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Evolution of the Lithic Industry in Central Dagestan During the Early Pleistocene: The Rising Occurrence of Flake Blanks

Archaeological data from stratified Early Pleistocene sites in Central Dagestan are arranged in a direct stratigraphic sequence, making it possible to reconstruct the changes in lithic industry over a span of 1.2 mln years, from ~2.0 to 0.8 Ma BP, and to separate the principal stages in the Early Paleolithic culture of the Caucasus. This study examines blanks found at sites of the Ainikab-Mukhkay group, such as Ainikab-1, and Mukhkay-1, -2, and -2a. Occurrences of large flake blanks (>10 cm) at the Oldowan and the Oldowan to Acheulean transitional stage are provided. Such blanks appear at the beginning of the Jaramillo paleomagnetic episode (~1.07 Ma BP). By the end of the Early Pleistocene, their share attains 25.77 % of the total number of blanks for morphologically distinct tools. They are absent in Oldowan deposits (~2 Ma BP). The totality of statistical data justifies the separation of the transitional Oldowan to Acheulean stage in the region, dating to 1.0–0.8 Ma BP.

Keywords: *Northeastern Caucasus, Early Pleistocene, lithic industry, evolution, flake blanks, statistics.*

Introduction

The issue of manifestations of the evolution of the Central Dagestan Paleolithic industry during the Matuyama chron was previously discussed elsewhere (Amirkhanov, 2016; Amirkhanov, Taimazov, 2019). The papers introducing archaeological materials from particular sites provided mainly descriptions of finds. The general inference following from such a consideration was the identification, in the periodization of the Early Paleolithic of this region, of a separate stage when the lithic industry was transformed from the Oldowan to the Acheulean. This stage corresponds to the *Early Pleistocene large flake industry*. We accepted the appearance of large flakes (> 10 cm) as blanks for tools as one of the main indicators of significant changes in the industry. The onset of this stage on the generalized stratigraphic column corresponds to one of the intervals of the Jaramillo Subchron.

In characterizing the evolution of the industry, we have previously relied mainly on value judgments. This study is an attempt to consider the issue in more detail, with an emphasis on statistical and chronostratigraphic aspects. For this, we carried out a comparative analysis of quantitative data of the collections from cultural layers at the Ainikab-1, Mukhkay-1, -2, and -2a sites. The artifacts for research were selected according to the following criteria: the cultural layers from which they originated were excavated over a fairly large area; the materials were located *in situ*, or at least in a stratigraphically clear position; in quantitative terms, the collections were statistically significant; the layers of the sites under

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consideration correlated with each other, had at least a generalized date, and were separated from one another in a vertical direction and, accordingly, in time.

Study materials

Over the past 15 years, the North Caucasian Paleolithic Expedition of the Institute of Archaeology RAS, with the participation of colleagues from the Institute of History, Archaeology and Ethnography of the Dagestan Federal Scientific Center RAS, has been excavating a group of Early Pleistocene sites in the central (mid-mountain) part of Dagestan (Fig. 1). Eight multilayered stratified sites were studied to varying degrees (Amirkhanov, 2007, 2016; Derevianko et al., 2012). Of these, excavations over a relatively large area were carried out at the sites of Ainikab-1, Mukhay-1, -2, -2a. Therefore, the following conclusions will be based on the data from these particular sites.

The profiles at the sites of the Ainikab-Mukhay group are unusually thick for archaeological sites of the Eurasian Early Pleistocene. The Mukhay-1 profile extends to a depth of 65.5 m; it represents 39 cultural layers, containing accumulations of flint items. At Mukhay-2, the profile is 73 m thick and includes 34 Early Paleolithic cultural layers. The profile at Ainikab-1 is slightly more than 13 m and contains 21 cultural layers.

In terms of lithology, these sections are comparable to each other, which makes it possible to correlate the corresponding archaeological materials. Correlation between the lithic collections from Mukhay-1 and Mukhay-2, located relatively close to each other (at a distance slightly less than 100 m), is sometimes possible at the level of small lithological units. Both sites are located in the marginal part of the ancient basin at the foot of the limestone mountains; the mountain slopes were the source of coarse material in this intermountain depression. In contrast, Ainikab-1 is closer to the central part of the basin. In this area, the alluvial and deluvial removal of clastic material was always more intense than in the areas adjacent to the mountains. Therefore, it is difficult to compare the sections in the compared zones of the basin at the level of small lithological units, although correlation at the level of large lithological units is possible.

The sequence of cultural layers at each of the sites under consideration covers the period from 1.95 to 0.8 Ma BP (Amirkhanov, 2016; Amirkhanov et al., 2012; Tesakov, Ozhereliev, 2017; Chepalyga et al., 2012). The profiles of the sites, as noted above, are comparable to each other, and their upper portions are attributed to the Jaramillo Subchron. Such clear chronological determinations and the possibility of direct stratigraphic observations lend validity to the conclusions following from the diachronic analysis of the archaeological material. The inferences concern typological, technological, and statistical alterations of stone tools in cultural layers of the named sites.

Discussion

The cultural layers of the studied sites in Central Dagestan, in aggregate, represent almost the entire Early Pleistocene, which makes it possible to raise the question of the place, in the Paleolithic periodization of the region, of the Oldowan and Early Acheulean periods and the corresponding industries. The noted similarity of the profiles under consideration suggests the transition from one cultural-chronological stage (period) of the Early Paleolithic to another throughout the phase represented by the geological sections of these sites. The results of comparative typological and technological analyzes of the lithic collections from different layers of these sites cannot have different interpretations, since they are based on obvious stratigraphic data, which have as yet been recorded neither in the Caucasus nor in Eurasia as a whole.

The material that we use for analysis is limited to flake blanks for tools (Fig. 2). This category of artifacts, of course, does not reflect all the changes associated with evolution of the Oldowan during almost 1 mln years in the range of 2–1 Ma BP. However, as noted above, it is a marker of a technological milestone, from which the transformation of the Oldowan industry into the Acheulean begins. Therefore, in the corresponding statistical calculations, all products of this kind have been taken into account, without dividing them into tools or simply blanks (see *Table*). We operate only with those items in the assemblage that have been converted

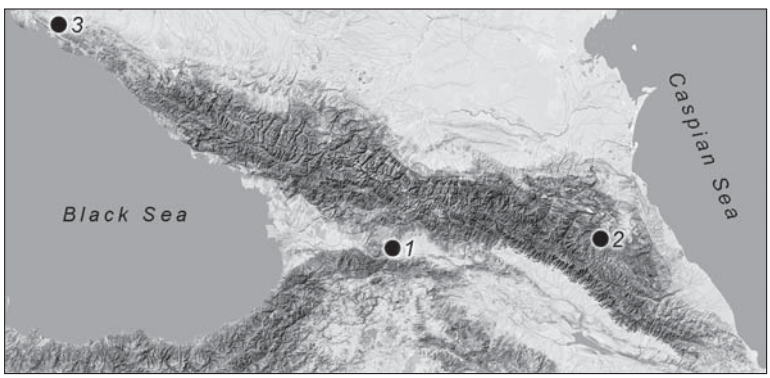

Fig. 1. Locations of the mentioned sites.
1 – Dmanisi; *2* – group of sites Ainikab-1, Mukhay-1, Mukhay-2; *3* – Kermek.

into tools. It seems that such approach makes it possible to reveal both the functional and technological significance of the considered group of blanks in a particular collection.

The comparative analysis is based on data relating to the sites of the Ainikab-Mukhay group (see *Table*). The four oldest sites are Ainikab-1, layer 21; Mukhay-2, layer 74; Mukhay-2, layer 80; Mukhay-2a, layer 2013 (1–3); these sites are united by the fact that their cultural layers lie below the level corresponding to the Olduvai paleomagnetic episode: i.e., these were formed before ~1.95 Ma BP. One site (Mukhay-1, layer 32) is dated within the range from ~1.21 to ~1.07 Ma BP. The remaining five are Mukhay-1, layer 4; Mukhay-1, layer 5b; Mukhay-1, layer 5; Mukhay-1, layer 7c; and Mukhay-1, layer 8. These latter refer to the period from the end of the Jaramillo episode (~0.99 Ma BP) to the turn of the Matuyama- Brunhes epochs (~0.8 Ma BP). For Ainikab-1, there are also two absolute dates obtained using the ESR method (Ahmed et al., 2010; Amirkhanov, Taimazov, 2019), which do not contradict the geological, geomorphological, and paleontological dates of the corresponding levels of the site profile.

It is important that the sites whose materials were subjected to the comparative analysis can be correlated by age not only with each other. Each of them is "embedded" both in the stratigraphic column of a separate multilayered site, and in the detailed general scheme of the cultural stratigraphy of the regional Early Pleistocene. Notably, this scheme is based on the data of direct stratigraphy, confirmed by consistent data from three sites, which were studied throughout the thickness of their profiles.

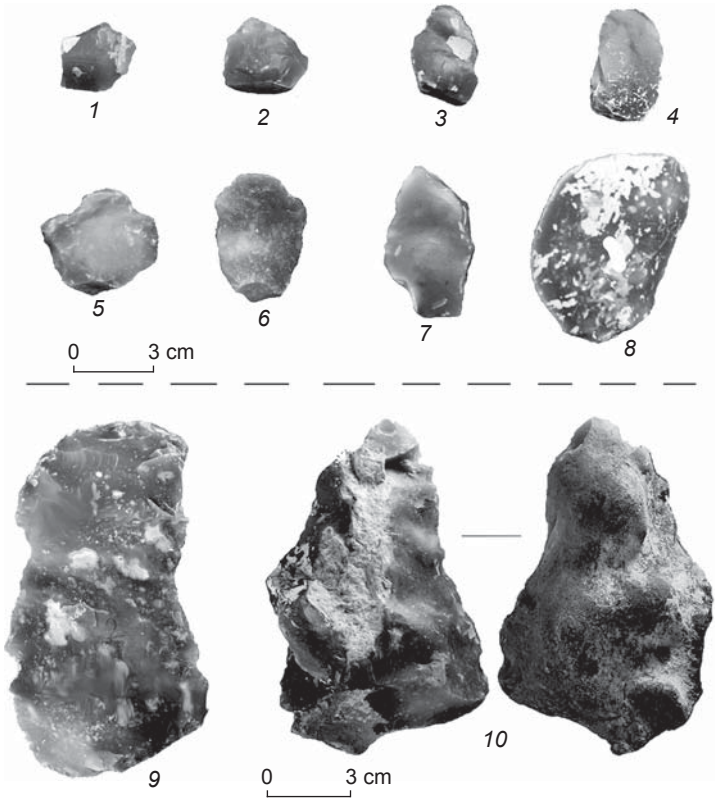

Fig. 2. Flake blanks of the classic Oldowan (*1–8*) and of the Early Pleistocene transitional large flake industry (*9*, *10*) in Central Dagestan. *1–8* – Ainikab-1, profile bottom; *9*, *10* – Mukhay-1, profile top.

Let us consider specific indicators of changes in the frequency of the use of large flakes as blanks for the manufacture of tools in the Early Pleistocene industries of Central Dagestan. First of all, noteworthy is the total absence of items of this type in the inventory of layers dating back to the time before the Cobb Mountain

Large flake tools in the collections of the Early Pleistocene sites in Central Dagestan

Site	Layer	Date, Ma BP*	Number of lithics, spec.		Percentage of large flake tools, %
			total	tools	
Mukhay-1	4	~0.8 – ~0.85	235	97	25.77
	5b	~0.8 – ~0.85	339	101	19.81
	5	~0.85 – ~0.99	465	101	14.85
	7c	~0.95 – ~0.99	186	43	6.98
	8	~0.95 – ~0.99	933	98	2.04
	32	~1.21 – ~1.07	586	111	3.6
Mukhay-2	74	> 1.95	370	128	0
	80	> 1.95	1079	99	0
Mukhay-2a	2013 (1–3)	> 1.95	738	56	0
Ainikab-1	21	> 1.95	166	44	0

*The dates of cultural strata are based on the paleomagnetic studies, as well as on the data of the paleontological and palynological identifications, geological-geomorphological characteristics, and solitary ESR-dates of the sites whose materials are considered here (see (Amirkhanov, 2016; Derevianko et al., 2012; Chepalyga et al., 2012; Tesakov, Ozhereliev, 2017)).

paleomagnetic episode (~1.21 Ma BP). This was mentioned in earlier publications. It has been noted that typical blanks in the local industry of the first half of the Early Pleistocene were small (3–5 cm on average) flakes and corresponding cores (Amirkhanov, 2016; Ozhereliev, 2014). The sizes of cores from layer 21 of Ainikab-1 are indicative: height 4.7 cm, width 5.9 cm, thickness 5.5 cm. The cores found in this layer (Fig. 3) are not large; their sizes were not predetermined by the shape and mass of the raw material units. In this case, the sizes of the cores cannot be explained by the sizes of the available pebbles. None of the varieties of raw materials found at the site are pebbles in their origin. All cores are made of mostly tablet-nodules, and originate from the horizons lying between limestone beds.

Comparisons of the corresponding contemporaneous materials from the Caucasus and the Azov Sea region produce a similar picture. Differentiated analysis of the Dmanisi inventory by the type of raw material has shown that the smallest cores are of flint (3.6 × 2.1 × 2.3 cm), and the largest of rhyolite or basalt (7.9 × 6,9 × 4 cm) (Lumley et al., 2005: 78). However, neither is included in the category of large flake cores.

Materials from the Azov Sea region dating to not later than the middle of the Early Pleistocene (Kermek site) also indicate the use of cores for the manufacture of medium and small flakes (Shchelinsky, 2013). Blanks exceeding 5 cm in length are not numerous at Kermek; very few significantly exceed this size. The length of negative scars even on the largest Kermek cores are 5 cm on average. Even if in some classifications flakes of this size are assigned to large, these are not those large flakes of the Early Acheulean and the "developed Oldowan" from the Olduvai Gorge, which were deliberately chopped off as blanks for bifaces, including hand-axes.

Thus, the materials from the Caucasus and the Azov Sea region, which represent primary reduction and belong to at least the first half of the Early Pleistocene, reflect the standards for core sizes and, consequently, the main features of the classic Oldowan blanks.

According to our observations, noticeable changes in the industry occurred approximately at the initial stage of the Jaramillo episode (1.07 Ma BP). At the very beginning of this period, the proportion of tools on large flakes in the collections from the sites in Central Dagestan was only 3.6 %, and at its end 6.98 %. In the period from 1.95 to about 1.1 Ma BP, in the northeastern Caucasus, features suggesting the use of large flake technology have not been noted.

The tendency towards the use of large flakes is more noticeable in the range from the final Jaramillo episode to the Late Early Pleistocene (0.85 Ma BP). Finally, the peak in the use of this type of blank falls on the boundary of the Early and Middle Pleistocene. During this period, more than a quarter of the tools on flakes (25.77 %) were associated with blanks of the type under consideration. At this stage also, other signs of the onset of a new era in the development of the lithic industry were noted—the Acheulean. For example, large flakes were regularly used for the manufacture of massive implements—picks and choppers. In the Oldowan strata, such tools were manufactured on nodules and fragments. Knives made on large flakes became common. In the upper layers of at least two sites (Ainikab-1 and Mukhay-1), solitary artifacts with bifacial trimming have been found. Another characteristic feature of this stage is the relative abundance of transverse two-edged choppers in the upper layers (Mukhay-1).

Thus, a transitional stage from Oldowan to Acheulean is identified

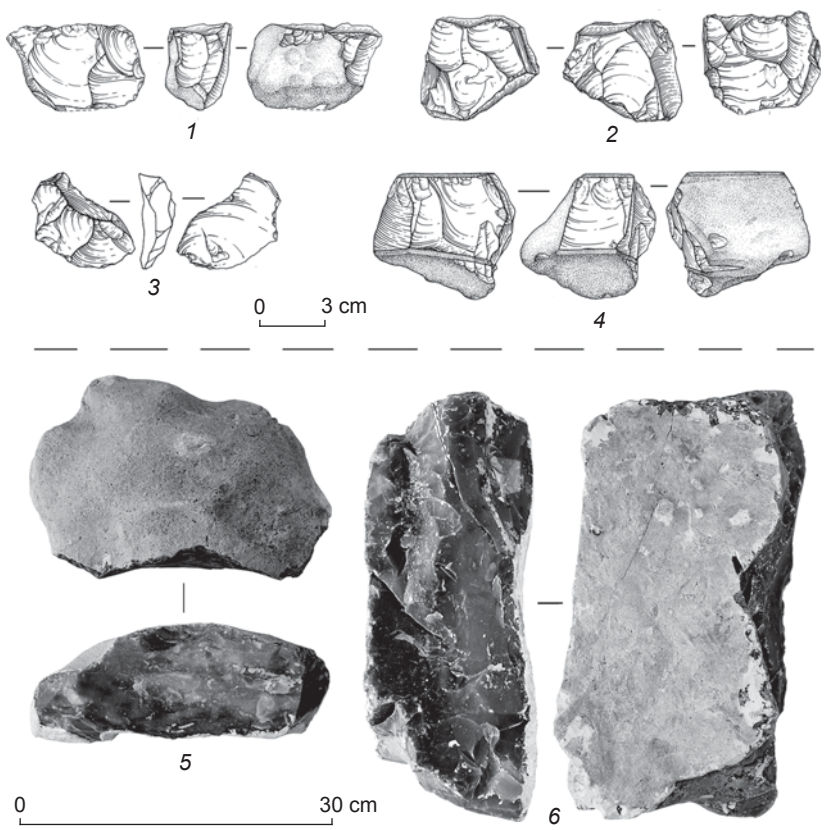

Fig. 3. Cores of the classic Oldowan (*1–4*) and of the Early Pleistocene transitional large flake industry (*5*, *6*) in Central Dagestan.
1–4 – Ainikab-1, layer 21; *5*, *6* – Mukhay-1, layer 7c.

in the development of the Early Paleolithic culture in the Caucasus, during which stage the lithic industry is still dominated by the typological set of the leading Oldowan forms without hand-axes; but at the same time, significant changes occur in the technology of processing stone raw materials. Such manifestations are recorded in different regions and at different times. Technological changes are the essence of this specific stage, which reveals itself in the Early Paleolithic oecumene at different times (and, perhaps, in various forms), but is inevitable in transition to the final stage of the Oldowan industry development. As follows from the presented analysis, in the northeastern Caucasus, the beginning of the Oldowan to Acheulean transition falls at a time of ca 1 Ma BP. The transition itself was not an instantaneous act, but took about 200 thousand years (Amirkhanov, 2016).

It is important to touch upon a question about the reasons for the turning-point in the development of the Oldowan industry, which determined the transition to the Acheulean era in the Caucasus. This issue in relation to the northeastern Caucasus requires correlation of this process with climatic, or, more broadly, paleogeographic, changes in the Late Early Pleistocene. Transformations in the lithic industry associated with the systematic use of large flakes coincided with a sharp and unidirectional change in the features of lithological deposits, as well as changes in palynological spectra in certain sections of the sites. For example, the part of the Mukhay-2 profile (depth 5.15–8.60 m) which corresponds to the Jaramillo paleomagnetic episode produced the distinctly specific palynological characteristics of the samples, making it possible to distinguish two palynological zones. This suggests an increase in the pollen of dark coniferous species (spruce, fir, hemlock). "There appears Serbian spruce (Picea omorica). Pine pollen is constantly present. Broad-leaf species are represented by hornbeam, linden, maple, pterocarya, and celtis. Small-leaf species include birch and alder. In the group of herbaceous species, pollen of Asteraceae and Chenopodiaceae is identified, which most often form rock-and-talus phytocenoses, as well as Astragalus and Leadenidae, which are mountain xerophytes, and wormwood. Spores of the Filicales fern are rare" (Shilova, 2013: 3; 2014: 2). The accumulation of sediments containing this set of pollen and spores should have occurred with a relative cooling and humidification of climate. The layers directly underlying this unit contrast considerably with the abovementioned palynological characteristics. The differences observed in the layers that formed earlier than the Jaramillo episode suggest a warmer and less humid climate.

The mentioned natural changes were followed by a significant change in the vegetation cover and fauna composition during the Jaramillo paleomagnetic episode. Judging by the data of the sites under study, glaciation did not form a continuous cover in the zone of the middle mountains, and even less so in the low mountains of the northeastern Caucasus, and did not lead to depopulation of this area. But the natural conditions most likely served as an impetus for a significant transformation of the culture—to the onset of the Oldowan to Acheulean transition. So far, we do not have sufficient information to describe this process in detail, but we are able to make assumptions concerning its time and duration, as well as the nature and significance of the technical and typological changes that occurred in the industry during the environmental fluctuations.

Conclusions

According to diachronic statistical indicators, during the Early Pleistocene, evolution of flake blanks for the manufacture of tools took place in the lithic industry of Central Dagestan. In the inventory of cultural layers dating back to the Olduvai paleomagnetic episode and earlier, blanks in the form of large flakes (>10 cm) are completely absent. The appearance of the large flakes in the area under study took place in the period immediately before the onset of the Jaramillo episode (from ~1.21 to ~1.07 Ma BP). The number of large flakes gradually increased, and reached its maximum by the Final Early Pleistocene (0.8 Ma BP). It is quite indicative that this corresponds to the time of the origin of the Acheulean elements in the studied region. The recorded phenomena reflect changes in the technological paradigm of primary reduction towards expanding the target settings and technical capabilities in the process of producing flake blanks.

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New Evidence of the Late Neopleistocene Peopling of the Lower Ob Valley

This study focuses on the early human occupation of the arctic part of the West Siberian Plain and introduces the finds at the Paleolithic site Kushevat (Shuryshkarsky District, Yamal-Nenets Autonomous Okrug), discovered in 2020. Geological and geomorphological characteristics of the Lower Ob region are provided, the chronology of the key Middle and Late Neopleistocene sequences is assessed, and criteria underlying the search for Paleolithic sites in the area are outlined. We describe the discovery and excavations at Kushevat, its stratigraphy and its faunal remains. On the basis of correlation with neighboring key Late Neopleistocene sections with a representative series of absolute dates, the age of the site is estimated at cal 50–35 ka BP. Results of a traceological study of a possibly human-modified reindeer antler are provided. Findings at Kushevat and the available information on the early peopling of northern Eurasia suggest that the boundary of the inhabited part of that region must be shifted ~200 km to the north. The Ob, therefore, is one of the last major Siberian rivers where traces of the Early Upper Paleolithic culture have been found. The discovery of a stratified site in its lower stretch is a milestone in the Paleolithic studies in the region. A large area over which faunal remains are distributed, and the presence of lithics among the surface finds, suggest that Kushevat is a highly prospective site for future archaeological studies of the early stages in the human peopling of the region.

Keywords: *Lower Ob, Late Neopleistocene, Paleolithic, paleontology, paleogeography, traceology.*

Introduction

The available scientific data make it possible to assert that the settling of human paleo-communities in the polar zone of Eurasia began quite early, and most likely took place in several stages (Pitulko, 2016; Zolnikov et al., 2020). The earliest evidence of human habitation in the Asian circumpolar zone has been recorded in the Yakutia and Krasnoyarsk Territory, and corresponds to the period of 40–35 ka BP.

