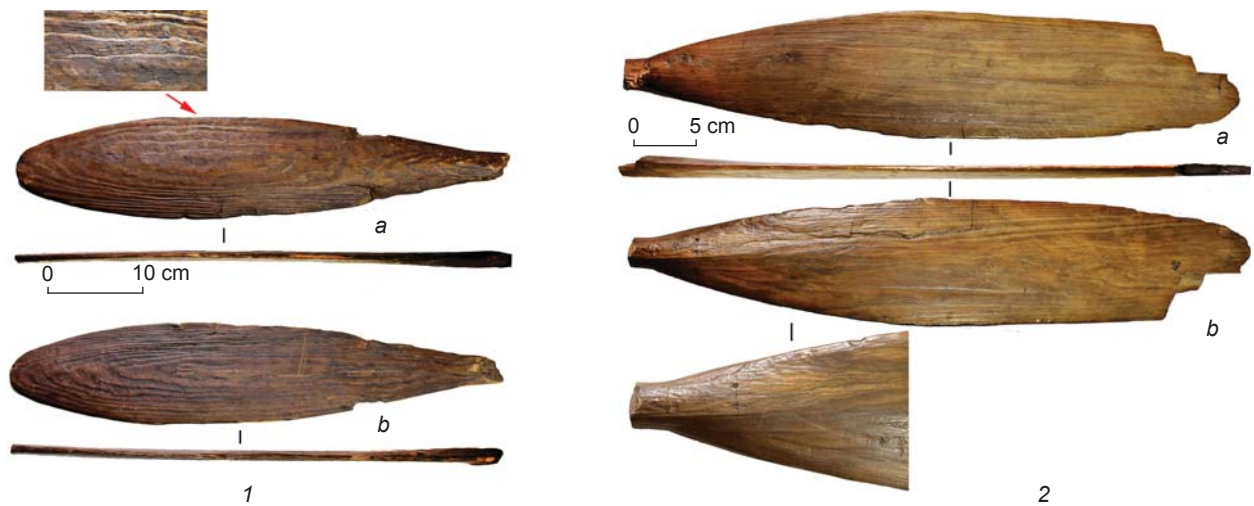


Fig. 5. Paddle blades TM-452/3 (*1*) and TM-6599/24 (*2*).
a – front; *b* – back.

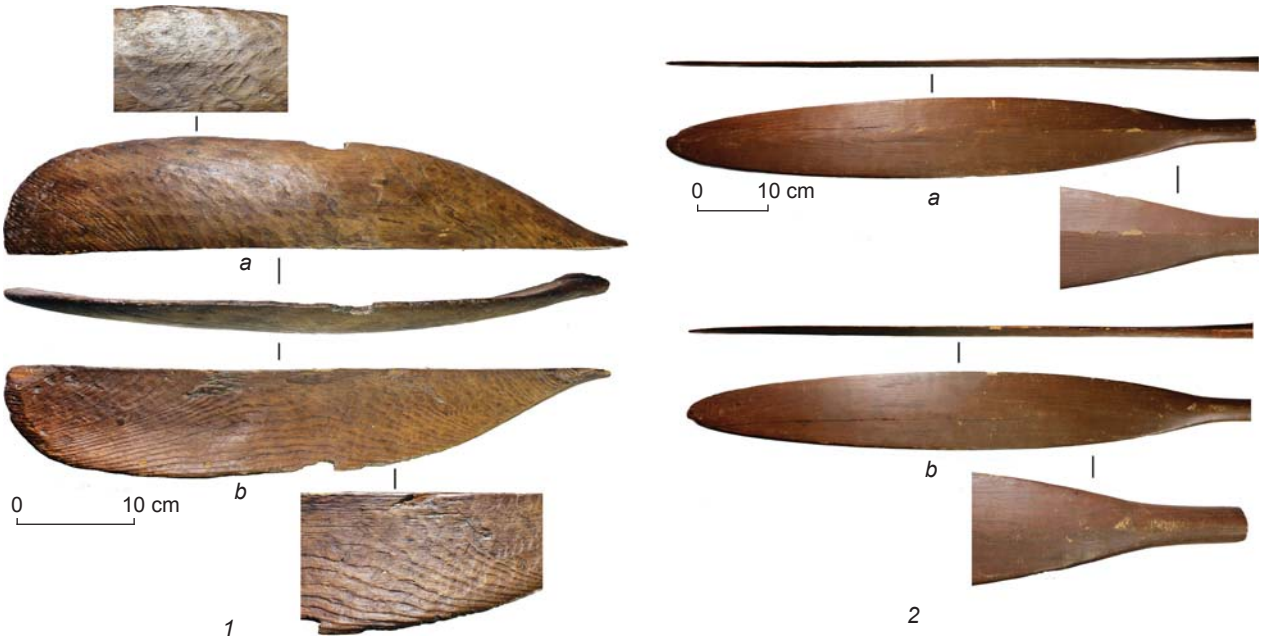
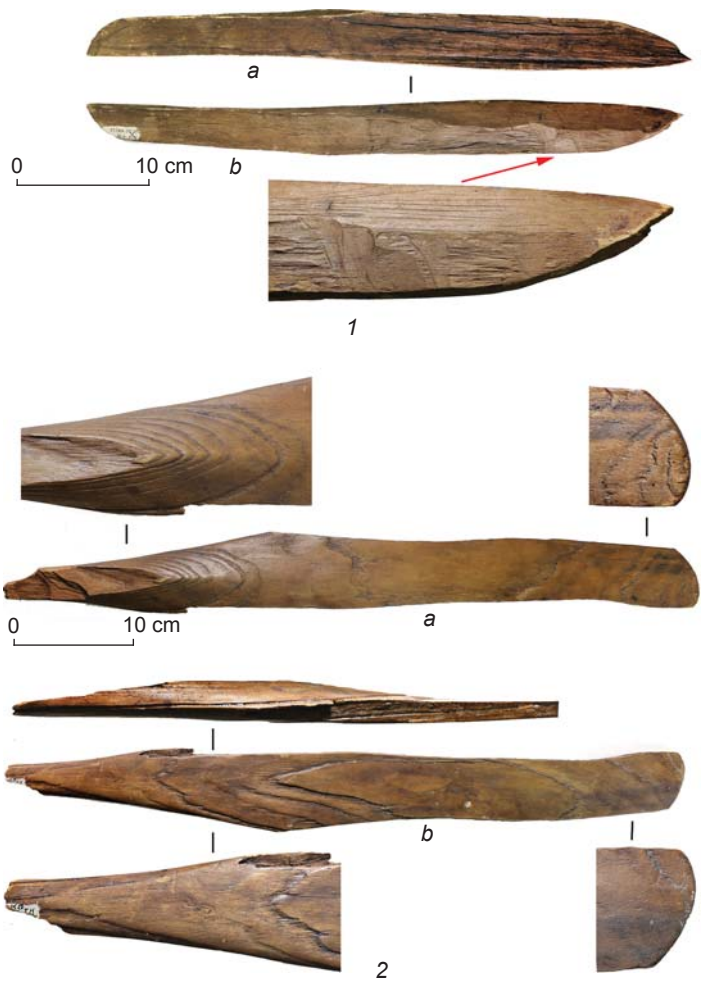


Fig. 6. Paddle blade fragment TM-452/20 (*1*) and blade TM-452, "separate sample" (*2*).
a – front; *b* – back.



of the handle, and from 2.1 to 2.9 cm at the broken end. The ends of the handles, with the exception of one (with widened oval shape), are flattened, slightly widened, and bent at an angle of 10–45°.

Items TM-?, TM-452/24, and TM-452/25 have long slanting cuts at the ends, which indicates that these are handle fragments of composite paddles. All these handles were made very carefully, using all secondary processing operations (scraping, planing with scrapers, abrasive grinding, and polishing with pieces of suede skin).

Radiocarbon dates have been obtained for three items: TM-452/24 (3924 ± 22 BP), TM-7285/1 (3946 ± 22 BP), and TM-452/23 (5090 ± 24 BP) (see Table 1, No. 2, 4, and 8).

Manufacturing technique and use

Comprehensive technical and technological analysis has shown that production of wooden paddles for boats has specific features. Trace

Fig. 7. Fragments of paddle blade blank TM-452/33 (*1*) and blade TM-7002/58 (*2*).
a – front; *b* – back.

analysis and xylotomy have revealed that most of the one-piece paddles were made of whole tree trunks, using almost all of the main and auxiliary wood-processing techniques (Mylnikov, 2008: 33–38). This feature of the manufacture of paddles dating to the 5th millennium BC (Ertebølle culture) and the selection of specific tree species are mentioned by European scholars (Klooß, 2015: 201–206, tab. 56–57; p. 207).

Blades of almost all the paddles have a fairly significant deviation from the straight line of the handle (up to 5–7 cm). This was done intentionally, to move water more effectively, in order to increase the efficacy of rowing, speed of movement, and maneuverability of the vessel. The first studies of the sources indicate that the sequence of paddle manufacturing could have been the following. First, searching for a tree with suitable straight grained wood and for a trunk section with a minimum number of knots. Then, splitting the log with an axe, wedges, and a mallet for obtaining bpaddleds (flitches), cutting out the blanks with a metal or stone knife from the bpaddled, and processing the blank by trimming, scraping, and grinding, for which adzes, stone or metal scrapers or scraper-knives, sand, and other abrasive materials might have been used (Pogorelov, 1998).

Anatomical analysis of the wood structure has revealed that mostly coniferous tree species, such as cedar, pine, and spruce, were used for making the paddles (both the whole paddles and fragments) (see Table 2). The clearest surviving traces of processing indicated that the main set of tools included an axe, adze with flat blade, and knife. Distinctive long, even spikes at the ends of many of the strips of wood (blanks for paddles) may indicate that these tools were metal (copper or bronze). Trace analysis identified the woodworking operations. Primary processing consisted of splitting, trimming and planing; secondary processing included shaving, scraping, sanding, and polishing.

The thoroughness of the secondary processing of the paddles is noteworthy. Their entire surface was sanded and polished: technological traces of planing on blades were sometimes entirely absent. In addition to evidence of the repair of handles, a careful attitude toward the paddles is manifested in their continued use after the breaking of the edges of the blade, since the breakage surface in some items was worn out and smoothened.

Most of the items show traces of long use. In some cases, the ends of the blades are crushed, chopped, broken, and have crude longitudinal scratches. Some items are split in half. On average, the handles were broken at a distance of 10 cm from the edge of the blade. The first scholars believed that if it was impossible to use a broken paddle as intended, blades and handles were reused as other products (Ibid.).

S.N. Pogorelov suggested that paddles with ellipsoid, wide blades, suboval, narrow blades, and partially with oval, wide blades, together with handles with a rounded end, as well as some paddles with the pommel of a stylized image of a beast's head, could have belonged to an earlier time. In his opinion, they showed traces of crude trimming and scraping with stone (?) tools. These items could have been made in the Late Neolithic–Early Chalcolithic. They also include paddles with a short reinforcing rib and composite paddles. At the end of the first half of the Chalcolithic, there probably appeared (and began to prevail) paddles with pommels showing a stylized image of the head of a waterfowl, with handles that had a slightly curved, flattened, or extended end, bent at an angle of 10–45°, as well as handles ending with a slanting unilateral cut with a longitudinal narrow groove. These were made by metal tools, which is confirmed by distinctive traces (Ibid.). E.A. Kashina and M.N. Chairkina suggested a wider chronological range for all types of Ural paddles, dating them to the Chalcolithic–Early Bronze Age (2017).

Analysis of the collection has revealed a significant predominance of one-piece paddles over composite paddles. The first category includes only one item (TM-?452/8) of average length, with a handle having a bent end, and with a wide blade of medium length, showing an ellipsoid shape. The item was made in the first half of the 4th millennium BC (see Table 1, No. 5). The rest of the paddles have a wide (TM-452/6, TM-2000/133, TM-22000/1) or narrow (TM-?452/21, TM-452/5, TM-22000/2) blade of oval or suboval shape. These include both short (TM-452/6, TM-2000/133, TM-?452/21, TM-452/5) and long (TM-22000/1, TM-22000/2) items. Ends of the handles in these items are straight (TM-? 452/21, TM-22000/2), slightly slanting (TM-452/5), rounded (TM-452/6), or bent (TM-22000/1). One of the paddles with a wide, oval blade (TM-2000/133) was dated to the last third of the 3rd millennium BC (see Table 1, No. 1). An item with a narrow oval blade (TM-?452/21; see Table 1, No. 3) was made probably somewhat earlier, in the third quarter of the 3rd millennium BC. A short paddle, which might have belonged to a child, with a similar blade (TM-452/5), was dated to the first half of the 4th millennium BC (see Table 1, No. 7). It was almost contemporaneous with the single item containing an ellipsoid blade.

Paddle fragments included only oval blades: wide (TM-452/3), very wide (TM-452/20), medium

(TM-6599/24), and narrow (TM-452, "separate sample"); short (TM-6599/24), medium (TM-452/3, TM-452/20, TM-7002/58), and long (TM-452 "separate sample"). A wide blade of medium length was made in the first third of the 4th millennium BC (see Table 1, No. 6).

Three handles oval in cross-section (TM-452/24, TM-452/25, TM-?), with bent ends, as with the handles of one-piece items (TM-7285/1, TM-452/23, TM-452/26, TM-?), to prevent hand slipping during rowing, also belonged to composite paddles. Radiocarbon dates for these handles of composite and one-piece paddles suggest the mid third millennium BC (see Table 1, No. 2, 4). The handle TM-452/23 has another design (with a widened oval shape) and quadrangular cross-section. It could have belonged to a one-piece paddle, dating to the earliest time—the early 4th millennium BC (see Table 1, No. 8).

Conclusions

The collection of paddles kept at the Nizhny Tagil Museum-Reserve of Mining and Metallurgy in the Urals, from mines VI and Dalniy of the Gorbunovo peat bog, shows a clear morphological resemblance to similar items from peat bog sites of the Trans-Urals. They are distinguished by substantial uniformity, common proportions of details, occasional composite handles, and figurative design (Eding, 1940; Raushenbakh, 1956: 9, 23, 25, 30, 123; Chairkina, 2005: 215–216; Pogorelov, 1998; Kashina, Chairkina, 2016, 2017). These features clearly differentiate these paddles from those found in the Baltic region, which demonstrate great variability (Kloß, 2015: Fig. 254; Hartz, Lübke, 2000: Fig. 2).

Long paddles with a pointed blade, possibly for men, could have served for pushing off and controlling boats; short paddles with an oval end, possibly for women, could have been used for rowing (Kulemzin, Lukina, 1977: 51). It cannot be excluded that small items were not used as paddles, but belonged to rites, games, everyday life, and/or production activities. Paddles with ornithomorphic or zoomorphic pommels of handles, and with drawings on the blades in black paint, could have had a sacred function. Traces of paint have been found on handles (Eding, 1940: 54) and blades (TM-2000/133) of the paddles from mine VI of the Gorbunovo peat bog. A blade fragment with a geometric pattern of two isosceles triangles filled with paint and facing each other with their apexes, and rows of dots moving away from them, was discovered at the Shuvakish I settlement (Chairkina, 2005).

The AMS-dates indicate that almost all the types of wooden paddles found at the Trans-Urals peat bog sites existed for a relatively long time, from the early 4th to late 3rd millennium BC (Chalcolithic–Early Bronze Age).

Acknowledgments

The authors express their gratitude to the Administration of the Nizhny Tagil Museum-Reserve of Mining and Metallurgy in the Urals for the opportunity to study archaeological evidence from the Museum's collection.

References

Chairkina N.M. 2005
Eneolit Srednego Zauralya. Yekaterinburg: Izd. Ural. Gos. Univ.

Chairkina N.M., Reinhold S., Mariaschk D., Vilisov E.V. 2019
Datirovka, kontekst, interpretatsiya novogo derevyannogo sooruzheniya VI razreza Gorbunovskogo torfyanika. *Uralskiy istoricheskiy vestnik*, No. 4: 30–39.

Eding D.N. 1928
Otchet o raskopkakh letom 1928 g. na Gorbunovskom torfyanike N. Tagilskogo okruga Uralskoy oblasti. *Archives of the IIMK RAN*. F. 2/1928, No. 186, fol. 4–9.

Eding D.N. 1929
Otchet o raskopkakh na Gorbunovskom torfyanike letom 1929 goda. *Archives of the IIMK RAN*. F. 2/1929, No. 186, fol. 65–81.

Eding D.N. 1936
Otchet o raskopkakh uralskoy ekspeditsii GIM na Gorbunovskom torfyanike N. Tagilskogo rayona Sverdlovskoy oblasti v 1936 g. *Archives of the IIMK RAN*. F. 2/1936, No. 284, fol. 1–24.

Eding D.N. 1940
Noviye nakhodki na Gorbunovskom torfyanike. In *Arkheologicheskiye pamyatniki Urala i Prikamya*. Moscow, Leningrad: Izd. AN SSSR, pp. 41–57. (MIA; No. 1).

Hartz S., Lübke H. 2000
Stone Age Paddles from Northern Germany: Basic Implements of Waterborne Subsistence and Trade. In *Schutz des Kulturerbes unter Wasser: Veränderungen Europäischer Lebenskultur durch Fluß- und Seehandel: Beiträge zum Internationalen Kongreßß für Unterwasserarchäologie (IKUWA '99), 18–21 Februar 1999 in Sassnitz auf Rügen*. Hrsg. H. von Schmettow. Lübstorf: Archäologisches Landesmuseum und Landesamt für Bodendenkmalpflege Mecklenburg-Vorpommern, pp. 377–387.

Kashina E.A., Chairkina N.M. 2016
Derevyanniye vesla VI Razreza Gorbunovskogo torfyanika v sobranii Gosudarstvennogo istoricheskogo muzeya. In *Sedmiye Bersovskiye chteniya: Materialy Vseros. nauch.-prakt. arkheol. konf. 2–4 dekabrya 2014 g., g. Yekaterinburg*. Yekaterinburg: Kvadrat, pp. 334–345.

Kashina E.A., Chairkina N.M. 2017
Wooden paddles from Trans-Urals and from Eastern and Western European peat-bog sites. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 45 (2): 91–100.

Klooß S. 2015
Mit Einbaum und Paddel zum Fischfang: Holzartefakte von Endmesolithischen und Frühneolithischen Künstensiedlungen an der Südwestlichen Ostseeküste. Neumünster: Wachholtz.

Kulemzin V.M., Lukina N.V. 1977
Vasyugansko-vakhovskiye khanty v kontse XIX – nachale XX v.: Etnograficheskiye ocherki. Tomsk: Izd. Tom. Gos. Univ.

Mylnikov V.P. 2008
Derevoobrabotka v epokhu paleometalla (Severnaya i Tsentralnaya Aziya). Novosibirsk: Izd. IAET SO RAN.

Pogorelov S.N. 1998
Vesla iz torfyanikovykh pamyatnikov Srednego Urala. *Voprosy arkheologii Urala*, iss. 23: 228–240.

Raushenbakh V.M. 1956
Sredneye Zauralye v epokhu neolita i bronzy. Moscow: Goskultprosvetizdat. (Tr. GIM; iss. 29).

Reimer P., Austin W., Bard E., Bayliss A., Blackwell P., Bronk Ramsey C., Butzin M., Cheng H., Edwards R., Friedrich M., Grootes P., Guilderson T., Hajdas I., Heaton T., Hogg A., Hughen K., Kromer B., Manning S., Muscheler R., Palmer J., Pearson C., van der Plicht J., Reimer R., Richards D., Scott E., Southon J., Turney C., Wacker L., Adolphi F., Büntgen U., Capano M., Fahrni S., Fogtmann-Schulz A., Friedrich R., Köhler P., Kudsk S., Miyake F., Olsen J., Reinig F., Sakamoto M., Sookdeo A., Talamo S. 2020
The IntCal20 northern hemisphere radiocarbon age calibration curve (0–55 cal kBP). *Radiocarbon*, vol. 62 (4): 725–757.

Starkov V.F. 1979
Otchet o raskopkakh na Gorbunovskom torfyanike v 1978 g. *Archives of the IA RAN*. P-1, No. 8460.

Starkov V.F. 1980
Otchet o raskopkakh na Gorbunovskom torfyanike v 1979 g. *Archives of the IA RAN*. P-1, No. 7896.

Starkov V.F. 1983
Otchet ob arkheologicheskikh raskopkakh na 6 razreze Gorbunovskogo torfyanika v 1980 g. *Archives of the IA RAN*. P-1, No. 9975.

Vilkunan J. 1986
Prehistoric paddles from Central Finland. In *The Maritime Museum of Finland: Annual Report 1984–1985*. Helsinki: National Bpaddled of Antiquities, pp. 8–12.

Received May 27, 2022.
Received in revised form September 8, 2022.

doi:10.17746/1563-0110.2023.51.4.096-104

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Spatial Distribution of Finds on the Eastern Outskirts of Poltse I, the Amur Region

On the occasion of the 60th anniversary of the first excavations at Poltse I

The study addresses the spatial arrangement of features at Poltse I—a Poltse culture settlement near the village of Kukelevo. An analysis of past scholarship reveals the sources of the modern understanding of the geographic and topographic location of the site and of its present condition. Although Poltse I and Poltse II, which is located nearby, were damaged by plowing in 1968, it is possible to continue excavations and obtain new information. On the basis of published materials, field plans in the archives, and artifacts at the SB RAS Institute of Archaeology and Ethnography, the first complete plan of excavations at Poltse I has been prepared, showing the arrangement of dwellings. Certain features of their design are described. Ceramic vessels found in each of the ten dwellings are listed. The vessels were placed along the perimeter of the interior, leaving free space around the central hearth and a passage to the exit. Most were concentrated in six dwellings. Only a few of them were used in everyday life, while most could have been destined for trade and barter. The abundance of ceramics (965 specimens and numerous separate fragments) makes Poltse I a key source for information on pottery manufacture, subsistence, and cultural ties. So far, it is impossible to say whether the vessels were manufactured in situ or imported.

Keywords: *Amur region, Kukelevo, Poltse I settlement, excavation plan, dwellings, Poltse culture, vessels.*

Introduction

The first information about the location of the Poltse I archaeological site in the scholarly literature was provided by A.P. Derevianko in 1966. According to his description, the settlement was located 5 km from the village of Kukelevo, on a 3–4 m terrace gently sloping down to a significantly swampy oxbow lake, a former channel of the Amur River, 3–4 m from the road to the village of Babstovo (38 km), which ran along the edge of the terrace (Derevianko, 1966a: 230). More detailed information on the location was provided in the report on the 1966 excavations: "The settlement of Kukelevo-Poltse* is located… after the 138 km marker of the Birobidzhan–Amurzet road. The settlement extends along an old river bed (now a chain of oxbow lakes at a distance of 50 m) north of the road that cuts off the settlement from the bank, that is, most likely, cuts off its southern part—a good half of the settlement adjacent

*That was the name of the site in the reports. It is indicated on some field drawings from the Archive and on the labels on boxes with material evidence in the Repository of the IAET SB RAS.

Archaeology, Ethnology & Anthropology of Eurasia 51/4 (2023) 96–104 E-mail: Eurasia@archaeology.nsc.ru

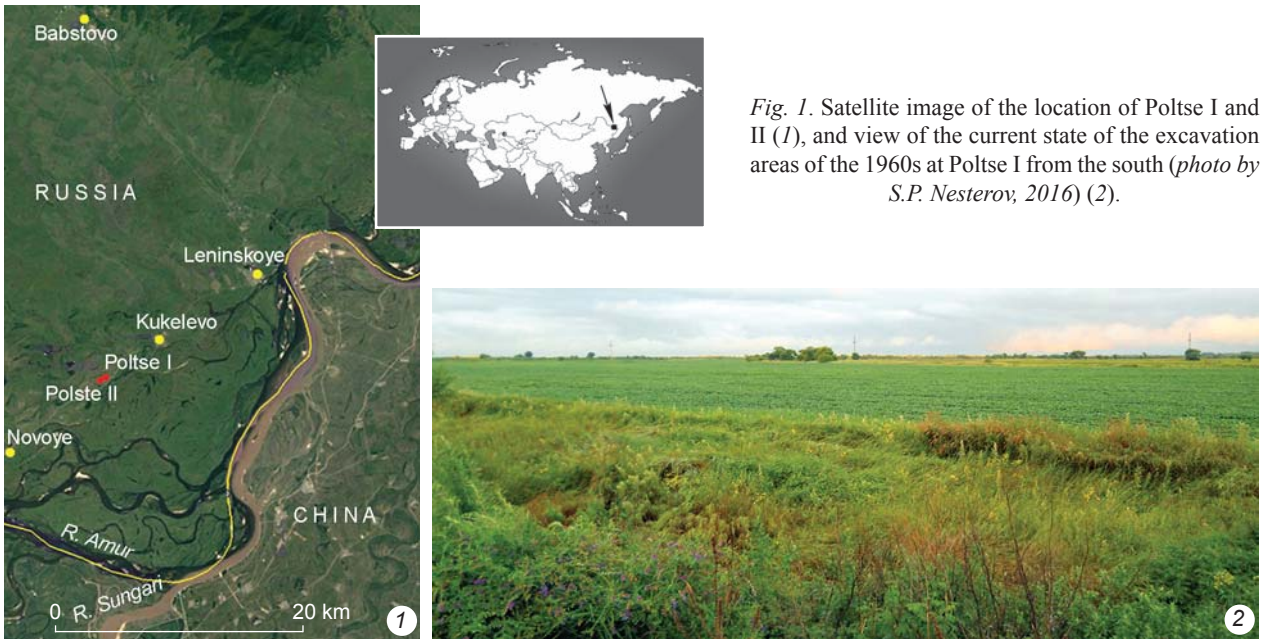


Fig. 1. Satellite image of the location of Poltse I and II (*1*), and view of the current state of the excavation areas of the 1960s at Poltse I from the south (*photo by S.P. Nesterov, 2016*) (*2*).

to the channel. The bank near the settlement is high and steep, although without precipices. The settlement is bordered by fields on the north. Probably, part of it has been plowed over. The western edge of the settlement is more damaged: there is a noticeable ditch from the last surviving dugouts, covering about 70 meters along the bank. The dugouts are located in close groups. The last dugouts to the east survived under a shallow plowed valley overgrown with small oak trees. The settlement probably continued further to the slope of the terrace, but the road and fields of the collective farm are there" (Derevianko, 1966b: fol. 1). About a dozen deep (up to 1.5 m) cup-shaped depressions, with diameters of 8–10 m and bottoms overgrown with young oak trees and bushes (Fig. 1), were discovered there in 1962 in a dense oak forest (Derevianko, 1966a: 230). Therefore, the excavations that began in 1963 and continued in 1964, 1966, and 1967 involved partial cutting down of the trees (Fig. 2, *1*).

During four years of permanent works at the Poltse I site, several more well-visible depressions were discovered, suggesting that the settlement consisted of approximately 20 dwellings. The settlement of Poltse II, partially destroyed to the south by the road and plowed over to the north, was discovered 200 m to the west of it. One dwelling out of 30 was explored there. Such close proximity of both settlements might have been caused by the terrain of the area at that time, or by their existence at different times; or Poltse II might have become a new settlement for the inhabitants of Poltse I, which perished from some catastrophic events as evidenced by traces of fire in nine out of the ten examined dwellings (Derevianko, 1976: 10, 83).

Fig. 2. View of the excavation areas of the 1960s from the southeast (from the original photo made for the book by A.P. Derevianko (1976: 11, fig. 3)) (*1*), and satellite image of the terrace in Poltse with traces of arable land (*2*).

The further history of these sites was neither straightforward nor clear in the 1960s, when an open appeal was made to the local Party and administrative organs of the Soviet government for providing assistance with archaeological works. In spite of this, the directorate of the Leninsky State Farm (Director N.S. Vankin from 1964 to 1985), which included the Kukelevo division, for some unknown reason in the spring of 1968, without the consent of the archaeologists, gave an order to plow the terrace with the unexcavated sections of the Poltse I and II settlements*. Apparently, it had been plowed earlier. For example, on the upper boundaries of dwelling 10 discovered at a depth of 40–60 cm from the ground surface, "the western part of the northern wall was plowed over; its upper part was destroyed" (Ibid.: 81). Traces of plowing are still visible today (Fig. 2, *2*).

Although research at Poltse I and II was interrupted, the sites were not completely destroyed. Since the depth of some depressions from the dwellings reached 1.0–1.5 m, and the plowing depth did not exceed 30–40 cm, these objects must have survived. In the future, with new methods of visual study (satellite images, drones) and geophysical research, using excavations in continuous areas, it will be possible to return to these sites for creating a general instrumental topographic map and conducting new excavations. Being eponymous with the Poltse culture of the Eastern Amur region, the Poltse I and II sites still provoke active scholarly discussion concerning the role played by the carriers of this culture in the Far East in the second half of the Early Iron Age.

Spatial structure of the excavated part of Poltse I

The first map of the site location and layout of dwelling depressions (Fig. 3, *1*, *2*) were published in 1970 (Okladnikov, Derevianko, 1970: 26, fig. 1, *2*). The map of the settlement shows 11 depressions (nine of them with numbers) and the excavation grid where letter designations go from south to north from A to M', and digital pickets are marked with 51 small strokes. Notably, their beginning does not coincide with picket A (Fig. 3, *2*). After comparing the description of the locations of the dwellings relative to one other in the text with the map, their inconsistency became clear. There was an obvious mistake, which could have occurred during the preparation of the publication. To match this map to the real position on the ground, it must be rotated 180° counterclockwise, which was done by Derevianko in his monograph "Amur Region…", and when doing so it was necessary to ignore the numbering of the depressions from the 1970 map (Fig. 3, *3*) (1976: 10, fig. 2).

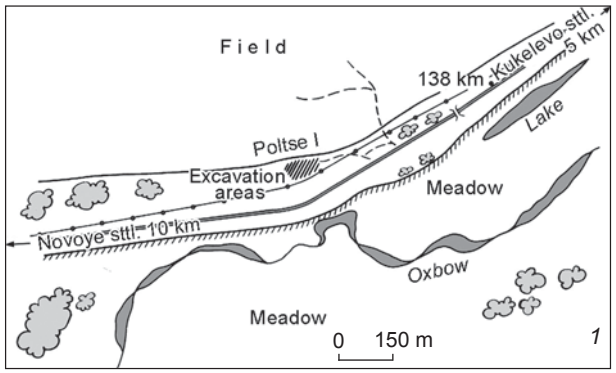
In 1966, the first attempts at creating a general map of excavations at Poltse I were made. It was completed in the field on graph paper and included the outlines of three previously explored dwellings (No. 1–3), one dwelling (No. 4) unearthed in 1966, and two unexcavated dwellings (No. 5 and 6). Cross-sections were made through the sub-square depression of dwelling 6 along lines 33 (north–south) and Я (west–east). Digital and letter benchmarks were indicated on them, and the trench was shown on the cross-section along line Я. On the second, final general map, dwelling 5 was already marked as explored, and only baulk lines without marked pickets were drawn through the depression of dwelling 6. Therefore, information from the field drawing was chosen instead of this (Fig. 4). These maps have not appeared in any publications of materials from Poltse I.

It was possible to make a general layout of the excavated dwellings because eight of them (except for dwellings 1 and 10) were included in a single excavation coordination grid (Fig. 5). However, this does not mean that the entire settlement area of approximately 2340 m^2 was unearthed. In 1964, dwellings 2 and 3 were explored using one excavation pit. In 1966, dwellings 4 and 5 were studied separately, but were linked to the common grid. According to the description, "dwellings at the settlement were located close to one other, especially in its eastern part where the inter-dwelling filling was not removed. Only in the area of dwellings No. 5, No. 6, No. 8, and No. 9, was it possible to unearth about 50 m^2" (Ibid.: 82). The space around dwellings 1 and 10, measuring 146 m^2, can be added to this amount.

The map of the excavated dwellings shows that they were placed in two rows with a narrow space in between, i.e. a "street". Dwellings 5, 4, and 10 can be included in the northwestern line, and dwellings 2, 3, 6, 7, and 9, in the southeastern line. Dwelling 8 adjoined the latter line, although was located further to the southeast. Noteworthy is dwelling 1, which was oriented to the cardinal points with its walls, whereas the other dwellings, with their corners.

Dwelling 1 (6 × 7 m) was the first structure explored in 1963. It was in this dwelling that the test pit was made in 1962, sized 50 × 50 cm, in which an intact vessel and fragment of a slate point were found. To excavate the dwelling, a two-meter grid was used (in subsequent years, works were carried out using a one-meter grid). The pit, rectangular in ground plan, was dug from the upper level of dense dark sandy loam, which lay immediately under the sod and had a depth of 1.1–1.2 m. The depression above it was 1.5 m deep. According to Derevianko, this pit contained a log construction, the lower layers of which left a groove 20–30 cm deep of a closed outline (1966a: 230–231). It was not possible to determine how high the layers of this log

*According to A.P. Derevianko, during the excavations, the state farm already grew vegetables for some special plant in the Khabarovsk Territory there.



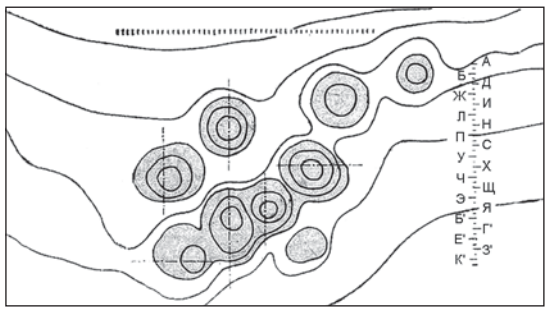


Fig. 3. General plan of the location of Poltse I, compiled in 1966 (*1*), and map of depressions on the eastern outskirts of the settlement, published in 1970 (*2*) and 1976 (3).
1, *3* – from the original drawings made for the book by A.P. Derevianko (1976: 10, fig. 1, 2); *2* – after (Okladnikov, Derevianko, 1970: 26, fig. 2).

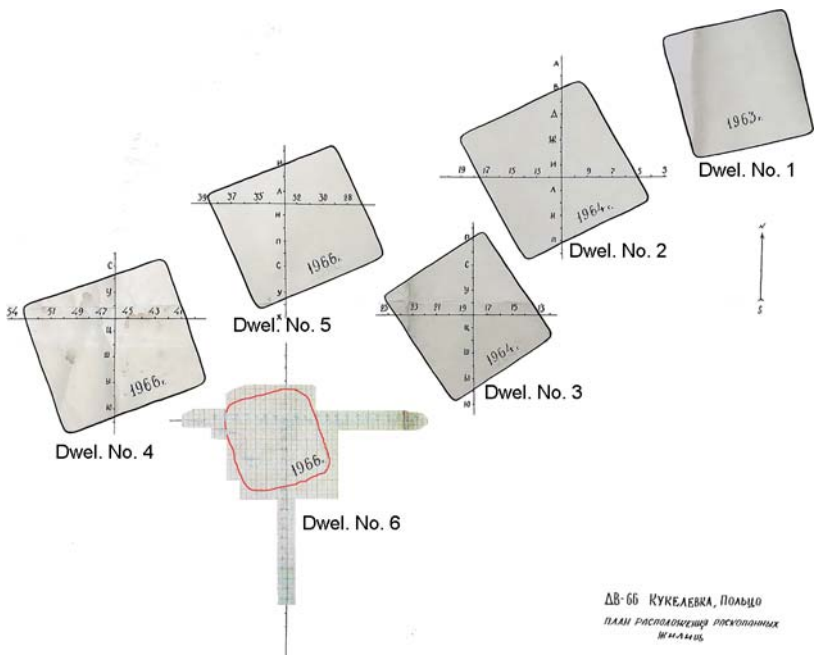


Fig. 4. Copy of the map of dwellings excavated in 1963, 1964, and 1966, from the Archive of the IAET SB RAS, with an insert from a field drawing on graph paper.

house rose, because the building had burned down. The pit contained 10 small post holes about 20 cm in diameter and 20–25 cm deep. Larger holes were located in the middle. These were intended for supporting the roof (Okladnikov, Derevianko, 1970: 50). The combination of logwork and a frame-and-post structure is known from winter buildings of the Yakuts on the Olenyok River (Istoriko-etnograficheskiy atlas…, 1961: 145). The structural features of dwelling 1, located on the northeastern outskirts of the settlement, could have been related to its purpose: "the absence of a hearth and the abundance of clay vessels of various types and sizes suggest that… a communal storage place for the entire village was located there" (Derevianko, 1966a: 242). If this was the case, the logwork placed in the deep pit protected supplies in the winter and served as a cellar in the summer. Food supplies were stored in containers of various sizes. Some vessels had burnt food residue on their surface. Thirteen bowls, two goblets, and a vessel with a

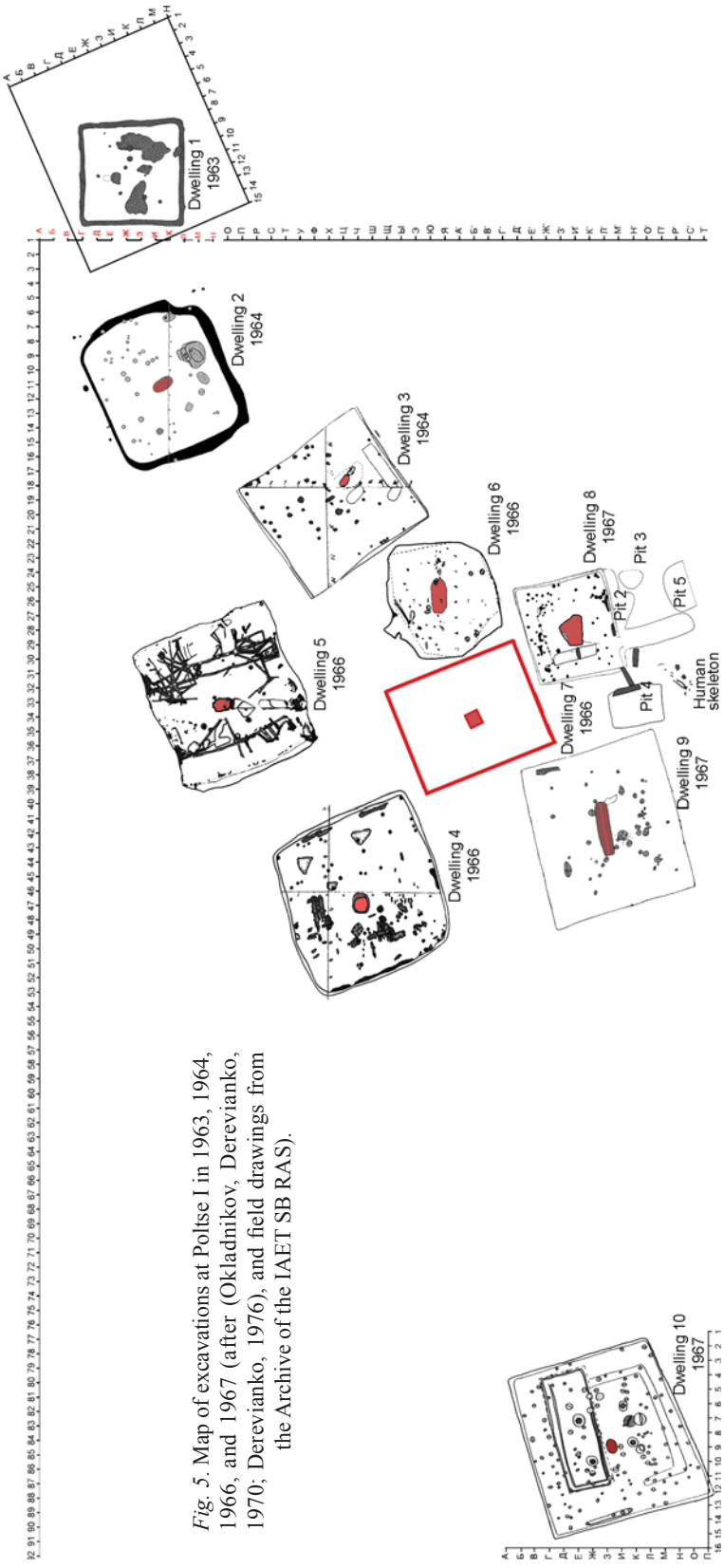


Fig. 5. Map of excavations at Poltse I in 1963, 1964, 1966, and 1967 (after (Okladnikov, Derevianko, 1970; Derevianko, 1976), and field drawings from the Archive of the IAET SB RAS).

side handle in the shape of a horn (Fig. 6, *1*), which could have been used to measure food, were also found there.

Dwelling 2 (10.8 × 8.6 m) was located approximately 6 m to the west of dwelling 1 (see Fig. 5). It was quadrangular in plan view, with rounded corners. It was a frame-and-post structure built in a pit 1.1 m deep ("not differing from the rest of the dwellings at this ancient settlement" (Okladnikov, Derevianko, 1970: 110)). To the east, dwelling 2 started the part of the village with buildings oriented with their corners toward the cardinal points. It was included in the southeastern row, but was slightly shifted in the northwestern direction. To the northeast, the "street" ended at dwelling 2. Its specific features include a relatively small hearth (1.2 × × 1.0 m) and the presence of a large number of various vessels, including 38 bowls, five so-called lamps, three spindle whorls, and a small double vessel with traces of red paint (see Fig. 6, *2*) (Ibid.: 53–110).

Dwelling 3 (9 × 10 m) had a quadrangular shape in plan view. It was located 4 m southwest of dwelling 2 and parallel to it, in a pit 30–40 to 50–60 cm deep (see Fig. 5). The oval hearth was shifted to the southeastern wall. Its size was 1.7 × 0.84 m; the depth of the hearth pit was 22 cm. The dwelling had a frame-and-post structure. Posts supporting the slopes of the roof were located in the middle in a circle. Some supported corner rafters, while others supported the middle part of the roof. It is possible that the posts stood under four corners of an upper frame that formed the smoke hole. Apparently, because of the large area of the roof and its heaviness, a large post supporting the upper ends of the corner rafters was set in the center (Ibid.: 110–147).

Dwelling 4 (11 × 10.5 m), which was located 17 m from dwelling 3 and approximately 6 m from dwelling 5, was investigated in 1966 (see Fig. 5). It was in a pit about 1.2 m deep and had a frame-and-post structure. Scholars have mentioned the unevenness of its floor, which rose sharply in the center. A rise in a strip of 80–100 cm was also observed along the walls. A hearth of round shape approximately 1.3 m in diameter was located almost in the center, with a slight shift to the southwest. It is

Fig. 6. Vessels from dwellings 1 (*1*) and 2 (*2*). Museum of History and Culture of the Peoples of Siberia and the Far East of the IAET SB RAS. *Photo by S.P. Nesterov*.

marked in sq. Ч-46 on the ground plan, while in cross-section, it is along line 46, and there is a depression in this place. In addition to the hearth, another large object inside the dwelling was a stone 42 × 33 × 65 cm in size, which, according to the description, was located in sq. Ч-45 (Ibid.: 147). However, this must have been a misprint because on the map it is located near the northeastern wall in sq. Ч-42. Another feature of dwelling 4 was the presence of a human skeleton inside, which was oriented with its skull towards the center of the building (Ibid.: 184). It was assumed that these were the remains of the inhabitant of the dwelling, who died during an enemy attack on the village. The invasion was sudden; based on the large number of vessels left in the dwellings, the inhabitants left them in a hurry. Interestingly, the person was very well equipped, with protective armor made of bone and iron plates, and a set of arrowheads (quiver), and could well have been a warrior from among the attackers who entered the dwelling and was killed there.

Dwelling 5 (8.95 × 9.6 m) had a sub-square shape in plan view and was built in a pit 50–60 cm deep between dwellings 2 and 4 (see Fig. 5). A hearth measuring 1.0 × 0.6 m was located almost in the center. A special feature of this building as an archaeological site was the preservation of a large number of charred parts of its frame-and-post structure. This allowed Derevianko to reconstruct the internal structure and external appearance of the dwelling (Fig. 7, *1*) (1976: 133, fig. 85).

Dwelling 6. The depression above this dwelling, unlike the other depressions of sub-quadrangular shape, was cup-shaped. The leaders of the excavations mentioned that it was located in the center of the settlement, 2 m from the corner of dwelling 3 in the east and 4 m from the wall of dwelling 5 in the north (Okladnikov, Derevianko, 1970: 228). However, according to the compiled excavation map, the distance to dwelling 5 was approximately 7 m (see Fig. 5). This dwelling was distinguished by the absence of traces of fire. Scholars have suggested that it was abandoned by its inhabitants due to a state of disrepair (Ibid.: 242). The closeness of dwellings 3 and 7 to dwelling 6 could have been caused precisely by the proximity to the old foundation pit. The approximate size of dwelling 6 according to the baulks was 6.5 × 6.4 m (Derevianko, 1976: 57, fig. 47). A hearth elongated along the west–east line was in the middle. Its size was 2.35 × 1.35 m; the depth of the hearth pit was 20 cm.

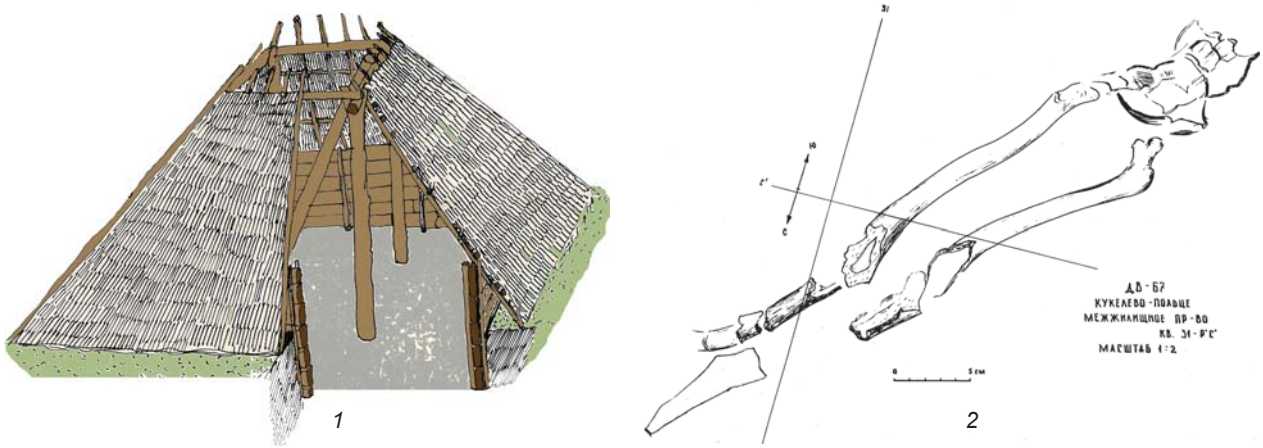


Fig. 7. Visual reconstruction of a Poltse dwelling (*1*), and human skeleton found near dwelling 8 (*2*).
1 – from the original drawing made for the book by A.P. Derevianko (1976: 133, fig. 85); *2* – from the field drawing kept in the Archive of the IAET SB RAS.

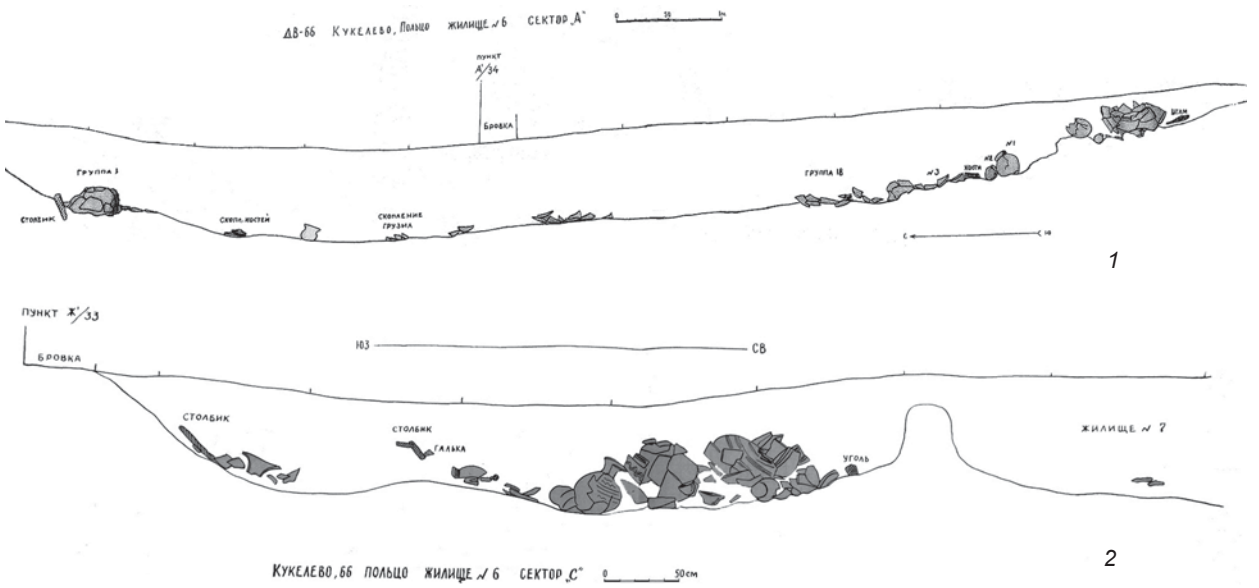


Fig. 8. Copies of the field drawings representing the contour cross-sections of dwellings 6 (*1*) and 7 (*2*) before their numbers were changed. Archive of the IAET SB RAS.

A protrusion similar to an entrance vestibule was on the northwestern side of dwelling 6. Multiple fragments of various ceramics occurred in the filling of the dwelling pit, suggesting that the inhabitants of neighboring dwellings used the pit for waste at the settlement.

Dwelling 7 (8.5 × 9.5 m) adjoined dwelling 6 to the southwest. Field drawings include contour cross-sections along line 34: south–north and southwest–northeast. The cross-section along the southwest–northeast was made from the edge of the baulk along line 33, from its intersection with line Ж', located south of the contour of dwelling 7, through a cluster of ceramic vessels in sector C. It also captured the northwestern part of dwelling 6, passing through the inter-dwelling space with the smallest distance between two buildings reaching only 32 cm (Fig. 8). Notably, the southwestern dwelling was marked as No. 6 and northeastern as No. 7 on these cross-sections. When the evidence from the first six dwellings was published, dwelling 7 appeared as No. 6 (Okladnikov, Derevianko, 1970: 241) and in the later monograph by Derevianko, the working numbering of dwelling No. 6 was adjusted to No. 7 (1976: 59)*.

Dwelling 8 (6.8 × 6.0 m) was bordered by dwelling 9 to the west and dwelling 7 to the north (see Fig. 5) (Ibid.: 68–69, 314–315). The hearth was located in the middle and presumably had an irregular pentagonal shape with rounded corners and a size of ~1.65 × 1.24 m. This structure was distinguished by an entrance corridor approximately 5 m long and 1.4 m wide near the southwestern corner, four pits (No. 2–5) on the southern side, and a human skeleton without a skull to the southwest of the entrance (see Fig. 7, *2*) (Ibid.: 82, fig. 73).

Dwelling 9 was almost square in shape (11.0 × 10.6 m) and was located to the west of dwellings 7 and 8 (see Fig. 5). An elongated hearth measuring 3.6 × 1.0 m was in the middle (Ibid.: 69–75, 316–322). This dwelling contained a large number of vessels, which occupied almost its entire space (Fig. 9).

Dwelling 10 was located 30 m to the west of dwelling 9 (see Fig. 5). Its location and the reference to the general grid were established conventionally, using this information. This dwelling had its own coordinate system marked on field drawings of 1967 as excavation pit II, dwelling No. 1. Only in the publication of 1976 was it assigned No. 10* (Ibid.: 75). Dwelling 10 was quadrangular in shape and measured 11.6 × 9.9 m.

Some spatial features of the Poltse I settlement (instead of a conclusion)

Despite some linearity in the placement of dwellings at the settlement, they were generally built quite close to

*However, the numbers were changed only in the publications (Okladnikov, Derevianko, 1970: 228–242; Derevianko, 1976: 56–59). In the Repository of the IAET SB RAS, the labels on the boxes with materials and on the vessels from these dwellings, as well as the codes, have remained unchanged. The numbers of dwellings correspond to the original field numbering, which is reflected in field drawings stored in the Archive.

*A similar situation occurred with dwelling No. 2 from the same excavation pit. Subsequently, it was assigned to the Poltse II site as dwelling 1 (Derevianko, 1976: 83).

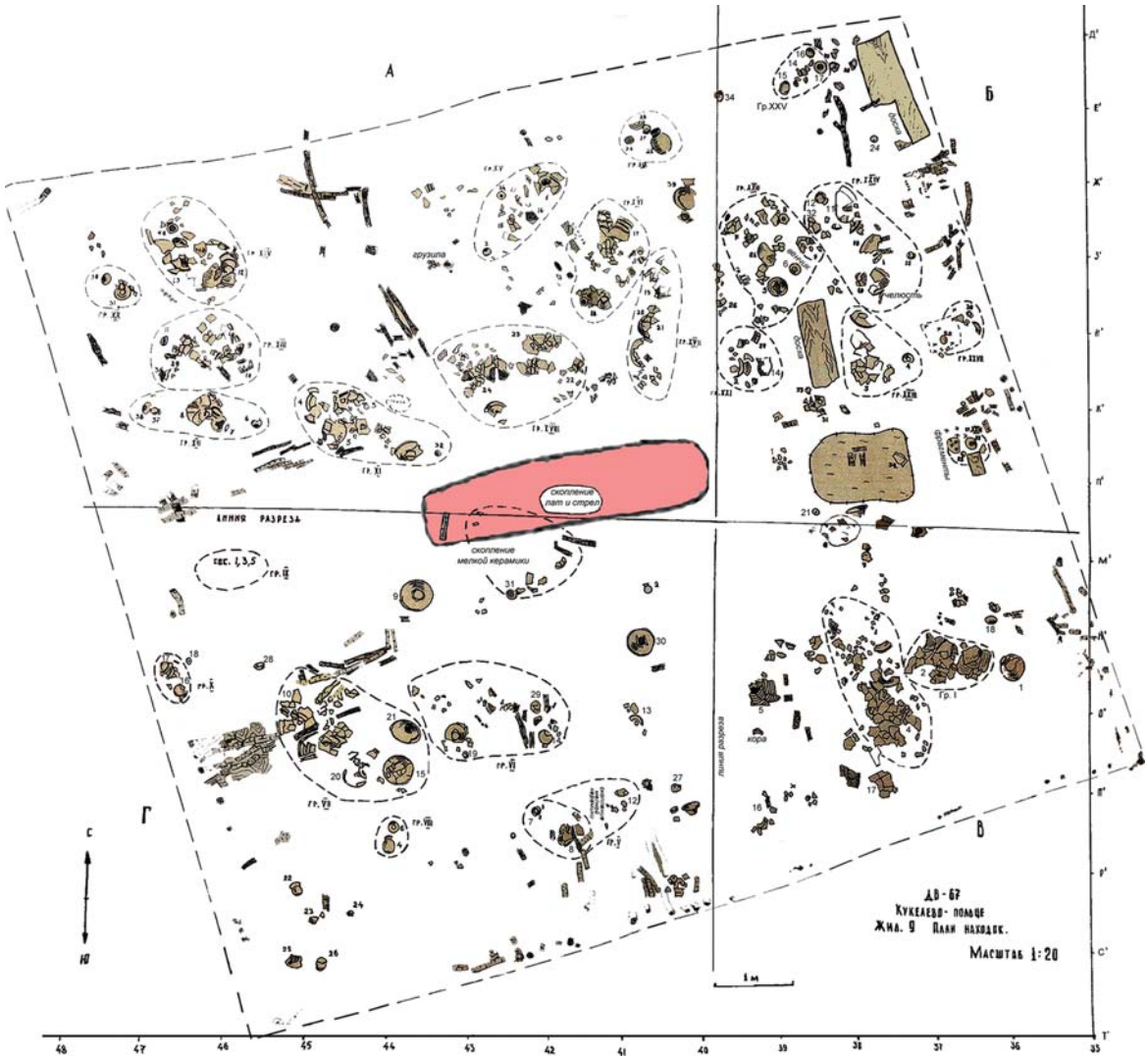


Fig. 9. Map of location of the finds in dwelling 9 (from the field drawing on graph paper; the outline of the dwelling and hearth were copied from other maps). Archive of the IAET SB RAS.

each other. The location of dwelling 10 at a distance from the main excavated group was associated only with the choice of locations for excavations. In this space, dwelling depressions were also present; and 200 m to the settlement of Poltse II was also a small distance. According to A.P. Derevianko and V.E. Medvedev, who participated in the excavations of the 1960s, both sites could have formed one large village with at least a hundred residential and utility buildings.

Specific features of the excavated dwellings included their varying sizes and presence of numerous pottery vessels of various types (see *Table*). The large area of a building did not always correspond to a large amount of pottery inside. The small number of vessels in dwelling 6 was a result of its poor state of repair. Owing to the disrepair of the building, everything of value had been removed from it. Subsequently, it could have been

Main features of dwellings

Dwelling No.	Area, m^2		Number of vessels
	of dwelling	of hearth	
1	42	Without hearth	96
2	92.8	1.4	256
3	90	1.4	146
4	115.5	1.3	104
5	86	0.6	139
6	~42	2.7	3 complete and 318 ceramic fragments
7	80.8	…	~59
8	~41	1.8	~5
9	~117	3.6	122
10	~115	0.9	~20

disassembled for household needs. Without it being dismantled, the building could have collapsed within 5–7 years. Dwelling 8 could also have been abandoned at the time of the fire. Indirect confirmation was found in the middle of the filling in the entrance corridor, which contained vessel fragments with a waffle decoration "and the jaw of an animal, apparently a boar", which ended up there as garbage (Derevianko, 1976: 69). Another difference between these dwellings and other dwellings was the presence of an entrance corridor represented by a small ledge and a long trench, extending from one of the walls.

In the inter-dwelling space, fifteen intact and broken vessels, spindle whorls, a ceramic ring, a rectangular adze, mallets, a fragment of a pestle, fragments of slate and bone arrowheads, retouched items, and animal bones were found (Ibid.: 82–83). Eight pits of different periods, which had a possible utility and garbage purpose, were discovered in the excavated area of the settlement. For example, a Neolithic waste pit with soil containing fish bones was found behind the northern wall of dwelling 4.

The collection of ceramic vessels from the excavated area of the Poltse I settlement totals 965 items (excluding numerous fragments). Most vessels were intact or archaeologically complete; 950 of them were found directly in dwellings. The pottery was predominantly concentrated in dwellings 1–5, and 9. Scholars identified the purpose of the relatively small dwelling 1 without a hearth as a public store house. The other four structures, 2–2.5 times larger in area, with hearths which were too small for such spaces, can be figuratively called "china shops". In the dwellings containing a large amount of pottery, there were vessels inserted one into the other, bowls stacked in a stack, and containers covered with bowls as a lid. This is clearly a way to store utensils to save space. Some large vessels contained millet. Judging by the layout of finds in dwelling 9, they were located along its perimeter (Fig. 9). The center and the area from the center to the middle of the southwestern wall, where the entrance was most likely located, remained relatively free. The inhabitants of the dwellings used only a small part of the vessels in everyday life, while the larger part was presumably intended for trade and exchange. The source of the pottery—whether domestic production or imported goods—has not yet been clearly identified.

Acknowledgments

This study was carried out under the R&D Project "Diversity and Continuity in the Development of Cultures in the Stone, Bronze, and Middle Ages in the Far Eastern and Pacific Regions of Eurasia" (FWZG-2022-0004).

The author thanks the Academician A.P. Derevianko, Dr. V.E. Medvedev, Academician V.I. Molodin, Dr. V.P. Mylnikov, Dr. T.I. Nokhrina, and leading specialist Y.A. Plotnikov for their help in preparing this article, as well as Dr. E.V. Parkhomchuk and the team from the Center for Collective Use "Geochronology of the Cenozoic" for analyzing the soil from the Neolithic pit.

References

Derevianko A.P. 1966a

K istorii Srednego Amura v zheleznom veke: (Po raskopkam poseleniya v mestnosti Poltse, u s. Kukelevo). In *Sibirskiy arkheologicheskiy sbornik*. Novosibirsk: Nauka, pp. 229–242. (Materialy po istorii Sibiri: Drevnyaya Sibir; iss. 2).

Derevianko A.P. 1966b

Nauchniy otchet o raskopkakh poseleniya rannego zheleznogo veka v 4 km ot s. Kukelevo v mestnosti "Poltse", 1966 g. *Archives of the IA RAN*. R-1, No. 3391.

Derevianko A.P. 1976

Priamurye (I tysyacheletiye do nashey ery). Novosibirsk: Nauka.

Istoriko-etnograficheskiy atlas Sibiri. 1961

Moscow, Leningrad: Izd. AN SSSR.

Okladnikov A.P., Derevianko A.P. 1970

Poltse – poseleniye rannego zheleznogo veka u s. Kukelevo. In *Materialy polevykh issledovaniy Dalnevostochnoy arkheologicheskoy ekspeditsii*, iss. I. Novosibirsk: IIFF SO AN SSSR, pp. 5–304.

Received June 26, 2023.
Received in revised form July 20, 2023.

doi:10.17746/1563-0110.2023.51.4.105-113

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Contents of an Early Byzantine Amphora from Kruglaya Bay, the Black Sea

A fragment of an amphora found in the Kruglaya Bay near Sevastopol was filled with an unknown brown substance with a strong smell of tar. On the vessel's neck, there is a round stamp ~30 mm in diameter, depicting the bust of an emperor encircled by an inscription. It resembles stamps on amphorae made in Alexandria and the Geronisos Island. The inscription reads, "✠επί Πτολεμαίου επάρχου". The gas chromatography–mass spectrometry analysis revealed dehydroabietic acid, methyl dehydroabietate, norabietatrienes, retene, and other phenanthrene derivatives, suggesting that the substance resulted from dry distillation of wood of the Pinaceae family. The headspace analysis yielded components of turpentine oil such as α-pinene, camphene, limonene, cymenes, and others terpenes. To establish the sample's origin, the amphora's content was compared with modern pinewood tar obtained by the traditional method. Given nearly identical chromatogram profiles of the amphora's contents and of tar in areas relating to resin acids, similar values of peak areas of biomarker components, and the presence of turpentine oil components in the sample, it is highly probable that the amphora indeed contained tar.

Keywords: *Late Roman amphorae, Black Sea, tar, pitch, gas chromatography, mass spectrometry.*

Introduction

The routes of active maritime trade have long passed through the Black Sea. The remains of numerous shipwrecks provide a valuable source of information for analyzing economic interactions between coastal regions across various historical periods (Zelenko, 2008; Okorokov, 2016). The depths of the sea preserve archaeological evidence undisturbed, but its detailed study is very complicated. In 2006 and 2008, the remains of two ships were found off the coast of Crimea. One sank in the 9th–11th century near Sevastopol; the other one, in the 13th century near the village of Foros on the southern coast of Crimea (Vakhoneev, 2015). When examining the sites of these shipwrecks, no remains of contents were found in the amphorae. In 2015, an accumulation of amphorae (Günsenin, type IIb) from the 11th–12th centuries and fragments of wooden structures

of a ship that transported wine were discovered in the Black Sea near Balaklava (Sevastopol area), at a depth of 85.6 m (Ginkut, Lebedinsky, 2018).

Although shipwreck sites are more accessible for examination in the shallow coastal zone (Zelenko et al., 2016), these have been subjected to heavy hydrophysical and anthropogenic impact. Underwater finds are associated with eroded cultural layers in the flooded area or with the functioning of ports, harbors, and anchorages. The problems of using the bays of the Heracles Peninsula as harbors of Chersonesus, as well as quantitative assessment of the area of that ancient city and its agricultural surroundings absorbed by the sea, still remain controversial. In this regard, underwater archaeological evidence is of special importance, since it makes it possible to determine the dynamics of the sea's advance, and the intensity of the use of bays in different historical periods. Underwater finds from Kruglaya Bay include a large number of complete amphorae and tableware typical for anchorages and harbors of the Hellenistic period and the Middle Ages. Numerous fragments of amphorae of the 8th–9th centuries recovered from the bottom of the bay were similar to some finds from the Phanagoria harbor (Bukatov, Arzhanov, 2021), which suggests that a significant part of the water area of Kruglaya Bay was used as the Chersonesus harbor starting from the 4th century BC. Archaeological evidence from the bay area includes large fragments and archaeologically intact pieces of pottery (amphora containers) from the Hellenistic period and the Middle Ages, dated back to the time from the 4th century BC (Kadeev, 1964). Such finds usually come from ancient harbors and anchorages, where cargo damaged during transportation was thrown overboard (Bukatov, Bondarev, Dyuzhenko, 2020).

In addition to the types and contents of amphorae, ceramics (Morozova, Waksman, Zelenko, 2021) also serve as a source of information, and analysis of pottery indicates the centers of vessel production. Under favorable conditions, remains of amphora contents and traces of organic compounds on the vessel's surface can be well preserved in shallow water, which provides valuable information about the cargo transported. One of the most informative and sensitive methods is gas chromatography-mass spectrometry (GC/MS) (Bonaduce et al., 2016; Oudemans, Boon, 1991; Colombini, Modugno, 2009; Reber, 2018; Charrié-Duhaut et al., 2009; Pollard et al., 2007). This method was used for studying archaeological samples of organic origin from Kruglaya Bay.

This article presents the data about a fragment of a vessel discovered during underwater archaeological research in Kruglaya Bay, and the results of studying components of its contents.

Materials and methods

The contents of an amphora, a part of which was discovered in Kruglaya Bay in 2020 by the underwater expedition from the Tauric Chersonese Museum-Reserve directed by A.A. Bukatov, were the subject of research.

For identifying components of amphora contents, the following substances were used: natural pinewood tar (100 %) (OgneBioZashchita Company, Russia) produced by traditional dry distillation of wood where tar is collected continuously at furnace temperature of 155–450 °C; chloroform (99.8 %) (Sigma-Aldrich, USA), pyridine (99.5 %) (Supelco, USA), toluene (99.5 %) (Supelco), N,O-bis(trimethylsilyl)trifluoroacetamide or BSTFA (99.0 %) (Sigma-Aldrich), trimethylchlorosilane or TMCS (99.0 %) (Sigma-Aldrich), helium (99.9995 %), and nylon filter, i.d. 0.45 μm (Sartorius, Germany).

For gas chromatography-mass spectrometry (GC/MS) analysis, a Clarus 600 TMS chromatography-mass spectrometer (PerkinElmer, USA) with quadrupole mass analyzer and electron ionization (EI) mode was used. Chromatographic separation was carried out using an Rtx 5MS column (30 m × 0.25 mm, 0.25 df) (Restek, USA). Turbomass 5.4.2 software (PerkinElmer, USA) and the NIST library (2017) were used to control the unit, collect, and process data.

Samples for research were prepared in the following way:

using the *GC/MS method*, the contents of the amphora dissolved in chloroform were concentrated to 2 mg/ml;

using the *GC/MS TMS method (analysis of trimethylsilyl derivatives)*, about 10 mg of the sample was placed in a 2 ml vial, dissolved in 300 μl of pyridine; 300 μl of BSTFA and 30 μl of TMCS were added. The vial was kept at 60 °C for an hour, after which 400 μl of toluene was added and the contents were analyzed;

using the *GC/MS method (headspace analysis)*, about 1 g of the sample was placed into a 20 ml vial for headspace analysis. The vial was thermostated at 120 °C for 60 minutes.

The sample was analyzed by the *GC/MS method* under the following conditions: GC – initial temperature 60 °C, holding for 1 min, heating to 280 °C at a rate of 5 °C/min, holding for 5 min at 280 °C. Carrier gas (helium) flow was 1 ml/min. Injector temperature was 280 °C. The split ratio was 10 ml/min. Sample volume was 0.5 μl. MS electron ionization (70 eV, interface and ion source temperatures are 280 and 240 °C, respectively) scanning mode was total ion current (TIC) in the range of m/z 45–450. The NIST 2017 library was used to identify the mass spectra obtained.

Trimethylsilyl derivatives were analyzed by the *GC/MS TMS method* under the same GC conditions as

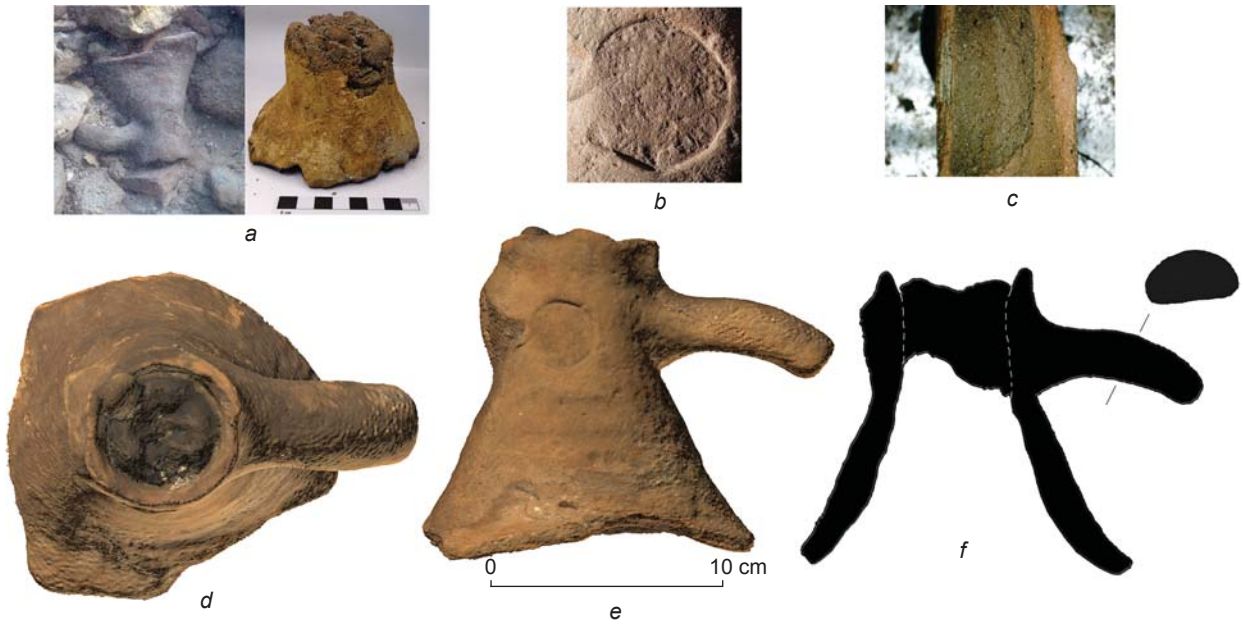


Fig. 1. Fragment of the upper part of the amphora *in situ* and its contents (*a*), stamp (*b*), fracture of the wall (*c*), top view (*d*), side view (*e*), cross-sectional view (*f*).

those used to analyze by the GC/MS. The split ratio was 50 ml/min, and m/z range was 45–550.