These are materials from archaeological and paleontological sites in the Lena and Yana river basins, as well as the mammoth remains with traces of butchering found in the mouth of Yenisei (Pitulko et al., 2016). In the European part of Russia, several archaeological sites of the same age have been reported from the Pechora River basin (Mamontovaya Kurya, Byzovaya); these sites are located close to the Arctic Circle (Pavlov, 2015). Until recently, the vast area of the Lower Ob basin situated between these regions remained a "blank spot" on the Paleolithic map of Eurasia. The northernmost site was Lugovskoye, aged 10.7–17.0 thousand years (according to calibrated ^{14}C dates); the site was discovered in the early 2000s not far from Khanty-Mansiysk (Zenin et al., 2006; Leshchinskiy et al., 2006). The situation in the region has begun to change in the last five years, during which the area has been subjected to intense archaeological studies aimed at searching for prehistoric sites.

Since 2016, searches specifically for Paleolithic sites in the Lower Ob and its tributaries have been carried out by expeditionary teams from the Institute of Archaeology and Ethnography SB RAS (Novosibirsk). The theoretical basis of the research is the modern concept that there were no paleogeographic (e.g. glaciers and ice-dammed lakes) or climatic barriers that might have hindered human settlement in this area. An additional confirmation of these assumptions is the discovery of lithic artifacts of Paleolithic appearance on the riverbanks (Zolnikov et al., 2018). In 2017, in the north of the Khanty-Mansi Autonomous Okrug–Yugra, an archaeological team led by S.S. Makarov and A.S. Rezvy discovered the Komudvany site, aged 12.1–15.3 thousand years (according to calibrated ^{14}C dates). This discovery shifted the known boundary of the ancient human settlement in the area 300 km northwards (Makarov, Rezvy, Gorelik, 2018). In addition, digital relief images have shown that there were valleys stretching through the Ural range, which indicates the possibility of direct migrations by Paleolithic humans from the Pechora Plain to the Lower Ob region (Zolnikov et al., 2020). During field studies in 2019–2020, new archaeological and scientific data were obtained, providing more comprehensive information on the early history of human settlement in the Northern Ob region, and clarifying the chronology and spatial boundaries of the early colonization of the circumpolar regions of Western Siberia.

Geological and geomorphological structure of the study region and determining the criteria for the search of Paleolithic sites

The area in the Lower Ob region investigated by the teams from the Institute of Archaeology and Ethnography SB RAS included the part of the river valley between the cities of Khanty-Mansiysk and Salekhard; however, the attention was focused primarily on a smaller portion of the valley within the boundaries of the Yamal-Nenets Autonomous Okrug, stretching from the village of Kazym-Mys to the village of Pitlyar. In its lower reaches, the Ob (between the villages of Peregrebnoye and Katravozh) is divided into two main branches: the western Malaya Ob; and the eastern Gornaya Ob, which then forms the Bolshaya Ob (Fig. 1). These two branches are separated by a wide (up to 50 km) floodplain with many channels. The banks of the Malaya Ob are mostly low—floodplains with rare erosional remnants; while the right bank of the Bolshaya Ob is high (up to 25 m and higher) and has a complex geological structure, which is not always reflected in the relief (Zolnikov et al., 2018, 2019). The basement for the terraces of this territory is the Middle Pleistocene glaciocomplex (over 130 ka BP) consisting of lacustrine-glacial "varved clays" and main moraines with outliers of alluvium, mainly sandy. The Middle Quaternary age of this glaciocomplex has been assessed by its overlying and underlying sediments. In the vicinity of Khashgort village, remains of small rodents were collected from intramoraine and submerged outliers, which provided the possibility of determining the Tobolsk complex of theriofauna (Borodin, Kosintsev, 2001). In a higher stratigraphic position, on mid-Quaternary moraines and "varved clays", near the village of Shuryshkary, on the left bank of the Malaya Ob, there is a peat bog, for which a series of radiocarbon dates beyond the limits of the method has been generated; another set of ^{230}Th / ^{234}U dates of 133 ± 14 and 141.1 ± 11.7 ka BP has been obtained in St. Petersburg State University (Astakhov et al., 2005). Alluvium lenses in the "varved clays" and in the outcrops at the mouths of the Pyak-Yakha and Pichugui-Yakha rivers, at the latitude of the Arctic Circle, have produced a series of transcendent radiocarbon dates and several OSL-dates with an average value of 133 ka BP (Astakhov, Nazarov, 2010). Thus, the mid-Quaternary glaciocomplex

includes the alluvial and lacustrine-boggy deposits of the first interglacial of the Upper Neopleistocene, with an age of ca 100–130 thousand years.

Notably, the roof of the Middle Quaternary glaciocomplex in the coastal sections either goes under the water's edge or rises almost to the cliff tops. Most of these incisions of various depths were obviously formed at the stage of deglaciation of the last Middle Quaternary ice period in northwestern Siberia, which was accompanied by the release of waters from ice-dammed lakes. Runoff channels are especially apparent on the left bank of the Ob, in the form of a series of overdeepenings of up to 300 m (Zolnikov, Guskov, Martysevich, 2004). Along the deepest of these runoff paleovalleys, the Upper Quaternary hydro-network of northwestern Siberia was formed. The presence of incisions and lining fluvial sediments therein, formed at the stage of the ice-dammed lakes' discharge, helps to explain the fundamental difference in the geological structure and age of deposits exposed by closely located digging trenches. It is noteworthy that fluvial sands and coarser detrital formations of the Late Glacial flood may occur at heights of 10, 20, or 30 m above the edge of the towpath, i.e., at the hypsometric marks that were never reached by the waters of the Ob. Therefore, the Ob alluvium could not have been deposited at the indicated heights. Depressions within paleo-incisions are often lined with gray clays or non-layered silts with a characteristic bog smell, sometimes stratified with solifluctional textures, scattered organic remains, or lenses of peat detritus.

In the research area on the right bank of the Bolshaya Ob, a reference for characterizing the deposits of the first interglacial horizon of the Upper Neopleistocene is the section near Pitlyar, showing the Middle Quaternary glaciocomplex overlain by fluvial sands, covered with a layer of aeolian sands, the bottom and top of which are formed by thin paleosols (Fig. 2). For the upper sand layer, four OSL-dates were obtained, with an average value of ~78 ka BP (Astakhov, Nazarov, 2010). Alluvial sands of the Early Upper Neopleistocene often occur in the uppermost portion of the Middle Quaternary complex, in the lower part of coastal sections. These sands are distinguished by good washing, medium grain-size, and oblique and parallel subhorizontal bedding. Often, peat interlayers are noted in them, usually confined to the upper part. Floodplain facies are rare, and occur as parallel thin/medium interbedding of sands and silts, usually less than 1 m thick.

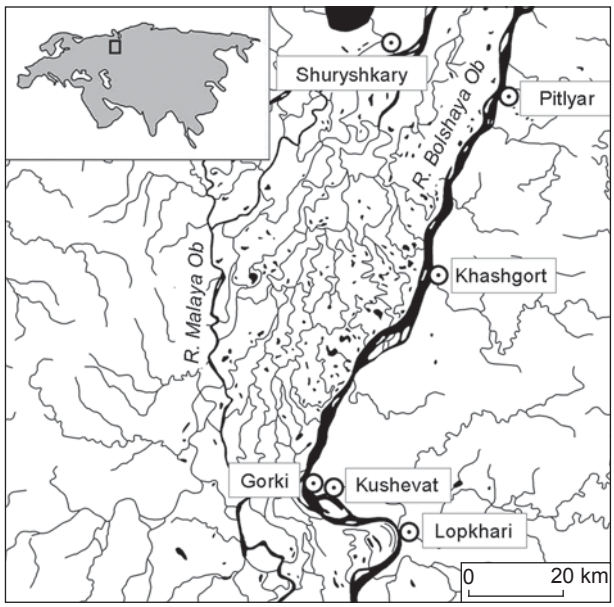

Fig. 1. The main area of the reconnaissance works in 2019–2020.

Deposits from the second stage of the Upper Neopleistocene, corresponding to the Zyryan Glaciation (90–60 ka BP) (Ibid.), whose boundary was located significantly further north than Salekhard, occur on the right bank of the Bolshaya Ob in the form of varvites, with maximum elevations above sea level not exceeding 60–70 m. For the top of a 10-m thick layer of varvites in the Pitlyar section (Fig. 2), two OSL-dates with an average value of ~73 ka BP are available. To the north of Salekhard, similar varvite formations in the Sangompan and Aksar sections are dated, respectively, to ~85 and ~90 ka BP (in the first case, there are four OSL-dates, in the second two OSL-dates) (Ibid.). The considered parallel-bedded stratum lies enveloping the alluvium or subaerial deposits without signs of erosion, which indicates the calm nature of the flooding of the Ob paleovalley by the waters of an ice-dammed lake. The top of this stratum, just as the top of the Middle Quaternary glaciocomplex, is characterized by numerous paleo-incisions of various depths and widths, caused by the waters flowing from dammed lakes during deglaciation of the Late Quaternary glacier in the West Siberian Arctic.

The above-described deposits are cut into by the 2nd and 1st above-floodplain terraces of the Ob and its tributaries. The alluvium of the 2nd terrace consists mainly of well-washed fine- and medium-grained light gray sands with oblique and parallel-subhorizontal

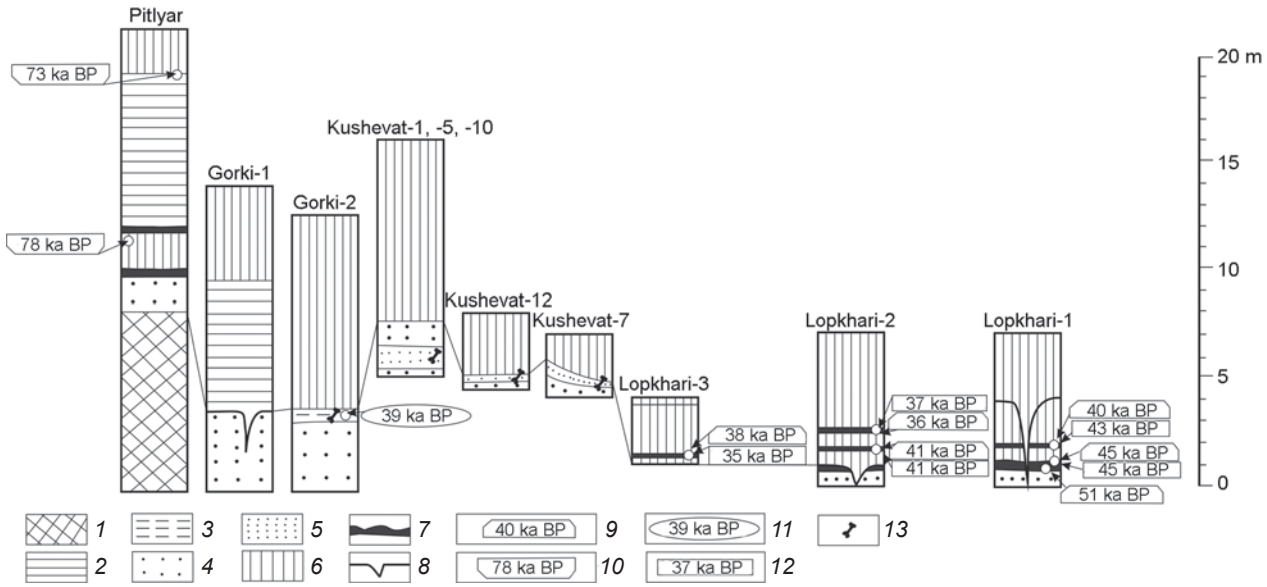

Fig. 2. Correlation pattern of the main sections of the Quaternary deposits in the Kushevat–Gorki–Lopkhari area.
1 – moraine diamicton; *2* – lacustrine-glacial varvites ("varved clays"); *3* – lacustrine-boggy deposits; *4* – alluvial sands of the paleo-Ob; *5* – alluvial sands of a shallow river; *6* – subaerial complex; *7* – paleosols; *8* – cryogenic wedges; *9* – ^{14}C dates obtained at St. Petersburg State University; *10* – OSL-dates (after (Astakhov, Nazarov, 2010)); *11* – AMS-dates obtained by the Royal Institute for Cultural Heritage, Brussels; *12* – AMS-dates obtained by the Center for Collective Use of Geochronology of Cenozoic at the accelerator mass-spectrometer of the Budker Institute of Nuclear Physics of SB RAS, Novosibirsk; *13* – paleofaunal remains.

bedding, and shows signs of ascending ripples. The top of these sands usually rises several meters above the edge of the towpath. The rest of the 2nd terrace's sections, visible in the coastal outcrops, includes aeolian (blown and overblown), deluvial, shallow-lacustrine-boggy and solifluctional deposits of the subaerial complex up to 5–10 m thick; this complex also covers the watershed areas not affected by the river waters. Exactly the sediments of subaerial origin aged 50–60 thousand years are the most promising for the detection of traces of Paleolithic humans, since the search for such evidence in the alluvium of the first Neopleistocene interglacial, and especially in the outliers of the Tobolsk alluvium, seems inexpedient at the current stage of research.

Kushevat

One of the areas identified as promising in terms of searching for Paleolithic sites was a right-bank section of the Kushevat channel of the Bolshaya Ob River within the abandoned village of Kushevat (Fig. 3). The selection criterion was the presence of south-facing promontories in this area, formed by several small nameless rivers cutting the coast with wide but short valleys. During the reconnaissance work in 2019, two test pits were established on the left-bank promontory of one of these rivers, flowing into a channel within the limits of the village. The choice of the place for test pitting was determined by the geomorphological setting: localization in promontory areas on second-order tributaries and the presence of terrace-like surfaces. The height of the test pits above the towpath was 6–8 m. The pitting (maximum depth 3.9 m) showed the following stratigraphy: modern soil (up to 0.3 m thick), subaerial sediments (pelitic non-layered silty sand, up to 0.7 m) and redeposited boulderless moraine (non-layered sand-aleuropelite, apparent thickness up to 2.8 m). No archaeological or paleontological materials were found in the pits.

In 2020, digging was carried out on the right bank of the mouth of the unnamed watercourse, which also looks like a high and wide promontory. In total, twelve test pits were made here, with a total area of ~10,000 m^2. In areas with the full thickness of the section at the 2nd terrace, test pits up to 3.5–4.0 m deep do not come out of the upper part of the subaerial cover, which consists mainly of aeolian sands and siltstones, as well as deluvial silt sands. However, in Kushevat's western part, the right side of the unnamed tributary "cut off" the cover that formed the upper subaerial tier of the 2nd floodplain

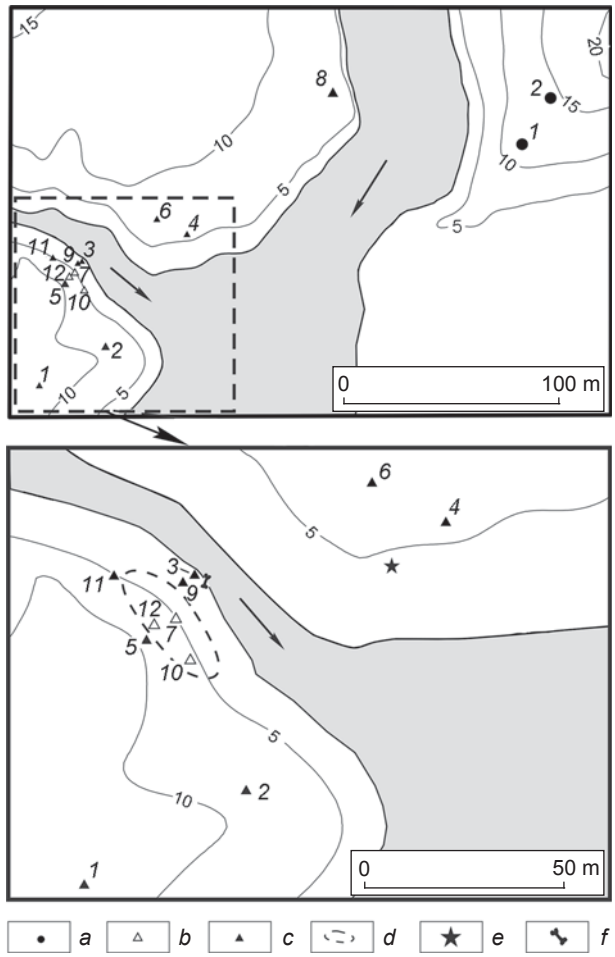

Fig. 3. The Kushevat map.
a – test pits of 2019; *b*, *c* – test pits of 2020, with and without the paleontological materials, respectively; *d* – the estimated boundaries of the bone-bearing layer; *e* – surface collected archaeological materials; *f* – surface collected paleontological materials.

terrace. In addition, preliminary examination of this area revealed a local accumulation of bone fragments on the towpath. It was suggested that the riverbank partially destroyed the bone-bearing layer at the border of the subaerial and alluvial tiers of the 2nd floodplain terrace. This was confirmed by further excavations.

Fig. 2 shows a composite section compiled using the data from three test pits (1, 5, 10), which are located downstream of the terrace. The total thickness of the subaerial complex in the composite section is 8.5 m. The subaerial stratum is underlain by the alluvial deposits of a large river (paleo-Ob) and its shallow tributary, clearly differing in texture and structural features. The alluvium of a large watercourse both overlaps and underlies the alluvium layer of the small river. This indicates the ancient age of the latter, and the fact that the section uncovers the deposits of the tributary's paleomouth; i.e., this fragment of the section seems to be prospective for the search for Paleolithic materials. As a result of the works in three test pits (7, 10, and 12), a bone-

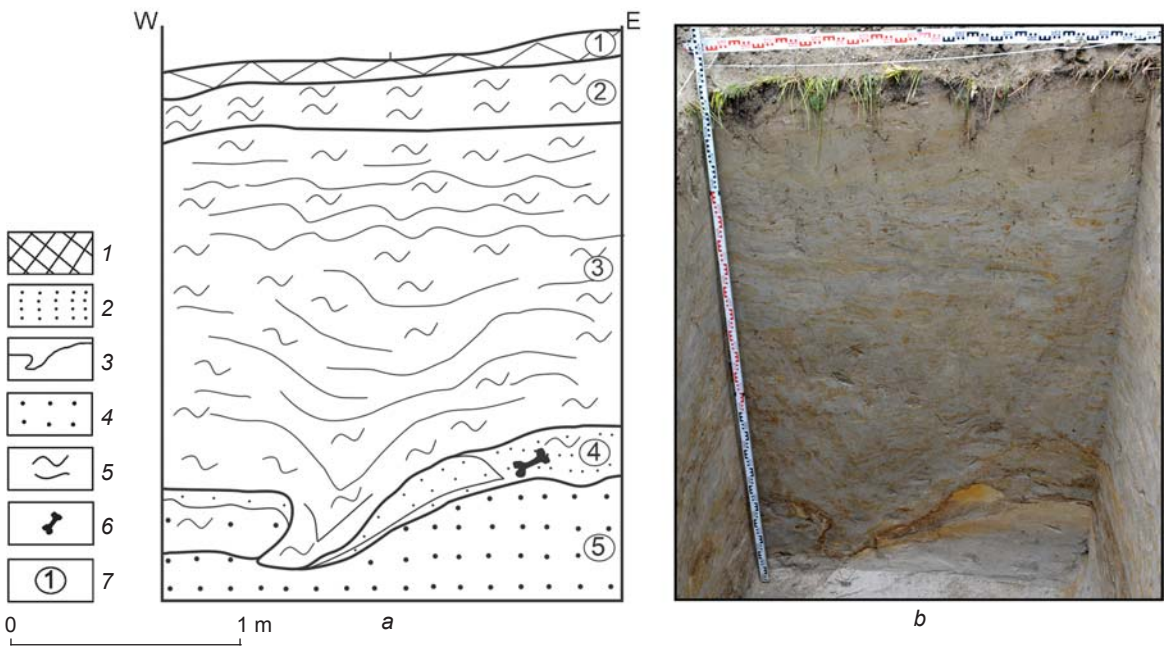

Fig. 4. Southern view (*b*) and stratigraphic section (*a*) of the northern wall at test pit 7.
1 – modern soil; *2* – aleurite; *3* – cryogenic deformations; *4* – sand; *5* – aleuropelite; *6* – paleontological material; *7* – number of the lithological layer.

bearing layer was found *in situ* under the bottom of the subaerial cover in the stratum represented by the interlayering of river alluvium and coastal slope deposits.

Below is a detailed description of the stratigraphy of the most expressive of the established sections.

Test pit 7. The 2nd floodplain terrace. The edge of the test pit is 7.4 m above the edge of the towpath of the Kushevat channel. The dimensions of the pit are 2.0 × 1.0 × 2.4 m. The following layers have been uncovered at the pit northern wall (Fig. 4).

Layer 1. Modern forest soil. Thickness 0.1 m.

Layer 2. Pale-brown, parallel-thin-bedded silt (small layers are 1–3 mm thick). The bedding is wavy deformed by solifluction, slightly inclined towards the tributary of the Kushevat channel. The subaerial cover is predominantly deluvial. Thickness 0.3 m.

Layer 3. Fine parallel subhorizontal interbedding of gray silt and ferruginous reddish silt sand. Stratification deformations by solifluctional processes are noted. The subaerial cover is predominantly deluvial and deformed by solifluction. Thickness 1.1–1.6 m.

Layer 4. Light gray with rusty spots and interlayers, well-washed medium-grained sand with gravel and small pebbles, dented and crushed by solifluction. Interlayers of gray silty sand. The alluvium is solifluctionally deformed and is subjected to sliding down the slope. The layer is curved, with base amplitude of up to 0.35 m. Average thickness 0.3 m. Paleontological material is recorded in the layer.

Layer 5. Parallel-subhorizontal-layered light gray sand, fine- to medium-grained, well-washed. Paleo-Ob alluvium. The top is subjected to solifluctional deformations. Visible thickness 0.6 m.

Characteristics of paleontological material

The total amount of faunal material from Kushevat is 31 specimens, of which 28 were found in a stratified context. The majority of the items were collected from test pits 7, 10, and 12 (see Fig. 3). In test pit 7, twelve bones were found (see Fig. 4, 5): a fragment of antler, the metacarpal and tibia of a reindeer (*Rangifer taradus*), five small fragments of tubular bones from a mammoth (*Mammuthus primigenius*), a fragment of the mandible of a bison (*Bison priscus*), and three unidentifiable fragments; in pit 10, there were two fragments of antler and two fragments of the base of the antler rod of a reindeer, a fragment of a rib of a bison or musk ox (*Bison priscus* / *Ovibos moschatus*), and an unidentifiable fragment; pit 12 contained six fragments of tubular mammoth bones, two fragments of a reindeer antler, and two unidentifiable fragments. The deposits containing these faunal remains have a common genesis and composition, and belong to the same geological unit. A fragment of a bison rib, the first phalanx of an elk (*Alces alces*), and a humerus of a red deer (*Cervus elaphus sibiricus*) were also collected on the coastal shallow close to pit 3. In general, the

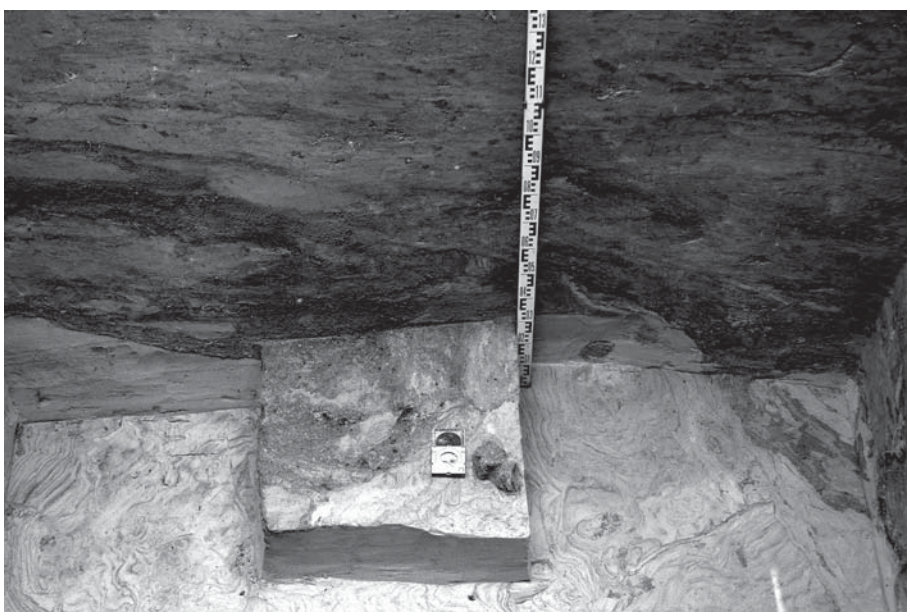

Fig. 5. The occurrence conditions of paleontological material in layer 4 of pit 7.

faunal assemblage of this locality demonstrates low species diversity; the main species are reindeer and mammoth. At the same time, the features of the reindeer remains suggest that their origin may be associated with hunting activities.

At present, the results of radiocarbon dating of faunal remains from the Kushevat locality have not yet been obtained. However, the analysis of the available data on the study area makes it possible to determine accurately and reliably the possible chronological framework of accumulation of the bone-bearing layer at the site. In this area, one of the best-studied sections of the Neopleistocene deposits and the closest to Kushevat (2 km to the west) is the Gorki section (see Fig. 2). Here, in a thin layer of lacustrine-boggy sediments, overlain by a subaerial cover 9.3 m thick, a fragment of a reindeer antler was found, which gave a calibrated AMS-date (RICH-27980.1.1) of 40,240 to 37,530 BP. The subaerial deposits unearthed in Kushevat and the Gorki promontory are chronologically close to loess-like loams in the section near the village of Lopkhari (5 km southeast of Gorki), described in detail earlier (Zolnikov et al., 2018). This is the section of the coastal cliff at the southern border of the village, where two trenches were made at the base of the subaerial cover and three peaty paleosols, underlying the alluvial deposits, were exposed (see Fig. 2). For the Lopkhari-1 lower paleosol layer, three ^{14}C dates in the range of cal 51–45 ka BP were generated at two laboratories (see *Table*). Thus, cross-dating shows that alluvial sedimentation was replaced by subaerial at the second floodplain terrace in the range of ~50–45 ka BP. The middle paleosol identified in both sections was dated in the same laboratories to cal ~43–40 ka BP, and the Lopkhari-2 upper paleosol layer was dated in the range of cal ~37–36 ka BP (see *Table*). The upper paleosol interlayer was exposed in the subaerial loess-like sandy loams in the test pit 2 km located northwards from the village of Lopkhari and dated to cal ~38–35 ka BP (see *Table*).

Currently, twelve dates in the range of cal ~51–35 ka BP are available for the lower part of the subaerial cover in the Gorki–Kushevat–Lopkhari area. Three dates in the range of cal 51–45 ka BP were obtained on the samples directly from the hydromorphic paleosol interlaying the alluvium and the subaerial cover. The available geological and geomorphological data indicate that the bone-bearing layer at Kushevat is confined exactly to this stratigraphic level.

Evidence of ancient human habitation at the Kushevat site

In the course of studying the paleontological material recovered from pits 7, 10, and 12, an item presumably with traces of anthropological effect was identified. Its

Radiocarbon dates of the Neopleistocene materials from the sections near the village of Lopkhari

Paleosol	^{14}C-date, BP	Calibrated date, BP	Code
Lopkhari-1			
Lower	41,530 ± 1280	47,167–42,680	LU-9875
	49,550 ± 620	≥51,148	GV-02019
	42,300 ± 382	45,622–44,426	GV-02480
Middle	38,640 ± 1160	44,523–41,375	LU-9876
	35,170 ± 296	40,955–39,695	GV-02479
Lopkhari-2			
Middle	36,060 ± 1110	42,511–39,261	LU-9878
	43,300 ± 386	46,500–35,605	GV-02482
Upper	32,520 ± 470	38,771–36,037	LU-9877
	31,910 ± 288	36,922–35,605	GV-02481
Test pit 2			
Upper (?)	30,940 ± 370	36,102–34,609	LU-9874
	33,290 ± 283	39,103–37,143	GV-02478

further analysis was carried out in the Paleotechnology Laboratory of the Scientific and Educational Center "New Archaeology" at the Novosibirsk State University. The osteological material was examined using an Olympus SZ2-ET stereoscopic microscope (maximum magnification ×56).

A fragment of a reindeer antler (pit 12) shows a small series of rather deep linear marks, which are clearly visible with the naked eye; and one less noticeable, slightly curved, superficial thin line (Fig. 6), most likely associated with the same processes as those that caused the formation of the series of marks. All scratches are quite long, without any deviations or additional thinner side marks. It can be inferred that each scratch was made by one translational motion of the tool along the antler (cutting). The deeper straight lines were formed through the stronger pressure on the implement. Considering the features of the marks and the fact that the antler was found *in situ*, the noted scratches cannot be associated with natural processes.

A small, irregularly retouched flake of yellowish-brown flint can be considered indirect evidence of the presence of ancient humans at Kushevat. The artifact was found on the riverbank near test pit 4, in the eroded accumulation of sediments similar in composition to the bone-bearing layer of the site. The connection of the flake with this particular lithological unit is not obvious, but quite probable.

Discussion

Intense archaeological research carried out in the Far North in the last two decades has significantly changed the scientific conceptions of the processes of the early peopling of this region, unfavorable for permanent residence. At present, numerous facts indicate that the first attempts to populate the northern territories, with their harsh climate but rich and diverse biological resources, occurred at

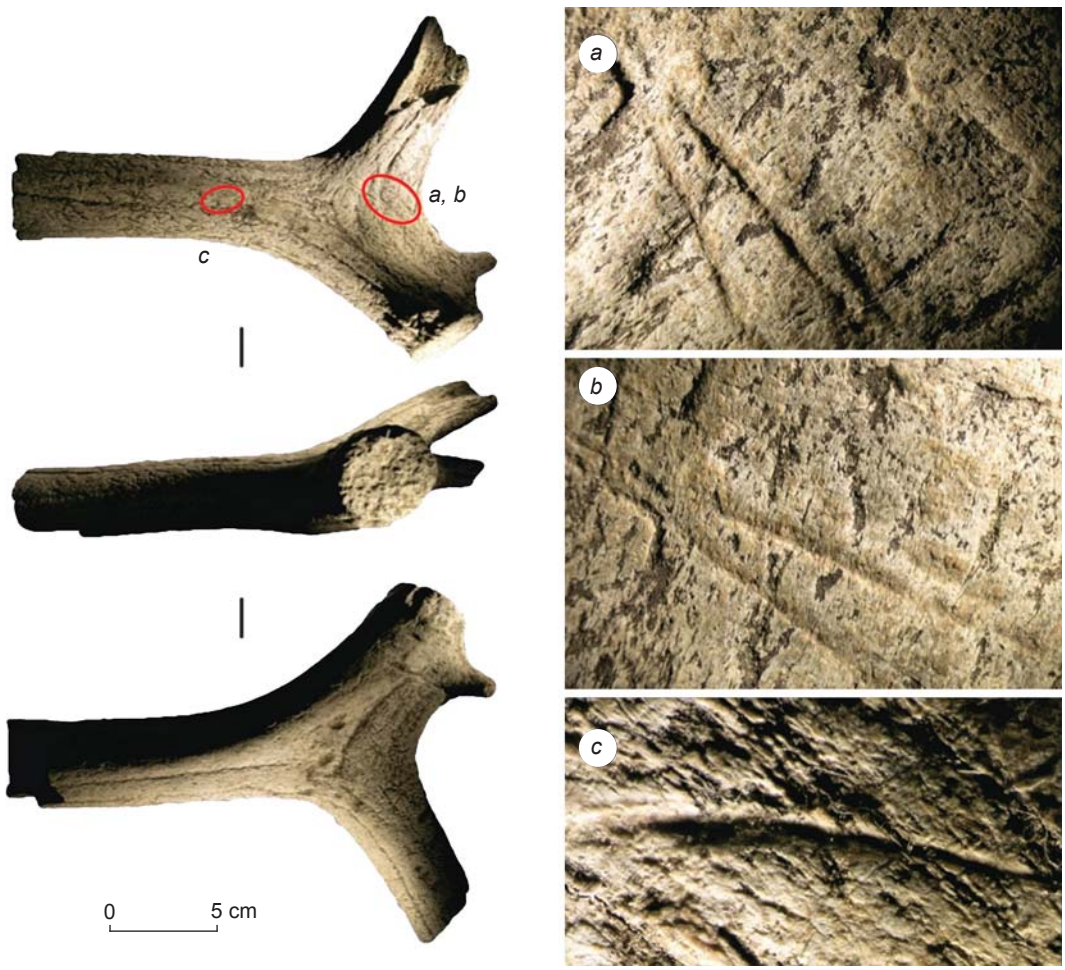

Fig. 6. A fragment of a reindeer antler with traces of anthropological effect.

very early stages of human history. Leaving aside the discussion about the chronology and cultural interpretation of materials from the Diring Yuriakh site in Central Yakutia, which were considered by various researchers in a very wide time frame from the late Early to the terminal Late Neopleistocene (Mochanov, 1992: 68–74; Ranov, Tseitlin, 1991; Derevianko, 2017: 78–84; Kuzmin, 2000), it can be argued that the first paleo-groups penetrated into the circumpolar zone no later than the initial stages of the Upper Paleolithic, ~40–35 ka BP (Pitulko, 2016). Northward migrations during this period have been recorded in different regions of Eurasia, from the northeast of Eastern Europe to Eastern Siberia (Pavlov, 2015; Pitulko, 2016; Pitulko et al., 2016). The most complete picture of the adaptation strategies and basic economic activities that made this process not only possible, but also successful, is given by the materials from the Yana site (northwestern Yakutia) (Pitulko, Pavlova, 2010: 175–196; Pitulko, 2012). Owing to the natural conditions, the unique set of artifacts has been preserved in full. The toolkit showed the importance of bone in the subsistence strategy of ancient people, the proportion of items made of bone, antler, and ivory in the kit, and how dependent people were on the availability and quantity of these materials, often associated with natural areas of accumulation of faunal remains—the so called mammoth graveyards (Derevianko et al., 2003: 120–126; Zenin et al., 2006; Makarov, Rezvy, 2009; Pitulko, Basilyan, Pavlova, 2011; Pitulko, 2016; Makarov, Rezvy, Gorelik, 2018).

The importance of such types of organic raw materials for the subsistence strategy of ancient humans can be traced not only in the regions of the Far North, where almost all the identified sites are associated either with "mammoth graveyards" or with the disposal of bone remains from solitary representatives of large fauna (Pitulko, 2016), but also in more southern regions, primarily where there is a certain deficit of other natural resources—stone and timber. This situation is most typical for the West Siberian Plain, including the middle and lower reaches of the Ob (Abramova, Matyushchenko, 1973; Makarov, Rezvy, 2009; Zenin, Leshchinskiy, 2017). This region is extremely poor in the Paleolithic sites, the bulk of which are concentrated in its western (foothills of the Urals) and eastern (foothills of the Altai-Sayan Highland) outskirts. The sites located near the Ob riverbed or in the lower reaches of its main tributaries are usually located in the immediate vicinity of the "mammoth graveyards", and reveal a rather small number of stone tools; however, their collections also contain very few items made from organic raw materials, which can be considered a result of the poor preservation of bone remains in general. At the same time, even the random finds collected from erosion areas in zones of natural accumulation of the Pleistocene fauna show traces of the use of bones by humans (Volkov, Vasiliev, 2017).

The dependence of ancient humans on the sources of organic raw materials should also have taken place in those regions of the Lower Ob where the research was carried out, since this area is extremely poor in lithic raw material suitable for continuous knapping. The main source of such material for the ancient population could have been the alluvium of the western tributaries of the Ob, flowing from the Ural Mountains and carrying flint pebbles, silicified and hornfelsed sedimentary rocks, quartzites, effusive rocks, etc. However, the long distance of transportation and the significant thickness of coastal sandy sediments, which complicate the search for the pebble material, do not make this source common and accessible. Another component of the local raw material is blocks, boulders, and pebbles from eroded deposits of ancient moraines; but they include quite few rocks suitable for continuous knapping; these are mainly shale, granite, quartz, and coarse weakly silicified sandstones. Thus, in the area under study, in the Late Neopleistocene, there were no easily accessible and abundant reserves of high-quality raw materials. This suggests the focus of the local paleo-groups on the material supplied primarily from the eastern foothills of the Urals; economical use of stone resources; absence of workshops or sites with a large number of lithic artifacts; and widespread use of alternative materials, primarily bone, antler, and ivory.

From the early stages of the Russian colonization of the Lower Ob basin and up to the present day, a large number of bone remains of representatives of the mammoth faunal complex have been found both on the Ob towpath (owing to seasonal erosion of the bedrock coast) and in a stratified context, although much less frequently. During field studies in 2016–2019, a representative collection (more than 100 specimens) of identifiable bone remains of Pleistocene fauna was collected on riverbanks in the lower reaches of the Ob, some of which were dated using the accelerator mass-spectrometer of

the Budker Institute of Nuclear Physics of SB RAS. Dates ranging from cal 50 to 15 ka BP were generated on 19 samples of mammoth bones, and 2/3 of them are in the range of cal 30–20 ka BP. The next most representative category was bone remains from the woolly rhinoceros (*Coelodonta antiquitatis*): six dates form two groups of cal 43–38 and 27–25 ka BP. The bones of reindeer and horse (*Equus ferus*) are represented in the same quantity (four samples each). The obtained dates are distributed fairly evenly in the same interval of cal 40–10 ka BP. Bison bone remains are more chronologically concentrated: all three samples showed a range of cal 50–40 ka BP. Two dates obtained from the bones of musk ox fall in the period of cal 41–32 ka BP. These data substantially supplement the list of dates generated on the surface faunal materials collected near Gorki: mammoth – 26,390 ± 250 BP, average calibrated value 30.6 ka BP; woolly rhinoceros – 28,750 ± 300 BP, average cal value 33.0 ka BP; bison – 32,550 ± 400 BP, average cal value 37.3 ka BP; wolf (*Canis lupus*) – >45 ka BP (Pitulko, 2016).

Thus, the dating of the Upper Pleistocene faunal materials from the Lower Ob region and their analysis make it possible to assert that during the second half of the Late Neopleistocene, the species composition of the megafauna did not actually change in this region. Consequently, an ancient man, being a consumer of bio-resources of the mammoth faunal complex, during all this time could live in familiar conditions and be guaranteed to meet animals of certain hunting species and areas of concentration of bone material of natural origin. The Kushevat site, discovered during the reconnaissance works of 2019–2020, is obviously associated with such a bone concentration area. The discovery of traces of anthropogenic activity on a fragment of the reindeer antler makes this site unique. The age of the bone-bearing layer of 35–50 thousand years assumed on the basis of a set of scientific data and the available ^{14}C- and AMS-dates from the nearby stratigraphic sections, makes Kushevat the most ancient and northernmost Paleolithic site known in the region at present.

Taking into account the available information about the early peopling of the northern regions of Yakutia, the mouth of the Yenisei, and the lower reaches of the Pechora, the discovery of the evidence of a contemporaneous human presence in the Lower Ob region does not seem extraordinary; on the contrary, it looks quite logical and expected. The fact that it is associated exclusively with traces of anthropological effect on the bones of game animals is also fully consistent with the natural conditions, in which the first colonists of these territories lived. First of all, this is a shortage of stone raw materials, which determines their limited use and, as a consequence, the rare occurrence of lithic artifacts. At the same time, solitary cores, spalls, and tools from a presumably Paleolithic age have been recorded among the collected surface materials from the towpath along the entire length of the Lower Ob, including the Gulf of Ob (Zolnikov et al., 2019).

Conclusions

Over the past 20 years, our ideas about the peopling of the northern regions of Eurasia have undergone significant changes. According to published data, the early colonization of the polar regions, which took place in several stages, began at the turn of the Upper Paleolithic (45–40 ka BP), and possibly earlier, and ended in the first half of the Holocene (11–6 ka BP) (Besprozvanny, Kosintsev, Pogodin, 2014; Velichko et al., 2014; Pitulko, 2016). Traces of the pioneering development of northern Eurasia were recorded on many large rivers of the Arctic Ocean basin (Pechora, Yenisei, Yana, Kolyma). The Lower Ob region remained a "blank spot" in this respect. The northernmost evidence of human presence in this region was found at the Komudvany site, dating to the Pleistocene-Holocene boundary and located ~350 km south of the Arctic Circle. The research results of 2019–2020 made it possible to push back the date of the first appearance of man in the circumpolar regions of the western part of the West Siberian Plain, and to shift the border of its peopling 200 km to the north. The Ob, therefore, has become one of the last major Siberian rivers where traces of the Early Upper Paleolithic culture have been found in the northern latitudes. At present, the issue of the early peopling of the Lower Ob basin is far from solved, because the studies at Kushevat are at their initial stage, and the archaeological evidence is present here only in the form of traces on the animal bones. At the same time, the discovery of a stratified Paleolithic complex in this region is itself a significant event for Paleolithic studies both in the region and in northern Asia as a whole. The large area of distribution of faunal remains at the site, along with the presence of lithic artifacts among the surface finds, suggest the great potential of Kushevat for further study of the

early stages of the history of the circumpolar regions of Siberia, as well as hope for the discovery of new stratified Stone Age sites here.

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Cruciform Signs Decorating Paleolithic Bone Artifacts from Cherno-Ozerye II, the Middle Irtysh Area

This study describes decorated bone artifacts from the Final Paleolithic or Epipaleolithic site of Cherno-Ozerye II in the Middle Irtysh area—a fragment of a bone dagger hilt found during the 1971 excavations, and fragments of bone "needle cases" found in 2019. An interpretation of the meaning of cruciform signs on the artifacts is suggested with reference to technology and form. Parallels from Ural and Eastern European sites are discussed. It is concluded that in terms of technology, morphology, and "syntax", the signs are stable markers of certain hunter-gatherer groups. Their specificity and possible meaning suggest that the Middle Irtysh area was a contact zone between Western (Ural) and Eastern Siberian groups of Paleolithic foragers. As a result of their interaction, an original decorative style was formed.

Keywords: Southwestern Siberia, Cherno-Ozerye II, Final Paleolithic, Epipaleolithic, decorative traditions, cruciform signs.

Introduction

The Cherno-Ozerye II site of the Final Paleolithic is located in the Middle Irtysh area. Collections of lithic and bone artifacts were gathered in the course of archaeological research at the site in 1968–1971 under the leadership of V.F. Gening and V.T. Petrin. The assemblage of bone artifacts contains a large number of ornamented items, including the well-known "Cherno-Ozerye dagger" (OMK 9675/702). Fragmented artifacts with damaged ornamental signs which were discovered at the site have not yet provoked any significant interest of scholars. Owing to the incomplete nature of such signs, it seems that an erroneous idea as to the futility of research in this area was formed. However, the evidence needs to be published and discussed, since it may lead to the study of the typology of subjects and of technological methods for creating ornamental patterns at the site, and in a wider context, elucidate the problems of settlement in the region and vectors in the development of contacts between human groups.

The cultural and historical capacity of paleo-ornamentation and its subject matter have been discussed both on the theoretical and practical level (Toporov, 1972; Gavrilov, 2009: 67–68; Kalinina, 2009: 117, 126; Privalova, 2009: 551; 2011: 1003; 2013: 1100–1101; 2014: 242; Privalova, Petrenko, 2014: 484, 489; Serikov, 2014: 104; Oshibkina, 2017: 16–17; Viktorova, 2017: 63; and others). Scholars have observed the brevity of Paleolithic ornamental signs (Kozhin, 1991: 132), which demonstrate only some features of evolved texts, such as a simplest rhythm of a limited set of elements and stability of their connections (Toporov, 1972: 78). However, the conciseness of records does not affect the heuristic capacity of the object under study. The groups that inhabited a particular region usually employed a specific set of signs in their practices of ornamental decoration, making their texts recognizable. Given the

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lack of sign diversity and in view of the importance of the "way of doing things" for any archaic person, the specific technical aspects of creating an element-sign are of interest. Accordingly, distinctive features of the technique used for making the sign on the surface, are important for understanding its genesis.

Thus, ancient artisans observed the order of combining signs of two or three forms, principles of arranging the composition/text on the surface of the object (the subject was rendered parallel or perpendicular to the axis of the object), morphological and technological features of producing signs, and a specific nature of the working surface (some bone cutters preferred to apply patterns on smooth planes, while others produced additional relief before starting work).

The combination of the forms of signs, techniques of their execution, and structures of records is unique and relatively stable for each group of bone carvers. This tradition was passed down from generation to generation for millennia despite changes in materials and semantic load of the sign (Voss, 1952; Ivanov S.V., 1963: 23, 42; Kozhin, 1991: 131–132, 143; Viktorova, 2017: 63; Oshibkina, 2017: 27; Volkov, Lbova, 2017: 166; and others); it was changed along with the group of which it was typical. This study aims at analyzing the Cherno-Ozerye ornamentation in accordance with the above parameters (shape and morphology of signs, technical features of their production, structure of the record, and distinctiveness of the ornamented surface), the importance of which has been theoretically formulated.

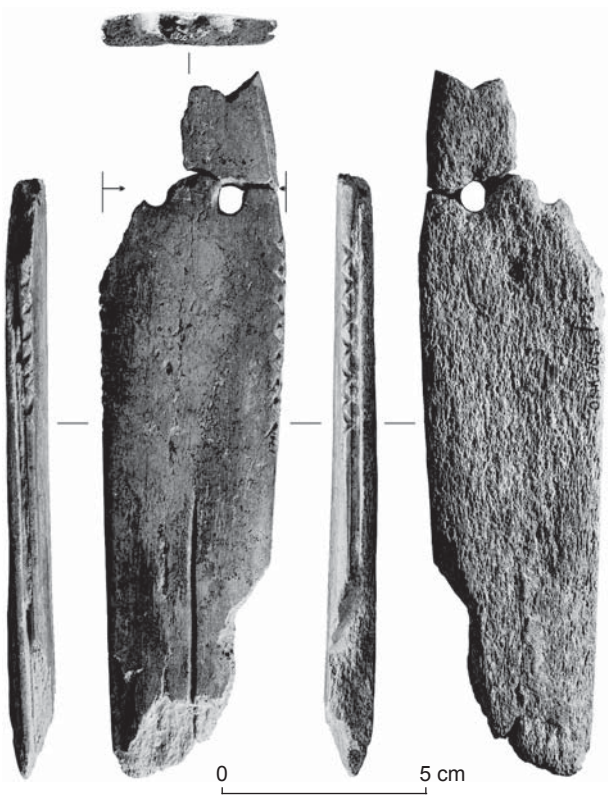

Fig. 1. Fragment of dagger hilt (OMK 9675/701). Cherno-Ozerye II.