Headspace analysis by the *GC/MS method* was carried out under the same GC conditions as those used to analyze by GC/MS. Headspace injection volume was 250 µl, and m/z range was 45–400.

Discussion

A fragment of the upper part of an amphora filled with hard brown substance was discovered in the area of a rocky shoal during underwater research in Kruglaya Bay. The fragment lay with its neck down in a layer of bottom soil (Fig. 1, *a*). The surface of the amphora's contents, which weighed 340 g, was lumpy at the point of contact with water and had streaks. A round stamp about 30 mm in diameter, showing a full-face image of emperor's head with an inscription around, was on the neck of the vessel (Fig. 1, *b*). This imprint is one of 12 stamps* on amphorae (Opait, Diamanti, 2014) from excavations in Constantinople, Athens, on the Geronisos Island (off the northwestern coast of Cyprus), Alexandria, Selia, and Tokra. The stamp on the fragment of the amphora in question has been largely erased. Small details have not survived, and only the outlines of the emperor's image and some letters are visible. This stamp was identified immediately upon discovery of the amphora owing to specific marine conditions (the find lay in the bottom sediments in a water area protected from waves) and to the absence of biological growth on the surface of the shard. Based on the design of the letters and a number of distinctive features (location of the stamp, image details), this stamp was similar to stamps on the artifacts from Alexandria and the Geronisos Island (Ibid.). The inscription reads as follows: ✞*επί Πτολεμαίου επάρχου* ("✞under Ptolemy the Eparch"). The stamp was made by the office of *kommerkiarios*. On similar stamps, the Emperor is shown holding a scepter surmounted by a cross in his left hand and probably a *mappa* in his right hand. On the imprint on a vessel fragment from Kruglaya Bay, these elements of the image are almost illegible. Only the end of the cross on the scepter can be barely discerned. Most of the amphorae branded in this way belong to the LRA2/LRA13 type. Such vessels were made mainly in the areas adjacent to the Aegean Sea. The color of the clay in the shard (Fig. 1, *c*) varies from light red-brown and pink to red-orange (5YR 6/4, 6-7/4,6). Considering the stratigraphic position and archaeological context, two similar stamps on the amphorae, which were made and found in Alasarna on the Kos Island (Greece), were attributed to the last quarter of the 6th–first quarter of the 7th century (Ibid.).

The contents extracted from the amphora fragment were carefully analyzed to establish their chemical composition. The homogenized sample was a brown, solid, resinous substance with a distinctive smell of wood tar. The mass fraction of insoluble sediment after

*Such stamps on items are rare, which can be explained by their poor preservation due to the low relief of the image and weak imprint of the stamp.

dissolving the contents of the amphora in chloroform was 6.54 %. The ash content after burning the sample in a crucible was 5.37 %, which indicated that the contents of the amphora were organic and the dissolved sample was highly representative. The inorganic composition of the sample was not studied, because the contents of the amphora had been in contact with sea water.

After analyzing the sample by GC/MS, chromatograms 2–4 were obtained. A fragment of a TIC chromatogram of the sample dissolved in chloroform with concentration of ca 2 mg/ml indicated a low intensity (Fig. 2, *a*) of the peaks belonging to the components with a retention time up to 28 min, which made their reliable identification problematic. The results of identifying the main peaks in the range of 28–40 min are shown in Table 1 in accordance with an increase in their retention time (t_R). The broadened peak in Fig. 2, *a* with a retention time of 38.16 min was identified (with the probability of 65–75 %) as abietic acid (AA). Broadening of the peak resulted from low volatility of the analyte and/or presence of other related compounds that were not separated from this component under the given chromatographic conditions. Moreover, the sample could have contained other high-boiling components.

For increasing volatility of high-boiling components, TMS derivatives were prepared using BSTFA with the addition of 10 % TMCS. Fig. 2, *b* shows a fragment of the TIC chromatogram from 28.0 to 40.5 min of analysis after silylation of the test sample. The results of identifying the main peaks, shown in the order of their appearance on the chromatogram on Fig. 2, *b*, are provided in Table 1. The peaks of the TMS derivatives of dehydroabietic and abietic acids, as well as peaks of other tricyclic diterpenoid compounds, demonstrated the highest intensity in the chromatograms. Acids with abietane and pimaran skeletons are the main components of resins obtained from the coniferous plants. A large

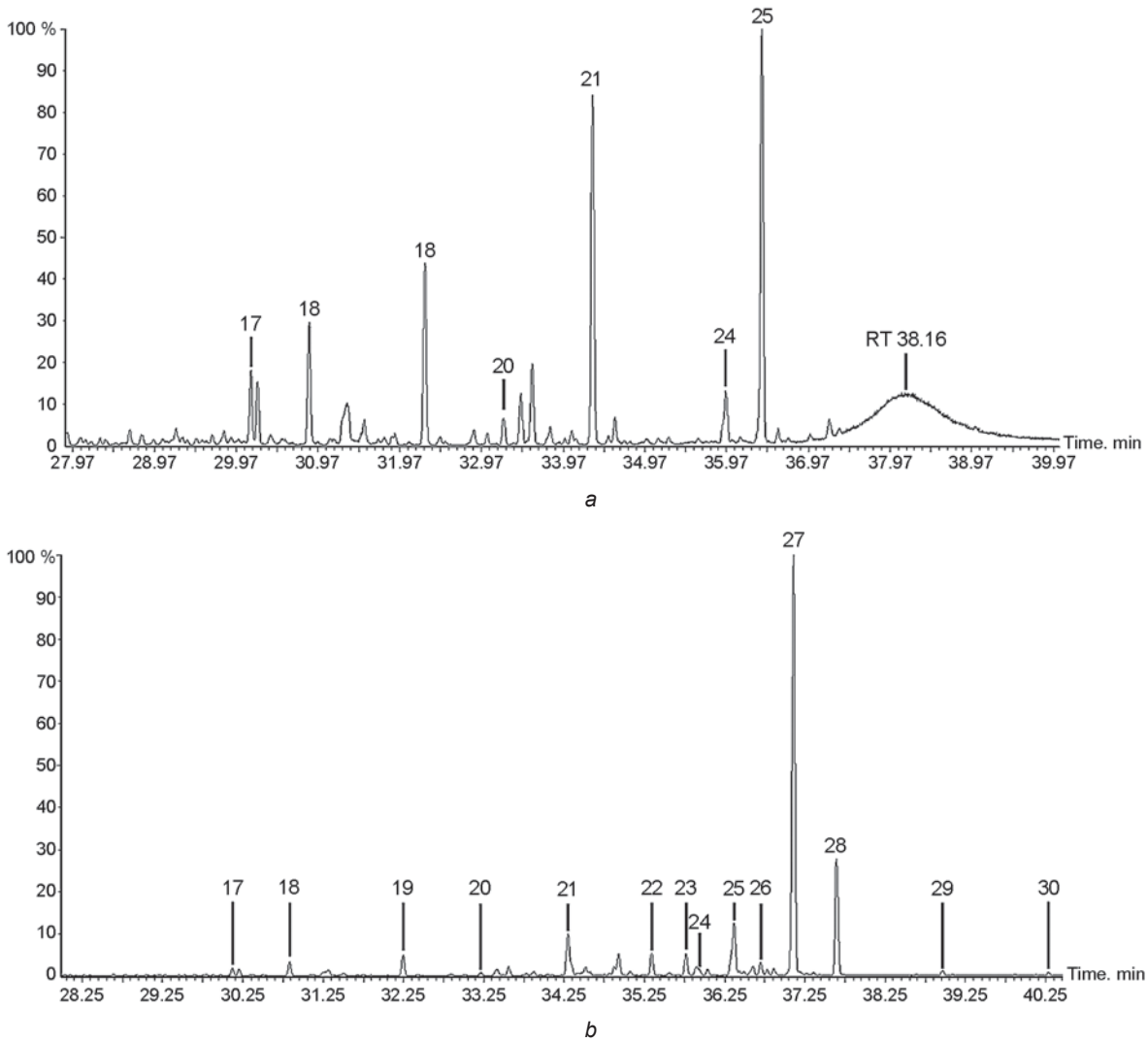
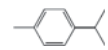
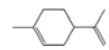
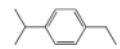
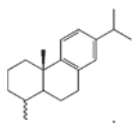
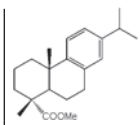
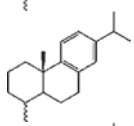
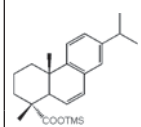
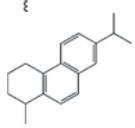
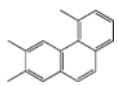
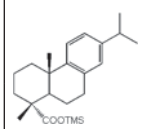
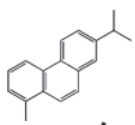
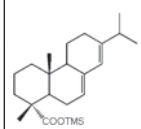
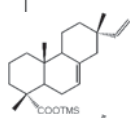
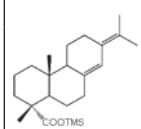
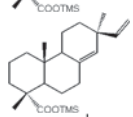
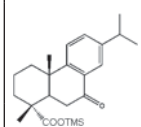
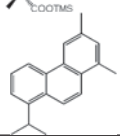


Fig. 2. Fragment of the TIC chromatogram of amphora contents (*a*) and amphora contents with BSTFA derivatization (*b*).

Table 1. **Results of identification of the main peaks**

Peak	t_R, min	Compound	Chemical structure	Matching degree	Peak	t_R, min	Compound	Chemical structure	Matching degree
Headspace analysis of amphora's contents by the GC/MS method									
1	2.57	2, 4-Heptadiene		931	10	5.69	Camphene		961
2	2.72	Toluene		918					
3	3.04	n-Octane		936	11	7.29	o/m-Cymene		962
4	3.40	1, 3-Dimethyl-1-cyclohexene		959	12	7.41	p-Cymene		953
5	4.09	m/p-Xylene		962	13	7.55	Limonene		947
6	4.49	o-Xylene		971	14	9.39	p-Ethylcumene		938
7	4.59	Nonane		942	15	9.90	Fenchol		854
8	5.11	Tricyclene		945	16	11.34	Borneol		879
9	5.33	α-Pinene		977					
Analysis of amphora's contents with and without derivatization by the GC/MS method									
17	30.15	18/19-Norabieta-8, 11, 13-triene*		859	25	36.40	Methyl dehydro-abietate		928
18	30.86	18/19-Norabieta-8, 11, 13-triene*		842	26	36.70	Didehydroabietic acid, TMS		(Colombini, Modugno, Ribechini, 2005; Otto, Simoneit, 2001)
19	32.28	10, 18-Bisnorabieta-5, 7, 9 (10), 11, 13-pentaene (1, 2, 3, 4-tetrahydroretene)		852					
20	33.25	2, 3, 5-Trimethylphenanthrene		809	27	37.11	Dehydroabietic acid, TMS		910
21	34.33	Retene		948	28	37.65	Abietic acid, TMS		896
22	35.34	Isopimaric acid, TMS		852	29	38.96	Neoabietic acid, TMS		(Max Planck Institute, (s.a.))
23	35.77	Pimaric acid, TMS		825	30	40.28	7-Oxo-dehydro abietic acid, TMS		805
24	35.96	8-Isopropyl-1,3-dimethylphenanthrene		872					

*Stereoisomeric compounds. Different procedures for data output of isomers on the column with (5% phenyl)-methylpolysiloxane are proposed in the studies by (Hamm, Bleton, Tchapla, 2004; Dimitrakoudi et al., 2011; Preusz et al., 2019; Stacey et al., 2010).

amount of dehydrobietic acid, and the presence of markers such as methyl ester of dehydroabietic acid, tetrahydrorethene, norabietatrienes, retene, and other phenanthrene derivatives in the sample, indicate that the contents of the amphora were a product of dry distillation of Pinaceae wood (Colombini, Modugno, Ribechini, 2005; Carpy, Marchand-Geneste, 2003; Izzo et al., 2013; Pollard, Heron, 1996; Mills, White, 1999; Hjulström, Isaksson, Hennius, 2006). The extremely low content of 7-oxo-dehydroabietic acid in the sample (the ratio of the peak areas of TMS derivatives of dehydroabietic acid (TMS-DA) and 7-oxo-dehydroabietic acid were ~140 : 1) and absence of 15-hydroxy-7-oxo-dehydroabietic acid, 15-hydroxy-dehydroabietic acid, and other oxidation products of dehydroabietic acid indicate a low degree of oxidation (Colombini, Modugno, 2009; Colombini, Modugno, Ribechini, 2005; Mezzatesta et al., 2021; Guo et al., 2021) and good preservation of the amphora's contents.

The general profile of the chromatogram in the area of resin acids (Fig. 2) was close to those of some archaeological samples (see, e.g., (Colombini, Modugno, Ribechini, 2005; Izzo et al., 2013)), but showed the greatest similarity with those of the modern samples of pine tar produced in classical furnaces (Egenberg et al., 2002).

Notably, products of dry distillation of wood are most often referred to as pitch or tar in archaeological literature. However, owing to their antiquity, poor preservation of samples, and many other reasons, they cannot be identified more accurately in most cases. In this article, just as in the study (Egenberg et al., 2002), the word "tar" denotes a sample in a liquid state at room temperature, and the word "pitch" denotes an almost solid sample at the same temperature.

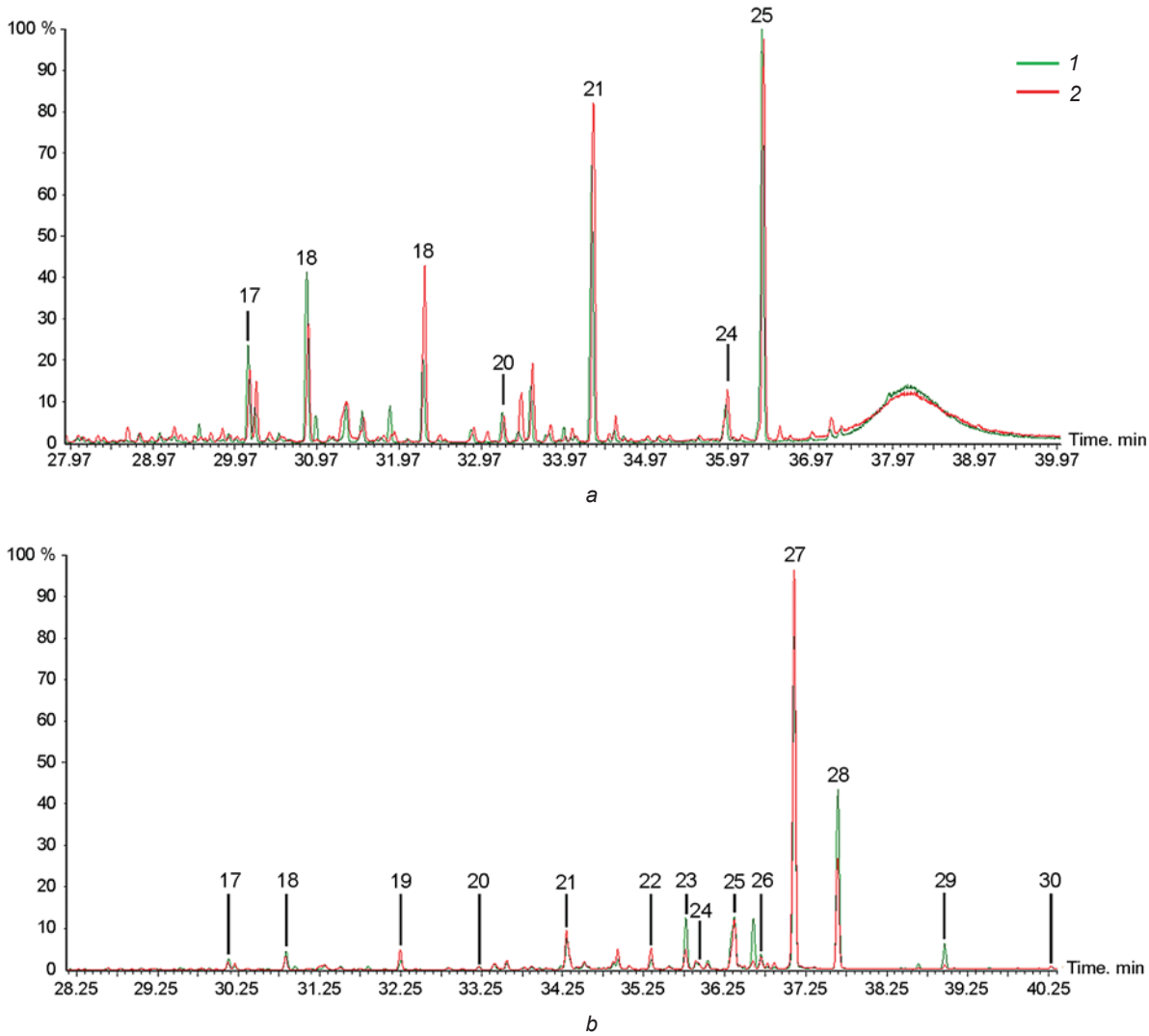


Fig. 3. Overlay of fragments of TIC chromatograms.
a – amphora contents (*1*) and modern wood tar (*2*) (sample concentration 2 mg/ml^{-1}); *b* – amphora contents with BSTFA derivatization (*1*) and modern wood tar with BSTFA derivatization (*2*) (sample concentration 10 mg/ml^{-1}).

Table 2. **Average values of peak areas, RSD, %**

Indicator	Amphora's contents	Modern wood tar	Areas ratio
Without derivatization, 2 mg/ml^{-1}			
Retene m/z 219	695,749 (2.99)	595,727 (3.2)	1.17
MDA m/z 239	1,116,129 (2.58)	1,207,031 (2.05)	0.92
With derivatization, 10 mg/ml^{-1}			
TMS-DA m/z 239	5,783,640 (5.14)	4,870,708 (2.44)	1.19
TMS-AA m/z 256	683,350 (5.94)	1,091,874 (2.29)	0.63

Note. Relative standard deviation is indicated in parenthesis, %.

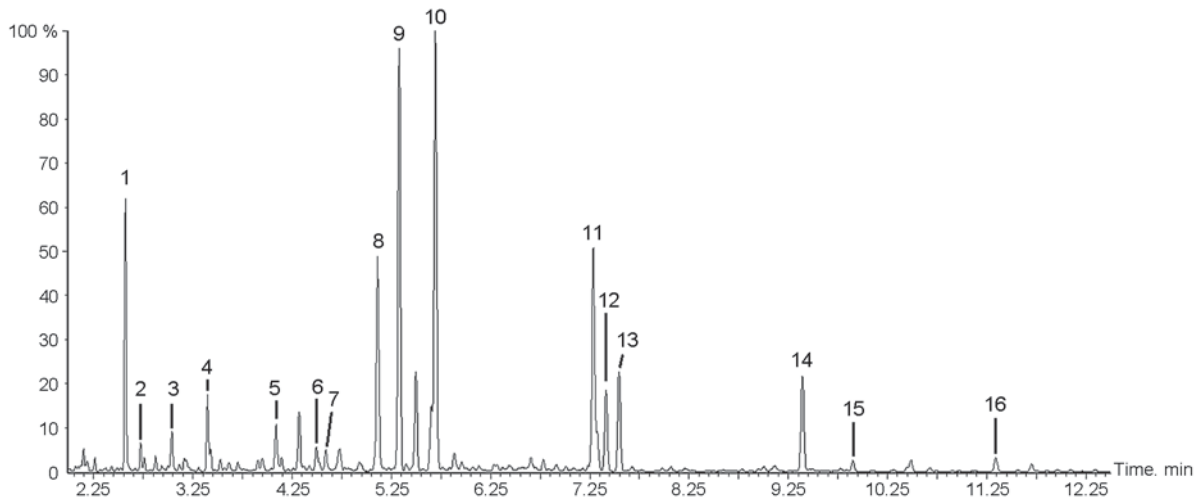


Fig. 4. Fragment of the TIC chromatogram obtained from headspace analysis of amphora contents using the GC/MS method.

To identify the nature of the sample in more detail, modern pine-tar obtained in the traditional way was compared with the contents of the amphora. Superposition of chromatograms obtained from solutions of the same concentration of amphora contents and modern tar without (Fig. 3, *a*) and with derivatization (Fig. 3, *b*) revealed identical general profiles. Table 2 shows a comparison of average peak areas of main ions belonging to key markers in the contents of the amphora and modern wood tar with and without derivatization. Average values (n=3) of peak areas for the main ions in retene, dehydroabietic acid methyl ester (MDA), and TMS derivatives of dehydroabietic acid (TMS-DA) and abietic acid (TMS-AA) were obtained by analyzing solutions of samples taken from the contents of the amphora and modern wood tar of the same concentration. Similar peak areas of retene, dehydroabietic acid methyl ester, and the TMS derivative of dehydroabietic acid in the contents of the amphora and modern tar suggest similar conditions for their production.

As was mentioned above, the peaks of highly volatile components (up to 28 min) had low intensity. For their reliable identification, headspace analysis, increasing the sensitivity of the method, was carried out under the same chromatographic conditions (column, carrier-gas flow, and thermostat temperature program) as analysis of the liquid phase by direct injection (of the dissolved samples). The fragment of the chromatogram (from 3 to 12.5 min) of headspace analysis of the amphora's contents suggests the presence of volatile components α-pinene, camphor, limonene, cymene, etc., which are components of turpentine oil, in the sample (Fig. 4) (Evans W.C., Evans D., 2009). This also serves as additional evidence of the good preservation of the amphora's contents. The modern wood tar sample also contained most of the volatile components provided in Table 1. However, from our point of view, it did not make sense to compare chromatogram profiles in the area of highly volatile components, owing to old age of the amphora's contents and their contact with water.

Conclusions

The almost identical profiles of chromatograms showing the contents of the amphora and modern wood tar in the area of resin acids, similar peak areas of components that serve as biomarkers, and the presence of turpentine oil components in the sample suggest, with a high degree of probability, that the amphora contained wood tar rather than pitch. Wood tar was widely used by ancient sailors for treating ropes and elements of wooden ship structures. Amphorae stamped in this way might have been intended for transporting olive oil or wine. Judging by its contents, the vessel under study had been reused. The examined stamped Late Roman amphora with remains of wood tar is the only one with such content among those discovered in the Northern Black Sea region. Until now, no traces of contents have been identified in containers of this type, owing to their significant fragmentation. Information on the place where the amphora fragment was discovered is important for reconstructing the outlines of the shores of the ancient bay. Considering the occurrence of the find under discussion, it can be assumed that the amphora with wood tar belonged to a ship that visited one of the harbors of Chersonesus, located in the present-day Kruglaya Bay in the last quarter of the 6th–first quarter of the 7th century.

Acknowledgments

This study was carried out in the "Tauric Chersonese" State Museum-Reserve and the Center for Collective Use "Analytical Center of St. Petersburg State Chemical and Pharmaceutical University", supported by Grant 075-15-2021-685 26/07/2021, as well as under the "Priority 2030" Program of Sevastopol State University (Strategic Project No. 3).

References

Bonaduce I., Ribechini E., Modugno F., Colombini M.P. 2016

Analytical approaches based on gas chromatography mass spectrometry (GC/MS) to study organic materials in artworks and archaeological objects. *Topics in Current Chemistry,* No. 374 (1): 6.

Bukatov A.A., Arzhanov A.Y. 2021

Srednevekoviye amfory iz podvodnykh razvedok v bukhte Kruglaya v 2020 g. In *Istoricheskiye, kulturniye, mezhnatsionalniye, religiozniye i politicheskiye svyazi Kryma so Sredizemnomorskim regionom i stranami Vostoka*. Moscow: Inst. vostokovedeniya RAN, pp. 55–57.

Bukatov A.A., Bondarev I.P., Dyuzhenko T.V. 2020

K voprosu o sushchestvovanii gavani Khersonesa v bukhte Kruglaya. *Khersonesskiy sbornik*. No. 21: 7–16.

Carpy A.J., Marchand-Geneste N. 2003

Theoretical study of the thermal degradation pathways of abietane skeleton diterpenoids: Aromatization to retene. *Journal of Molecular Structure: Theochem*. No. 635: 55–82.

Charrié-Duhaut A., Burger P., Maurer J., Connan J., Albrecht P. 2009

Molecular and isotopic archaeology: Top grade tools to investigate organic archaeological materials. *Comptes Rendus Chimie*, No. 12: 1140–1153.

Colombini M.P., Modugno F. 2009

Organic mass spectrometry in art and archaeology. Chichester: Wiley & Sons.

Colombini M.P., Modugno F., Ribechini E. 2005

Direct exposure electron ionization mass spectrometry and gas chromatography/mass spectrometry techniques to study organic coatings on archaeological amphorae. *Journal of Mass Spectrometry*, No. 40: 675–687.

Dimitrakoudi E.A., Mitkidou S.A., Urem-Kotsou D., Kotsakis K., Stephanidou-Stephanatoud J., Stratis J.A. 2011

Characterization by gas chromatography–mass spectrometry of diterpenoid resinous materials in Roman-age amphorae from northern Greece. *European Journal of Mass Spectrometry*, No. 17: 581–591.

Egenberg I.M., Aasen J.A.B., Holtekjølen A.K., Lundanes E. 2002

Characterisation of traditionally kiln produced pine tar by gas chromatography-mass spectrometry. *Journal of Analytical and Applied Pyrolysis*, No. 62: 143–155.

Evans W.C., Evans D. 2009

Volatile oils and resins. In *Trease and Evans' Pharmacognosy*. 6th edition. London: Baillière Tindall, pp. 263–303.

Ginkut N.V., Lebedinsky V.V. 2018

"Vorotnichkoviye amfory" tipa Gunsenin II s zatonuvshego bliz Balaklavy vizantiyskogo korablya. *Antichnaya drevnost i Sredniye veka*, No. 46: 151–165.

Guo L., Zhang Y., Wang L., Zhao X., Yang F., Peng M., Guo J., Li K., Wang X. 2021

A multi-analytical approach for the identification of the natural resin from the Ming tomb in Shaanxi, China. *Heritage Science*, No. 9: 109.

Günsenin N. 2018

La typologie des amphores Günsenin. Une mise au point nouvelle. *Anatolia Antiqua*, No. XXVI: 89–124.

Hamm S., Bleton J., Tchapla A. 2004

Headspace solid phase microextraction for screening for the presence of resins in Egyptian archaeological samples. *Journal of Separation Science*, No. 27: 235–243.

Hjulström B., Isaksson S., Hennius A. 2006

Organic geochemical evidence for pine tar production in Middle Eastern Sweden during the Roman Iron Age. *Journal of Archaeological Science*, No. 33: 283–294.

Izzo F.C., Zendri E., Bernardi A., Balliana E., Sgobbi M. 2013

The study of pitch via gas chromatography-mass spectrometry and Fourier- transformed infrared spectroscopy: The case of the Roman amphoras from Monte Poro, Calabria (Italy). *Journal of Archaeological Science*, No. 40: 595–600.

Kadeev V.I. 1964
Otchet o podvodnykh issledovaniyakh v Portovom rayone. 1964 g. Nauchno-arkhivniy otdel gosudarstvennogo muzeya-zapovednika "Khersones Tavricheskiy". F. 1, D. 1160, 1161.

Max Planck Institute of Molecular Plant Physiology, Department of Molecular Plant Physiology. (s.a.)
http://gmd.mpimp-golm.mpg.de/Spectrums/a237ab3f-39fd-4ce5-a3b4-e2cb4637bebc.aspx

Mezzatesta E., Perraud A., Vieillescazes C., Mathe C. 2021
GC-MS and PCA analyses of diterpenoids degradation state in 21 human mummies of Ancient Egypt dating from New Kingdom to Graeco-Roman Period. *Journal of Cultural Heritage*, No. 47: 43–49.

Mills J.S., White R. 1999
The Organic Chemistry of Museum Objects. London: Butterworth Heinemann.

Morozova Y., Waksman S.Y., Zelenko S. 2021
Byzantine amphorae of the 10th–13th centuries from the Novy Svet shipwrecks, Crimea, the Black Sea. In *Multidisciplinary Approaches to Food and Foodways in the Medieval Eastern Mediterranean*. Lyon: Maison de l'Orient et de la Méditerranée, pp. 429–446.

Okorokov A.V. 2016
Svod obyektov podvodnogo kulturnogo naslediya Rossii. Pt. 1: Chernoye i Azovskoye morya. Moscow: Inst. naslediya.

Opait A., Diamanti C. 2014
Imperial stamps on Early Byzantine amphoras – the Athenian Agora examples. *Rei Cretariae Romanae Fautores*, No. 43: 55–61.

Otto A., Simoneit B.R.T. 2001
Chemosystematics and diagenesis of terpenoids in fossil conifer species and sediment from the Eocene Zeitz formation, Saxony, Germany. *Geochimica et Cosmochimica Acta*, No. 65: 3505–3527.

Oudemans T.F.M., Boon J.J. 1991
Molecular archaeology: Analysis of charred (food) remains from prehistoric pottery by pyrolysis – gas chromatography/mass spectrometry. *Journal of Analytical and Applied Pyrolysis*, No. 20: 197–227.

Pollard A.M., Batt C., Stern B., Young S. 2007
Mass spectrometry. In *Analytical Chemistry in Archaeology*. Cambridge: Cambridge Univ. Press, pp. 160–194.

Pollard A.M., Heron C. 1996
Archaeological Chemistry. Cambridge: Royal Society of Chemistry.

Preusz M., Tříska J., Vrchotová N., Vilímek J., Enei F., Preusz K. 2019
Chemical profile of organic residues from ancient amphoras found in Pyrgi and Castrum Novum, Tyrrhenian Sea (Italy). *Journal of Archaeological Science: Reports*, No. 24: 565–573.

Reber E.A. 2018
Gas chromatography-mass spectrometry (GC-MS): Applications in archaeology. In *Encyclopedia of Global Archaeology*. Cham: Springer, pp. 1–17.

Stacey R., Cartwright C., Tanimoto S., Villing A. 2010
Coatings and contents: Investigations of residues on four fragmentary sixth-century BC vessels from Naukratis (Egypt). *British Museum Technical Research Bulletin*, No. 4: 19–26.

Vakhoneev V.V. 2015
"Khersones A" i "Forosskiy vizantiets" – glubokovodniye srednevekoviye korablekrusheniya v akvatorii Kryma. *Voprosy podvodnoy arkheologii*, No. 6: 15–35.

Zelenko S.M. 2008
Podvodnaya arkheologiya Kryma. Kiev: Stilos.

Zelenko S.M., Lebedinsky V.V., Kuzminov V.V., Novitskaya R.S., Tsarenko S.A., Morozova Y.I., Pronina Y.A. 2016
Podvodno-arkheologicheskiye issledovaniya v Yugo-Vostochnom Krymu v 2014 g. Sudakskiye arkheologicheskiye ekspeditsii. Feodosiya: Art-Laif.

Received May 26, 2022.
Received in revised form July 28, 2022.

doi:10.17746/1563-0110.2023.51.4.114-118

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Shift of the Yenisei and Abakan Beds as Reasons for Constructing the Second Abakan Fort in 1707

The study explores the reasons behind the relocation of the construction site for Fort Abakan from the mouth of the Abakan River, as initially planned, to the right bank of the Yenisei River, between two mountains, Unyuk and Turan. The shift of sand ridges, damming these rivers and changing their beds, is examined, and the locations of the projected forts are described. Written sources suggest that the Abakan and Yenisei beds as related systems changed their positions simultaneously, likely between 1691 and 1697 and definitely no earlier than 700–400 BC. Modern hydrological data suggest that processes that occurred in the region in the Early Modern Age were essentially like those that occurred in the Early Iron Age. The earlier date of the Abakan bed's change is evidenced by the destruction of the 1st millennium BC Tagar sites near Sartykov village on the Abakan. At present, the Yenisei makes an abrupt eastward turn in that place, following the general direction of rivers in the region. D.A. Klements's idea that after leaving the Western Sayan canyon, the Yenisei had flowed westwards is rejected. The change of location for the prospective fort was caused by the evolution of riverine systems of Western Siberia, specifically by the shift in the Abakan bed.

Keywords: *Yenisei Region, 18th century, second Abakan and Sayan forts, construction locations, unsuitability of projected locations, relocation of construction sites, hydrological factors.*

Introduction

The Russian expansion to Siberia, particularly in the 18th century, implied the construction of a wide network of defensive facilities owing to the presence of external and internal military threats. On the territory of the Yenisei region during Peter the Great's reign, the second Abakan fort (1707, the first was built in 1675, but quickly ceased to exist, probably destroyed by the Yenisei Kyrgyz) and Sayan fort (1718) were built (Fisher, 1774; Kozmin, 1916, 1925; Kopkoev, 1959; Arzymatov, 1966; Istoriya Khakasii…, 1993: 192, 193, 195; Abdykalykov, Butanaev, 1995; Kyzlasov, 1996; Chertykov, 2007: 220, 221; Butanaev, 2007). The practice of Russian defense architecture, before the start of construction of a specific object, involved a search for the most suitable location. The search consisted of collecting information from all possible sources, including the results of field exploration routes and interviews with knowledgeable people. For example, even before the decision was made to create the second Abakan fort, the Krasnoyarsk Governor (*voivode*) pantler Lev Mironovich Poskochin by 1691 had collected the information about suitable places for the future fort on the Abakan River. In his conclusion, the voivode noted the availability of places for building a fort, where it was possible to settle 400 or more service people and many peasants; with large pine forests, arable lands, meadows, and good hunting and fishing grounds. Poskochin's message notes that the geographical reference was the "Rock"—the ridge of the Western Sayan, located near the Abakan River of that time (Chertykov, 2007: 221).

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However, according to the testimony given by Tomsk, Krasnoyarsk, and Kuznetsk servicemen in the Sibirsky Prikaz in 1697, there were no good conditions for putting a fort on the Abakan River: there were no pine forests, nor hunting grounds, nor arable lands, and the soil was sandy (Ibid.) and pebble. There was no mention of the location of the Western Sayan ridge near the site of the proposed construction of the second Abakan fort. In the same year, this information was confirmed by other Krasnoyarsk servicemen in the Sibirsky Prikaz, as well as by two local "Tatars" who believed that the fort should be built, not on the Abakan River, but at the mouth of the Tuba River—half a day's journey downstream from the mouth of Abakan at that time (Ibid.: 222).