Research sources and methods

Research sources were fragments of bone artifacts with remains of ornamental inscription. One of them was the fragment of a dagger hilt (OMK 9675/701) discovered during archaeological works at the site in 1971 and kept in the funds of the Omsk State Museum of Local History (Fig. 1). As an exhibit, the item is of little interest because of its fragmented state and specific design with ornamentation located on the sides and not noticeable when looking at the front side of the item. Its representation was placed on the flyleaf of one of the monographs on the studies of the Paleolithic in the West Siberian Plain (Petrin, 1986). Three other fragments of bone "needle cases" (ChZ II. 65, ChZ II. 67, ChZ II. 69), discovered in 2019, are being published for the first time. They are kept in the Museum of Archaeology and Ethnography at the Museum Complex of Dostoevsky Omsk State University (Fig. 2, *2*, *a–c*).

Rows of cruciform signs constitute the core of the surviving ornamental subjects on three of the artifacts. The signs on fragment OMK 9675/701 exemplify macroform, and those of other finds are microform. Differences in size of cruciform elements of ornamentation, which was represented on items of different functional purposes, testify to persistence of interest in these signs among bone carvers of the site. Analysis of symbolism of these records is problematic because of their "popularity" in the Paleolithic; the semiotic capacity of the cruciform sign excludes an unambiguous interpretation. For "reading" paleoornamentation, it is necessary to focus on identifying technological features in the working skills of the Cherno-Ozerye artisans, originality of the syntax of the surviving ornamental subjects, and morphology of the signs, find their parallels and, if possible, establish the information capacity. These problems can be solved by the methods of trace studies and experimental modeling* (Semenov, 1957; Girya, 1997). Use-wear analysis was carried out using a MBS-10 microscope. For photo recording, a Canon EOS 800D SLR camera (matrix dimensions 22.3 × 14.9 mm, resolution 24.2 million pixels) with a Canon EF-S 60mm f / 2.8 Macro USM macro lens was used. For obtaining high-resolution images, the stacking method was applied (frames were pasted together using the Helicon Focus software).

*Owing to the limited volume, the article only presents the results of use-wear analysis.

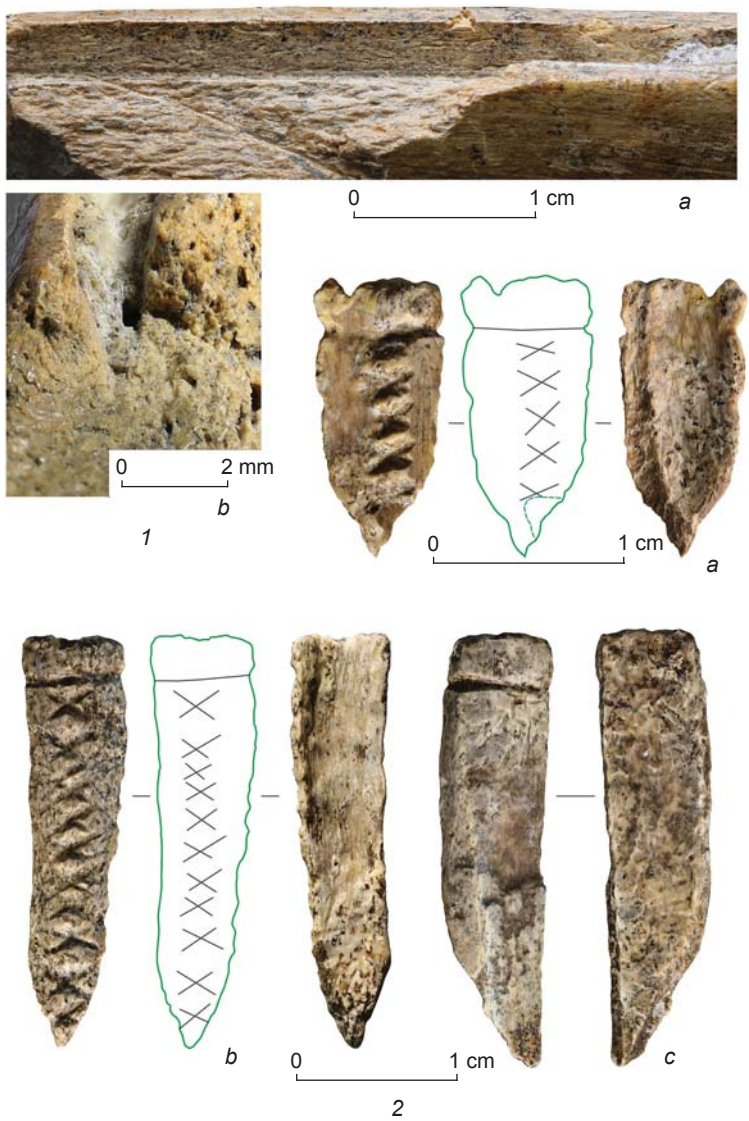

Fig. 2. Fragment of dagger hilt (*1*) and fragments of "needle cases" (*2*). Cherno-Ozerye II.
1: *a* – fragment of the left wall of the groove for inserts (close-up), *b* – profile of the right groove for inserts; 2: *a* – ChZ II. 67, *b* – ChZ II. 65, *c* – ChZ II. 69.

The syntax of ornamental records and morphology of signs are viewed in light of the theory of semiotic analysis of sign systems, presented in the works of Vyach.Vs. Ivanov (1976) and U. Eco (2016, 2019). Many aspects of this theory have been adapted in Russian studies of paleoornamentation (Ivanov S.V., 1963; Kozhin, 1991; Kalinina, 2009; and others).

Analysis of sources

Fragment of dagger hilt (OMK 9675/701). The length of the fragment is 172 mm, width 42.1 mm, and thickness 10.7 mm. The fragment has survived in a satisfactory state (see Fig. 1). Its raw material is a split, flat bone of a large ungulate. The facial surface of the natural outer layer of bone is polished; the reverse surface is a dense spongy substance. The surviving areas of grooves for blades are filled with grayish, dense mortar, which is possibly restoration cement resembling the loam in which the artifacts were found. The surface color is brownish-beige. Rare spots of dendrites are visible. The item was interpreted as a fragment of a dagger hilt (Petrin, 1986: 62).

Channels of two through holes have been preserved in the area of the upper fracture. They are biconical in cross-section; they were made using the counter-drilling technique and are located with slight deviation from the horizontal axis. The diameter of the least damaged hole is 7.3–4.9–6.8 mm. A large and deep U/V-shaped slit (its shape changes in cross-section), 47.3 mm long, 1.8 mm wide, and 1.5 mm deep was made on the front side of the item along its long axis. Its uppermost point is located 60 mm from the area of the holes on the hilt. The area of cutting was first marked by tracing; marks of both procedures are visible on the sides and in the lower part of the slit (Fig. 3, *3*).

Grooves for the inserts have survived on the sides of the artifact. These were made using techniques typical for producing insert tools in that period: the side of the blank was flattened by shaving and smoothing; the slit was made in the center of the resulting area. Zones of damage on the hilt make it possible to establish the sizes and configurations of the slits: the depth of one of them is 3.3 mm; its width is 1.7–2.0 mm; the channel is V-shaped in cross-section (see Fig. 2, *1*).

The area near the edges of the grooves that is located next to the holes is decorated with rows of cruciform signs set close to one another, which occupy three planes—the frontal plane (the zone of the slit for the inserts) and two planes adjacent to it (see Fig. 3, *1*, *2*). These signs can be perceived by the viewer in different ways owing to the intersection of elements in the zone of the slit. For example, V.T. Petrin regarded them as V-shaped elements, the rows of which formed zigzags: "15 cuts forming a zigzag were made on the lateral faces along the edge of the groove for the inserts" (1986: 62). It is possible to assert that the signs constitute a cruciform figure if we reconstruct the movements of the knife blade with which they were carved (that is, if we "continue" the lines), and pay particular attention to the signs made with deviations;

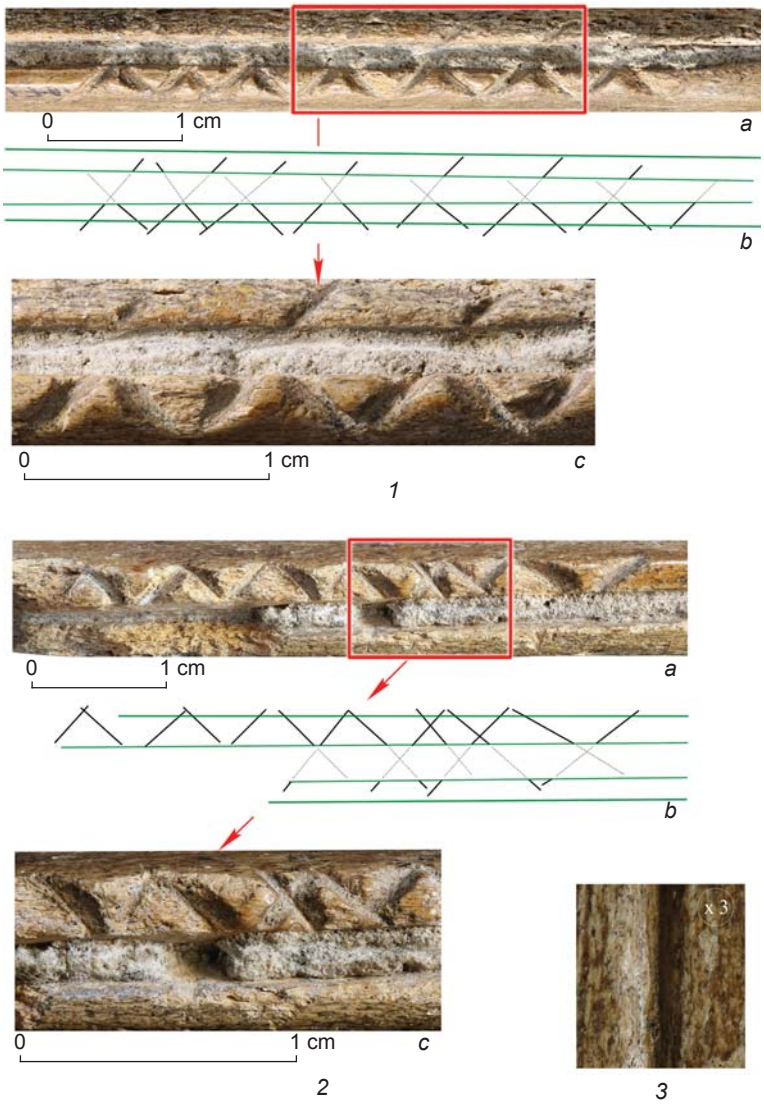

Fig. 3. Ornamental inscriptions on the right (*1*) and left (*2*) sides of the dagger hilt; fragment of the medial cut (*3*). Cherno-Ozerye II.
1: *a* – entire group of signs (close-up), *b* – record pattern, *c* – individual subject (close-up); *2*: *a* – entire group of signs (close-up), *b* – record pattern, *c* – individual subject (close-up); *3* – magnification ×3.

for example, the "small cross", in which the zone of intersection of the elements was shifted from the groove to the edge of the side of the artifact (see Fig. 3, *2*, *c*).

It is not as simple as it would seem to establish the execution technique of the cruciform signs. The slits, which are V-shaped in cross-section with sides diverging at an angle of 50–90° at a distance from 1.5 to 1.7 mm, which is comparable with the width of the central cut on the frontal side of the item, cannot be obtained by lightly sliding a cutter along the bone edge. These slits resulted from sticking the working edge of the tool into the surface and pulling the working edge set at an angle to the vertical axis of the slit. The width of divergence of the sides indicates the alternate processing/treatment of both sides of the slit. The operations had to be repeated several times until the required depth was obtained: distinctive grooves left by the working edge of the tool have been preserved on the bottom of the cut. The surfaces of the sides are smooth.

The angle between the elements of the cruciform signs is about 90° (± 10°). The signs are set close together in a strict order on the right side and with disturbances in the rhythm on the left side (see Fig. 3, *1*, *2*). As experiments show, the artisan had to "enter" the rhythm, which developed with continuous repetitive movements. The "field" where this rhythm was "entered" was the left side of the item. The right side was processed by already confident movements of the hand and tool.

It is difficult to establish the condition of the bottom of the many channels/slits, their sides*, and specific features in intersection points of the elements**: the incisions are often covered with cement; the signs are located in several planes. Notably, these were the largest of the cruciform signs that decorated the artifacts at Cherno-Ozerye II.

The texts on the left and right sides differed in the number of surviving signs. There were seven signs and one element, apparently of the eighth, unfinished sign (see Fig. 3, *1*, *a*, *b*) on the right side, and four or five signs (depending on the method of counting) and elements of three more signs (see Fig. 2) on the left half-destroyed side. It is not possible to establish how many signs there were originally in the texts on both sides. It may be assumed that the rhythm of the semantic units was important for the artisan, and not their number.

Fragments of bone "needle cases" (ChZ II. 65, ChZ II. 67, ChZ II. 69). Three fragments of the diaphysis of a tubular bone of a small animal (hare or bird) with ornamental inscription on its surface (see Fig. 2, *2*) were discovered in 2019 during the study of the site. Although the fragments compactly occurred in the layer, subtle differences (not only in design) do not make it possible to consider them as parts of a single artifact. Two finds (ChZ II. 67 and ChZ II. 65) may be

*The tool can be identified from its roughness, and the technical condition of the tool from retouching and chipped spots.

**This makes it possible to establish which element was made first.

fragments of "needle cases". These are the smallest ornamented artifacts in the collection from the site: ChZ II. 65 measures 26 × 7 × 1.2 mm; ChZ II. 67 – 15 × 7 × 1 mm, and ChZ II. 69 – 27 × 7 × 1 mm. The reconstructed diameter is 5–7 mm.

All three items have survived in satisfactory condition; they have a light, gray-brown surface; the original edge has mostly been preserved. In their shapes, two fragments (ChZ II. 65 and ChZ II. 67) show similarities with the find described above: the ornament consists of groups of small slanting criss crosses. The chain of criss crosses stretches along the long axis of the items to the preserved transverse band, which encircles the edge of the items. Five signs with miniature elements up to 1.8 mm have survived on fragment ChZ II. 67. One angle between the intersecting lines is 50°; the other angle is 130°. Eleven signs are visible on fragment ChZ II. 65. The length of the elements ranges from 2.5 to 3.0 mm; the angle between the intersections is 60° (± 10°) and 120°. This subtle difference in angular rates affects the visual perception of both the sign and the text as a whole; in addition, presence of this difference indicates that these finds were fragments remaining from different items. Obviously, different artisans worked on their design: one of them was trained to represent one combination of angles, while the other another combination of angles. The elements are V-shaped in cross-section; the depth of the incisions reaches 1 mm; the distance between the sides in the upper part is 1.0–1.2 mm.

Only the band located across the long axis of the artifact, 2 mm from the rim, has survived on the third fragment (ChZ II. 69). It is V-shaped in cross-section; the depth of cut of this sign on all three fragments varies from 1.0 to 1.5 mm; the difference between the sides in the upper part is 1.0–1.5 mm.

A specific feature of the artifacts discovered in 2019 was preparation of their surface before engraving the signs: several thin removals were made in the area of future ornamentation, which resulted in a ledge on the surface of the bone (see fragment ChZ II. 69; the work on making such a relief was clearly initiated, but not finished); the signs were made on the edge of that ledge. Owing to the close, strictly rhythmic arrangement of criss crosses (often with interweaved ends of the elements), a subtheme—a chain of relief micro-rhombs—appeared on the convex surface (ChZ II.65 and ChZ II.67). It is not clear which result the artisan wanted to obtain: the row of criss crosses or relief rhombs, since both signs (cross and rhomb) were typical of the Cherno-Ozerye ornamentation.

The ventral part of fragments ChZ II. 65 and ChZ II. 67 deserves particular attention. Their surface is covered with shallow grooves/scratches left by a pointed tool, which were tightly arranged and oriented along the long axis of the artifact. The lower boundary of the zone with scratches is located 3 mm from the edge of fragment ChZ II. 67, and 14–15 mm from the edge of fragment ChZ II. 65. These damages can be explained by regular contact of the ventral side of the artifact with a hard and sharp item. Such marks appear when a dressmaker, without looking, puts a needle into a container-socket. The evidence from the site includes one bone needle with polished surface, 73 mm long, with maximum thickness of 1.5 mm. It is subrectangular in cross-section, with a rounded tip; the diameter of the eye hole is 0.5 mm (Gening, Petrin, 1985: 53, fig. XX, *2*). Finds ChZ II. 65 and ChZ II. 67 are probably the fragments of needle cases that belonged to "muscular dressmakers"; this role was possibly played by men. Scratches similar to those described above could appear if the needle was pushed into the needle case not only in a half-blind mode, but also with great effort. The angle of entry of the needle into the socket, established by the length of the needle track on the walls of various fragments, was also different, which means that these fragments belonged to different items. The question of the gender of their owners remains open. If these needle cases were kept in humid conditions, their surfaces could become susceptible to any, even slight, mechanical impact, in which case the assumption of "muscular dressmakers" can be discarded.

Discussion

Ornamental decoration of bone items cannot be discussed without analyzing their technical, typological, and stylistic parallels.

Many studies have focused on technical and typological analysis of regional ornamental evidence (Rusinowo…, 2017; Enshin, Skochina, 2017; Volkov, Lbova, 2017; Akhmetgaleeva, Dudin, 2017; Majkić et al., 2017; and others). However, they rarely consider issues related to physical and technological indicators of signs/elements or other technical features of methods used for representing signs on bone surface. Insufficient knowledge of these issues has been primarily caused by the lack of technical equipment in museum laboratories and in a number of scientific research centers, as well as lack of specialists in use-wear analysis and experimenters who elaborate the systems for describing the observations.

The tradition in Russia of studying these problems has only started to emerge. The issue of techniques used for creating representations has not yet received proper consideration. We should try to address some of them using the example of finds from Cherno-Ozerye II. The majority of ornamental elements on the fragments under discussion were created by carving, which is also confirmed by experiments. People from Cherno-Ozerye were familiar with the sawing method; in some cases its

use seems more appropriate, but they did not apply it when they made the items under discussion. According to some scholars, the cutting/carving procedure is archaic (Akhmetgaleeva, Dudin, 2017: 31), and its traces on the artifacts of the transition period from the Paleolithic to the Mesolithic are surprising. Obviously, different groups of bone carvers created technological chains of ornamentation, which are difficult to attribute chronologically.

The signs were carved using an ordinary blade (tool with thin, unretouched working edge, since retouching leaves traces on the surface of the sides of the channel), fastened in a holder. Bone was kept in water for softening, which facilitated cutting.

The depth and angle of divergence between the sides of the cuts depended on the size of the tool, preferences of the bone cutter, and individual features of handling the tools by the artisan; they may serve as individual markers. Such aspects of the sign as width and depth of cuts, which ensure the accuracy of its reading, are archaic features. This becomes clear when Paleolithic ornamental texts are compared with the "spider web" patterns of the Mesolithic.

Discussion about the style of patterns and signs is traditional in the history of paleoart. The Cherno-Ozerye patterns are recognizable owing to syntactic features in construction of compositions and distinctive morphology of their constituent signs. Bone cutters arranged straight and slanting crosses in rows oriented along the long axis of the artifact. Changes in the shape of crosses may reflect both the period of creation and transformations in the semantic paradigm of the sign. This element is known both from the European evidence and from the Final Paleolithic of the Urals. Slanting crosses rarely appear on the finds from the Trans-Urals and western regions of Western Siberia. Such crosses can be found in the decoration of the artifacts from the Cherno-Ozerye II site and in the ornamental composition, albeit in a different syntactic context, on the dagger from Aitkulovo (Irtysh region) (according to a number of features, it can be attributed to the Mesolithic of this area) (Kungurov, Shemyakina, 1994). It has not been found in the contemporaneous ornamental records on the artifacts discovered in the eastern and southern parts of Siberia (or such evidence has not been published).

Territorially close parallels to the slanting cruciform signs under consideration are ornamental elements on a groundhog bone from Shulgan-Tash Cave (Urals) (Zhitenev, 2014, 2016). The record consists of four slanting crosses, which are located parallel to the long axis of the bone, and are separated by short transverse incisions (Zhitenev, 2014: 47). Information about the size of the signs and their execution technique has not yet been published, but the differences in the syntax of the signs of the compared inscriptions (with the closeness of their shape being preserved) are obvious. If we take ornamentation on the groundhog bone from Shulgan-Tash Cave for an archetype according to the dates of the Pleistocene deposits (from 13,930 ± 300 BP (GIN-4853) to 16,010 ± 100 BP (KN-5023) (Ibid.: 45)), the composition on the artifacts from Cherno-Ozerye II can be considered to be its variant: while maintaining a number of key features (shape of signs, their structural features, vector of development of the record), some changes are noticeable. This set of features makes it possible to see the roots of the Cherno-Ozerye tradition of using cruciform signs in the Ural version of ornamentation.

Another distinctive feature of the Cherno-Ozerye crosses is that these signs are located on several planes formed either by the joint of the facets in the end part of the product (OMK 9675/701), or by surface modification (ChZ II. 67 and ChZ II. 65). This modification technique is well known from the evidence of Western and Central Europe, and the Urals. Traces of using this technique in modeling specimens ChZ II. 65 and ChZ II. 67 are barely noticeable, but they appear clearly on a territorially close parallel—a bone fragment with diamond-shaped signs from Shulgan-Tash Cave (Ibid.: 47).

We should discuss the question of the importance of the preparatory stage for drawing cruciform signs on the bone surface. Preparation of convex relief, just as the specific location of cruciform signs, is known from the Kostenki-Avdeyeva evidence (see (Gvozdover, 1985; Demeshchenko, 2006; Verkhniy paleolit…, 2016)). Several "needle cases" have been found at the Avdeyeva site in Central Russia, which were designed almost the same way as the Cherno-Ozerye fragments. Tightly grouped slanting crosses were placed on the prepared faces along the long axis of the artifact; they were separated by sparse, straight incisions located perpendicular to the axis (see (Abramova, 1962: Pl. XXX, *12*; Gvozdover, 1985: 12)). Noteworthy is the complete coincidence of stylistically important design features on the "needle cases" from Avdeyeva and Cherno-Ozerye II, such as preliminary modeled relief and location of a row of slanting crosses along the long axis of the item. Ancient "needle cases" were often decorated with cruciform signs; the figure in the form of a cross was associated with the technology of bonding and joining. Clearly, the pattern of fastening seams typical of artifacts made of soft materials, was aesthetically conscious and was replicated on materials which were not suitable for sewing (Demeshchenko, 2006: 11). The connecting nature of the sign is emphasized by its specific placement in the zone of "joining spaces" on the sides or facets of bone items.

Such cruciform images do not often appear on dagger hilts. Ornamentation consisting of groups of cruciform signs has been found on the famous "Cherno-Ozerye dagger" where the groups of slanting cruciform signs are located in the same way as on the OMK 9675/701 find—

at the ends, in the center, but not in the area of the hilt. It is possible that the inhabitants of the site customarily represented criss crosses (straight or slanting) on the ends of daggers. There are very few items with similar design among numerous tools of this type in the Upper Paleolithic and Mesolithic collections from Eurasia. The closest parallel to the composition under discussion is the ornament on a fragment of a dagger point from the 4th cultural layer of the Ivanovskoye-7 site (Middle Volga region). M.G. Zhilin, one of the heads of the excavations, mentions "ornamentation of a band of slanting intersecting crosses", made with the corner of a broken blade or flake on the edges of a Mesolithic tool (2018: 45, fig. 22, *1*).

Semantic explanations can be found for the stylistic features of the Cherno-Ozerye cruciform records mentioned above. Based on the theory of genesis of visual activities, developed by A.D. Stolyar (1985: 134–137), I.V. Kalinina mentioned that the cruciform sign was one of the first technological symbols of the "closed wound", fastening, tying, and bandaging, which appeared in art since the Mousterian period (2001: 55–56). Images on the fragments under consideration may serve as confirmation of the plectogenic theory explaining the origin of that subject (Ivanov S.V., 1963: 14–15; Ivanov Vyach.Vs., 1976: 245). "The symbolism of the slanted cross… goes back to the most ancient methods of fastening, tying, and sewing together. Ornamentation, while performing a 'protective' function, 'strengthened' flint inserts in the point, and 'protected' the edge of the groove. By replacing binding, spiral ornamentation and the slanted cross 'strengthened' the handle of the point and place of its connection with the shaft" (Kalinina, 2009: 241). Obviously, our ornamental inscription on the dagger fragment from Cherno-Ozerye II can be considered a sign of such symbolic "strengthening" of the weapon. The rows of cruciform signs on the needle cases are a reference to the results of needlework, to symbolically fastened planes. Differences in shape and size of the signs (in one case they are larger, in the other case smaller; in one case they resemble straight lines, in the other case slanting lines) should be interpreted in the context of chronology of the subjects using wider evidence.

Conclusions

The fragments of the artifacts described herein and damaged records of signs appearing on them are extremely informative. They can be used for analyzing various aspects of the history of paleoart, primarily the criteria for assessing technical and morphological features of Paleolithic/Mesolithic ornamentation, as well as algorithms and conditions for their observation.

From our point of view, study of the technique of creating ornamental patterns is necessary for reconstructing the historical and cultural potential for the artifacts and describing techniques for executing ornamentation in a specific group. Analysis of stylistic features of the fragmented ornamental subjects is crucial for establishing the boundaries of the area where a specific ornamental motif existed/emerged. Most of the parallels with the items under discussion originated from the territories to the west of the Urals. The center of the area of the specific Western ornamental tradition was probably located there, and the periphery of this area was to the east of the Urals, or alternatively, we should not include the regional Ural and Western Siberian collections into scholarly research because of their fragmented nature, sparsity, etc. Sometimes it is easier to connect the genesis of the Neolithic ornamental patterns appearing on Western Siberian items with the pictorial subjects of the Middle East (Enshin, Skochina, 2017: 15) rather than with local traditions. This study has revealed ornamental traditions that emerged on a local basis in the Irtysh region, but with the involvement of traditions typical of the Urals. Even a superficial consideration of such a simple motif as a series of cruciform signs gives grounds for suggesting that the border of the ancient Ural ornamental zone (where this sign was used in the Paleolithic and more actively in the Mesolithic) should be moved one thousand kilometers to the east of the Urals. When this motif was transferred to the Middle Irtysh area, it became transformed—some elements dropped out of the texts and there were some changes in the syntax. Taking into account the previously published suggestion concerning the Malta influence (Schmidt, 2017), it would be correct to speak not about "losses in the set of signs", but about replacement of some signs and principles of their grouping, typical of the Ural ornamental tradition, with Eastern Siberian ones, when "Ural crosses and rhombs" became combined with "pearl threads", the prototypes of which appear in the decoration of items from the Malta site (Cis-Baikal). The need to place a narration of a certain volume (which should not be too large) on a limited surface of bone must have forced artisans to give something up while creating a composition and operate only with the "main" thing; it might have been signs of a certain shape, text layout, etc. As a result of contacts between various groups on the territory under discussion, a distinctive (composite) ornamental language emerged.

It will be possible to expand the empirical basis of this assumption and strengthen its argumentation, if the evidence kept in museums is published, archaeological research in the region is continued, and methodological foundations of the history of paleoart are further developed.

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From Ore to Metal: Exploitation of the Novotemirsky Mine, Southern Trans-Urals, in the Second Millennium BC

The Novotemirsky mine was the first in the Southeastern Urals to have large areas of the site uncovered. This has yielded new information on the technologies practiced by the first metallurgists in the region and on the evolution of these practices in the second millennium BC. Cultural layers revealed evidence of all stages of Bronze Age metal production. Mining is documented by pits of various forms and adjoining waste dumps. This is the first time that shaft mining has been discovered in the Bronze Age of the Southern Trans-Urals. Metal smelting is evidenced by a copper-smelting furnace with slag. Metal tools were cast in bivalve molds, of which one, made of chloritolite, was used for casting pickaxes. Results of radiocarbon AMS dating indicate three stages of mine exploitation in the Bronze Age, correlating with the chronological sequence of regional cultures. The furnace was built during the Sintashta period (2100–1900 BC). The shaft mine and the adjacent dumps date to the Alakul period (1700–1500 BC). Features dating to the Final Bronze Age (1500–1200 BC) have yet to be identified. It has been demonstrated that the same mines were exploited by people associated with various archaeological cultures in the second millennium BC, implying that a metallurgical center functioned in the Trans-Urals over the entire Late Bronze Age. Given that indicators of metallurgy are quite rare at unfortified sites, and that the technology changed, it can be assumed that smelting and casting became more specialized during the Alakul period: certain operations were performed at mines and/or nearby settlements.

Keywords: *Ancient mine, copper metallurgy, Late Bronze Age, Southern Urals.*

Introduction

Territorial distribution of the metal-producing cultures reached an unprecedented scale in the Eurasian Metallurgical Province of the Late Bronze Age. At the stage of its emergence, its western fringe was in the Southern Trans-Urals, with the Sintashta center of metallurgy (Chernykh, 2008: 47–49; Bochkarev, 2010: 52–53). Development of metal production in the second millennium BC is a debated issue. Some scholars argue for a clan-oriented organization of miners and metallurgists inhabiting the fortified settlements (ca 2100–1900 BC) and degradation of metal production in the "traditional" cattle-breeding society of the Alakul period (ca 1900–1500 BC) (Vinogradov, 2018). On the contrary, other scholars consider the scale of the Sintashta metallurgy to be exaggerated and specialization to have emerged at the subsequent stages of the Late Bronze Age, associated, among other factors, with changes in ore procurement and development of richer sources (Grigoriev, 2013: 263, 481; Chechushkov, Petrov, 2021).

We suggest that this contradiction may be resolved by taking a closer look at mining as a component of metal production outside the settlements. The object of research is the ancient Novotemirsky mine—one of the three mines (along with Vorovskaya Yama and Novonikolaevsky) known in the Southern Trans-Urals, which have been reliably dated to the Bronze Age (Zaykov et al., 2005; Ankushev et al., 2018) (Fig. 1). In the course of archaeological works, fundamentally new data on metallurgical processes at copper deposits of the region in the second millennium BC have been obtained. These processes are analyzed in this article.

Materials and methods

The Novotemirsky ore occurrence is located in the Chesmensky District of the Chelyabinsk Region. It is confined to the Kulikovsky ultrabasic massif at the contact of apoharzburgite serpentinites with rodingites. The primary copper ores are represented by chalcopyrite and bornite. Chrysocolla, malachite, azurite, less frequently delafossite, covellite, chalcosine, and native copper occur in the oxidation zone. At the first survey in 2014, the mine looked like an oval-shaped swampy quarry, with slightly slanting bottom measuring 30 × 20 m and reaching 2.5 m in depth, surrounded by crescent-shaped sodded dumps (Yuminov, Ankushev, Rassomakhin, 2015). In 2017–2019, the expedition of the South Ural Humanitarian Pedagogical University and Institute of Mineralogy of the South Urals Research Center of Mineralogy and Geoecology of the Ural Branch of the Russian Academy of Sciences conducted archaeological excavations, and geological, mineralogical, and geophysical works. In the northern half of the site, V.V. Noskevich carried out a ground penetrating radar survey (Medvedeva et al., 2019); two excavation pits were made in the southern half of the site over a total area of 400 m^2 (Fig. 2, *1*). The cultural layer of the investigated area consisted mainly of waste

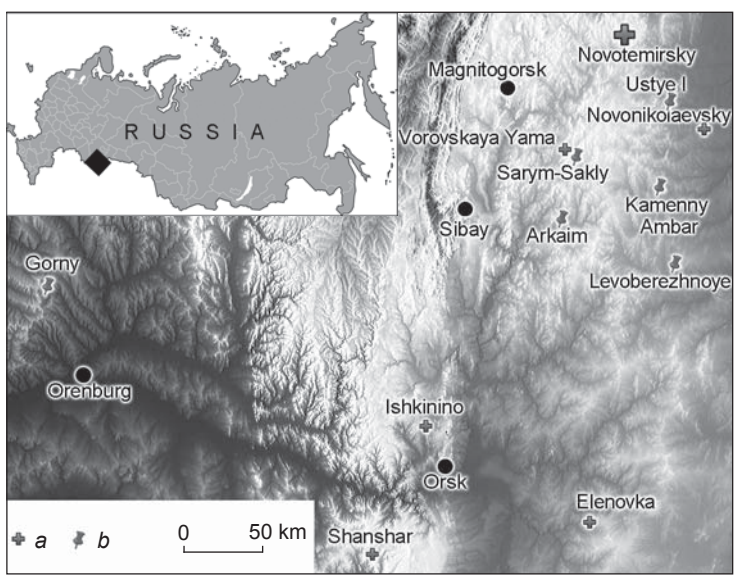

Fig. 1. Location of archaeological sites of the Bronze Age mentioned in this article, in the Ural-Mugodzhary region.
a – mine; *b* – settlement.

Fig. 2. Orthophotomap of the Novotemirsky mine, showing the boundaries of the excavation in 2018–2019 (*1*) and bottom part of mine No. 1 (*2*).
a – outline of mine No. 1; *b* – excavation grid marks.

dumps of various thickness poured over the buried soil: up to 0.6 m in the southeastern part and up to 1.6 m in the southwestern part of the site. The cultural layer contained extremely scarce finds, which consisted mostly of fragments of stone mining tools from imported (sandstone) and local (serpentinite, rodingite) rock. Pottery is represented by isolated specimens, its overwhelming majority coming from deepened objects. The osteological complex, which was also dispersed in the filling of the dumps and deepened objects, included 112 fragments of animal bones with a total weight of 1.11 kg. There were no signs of dwelling structures in the excavated area.

Owing to low presence of artifacts and other remains of human activities in the layer, radiocarbon analysis was chosen as the main dating method, taking into account the stratigraphic context. The age of the samples was established using accelerator mass spectrometry at the Center for Collective Use "Laboratory of Radiocarbon Dating and Electron Microscopy" of the Institute of Geography RAS (Moscow, Russia) and Center for Applied Isotope Studies at the University of Georgia (Athens, USA). Conventional ^{14}C dates were calibrated using the OxCal 4.2.3 software (Bronk Ramsey, 2017) and the IntCal13 calibration curve (Reimer et al., 2013).

Evidence for various stages of metal production at the Novotemirsky mine

Mining. The present-day appearance of the site does not reflect the real morphology of the shafts, because they were filled with waste in ancient times. Geophysical methods revealed a more sophisticated structure of the main quarry as opposed to its current bowl-like shape with a smooth, silty center. A ground penetrating radar survey in the northern part of the site revealed the bottom of the quarry at a depth of 1.5–2.0 m under muddy sediments, as well as several vertical shafts with a width of 0.5–1.5 m extending deeper than 4 m (Medvedeva et al., 2019).

Mine No. 1 was chosen as the main object of excavation. It was a vertical shaft in the southeastern part of the site visually with no raised waste dumps. At the level of the present-day surface, the mine looked like an oval depression with a diameter of 16 m and depth of 0.5 m, sodded with green moisture-loving vegetation. A bush grew in the center. On the level of the virgin soil, the mine had the form of a subrectangular area measuring 6 × 4 m and oriented along the NW–SE line (Fig. 3, *1*). Starting from a level of –500 cm (approximately 4 m from the present-day surface),

the mine acquired a regular rectangular outline measuring 2.6 × 1.7 m and retained this shape with strictly vertical walls to the very bottom, which was found at a level of –910 cm (8.0–8.5 m depth from the present-day surface). The bottom was flat, with a small (up to 10 cm high) rise of the middle transverse (see Fig. 2, *2*).

The upper filling of the mine (see Fig. 3, *3*) consisted of an organo-mineral soil horizon formed in the depression after abandoning the site. Underneath was located a loose, reddish brown layer with large-sized rubble of serpentinite and fragments of copper-magnetite ores—dumped waste that "slipped" into the mine from the adjacent area. The main filling of the shaft, starting from a level of –350 cm to the bottom, was yellow, sandy loam with serpentinite rubble, which included dark, humic interlayers arranged en echelon. Large rock fragments (15–20 cm in size)

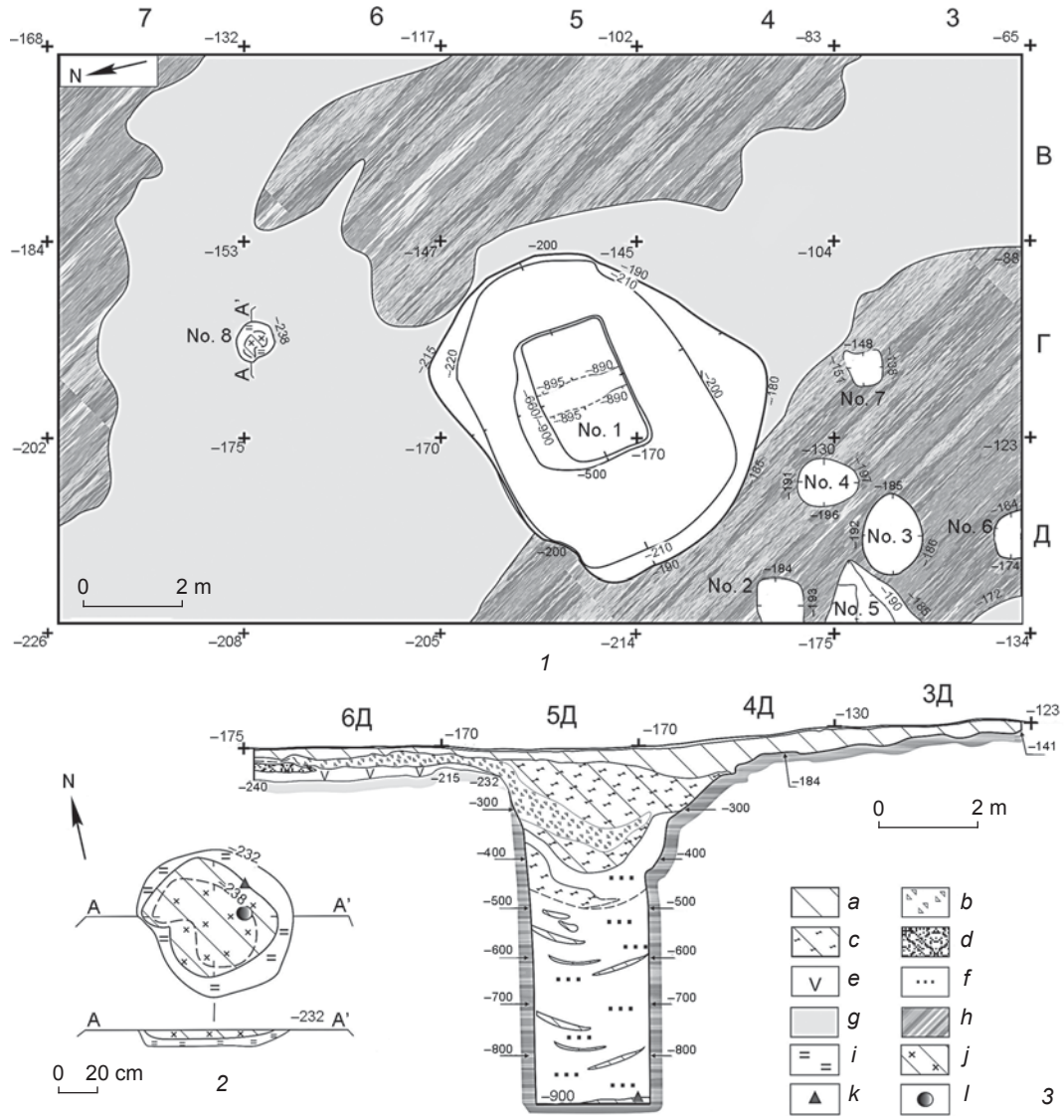

Fig. 3. Mining and metallurgical objects of excavation A: No. 1 – mine; No. 2–7 – pits; No. 8 – metallurgical furnace. *1* – general plan of the excavation at the level of the virgin soil; *2* – plan and cross-section of the metallurgical furnace; *3* – eastern profile of mine No. 1.

a – dark gray, humic sandy loam; *b* – brown, humic sandy loam with large (up to 26 cm; on average 5–10 cm) serpentinite rubble; *c* – gray, humic sandy loam with small (3–5 cm) serpentinite rubble; *d* – light gray, small (2–4 cm) serpentinite ruble; *e* – buried soil; *f* – yellow sandy loam with small (1–3 cm) serpentinite rubble and isolated, large rock fragments; *g* – virgin soil of yellow sand with rubble; *h* – virgin soil of light gray bedrock outcrops of serpentinite; *i* – reddish calcined sandy loam; *j* – dark gray ashy soil with charcoal, small fragments of animal bones, ceramics, and slag; *k* – location of pottery fragments; *l* – location of large pieces of metallurgical slag.

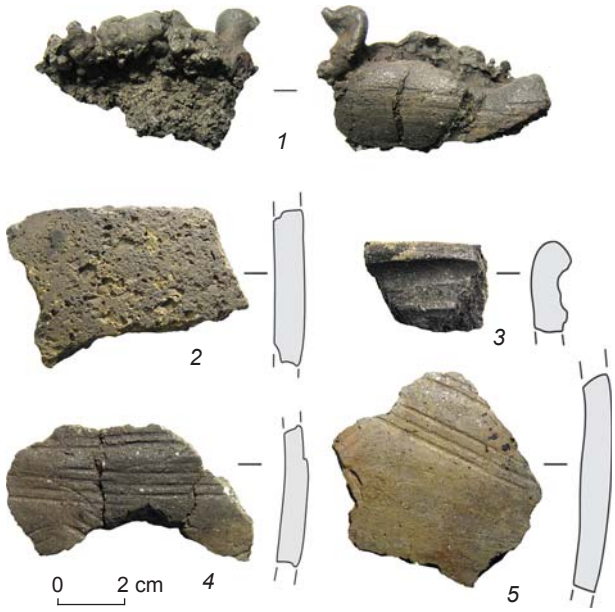

Fig. 4. Metallurgical slag (*1*) and pottery fragments of the Bronze Age (*2–5*).

occasionally occurred in the layer. This filling resulted from collapsed walls in the upper layers of the mine at the level of the weathering crust. Fragments of wood and cattle bones, as well as two stone tools (a pick-hoe made of sandstone and counterweight of serpentinite), were found in its bottom part. Pottery fragments of the Alakul culture of the Bronze Age (Fig. 4, *4*, *5*) were discovered in the southeastern part of the mine bottom.

There were also some shafts of different morphology. Six pits of various shapes with diameter reaching 1.5 m and depth up to 1 m, made in serpentinite and filled with humic, sandy loam with rubble, were found in the immediate vicinity of mine No. 1. These pits remained after mining thin ore veinlets. A shaft of yet another type (conventionally called a "winding manhole") was found while unearthing a dump on the southern slope of the quarry. Based on the results of the GPR survey, it is possible to assume the presence of similar mines corresponding to the shape of the ore body, in the northern part of the quarry (Ibid.).

Smelting metals from ores. A unique find for the Bronze Age of the Southern Trans-Urals was a metallurgical furnace located directly at the deposit. It was located 4 m north of the northwestern corner of the mine No. 1, in the buried soil, partially cutting through the virgin soil. The furnace looked like a bowl-shaped depression reaching 0.2 m in depth, with a flattened bottom. At the level of the virgin soil, the diameter of the furnace was 0.6 m. The object had black, ashy filling surrounded by a red-colored, calcined rim and contained pottery fragments, small burnt animal bones, metallurgical slag, and pieces of oxidized copper ore.

Pottery fragments (21 pieces) were most likely parts of a single undecorated vessel. Its outer and inner sides were carefully smoothened; their thickness was up to 1 cm; their color was light brown. The clay compound contained abundant admixture of shells burnt on the outer surfaces from the impact of high temperatures (Fig. 4, *2*).

Metallurgical slag amounted to 249 specimens with a total weight of 264 g. It was able to reconstruct slag of flattened shape with protruding edges from several large fragments (Fig. 4, *1*). The inner surface (adjacent to the metal) was bumpy; the outer surface was relatively smooth, with grass imprints. By using optical and electron microscopy, it was established that the metallurgical slag of the ancient mine belonged to the Cr-rich spinel of olivine type, similar to the Sintashta settlements (Grigoriev, 2013: 123; Ankushev et al., 2021). Such slag emerges during processing of oxidized copper ores confined to ultrabasites, which is confirmed by the presence of serpentinite and Cr-rich spinels remains. The slag from the Novotemirsky mine contains neogenic sulfides, which has also been observed at the Abashevo settlements (Grigoriev, 2013: 270), indicating the use of mixed oxide-sulfide ores by ancient metallurgists.

Metalworking. A stone mold for casting a mining tool was found 2.9 m southeast of mine No. 1, in the field of waste dump. It consisted of two parts—the matrix and cover (Fig. 5), both made of

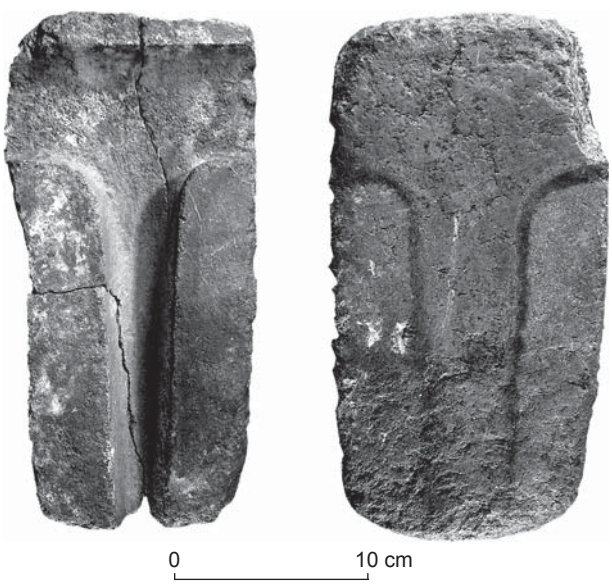

Fig. 5. Chloritolite bivalve casting mold of a pickaxe.

chloritolite. The matrix had a rectangular shape and measured 22.9 × 11.3 × 6.0 cm. A T-shaped negative of a pickaxe, consisting of a "beak" (15.5 × 2.0 to 4.0 × 2.0 cm in size) and plate for forming an open socket (11.3 × 5.0 to 1.0 × 2.0 cm in size) was carved in the matrix. Traces of high-temperature impact in the form of black calcined edging, penetrating to a depth of 0.3–0.5 cm were found along the edges of the negative recess. The size of the cover was 23.3 × 12.0 × 5.6 cm. Traces of use were also visible in the area adjacent to the negative recess in the form of a black outline with a reddish, calcined filling (0.5–1.0 cm thick) from the product blank. The adjoining surfaces of the mold parts were carefully polished; the outer surfaces were given a correct shape using the pecking technique.