Despite everything, a final government decision was made to create the second Abakan fort on the eponymous river; and a team of builders, staffed by servicemen from Krasnoyarsk, Yeniseisk, Tomsk, and Kuznetsk, headed to the mouth of the Abakan in July 1707. The construction managers who arrived at the intended site sent a reconnaissance group up the Abakan and, on the basis of the data received from it, concluded that the area at the mouth and further upstream really did not meet the accepted requirements for placing a fort. There were many swampy areas, and an insufficient amount of construction timber or other forest lands (a small pine forest existed only on Tagarsky Island, on the right bank of the Yenisei), opposite Mount Samokhval. There were no conditions for arable farming and, consequently, for resettlement of peasants, because the turf layer over the pebble and sandy bottom was weak, which did not allow plowing (the land around the mouth of the Abakan is not plowed today, either). As a result, the fort was built on the right bank of the Yenisei, 70 km downstream the mouth of Abakan, between the Unyuk and Turan mountains. The fort was named, as planned, Abakan (Ibid.: 222).

Fort Sayan was also not built at the place indicated in the assignment, but 7–8 versts downstream the Yenisei, where the river flowed out of the Western Sayan canyon. The new site differed from the one "marked" for construction (now it is the southern part of the town of Sayanogorsk), which was narrow, squeezed by the river and the edge of the Yenisei canyon, and also poorly protected from floods, since it was located on a rather low bank. At the new site, the normal height of the bank above the water's edge was ca 9 m. On both banks of the Yenisei River between the modern villages of Novoyeniseika (Beysky District of the Republic of Khakassia) and Ochury (Altaisky District), there are large tracts of pine forest. On the right bank of the Yenisei, near the Shunery village (Shushensky District of the Krasnoyarsk Territory), there are vast fields with rich chernozems, fully suitable for arable farming, as well as a large pine forest. Notably, from the territory of Fort Sayan, although only over a limited area, it was possible to monitor the entire channel of the Yenisei; this is a very important point in terms of fortification.

In connection with the above, the question arises why the area around Abakan in the message of the voivode Poskochin was assessed as suitable for building a fort, although according to the testimony of service people, was unsuitable for this task. The purpose of this article is to identify the reasons for the relocation of the construction of the second Abakan fort.

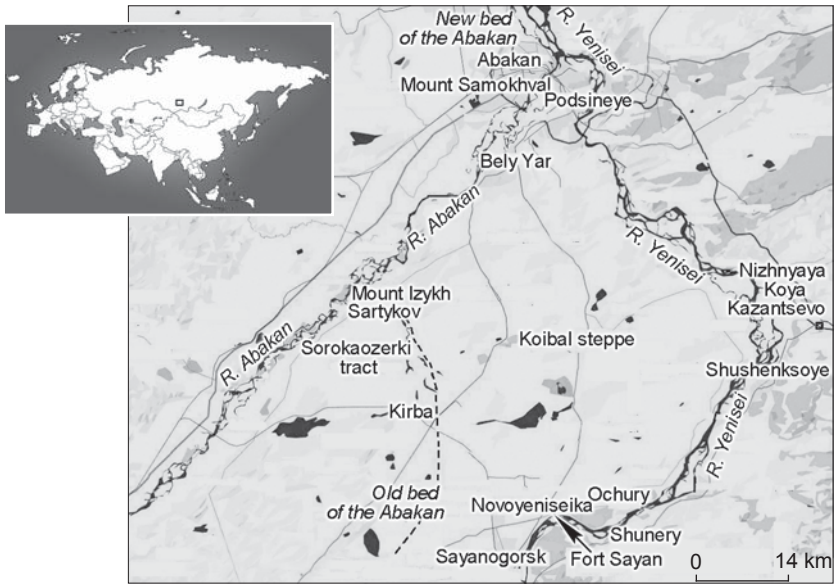
Study results and discussion

Both forts—the second Abakan and Sayan—were located on the right bank of the Yenisei, as was stipulated in the construction assignments. Both also have in common the fact that the fortifications were erected in places other than those initially planned, a circumstance quite rare in the history of Russian fortification of Siberia in the 18th century (Pamyatniki…, 1882: Doc. No. 78, p. 313).

As for the second Abakan fort, the discrepancy in assessments of supposedly the same area in which the fort was planned to be built can be explained if we assume that between 1691 and 1697, the beds of the Abakan and Yenisei rivers changed. Voivode Poskochin's informants inspected the area near the old stream, at the foot of the Western Sayan. His descriptions correspond to the modern natural situation, for example, the presence of a dry pebble bed and traces of river backwaters near the Ochury village. However, the builders of the second Abakan fort observed the mouth of the Abakan already in a new place (where the city of the same name now stands), which was recognized in 1707 as unsuitable for the construction of a fortified settlement.

D.A. Klements was the first to consider this problem (Kozmin, 1916: 35–64). He suggested that the Yenisei changed its bed below the Oznachennaya village, which existed at that time, at the exit from the Western Sayan canyon, having made a turn to the west in the steppe. The floor for the Yenisei River was the supposedly modern bed of Abakan in the area from the village of Sartykov (Altaisky District of the Republic of Khakassia), slightly above Mount Izykh. Unfortunately, this scholar did not indicate the time of this event.

There is the following objection to this version: at present, there is no natural gravity flow of the Yenisei to the north and west directly when it leaves the Western Sayan, since both banks are high and steep here, oriented to the east. Therefore, for example, irrigation systems in the Koibal steppe, which operated during Soviet times, were filled with water from the Yenisei only with the help of powerful pumps. The fact that today the Yenisei, from its exit from the Sayan ridge, flows in the eastern and even southeastern directions, but not in the western, also needs to be explained.



Modern map of the research region.

According to V.K. Chertykov, the Abakan River near Mount Izykh was making a turn and was flowing into the Yenisei near the village of Oznachennaya in the period of 1691–1697 (2007: 231). However, this assumption does not take into account the mainly northward direction of water flows in the region, or the fact that Oznachennaya is located far south of Mount Izykh.

The lower date of the shift of the Abakan bed can be established by such an indirect sign as the erosion by the river of Mount Izykh, where several archaeological sites of the Early Iron Age were partially destroyed by water (their remains were studied in 2022 by the archaeological team of the Katanov Khakass State University, with the participation of the author). Considering this, it can be assumed that the destruction of the foot of Mount Izykh occurred no earlier than the 5th–7th centuries BC and no later than the end of the 17th century AD.

Importantly, the author had chances to visit this place in 1985 and 2022. During the first visit, it was recorded that the fast rushing water of Abakan was in direct contact with the foot of the mountain, beating forcefully against the rocks; during the second visit, the river bed significantly (up to 100 m) retreated into in the northern direction, and on the drained part of the floodplain, where high water used to flow in the past, 30-year-old trees now grew. Hence, today, there is no immediate threat of erosion of the riverbank near the Sartykov village, with the archaeological sites located here, but the possibility of their destruction by rain and spring freshet remains.

The most noticeable traces of the former bed of the Abakan—a flat swampy area—remained in the large Sorokaozerki tract in the interfluve of the Yenisei and Abakan, in the center of the Koibal steppe, near the village of Kirba (Beysky District of the Republic of Khakassia) (Urochishche Sorokaozerki… (s.a.)). These are “chains” and individual small lakes (Adaikol, Berezovskoye, Bugaevo, Zhuravlinoye, Zalivnoye, Kochkovskoye, Krasnoye, Moyrykhkol, Okelkol, Podgornoye, Ptichye, Sabinskoye, Sobachye, Sosnovoye, Stolbovoye, Chalpan, Chernoye, etc.), usually of elongated in shape, oriented almost along the N–S line, with deviations to the NW and NE. Most of them are located north of the village of Kirba.

Changes in the Abakan bed can be reconstructed as follows. After reaching the plain, the river flowed east along the Western Sayan ridge (“Rock”) to the point where the Yenisei exits the Western Sayan canyon. It was this area that was mentioned in the documents as “Rock” (the Western Sayan ridge), as well as favorable conditions for the settlement of peasants, possibility of farming, etc. However, later, as a result of hydrological processes, the Abakan runoff rushed in a northern direction, through the future Sorokaozerki tract, to a place further up the foot of Mount Izykh. The Yenisei River, after leaving the Western Sayan canyon, passing, as noted, to the NE, then to the E, and near the Shunery village again to the NE, created a long bow facing far to the E from the place where the river exits the canyon, with a maximum distance at the villages of Kazantsevo and Shushenskoye (Shushensky District of the Krasnoyarsk Territory); then, the river flowed in a northwestern direction, receiving the largest left tributary, the Abakan River, higher up Mount Samokhval. In connection with the version proposed by Klements, it is important to note that the flow of the Yenisei in a western direction is unlikely owing to the presence of high banks here; in addition, the Yenisei and Abakan rivers generally move in the eastern and northeastern directions.

The author's assumption is consistent with the evolution of river systems in Western Siberia. This is a former seabed, with a flat topography. Therefore, riverbeds are unstable. They "wandered" along the leveled swampy surface, adapting to the mesorelief and the general slope to the north. This is typical of the Yenisei and Abakan also today (Maloletko, 2008: 110). The most mobile was the mouth of Abakan. At present, at the place of its modern confluence with the Yenisei, its width can be traced over a stretch of almost 30 km (Popov, 1977: 17).

When leaving the mountains, many rivers usually form braided beds (Maloletko, 2008: 127). The Abakan bed is composed of a loose substrate—fine sand and sandy loam, i.e. young sediments; consequently, the surfaces of such sediments could be easily eroded, and the water flow could quickly reshape the channels, including the main ones. This was facilitated by the fact that on the plain the Abakan was flooded to a great depth, and thus significant current speeds were created (Popov, 1977: 50), which was noted by the author on the riverbed section near the Sartykov village.

On the Abakan, large sand ridges, moving along the main bed of the river, occasionally blocked the entrances and exits from the secondary channels into the main stream. The river had multiple arms, and constant redistributions of water and sediment flows between the main stream and secondary channels were continuously rebuilding them (Ibid.: 127–128). Probably, this was what happened on the Abakan in 1691–1697, when informants of the voivode Poskochin examined the area near its old riverbed, at the foot of the Western Sayan.

It can be assumed that owing to a large amount of sediment brought by the Abakan from the west to the Yenisei, and the formation of large sand ridges, the Yenisei's bed was blocked, and the Abakan turned northwards, towards the modern Sorokaozerki tract, with the consequent underwashing of Mount Izykh. This was also the case in the 20th century. A significant number of the ridges have been preserved along the right bank of the Abakan; currently these are preserved in the Peski tract, in the form of river terraces from young sediments near the villages of Matkichik, Ust-Tabat, Koibaly, and Burek sands (all in the Beysky District of Khakassia), as well as sands on Mount Izykh near the village of Sartykov, etc. Remains of sand ridges also occur along the Yenisei, for example, near the villages of Shunery and Nizhnyaya Koya (Shushensky District, Krasnoyarsk Territory), Novoyeniseyka (Beysky District of the Republic of Khakassia), and others. For this reason, in 1936, the flood led to a shift of the Abakan bed within the city, and began to flow into the Yenisei—not upstream Mount Samokhval as before (in the area of the modern poultry farm near the Podsineye village), but downstream of it. A powerful flood in the Abakan city occurred in 1969. In 2011, because of the shift in the Abakan bed, the span of a railway bridge collapsed in the Askizsky District of the Republic. In 2023, another change in the Abakan riverbed occurred: the stream moved and approached boom No. 8 of the South Dam in Abakan.

Conclusions

Thus, on the basis of all the available information, we should conclude that there were several reasons for the relocation of the construction sites of the above forts.

In general, the builders of both forts made the right decisions, having refused to erect fortifications either at the mouth of the Abakan of that time or at the designated place on the Yenisei. Credit must be given to the construction leaders of both objects—the Krasnoyarsk boyar's son Konon Samsonov and the Tomsk boyar's son Ilya Tsytsurin (the second Abakan fort), as well as the Krasnoyarsk nobleman Ilya Nashivoshnikov (Fort Sayan), who took responsibility for such important decisions, which had a positive effect on the Russian development of the region, including the creation at a later time of a "chain" of outposts in the south of the Yenisei region. This is also confirmed by the history of the development of the territory of the modern city of Abakan. Already from the beginning of its construction in the 1930s, there were frequent floods. The two most significant of them, being the result of the movement of large sand ridges, took place in 1936 and 1969. However, in the area of Fort Sayan, this did not happen. Even before the construction of the Sayano-Shushenskaya hydroelectric-power station on the Yenisei, according to residents, the water during floods did not reach the territory of the fort, nor the church located on a small hill outside the fort. This means that the sites for the construction of these two objects of Russian fortification of the 18th century, unauthorizedly relocated against the initial plan, were quite well chosen.

Acknowledgement

The study was carried out under the State Assignment of the Ministry of Science and Higher Education of the Russian Federation for scientific work (Project No. FSUS-2020-0021).

References

Abdykalykov A., Butanaev V.Y. 1995
Materialy po istorii Khakasii XVII – nachala XVIII v. Abakan: Izd. Khak. Gos. Univ. im. N.F. Katanova.

Arzymatov A. 1966
Iz istorii politicheskikh otnosheniy yeniseiskikh kirgizov s Rossiyey v XVII–pervoy polovine XVIII v. Frunze: Kyrgyzstan.

Butanaev V.Y. 2007
Istoriya vkhozhdeniya Khakasii (Khongoraya) v sostav Rossii. Abakan: Izd. Khak. Gos. Univ. im. N.F. Katanova.

Chertykov V.K. 2007
Khakasiya v XVII – nachale XVIII veka i yeyo vzaimo-otnosheniya s Rossiyey i gosudarstvami Tsentralnoy Azii. Abakan: Khak. kn. izd.

Fisher I.E. 1774
Sibirskaya istoriya s samogo otkrytiya Sibiri do zavoyevaniya sey zemli rossiyskim oruzhiyem. St. Petersburg: Imp. Akad. nauk.

Istoriya Khakasii s drevneishikh vremen do 1917 goda. 1993
Moscow: Vost. lit.

Kopkoev K.G. 1959
Dobrovolnoye prisoyedineniye Khakasii k Rossii. In *250 let s velikim russkim narodom*. Abakan: Krasnoyar. kn. izd., Khakas. otd., pp. 19–37.

Kozmin N.N. 1916
D.A. Klements i istoriko-etnograficheskiye issledovaniya v Minusinskom kraye. *Izvestiya VSOIRGO*, vol. 45: 35–64.

Kozmin N.N. 1925
Khakasy. Istoriko-etnograficheskiy i khozyaistvenniy ocherk Minusinskogo kraya. Irkutsk: Izd. Irkut. sektsii nauchnykh rabotnikov.

Kyzlasov L.R. 1996
O prisoyedinenii Khakasii k Rossii. Abakan, Moscow: Izd. Khak. Gos. Univ. im. N.F. Katanova.

Maloletko A.M. 2008
Evolyutsiya rechnykh sistem Zapadnoy Sibiri v mezozoye i kainozoye. Tomsk: Tom. Gos. Univ.

Pamyatniki Sibirskoy istorii XVIII veka. 1882
Bk. 1: 1700–1713. St. Petersburg: [Tip. MVD].

Popov I.V. 1977
Zagadki rechnogo rusla. Leningrad: Gidrometeoizdat.

Urochishche Sorokaozerki (No. 0601637). (s.a.)
Reyestr zaregistrirovannykh v Gosudarstvennom kataloge geograficheskikh nazvaniy obyektov (*A* – avtomatizirovanniy) na 16.12.2022. Respublika Khakasiya N-46-087 53°23’ 91°11’.

Received March 13, 2023.
Received in revised form April 13, 2023.

doi:10.17746/1563-0110.2023.51.4.119-125

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Corvids in the Buryat Traditional Worldview

Using a structural-semiotic approach together with a comparative historical one, and based on ethnographic, lexical, and folklore sources, this study focuses on the raven and the crow as characters in Buryat mythology. Buryat terms for these birds are of Mongolian origin. Folk beliefs concerning the raven are more elaborate than those concerning the crow. The image of the raven is ambiguous, whereas the crow is an unambiguously negative character. The analysis of vocabulary and of the minor genres of folklore shows that Buryats paid attention to the various zoological features of these birds: plumage color and voice in the crow; plumage color, size, beak, flight duration, collectivism, emotionality in expressing joy and greed in the raven. The essence of both birds of prey was believed to be impure. The raven symbolized heaven, spring, vigilance, war, masculinity, and rancor. Being intelligent and independent, the raven was the Buddhist deity's aide. Unlike the crow, the raven was patronized by evil spirits and other demonic characters. The crow was a feminine character, a symbol of sky, winter, water, bloodlust, and rumor. Both birds were associated with shape-shifting. The Buryat views, then, combined specifically ethnic and universal ideas about corvids.

Keywords: *Buryats, traditional worldview, shamanism, Buddhism, ravens and crows, folklore.*

Introduction

Corvids play a special role among ornithomorphic imagery in the mythology of the peoples of the world. Ravens and crows have been associated with a wide range of functions, different habitation realms, celestial bodies, and deep meanings (Mify…, 1980: 202, 839). The image of the raven is the most distinctive. Among some ethnic groups (several Paleo-Asian peoples of Northeast Asia and North American Indians), this bird was revered as a totem and acted as a demiurge or cultural hero.

Both *Corvidae* species are a part of the Buryat gallery of zoomorphic images, but these have not yet been discussed in Buryat ethnography. This article analyzes images of ravens and crows in the traditional beliefs, of the Buryats with to establish their symbolism and meanings in a comparative context.

Origins of the Buryat names for crows and ravens

The wild fauna of the Baikal region includes ravens, primarily common ravens (*Corvus corax subcorax*). In addition, this region is inhabited by black crows (*Corvus corone*), which also belong to this biological genus. In Buryat vocabulary, the raven is designated as *khiree*, and the crow as *turlaag*.

Before starting our discussion, the origin of the Buryat names for the corvids should be established. The Mongols call the raven *kheree(n)* (Bolshoy akademicheskiy mongolsko-russkiy slovar…, 2001–2002: 1474). The Kalmyks call this bird *kire* (Russko-kalmytskiy slovar, 1964: 80), and the Khamnigans call it *kiree* (Khamnigansko-russkiy slovar, 2015: 173). These names for the bird originated from the language

Archaeology, Ethnology & Anthropology of Eurasia 51/4 (2023) 119–125 E-mail: Eurasia@archaeology.nsc.ru

of the medieval Mongols: cf. *qong keri'ē* 'raven' (Poppe, 1938: 302). Identical name appears among the modern Khorchits: *khon kheree* 'raven' (Bolshoy akademicheskiy mongolsko-russkiy slovar…, 2001–2002: 1474). The phrase *khon khiree* occurs in Buryat shamanic poetry. In the Buryat language, the word *khon* has two main meanings: 'sonorous (sound)' and 'dead' (Buryaad-orod toli…, 2010: Vol. II, 441). While the first meaning may well indicate the specific cry of this bird, the second may imply that the Buryats perceive the raven as a representative of the other world.

Notably, the medieval Mongols had the same name for both the crow and the raven: *keri'ē*, *keriyē* 'crow' (Poppe, 1938: 21). This tradition has been lost in the modern Mongolian languages. To denote a crow, the Buryats use the word *turlag*. The Kalmyks use *turlag*, *shaazkha* (Kalmytsko-russkiy slovar, 1977: 518), and the Khamnigans the words *turlaaki*, *turlaag* (Khamnigansko-russkiy slovar, 2015: 280). In the Mongolian language, the word *turliakh*, consonant with these names, has a different meaning of *jackdaw* (Bolshoy akademicheskiy mongolsko-russkiy slovar…, 2001–2002: 992), while ethnic variants of the above-mentioned Kalmyk nomination of *shaazha* in Mongolian languages usually denote magpie.

The Mongolian dictionary of Muqaddimat Al-Adab gives another name for the raven – *quzyun* (Poppe, 1938: 302). Most likely, this has Turkic roots and does not appear in the languages of the modern Mongolian peoples. Indeed, the Old Turkic people had the word *quzyun* 'raven' (Drevnetyurkskiy slovar, 1969: 475), which has survived in the vocabulary of some Turkic ethnic groups: Bashkir *кожғоп*, Kyrgyz *kuzgun*, Turkish *kuzgun*, Khakass *khuskhun*. Meanwhile, some Turkic peoples use other designations for raven: Altaians – *kargan*, Kazakhs – *karga*, Kirghiz – *karga*, Chuvashes – *çăhan*, and Yakuts – *suor*. Significantly, in the Old Turkic glossary, the word *qarya* (Ibid.: 426) (whose derivatives are ethnic variations of the word *karga*) defines the representatives of close biological species—raven and crow. In the latter meaning, it is used by some modern Turkic peoples: Uzbek. *qarg'a* 'crow'; Khakass *kharga* 'crow'.

Hence, the Buryat designations of raven and crow clearly have their origins in the Mongolian language.

Description of ravens and crows based on vocabulary and small genres of folklore

According to the Buryat vocabulary and folklore, the image of a raven shows typical features of that bird in the wild. First, the Buryats noted its external zoological features. For example, its dark, blue-black (in the Buryat language, the phrase *khab khara* 'blackest black' is used to denote this color) plumage is reflected in the phrase: *khara khiree* 'black raven'. The Buryats, like other Turkic-Mongolian peoples, were prejudiced against birds with black feathers, which were considered the messengers of the Lower World. In addition, the size of the raven was taken into account (it is one of the largest representatives of the *Passeriformes* order): *turag khiree shuvuun* lit. 'huge bird raven, raven'.

In small genres of Buryat folklore, specific features of the crow, such as its cry and plumage color, were emphasized:

Khaar-khaar duutai,
Khara togon degeltey (Onhon ugenuud…, 1956: 22).

With the song "Kar-kar",
With the robe made of black silk (crow) (translation by the author – **A.B.**).

In the riddle about the raven, both its black plumage and the strength of its large beak were emphasized:

Khara torgon degelee
Khaishalaagui umdebeb,
Khara bulad hukhee
Khataalgaagui baribab (Ibid.: 22).

I put on black, silk,
Uncut robe,
I took untempered
Black steel axe (raven) (translation by the author – **A.B.**).

People associated the long flights typical of ravens and other birds of prey with their ability to cover very long distances: *Khireegeyshie khurekhegui gazar* 'Where the raven did not carry bones' (Ibid.). The expression among the Mongols, in which this bird was called *turag shuvuu* 'big bird': *turag shuvuu nisch khurehgui, tuurait mor davkhizh khurekhgui gazar tsetsen* 'a place where neither a raven can fly to, nor a good horse can hop to' (Bolshoy akademicheskiy mongolsko-russkiy slovar…, 2001–2002: 992), has the same meaning.

Among their behavioral features, the Buryats noted the manifestation of a collective principle in ravens, although it is known that these birds only occasionally gather in flocks: *Khiree khireegei nyude tonshokhogui* 'A raven would not peck out another raven's eye' (Buryaad-orod toli…, 2010: Vol. II, 427). Note that the proverb has a negative connotation: it is usually used to describe people with generally bad inclinations. It was probably borrowed by the Buryats through the Russians from the European culture, since this saying belonged to the Ancient Romans: *Cornix cornici nunquam confodit oculum* 'A raven would not peck out another raven's eye'.

The Buryats associated the manifestations of some feelings and vicious inclinations by a person with images of raven and crow. For example, when someone shows great joy, people usually say: *Bayarlahan khiree barkhirba* 'A delighted raven cawed'. Such saying probably emerged from observations of emotional behavior of this bird.

In Buryat beliefs, the image of a raven is associated with greed. Criticizing such a bad trait in a person, the people would say: *Khentei khun khiree mete* 'A greedy person is like a raven'.

The Buryats considered the crow and raven as unclean birds. According to an 18th-century source, there was a ban on eating their meat (Miller, 2009: 256). This ban probably took into account the omnivorous nature of birds, which could also eat carrion.

Noteworthy is the color symbolism that is consistent with the color of these birds. For example, the expression *khiree khara* 'black raven' implies that the Buryats considered raven as a vile bird.

Both the raven's eating of carrion and its habit of pecking out the eyes of living but weakened livestock, especially during *dzut* (lack of fodder), triggered beliefs about its unclean nature.

This may be consistent with a popular belief about the miraculous healing properties of a raven's tears in treatment of eye diseases: "(the raven) is revered as a doctor of eye diseases and blindness in people. The Buryats often catch a raven and prick it in the eye as if making it cry; they anoint the eyes with the flowing liquid or inject it in drops. They claim that this makes the blind see" (Smolev, 1901: 107). According to Buryat popular beliefs, this bird is a symbol of vigilance. This prejudice is probably based on the assertion that human and animal eyes are supposedly the focus of vital energy: by eating the eyes of its victims, the bird receives vital energy, and in turn, the person gets this energy and becomes cured of blindness through the tears of raven.

In the vocabulary of popular botany, the mature fruits of Dahurian asparagus *Asparagus davuricus* Fisch ex Link are associated with black and shiny raven eyes. The Buryats call this medicinal plant, listed in the Red Book, *Khiree nyuden* 'Raven eye' (Buryaad-orod toli…, 2010: Vol. II, 427), and the Mongols, *Khereeniy nud* 'botanical: Dahurian asparagus, raven eye' (Bolshoy akademicheskiy mongolsko-russkiy slovar…, 2001–2002: 1474).

A negative attitude towards ravens (which acts as a kind of harbinger of misfortune) can be seen, for example, in the following saying:

Bookhoin urda khiree,
Boroogoi urda khalkhin (Onhon ugenuud…, 1956: 13).

(There is) a raven before (appearance of) lice,
(There is) wind before the rain (translation by the author – **A.B.**).

According to traditional Buryat beliefs, the crow is a symbol of natural rhythms, specifically, of winter. According to popular observations, after migration of birds to the south, crows, along with magpies, stay to spend the winter. This is how this observation is conveyed in a riddle:

Khaanay ukher
Khamagaaraa (correctly, *khamta garaa*) (remark by the author – **A.B.**) *belshebe*,
Kharagshan ereegshen
Khoeryn gazaa ulebe (Ibid.: 23).

Khan's cows
All went to graze together.
Black and spotted,
Two have stayed (crow and magpie) (translation by the author – **A.B.**).

It is curious that the qualities attributed to the raven and crow among the Buryats, reveal some parallels in the language of the Old Turkic peoples. This is no coincidence, because the presence of a Turkic ethnic component among the Buryat ancestors is known. The Old Turkic people also associated the crow with the cold season of the year: *Bir qarya birla qis kelmas* 'Winter does not come with one crow' (Drevnetyurkskiy slovar, 1969: 426). The image of raven evoked negative connotations for them. This can be observed in the opposition of raven and swan, which is based on color contrast and, accordingly, on the different symbolism of these birds: *Qara quzyun erdim quyu qildi čal* 'I was a black raven, he made (me) a white swan' (Ibid.: 475). In this regard, we should recall that white swan is considered a sacred bird and totemic ancestor of the Turkic peoples. For the Old Turkic people, one of the indicators that the raven belonged to unclean birds was its sharp cry: *Quzyun qoburya ulati javlaq belgülüg qorqinčiy ünlüg quslar* 'Ravens, owls, and other birds pointing to bad omens with terrible voices' (Ibid.).

The importance of ravens and crows in the traditional consciousness of the Buryats is confirmed, for example, by the Buryat surnames derived from nicknames, "Kheree" and "Turlaag" (Mitroshkina, 1987: 82).

Images of ravens in Buryat mythological beliefs

Unlike the crow, which was considered a sign of winter, the Buryats perceived the raven as a symbol of spring:

Saibad gekhede – ubel,
Shalshad gekhede – zun,
Khara khireegei khaahirkhada – khabar (Menyelte mergen, 1984: 42).

(When) it turns white – it is winter,
(When) it starts to rustle – it is summer,
When the raven caws – it is spring… (translation by the author – **A.B.**).

The crow possessed the symbolism of water, because it was considered a harbinger of rain. According to popular beliefs, if a black crow cries, it will rain. This idea has ancient origins; it has been found among

different peoples, such as Vepsians (Vinokurova, 2007: 104), Chuvashes (Chuvashskaya mifologiya, 2018: 134), Mongols, etc. It also reminds us of the Ancient Roman poet Ovid, who is credited with the idea that this bird was a sign of rain (de Vries, 1976: 275). Incidentally, in the Slavic culture, the image of a raven, which signified spring, was associated with spring rain, and thus was also endowed with symbolism of water.

The Buryats, like some other peoples of Eurasia, e.g. the Khakass people (Burnakov, 2010a: 348), believe that the raven is connected to the sacramental drink—the water of eternity (*munkhuin khara uha*) (Burchina, 2007: 229)—the equivalent of the living and dead water mentioned in Slavic fairy tales. Using this life-giving drink, the cultural hero resurrects the deceased mighty warrior.

In Buryat folklore, the image of the raven is ambivalent. In a Buryat fairy tale, the raven is a respected character, independent, capable of acting contrary to the authorities. The Buryats believed that he was "a free bird who does not pay tribute (to the king of birds)" (Smolev, 1901: 107).

The raven is endowed with an ability to speak human language and to give wise advice. Obviously, this is a reflection of a popular perception of this bird as intelligent creature. Incidentally, ornithologists consider the raven one of the most intelligent birds. This is illustrated by the following fragment of the legend:

> Nogodoy raised her eyes,
> And looked up through the smoke hole,
> And the hole is closed
> By the wings of a raven bird.
> Now the raven came down below
> To the nice maiden Nogodoy
> And he said in human language,
> Only bluntly, in a sharp tone… (Namsaraev, 1990: 25).

The crow is a symbol of the spread of rumors, through which the cultural hero learns about the hidden cause of illness, the location of treasure, etc.

In the traditional Buryat worldview, the raven, like any flying bird, is a symbol of the sky. It is no coincidence that the Buryat mythology endowed this bird with the role of a messenger from higher powers, mainly black celestials (Khangalov, 1960: 74). Moreover, in the epics of the Buryats, one of celestial beings, Som Sagan Noyon—a mediator between the opposing light and dark sides of the sky—turns into a raven. He takes the form of a black raven before light deities, and the form of a white raven before dark deities.

In folklore, the image of the raven is associated with assistance to Buddhist servants and deities. For example, in the legend *Nogoon Dari ekhe* 'Green Tara Mother', the wise raven helps this *ḍākinī* and her son, and as a reward receives longevity and sharp eyesight (Smolev, 1901: 105). In another legend, Green Tara thanked the raven by "giving it the ability to see a piece of meat only the size of a thumb beyond sixty rivers and to fly without fear of frost under the sky above the clouds" (Potanin, 1883: 297). It may be assumed that this motif was borrowed by the Buryats through the Mongols from Tibetan Buddhism. Among the Mongols, the Green Tara Mother was considered a celestial patroness, and the legend "Nogoon Dara ekhiyn tuuzh" ("The Tale of the Green Tara") became famous among them. The above-mentioned zoological features of ravens (ability to fly high and visual acuity) are emphasized in various epics and fairy tales of the Buryats and many other Eurasian peoples.

An example of a negative attitude towards the raven appears in the fairy tale "The Angry Raven". This bird is presented as a vengeful and cunning creature. It achieves its goal, but cannot survive the joy of its success (Buryatskiye narodniye skazki…, 2000: 95).

The image of the raven, as mentioned above, is associated with the other world. Like the yellow fox, the raven is linked to the ensuing chaos. In Buryat folklore, the violation of the former order is conveyed by the following lexical expression: "(only) the black raven screams and the yellow fox barks" (Khangalov, 1960: 274). The Buryats also considered the fox a representative of the underworld (Badmaev, 2021b: 39). Notably, in the mythology of the peoples of Eurasia, birds such as ravens appear as guides or intermediaries between the worlds (for the example of the Indians, see (Krishna, 2010: 93)).

The Buryat epics reflects the symbiosis of raven and wolf, which manifests itself in the nature in their joint procurement of meat. We have discussed this issue and have demonstrated the chthonic nature of the wolf (Badmaev, 2021a: 97). In the mythology of many other peoples of Eurasia, these wild animals are considered companions of the other world. Moreover, in the traditional thinking of the Buryats, like other Turkic-Mongolian peoples, raven and wolf were associated with bloodthirstiness and war. This is shown in the Buryat epics, which thus portray the culmination of a brutal battle as a bloody feast organized by the corvids:

> Unfinished battle
> Boils with renewed vigor.
> Rivers of blood, mountains of meat
> Feed black ravens.
> White-sided magpies
> Are also here, rummaging and chirping (Namsaraev, 1990: 122).

In the traditional Buryat worldview, the raven has an *ezhin*—a mythical master and lord. Out of fear of angering him, there is a ban on killing this bird. Crows were not believed to receive such protection, but they have been kept out of the way, too. It was supposed that raven's *ezhins* were individual powerful dark master-spirits. In

shamanic poetry, these are, for example, Azhirai-bukhe, the Master of the Black Horse and helper of the ruler of the Lower World. His son is a black raven, and his daughter is a yellow raven (Khangalov, 1958: 360). Yellow ravens, of course, do not exist in nature; in this case, the color of the bird's plumage acts as a sex marker: black symbolizes masculinity and yellow, femininity.

It seems natural that ravens are called the children of Azhirai-bukhe, since ancient military cult is associated with this mythical character among the Buryats. In the Buryat epics, ravens often turn out to be the warriors of dark lords. For instance, in the epic "Geser", the devil Lobsogoldoy addresses them as follows:

You, my winged warriors,
You, my four pillars,
My black, watchful ravens (1986: 172).

In the mythopoetics of the Turkic peoples, warriors are also associated with ravens. For example, in the Altai epic "Maadai-kara", one of the offspring of evil is described as follows:

His people are like thick smoke,
His troops are like a flock of ravens,
Zaisans are like evil wolves (1979: 25).

In the same epics, flying ravens are described as a formidable army:

And in the brightened skies,
Striking terror, spreading fear,
Black, clawed, and gloomy,
A horde of ravens can be seen.
It croaks and caws.
The ravens fly like a thunderstorm,
Their eyes furrow the earth; their breath
And the flapping of their wings
Are like a hurricane (Ibid.: 67).

In the mythological views of the Altaians, the arrow, which usually personifies the masculine principle in the traditional cultures of the Turkic-Mongolian peoples, is likened to a raven:

And clouds of arrows fly at her,
Like a mad flock of ravens… (Altaiskiye geroicheskiye skazaniya, 1983: 212).

Thus, it can be argued that the Buryats and Southern Siberian Turkic peoples had a common view on the masculine nature of raven's image.

According to the traditional beliefs of the Buryats, this bird of prey is a spy for evil spirits. For example, in "Geser", the spying raven fulfills the will of the earthly offspring of Atai Ulaan, the head of the black celestials (1986: 207). In the same epic, the crow is associated with a demonological character, serving him as a formidable guard or transportation:

And the crows surround her,
Threaten Geser's wife
By sharp points of iron claws.
Suddenly, riding on a gray crow,
A man flies up to her (Ibid.: 67).