Thus, all stages of metal production, including mining (shafts of various morphologies and waste dumps), smelting of metals from ores (metallurgical furnace with slags and technological ceramics), and metalworking (parts of a casting mold with traces of use) were found at the Novotemirsky mine.

Chronology of the structures

Discovery of evidence manifesting all stages of metal production at the mine leads to the problem of its exact dating and correlating with stages and cultural entities of the Bronze Age. Various carbon-containing samples, such as animal bones from the filling of the mine and dumps around it, as well as charcoal from the furnace, were taken for radiocarbon analysis (see *Table*).

We can confidently speak about mining and metallurgical processes at the Novotemirsky mine since the turn of the third–second millennium BC and during the first half of the second millennium BC. The metallurgical furnace with artifacts found in it was the earliest object of the site (21st–20th centuries BC). Preliminarily, it can be attributed to the Sintashta or Abashevo culture, based on similar morphological and mineralogical-geochemical features of slag from the settlements of these cultures (Grigoriev, 2013: 270; Ankushev et al., 2021), and based on the composition of clay compound in ceramics with artificial addition of shells, which was mostly typical of the early stages of the Late Bronze Age in the region (Dubovtseva, Kiseleva, Panteleeva, 2016: 107), as well as location of the mine in the immediate area of the Sintashta fortified settlements.

Mine No. 1 was built later, in the 17th–16th centuries BC. Fragments of the Alakul pottery that

Results of radiocarbon dating of samples from the cultural layer of the Novotemirsky mine

Lab code	Place of sampling	Material	^{14}C age, years BP (1σ)	Calibrated age interval, years BC, probability		C/N_{atm}	$\delta^{15}N$, ‰	$\delta^{13}C$, ‰
				1σ	2σ			
IGAN-7436	Furnace, grid 6Г, depth –234	Charcoal	3610 ± 20	[2016…1996] 0.29 [1980…1939] 0.71	[2028…1911] 1.00	–	–	–
IGAN-7437	Mine No. 1, depth –900	Animal bone, large cattle	3335 ± 20	[1661…1611] 0.94 [1571…1566] 0.06	[1685…1601] 0.80 [1585…1543] 0.19 [1539…1535] 0.01	3.05	5.07	–19.45
IGAN-7042	Dump in grid 6Д, depth –221	Animal bone, small cattle	3240 ± 25	[1594…1589] 0.05 [1531…1494] 0.68 [1479…1456] 0.27	[1608…1581] 0.12 [1562…1443] 0.88	2.83	5.96	–19.90
IGAN-7043	Same	Same	3300 ± 25	[1614…1599] 0.22 [1586…1534] 0.78	[1630…1509] 1.00	2.80	5.40	–19.78
IGAN-7438	Dump in grid 7Г (upper layers), depth –188	Animal tooth, large cattle	3095 ± 20	[1409…1382] 0.44 [1342… 1307] 0.56	[1419…1367] 0.43 [1365…1296] 0.57	3.22	6.37	–20.09

were found at the bottom indicate its cultural identity. The cultural layer of that period, where animal bones of the same time were found in intermediate buried soil between two layers of dumps, was determined to be north of the mine. The casting mold of the pickaxe, whose age was established from the stratigraphic position and similarity to a typologically similar object from the Gorny I settlement in the Kargaly mining and metallurgical center (Kargaly, 2004: 135, fig. 5.1) could probably have belonged to the same period.

The last stage in the development of the deposit in the Bronze Age might have coincided with the final stage of that period: the 15th–13th centuries BC. This date was obtained from a tooth in a crushed animal jaw, which was found in the northern dump. However, owing to the lack of metallurgical objects with dating evidence from the final stage of the Bronze Age, it is premature to speak about ore mining in that period.

In total, the set of artifacts indicates that people have visited the deposit since the 21st century BC to the present day. Currently, there is no industrial activity at the mine. However, according to the local residents, the lake that was formed in the center of the quarry still attracts shepherds as a watering place for livestock, which explains the presence of the cultural layer of the Modern Age and Contemporary Period.

Discussion

The current appearance of the Novotemirsky mine as a quarry surrounded by a ring of collapsed waste dumps significantly differs from its true structure—a system of mining shafts of various depths, shapes, sizes, and the strata of waste dumps of different periods hiding it. In this regard, one should question the hypothesis of an exclusively open-pit method of ore mining in the Ural-Mugodzhary region in the Bronze Age (Zaykov et al., 2013). Shafts and mines, which differed in shape even within the boundaries of the Novotemirsky deposit, were constructed along with quarries. The mine discovered there was the first thoroughly investigated object of the Alakul culture, which has made it possible to clarify the shape and depth of possible shafts, and raise the question of mining systems.

The discovered copper-smelting furnace dating to the turn of the third–second millennium BC gives grounds to assert that metallurgical processes at the mines of the Southern Trans-Urals during this period were not limited only to extraction and primary concentration of copper ore. It has been proven for the first time that a part of the metal was smelted directly at the deposit. Cr-rich spinel containing olivine slag from the furnace were similar to those found at the fortified settlements of the Sintashta culture, such as Ustye I, Kamenny Ambar, Levoberezhnoye, Sarym-Sakly, and Arkaim (Grigoriev, 2013: 123, 125, 129; Ankushev et al., 2021), which suggests that metallurgical procedures for smelting metals from ores were identical at deposits and in settlements.

The next stage of site functioning was associated with the Alakul period, represented by mine No. 1, adjoining dumps, and probably the casting mold of the pickaxe. The discovery of evidence of ore mining by the carriers of the Alakul culture in the Southern Trans-Urals is extremely important. It confirms the continued use of local copper raw materials in this region during the first half of the second millennium BC, despite almost complete absence of evidence for metal smelting from copper ores in unfortified settlements (Grigoriev, 2013: 438–439; Alaeva, 2014). Moreover, the Novotemirsky mine is an excellent example of using the same deposits in the Alakul period (ca 1900–1500 BC), which followed the Sintashta period (ca 2100–2000 BC). In this regard, the site is comparable with such multicultural sites as the Vorovskaya Yama (Zaykov et al., 2005) and Ishkinino mines (Tkachev, 2019).

The established fact of ore mining both in the Sintashta and Alakul periods makes it possible to speak about functioning of a locality focused on metallurgy as part of the Trans-Urals mining and metallurgical center throughout the entire Late Bronze Age. Accordingly, the sharp decrease in the volume of slag at the unfortified Alakul settlements as compared to the fortified Sintashta settlements cannot be explained by complete cessation of the use of local ore resources and procurement of metal from regions richer in ore deposits. A certain volume of metal smelting operations was carried out directly at the deposits. It is likely that it was limited to the miners' needs for metal tools.

Nevertheless, with the continued use of local ore sources, it is preferable to speak about an increase in specialization of metal production from the Sintashta culture in the turn of the third–second millennium BC to the Alakul culture of the first half of the second millennium BC. If in the Sintashta period the full cycle of metal production was carried out at each of the fortified settlements, in the Alakul period one may assume transferring a part of metallurgical operations (primarily smelting of metals from ores)

to the settlements located in the immediate vicinity of the deposits. A similar model of organizing metal production is demonstrated by other regions where the Alakul culture was distributed, in particular, its Mugodzhary local version. The Elenovka-Ushkatty, Ishkinino, and Shanshar archaeological microdistricts are the reference areas associated with copper deposits (Tkachev, 2011).

No such complexes have yet been found in the Southern Trans-Urals, which makes micro-regional studies of the areas surrounding the preserved ancient mines all the more important. Nine unfortified settlements of the Bronze Age have been surveyed at a distance of up to 10 km from the Vorovskaya Yama deposit in the valley of the Zingeika River, and metallurgical slags have been found in the test pits in half of them (Ankushev et al., 2016). It is possible that settlements of miner-metallurgists of not only the Sintashta period, but also of the Alakul period will be discovered in that area in the future.

Conclusions

To this day, the Novotemirsky site is the most ancient copper mine in the Southern Trans-Urals. Its study has revealed that the shaft mining method was widely used along with open-pit (quarry) method of ore mining. The development of this deposit throughout the entire second millennium BC by the carriers of different cultures indicates the use of the same ore sources in the Southern Trans-Urals in the Bronze Age. However, obvious changes in the technological components in the communities following the Sintashta may be associated with sophistication and specialization of metallurgy. Further research of mining sites in the Southern Trans-Urals and the associated microdistricts would contribute to better understanding of metallurgical technologies specific for each period, as well as social organization of this sector of the economy.

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On a Distinctive Feature of the Andronovo (Fedorovka) Funerary Rites in the Baraba Forest-Steppe

This article summarizes the findings relating to a spatially localized group of graves at the Andronovo (Fedorovka) cemetery Tartas-1 in the Baraba forest-steppe. Several rows of graves combine with ash pits suggestive of ritual activity. In the infill of graves, there were ash lenses with mammal and fish bones, and potsherds with traces showing the signs of applied heat. Ash had been taken from nearby ash pits with similar infill and artifacts. Faunal remains from graves and ash pits (limb bones of cattle, sheep/goat, and horse) indicate sacrificial offerings. In the ash layer of grave No. 282, there was an incomplete human burial, also believed to be a sacrifice. Features such as the orientation of the graves, their alignment, the position of human remains, and the grave goods in that area are similar to the Andronovo (Fedorovka) burial practice and do not differ from those in other parts of the cemetery. No complete parallels to this rite have been revealed. Some similarities, such as the use of ash, and the presence of animal bones, sacrificial pits, etc. at other sites are listed. A reconstruction of the funerary sequence and possible interpretations are considered. It is concluded that those graves were left by a group of Andronovo migrants who maintained close ties with the native population. Unusual features of the burial rite, therefore, can reflect an attempt to consolidate the immigrant groups on the basis of traditional ritual practices, where the major role was played by fire and its symbols.

Keywords: *Baraba forest-steppe, Andronovo (Fedorovka) culture, burial and funerary practice, ash layer, sacrifice.*

Introduction

At present, a significant number of burial complexes of the Andronovo (Fedorovka) culture have been discovered and investigated on the forest-steppe territory located on the right bank of the Irtysh River. These include a series of burial grounds in the central part of the Baraba forest-steppe (see (Molodin, 1985)), monographically investigated burial complexes in the western part: Stary Tartas-4 (Molodin, Novikov, Zhemerikin, 2002), Stary Sad (Molodin et al., 2016), Sopka-2/5 (Molodin, Grishin, 2019), as well as the most grandiose necropolis under study—Tartas-1 (Fig. 1). The materials obtained in the course of the study of these objects significantly enrich our conceptions about the funerary practice of the Andronovo (Fedorovka) people.

Evidence of burial rituals using fire was found during excavations of many Andronovo cemeteries throughout the territory where this culture was spread. Alakul sites are characterized by altars—pits with vessels, ash, and animal bones, which were made over burials under a mound (see, e.g., (Usmanova, 2005: 130; Sotnikova, 2014: 268; Stefanov, Korochkova, 2006: 77)); backfilling/covering of the dead with the remains

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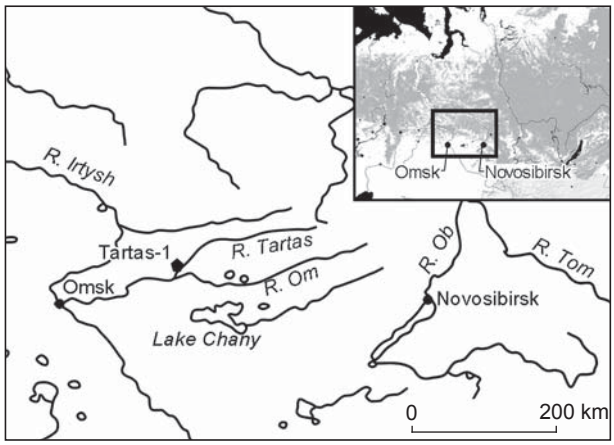


Fig. 1. Location of the Tartas-1 site.

of a funeral pyre; and traces of fire in the infill of the burial chamber (Khabarova, 1994: 10) and the burning of the burial chamber (*domovina*) (Matveev, 1997). In the Fedorovka burial grounds, there occur traces of the cremation rite, of the lighting of fires in the upper part (burnt ceiling) or at the bottom of the burial chamber, and also (but less often) the remains of funeral feasts in the form of burnt animal bones under the mound (Khabarova, 1994: 17). According to E.E. Kuzmina, these are all the manifestations of the same cult of fire, though they are completely different ritual actions performed at different times and on different occasions (1986: 88).

Studies at the Tartas-1 cemetery, located in the Baraba forest-steppe (Vengerovsky District of the Novosibirsk Region), made it possible to identify another variation for the ritual use of fire in the funerary practice of the Andronovo (Fedorovka) culture—flat graves were covered with a layer of ash containing burnt animal bones and ceramic fragments. The purpose of this work is to conduct a comprehensive analysis of this group of graves, to identify the features of ritual manifestations, and to attempt to interpret them.

Characteristics of the complex objects

At present, approximately 800 graves at Tartas-1 are investigated, more than 50 % of which belong to the Andronovo (Fedorovka) culture. The research methodology for this complex presupposes the continuous opening of sediments over the entire area of the site, taking into account the data of geophysical monitoring, while all of the excavation is done only by hand (Molodin et al., 2003). This approach makes it possible to accurately determine the boundaries of the site, and to carry out an in-depth analysis of spatial distribution of the graves and the grave goods, as well as to determine their chronological affiliation, and to reveal the specifics of ritual activity. Earlier, the authors noted that materials from different parts of the cemetery could reflect different periods of the appearance in the Baraba forest-steppe of the Andronovo (Fedorovka) people and related populations, as well as the stages of their interaction with the indigenous population—the Late Krotovo (Cherno-Ozerye) people (see, e.g., (Molodin, 2011; Molodin, Durakov, Kobeleva, 2018)).

Graves with an ash filling are compactly localized in the southwestern part of the necropolis (Fig. 2). Unfortunately, this part of the site has undergone significant destruction: there was a quarry and a dirt road here. Thus, it is not possible to establish the number of such graves that were in this place initially. Indisputable traces of rituals using ash, burnt bones, and potsherds were recorded in 23 graves (Tables 1, 2). The graves form several rows, aligned along the N-S line, with insignificant deviations. In some graves, no traces of ash were found in the infill. This can be explained by the destruction of the upper part of the cultural layer (No. 188–190, 240): the difference in benchmarks at the level of fixation of spots and at the bottom of the selected quarry is up to 1 m. The presence of ash in the graves under consideration is possibly a differentiating feature. For example, the absence of such a filling in shallow children's burials (No. 184, 186, 191, 232, 236, 327, 308, 309, 417, 415) can be considered a feature of the funerary rite.

The sub-rectangular grave pits are of the same size. They differ from other Andronovo (Fedorovka) graves of the cemetery only in their specific infill. In the lower part, there is a layer of grayish-yellow sandy loam, in the middle (main) part, dark-gray dense sandy loam. In the upper part, a cup-shaped lens of ashy sandy loam is registered, the thickness of which in different burials ranges from 0.05 to 0.4 m (Fig. 3). An oval lens occupies the central part of the grave pit. The color of this layer varies from light gray to ashy-orange. In some spots, stratification is observed. In the lower part of the lens, insignificant brown areas can be seen. The specificity of this flat-grave burial ground lies in the fact that the upper layer is plowed up almost to the level of virgin soil; therefore, the contours of the graves are most often recorded in the form of dark gray spots while cleaning the yellow native loam. However, in researching this section of the necropolis, it was possible to trace the ashy layer 0.1–0.2 m higher than the level of the ancient buried soil (graves No. 287, 288, 310) (Fig. 3, *3*). Grave No. 311 was located in two trenches; therefore, its cross-section was laid from the level of the modern daylight surface. This section clearly shows that the sandy loam layer rises above the level of the buried soil in the form of a small compact mound (Fig. 3, *4*). In the section of grave No. 312, several interlayers of calcined and gray-ashy sandy loam were noted (Fig. 3, *5*). The lens, judging

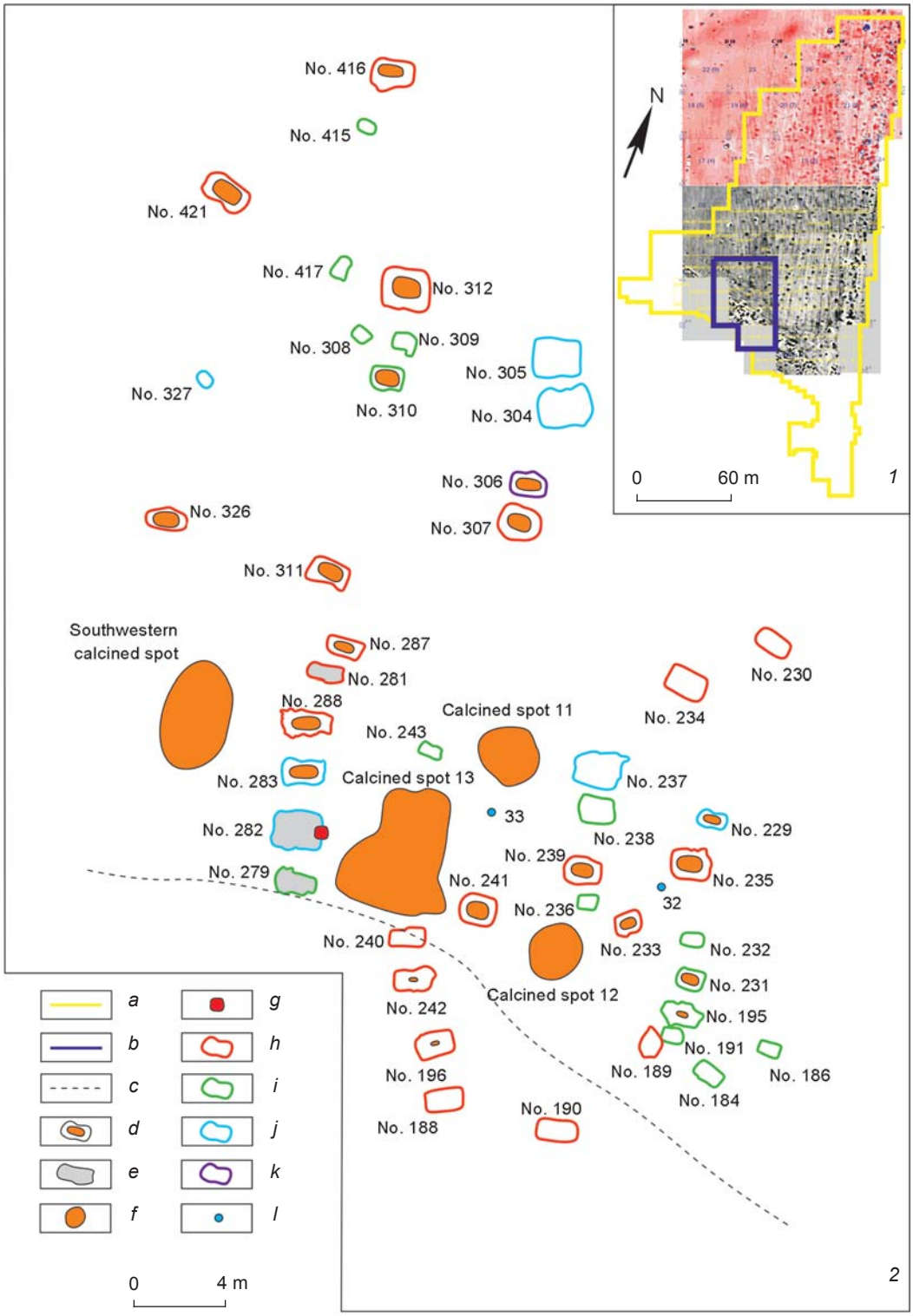


Fig. 2. Magnetogram of the Tartas-1 site (*1*), and the scheme of graves with ash filling on it (*2*).
a – boundary of the investigated area of the burial ground; *b* – boundary of the analyzed area; *c* – conditional boundary of the quarry; *d* – grave with ash filling; *e* – grave with ash content in the infill; *f* – calcined spot; *g* – partial burial in the upper part of the grave pit; *h* – burial according to the rite of inhumation (adult); *i* – burial according to the rite of inhumation (child); *j* – burial according to the rite of cremation; *k* – biritual burial; *l* – an object of a ritual nature (a cluster of talus bones (32) and a horse bone (33)).

Table 1. **Graves with ash filling at Tartas-1**

Grave No.	Dimensions of grave pit, m	Features of the burial rite	Grave goods
195	1.75 × 1.1 × 0.54	Child in a flexed position on the left side	Vessel, cow's talus bone, bronze earring
196	1.6 × 1.12 × 0.5	Adult in a flexed position on the left side	Vessel
229	1.3 × 0.8 × 0.4	Cremation (2 persons?)	"
231	1.2 × 0.9 × 0.7	Two children in a flexed position on the left side	Vessel, two talus bones of a sheep
233	1.15 × 0.9 × 0.5	Adult, secondary burial	Ditto, bone spoon, bone distributor
235	1.8 × 0.95 × 0.59	Adult, secondary burial (only skull)	Vessel, dish made of horn
239	1.7 × 0.9 × 0.6	Adult in a flexed position on the right side	Vessel
241	1.65 × 1.35 × 0.78	Adult in a flexed position on the left side	Vessel, two bronze temple rings
242	1.65 × 1.06 × 0.65	"	Vessel, two silver rings
279	0.9 × 0.45 × 0.53	Child in a flexed position on the right side	Vessel
281	1.58 × 0.7 × 0.25	Adult in a flexed position on the left side	Vessel, animal's tooth
282	2.22 × 1.66 × 1.0	Cremation	Vessel
283	1.96 × 1.0 × 0.54	"	Sheep's lower jaw (?)
287	1.62 × 0.77 × 0.43	Adult in a flexed position on the left side	Four talus bones, a long bone item
288	2.1 × 1.06 × 0.69	"	Vessel, horn spoon, animal's tooth
306	1.47 × 0.97 × 0.82	Cremation and a child in a flexed position on the left side	Vessel
307	1.94 × 1.45 × 1.03	Adult in a flexed position on the left side	Vessel, bones of a large bird (?)
310	1.47 × 0.99 × 0.63	Child in a flexed position on the left side	Vessel
311	1.74 × 1.1 × 0.44	Adult in a flexed position on the left side	"
312	2.07 × 1.79 × 1.22	"	Vessel, accumulation of fish scale, bronze awl, two flared bronze earrings, bronze bead, five talus bones, two bronze earrings, fragments of a complex bronze decoration, bronze plaques, bracelets made of bronze beads
326	1.8 × 0.88 × 0.59	Adult, secondary burial (some bones are in articulation)	Vessel, fragment of a casting mold
416	1.9 × 1.5 × 0.7	Two persons: adult in a flexed position on the left side; adult, secondary burial, clearly localized accumulation of bones	Two vessels, bronze needle, bronze bracelets made of beads, temple ring, fish bones and complete skeletons
421	2.12 × 1.25 × 0.65	Secondary burial (several bones)	–

Table 2. **Finds from the objects with ash filling at Tartas-1**

Place of discovery	Potsherds	Number of animal's bones/incl. identifiable, spec.	Fish scale and/or bones	Other finds
Grave No.:				
195	1	13/1	–	–
196	+	–	+	–
229	–	2/1	–	–
231	–	1/1	–	–
233	–	30/1	–	–
235	3	80/25	–	–
239	7	31/4	–	–
241	27	207/22	+	–
242	1	6/1	+	–
282	–	–	+	–
283	–	21/3	+	–
287	+	17/2	–	–
288	–	30/1	+	–
306	+	25/9	–	–
307	+	162/24	–	–
310	+	44/3	–	–
311	+	93/6	–	–
312	+	1/1	+	–
326	+	350/15	–	–
416	–	–	–	Bone point, bronze plaque
421	+	–	–	–
Calcined spot:				
11	26	56/13	–	–
12	56	156/26	–	–
13	50	477/46	–	–
Southwestern part	–	245/27	–	–

by its clear lower boundary, was formed after filling the main volume of the grave pit, and not as a result of soil subsidence. An ash pit was specially built in the central part of the burial chamber.