Another aspect of the raven is being the messenger of death and misfortune. Its cry was considered ominous. People would say: "When the raven cries… there will be misfortune. If a raven lands on someone's house and screams, this is a bad omen" (Khangalov, 1960: 74). The same sign was associated with a crow: "If a crow croaks – it is a bad luck" (Osokin, 1906: 223). Note that the characteristics of corvids are similar among many peoples of Eurasia (Burnakov, 2010a: 348; Gura, 1997: 537; Tresidder, 1999: 50; Chuvashskaya mifologiya, 2018: 134; and others).

The Buryats gave attention to variety of sounds made by ravens: "If (the raven) screams with a different sound, it promises wealth" (Smolev, 1900: 28). The connection between this image and the precious treasure stored in the ground testifies to the chthonic nature of this bird. The same idea can be seen in the traditional views of some other peoples (Slavs (Gura, 1997: 532), Khakass people (Burnakov, 2010b: 120), etc.), which emphasizes its universal nature.

In Buryat shamanic poetics, the raven is associated with the motif of shape-shifting. It was believed that the shaman could turn into raven:

Gray hare is our run,
Gray wolf is our carrier,
Raven *khon* is our shape-shifting,
Eagle *khoto* is our messenger! (Khangalov, 1958: 177).

Interestingly, in Buryat legends, a woman who was supposedly beautiful and dissolute during her lifetime, after death, turns into a crow (essentially, a demonic character – *muu shubuu(n)* 'bad bird'); taking the form of an evil shape-shifting bird, she kills lonely male travelers (Zhamtsarano, 2001: 104). Given this, it can be assumed that in the traditional beliefs of the Buryats, the image of the crow was linked to the female principle.

There are no legends wherein a raven would appear as a mythical ancestor or patron of any Buryat family clan. This means that for the Buryats, this bird of prey was not a totem.

As far as the Mongolian superethnos is concerned, the issue of the raven as a totemic ancestor is not so clear-cut. Among the medieval Mongols, one can distinguish the tribe of the Kereits (*khereed* 'ravens'), whose ethnic name was associated with this bird. In the late 12th to early 13th centuries, they formed the separate khanate of Van Khan. Among the Mongols of that time, their power elite stood out as belonging to the Nestorian Christians. Indirect evidence of reverence for ravens by some of the Mongols of Genghis Khan is probably one of their battle

cries (traditionally containing an indication of the totemic animal)—"kkhu-kkhu", which resembles the caw of this bird: at the sight of the victim, the raven utters a loud, guttural "kuukh-kuukh". This is a direct association of an attacking steppe warrior on the horseback with a raven who discovered the carrion. The custom of Buryat hunters who imitate the caw of a raven after killing a bear can be viewed in the same context.

The above facts can be explained by the Turkic origin of both the Kereits and some other tribes that became a part of the Mongol state of Genghis Khan. The raven was revered as an ancestor among some ethnic groups of the Siberian Turkic people (Yakuts, Teleuts, etc.) (Burnakov, 2010b: 116).

Conclusions

The study of Buryat popular beliefs about ravens reveals the richness of the image of the raven, while the image of the crow appears to be more fragmentary. At the same time, the image of the raven is ambivalent and polysemantic, while that of the crow has a clear negative connotation.

Analysis of vocabulary and small genres of folklore indicates that the Buryats gave attention to the external zoological features of corvids: color of plumage and cry in crows, and color of plumage, size, prominent beak, and flight duration in ravens. They also noticed behavioral features of the birds. Ravens were distinguished by their collective nature, emotional expression of joy, and greed. The Buryats associated both birds with unclean natures and therefore did not eat their meat; they perceived their black plumage as a sign of belonging to the Lower World, etc.

According to the mythological beliefs of the Buryats, the raven was a symbol of the sky, spring, vigilance, war, masculinity, and vengefulness. As a messenger of the black celestial beings and their spy, he was associated with underground treasure and acted as assistant to the Buddhist deity Green Tara. It was distinguished by intellectual capacities and independence. Unlike the crow, the raven was believed to have patrons—dark master spirits and other demonic characters.

In the traditional worldview of the Buryats, the crow was a symbol of the sky, winter, water, bloodthirstiness, and spreading rumors, and had a feminine nature.

Both birds of prey were associated with the idea of shape-shifting, although of different kinds. A demonic creature was believed to turn into a crow, while shamans of some clans turned into ravens during their mystical journeys and fights with other shamans.

Individual traditional beliefs of the Buryats about corvids find parallels in the cultures of different peoples of Eurasia, which may be explained by the universal nature of these views, as well as ethnic and cultural contacts (for example, with the Turkic peoples of Siberia and Central Asia) in different historical periods.

Acknowledgment

This study was carried out under IAET SB RAS R&D Project No. FWZG-2022-0001 "Ethnic and Cultural Diversity and Social Processes in Siberia and the Far East in the 17th–21st Centuries".

References

Altaiskiye geroicheskiye skazaniya. 1983
A. Kalkin (narrator), A. Plitchenko (trans. from Altaian). Moscow: Sovremennik.

Badmaev A.A. 2021a
Obraz i simvolika volka v mirovozzrenii i rituale Buryat. *Tomskiy zhurnal antropologicheskikh i lingvisticheskikh issledovaniy*, iss. 2 (32): 93–101.

Badmaev A.A. 2021b
Obraz lisitsy v traditsionnykh mifologicheskikh vozzreniyakh Buryat. *Gumanitarniye nauki v Sibiri*, vol. 28 (2): 36–40.

Bolshoy akademicheskiy mongolsko-russkiy slovar. 2001–2002
Mongol oros delgerengyj ikh tol, A. Luvsandendev, T. Tsedendamb (eds.), G.T. Pyurbeev (resp. ed.). Moscow: Academia.

Burchina D.A. 2007
Geroicheskiy epos unginskikh buryat: Ukazatel proizvedeniy i ikh variantov. Novosibirsk: Nauka.

Burnakov V.A. 2010a
Obraz vranovykh ptits v mirovozzrenii khakasov. *Problemy istorii, filologii, kultury*, No. 4 (30): 346–362.

Burnakov V.A. 2010b
Voron v simvolakh i poveryakh khakasov. In *Kultura kak sistema v istoricheskom kontekste: Opyt Zapadno-sibirskikh arkheologo-etnograficheskikh soveshchaniy. Materialy XV Mezhdunar. Zap.-Sib. arkheol.-etnogr. konf.* (Tomsk, 19–21 maya 2010 g.). Tomsk: Izd. Tomsk. Gos. Univ, pp. 116–121.

Buryaad-orod toli. 2010
Buryatsko-russkiy slovar. Vol. II: O – Ya. In 2 vols. K.M. Cheremisov, L.D. Shagdarov (comp.). Ulan-Ude: Respublikanskaya tipografiya.

Buryatskiye narodniye skazki: O zhivotnykh. Bytoviye. 2000
E.V. Barannikova, S.S. Bardakhanova, V.S. Gungarov, B-K.B. Tsybikova (comp.). Novosibirsk: Nauka. (Pamyatniki folklora narodov Sibiri i Dalnego Vostoka; vol. 20).

Chuvashskaya mifologiya: Etnograficheskiy spravochnik. 2018
Cheboksary: Kn. izd.

de Vries Ad. 1976
Dictionary of Symbols and Imagery. Amsterdam: North-Holland Publishing Company.

Drevnetyurkskiy slovar. 1969
V.M. Nadelyaev (ed.). Leningrad: Nauka.

Geser. Buryatskiy narodniy geroicheskiy epos. 1986
Vol. II. Ulan-Ude: Buryat. kn. izd.

Gura A.V. 1997
Simvolika zhivotnykh v slavyanskoy narodnoy traditsii. Moscow: Indrik.

Kalmytsko-russkiy slovar. 1977
B.D. Muniev (ed.). Moscow: Rus. yaz.

Khamnigansko-russkiy slovar. 2015
D.G. Damdinov (ed.). Irkutsk: Ottisk.

Khangalov M.N. 1958, 1960
Sobraniye sochineniy, vol. 1, vol. 3. Ulan-Ude: Buryat. kn. izd.

Krishna N. 2010
Sacred Animals of India. New Delhi: Penguin Books India.

Maadai-kara. Altaiskiy geroicheskiy epos. 1979
A. Plitchenko (ed.). Gorno-Altaisk: Kn. izd.

Menyelte mergen. 1984
T.-A. Dugar-Nimaev (ed.). Ulan-Ude: Buryat. kn. izd.

Mify narodov mira: Entsiklopediya. 1980
S.A. Tokarev (ed.). Moscow: Sov. entsikl.

Miller G.F. 2009
Opisaniye sibirskikh narodov. Moscow: Pamyatniki istoricheskoy mysli.

Mitroshkina A.G. 1987
Buryatskaya antroponimiya. Novosibirsk: Nauka.

Namsaraev K. 1990
Sagadai mergen: Epicheskaya poema, V.N. Malmi (trans. from Buryat). Moscow: Sovremennik.

Onhon ugenuud, taabarinuud. 1956
D. Madason (comp.). Ulan-Ude: Buryat-mongoloy nomoy kheblel.

Osokin G.M. 1906
Na granitse Mongolii: Ocherki i materialy k etnografii Yugo-Zapadnogo Zabaikalya. St. Petersburg: [Tip. A.S. Suvorina].

Poppe N.N. 1938
Mongolskiy slovar Mukaddimat Al-Adab. Moscow, Leningrad: Izd. AN SSSR. (Tr. IV AN SSSR; vol. XIV).

Potanin G.N. 1883
Ocherki Severo-Zapadnoy Mongolii. Rezultaty puteshestviya, ispolnennogo v 1876–1877 gg. po porucheniyu Imperatorskogo Russkogo Geograficheskogo Obshchestva. Iss. IV: Materialy etnograficheskiye. St. Petersburg: [Tip. V. Kirshbauma].

Russko-kalmytskiy slovar. 1964
I.K. Ilishkin (ed.). Moscow: Sov. entsikl.

Smolev Y.S. 1900
Tri tabangutskikh roda selenginskikh buryat: Etnograficheskiy ocherk. Moscow: Tov. Tip. A.I. Mamontova.

Smolev Y.S. 1901 (1902)
Buryatskiye legendy i skazki. *Trudy KOPOIRGO*, vol. 4 (2): 95–107.

Tresidder J. 1999
Slovar simvolov. Moscow: FAIR-PRESS.

Vinokurova I.Y. 2007
Zhivotniye v traditsionnom mirovozzrenii vepsov (opyt rekonstruktsii): D.Sc. (History) Dissertation. Petrozavodsk.

Zhamtsarano T.Z. 2001
Puteviye dnevniki 1903–1907 gg. Ulan-Ude: Izd. BNC SO RAN.

Received December 9, 2022.

doi:10.17746/1563-0110.2023.51.4.126-134

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The Old Believers' Churchyard: Semiotics of Cultural Space (The Case of the Ust-Tsilma Old Believers-Bespopovtsy in the Komi Republic)

This study addresses the structure of cemeteries and types of tombstones in the funerary tradition of the Russian Priestless Old Believers (known as Bespopovtsy) living in the Ust-Tsilma District of the Komi Republic. For the first time, a description of their graveyards, known as "mogilniki", or "mogily", is provided, and their history and preservation are outlined. Traditional beliefs concerning cemeteries and their arrangement are cited. The symbolism of the forms of tomb structures, reproducing not only canonical prescriptions and requirements, but also certain pre-Christian beliefs, is analyzed in detail. Folk terms relating to the dead and the afterlife are included. The degree and nature of post-revolutionary transformations, profoundly affecting the foundations of the Old Believers' culture, are explored. Despite the attempts to preserve traditions, modern lifestyles took root in the 1960s and 1970s. Elements of local specificity in funerary rites have nonetheless survived and can be seen in the symbolism of tombstones, synthesizing Christian and pre-Christian traditions. Findings of ethnographic, linguistic, and archival studies are presented.

Keywords: *Traditional culture, Russian Priestless Old Believers, cemetery, tombstones, deceased, ancestors.*

Introduction

In the system of spiritual and religious values, the cemetery (from Greek κοιμητήριον, 'sleeping place') is one of the most important cultural objects, which is considered to be both the final resting place of a person and most importantly, a sacred place for keeping ritual dialogue between the living and the dead. In his *Homily on the Cemetery and the Cross*, John Chrysostom speaks about this: "Since today Jesus descended among the dead, for this reason we are gathering here. For the same reason, moreover, this place is called a *koimeterion*, in order that you may learn that those who have reached their end and who lie here are not dead, but rather are sleeping and resting. <…> Hence, the place is called a *koimeterion*, for the name is both useful for us and full of much wisdom" (John Chrysostom, 2022: 7, 9). Believers associate graveyards with light and a bright life. Popular ideas about this emerged under the influence of Patristic writings about the heavenly afterlife, which the Holy Fathers discussed upon the Crucifixion and Resurrection of Christ. St. John Chrysostom thus says in his Homily *Let No One Mourn the Dead*: "…after escaping the dark life and leaving for the true light, we bury [the dead] towards the east, signifying the rising of the dead". In the mythological worldview, the cemetery personified "the other world" and was considered a "foreign realm", which required a respectful attitude and corresponding

Archaeology, Ethnology & Anthropology of Eurasia 51/4 (2023) 126–134 E-mail: Eurasia@archaeology.nsc.ru

behavior. According to the observation of S.M. Tolstaya, "the cemetery turns out to be a whole world inhabited by special 'residents', who have their own rules, restrictions, and boundaries, which require the mastering of proper rituals, which makes a cemetery something like 'an embassy of the other world' on earth" (cited after (Andryunina, 2013: 43)).

A distinctive aspect of cemeteries and burials among the Old Believers is that they bury their fellow believers in a separate location from representatives of other denominations, often separating their burials with an enclosure. Cemeteries in rural settlements are of particular interest. Arranging them, the Old Believers were guided by both ecclesiastical concepts about the afterlife and pre-Christian beliefs. This article will examine the history of the creation and functioning of cemeteries among the Priestless Old Believers living in the Ust-Tsilma District of the Komi Republic. Until now, this topic has not been studied nor did it attract the attention of travelers and writers about everyday life who visited the Pechora region in the 19th century. This study is based on modern field materials of the author (hereafter, FMA), as well as records kept in the Scientific Archive of the Komi Science Center of the Ural Branch of the Russian Academy of Sciences (hereafter, SA KSC UB RAS). Some information on this topic was also found at the State Archive of the Arkhangelsk Region (hereafter, SAAR).

Location and structure of the cemetery

The development and operation of rural cemeteries in the Ust-Tsilma villages were associated with denominational issues and with the emergence of villages especially during the period of intensified repressive policies under Tsar Nicholas I (1825–1855), aimed at eradicating the Old Believers' faith. Families tied by kinship or several family clans settled within the boundaries of a single village. Therefore, a specific feature of cemetery development in the villages along the Pechora River was their quantity. In some villages, there were several graveyards named after the founders of family clans. Even in the 1950s, there were five cemeteries (previously, there had been even more) in the volost (later, district) village of Ust-Tsilma. Some of these cemeteries bore the names of family clans: "Ivanovo" (originally emerged as a holy place), "The Fedoseikov Family Cemetery", and "The Semyonov Family Cemetery". In addition, there existed a public cemetery "At the Forest Grove", where Christians of the official Orthodox Church were buried, as well as Old Believers some distance from them, and a graveyard where Ust-Tsilma residents who died from the Spanish flu were buried. There were four cemeteries in the village of Koroviy Ruchei ("The Ivankov Family Cemetery", "Ipatovsko", "The Startsev Family Cemetery", and a common village cemetery), two each in the villages of Garevo and Chukchino. Two graveyards in the settlements of Zamezhnaya and Zagrivochnaya on the Pizhma River appeared under the following circumstances. The former settlement what is now the public cemetery is located near the village, while the burials of representatives of the Churkin-Kirikov family clan are beyond the Pizhma River. In the latter settlement, a graveyard on a high hill over the river ended up within village boundaries due to heavy development and was closed in the 1970s. Currently, there is one cemetery operating one km from the village.

A particular situation occurred in rural settlements inhabited by various ethnic groups, primarily in those bordering with the Komi and Nenets people. The Komi were buried separately in the village of Neritsa despite the fact that they were Old Believers. The situation was the same with the Nenets: "*In the past, in Neritsa, people were buried separately, near their houses. The Komi, Nenets, and Russians were buried in families, and under the Soviets already in the same cemetery. In the past, there were people exiled; this was after the Great Patriotic War; they were buried apart, and instead of a cross, fir trees were planted*" (FMA. Recorded in the village of Ust-Tsilma in 2022 from an interview with L.O. Babikova, born in 1966). In other villages (even those near the border), people were buried according to the family clan principle: graves of the representatives of a particular family clan were grouped in one place.

The graveyard is a village of the dead, according to a children's riddle: "The village is inhabited, / Roosters do not crow, / People do not get up. – ***A cemetery***" (Deti…, 2008: 87). The Ust-Tsilma Old Believers believed that a graveyard was a holy place: "*The cemetery is the most holy place, there is no holier place. There is eternal peace, no swearing, no cursing, no fighting there. The deceased rest there. People only pray there and commemorate the deceased with good words*" (FMA. Recorded in the village of Chukchino in 2009 from an interview with A.M. Babikova, born in 1922). Naming the area that separated the cemetery and residential buildings in the village of Zamezhnaya "*Christ's Swidden*", was associated with the idea of the holiness of the graveyard. This land remained deserted for a long time, and only in the 20th century (after the Revolution of 1917), did the village administration organize its development.

In the Ust-Tsilma terminology, a cemetery is called a *mogilnik* or *mogily* ('graveyard' or 'graves'). The Ust-Tsilma people did not formerly use the term *kladbishche* ('cemetery'); only starting in the 1960s, did it gradually begin to be employed: first, by young people returning to their home village after studying in the cities, then, by middle-aged rural residents and Soviet-minded young people who disdained everything traditional. Currently,

the designation *mogily* ('graves') is used exclusively by pious elderly people who observe old Church canons and the rules of the fathers.

Archaic beliefs about the structure of cemeteries and graves have been largely preserved among the residents of villages along the Pechora River who may have inherited these traditions from the first settlers. A high, dry, and light-filled place beyond the fields, near a stream, beyond a river, or next to it, 200–300 m from the residential area, was chosen for a graveyard. Most of the Ust-Tsilma cemeteries are located on hills, since the Old Believers associated "the other world" with a mountain, the "upper world": "*our parents are watching over us from above*"; "So we are carrying you to the big mountain, / To the big mountain, yes, to the sloping one" (funeral lament). The expressions "*our parents are watching us*", "*they are watching our life*", "*our parents wait for prayers from us*" reflect beliefs about the uninterrupted connection between the living and the dead: "*My parents, grandpa, and grandma, are buried in our cemetery, beyond the field. When I lug manure in the morning, I greet them. They watch us; we watch them. This is how life works*" (FMA. Recorded in the village of Chukchino in 2009 from an interview with I.A. Babikov, born in 1940).

In a number of villages along the Pizhma River, cemeteries are located on the opposite bank of the river; in Ust-Tsilma and some adjacent settlements, beyond the stream. The role of the river as a mystical road connecting the worlds is well known and is reflected in folklore and funeral rituals (Levkievskaya, 2004: 345–347). Crossing the river by the deceased is associated with relocation to the "other world", which is the end point in the journey of the soul of the deceased person, and with cleansing the soul from earthly sins: "*People are buried beyond the river. We must bring the dead across the water. It is said, their sins are cleansed, and the pure soul will go to heaven; the sins remain on the home side*" (FMA. Recorded in the village of Borovskaya in 2010 from an interview with O.E. Chuprova, born in 1954). It is no coincidence that in the past, the clothes taken from the deceased, the items used for washing the body, and the wood chips left from making the coffin and cross, were brought by the Ust-Tsilma Old Believers to the river, which was supposed to carry everything away from the deceased. In funeral laments, the deceased "sails away" to the "other world" in a "*light-weight boat, a boat made of spruce, without an oar for rowing*". Currently, rural residents have lost their understanding of the river as the most important component of the model of the Universe. Since transporting the deceased across a river/stream is now considered a laborious and meaningless process, in the 21st century, new graveyards began to emerge near villages.

Two cemeteries in the Ust-Tsilma District—in the villages of Skitskaya (Dronova, 2007a) and Ust-Tsilma (Ivanovo cemetery) (Dronova, 2007b)—are located in areas associated with religious practices. The former is related to Velikopozhensky Skete (from the first third of the 18th century to 1857). Two large eight-pointed crosses and a chapel where the remains of skete dwellers who ended their lives by self-immolation in 1843 were laid to rest, were built at that cemetery. In the 1970s, a votive prayer barn funded by P.P. Chuprova was built there. Both the barn and the cemetery operate to this day.

A revered place in the village of Ust-Tsilma is associated with the locally revered saint Ivan, whose name led to various designations, such as "Ivanov Hill", "to Ivanushka"/"at Ivanushka", used in the late 19th century (SAAR. F. 487, Inv. 1, D. 15, fol. 5); "to Ivan", "Graves at Ivan's", "Ivan's Hill", and "Ivan's Cemetery", which are still actively used today. Currently, the notion of going "to Ivan" is also used by the Old Believers to mean "it is time for eternal rest". Over the saint's grave, a chapel was built, which was renovated twice over the past century. Traditionally, a commemorative service to Ivan is served there on St. John the Baptist's Day (July 7, according to the Gregorian calendar). The "feedback" of the dead to the living is believed to be strengthened if the deceased was a righteous person or a saint. People make votive prayers there, ask for help and, as Christians believe, receive it, which confirms the importance of the sacred place in ritual practices of the Ust-Tsilma residents. Until the mid-20th century, mentors and devout Christians were buried at the Ivanovo cemetery. During the Soviet period, the revered place was defiled. The village administration insisted that all the dead, including "unclean persons", had to be buried there. Many elderly villagers were outraged by the fact that contrary to the opinion of deeply religious people, in the 1950s, members of the Communist Party who destroyed the traditional way of life were also buried there in the center of the revered place: "*The precepts of our parents were completely disregarded. Party members are buried next to devout people. In the past, they did not do that; those were buried behind, on the side. And now, what can I say, everything is all mixed up*" (SA KSC UB RAS. F. 5, Inv. 2, D. 568, fol. 32). A similar practice is also typical for other Old Believers' areas (Kovrigina, 2014: 240). Currently, all cemeteries in the Ust-Tsilma District are Old Believer cemeteries; those who adhere to the official Orthodox church are also buried there.

Archival documents testify to the complex attitude of the government and Church officials towards family cemeteries in the 19th century. With the intensified persecution of Old Believers in the 1830s–1860s, it was quite difficult to maintain the tradition of burying people at family cemeteries, since it was prescribed to bury Old Believers only at common parish graveyards. It is known from the archival document "Secret Instructions on the Procedure for Burying Dead Schismatics" that until 1839

they were allowed to be buried "only near Orthodox cemeteries", and those who disobeyed were strictly forbidden to be issued death certificates (SAAR. F. 1, Inv. 4, V. 5a, D. 584, fol. 9v). Therefore, the Ust-Tsilma residents "buried the bodies of dead schismatics not at cemeteries, but near their homes, which is prosecuted, and perpetrators are brought to justice" (SAAR. F. 538, Inv. 1, D. 51, fol. 5). Seeing the hopelessness of measures aimed at closing Old Believers' graveyards, the local authorities referred to the circular order of the Ministry of Internal Affairs from December 14, 1839, No. 7670 and ordered: "Regarding cemeteries for schismatics: the Sovereign Emperor, taking into consideration, on the one hand, that according to the popular understanding, most of those who are about to die, wish to be buried in the same place as their ancestors, thus gives his supreme order: 1. Leave the currently existing cemeteries of the schismatics who do not accept the priesthood from the diocesan authorities and perform burials according to their own rites, but in the future, do not allocate special cemeteries but give them a separate place at common cemeteries. With the absence of priestly funeral rite, bodies must be buried only after certification by the local police; 2. It is not forbidden to bury former schismatics at common cemeteries" (SAAR. F. 1, Inv. 4, V. 5a, D. 584, fols. 11r–11v). Relatives who secretly put their loved ones to rest without a Church funeral service were strictly punished: "In 1855, for burying their daughter in an 'unspecified place' and without a Church funeral service, Savva and Matryona Ostashov from Ust-Tsilma were punished with 30 lashes by a birch rod. The court sentenced four other Ust-Tsilma residents for burying their relatives, although in a 'legal' place, but without a funeral service by a priest, to village detention for three weeks" (Gagarin, 1975: 121). However, despite the severity of punishments, the Ust-Tsilma residents still followed the traditions "of their grandfathers" and buried the deceased at their cemeteries, but earlier than the usual day, sometimes on the day of death, in order to avoid a Church funeral service.

The years of 1900–1903 were marked by a new wave of directives to close down family cemeteries. It was ordered to close them down in seven villages "adjacent to the Ust-Tsilma parish", and one on the Pizhma River in the village of Zagrivochnaya, 10 versts from the parish in the village of Zamezhnaya "as being illegal" (SAAR. F. 29, Inv. 2, V. 6, D. 287, fol. 6). The cemeteries that were in the villages listed in the archival file are still operating now.

The Komi Old Believers' settlements faced a different situation: the matter of burying Old Believers was considered by the local authorities to be under state regulations of the early 19th century: "…schismatics must not be buried together with the Orthodox, because, at the suggestion of the Committee of Ministers of May 7, 1812, special places are allocated for their burials, away from the villages, which should be supervised by the parish priest, the rural dean, and the county police" (Vlasova, 2010: 132).

In the arrangement of cemeteries, focus was placed on the natural environment: it was strictly forbidden to cut down the forest; the graveyard always stood out against the background of a village or empty landscape. The place chosen for the cemetery was consecrated: the land was censed while reciting the Jesus Prayer. Trees were not planted on purpose, but subsequently people carefully looked after the territory. Dried trunks were cut down and taken outside the graveyard, where they decayed fully. The removal of trees, branches, berries, mushrooms, and grass from the cemetery was strictly forbidden. It was believed that those who violated the ban doomed themselves or their loved ones to misfortune. However, it was allowed to take away things used on the day of burial, such as the censer from which the coals were always poured onto the grave, and working tools. In the past, while transporting the deceased to the cemetery, the coffin was covered in accordance with the sex of the deceased. Woman's coffins were covered with a large scarf, men's, with a veil. After the burial, the covers were given to the godchildren for commemoration of the soul, and if there were none, to the closest relatives. Long towels on which the coffin was lowered into the grave were immediately torn into pieces and distributed to the gravediggers or orphans.

In the past, Ust-Tsilma cemeteries and graves were not surrounded by enclosures, which emphasized the special quality of the world of the dead: "the other world" had no boundaries, the deceased were "returned" to nature. Ideas about the need to make a fence around the graveyard vary in different areas. Ambiguity of attitudes towards this is also present in the Old Believers' regions (Kozhurin, 2014: 514). It was also not customary for the Tuvan Chapel Old Believers and Ural Old Believers to make enclosures around cemeteries and graves. This was explained by the obstacles "that a person would have to face on the Judgment Day: it would be difficult for him to get out of the grave because of the iron fence" (Danilko, 2019: 53). However, it is also known that among Old Believers on the Vyg River, already in the 19th century, cemeteries were "enclosed with a log fence" (Yukhimenko, 2002: 333). Enclosures were also made in non-Old Believer areas (Dobrovolskaya, 2013: 113).

Despite the stability of the funeral rite, innovations in the arrangement of graveyards and graves appeared during the Soviet period due to radical changes of life in the countryside. Before collectivization, pasture and hayfields in the villages along the Pechora, Pizhma, and Tsilma rivers were located beyond the river, where the villagers brought all of their livestock and resettled themselves in the spring. During collectivization, economic life in the villages changed: individual

farms ceased to exist, and peasants were forced to work on collective farms, leaving their livestock in the village. Cattle wandered around the surrounding areas, including cemeteries, which made it necessary to fence them with funding from village councils. Other innovations also appeared in the 1960s–1970s, such as painted grave structures, wreaths, and artificial flowers on graves. According to the Old Believers of the older generation, these changes were associated with loss of faith and traditional beliefs about the deceased, with a disdainful attitude towards ecclesiastical laws and the delusion that the deceased need "decoration": "*The dead body does not need decoration. The dead wait for prayers from us. My mother said that those who are not commemorated simply lie like stones. While those who are commemorated – those souls fly to heaven*" (FMA. Recorded in the village of Chukchino in 2008 from an interview with E.A. Babikova, born in 1950).

Nowadays, all cemeteries have fences. Some burials are surrounded by a wooden or metal enclosure around the space "reserved" for relatives. All grave structures are painted; the inscription concerning the deceased on the cross/post is replaced with photoceramics; red stars are nailed to the monuments of war veterans. This enculturation is associated with modern ideas about the memory of the deceased. Importantly, some innovations are now welcomed by the believers: "*People will come to the grave, see the photograph, and will commemorate, remember*". Similar innovations are also typical of the Old Believers living in other Russian regions (Kovrigina, 2014: 239).

In the villages along the Pizhma and Tsilma rivers, at every cemetery, one can see stretchers or poles leaning against a tree. On the day of the funeral, gravediggers bring them, and after transporting the coffin, they leave them at the graveyard. In the village of Ust-Tsilma and villages along the Pechora River, people use household poles, which are then returned to the household owners: "*the poles are disassembled so that the soul of the deceased would not return to the house*".

As in all places, graves at the cemetery are located along the EW line: the deceased is "*buried with his feet towards the east, facing the Last Judgment*"; according to John Chrysostom, "We bury [the deceased] towards the east, signifying the raising of the dead". The cross or post installed at the feet is associated not only with identification of the deceased, but also with the idea that he/she is praying while looking at the cross or icon, inserted into the post.

Types and varieties of funerary monuments

Three types of grave monuments were traditionally made in the Ust-Tsilma villages: crosses, high posts for adult burials, and low posts for children. Their height matched the height of the deceased person. All had a gable roof. Eight-pointed crosses were placed on the graves of mentors and ordinary Old Believers who died of natural causes. The Cross is the main Christian symbol signifying the victory of Christ over hell and death. The Cross is "the will of the Father, the glory of the Only Begotten, the exultation of the Spirit, the adornment of the angels, the security of the Church, the boast of Paul, the rampart of the saints, the light of the whole world" (John Chrysostom, 2022: 14). In the Russian North, setting up wooden crosses was primarily associated with piety. In villages, they were placed near houses; on the Kandalaksha, Tersky, and Zimny coasts of the White Sea they were put at fishing grounds, at encampments, as a "sign" along the roads, in memory of dead sailors and hunters; and they were set up as a vow, or in graveyards (Ovsyannikov, Chukova, 1990: 63). The installation of a grave cross was associated with the ideas of a bright afterlife, with hope for the future resurrection and eternal life for the souls of the deceased. It was based on a pillar hewn from a log with a diameter of 25–30 cm; two crossbeams were attached at the top. The upper crossbeam had arms 15–20 cm long, and the lower one had arms up to 50 cm long, on which a recess was made in the center and a cast icon was inserted (Fig. 1). Wooden icons, as was customary on the Vyg, were not attached to grave monuments in Ust-Tsilma villages. Another, slanted crossbeam was placed at the bottom of the pillar. The pillar's top was sharpened and a roof was attached. The bottom of its slopes was shaped in the form of five pointed teeth associated with five fingers. The inscription was pecked on the pillar: "Here lies the body of the servant of God (full name), born (date), died (date)" or "The body of the servant of God (full name), born (date), died (date) rests here". In the past, the roof ridge of the cross was decorated with carved stylized figures of animals or birds (Fig. 2). Horse head images facing in opposite directions were carved at the ends of the ridge. This decorative motif goes back to the 1st – early 2nd millennium AD, when women's clothing was decorated with horse-shaped pendants (Gribova, 1975: 77). The cult of the horse is reflected in the art of the Russian North, as evidenced by images of horse heads on the roofs of Mezen houses or figures of horses on Palashcheliye distaffs (Dmitrieva, 1988: 158). In the ancient Slavic tradition, the horse was a sacrificial animal in the funeral rite, and was considered a guide to the "other world". The design of grave monuments might have been related to similar ideas. Such roof ridges of grave monuments are widespread in the Komi culture and in the Ust-Tsilma villages neighboring the Komi-Izhma villages. A similar design of the roof ridge in burial structures has also been observed in the Udora villages of the Komi Old Believers (Vlasova, 2010: 139).

Eight-pointed crosses on the graves of mentors and those who were well-versed in Old Church Slavonic stand out at the cemeteries examined by the current author. According to the stories of old-timers, when those reached old age, they each made a cross for themselves and kept it for several years in the *povet**.

Since the 1960s, eight-pointed crosses began to be simplified and replaced with six-armed and sometimes four-armed crosses, which, however, did not become very widespread. Currently, grave crosses are not produced in all settlements of the Ust-Tsilma District. This is explained by the fact that people have departed from the faith and do not comply with church laws. The Kerchomya Komi Old Believers explain replacement of eight-pointed crosses with posts: "My grandfather saw the point of setting up a post in the fact that if you put up a cross, you need to fence off the place so dogs and other creatures won't defile the cross. But it is difficult to keep track of this, so it is better to set up a post instead of a cross" (Shurgin, 2009: 82).

Since the 1960–1970s, high or low posts, previously intended for "secular" Old Believers (those who married the representatives of a different religion), have become widespread as grave monuments. Posts were also placed on graves in the Russian Old Believers' settlements of the White Sea region (Opolovnikov, 1989: 140). In the mid-20th century, the tradition of burying people who died an unnatural death outside the rural cemetery was interrupted. They began to be buried in the circle of family graves, and a grave monument (a post with a roof) was erected. The post was square in cross-section; the upper part was slightly wider than the base and was interpreted as the "head". The roof was the same as that in burial structures of the first type. Nowadays, the post is often made the same width along its entire length, which is primarily associated with loss of beliefs about it as a projection of a person. There is also another explanation: "*They are in a hurry and do not want to shape it. It is faster that way*". Changes also have affected the design of the bottom part of the roof slopes. It is either flat or the number of teeth varies from four to seven.

In the 1970s, "a cross or post was placed on the grave in accordance with 'what the parents would tell' their children before death. Yet, that being the case, only those who deserved it by strictly observing the canons of faith, were honored by the cross. After death, the majority of ordinary Old Believers were expected to set up a post on their graves and put a small copper icon on it—the Crucifix and images of male saints for the male deceased, images of the Mother of God and female saints for the female deceased" (Shurgin, 2009: 82). According to popular beliefs, the deceased "gets up" and prays while looking at these icons. Similar ideas existed in other areas of the Russian North (Ivanova, 2007: 121). In the last three decades, eight-pointed crosses cut out from aluminum (for male burials) or baptismal crosses (for female burials) have been attached to grave monuments instead of icons due to more frequent cases of vandalism since the 1980s. Outsiders sometimes remove icons from grave monuments and damage burial structures. As the carriers of the culture say, "*the crosses/posts stand blind now*". Many elderly believers procure such

Fig. 1. Cemetery in the village of Ust-Tsilma. *Photo by T.I. Dronova*.

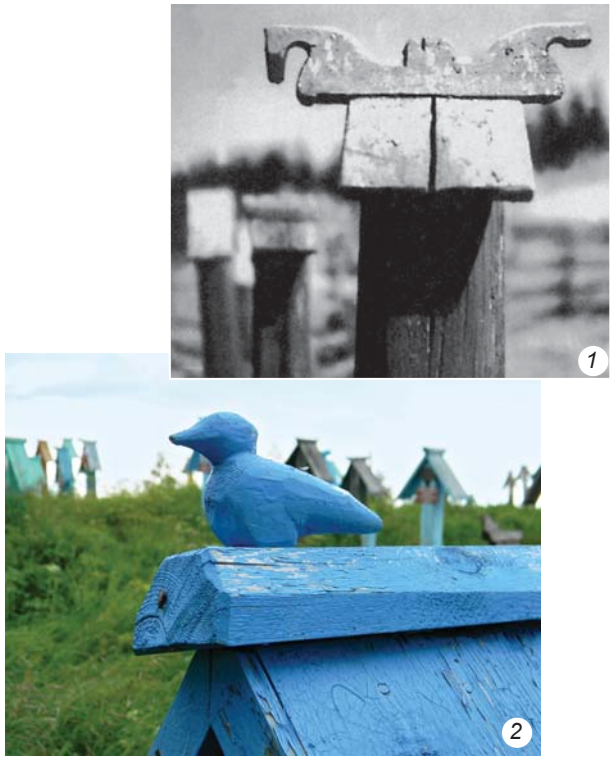

Fig. 2. Decoration of roof ridges of grave monuments in the villages of Garevo (*1*) and Trusovo (*2*) of the Ust-Tsilma District. *Photo by I.N. Shurgin and T.I. Dronova.*

*Attic space above the barn where hay, bath-house birch whisks, and various equipment are stored.

crosses during their lifetime and notify their loved ones about their location.

Until the 1980s, the third type of grave structures was intended for baptized infants and adolescents. At present, it is also used for unbaptized infants. The post was made of thin beams (10–15 cm in diameter). The bottom of the gable roof was left even. The top was equipped with a horse-shaped ridge decoration. An icon was not installed. Instead, the last name, first name, patronymic name, and date of death were pecked out. In the Komi Old Believers' villages, small crosses were set up on children's graves (Vlasova, 2010: 140).

Rare grave structures include low posts under a wide roof with gables, a traditional stylized horse and two slopes, the bottoms of which are shaped like sharp-angled teeth. Such monuments called *namogilnichki* (lit. 'small monuments on the grave') were common on the Vyg River.

Monuments of a low tetrahedral pillar with spherical top appear at cemeteries in three rural settlements along the Pechora River (villages of Ust-Tsilma, Karpushovka, and Koroviy Ruchey). Similar monuments have been observed on the Pinega and Mezen rivers. In the Ust-Tsilma villages, "posts without icons, with 'knob' tops, marked the burials of all those who died an unnatural death, without repentance, and therefore were not worthy of holy icons" (Shurgin, 2009: 83).

In the village of Skitskaya, which emerged on the site of the cells of the Velikopozhensky monastery, back in the first third of the 20th century, grave monuments were made similar to the Vyg low tetrahedral posts with hewn edges, decorated with carved geometric patterns. The remains of three such monuments were placed in a pit next to massive crosses and a small log building where, according to oral tradition, the bones of self-immolating Old Believers were buried. Currently, low, eight-pointed crosses and posts are put on graves.

In the past, burial structures were not painted but were left in their natural state. Now, as before, monuments are made of larch, with the lifespan of the larch items exceeding fifty years. When a cross or post decays, the remaining part is taken to the outskirts of the cemetery and the burial becomes nameless. It sometimes occurs that when digging a grave, people come across an old coffin and bury the newly deceased nearby or higher.

Grave arrangement followed the idea that it was the last home of a person. According to the Christian understanding, death is a milestone that ends a person's temporary earthly life and opens the eternal life of the soul. According to the Ust-Tsilma proverbs, "*A person is born for death, but dies for life*", "*We are born for a visit, but we die for an age*", "*We are born for an age, but we die for life*". As O.V. Nikiforova observed, "birth is not the beginning since death is inevitably intrinsic to birth; birth predetermines death. Death is also not the end, because life is embedded in death. Death predetermines life just as life predetermines death" (2015: 489). When escorting the deceased to the "other world", people would arrange his/her burial place taking these ideas into consideration. At cemeteries, some grave monuments consist of two parts: a cross/post and a *domovina* (variants: *golubets* (Tsilma, Ust-Tsilma), *golubnitsa* (Ust-Tsilma) (Markova, Nesanelis, 1990: 100), or *sklep* (Zamezhnaya); in the Russian North, these were called *srubtsy*). Scholars attribute such burial structures to the pre-Mongol period (Ermonskaya, Netunakhina, Popova, 1978: 28). Currently, they have survived mainly among the Old Believers. Residents of the Ust-Tsilma District do not know the origin of these wooden grave structures. In the Dictionary of V.I. Dahl, *golbets* is "a grave monument of logwork with a roof, booth, or hut; now they are prohibited; all monuments are also called this, especially a cross with a roof" (1880: 380). In Rus, the word *golubets* had two meanings: a grave monument with a carved post and roof, and an extension near the stove covering the entrance to the basement. Both meanings are related to the concept of "depth". In Ust-Tsilma villages, the use of the word *golubets* as a name for a grave monument has not been identified, but it is applicable to a plank structure covering the grave mound. According to popular beliefs, the coffin/*golubets* is the last home of the deceased. This idea can also be reconstructed from the folklore texts: "new upper room", "bright room", "bright room without doors and without windows", "bright room without windows and jambs" (Pechorskiye prichitaniya…, 2013: 133), "a built nest", "new high chamber", "new upper room", "evil wicked chamber" are the names of the coffin in funeral laments:

> They gave you a new room.
> A new room, but without gaps,
> Without removed grooves.
> The chamber is bright, yet without windows,
> Without brick stoves,
> Without squeaky doors.
> There will be no way out from that room.
> No going out and no leaving it
> (SA KSC UB RAS. F. 5, Inv. 2, D. 568, fols. 5–6).

The opinions of the present-day Ust-Tsilma Old Believers regarding the use of *domovina*/*golbets*/*golubnitsa* differ. Some believe that this is the last home of the deceased. Others explain the purpose of the structure as follows: "*so that the grave not be trampled*", "*now everyone without exception smokes—so that tobacco would not fall on the ground*". According to L.F. Soloviev, a resident of the village of Zamezhnaya, grave plank structures on the Pizhma were called *sklepy*; their construction was not large scale, these were rather individual cases. In fact, most Pizhma residents believe that the soil at the grave should be open. "*In recent*

decades, it has become fashionable to cover graves with boards for beauty. Some people plant flowers on top. But this was not done before" (Ibid.: fol. 39).

All burial structures known to the current author have been made of boards. They have a gable top (roof). To prevent water from getting inside, the boards were overlapped by stacking. Roof slopes were connected by a board. The custom of cutting out a "window" that remained open in one of the walls of the *domovina* is associated with the idea of the *domovina* as the person's last home. Later, people began to make a hole in the roof of the *golubets*, and cover it with a lid. Old Believers thus explained the purpose of the "window": "so the deceased could see the Second Coming of Christ" (Gunn, 1979: 114). Only near the Tsilma River, in a locally revered place of worship on the Tobysh River called "At the Deceased", does the *domovina* consist of logwork with two layers connected by one transverse log thereby leaving a gap between the layers. The top is flat and is made of tightly placed thin logs. A similar design of graves is now practiced among the Upper Pechora Old Believers-*skrytniki* (lit. 'the hidden ones') in the village of Skalyap.

During the Soviet period, the government introduced significant changes to the life of traditional society, which also affected the structure of cemeteries and funeral culture, since centuries-old traditions were recognized as being backward and relics of the past. The Ust-Tsilma Old Believers call the Soviet period the most destructive, when not only books and icons were burned, but cemeteries were destroyed. As the old-timers recall, "*they eradicated the sacred*". Five cemeteries were closed in Ust-Tsilma (plowed over for fields, passed on for construction sites), and one cemetery was closed in each of two adjacent villages.

Attempts were made to eradicate traditional lamentations for the deceased on the day of the funeral/commemoration. As in all places, the division of burial places by religion was abolished (Mokhov, 2014: 252). People who died an unnatural death were buried along with everyone else. In the 1970s, funerals with the participation of brass bands were introduced (this is how the members of the Communist Party and veterans of World War II were mostly buried), but in the post-Soviet period this innovation disappeared. Currently, stone monuments have been set up in Ust-Tsilma, which, according to old-timers, is unacceptable. The understanding that items accompanying the deceased to the "other world" must be subject to natural decay remains in the burial culture of the Ust-Tsilma Old Believers. In the past, burial structures were not restored. It was believed that with their natural decomposition, the deceased would join the ancestors, which were called in funeral prayers "not each by name, but all together". Other monuments violated this order of things. In addition, in commemorative rituals of the Ust-Tsilma residents, stone was associated with oblivion. According to popular beliefs, a deceased person who did not receive commemoration, "*lies like a stone*", "*there was a memory, but it has become a stone*".

Despite the ongoing transformations, the desire to be buried next to one's relatives according to the customary rules remains quite stable. Many Old Believers, who left their villages to reside permanently in the cities and towns of the Komi Republic, leave wills requesting that their place of repose be near their ancestors, and their relatives fulfill their last wishes.

Conclusions

This study has shown that cemeteries served as important places in the culture of the Ust-Tsilma Priestless Old Believers, being the location, according to people's beliefs, where communication occurs between the earthly and other world. Until the mid-20th century, graveyards in the Lower Pechora region did not undergo major transformations due to the well-known self-isolation of the residents. The lifestyle of the Ust-Tsilma people is still determined by old ecclesiastical traditions, but since it does not encompass all aspects of life, traditional ideas and beliefs contribute to social order. This makes it possible to consider the Ust-Tsilma group as ethnic and confessional, and its traditional culture as local.

Family cemeteries, as well as traditions of arranging graveyards and graves, have survived from the time of the arrival of the first settlers to the Pechora River and its tributaries, the Pizhma, Tsilma, and Neritsa rivers. The cemetery is the world of the dead; every village has its own cemetery. In some settlements, there are several cemeteries, where burials are made according to family clan affiliation. Many graveyards are currently incorporated into the rural environment, but still operate. Attempts to close them have been unsuccessful.

In the understanding of the Ust-Tsilma Old Believers, death does not interrupt the relationship between people. The living take care of the burial places of their loved ones and pray for their repose, while the deceased "watch" the living and, depending on their actions, "send" grace or "punish" them for correction. This is revealed by the Ust-Tsilma proverbs: "*Burying the deceased is half the work; what is more important is how they will be commemorated*", "*The dead does not stand at the gate, but brings out his own*". Regulation of ritual actions performed at the cemetery is regarded as a way of ensuring grace and peace for the living and dead. Even today, the memory of the dead and belief in the afterlife makes young Ust-Tsilma residents turn to the ancient traditions of their grandfathers, thereby supporting and prolonging them.

Acknowledgment

This study was carried out under the state assignment of the Federal Research Center in the Komi Science Center of the Ural Branch of the Russian Academy of Sciences (Project State Registration Number FUUU-2021-0010).

References

Andryunina M.A. 2013
"Posolstvo" inogo mira na zemle – simvolika kladbishcha v narodnoy kulture. *Slavyanovedeniye*, No. 6: 43–51.

Dahl V.I. 1880
Tolkoviy slovar zhivogo velikorusskogo yazyka, vol. 1. 2nd edition. Moscow, St. Petersburg: Izd. M.O. Volfa.

Danilko E.S. 2019
"Smert blizhe rubashki": Pokhoronnaya obryadnost staroobryadtsev chasovennykh. *Noviye issledovaniya Tuvy*, No. 1: 44–59.

Deti i detstvo v narodnoy kulture Ust-Tsilmy: Issledovaniya i materialy. 2008
T.I. Dronova, T.S. Kaneva (comp.). Syktyvkar: Syktyvkar. Gos. Univ.

Dmitrieva S.I. 1988
Folklor i narodnoye iskusstvo russkikh Yevropeiskogo Severa. Moscow: Nauka.

Dobrovolskaya V.E. 2013
Kladbishche kak mesto vstrechi zhivykh i mertvykh: Pravila, reguliruyushchiye vzaimootnosheniya dvukh mirov v traditsionnoy kulture Tsentralnoy Rossii. *Slověne*, No. 1: 111–122.

Dronova T.I. 2007a
Legendy i predaniya o mestnochtimykh svyatykh i poklonnykh mestakh Pizhemskogo kraya (po materialam issledovaniy nizhnepechorskikh staroverov-bespopovtsev). In *Traditsionnaya kultura Russkogo Severa: Istoriya i sovremennost: Materialy V nauch. konf. po izucheniyu narodnoy kultury Russkogo Severa*. Petrozavodsk: pp. 33–36.

Dronova T.I. 2007b
Lokalniye traditsii v prazdnovanii Ivanova dnya u staroverov-bespopovtsev Ust-Tsilmy (konets XIX–XXI vv.). *Etnograficheskoye obozreniye*, No. 2: 106–118.

Ermonskaya V.V., Netunakhina G.D., Popova T.F. 1978
Russkaya memorialnaya skulptura: K istorii khudozhestvennogo nadgrobiya v Rossii XI – nachala XX v. Moscow: Iskusstvo.

Gagarin Y.V. 1975
Presledovaniye staroobryadchestva v komi kraye russkoy pravoslavnoy tserkovyu i samoderzhavnym gosudarstvom v XIX–XX vv. In *Voprosy istorii Komi ASSR (XVII–XX vv.)*, V.N. Davydov (ed.). Syktyvkar: [s.l.], pp. 116–132. (Trudy IYALI KF AN SSSR; iss. 16).

Gribova L.S. 1975
Permskiy zveriniy stil: Problemy semantiki. Moscow: Nauka.

Gunn G.P. 1979
Po nizhney Pechore. Moscow: Iskusstvo. (Dorogi k prekrasnomu).

Ivanova A.A. 2007
Kladbishcha i mogilniki v kulturnom landshafte Pinezhya. *Traditsionnaya kultura*, No. 4: 117–122.

John Chrysostom. 2022
Chrysostom's Homily on the Word Koimeterion and on the Cross: A Translation and Commentary, D.M. Friel (transl.). *Vigiliae Christianae.* No. 76, pp. 1–36.

Kovrigina I.A. 2014
Pogost kak fenomen kultury staroobryadtsev Zabaikalya. *Vestnik Irkutskogo gosudarstvennogo tekhnicheskogo universiteta*, No. 3: 238–242.

Kozhurin K.Y. 2014
Povsednevnaya zhizn staroobryadtsev. Moscow: Molodaya gvardiya.

Levkievskaya E.E. 2004
Predstavleniya o "tom svete" u vostochnykh slavyan. In *Slavyanskiy almanakh*. Moscow: Indrik, pp. 342–367.

Markova Z.M., Nesanelis D.A. 1990
Ob arkhaike v semanticheskoy strukture dialektnogo slova (golbets – golubets – golubnitsa). In *Russkiye govory Komi ASSR i sopredelnykh oblastey: Mezhvuzovskiy sb. nauch. tr.*, V.V. Kolesov (ed.). Syktyvkar: Syktyvkar. Gos. Univ., pp. 96–104.

Mokhov S.V. 2014
"Pamyat ne v kamne zhivet": Prostranstvo Rogozhskogo kladbishcha v rasskazakh yego posetiteley. *Antropologicheskiy forum*, No. 22: 249–266.

Nikiforova O.V. 2015
Leksicheskaya obyektivatsiya narodnykh predstavleniy o smerti v nizhegorodskikh govorakh. *Vestnik Nizhegorodskogo universiteta im. N.I. Lobachevskogo*, No. 2: 489–492.

Opolovnikov A.V. 1989
Sokrovishcha Russkogo Severa. Moscow: Stroyizdat.

Ovsyannikov O.V., Chukova T.A. 1990
Severniye derevyanniye kresty (k voprosu o tipologii). In *Yazychestvo vostochnykh slavyan*. Leningrad: Gos. muzey etnografii, pp. 60–76.

Pechorskiye prichitaniya i zametki o pokhoronnom obryade v zapisyakh ekspeditsii GIII 1929 g. (iz polevykh dnevnikov A.M. Astakhovoy). 2013
T.S. Kaneva (ed. and comm.). In *Iz istorii russkoy folkloristiki*, iss. 8. St. Petersburg: Nauka, pp. 109–146.

Shurgin I.N. 2009
Ot lesnoy izbushki do tserkvi divnoy: Derevyannaya arkhitektura komi. Moscow: Sovpadeniye.

Vlasova V.V. 2010
Staroobryadcheskiye gruppy komi: Konfessionalniye osobennosti sotsialnoy i obryadovoy zhizni. Syktyvkar: Komi NC UrO RAN.

Yukhimenko E.M. 2002
Vygovskaya staroobryadcheskaya pustyn: Dukhovnaya zhizn i literatura, vol. 1. Moscow: Yazyki slavyan. kultury.

Received May 19, 2022.
Received in revised form June 24, 2022.

doi:10.17746/1563-0110.2023.51.4.135-141

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A Case of Surgical Treatment of Lower Molars in a Mesolithic Sample from a Cemetery on the Yuzhny Oleniy Ostrov, Karelia, Russia

Here, we present the earliest case of surgical treatment of mandibular permanent molars known in Northern Eurasia. It concerns an aged woman buried at a Mesolithic cemetery on the Yuzhny Oleniy Ostrov (Island) in Lake Onega, southern Karelia, 8250–8050 cal BP. Our objective was to reconstruct the technology of surgical intervention, and to diagnose and describe the underlying condition. To do this, we carried out an examination of teeth and bone tissues of the upper and lower jaws and a traceological analysis of identified lesions. As we found, in the last few months of her life, the woman underwent several dental operations, including the extraction of the lower left third molar and, in a stepwise fashion, of fragments of the distal part of crown and lingual part of the distal root of the lower right first molar. The first operation was successful—the woman survived for at least two months after it had been performed. The second operation was also successfully performed at least two months before death, likely immediately after the trauma. The mesial part of the crown was removed just before death. No ancient cases where fragments of an injured tooth were removed are known to us. The removal of the lower third molar can be compared only with the earliest previously known case, described in a sample from the Pucará de Tilcara fortress in Northern Argentina (15th–16th centuries AD). Indications for surgery partly coincide in both cases, and include complications of apical periodontitis and the development of osteomyelitis. However, the technology of surgery and its logistics are different.

Keywords: Mesolithic, tooth extraction, osteomyelitis, paleopathology, septic cavernous sinus thrombosis.

Archaeology, Ethnology & Anthropology of Eurasia 51/4 (2023) 135–141 E-mail: Eurasia@archaeology.nsc.ru

Introduction

Cases of dental treatment are rarely described in paleoanthropological studies and are, thus, of a great interest for researchers. A thorough analysis of such cases can help to reconstruct the techniques of ancient dental treatment, contributing to the history of dentistry, as well as to the knowledge regarding human views about their body in the past. Some evidence of oral hygiene and dental treatment are found as early as in the Middle Paleolithic. Traces of the use of toothpicks for cleaning the dental spaces and, possibly, reducing the pain accompanying inflammatory diseases have been reported from various localities in Eurasia (Lozano et al., 2013). In a sample from Chagyrskaya Cave (Altai Mountains, Russia), a case of scraping of a carious cavern by a stone tool was detected (unpublished data of A.V. Zubova, L.V. Zotkina, and K.A. Kolobova, being prepared for publication).

There is evidence of the use of toothpicks in the Upper Paleolithic (see, e.g., (Alt, Pichler, 1998: 404, fig. 15)). A case of treatment of caries of the lower third molar by scraping the cavern by a stone edge was described at Villabruna in northern Italy (Oxilia et al., 2015).

In the Neolithic, the techniques of dentistry became even more diverse: drilling of carious cavities (Coppa et al., 2006), trephination of odontogenic abscesses (Bennike, Fredebo, 1986), and, probably, filling of teeth fissures with beeswax to reduce tooth sensitivity (Bernardini et al., 2012). But for quite a long time, between the Late Pleistocene and the period of the dispersal of Neolithic tribes in Europe, there have been no skeletal evidence of dentistry. In the present study, we describe the first case of surgical dental treatment for the Mesolithic of Northern Europe (and North Eurasia in general).

Traces of dental treatment were detected in an individual buried at the island of Yuzhny Oleny Ostrov in the Onega Lake (South Karelia). The necropolis is located in the northwestern part of a small island nearby a larger (Klimenets) island, and contains more than 170 burials. The number of burials might originally exceed 400, but most of them were occasionally destroyed in modern times. The burials are predominantly single (116), while double (16) and triple (3) burials are much rarer. These lie in boulder-pebble Quaternary sediment at a depth from 0.5 to 1.22 m (Gurina, 1956: 11–15). The deceased were typically buried in an extended supine position, with the head eastwards, with small deviations to the southeast or northeast. Several unique vertical burials were excavated as well. Most of the skeletons were thickly covered with ocher (Ibid.: 16). The site belongs to the Late Mesolithic Onega culture, and dates to the range from 8250 to 8050 cal BP. The necropolis is believed to have been used by various Mesolithic Onega populations as a common burial ground. The tribes might gather at the island in order to resolve the issues of using the hunting and fishing grounds that became acute due to the climate crisis related to the 8200 BP cooling event (Schulting et al., 2022).

The traces of dental treatment discussed in the present article were detected in the skull of a female from burial 142—a single burial at the northern margin of the necropolis. The deceased was placed to the grave in an extended supine position, with her head to the southeast. Her arms were bent in the elbows, while the hands were placed on the pelvis. Grave goods from the burial included only a bone borer and a fragment of bone arrowhead; the skeleton was thickly covered with ocher (Gurina, 1956: 412–413).

The aim of the present study was to reconstruct the techniques of the dental treatment applied to the dentition of the female. We set out to diagnose and describe the pathogenesis of the diseases that evoked the treatment, and to compare our cases with those published previously.

Material and methods

The skull from burial 142 (MAE collection, No. 5773-74) was studied. The specimen is well-preserved, with some small post-mortem damage. The cortical layer of the occipital bone displays subtle breaks around *foramen magnum*; the sphenoid bone is destroyed; a small hole is present in the central part of the cranial vault. The right zygoma and mandible (two fragments) were remodeled with wax. The cortical layer of the anterior wall of the maxilla is partially broken; the roots of the frontal teeth and first molars are visible. The roots of the mandibular lateral incisors and canines are partially naked; the upper left central incisor, lower left canine, and lower first premolar were lost post-mortem. Teeth were covered with wax-rosin mastic and plasticine, which cannot be removed completely.

The sex of the individual could not be determined based on morphological criteria, since the innominates were severely damaged and thus not informative. The results of genetic analysis showed that the individual was a female (W. Haak, personal communication). The age-at-death is estimated as older than 50 years, based on complete obliteration of the endocranial sutures and severe dental wear, which led to the loss of more than a half of the teeth crowns height.

The diagnostic of the diseases that led to the dental surgery was based on both visual inspection of the dentition and CT imaging. The CT was performed using the direct geometric magnification technique at the Department of Electronic Instruments and Devices of LETI (St. Petersburg Electrotechnical University) by MRCT-04 scanner (scanning parameters: X-ray tube voltage 140 kV, amperage 50 μA, no filter, slice thickness 0.1 mm).

For reconstructing the surgical techniques, traceological analysis of the dental and bone lesions was carried out at the Laboratory of the Experimental Traceology of the Institute for the History of Material Culture RAS, using a binocular microscope MBS-9 (oblique illumination, magnification up to ×98). A multifocal photographical fixation of the traumatic lesions and surgical manipulations was performed using the CANON EOS Utility software. The resulting image was aggregated in the Helicon Focus 5.2 software.

Results

Paleopathological description of the dentition. Manifestations of chronic generalized periodontitis (II–III degree) were detected during the assessment of general condition of the dental system of the deceased. Both maxillary and mandibular alveolar margins are blunt; the alveolar ridges between the incisors and canines are porous. The roots of the mandibular frontal teeth are naked from both vestibular (3.2 mm on average) and lingual (3 mm) surfaces (post-mortem damage disregarded). The same values for the maxillary teeth: 3.5 and 2.5 mm, respectively. All the teeth exhibit dental calculus, many display pre-mortem chipping (the largest defects are observed in the molars). No visible signs of caries are present.

Traces of surgery. Our traceological analysis detected signs of intentional manipulations with two teeth of the mandible: right first and left third molars. In the area of the socket of the latter, a large lesion 17.32 mm long and 11.26 mm deep is observed. This was likely a result of the extraction of the tooth and lingual alveolar wall (Fig. 1). Traces of the initial penetration of a cutting tool were detected in the distal part of the socket (Fig. 1, *a*); the incision of the soft tissue and bone was then continued in the mesial direction (Fig. 1, *b*). The cut fragment was removed together with the tooth. Bone regeneration and pre-mortem polishing of the internal side of the incision are observable at the lesion. Newly formed cancellous bone is present at the bottom of the socket (Fig. 1, *c*). Enamel wear and regeneration of the edge of incision suggest that the individual have survived for at least several months after the surgery.

The lower right first molar was crushed pre-mortem simultaneously with its antagonist, which was likely due to biting a hard object. The upper tooth exhibits only a partial chipping of the crown, while the lower molar crushed completely in the longitudinal direction and lost the distal part of the crown and the distal root (Fig. 2). Two sets of lesions were detected in the vestibular part of its socket (Fig. 3). The first set includes chippings, 1.2 mm in size on average, that surround the apical part of the cell of the distal root (Fig. 3, *a*). The force that caused those was directed from inside the socket to the external surface of the wall. Those lesions are likely a result of removing of a broken fragment of the root.

The second set of lesions includes traces of cutting the cell of the mesial root from the vestibular side. A jagged

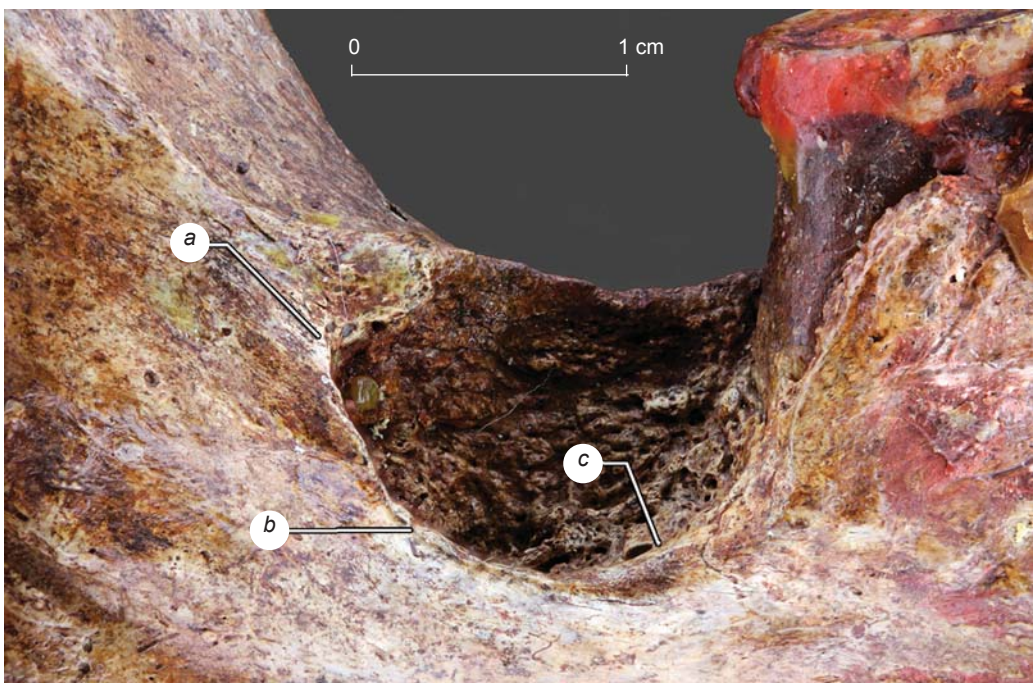

Fig. 1. Macrophotography of the socket of the extracted lower left third molar. *Photo by A.A. Malyutina.*
a – trace of the initial penetration of the cutting tool; *b* – manifestations of the bone incision; *c* – newly-formed cancellous bone.

Fig. 2. A fragment of the right half of the mandible with a damaged lower first molar. *Photo by A.A. Malyutina.*

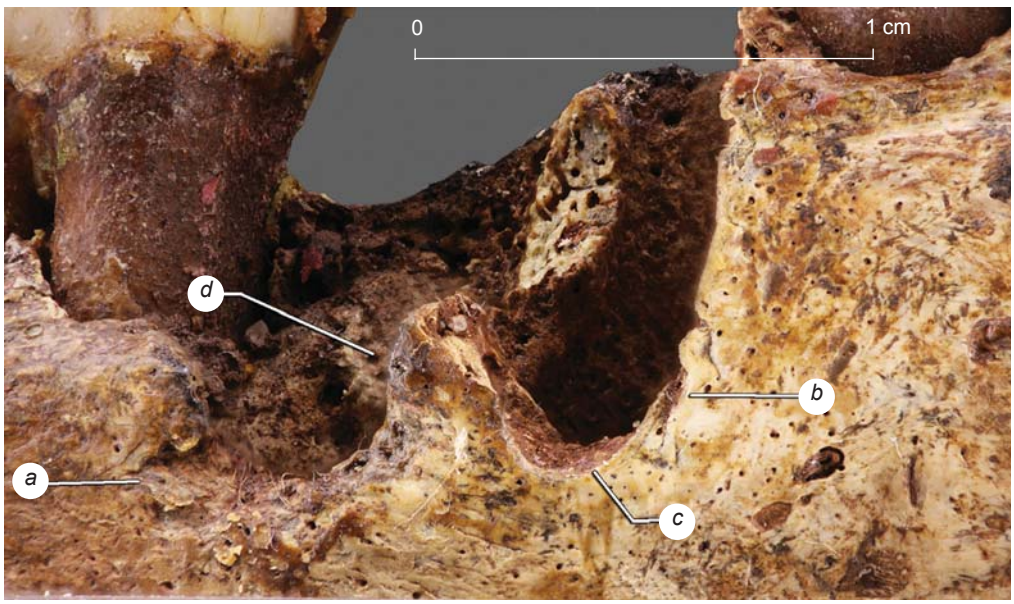

Fig. 3. Macrophotography of the signs of the surgery in the area of the lower right first molar. *Photo by A.A. Malyutina.*
a – traces of crushing the root; *b* – trace of the initial penetration of the cutting tool; *c* – manifestations of the bone incision; *d* – newly-formed cancellous bone.

indentation is visible in the vestibular surface near the mesial wall of the socket: a trace of the initial incision of bone by a cutting tool with a thin and sharp tip (Fig. 3, *b*). The indentation continues as a straight cutting line, which can be traced along the whole preserved apical part of the cell of the mesial root (Fig. 3, *c*). Signs of healing both at the chippings and cut marks are absent, but present in the lingual part of the cell of the distal root which is partially filled with spongy bone (Fig. 3, *d*).

Reconstruction of the etiopathogenetic mechanisms of development of the diseases which led to the surgery. The lesions observed in the alveoli of the two described molars are the evidence of several dental surgeries carried out during the last several month of the woman's life. The most large-scale of those was the extraction of the lower left third molar. It was difficult to determine the ultimate cause of the surgery based on a visual assessment only, since the process of bone

healing has remodeled the initial lesions. However, the results of CT scanning and a detailed analysis of the general conditions of teeth and bone of the left half of the mandible have facilitated our reconstruction of the pathogenesis of the diseases that might have been the indications for the surgery.

The pathogenetic process was generalized and involved not only the left third molar, but the neighboring teeth as well. As was noted above, the deceased suffered from chronic periodontitis progressing due to the poor oral hygiene. A deep periodontal pocket had formed in the lower left first molar. The poor oral hygiene also led to the development of a carious lesion of the proximal surface of this tooth from the side of the second premolar (Fig. 4, *a*). The cavity does not penetrate to the occlusal surface, which remains complete; thus, the lesion could not be detected visually. But it is visible in the CT image as a dimmed spot in the tooth crown of a T-shape and a heterogeneous structure.

Caries had likely progressed for a long time, since the cavity reached the pulp chamber (Fig. 4, *b*). It had also triggered chronic pulpitis, which developed into apical periodontitis manifesting by forming of cystogranulomas in all the roots of the tooth (Fig. 4, *c*). As all these lesions were quite large, the process had been developing for a long time.

Periodontitis was complicated by chronic osteomyelitis near the lower left first molar. Numerous cavities indicating the latter disease are visible in the CT image of the mandible as dimmed spots (Fig. 4, *d*). The pathological locus had extended and led to bone resorption not only in the area of the M_1, but also of neighboring teeth, including the left third molar. The bone tissue surrounding the socket near the surgery point is porous and exhibits cavities similar to those detected near the first and second molars. A large bone cavity at the bottom of the M_3 socket, reaching the mandibular canal, is also a manifestation of osteomielitis (Fig. 4, *d*). The development of chronic osteomyelitis from the first towards the third molar could have provoked a gradually increasing pain, redness, and swelling of the soft tissues of the maxillofacial area, the formation of fistulas with purulent exudate, increased body temperature, chills, and weakness. These symptoms might have been the cause for the extraction of the tooth.

The manipulations on the lower right first molar were of a different kind. Those were a result of an acute mechanical injury that led (according to the position of the sings of healing) to breaking the tooth crown into at least three parts two of which were extracted pre-mortem at different times. The removal of the lingual part of the distal root and the neighboring part of the crown was likely carried out without using any tool, immediately after the trauma, and at least two months before the death of the individual, which is suggested by a partial filling of the socket by newly formed bone. The mesial part of the root was removed much later, and no signs of healing is visible in this part of the socket. The part of the root was likely firmly anchored in the alveolus after the trauma owing to the pear-like shape of the root, which can be reconstructed based on the socket's configuration. This had obstructed the surgery and led to the damage to the vestibular surface of the mandible and to forming the chips detected by the traceological analysis.

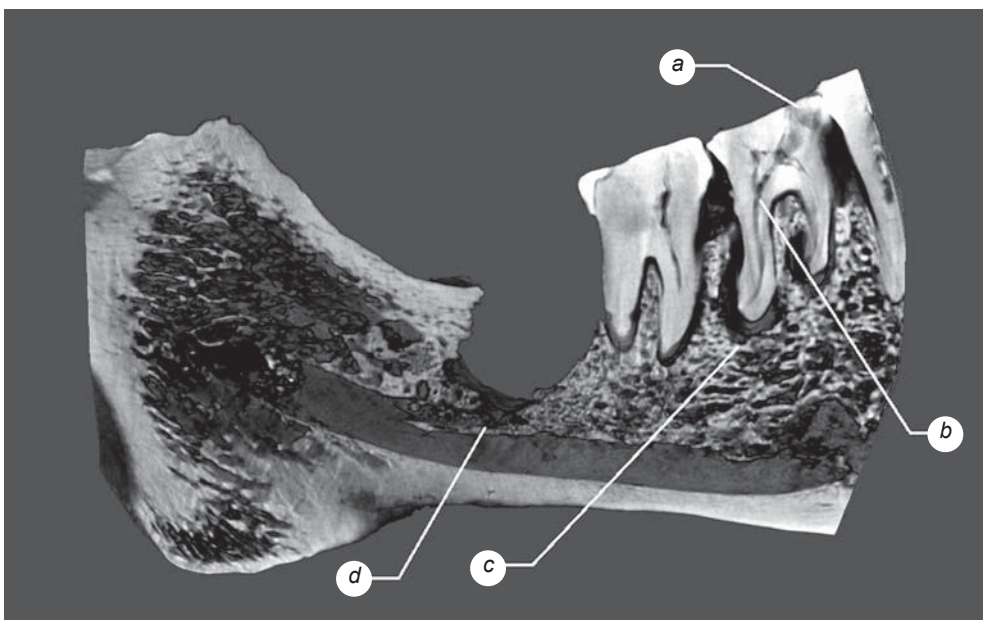

Fig. 4. A CT image of the left side of the mandible.
a – carious cavity; *b* – manifestations of chronic pulpitis; *c* – area of cystogranulomas; *d* – cavity in the apical area.