In 21 objects (91 %), in a layer of ashy sandy loam, in pits dug in the upper part of the filling of the burial chambers, animal bones with charring, fish bones and scales, and potsherds were recorded, some with traces of secondary firing (Table 2). In grave No. 416, in this layer, a bone point and a bronze plaque were found. The bones and scales of fish occur in the infill of seven burials (30.4 %). In two graves, it was possible to identify the scales and pharyngeal bones of a crucian carp (Molodin et al., 2015: 78). Potsherds were found in the ash filling of 10 graves (43.4 %).

The bones of animals are presented in the form of chopped and chipped fragments of various sizes. Their number ranges from 1 to 350 units. The color of the bones ranges from light brown to black. There are isolated light gray and white fragments relating to the initial stages of the calcination process (Cain, 2005: 875). The surface of the bones is smooth; the traces of cracking are wavy. These characteristics suggest the short-term presence of bones in a fire of a temperature of no more than 300 °C (Shipman, Foster, Schoeninger, 1984), which corresponds to the conditions of an open fire.

The specific identification of bones is difficult owing to their fragmentation. Most of the collection consists of fragments of diaphysis, fragments of tubular bones, metapodia, phalanges, and a lesser part consists

Fig. 3. Features of infill of the graves with ash backfill at Tartas-1.
1 – No. 306; *2* – No. 310; *3* – No. 287; *4* – No. 311; *5* – No. 312.

of teeth, ribs, vertebrae, and talus bones. On average, approximately 8–10 % of bone fragments can be identified as species* (Table 3). Fragments of cow bones (118 spec.) make up 55.8 %, while those of sheep/goats (33 spec.) comprise 27.5 %. The bones of horse, elk, roe deer, bear, fox, and birds are rare. Among the bovine remains, various limb bones prevail (80 %). There are fragments of jaws, teeth, ribs, and pelvis, as well as one lumbar vertebra. The sheep/goat bone fragments are represented mainly by the limb bones (78.5 %). There are few fragments of jaw and teeth, and two vertebrae (thoracic and lumbar). Wild animals are represented by phalanges, astragals, and heel bones. Most of the bones of birds are fragments of the diaphysis of long bones. The osteological spectrum definitely reflects the character of herd of the Andronovo (Fedorovka) population, which was dominated by cattle. The discovered fragments of bones, judging by their morphology, may be evidence of a funeral feast or some other special actions associated with burial practices.

The burial rite, which is represented by the graves of the analyzed area, is typical of the Andronovo (Fedorovka) part of the Tartas-1 necropolis: the graves correspond to the rites of inhumation, more rarely of cremation (see Table 2). The deceased was usually buried in a flexed position on the left side, with his head predominantly in the direction of NE, with slight deviations. The burials are mostly individual, with the

*Osteological identifications are carried out by S.K. Vasiliev.

Table 3. **Species composition of osteological remains from the objects with ash filling at Tartas-1, spec.**

Place of discovery	Cow	Sheep/ goat	Horse	Elk	Roe deer	Bear	Fox	Bird
Grave No.:								
195	1	–	–	–	–	–	–	–
229	1	–	–	–	–	–	–	–
231	–	1	–	–	–	–	–	–
233	1	–	–	–	–	–	–	–
235	20	4	–	–	–	–	–	1
239	2	2	–	–	–	–	–	–
241	12	8	–	1	–	–	–	1
242	1	–	–	–	–	–	–	–
283	1	–	–	–	–	–	2	–
287	–	2	–	–	–	–	–	–
288	1	–	–	–	–	–	–	–
306	6	3	–	–	–	–	–	–
307	9	7	3	2	–	–	–	3
310	2	1	–	–	–	–	–	–
311	5	1	–	–	–	–	–	–
312	1	–	–	–	–	–	–	–
326	4	4	1	1	2	2	–	1
Calcined spot:								
11	12	–	1	–	–	–	–	–
12	13	1	12	–	–	–	–	–
13	20	8	16	–	–	1	–	1
Southwestern part	6	–	11	–	–	–	–	–

exception of graves No. 231 (two children), No. 306 (biritual)*, and No. 416 (inhumation on the left side in combination with a secondary burial). Noteworthy are also graves No. 233, 326, and 421, which are secondary, without traces of penetration. The grave goods include ceramic vessels, bronze ornaments and awls, the astragals of cow and sheep/goat, and horn products (a spoon and a dish). Burial dishwear found in this part of the burial ground (Fig. 4) are generally typical of the Andronovo (Fedorovka) ceramics of the region (see, e.g., (Molodin, Mylnikova, Ivanova, 2014)).

It is necessary to focus on the characteristics of grave No. 282, the materials of which were partially introduced into scientific use (Molodin et al., 2008: 205). Above its northeastern wall, at the level of the buried soil, an oval spot of gray ash was revealed in which the lower part of a human skeleton was located, including several lumbar vertebrae, sacrum, bones of pelvis and lower extremities in articulation and in the correct anatomical position (Fig. 5, *1*), which implies the preservation of soft tissues at the time of burial. Partial burial (the remains were laid in a flexed position on the left side), oriented along the NE-SW line, in accordance with the canons of the classical burial practice of the Andronovo (Fedorovka) people. Grave goods are absent. The main grave pit measuring 2.22 × 1.66 m was located at the level of virgin soil. It had a regular subrectangular shape and a depth of 1 m from the roof. At the bottom of the grave pit, in the center, traces of cremation were found—a dense oval accumulation of fragments of calcified bones, aligned along the NE-SW line (Fig. 5, *2*). At the northeastern wall of the chamber, there was an Andronovo (Fedorovka) vessel (Fig. 5, *3*). The location of the upper burial in a layer of ash filling, its partial character, the absence of a pit and grave goods testify to its sacrificial and accessory qualities.

*The term "biritual burial" means a combination of inhumation and cremation in one grave pit.

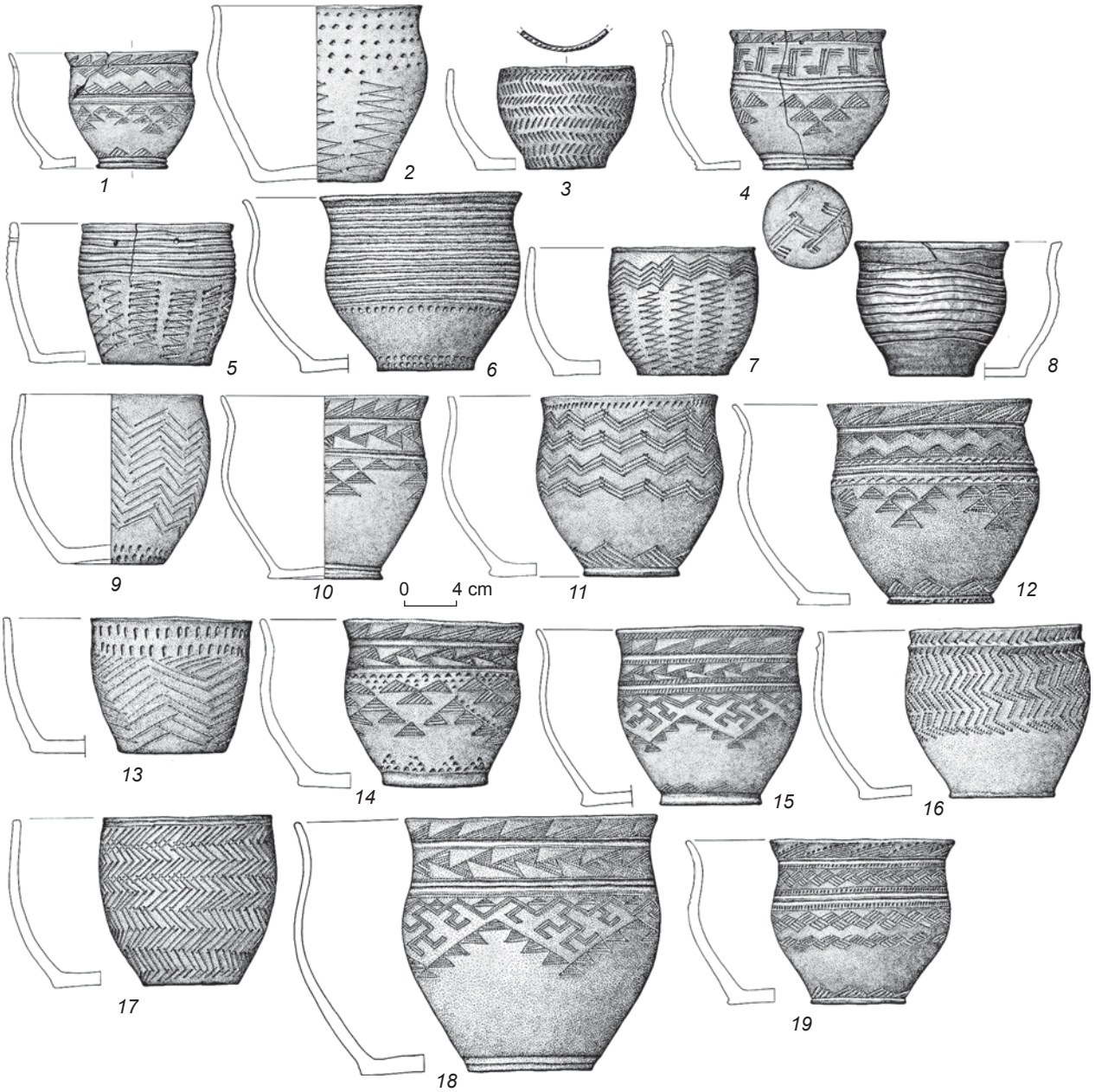


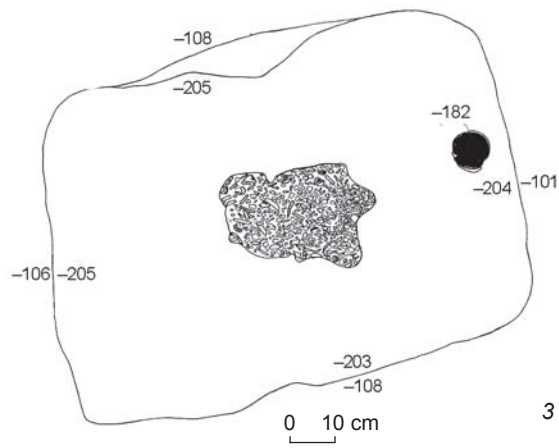
Fig. 4. Ceramic vessels from graves with ash filling at Tartas-1.
1 – No. 195; *2* – No. 196; *3* – No. 229; *4* – No. 231; *5* – No. 233; *6* – No. 235; *7* – No. 239; *8* – No. 288; *9* – No. 241; *10* – No. 242; *11* – No. 281; *12* – No. 282; *13* – No. 306; *14* – No. 307; *15* – No. 310; *16, 19* – No. 416; *17* – No. 311; *18* – No. 312.

Between two rows of graves, several zones of calcined soil with a high content of ash and burnt bones were recorded (see Fig. 2). The spots of burnt soil are located in the bed of the dug up quarry, so it is impossible to establish the exact boundaries of the site where the fire was made in ancient times.

Calcined spot 11 is an amorphous spot 2.75 × 2.6 m in size, composed of dark gray, ashy sandy loam with brown and black interlayers, up to 0.1 m thick. Calcined spot 12 is recorded as a rounded spot 2.1 × 1.95 m made from gray, ashy sandy loam, up to 0.1 m thick. Calcined spot 13 occupies the largest area. It is an amorphous spot 5.5 × 5.0 m in size, up to 0.15 m thick, made of light gray, gray, and brown ashy sandy loam. This layer was uneven, filling small depressions in the underlying layer marking the level of the ancient buried soil. An infill of a similar composition was recorded southwest of the last row of Andronovo (Fedorovka) graves No. 279, 282, 283, 288, 281, 287, 311 in this part of the necropolis.

Fragments of ceramics (more than 130 spec.) and fragments of burnt bones (more than 900 spec.) were found in the infill of all objects. The ceramic complex

Fig. 5. Grave No. 282 at Tartas-1.
1, *2* – upper layer; *3* – lower layer.



consists of fragments of jar vessels with an Andronovo (Fedorovka) appearance, some with traces of secondary firing (Fig. 6). The collection of osteological finds is similar in size and color to the remains from the ash lenses of the burials described above. Only 10 % of the fragments are subject to species identification (see Table 3). Almost half of the collection (45.6 %) is cow bones, while horse bones comprise 43.4 %, and sheep/goat bones make up 10 %. The comparison revealed an almost complete coincidence of the species composition of bones from calcined spots and burials, with the exception of the ratio of sheep/goat and horse bones. However, it should be kept in mind that twelve bones of a horse from the calcined spot 12 belong to one individual and represent fragments of the lower jaw that had fallen apart under the influence of fire. It is curious that in the infill of the rest of the calcined spots there are fragments of the horse's lower jaw. As for cow and sheep goat bones, 80 % of the identifiable fragments are from the lower extremities.

Thus, the identical composition of the infill of the calcined spots and ash lenses in the burials suggests that it was these objects that were the source of material for filling the grave pits; here the food was burned, mainly pieces of meat from domestic animals. It is not entirely clear what caused the presence of fragmented Andronovo (Fedorovka) household pottery in these objects. In combination with meat leftovers, it was probably associated with food consumption; a piece of pottery served as a symbol of a whole vessel in which food was prepared and served.

At the investigated site of the burial ground, two objects of a ritual nature were discovered. Object 32, located between graves No. 232, 233, and 235, was an accumulation of no less than 30 poorly preserved sheep/goat astragals, two of which had holes. Among the astragals, there was a cow's incisor tooth. It needs to be reminded that astragals, including the ones with holes, are typical for the burials of the Andronovo (Fedorovka) culture. They are also presented at Tartas-1. Object 33, located between the calcined segments near grave No. 241, is a fragment of a horse's tibia, set vertically into the ground.

Interpretation of the burial and funerary rite

The nature of the infill of the grave pits with ash lenses suggests that these are the traces of a post-burial ritual associated with fire and sacrifices. In our opinion, the actions took place here in the following sequence. After the completion of the burial ceremony, which took

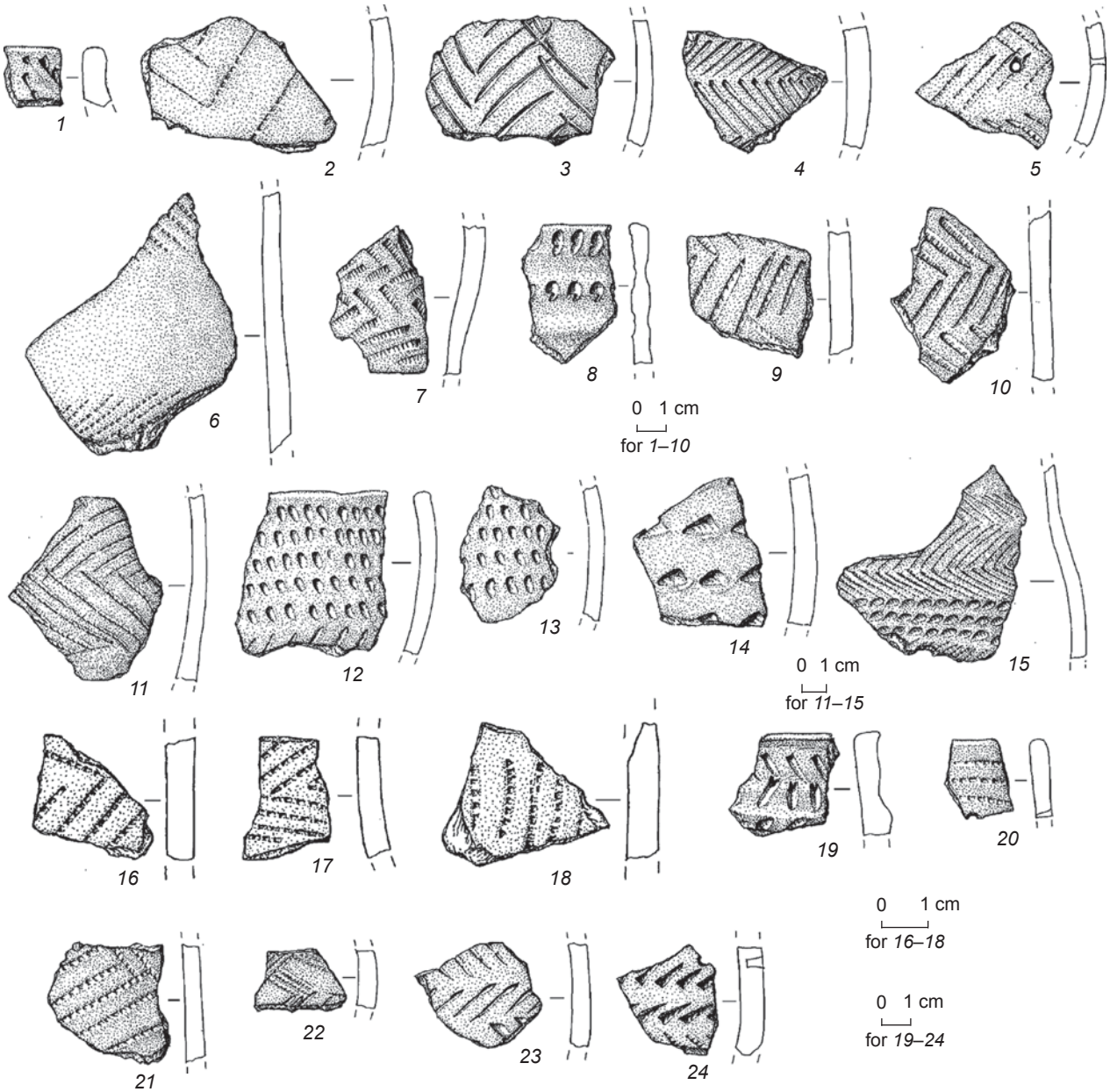


Fig. 6. Potsherds from graves in the ash filling of the Tartas-1 burial ground.
1 – No. 195; *2–4* – No. 235; *5–10* – No. 241; *11* – No. 196; *12–15* – No. 310; *16* – No. 287; *17* – No. 311; *18* – No. 312; *19–24* – No. 326.

place in accordance with the funerary tradition of the Andronovo (Fedorovka) culture, the grave pit was filled up to the level of the daylight surface. After some time, an oval depression was made in it, into which ash with bones and potsherds was poured. The absence of calcination in the bottom layer of the ash lens is a sign that the fire was not built directly in the prepared pit. However, the brown color indicates a high temperature of the ash being filled in. Its source was probably one of the ash pits located between the rows of burials in this section of the cemetery. From this backfill, a small elevation (mound) was formed above the grave pit. Taking into account the presence of several interlayers of ash in some graves, it can be assumed that such actions were performed repeatedly.

The main layer of the ash pit was formed as a result of burning a large amount of wood (possibly grass and brush) on an open fire, the temperature of which was at least 300 °C. The combustion product of this particular fuel is fine light gray ash (Braadbaart, Poole, Huisman, 2012). Animal bones and potsherds, judging by their color and texture, were on fire for a short time.

Ash pits were created also for carrying out other acts, which are difficult to reconstruct conclusively. Accumulations of bones, in particular talus, are associated

with these actions. Researchers have noted the use of talus bones in burial practice (see, e.g., (Usachuk, Panasyuk, 2014)), as well as in ritual practice at sanctuaries (Molodin, Efremova, 1998); for example, talus bones were found in a Bronze Age layer at the grotto sanctuary Kuylyu (the Altai Mountains) (Molodin, Efremova, 2010). Bones of animals and humans deliberately installed in an upright position are extremely rare at archaeological sites. Such a burial was reliably recorded at the medieval burial ground Abramovo-10 in the Baraba forest-steppe. It contained three upright femurs of adult humans, two of which faced upward with their proximal ends, and one with its distal end. Nearby, there were also vertically standing human femurs; two were oriented upward with their distal ends, one with its proximal end (Molodin, Sobolev, Solovyev, 1990: 153, fig. 104, 105). These objects are presumed to be human sacrifices (Ibid.: 165). According to ethnographic data, among Siberian aborigines, such actions as "sticking" (installing vertically) or "burying" objects in the ground were considered a reliable way of "transporting" them to the lower world (Kosarev, 2000: 45–48).

Thus, the entire cycle of activity can be interpreted as a funeral sacrifice. In this case, fire acted as a means of "transporting" the sacrifice (Usmanova, 2013: 288). The composition of the remains of the sacrificial complex by species and morphology is quite stable—these are the bones of limbs, fragments of jaws, and single bones of other parts of skeleton of a cow, sheep, horse, or in rare cases, wild animals (elk, roe deer, bear, fox), birds, and bones and scales of fish. It can be assumed that only certain parts of the animal carcasses were sacrificed. According to the classification by D.G. Zdanovich, such sacrificial complexes belong to the category of "partial" (2005).

The context of the discovery of human bones in an ash spot above grave No. 282 allows us to consider these remains as evidence of a sacrificial ritual in which partial human remains served as the sacrificial victim. It is interesting that their placement in the upper part of the burial chamber corresponds to the canons of the Andronovo (Fedorovka) burial practice in terms of orientation and the posture of the deceased.

Sacrifice, in this case a ritual action of burning and burial in the ground, can be interpreted as the voluntary transfer of some property to supernatural beings or entities (gift) (Bergman, 1987: 32), as a form of commemoration or veneration of the dead (Zdanovich, 2005). However, it should not be forgotten that the proposed interpretations are based on fragmentary archaeological materials, as well as on our subjective assessments. One should also take into account the variety of methods, purposes, places of sacrifice and those to whom it could be intended (see, e.g., (Dmitrieva, 2000; Shilov, 2000; Khrshanovsky, 2000; Burkert, 2000)).

Despite the fact that a huge number of Fedorovka and Alakul burial grounds have been studied in the territory from the Urals to the Minusinsk Basin, we were unable, from the materials of these studies, to identify complete analogs to the rite described above. However, certain similar elements have been found.

Undoubtedly, the typologically close elements appear to be altars located near the grave pits in the burial mounds of the Alakul and Fedorovka cemeteries (Usmanova, 2005; Sotnikova, 2014; Stefanov, Korochkova, 2006; Zdanovich, 2005; and others). The similarity is manifested in the partial character of sacrifices, in the use of fire and ash, and in the composition of the sacrificial "herd" (large and small horned cattle, horses). Notably, in the composition of the sacrificial complexes at Tartas-1, the amount of bones of large and small cattle exceeds the amount of horse bones.