An incision of the mesial root's socket was performed simultaneously with removing the fragments of the distal root. The purpose of this is unclear: it could be an accessory manipulation during the root extraction, or a separate surgery carried out in order to heal the postoperative complications. Not more than a few days separated the extraction of the root and the incision of the socket: the woman died shortly after those surgeries.

Discussion

A thorough comparative analysis of the case presented in our study is obstructed by the almost complete absence of publications of detailed reconstructions of examples of dental surgery based on archaeological cranial data. The extraction of the lower third molar can only be compared with the most ancient known case (15th–16th centuries AD) described in the sample of the Omaguaca Indians from the Pucará de Tilcara fortress in Northern Argentina (Zubova et al., 2020). An individual from the fortress lost his both lower third molars due to a surgery. A comparison of that with the present study has shown that the indications for surgery were partially similar in both cases: complications of apical periodontitis and the development of osteomyelitis. But the techniques and organization of the surgeries were different.

At Pucará de Tilcara, the surgery was carried out in the plane of the mandibular occlusal surface via a subtle widening of the alveolar contour, followed by scraping of its filling by multiple semi-circular movements of a cutting tool. Every movement led to only a shallow penetration, with the aim to preserve the mandibular body as much as possible (Ibid.: 153). But in the Yuzhny Oleniy Ostrov individual, the tooth was extracted by one or two deep incisions from the lingual part of the mandible, excluding any possibility of preserving the bone tissue. The possibility for the Omaguaca surgeon to carry out the manipulations with multiple delicate movements likely suggests that the patient was immobile. But in our case, on the contrary, the extraction was performed with a minimal number of movements and disregarding the scale of the possible damage. This can suggest that the surgery was carried out rapidly, and no attempt to immobilize or anesthetize the patient was made.

Despite the clear superiority of the system of medical knowledge and technologies in the Inca Empire as compared to the South Karelian Mesolithic tribes, the outcome of the surgery was negative in both cases. While the extraction of the first tooth in the Argentinian individual was successful, the second surgery led to the death of the patient as the surgeon underscored the severity of pathology and missed the deadline for the intervention: this likely resulted in the development of fatal phlegmon and sepsis (Ibid.: 155).

The female buried at Yuzhny Oleniy Ostrov was alive for at least two months after the extraction of the lower third molar. The large alveolar resection stimulated an adequate blood outflow from the area of inflammation and the subsequent wound healing. But the patient died a few days after the removal of fragments of the right first molar. The cause of death was most likely septic thrombosis of the cavernous sinus, which developed as a result of an exacerbation of chronic osteomyelitis provoked by the additional traumatization. The removal of the right first molar's fragments was carried out with a minimal opening of the socket. This provoked the formation of a hematoma, with its possible subsequent suppuration and spread of the infectious process along the venous outflow paths into the pterygoid venous plexus of the deep region of the face, anastomosing with the cavernous sinus through the system of the ophthalmic veins and the venous plexuses of the oval (*foramen ovale*) and torn (*foramen lacerum*) foramina of the middle cranial fossa.

Thus, the surgical molar extraction could not stop the development of the pathological process, which also partially affected the left mandibular canal. It is feasible that, similar to the Pucará de Tilcara individual, this led to the development of sepsis equally fatal for both a Mesolithic Karelian and an Omaguaca Indian person in the middle of the 2nd millennium AD.

Conclusions

The dental lesions detected in the female skull from burial 142 of the Oleniy Ostrov burial site evidence a unique for the Mesolithic Eurasia case of multiple dental surgical interventions in the same individual. The absence of similar cases in other burials of the necropolis cannot lead to a conclusion regarding a comprehensive and widespread system of surgical knowledge in that ancient population. But even this single case provides an insight about the medical traditions of the North European Mesolithic humans. A comparison of the case of a lower third molar extraction with a similar surgery performed by an experienced Inca surgeon at the Pucará de Tilcara fortress has shown that for almost 8000 years the technique of dental surgery did not influence the outcome of an extraction. The principal factors of the survival of the patient were the quality of the diagnosis determining the timeliness of an intervention; patient's immune strength; the presence or absence of means of fighting with chronic infectious diseases and postoperative infectious complications. The latter were extremely limited in ancient times and clearly insufficient to ensure the patient's recovery, in both cases discussed.

Acknowledgement

This study was supported by the Russian Science Foundation, Project No. 21-18-00376.

References

Alt K.W., Pichler S.L. 1998
Artificial modifications of human teeth. In *Dental Anthropology: Fundamentals, Limits and Prospects*, K.W. Alt, F.W. Rösing, M. Teschler-Nicola (eds.). Wien: Springer, pp. 387–415.

Bennike P., Fredebo L. 1986
Dental treatment in the Stone Age. *Bulletin of the History of Dentistry*, vol. 34: 81–87.

Bernardini F., Tuniz C., Coppa A., Mancini L., Dreossi D., Eichert D., Turco G., Biasotto M., Terrasi F., De Cesare N., Hua Q., Levchenko V. 2012
Beeswax as dental filling on a Neolithic human tooth. *PLoS ONE*, vol. 7 (9).

Coppa A., Bondioli L., Cucina A., Frayer D.W., Jarrige C., Jarrige J.-F., Quivron G., Rossi M., Vidale M., Macchiarelli R. 2006
Early Neolithic tradition of dentistry. *Nature*, vol. 440: 755–756.

Gurina N.N. 1956
Oleneostrovskiy mogilnik. Moscow, Leningrad: Izd. AN SSSR. (MIA; vol. 47).

Lozano M., Subirá M.E., Aparicio J., Lorenzo C., Gómez-Merino G. 2013
Toothpicking and periodontal disease in a Neanderthal specimen from Cova Foradá site (Valencia, Spain). *PLoS ONE*, vol. 8 (10).

Oxilia G., Peresani M., Romandini M., Matteucci C., Debono Spiteri C., Henry A.G., Schulz D., Archer W., Crezzini J., Boschin F., Boscato P., Jaouen K., Dogandzic T., Broglio A., Moggi-Cecchi J., Fiorenza L., Hublin J.-J., Kullmer O., Benazzi S. 2015
Earliest evidence of dental caries manipulation in the Late Upper Palaeolithic. *Scientific Reports*, vol. 5, Art. No. 12150.

Schulting R.J., Mannermaa K., Tarasov P.E., Higham T., Bronk Ramsey C., Khartanovich V., Moiseyev V., Gerasimov D., O'Shea J., Weber A. 2022
Radiocarbon dating from Yuzhniy Oleniy Ostrov cemetery reveals complex human responses to socio-ecological stress during the 8.2 ka cooling event. *Nature Ecology & Evolution*, vol. 6: 155–162.

Zubova A.V., Pikhur O.L., Obodovsky A.V., Malyutina A.A., Dmitrenko L.M., Chugunova K.S., Pozdnyakov D.V., Bessonov V.B. 2020
A case of surgical extraction of the lower third molars in a cranial series from the Pucara de Tilcara Fortress (Jujuy Province, Argentina). *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 48 (2): 149–156.

Received December 8, 2022.

doi:10.17746/1563-0110.2023.51.4.142-151

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Origin of the Andronovans: A Statistical Approach

The origin of the Andronovo population is explored using a statistical rather than typological approach. Four questions are raised. Which Eastern European populations of the Middle Bronze and the transition to the Late Bronze Age had taken part in Andronovo origins? What was the contribution of the southern groups? What was the role of the autochthonous Siberian substratum? What was the population background of the dichotomy between two major Andronovo cultural traditions, Fedorovka and Alakul? To address these questions, measurements of 12 male Andronovo cranial samples (nine relating to Fedorovka and three to Alakul) and 85 male cranial samples from Eastern Europe, Siberia, Kazakhstan, Southwestern Central Asia, Southern Caucasus, and the Near East were subjected to canonical variate analysis, and minimum spanning trees were constructed. The results suggest that the most likely ancestors of Andronovans were Late Catacomb tribes of Northern Caucasus, people of Poltavka, Sintashta, and those associated with the Abashevo-Sintashta horizon. While no direct parallels with Southern Caucasian, Southwestern Central Asian or Near Eastern populations were found among Andronovo groups, some of them could have inherited the southern component from either the Abashevo or the Catacomb people. In the former case, one should postulate a gradient: Fatyanovo → Balanovo → Abashevo → Sintashta → Petrovka → Andronovo; in the latter case, the variation within Andronovo is directly derivable from that among the Catacomb populations. Andronovo groups displaying an autochthonous Siberian tendency demonstrate various degrees of "mutual assimilation" between immigrants and pre-Mongoloid natives. Differences between the Fedorovka and Alakul samples are significant but very small. A special role of Petrovka in the origin of Alakul is not supported by the analysis.

Keywords: *Southern Siberia, Eastern Europe, Late Bronze Age, Andronovo culture, Fedorovka tradition, Alakul tradition.*

Introduction

The origin of the Andronovo people remains somewhat enigmatic. This general problem consists of several partial ones. First, which Eastern European populations of the Middle Bronze Age and the transition to the Late Bronze Age had taken part in Andronovo origins? Second, what was the contribution of the southern (Southern Caucasian, Southwestern Central Asian, and Near Eastern) groups? Third, what was the role of the autochthonous Siberian substratum? Fourth, what was the population background of the two major Andronovo cultural traditions, Fedorovka and Alakul?

The first problem can be examined on the basis of cranial material that has appeared in the recent years and relates to the Poltavka, Sintashta, and Petrovka cultures, as well as to the Abashevo-Sintashta horizon (see below).

I have already tried to answer the second question, stating that migration impulses resulting in the emergence of the Andronovo population had originated in Eastern

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Europe (including Northern Caucasus) and Central Europe, and that physical anthropology provides no grounds whatever for speaking of migrations from the south (Kozintsev, 2008, 2009, 2017). This evoked criticism: gracile Andronovo (Fedorovka) "Mediterraneans" of the Altai reveal, as the critics claim, Southern Caucasian parallels (Kiryushin, Solodovnikov, 2010), which they ascribe to the Samus-Yelunino substratum. Dental anthropology and cranial nonmetrics, too, have revealed southern (typologically "Mediterranean") traits in those people (Tur, 2009, 2011). The same tendencies were found by A.A. Kazarnitsky (2012: 141–143) in Middle and Late Bronze Age populations of Kalmykia, some of which were shown to be likely ancestors of Andronovans (Kozintsev, 2009). Kazarnitsky was the first to note that in the Bronze Age, maximal cranial gracility was found not in the south (in Southern Caucasus), but in the west—in Central and Western Europe. Among the samples he studied, the most gracile ones resemble those from Southern Caucasus. "This allows us", he writes (Ibid.: 141), "to reject with a fair degree of certainty the idea that Western European groups had taken part in the origin of Middle and Late Bronze Age populations of the northwestern Caspian (Shevchenko, 1986)". All the above appears to uphold the key role of the southern impulse in the Andronovo origin, too. Isn't it time for me to admit that I was wrong?

I wouldn't hesitate to do that, were it not for genetics, which unambiguously points to the western rather than southern source of migrations resulting in the origin of Sintashta, Petrovka, Andronovo, and Srubnaya populations. Two thirds of their gene pool were inherited from the steppe populations of the Early and Middle Bronze Age, and one third from the Corded Ware groups. This conclusion, based on the genome-wide analysis (Narasimhan et al., 2019), forced K.N. Solodovnikov and A.V. Kolbina (2018) to accept the importance of the Central European component in the formation of Sintashta (and, consequently, Andronovo) populations, whereas A.A. Khokhlov and E.P. Kitov (2019) have remained unconvinced. Therefore, one should revisit cranial materials and try to understand the reason of the controversy.

The third question, about the autochthonous Siberian component, has become much clearer after T.A. Chikisheva (2012: 69–72, 98–101, 113–115) had introduced new cranial samples from the Baraba forest-steppe (see also (Chikisheva, Pozdnyakov, 2003, 2019)).

The fourth question, concerning the nature of differences between Fedorovka and Alakul, can also be revisited with the help of new materials, since now we have as many as 12 Andronovo samples—nine from Fedorovka burials, and three from those associated with the Alakul tradition. A special focus of interest is the Petrovka sample, because some view Petrovka as early Alakul (Tkachev, 2003; Vinogradov, 2011: 141).

Materials and methods

For a complete analysis (statistical and graphical), measurements of 58 male cranial samples were used, relating to the following cultures, periods, and territories of Siberia, Kazakhstan, and Eastern Europe*:

1. Andronovo (Fedorovka) culture, Central, Northern, and Eastern Kazakhstan (Solodovnikov, Rykun, Loman, 2013)**;
2. Same, Baraba forest-steppe (Chikisheva, 2012: 12, 113–115);
3. Same, Rudny Altai (Kiryushin, Solodovnikov, 2010);
4. Same, Barnaul stretch of the Ob, Firsovo XIV (Ibid.);
5. Same, Barnaul-Novosibirsk stretch of the Ob (Ibid.);
6. Same, Chumysh River (Ibid.);
7. Same, Tomsk stretch of the Ob, Yelovka II (Solodovnikov, Rykun, 2011);
8. Same, Kuznetsk Basin (Chikisheva, Pozdnyakov, 2003);
9. Same, Minusinsk Basin (Solodovnikov, 2005);
10. Andronovo (Alakul-Kozhumberdy) culture, Southern Urals and Western Kazakhstan (Khokhlov, Kitov, Kapinus, 2020);
11. Andronovo (Alakul) culture, Central, Northern, and Eastern Kazakhstan (Solodovnikov, Rykun, Loman, 2013)***;
12. Same, Omsk stretch of the Irtysh, Yermak IV (Dremov, 1997: 83, 85);
13. Yamnaya-Catacomb group, Kalmykia (Kazarnitsky, 2012: 77);
14. Early Catacomb culture, Kalmykia (Ibid.: 69);
15. Same, Lower Dnieper, Verkh-Tarasovka (Kruts, 2017: 68, and unpublished);
16. Same, Kakhovka (Ibid.);
17. Same, Northwestern Azov, Molochnaya River (Ibid.);
18. Catacomb culture, Stavropol (Romanova, 1991);
19. Same, Southern Kalmykia, Chogray (Kazarnitsky, 2011: 75);
20. Same, Northern Kalmykia (Kazarnitsky, 2012: 91);
21. Same, Volga Basin (Shevchenko, 1986);

*In cases where a sample was studied or rearranged by several authors, the latest publication is indicated—one from which the data were taken. While the overlap between samples has been minimized, it was, regrettably, impossible to avoid it altogether, which decreases the statistical significance of the results to some extent.

**In the publication, male and female crania are pooled with the help of standard coefficients of sex dimorphism. I used only measurements of male crania, kindly provided to me by K.N. Solodovnikov.

***Measurements of male crania are used, provided by K.N. Solodovnikov.

Averages and standard errors of traits in the Abashevo-Sintashta and Sintashta male cranial samples

Traits	Abashevo-Sintashta			Sintashta		
	N	*M*	*SE*	*N*	*M*	*SE*
1. Cranial length	6	185.5	3.9	18	188.1	1.7
8. Cranial breadth	6	139.3	2.7	18	138.0	1.3
8:1. Cranial index	6	75.2	1.2	16	73.9	1.0
17. Cranial height	5	131.8	3.3	14	137.9	1.9
9. Minimal frontal breadth	6	97.8	2.0	21	98.2	0.9
45. Bizygomatic breadth	5	135.8	4.7	11	138.7	1.7
48. Upper facial height	5	67.0	2.8	17	71.5	1.0
55. Nasal height	6	50.2	1.3	17	51.6	0.7
54. Nasal breadth	6	24.0	0.5	16	24.5	0.3
51. Orbital breadth (mf)	5	42.6	1.3	15	42.9	0.4
52. Orbital height	5	32.0	1.1	17	32.1	0.4
77. Naso-malar angle	6	135.5	1.4	16	137.3	0.9
∠zm'. Zygo-maxillary angle	6	130.3	2.3	13	127.5	1.4
SS : SC. Simotic index	6	45.3	2.4	15	58.0	3.2
75 (1). Nasal protrusion angle	5	28.2	2.3	18	32.7	1.6

Note. *N* – number of observations, *M* – mean, *SE* – standard error.

22. Same, Lower Volga (Khokhlov, 2017: 282–283);
23. Same, Don Basin (Shevchenko, 1986);
24. Same, Crimea (Kruts, unpublished);
25. Same, Lower Dnieper, Kherson (Ibid.);
26. Same, Zaporozhye (Kruts, 2017: 68, and unpublished);
27. Same, Kakhovka (Ibid.);
28. Same, Krivoy Rog (Kruts, unpublished);
29. Same, Lower Dnieper, Verkh-Tarasovka (Kruts, 2017: 68, and unpublished);
30. Same, Samara-Orel watershed (Kruts, unpublished);
31. Same, Yuzhny Bug-Ingulets watershed (Ibid.);
32. Fatyanovo culture, Central Russia (Denisova, 1975: 94);
33. Balanovo culture, Chuvashia, Balanovo (Akimova, 1963);
34. Abashevo culture, Mari El, Pepkino (Khalikov, Lebedinskaya, Gerasimova, 1966: 39–42);
35. Poltavka culture, Samara stretch of the Volga and the Volga steppe (Khokhlov, 2013: 187–188);
36. Babino (Multi-Cordoned Ware) culture, Dnieper steppes (Kruts, 1984: 48, 50);
37. Lola culture, Northern Caucasian steppes (Kazarnitsky, 2012: 112);
38. Krivaya Luka cultural group, Middle Volga (Khokhlov, 2017: 275–276);
39. Abashevo-Sintashta horizon, Volga-Ural forest-steppe (Khokhlov, Grigoryev, 2021). Averages and standard errors (see *Table*) were calculated after individual data (Ibid.);
40. Sintashta culture, Volga-Ural area (Potapovka type burials) and Eastern Urals. Averages and standard errors (see *Table*) were calculated after individual data published by G.V. Rykushina (2003) and relating to Krivoye Ozero, E.P. Kitov (2011: 71) relating to Bolshekaragansky, and A.A. Khokhlov (2017: 286–293) relating to Potapovka I, Utevka VI, Grachevka I, Krasnosamarsky IV, Tanabergen II, and Bulanovo I. Crania from Potapovka 2-1, 2-2-1, 2-2-2, and 5-16, which are earlier (Otroshchenko, 1998), and those from burials 4 and 9 at Bulanovo with Seima-Turbino artifacts (Khalyapin, 2001; Khokhlov, 2017: 100) were excluded;
41. Petrovka culture, Southern Urals and Northern Kazakhstan (Kitov, 2011: 74–75);
42. Okunev culture, Khakas-Minusinsk Basin, Tas-Khazaa (Gromov, 1997);
43. Same, Uybat (Ibid.);
44. Same, Chernovaya (Ibid.);
45. Same, Verkh-Askiz (Ibid.);
46. Karakol culture, Gorny Altai (Tur, Solodovnikov, 2005);
47. Chaa-Khol culture, Tuva (Gokhman, 1980);
48. Yelunino culture, Upper Ob (Solodovnikov, Tur, 2003);
49. Samus culture, Tomsk-Narym stretch of the Ob (Solodovnikov, 2005)*;
50. Chemurchek culture, Western Mongolia (Solodovnikov, Tumen, Erdene, 2019);
51. Ust-Tartas culture, Baraba forest-steppe, Sopka-2/3 (Chikisheva, 2012: 69–72);
52. Same, Sopka-2/3A (Ibid.);

*Only measurements of male crania were used.

53. Odino culture, Sopka-2/4A (Ibid.: 98–101);

54. Same, Tartas-1 (Chikisheva, Pozdnyakov, 2019);

55. Same, Preobrazhenka-6 (Ibid.);

56. Krotovo culture, classic stage, Sopka-2/4B, C (Chikisheva, 2012: 98–101);

57. Late Krotovo (Cherno-Ozerye) culture, Sopka-2/5 (Ibid.);

58. Same, Omsk stretch of the Irtysh, Cherno-Ozerye-1 (Dremov, 1997: 83, 85).

Also, to address the question of southern affinities of the Andronovans, measurements of 39 samples from the Caucasus, Southwestern Central Asia, and the Near East were employed*.

Early Bronze Age groups—those associated with the Yamnaya and Afanasyevo cultures—were not included because of the chronological gap separating them from Andronovo. In theory, admittedly, descendants of Afanasyevans could have survived in certain areas of Southern Siberia for several centuries and provided a substratum for the Andronovo populations. V.P. Alekseyev (1961) even regarded the Afanasyevans of the Altai as ancestors of all Andronovans, which is hard to accept today. However, the Andronovo (Fedorovka) people of Firsovo XIV and Rudny Altai are indeed indistinguishable from the Afanasyevans of Saldyar in Gorny Altai (Kozintsev, 2009). The similarity is all the more impressive because of territorial proximity of those groups, so one needn't postulate any migrations. And still, there are no direct indications that descendants of Afanasyevans had survived until the Andronovo age. Also, Afanasyevans are very similar to Catacomb people (Kozintsev, 2009, 2020), so caution must be applied when assessing such parallels.

The trait battery includes 14 principal measurements: cranial length, breadth, and height, minimal frontal breadth, bizygomatic breadth, upper facial height, nasal and orbital height and breadth, naso-malar and zygo-maxillary angles, simotic index, and nasal protrusion angle. Measurements were processed with canonical analysis, Mahalanobis' distances corrected for sample size (D^2_c) were calculated, and minimum spanning trees (MST), showing the shortest path between group centroids on the plane generated by two canonical variates, were constructed. The latter method, unlike cluster analysis, is optimal for revealing gradients**. B.A. Kozintsev's package CANON and Ø. Hammer's package PAST (version 4.05) were used.

Obviously, being stochastic, the conclusions of this study need to be verified by archaeological and genetic data.

Results

Andronovans versus Eastern European groups of the Middle and transition to the Late Bronze Age. Fig. 1 shows the arrangement of 58 populations included in the principal analysis on the plane of the first two canonical vectors, describing 68 % of the total variation. Close ties between Andronovans and Catacomb people are evident: most Andronovo samples (No. 1, 3–6, and 8–11) are either within the Catacomb cluster, occupying most of the left half of the graph, or close to it. The same applies to the Poltavka and Petrovka samples (No. 35 and 41). Three post-Catacomb samples—Babino (No. 36), Lola (No. 37), and Krivaya Luka (No. 38)—differ from all Andronovo and Catacomb ones, except the early Catacomb sample from Kakhovka (No. 16), by being very gracile (typologically "Mediterranean"). The Corded Ware cluster is markedly stretched. Its most gracile group, Fatyanovo (No. 32), is close to the post-Catacomb samples; Abashevo (No. 34) displays a Catacomb-Andronovo tendency; and Balanovo (No. 33) is intermediate. The Sintashta group (No. 40) falls inside the Corded Ware cluster, while being actually closer to certain Catacomb and Yamnaya samples than to those associated with the Corded Ware tradition (see below). Four Andronovo samples (No. 2, 7, 8, and 12) exhibit a shift toward Siberian autochthones (see below). One of them, in which this tendency is relatively weak (No. 8, from the Kuznetsk Basin) is connected with Abashevo-Sintashta (No. 39) by the MST edge.

To better understand the nature of variation in European groups, we will exclude three Andronovo samples, in which the native Siberian tendency is the strongest (No. 2, 7, and 12), as well as all the presumably autochthonous Siberian populations (No. 42–46 and 50–58), and repeat the analysis for the remaining samples (Fig. 2). Although the two new canonical variates now account for only a half (53 %) of the total variation, the pattern has become clearer. The Corded Ware cluster is now separated from the Catacomb-Andronovo one. The Sintashta group (No. 40) is no longer within the former, being shifted towards Catacomb and Andronovo samples. Yelunino (No. 48), on the other hand, joins the Corded Ware groups, despite being actually close only to Chaa-Khol (No. 47). Poltavka (No. 35) and Petrovka (No. 41), as before, are in the center of the Catacomb-Andronovo cluster.

Let us estimate the mean differences between the 12 Andronovo groups and ten others, whose role in Andronovo origin is the most probable on the basis of

*The sources of data are indicated in publications by Kiryushin and Solodovnikov (2010), Kozintsev (2000), Khudaverdyan (2009), Khodjayov, Mustafakulov, and Khodjayova (2011: 6–13, 97–103), and Kazarnitsky (2012: 140).

**Previously, I used a different approach—nonmetric multidimensional scaling of the distance matrix and finding the shortest path between group centroids in the original multidimensional space (Kozintsev, 2020, 2021). The experts have not yet decided which method is better.

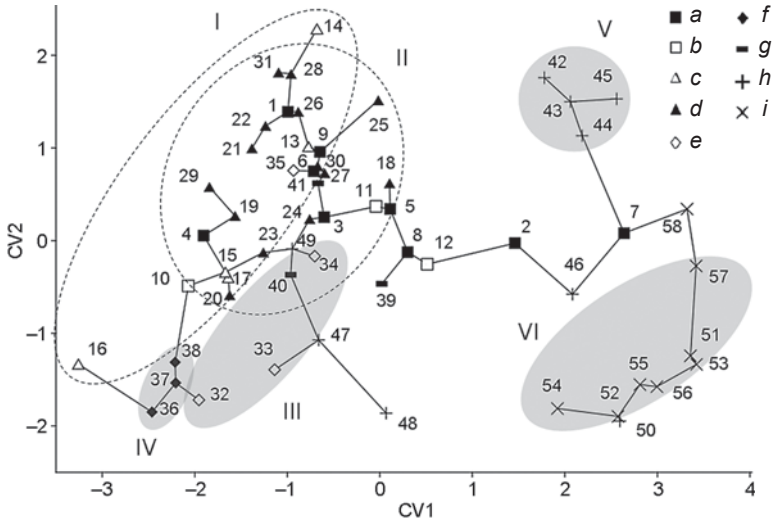


Fig. 1. Position of male cranial samples on the plane of two canonical variates, CV1 and CV2.

Straight lines are edges of the minimum spanning tree, showing the shortest path between group centroids on the plane. Dashed contours and spots show groupings based on archaeological criteria**:** I – Early Catacomb; II – Late Catacomb; III – Corded Ware; IV – post-Catacomb; V – Okunev; VI – Baraba native Siberian. *a* – Fedorovka; *b* – Alakul; *c* – Early Catacomb; *d* – Late Catacomb; *e* – other Middle Bronze Age groups; *f* – post-Catacomb; *g* – other groups transitional between Middle and Late Bronze Age; *h* – Okunev and Okunev type; *i* – Baraba native Siberian. See text for group numbers.

archaeological, genetic, and geographic criteria, namely three Late Catacomb groups—those from Northern Caucasus (No. 18–20, pooled), Volga (No. 21) and Don (No. 23), Balanovo (No. 33), Abashevo (No. 34), Poltavka (No. 35), Babino (No. 36), Abashevo-Sintashta (No. 39), Sintashta (No. 40), and Petrovka (No. 41). Because variation within Andronovo is important, the distance of each Andronovan sample and each of the ten others was regarded as one observation. In each of the following cases, therefore, ranked in the decreasing order of mean D^2_c (i.e., in the increasing order of similarity), the sample consists of 12 observations, which were used to calculate the average distance, its error, and the 95 % confidence interval (Fig. 3):

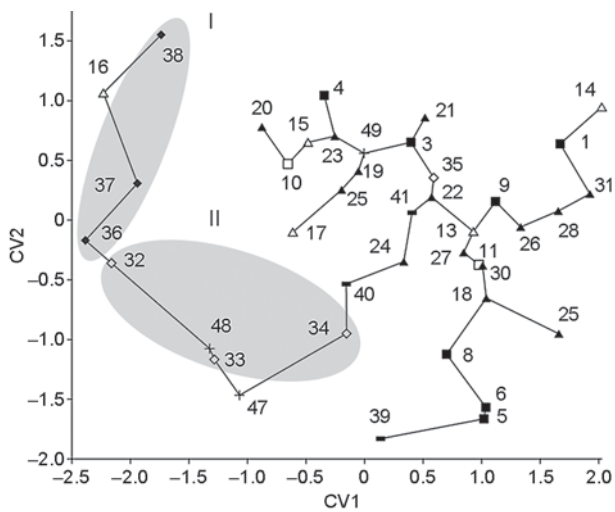


Fig. 2. Position of male cranial samples on the plane of two canonical variates, CV1 and CV2. Native Siberian groups and Andronovo samples with a native Siberian tendency are excluded.

Cultural groupings shown by spots: I – post-Catacomb; II – Corded Ware. See Fig. 1 for explanations.

Babino – 15.03 ± 1.95;
Balanovo – 10.17 ± 1.27;
Catacomb (Volga) – 7.55 ± 1.64;
Abashevo – 7.26 ± 0.95;
Petrovka – 6.66 ± 1.15;
Catacomb (Don) – 6.18 ± 1.35;
Abashevo-Sintashta – 5.38 ± 0.73;
Sintashta – 5.01 ± 0.91;
Poltavka – 4.94 ± 1.20;
Catacomb (Northern Caucasus) – 4.75 ± 1.05.

The general comparison of all these estimates shows that the differences are highly significant: according to ANOVA, $F = 19.6$, $d.f. = 9; 110$, $p < 0.001$; according to the nonparametric Friedman test, $\chi^2 = 53.8$, $d.f. = 9$, $p < 0.001$. The pairwise comparison of mean distances using the parametric Tukey test shows that the Babino sample is significantly further from those of Andronovo than the remaining ones, whereas Balanovo is further from Andronovo than any of the six samples of the right flank, beginning from Petrovka. The Wilcoxon nonparametric test is more informative, showing that differences between all the groups, except the last four, are significant. Precisely these four groups, therefore—Catacomb from Northern Caucasus, Poltavka, Sintashta, and Abashevo-Sintashta—are closest to Andronovo samples.

The role of the southern component. In this case, there is no need to construct any graphs—it suffices to simply compare each of the 12 Andronovo samples with each of the 39 southern ones (see above). How many Southern Caucasian, Southwestern Central Asian, and Near Eastern groups, then, are close to those associated with the Andronovo culture ($D^2_c < 1$)?

Fedorovka tradition, Central, Northern, and Eastern Kazakhstan – none;

same, Baraba forest-steppe – Dashti-Kazy (Tajikistan, Upper Zarafshon) (Khodjayov, 2004);

same, Rudny Altai – Dashti-Kazy;

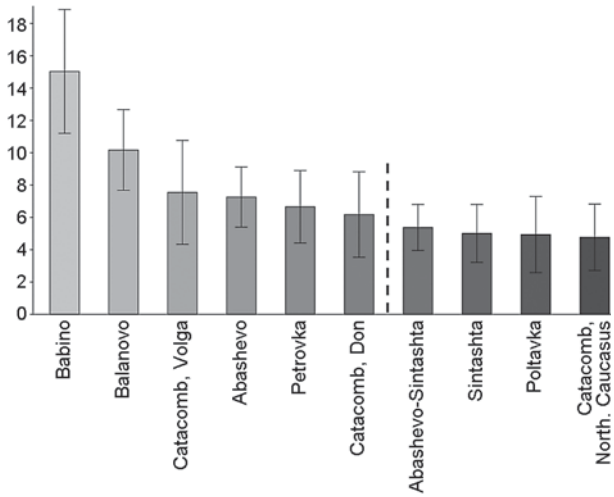


Fig. 3. Average distances (D^2_c) between 10 Middle and transitional to Late Bronze Age samples and 12 Andronovo groups with 95 % confidence intervals.

same, Barnaul stretch of the Ob, Firsovo XIV – none;
same, Barnaul-Novosibirsk stretch of the Ob – none;
same, Chumysh – none;
same, Tomsk stretch of the Ob, Yelovka II – none;
same, Kuznetsk Basin – Dashti-Kazy;
same, Minusinsk Basin – none;
Alakul-Kozhumberdy tradition, Southern Urals, and Western Kazakhstan – none;
Alakul tradition, Central, Northern, and Eastern Kazakhstan – none;
same, Omsk stretch of the Irtysh, Yermak IV – Dashti-Kazy.

We will return to the late sample from Dashti-Kazy in the Discussion. The Yelunino group is far from all Andronovo groups and doesn't display a single southern parallel. The Samus sample is close to only one Andronovo group—that from Rudny Altai, and likewise shows no southern affinities. By contrast, Firsovo XIV, Rudny Altai, and Alakul-Kozhumberdy are in the very midst of Catacomb groups (see Fig. 2), being also close to a number of Yamnaya and Srubnaya ones. The first reveals five very close Yamnaya and Catacomb parallels; the second, seven; and the third, whose purportedly southern ties were the subject of prolonged and heated debates (for a review, see (Kozintsev, 2017)), likewise seven.

The aboriginal Siberian component. Let us return to Fig. 1. As noted above, four Andronovo samples exhibit a marked eastern shift. They are arranged in a gradient along the first canonical vector, the eastern traits increasing in the following order: Fedorovka from the Kuznetsk Basin (No. 8) → Alakul from Yermak IV in the Omsk stretch of the Irtysh (No. 12) → Fedorovka from the Baraba forest-steppe (No. 2) → Fedorovka from Yelovka II in the Tomsk stretch of the Ob (No. 7). Whereas the Kuznetsk sample is not far from, say, the Catacomb group of Stavropol (No. 18), Yelovka is rather close to the morphologically "easternmost" groups such as Andronovo from Cherno-Ozerye (No. 58), and Late Krotovo from Sopka 2/5 (No. 57). Halfway between the Fedorovka-type Andronovans of the Baraba forest-steppe and Yelovka II, along the first canonical vector, is the Karakol sample (No. 46). The further accretion of eastern traits terminates abruptly, and the pattern acquires an entirely different meaning, mirrored by the second canonical vector. Here, the Andronovans of Baraba and Tomsk are intermediate between the Okunev people (whom T.A. Chikisheva attributes to the Southern Eurasian Formation) and the autochthonous Neolithic and Bronze Age populations of Baraba, which, in her view, exemplify the Northern Eurasian Formation; close to which are the Chemurchek people of Mongolia (No. 50).

Fedorovka versus Alakul. It appears impossible to discern any regularity in the position of Fedorovka and Alakul samples on the graphs (see Fig. 1, 2). To approach this problem in more detail, we will confine the analysis to Andronovo groups. As it turns out, the Fedorovka people differ from those of Alakul only on the sixth canonical variate. Its mean value in nine Fedorovka groups is -0.217 ± 0.082; in three Alakul groups, 0.659 ± 0.210, and there is no overlap (Mann-Whitney p = 0,016). But even if this vector is artificially separated, the opposition between Fedorovka and Alakul is quite indistinct (Fig. 4). Traits with the highest loadings on CV6 are cranial and nasal height, and those with opposite signs, upper facial height and nasal breadth. But capturing such a structure of relationships by means of simple indices (vertical facio-cerebral and nasal) proves impossible, because the share of variation explained by CV6 is too small, only 2.7 %.

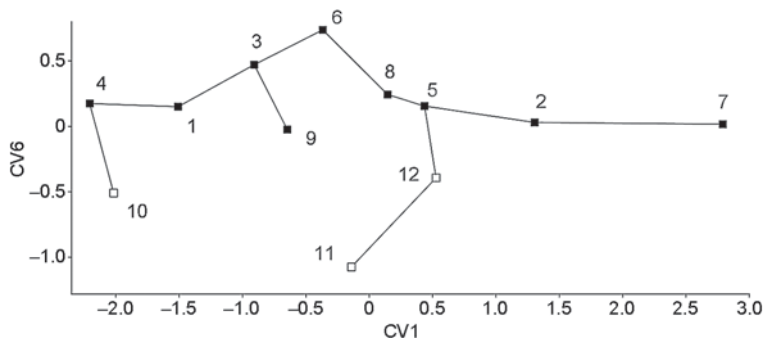


Fig. 4. Position of male Fedorovka and Alakul samples on the plane of the first and sixth canonical variates.
See Fig. 1 for explanations.

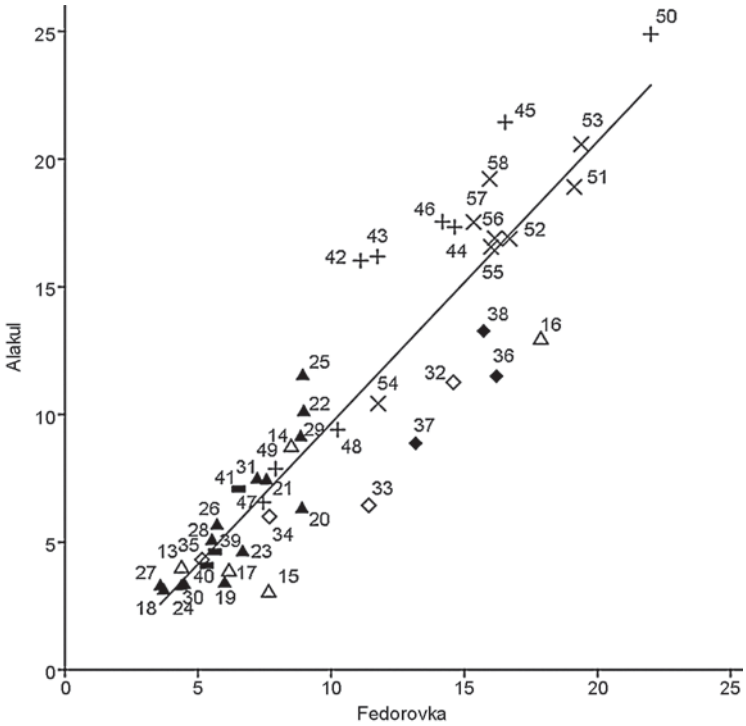


Fig. 5. Correlation between average distances of Fedorovka and Alakul groups from others.
See Fig. 1 for explanations.

The correlation between average distances (D^2_c) of the Fedorovka and Alakul groups from 46 others (Fig. 5) is quite strong ($r_s = 0.92$, $p < 0.001$), demonstrating yet again that differences between them are very small. If the analysis is confined to ten groups selected on extra-anthropological grounds (see above), the coefficient of rank correlation drops to 0.83 ($p = 0.003$). The largest disagreement concerns the Petrovka group, which, on average, is closer to Fedorovka samples (6.52) than to those associated with Alakul (7.08), although certain archaeologists view Petrovka as early Alakul.

Discussion

The relative contribution of Eastern European populations to the origins of Andronovo is far from being well understood. On the one hand, Fig. 2 reveals a vector, along which the samples are arranged in the following succession: Fatyanovo → Balanovo → Abashevo → Sintashta → Petrovka → Andronovo, which agrees with geographic, archaeological, and genetic facts (Nordqvist, Heyd, 2020: 20, fig. 11). Admittedly, the special role of Petrovka as an immediate precursor of Alakul is not supported by the analysis. Fig. 2 shows a continuity between Abashevo-Sintashta and the subcluster of Fedorovka samples from the Barnaul-Novosibirsk area, the Chumysh, and the Kuznetsk Basin. On the other hand, while Andronovans are opposed to the Sintashta and Abashevo people (let alone those of Balanovo and Fatyanovo), being connected with them only by a gradient, their close connection with the Catacomb and Poltavka people is direct, without any gradients (See Fig. 2, 3).

Interpreting the differences between the Andronovo groups (except those revealing an autochthonous Siberian tendency, see below) is no easier than understanding the geographic and chronological differences between the Catacomb samples. Only one thing is apparent: in terms of craniometry alone, the variation within Andronovo is fully derivable from that within the Catacomb community. The same applies to the problem of the southern component. Postulating Southern Caucasian affinities of the Andronovans of the Altai was as futile as searching for the sources of the Alakul-Kozhumberdy population in Southwestern Central Asia. I must reiterate my earlier claim: no direct southern parallels have been detected for any Andronovo group. Or rather, to be more precise, there is one single parallel—with an immigrant population associated with the intrusive culture of the Steppe Bronze, attested by burials at Dashti-Kazy in Tajikistan (Khodjayov, 2004). This late and sharply heterogeneous group, dating to 1200–1000 BC and apparently resulting from a mechanical admixture of highly dissimilar individuals (aborigines and people of steppe descent), has no bearing on our topic.

As for the indirect ties of Andronovans with the south, if the presumed (but unconfirmed) Yelunino substratum is disregarded, two possibilities remain. One is that Andronovans had received the southern component from the Corded Ware people, as suggested by the genome-wide analysis (Narasimhan et al., 2019). Certain physical anthropologists accepted this idea (Solodovnikov, Kolbina, 2018), while others rejected it (Khokhlov, Kitov, 2019). What do cranial data suggest? The gradient Fatyanovo → Balanovo → Abashevo → Sintashta → Petrovka → Andronovo (Fig. 2) is easy to understand. An intense influx of southern genes to Europe from the Near East with the spread of farming is a well-known fact, accounting for A.A. Kazarnitsky's findings (see above). During the Middle and Late Bronze Age, the southern component gradually decreased on its way from Central Europe to the Urals, being replaced by the steppe component (Narasimhan et al., 2019).

The second possibility is that Andronovans had inherited southern affinities from the Catacomb people, who are cranially very close to them. Dental data suggest

likewise (see (Zubova, Chikisheva, Pozdnyakov, 2014)). The Catacomb people, on the other hand, could have received the southern genes both directly from Southern Caucasus (Kazarnitsky, 2012: 141, 143) and indirectly, with the Yamnaya legacy (for the origin of the southern component in the Yamnaya population, see (Anthony, 2019; Kozintsev, 2019)). If "the origin of cultures transitional between the Middle and Late Bronze Age <…> should be viewed in the context of a general destruction and dissociation of the Corded Ware, Catacomb, and Abashevo communities" (Litvinenko, 2003: 148), then, in the case of Andronovans, it suffices to assume that the "strong underlying Catacomb substratum" (Ibid.) turned out to be stronger than that of Abashevo-Corded Ware. Geneticists point to the importance of the Yamnaya contribution to Sintashta and Andronovo, but they did not examine the Catacomb component, which is close to Yamnaya.

As regards Andronovo groups displaying an autochthonous Siberian tendency, what we deal with here is not "Mongoloid admixture", as commonly assumed, but various stages of "mutual assimilation" of immigrants and pre-Mongoloid autochthonous populations of Siberia (Chikisheva, 2012: 123; Kozintsev, 2021). The share of the aboriginal component is relatively minor in Fedorovka people of the Kuznetsk Basin and the Alakul people of the Omsk Irtysh area (Yermak IV). It is much higher in Fedorovka people of the Baraba forest-steppe and especially the Tomsk stretch of the Ob (Yelovka II), who resemble those associated with the natives of Cherno-Ozerye, culturally influenced by Andronovans, and the Karakol people, whose western traits have a pre-Andronovo origin. Interestingly, the Yelovka II group is the earliest known population displaying a "Uralian" combination of craniometric and cranial nonmetric traits, apparently evidencing the southward spread of the Uralic speakers from the taiga to the sub-taiga belt (Kozintsev, 2004, 2021).

Differences between the Fedorovka and Alakul groups are inappreciable as compared to those within them, indicating common origin. The same conclusion was reached by dental anthropologists, who ascribe the differentiation between these two traditions to social factors (Zubova, Chikisheva, Pozdnyakov, 2014), and even earlier by O.N. Korochkova (1993). The nature of those factors remains a matter of guesswork.

Conclusions

1. The most likely ancestors of Andronovans are Late Catacomb people of Northern Caucasus, as well as those associated with Poltavka, Sintashta, and the Abashevo-Sintashta horizon.

2. Andronovans display no direct southern ("Mediterranean") affinities. But they could have received the southern component indirectly either from the Catacomb or from the Abashevo people.

3. Andronovo groups showing an autochthonous Siberian tendency demonstrate various stages of "mutual assimilation" between the immigrants from the west and the pre-Mongoloid natives of Siberia.

4. Interpreting the cultural division between the two Andronovo traditions—Fedorovka and Alakul—in terms of physical anthropology is impossible. Apparently, they had a common origin.

Acknowledgement

I am thankful to K.N. Solodovnikov and the late S.I. Kruts for granting me access to their unpublished data.

References

Akimova M.S. 1963
Paleoantropologicheskiye materialy iz Balanovskogo mogilnika. In *Bader O.N. Balanovskiy mogilnik: Iz istorii lesnogo Povolzhiya v epokhu bronzy*. Moscow: Izd. AN SSSR, pp. 322–362.

Alekseyev V.P. 1961
Paleoantropologiya Altaye-Sayanskogo nagoriya epokhi neolita i bronzy. In *Antropologicheskiy sbornik*, iss 3. Moscow, Leningrad: Izd. AN SSSR, pp. 107–206. (TIE, Nov. ser.; vol. 71).

Anthony D. 2019
Archaeology, genetics, and language in the steppes: A comment on Bomhard. *Journal of Indo-European Studies*, vol. 47 (1/2): 173–196.

Chikisheva T.A. 2012
Dinamika antropologicheskoi differentsiatsii naseleniya yuga Zapadnoi Sibiri v epokhi neolita – rannego zheleza. Novosibirsk: Izd. IAET SO RAN.

Chikisheva T.A., Pozdnyakov D.V. 2003
Andronovo populations of West Siberia: Cranial data. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 3: 132–148.

Chikisheva T.A., Pozdnyakov D.V. 2019
The physical anthropology of the Odino people, Western Siberia. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 47 (4): 128–139.

Denisova R.Y. 1975
Antropologiya drevnikh baltov. Riga: Zinatne.

Dremov V.A. 1997
Naseleniye Verkhnego Priobiya v epokhu bronzy (antropologicheskiy ocherk). Tomsk: Izd. Tomsk. Gos. Univ.

Gokhman I.I. 1980
Proiskhozhdeniye tsentralnoaziatskoi rasy v svete novykh paleoantropologicheskikh materialov. In *Issledovaniya po paleoantropologii i kraniologii SSSR*. Moscow, Leningrad: Izd. AN SSSR, pp. 5–34. (Sbornik MAE; No. 36).

Gromov A.V. 1997
Proiskhozhdeniye i svyazi naseleniya okunevskoi kultury. In *Okunevskiy sbornik*. St. Petersburg: Petro-RIF, pp. 301–358.

Kazarnitsky A.A. 2011
Paleoantropologiya epokhi bronzy stepnoi polosy Yuga Vostochnoi Evropy. Cand. Sci. (History) Dissertation. IEA RAN. St. Petersburg.

Kazarnitsky A.A. 2012
Naseleniye azovo-kaspiyskikh stepei v epokhu bronzy (antropologicheskiy ocherk). St. Petersburg: Nauka.

Khalikov A.K., Lebedinskaya G.V., Gerasimova M.M. 1966
Abashevskaya kultura (Pepkinskiy chelovek). Ioshkar-Ola: Mari. kn. izd. (Trudy Mar. arkheol. ekspeditsii; vol. 3).

Khalyapin M.V. 2001
Pervyi beskurgannyi mogilnik sintashtinskoi kultury v stepnom Priuraliye. In *Bronzovyi vek Vostochnoi Evropy: Kharakteristika kultur, khronologiya i periodizatsiya: Materialy Mezhdunar. nauch. konf. "K stoletiyu periodizatsii V.A. Gorodtsova bronzovogo veka yuzhnoi poloviny Vostochnoi Evropy"*. Samara: Nauch.-tekhn. tsentr, pp. 417– 424.

Khodjayov T.K. 2004
Novye antropologicheskiye materialy epokh neolita i bronzy srednego i verkhnego Zarafshana. *Vestnik antropologii*, No. 11: 87–101.

Khodjayov T.K., Mustafakulov S.I., Khodjayova G.K. 2011
Paleoantropologiya yuga Srednei Azii epokhi eneolita i bronzy. Moscow: IAE RAN.

Khokhlov A.A. 2013
Paleoantropologiya Volgo-Uraliya epokh neolita i bronzy. Dr. Sci. (History) Dissertation. IEA RAN. Moscow.

Khokhlov A.A. 2017
Morfogeneticheskiye protsessy v Volgo-Uraliye v epokhu rannego golotsena (po kraniologicheskim materialam mezolita – bronzovogo veka). Samara: Izd. Samar. Gos. Sots.-Ped. Univ.

Khokhlov A.A., Grigoryev A.P. 2021
Kraniologicheskiye materialy iz pogrebeniy abashevskoi kultury finala srednei bronzy Povolzhiya i Priuraliya. *Vestnik Tomskogo gosudarstvennogo universiteta*. *Istoriya*, No. 69: 132–139.

Khokhlov A.A., Kitov E.P. 2019
Teoreticheskiye i prakticheskiye aspekty problemy proiskhozhdeniya fizicheskogo oblika nositelei kultur sintashtinskogo kruga pozdnego etapa epokhi bronzy. *Povolzhskaya arkheologiya*, No. 1: 59–71.

Khokhlov A.A., Kitov E.P., Kapinus Y.O. 2020
K probleme antropologicheskikh svyazei mezhdu nositelyami srubnoi i alakulskoi kultur pozdnego etapa epokhi bronzy v Yuzhnom Priuraliye i zapadnokazakhstanskikh stepyakh. *Vestnik Volgogradskogo gosudarstvennogo universiteta*. Ser. 4: Istoriya. Regionovedeniye. Mezhdunarodnye otnosheniya, vol. 25 (4): 66–83.

Khudaverdyan A.A. 2009
Naseleniye Armyanskogo nagoriya v epokhu bronzy: Etnogenez i etnicheskaya istoriya. Yerevan: Van Ariyan.

Kiryushin Y.F., Solodovnikov K.N. 2010
The origins of the Andronovo (Fedorovka) population of southwestern Siberia, based on a Middle Bronze Age cranial series from the Altai forest-steppe zone. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 38 (4): 122–142.

Kitov E.P. 2011
Paleoantropologiya naseleniya Yuzhnogo Urala epokhi bronzy. Cand. Sci. (History) Dissertation. IEA RAN. Moscow.

Korochkova O.N. 1993
O fedorovskoi culture. In *Problemy kulturogeneza i kulturnoye naslediye. Materialy konf*., pt. 2. St. Petersburg: IIMK RAN, pp. 84–87.

Kozintsev A.G. 2000
On the biological affinities and origin of the Northern Pontic Scythians. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 3: 145–152.

Kozintsev A.G. 2004
Kety, uraltsy, "amerikanoidy": Integratsiya kraniometricheskikh i kranioskopicheskikh dannykh. In *Paleoantropologiya, etnicheskaya antropologiya, etnogenez: K 75-letiyu Ilyi Iosifovicha Gokhmana*. St. Petersburg: MAE RAN, pp. 172–185.

Kozintsev A.G. 2008
The "Mediterraneans" of Southern Siberia and Kazakhstan, Indo-European migrations, and the origin of the Scythians: A multivariate craniometric analysis. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 36 (4): 140–144.

Kozintsev A.G. 2009
Craniometric evidence of the early Caucasoid migrations to Siberia and Eastern Central Asia, with reference to the Indo-European problem. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 37 (4): 125–136.

Kozintsev A.G. 2017
Proiskhozhdeniye zapadnykh alakultsev (ob odnoi zatyanuvsheisya diskussii). In *Radlovskiy sbornik: Nauchnye issledovaniya i muzeinye proekty MAE RAN v 2016 g*. St. Petersburg: MAE RAN, pp. 277–287.

Kozintsev A. 2019
Proto-Indo-Europeans: The prologue. *Journal of Indo-European Studies*, vol. 47 (3/4): 293–380.

Kozintsev A.G. 2020
The origin of the Okunev population, Southern Siberia: The evidence of physical anthropology and genetics. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 48 (4): 135–145.

Kozintsev A.G. 2021
Patterns in the population history of Northern Eurasia from the Mesolithic to the Early Bronze Age, based on craniometry and genetics. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 49 (4): 121–132.

Kruts S.I. 1984
Paleoantropologicheskiye issledovaniya Stepnogo Pridneproviya (epokha bronzy). Kiev: Nauk. dumka.

Kruts S.I. 2017
Skify stepei Ukrainy po antropologicheskim dannym. Kiev, Berlin: Izd. Oleg Filyuk. (Kurgany Ukrainy; vol. 5).

Litvinenko R.A. 2003
Yuzhno-uralskiy ochag kulturogeneza i kultura Babino (KMK): Problema vzaimosvyazi. In *Abashevskaya kulturno-istoricheskaya obshchnost: Istoki, razvitiye, naslediye: Materialy Mezhdunar. konf*. Cheboksary: Chuvash. gos. inst. gumanit. nauk, pp. 145–152.

Narasimhan V., Patterson N., Moorjani P., Rohland N., Bernardos R., Mallick S., Lazaridis I., Nakatsuka N., Olalde I., Lipson M., Kim A., Olivieri L., Coppa A., Vidale M., Mallory J., Moiseyev V., Kitov E., Monge J., Adamski N., Alex N., Broomandkhoshbacht N., Candilio F., Callan K., Cheronet O., Culleton B., Ferry M., Fernandes D., Freilich S., Gamarra B., Gaudio D., Hajdinjak M.,

Harney É., Harper T., Keating D., Lawson M., Mah M., Mandl K., Michel M., Novak M., Oppenheimer J., Rai N., Sirak K., Slon V., Stewardson K., Zalzala F., Zhang Z., Akhatov G., Bagashev A., Bagnera A., Baitanayev B., Bendezu-Sarmiento J., Bissembaev A., Bonora G., Chargynov T., Chikisheva T., Dashkovskiy P., Derevianko A., Dobeš M., Douka K., Dubova N., Duisengali M., Enshin D., Epimakhov A., Fribus A., Fuller D., Goryachev A., Gromov A., Grushin S., Hanks B., Judd M., Kazizov E., Khokhlov A., Krygin A., Kupriyanova E., Kuznetsov P., Luiselli D., Maksudov F., Mamedov A., Mamirov T., Meiklejohn C., Merrett D., Micheli R., Mochalov O., Mustafokulov S., Nayak A., Pettener D., Potts R., Razhev D., Rykun M., Sarno S., Savenkova T., Sikhymbaeva K., Slepchenko S., Soltobaev O., Stepanova N., Svyatko S., Tabaldiev K., Teschler-Nicola M., Tishkin A., Tkachev V., Vasilyev S., Velemínský P., Voyakin D., Yermolayeva A., Zahir M., Zubkov V., Zubova A., Shinde V., Lalueza-Fox C., Meyer M., Anthony D., Boivin N., Thangaraj K., Kennett D., Frachetti M., Pinhasi R., Reich D. 2019

The formation of human populations in South and Central Asia. *Science*, vol. 365 (6457): 1002–1007. URL: https://doi.org/10.1126/science.aat7487

Nordqvist N., Heyd V. 2020

The forgotten child of the wider Corded Ware family: Russian Fatyanovo culture in context. *Proceedings of the Prehistoric Society*, vol. 86: 65–93. URL: https://doi.org/10.1017/ppr.2020.9

Otroshchenko V.V. 1998

O kulturno-khronologicheskikh gruppakh pogrebeniy Potapovskogo mogilnika. *Rossiyskaya arkheologiya*, No. 1: 43–53.

Romanova G.P. 1991

Paleoantropologicheskiye materialy iz stepnykh raionov Stavropoliya epokhi rannei i srednei bronzy. *Sovetskaya arkheologiya*, No. 2: 160–170.

Rykushina G.V. 2003

Antropologicheskaya kharakteristika naseleniya epokhi bronzy Yuzhnogo Urala po materialam mogilnika Krivoye Ozero. In *Vinogradov N.B. Mogilnik bronzovogo veka Krivoye Ozero v Yuzhnom Zauralye*. Chelyabinsk: Yuzh.-ural. kn. izd., pp. 345–360.

Shevchenko A.V. 1986

Antropologiya naseleniya yuzhnorusskikh stepei v epokhu bronzy. In *Antropologiya sovremennogo i drevnego naseleniya evropeiskoi chasti SSSR*. Leningrad: Nauka, pp. 121–215.

Solodovnikov K.N. 2005

Kraniologicheskiye materialy iz mogilnika andronovskoi kultury Firsovo XIV v svete problem formirovaniya naseleniya Verkhnego Priobiya v epokhu bronzy. In *Izucheniye istoriko-kulturnogo naslediya narodov Yuzhnoi Sibiri*, iss. 1. Gorno-Altaisk: AKIN, pp. 35–47.

Solodovnikov K.N., Kolbina A.V. 2018

Materialy k antropologii sintashtinskoi kultury Turgaiskogo progiba. In *XXI Uralskoye arkheologicheskoye soveshchanie, posvyashchennoye 85-letiyu so dnya rozhdeniya G.I. Matveyevoi i 70-letiyu so dnya rozhdeniya I.B. Vasilieva*. Samara: Izd. Samar. Gos. Sots.-Ped. Univ., pp. 167–169.

Solodovnikov K.N., Rykun M.P. 2011

Materialy k antropologii pakhomovskoi kultury epokhi bronzy Zapadnoi Sibiri. *Vestnik antropologii*, No. 19: 112–129.

Solodovnikov K.N., Rykun M.P., Loman V.G. 2013

Kraniologicheskiye materialy epokhi bronzy Kazakhstana. *Vestnik arkheologii, antropologii i etnografii*, No. 3: 113–131.

Solodovnikov K.N., Tumen D., Erdene M. 2019

Kraniologiya chemurchekskoi kultury Zapadnoi Mongolii. In *Drevnosti Vostochnoi Evropy i Yuzhnoi Sibiri v kontekste svyazei i vzaimodeistviy v evraziyskom kulturnom prostranstve (novye dannye i kontseptsii)*, vol. 2. St. Petersburg: IIMK RAN, pp. 79–81.

Solodovnikov K.N., Tur S.S. 2003

Kraniologicheskiye materialy eluninskoi kultury epokhi rannei bronzy Verkhnego Priobiya. In *Kiryushin Y.F., Grushin S.P., Tishkin A.A. Pogrebalnyi obryad naseleniya epokhi rannei bronzy Verkhnego Priobiya (po materialam gruntovogo mogilnika Teleutskiy Vzvoz-1)*. Barnaul: Izd. Altai. Gos. Univ., pp. 142–176.

Tkachev V.V. 2003

Nachalo alakulskoi epokhi v Uralo-Kazakhstanskom regione. In *Stepnaya tsivilizatsiya Vostochnoi Evrazii*. Vol. 1: Drevniye epokhi. Astana: Kultegin, pp. 109–124.

Tur S.S. 2009

Odontologicheskaya kharakteristika naseleniya andronovskoi kultury Altaya. *Izvestiya Altaiskogo gosudarstvennogo universiteta*, No. 4-2: 228–236.

Tur S.S. 2011

A nonmetric cranial study of the Andronovo series from the Altai. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 39 (1): 147–155.

Tur S.S., Solodovnikov K.N. 2005

Novye kraniologicheskiye materialy iz pogrebeniy karakolskoi kultury epokhi bronzy Gornogo Altaya. In *Izucheniye istoriko-kulturnogo naslediya narodov Yuzhnoi Sibiri*, iss. 1. Gorno-Altaisk: AKIN, pp. 35–47.

Vinogradov N.B. 2011

Stepi Yuzhnogo Urala i Kazakhstana v pervye veka II tys. do n.e. (pamyatniki sintashtinskogo i petrovskogo tipa). Chelyabinsk: Abris.

Zubova A.V., Chikisheva T.A., Pozdnyakov D.V. 2014

Antropologicheskiye aspekty genezisa predstavitelei andronovskoi kulturno-istoricheskoi obschnosti. In *Arii stepei Evrazii: Epokha bronzy i rannego zheleza v stepyakh Evrazii i na sopredelnykh territoriyakh: Sbornik pamyati Eleny Efimovny Kuzminoi*. Barnaul: Izd. Altai. Gos. Univ., pp. 541–554.

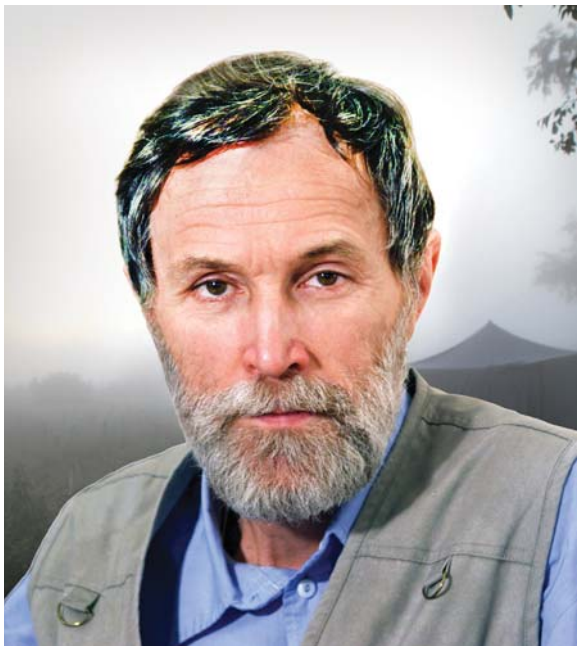
Received August 18, 2022.

Vladimir Pavlovich Mylnikov (in Honor of his 75th Birthday)

V.P. Mylnikov, Doctor of Historical Sciences, Leading Researcher at the Institute of Archaeology and Ethnography SB RAS, a prominent scientist, a recognized expert in the field of ancient wood-processing technologies, was born on October 27, 1948, in a family of native Novosibirsk residents. He grew up in a working-class family, which moved from Novosibirsk to the construction of Akademgorodok in early 1958. Vladimir studied in school and began his career in the town of scientists, which was built before his eyes. In 1967, he worked as a communications technician at a local telephone exchange where he met Academician A.P. Okladnikov and the family of A.P. and E.I. Derevianko. In 1968, V.P. Mylnikov got a job of an electrical mechanic at the Institute of Economics and Organization of Industrial Production of the Siberian Branch of the USSR Academy of Sciences, and established close ties with archaeologists at the Institute of History, Philology, and Philosophy of the Siberian Branch of the USSR Academy of Sciences. Friendship with the people of an extraordinary profession determined his future destiny. The next year, Vladimir Mylnikov started his work in the photo laboratory of this research institute, which became his home for all the subsequent years. Here he turned into a professional photographer. His scientific photographs illustrate many field reports and well-known monographs prepared by the researchers of the Institute, as well as textbooks on archaeology.

The enthusiasm for archaeology and expeditionary research inspired Vladimir Mylnikov to get a degree at the History Department of the Kemerovo State University in 1983–1989, and to begin a career as a scientist. He went through a long and difficult path from a Senior Laboratory Assistant in the Archaeology Department to a Chief Researcher and Head of the Museum Studies Department.

Academician A.P. Okladnikov, during the twelve-year long joint work with V.P. Mylnikov, had a favorable effect on growing the personality of the future scientist. Vladimir Mylnikov was lucky to participate in annual field studies of archaeological sites of almost all eras—from the Old Stone Age to the ethnographically modern period; the field works were carried out in the Far East, Transbaikalia and Cisbaikalia, Western and Eastern Siberia, Tuva, Altai, Kazakhstan, the Urals, and Mongolia.



Vladimir also benefited from the participation in the work of archaeological teams of other Institute scholars, and in international expeditions with colleagues from Mongolia, USA, Germany, and Kazakhstan.

In 1995, V.P. Mylnikov successfully defended his Ph.D. thesis entitled “Wood-Processing by the Carriers of the Pazyryk Culture” and his doctoral dissertation “Woodworking in the Late Bronze Age (Northern Asia)” in 2003. He developed and introduced a new method for express reconstruction of funeral wooden structures during excavations of archaeological sites with ancient wood in the Altai Mountains, Tuva, and Mongolia. The findings of traceological and experimental studies provided the good grounds for him to identify the types of tools and working techniques and to reconstruct the chains of operations in manufacturing the main categories of wooden items. V.P. Mylnikov distinguished three main branches in woodworking during the Late Bronze Age in North Asia: construction, carpentry/joinery, and carving—simple, complex, and artistic. On the basis of functional analysis of artifacts, he identified the main types of wooden items produced by particular working

methods. The scientist has also identified and classified the main types of burial structures and funerary beds.

V.P. Mylnikov is the author of the guidebook "Methods for the Study of Wooden Archaeological Items During Field and Laboratory Work", developed and put into practice in 1994. Since then, this book has been successfully used in the archaeological studies in Russia, Mongolia, and Kazakhstan. The large-scale analytical works at the world-famous site of Pazyryk-5 were carried out in 2017–2019 using the above methods, and the long-lasting debate concerning the attribution of the internal burial constructions has been resolved.

V.P. Mylnikov is the author and co-author of more than 200 scientific articles, including 27 monographs, and four learning guides. His papers have been published both in Russia and abroad. Being a talented researcher, professional photographer, active popularizer of science, he has prepared a number of popular science works.

Vladimir Mylnikov is an experienced scientific coordinator and organizer. From 1988 to 1994, he headed the Seminsky Archaeological Team; in 2004 and 2006, he acted as a deputy head of the International Russian-German-Mongolian Archaeological Expedition in Mongolia; and in 2005, he was the leader of this Expedition. In 1978–1984, V.P. Mylnikov was the head of the photographic laboratory of the Institute of History, Philology and Philosophy of the Siberian Branch of the USSR Academy of Sciences; in 2003–2005, he headed the Department of Museum Technologies and Restoration of the Institute of Archaeology and Ethnography of the SB RAS; in 2005–2013, Mylnikov headed the Museum Studies Department at the Institute. In 2006–2013, he was the Deputy Chairman of the Scientific Council for Museums of the SB RAS. From 2007 to 2018, Vladimir Mylnikov taught a special course "Fundamentals of Conservation and Restoration of Archaeological and Ethnographic Items" for students of the Institute for Humanities of the Novosibirsk State University.

V.P. Mylnikov has been working for the Siberian Branch of the Russian Academy of Sciences for 55 years. He is an Honored Veteran of the Siberian Branch of the USSR Academy of Sciences, has diplomas from the local Komsomol Organization in Novosibirsk; letters of gratitude from the administration of the Sovetsky District of Novosibirsk and the Ministry of Culture of the Altai Republic. Mylnikov was awarded the honorary badge "Silver Sigma" of the Siberian Branch of the Russian Academy of Sciences, memorial signs "For Work for the Benefit of the City" of Novosibirsk, and the medal of the Ministry of Science and Higher Education of the Russian Federation "For Impeccable Work and Distinction" of the 3rd degree. He has been awarded a Letter of Gratitude from the President of the Russian Academy of Sciences for the many years of fruitful work for the benefit of science; Certificate of Honor from the Presidium of the Russian Academy of Sciences and the Council of the Trade Union of Workers of the Russian Academy of Sciences.

Vladimir Mylnokov has a wonderful, friendly family of like-minded people. His wife Lyudmila is an archaeologist, Doctor of Historical Sciences. Beautiful daughters, who took part in archaeological expeditions in Western Siberia, the Far East, and the Altai, together with their parents, from the early childhood. Although the daughters did not become archaeologists, they retained the affection for this difficult but romantic profession for their lives, and try to instill it in their growing children.

At his anniversary, V.P. Mylnikov is full of creative ideas. He is a unique specialist, perhaps the only one of his kind, and he will certainly continue to delight the scientific community with new discoveries, monographs, and articles.

Friends and colleagues warmly congratulate our dear Vladimir Pavlovich Mylnikov, wish him many years of life and creative success in all his endeavors.

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AKIN – Agency for Cultural and Historical Heritage of the Altai Republic (Gorno-Altaysk)

AN AzSSR – Academy of Sciences of the Azerbaijan Soviet Socialist Republic

AN SSSR – USSR Academy of Sciences

AzFAN SSSR – Azerbaijan Branch, USSR Academy of Sciences

BAR – British Archaeological Reports

BNC SO RAN – Buryat Science Center, Siberian Branch, Russian Academy of Sciences (Ulan-Ude)

CNRS – Centre National de la Recherche Scientifique

DAN – Proceedings of the USSR Academy of Sciences

GAIMK – State Academy for the History of Material Culture (Moscow)

GIM – State Historical Museum (Moscow)

IA AN SSSR – Institute of Archaeology of the USSR Academy of Sciences

IA RAN – Institute of Archaeology, Russian Academy of Sciences (Moscow)

IAET SO RAN – Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences (Novosibirsk)

IIFF SO AN SSSR – Institute of History, Philology and Philosophy, Siberian Branch, USSR Academy of Sciences (Novosibirsk)

IIMK RAN – Institute for the History of Material Culture, Russian Academy of Sciences (St. Petersburg)

IYALI KF AN SSSR USSR – Institute of Language, Literature and History, Komi Branch, USSR Academy of Sciences

KOPOIRGO – Troitskosavsk-Kyakhta Branch of the Amur Department of the Imperial Russian Geographical Society

KSIA – Brief Communications of the Institute of Archaeology, Russian Academy of Sciences

LOIA AN SSSR – Leningrad Branch of the Institute of Archaeology of the USSR Academy of Sciences

MAE – Peter the Great Museum of Anthropology and Ethnography (Kunstkamera), Russian Academy of Sciences (St. Petersburg)

MIA – Materials and Investigations on Archaeology in the USSR

SAIPI – Siberian Association of Prehistoric Art Researchers

SPbGU – Saint Petersburg State University (St. Petersburg)

SVFU – North-Eastern Federal University (Yakutsk)

UrO RAN – Ural Branch of the Russian Academy of Sciences

VSOIRGO – East Siberian Department of the Imperial Russian Geographical Society

ZIN – Zoological Institute of Russian Academy of Sciences (St. Petersburg)

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