Human sacrifices are very rare at Andronovo sites. Only a few cases are mentioned in the literature. In grave 7 of the Ermak IV cemetery (left bank Irtysh region), a layered burial was discovered (Sotnikova, 2008). In its upper part, a 6–7-year-old child was buried in a crouched position on his left side. Behind his ribcage, there were two skulls (without the lower jaws) and the scattered bones of the legs of a cow. Under the central part of the skeleton, there was the lower jaw of a horse. Below, under the skeleton, the skull, upper ribs, and vertebrae of a newborn calf were found. The infill contained scattered limb bones of at least three horse specimens. In the central part of the grave pit, at a depth of 0.5 m from the virgin soil level, a part of the sheep carcass with an embryo was buried, cut off along the line of the lower ribs of the chest. Under its remains, traces of the covering of the burial chamber were recorded. The lower grave was made at the bottom of a grave pit in a wooden frame, partially burnt (Ibid.). The author of the study interprets this complex as traces of a ritual in which "the sacrificial victim goes through the stages of death and rebirth", but the main thing is the opposition of "old"/adult and "new"/child (Ibid.: 41). Another cult and memorial complex associated with human sacrifice was found in kurgan 3 of the Korbolikha I burial ground (forest-steppe Altai). The oval pit in the center was filled with bones from the dismembered carcasses of a cow, sheep/goat, and horse, arranged in eight layers. In the fourth layer near the western wall, along with the bones of animals, a part of the skeleton of a teenager was found—vertebrae, ribs, sternum, and several tubular bones of the extremities. Some of the ribs and vertebrae were in anatomical order (Mogilnikov, 1998). The traces of the human sacrifices show similarities in age of the interred, the location of the bones not at the bottom of the grave pit, and the combination of human and animal bones. Several more human sacrifices are known from the materials of the settlement of Nizhnie

Kairakty (Western Kazakhstan), in which three ritual complexes with human skulls were recorded (Dmitriev, 2016). It can be stated that human sacrifices were part of the ritual system of the Andronovo population, but they were extremely rare.

Curious analogies come to light when analyzing traces of ash and ash pits of contemporaneous burial grounds of the Alakul and Fedorovka cultures. The materials of the Lisakovsk burial ground (Northern Kazakhstan) indicate that over some burials, peculiar "domes" ("nuclei") were built, consisting of the discharge from a grave pit mixed with specially imported ash. These graves were then covered by a common burial mound (Usmanova, 2005: 76). The ash lenses in the graves at Tartas-1 can also be interpreted as individual mounds marking the graves. Taking into account the location of such graves and altars at the Lisakovsk burial ground, E.R. Usmanova interprets traces of the use of fire and ash as the distinctive signs of a social group (Ibid.: 130). This explanation is also applicable to the group of graves at Tartas-1.

Ash pits have not yet been found on the territory of the Andronovo cemeteries. This can be explained by the imperfection of the excavation technique; cases of opening of deposits throughout the entire area of the site are extremely rare. However, ash pits are often found in settlements. They are recorded in pits near dwellings, in large ditches, or in the form of a mound on the surface. The tradition of creating ash pits became wide-spread in Andronovo-type cultures of the Late Bronze Age. Here, ash pits acquire not only a household, but also a ritual character; they contain traces of human sacrifices (Korochkova, 2009).

It is relevant to mention a complex previously studied at the Early Timber Grave Smelovka burial ground (in the Volga forest-steppe region), which is semantically close to the one under consideration. Several compact ash pits were recorded on the territory of that necropolis, the infill of which was used to fill the grave pits, as well as to mark the space around the burials (Lopatin, 2010). In this case, we observe the result of the convergent development of ideas about the role of fire in the burial practice of the population of the steppes and forest-steppes of Eurasia.

Conclusions

At the Tartas-1 burial ground, a compact section of the Andronovo (Fedorovka) necropolis was recorded, which differs from the surrounding massif of burials by the peculiarities of the funerary and burial rite. There are several rows of grave pits and an ash pit on the site. A special feature of the infill of the graves is the presence of an ash lens, which was a small elevation (mound) above the level of the ancient buried soil. The formation of this layer took place after the burial and filling of the main volume of the grave pit with soil, which makes it possible to attribute these lenses to the traces of the post-burial funerary practice. The source of ash were the ash pits located nearby. The infill of ash lenses and ash pit contains burnt fragments of animal bones, potsherds, fish bones and scales. The species and morphological composition of the osteological finds is constant and dominated by bones of the limbs of cow and sheep/goat, with fewer bones of horses, birds, and wild species. This allows us to consider these bones as traces of sacrifices—certain ritual actions associated with the veneration of the dead or spirits, or the remains of a sacrificial funeral feast. The partial burial of a teenager recorded in this layer above the grave is interpreted as a human sacrifice. It should be noted that in such features as the orientation of graves, their placement on the grave field in rows, the position of the buried person, and the grave goods, the burial rite on the section of the necropolis under consideration corresponds to the canons of the Andronovo (Fedorovka) population, and does not differ from those on other sections of the burial ground.

What is the reason for the "specialization" of this part of the necropolis and the features of the burial and funerary practice presented on it? As was noted, the materials from different parts of the burial field can serve as markers of the periods of penetration of the Andronovo (Fedorovka) people into the territory of the Baraba forest-steppe and their interaction with the indigenous Late Krotovo populations (Molodin, 2011). On this site, traces of such interaction are clearly recorded: fish appears in the funerary rite (Molodin et al., 2015), the sacrificial rites include not only domestic, but also wild animals, and the tradition of secondary burials expands. Perhaps, the graves in question were left by one of these groups of migrants who actively contacted with the local population. In this case, the transformation of the rite may be the result of the adaptation of the alien population to local conditions, or an attempt to consolidate it by strengthening the role of traditional ritual practices, in which fire and its symbols occupied one of the main places. In order to confirm or refute this assumption, as well as to identify other reasons for the allocation of the section of the burial ground, it is necessary to conduct isotopic, anthropological, and paleogenetic studies; these will help to establish the radiocarbon age of the complexes, to reconstruct the genetic history of the population, and to identify the presence or absence of kinship of the buried.

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A Method for Attributing Non-Refitting Fragments to a Single Artifact: The Case of Bronze Age Flat Figurines

In recent decades, several new methods for studying archaeological artifacts, mostly based on digital technologies, have been developed. One of the most promising trends is 3D modeling, allowing researchers to deal with an exact virtual copy of the artifact, which can be manipulated in every way. We propose a new method for determining whether non-applicable fragments belong to one artifact, based on 3D modeling and mathematical statistics. After applying it to two (and possibly more) fragments, one gets an unambiguous answer as to whether the application is statistically reliable (i.e., falls within 95 % confidence limits). Precise computerized measurements on 3D models, following a single algorithm, allow us to verify the results. This method was tested on non-refitting fragments of figurines from the Bronze Age cemetery Tourist-2. Two anthropomorphic figurines from the same cemetery were used to verify the conclusions and elaborate the algorithm.

Keywords: *Method for attributing fragments to one artifact, 3D modeling, mathematical statistics, Bronze Age, zoomorphic figurines, anthropomorphic figurines.*

Introduction

In many cases, when archaeological artifacts are incompletely preserved, and the available fragments are non-refitting, it becomes a big problem to relate the constituent parts to each other. And although sometimes it is possible to judge whether the fragments belong to one object by the texture, color, and shape as a whole, this is far from always obvious and scientifically substantiated. This problem is especially acute when working with relatively homogeneous materials, for example with ceramics of the same complex, where the characteristics of technology and ornamentation are very similar or even identical. The study of isolated unique finds does not simplify the task. For instance, two ornamented fragments of a small figurine made of shale found at the Tourist-1 settlement are very similar in such parameters as raw material, color, texture, decor features, and technological characteristics. However, the possibility of creating two or more artifacts from the same material using the same manufacturing techniques cannot be ruled out. In such cases, the belonging of fragments to the same or different items should be justified, because this is fundamental for understanding their stylistics and how the sculptures looked, in order to search for analogs and study their semantics.

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In recent years, the development of digital technologies has led to the emergence of new tools for the study of archaeological artifacts. Among the most productive areas are 3D modeling, high-precision measurements, and statistical modeling. Modern methods, highly improved as a result of the use of the latest technological equipment, make it possible to obtain previously inaccessible scientific knowledge. For example, geometric-morphometric analysis gives the opportunity to carry out a comprehensive comparison of the shape of lithic artifacts relying on thousands of coordinates (Richardson et al., 2013; Herzlinger, Goren-Inbar, Grosman, 2017; Herzlinger, Grosman, 2018; Shalagina et al., 2020; Kolobova et al., 2020). The analysis of the sequence of flakes was optimized using 3D morphometry methods (Zotkina, Kovalev, Shalagina, 2018; Shalagina, Kolobova, Krivoshapkin, 2019). New algorithms for determining the metric parameters of lithic artifacts (Bretzke, Conard, 2012; Kolobova et al., 2021), measurements of angles on 3D models of items provide new information about the technological and cultural variability of assemblages in individual regions (Valletta et al., 2020). Calculation of the center of gravity makes it possible to classify archaeological artifacts (Grosman, Smikt, Smilansky, 2008; Grosman et al., 2014) and also determine their function (Grosman, Ovadia, Bogdanovsky, 2014; Kolobova, Fedorchenko, Basova et al., 2019).

An important area of research is expanding the capabilities of the applicative method for lithic artifacts (Sumner, Riddle, 2008; Lang, 2013; Delpiano, Peresani, Pastoors, 2017), when with the use of 3D modeling the processes of rendering splices are optimized. In some studies, new mathematical models are created for the machine selection of the refitting fragments or artifacts (Stamatopoulos, Anagnostopoulos, 2016; Cooper, Qiu, 2006). In this article, we propose a new method for attributing non-applicable fragments to one artifact, based on 3D modeling and mathematical statistics.

Materials and methods

To demonstrate the method, we use two fragments of a small figurine made of shale found at the Bronze Age cemetery Tourist-2 (Novosibirsk) in close proximity to each other. However, these are not fitting, which means that these can be parts of different sculptures (Basova et al., 2017; Zotkina et al., 2020). As a result, we will determine the statistical probability of the belonging of the two fragments to one product. This method is based on the assumption that metric parameters of the fragments of one artifact, which are close to each other, should belong to the same statistical sample. Consequently, as a result of the fragments' comparison, the null hypothesis (H0) will be accepted, which asserts the absence of any difference in the metric parameters of the two fragments. The condition for applying this method is the constancy of the analyzed parameter of the artifact. In our case, a flat figurine is analyzed, the thickness of which is a relatively constant indicator throughout the entire length.

To implement the method, the following procedures need to be performed.

1. 3D modeling of the investigated artifact to obtain its scaled model. We used a structured illumination 3D scanner Range Vision 5M according to the published technique (Kolobova, Fedorchenko, Basova et al., 2019). As a result, high-precision scaled models were obtained that fully corresponded to the original figurines, which made it possible to measure the thickness of artifacts with a precision of up to ten thousandths of a millimeter, whereas when using modern calipers, only up to hundredths (Kolobova et al., 2013; Kolobova, Shalagina, Chabai et al., 2019). Machine measurements are on average 20–30 % more accurate than manual measurements (Grossman, Smikt, Smilansky, 2008). Their accuracy is also supported by the ability to control the measurement angle and maintain the distance between points, which is nearly impossible with manual measurements.

2. Metric measurements of 3D models of artifacts of the most stable parameter. Thickness measurements were made along the selected longitudinal section of the models, perpendicular to the product planes, at regular intervals, as shown in Fig. 1–4. At the same time, measurements were excluded in the area of small breaks and splinters.

3. Statistical comparison of samples obtained from measurements.

4. With a significant variance in the samples, a comparison of metric parameters in those zones of artifacts that were presumably located closest to each other before fragmentation.

As a result of metric measurements, we derived two selections of samples that need to be compared with each other. All statistical calculations were performed using the PAST-3 program. The normalcy of distribution was checked using the Shapiro-Wilk test. If the distribution was normal, the Student's *t*-test was applied; if abnormal, the nonparametric Mann-Whitney test was used. This method can also be used for three or more fragments of artifacts. However, in this case, it is recommended to use ANOVA test for normally distributed data, and Kruskal-Wallis test for abnormal ones (Hammer, Harper, Ryan, 2001).

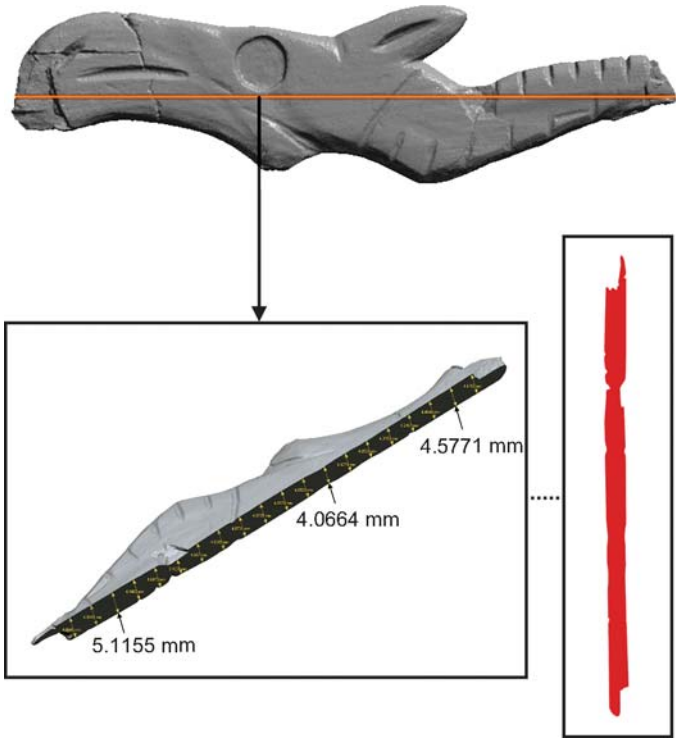

Fig. 1. 3D model of a fragment of a zoomorphic sculpture with head, its conventional longitudinal section, and measured metric parameters.

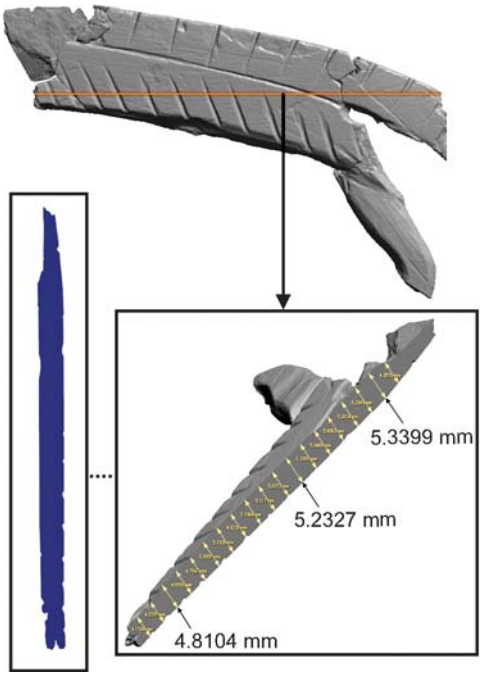

Fig. 2. 3D model of a fragment of a zoomorphic sculpture with croup, its conventional longitudinal section, and measured metric parameters.

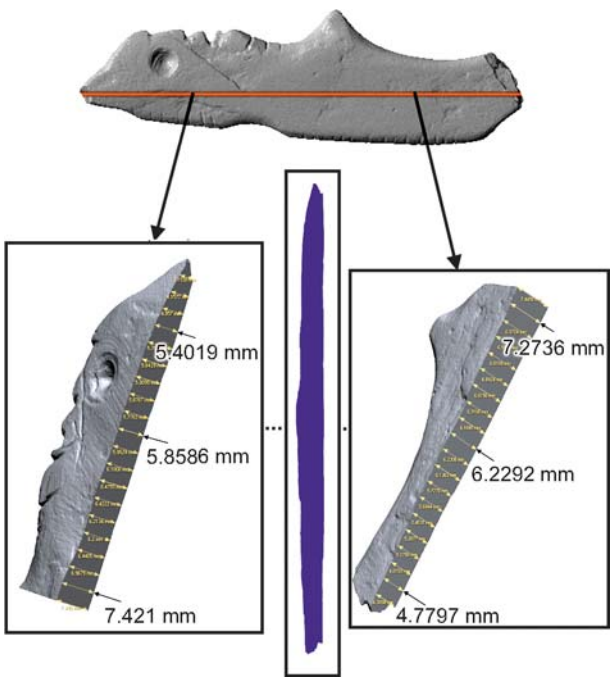

Fig. 3. 3D model of an anthropomorphic sculpture made of shale, its conventional longitudinal section, and transverse fragmentation, with indication of metric parameters.

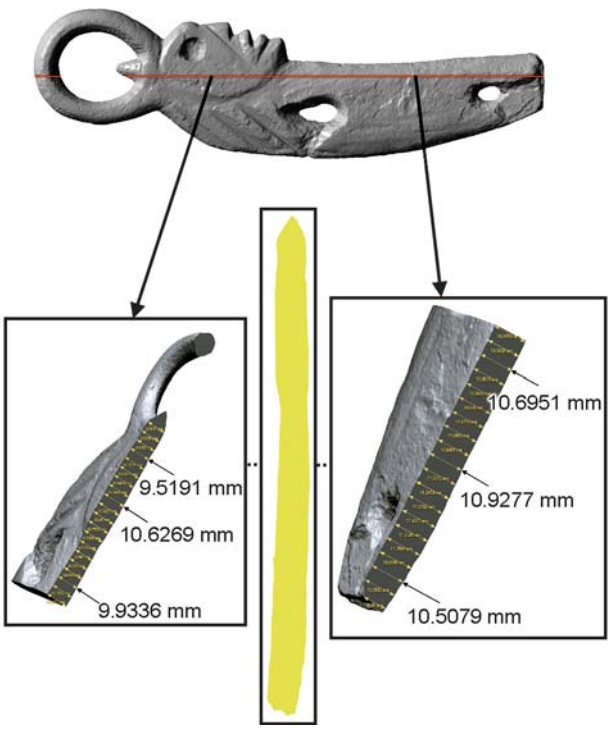

Fig. 4. 3D model of an anthropomorphic sculpture made of burl, its conventional longitudinal section, and transverse fragmentation, with indication of metric parameters.

If as a result of calculations the null hypothesis (H0) is confirmed at $p = 0.05$, then it is recognized that the fragments are constituent parts of one artifact, with the probability of an error of the first type of 5 %.

Results of the statistical analysis

First of all, we tested non-refitting fragments of zoomorphic figurines. To verify the data obtained and the conclusions drawn, two whole anthropomorphic flat figures (shale and burl) from the Tourist-2 assemblage were taken. They demonstrate fairly stable thickness indicators. This finding makes it possible to put forward a null hypothesis, suggesting that the values of this indicator of one figurine belong to one data sample.

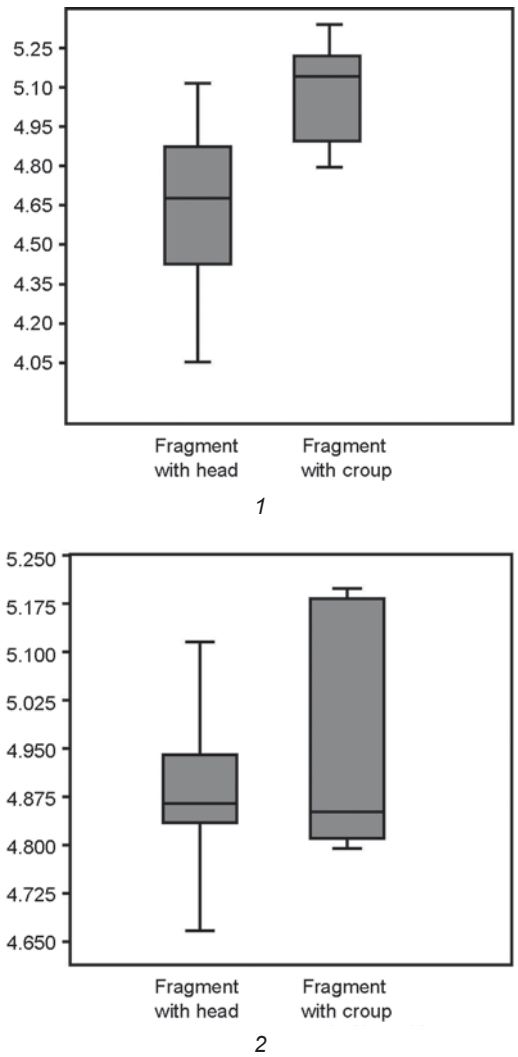

Fig. 5. Box plot of thickness values of two zoomorphic fragments.
1 – along the entire length; *2* – in the presumably medial part.

Both sculptures have a lenticular longitudinal section, where the thickness decreases in the proximal and distal parts, and increases in the medial part (see Fig. 3, 4). For example, the thickness of a figurine made of shale in the proximal part is 4.1–5.8 mm, in the medial part 6.8–7.4 mm, in the distal part 4.3–5.2 mm; the thickness of a figurine made of burl is 8.6–9,4 mm, 10.4–11.0 mm, and 7.0–10.5 mm, respectively. Both figurines show a slight change in thickness in profile view—within 1–2 mm.

To determine whether two zoomorphic fragments belong to the same or different sculptures, we compared the distribution of thickness values on the box plot (Fig. 5, *1*). In the fragment with head and neck, this parameter is 4.0–4.6 mm in the nasal area and 4.8–5.1 mm in the neck area, which generally corresponds to the trend towards an increase in the thickness of the sculpture in the medial part (see Fig. 1). In the fragment with croup, the values of the indicator vary from 4.8–5.2 mm in the proximal part to 5.0–5.3 mm in the distal part (see Fig. 2). The part of the figurine, where the tail may have been located, is broken off, so in this particular example it is impossible to trace the tendency of the decreasing thickness of the item.

We compared the values of the analyzed parameter of two fragments (see Fig. 5, *1*) without taking into account measurements in the damaged parts (18 measurements of the thickness of the fragment with head and 17 of the fragment with croup). They exhibit a normal distribution, so both parametric and nonparametric tests can be used. For example, the Student's *t*-test demonstrates a significant difference between the samples of thickness values: $t = 2.64$ at $p = 0.0123$ (the critical value of the test is at $p = 0.05$). Hence, the null hypothesis is rejected. Thus, if we take into account all the values of the parameter, we can rather conclude that the fragments belonged to different sculptures.

The anthropomorphic shale figurine (see Fig. 3) demonstrates the greatest stability of the thickness values along the entire length (Fig. 6). These values have a normal distribution; the Student's *t*-test indicates that the samples are the same ($t = 0.02$; $p = 0.97$). However, if we simulate the fragmentation of the anthropomorphic burl figurine, arbitrarily dividing the thickness values into two groups with a boundary in the medial part (see Fig. 4), then, as in the case with the zoomorphic fragments, we will get a significant difference (Fig. 7, *1*). Both groups show a normal distribution, so we use the *t*-test. As in the case with the zoomorphic fragments, thickness values of the two parts of the anthropomorphic burl figurine differ significantly ($t = 4.8$, $p = 2.15\text{E-}5$). This is due

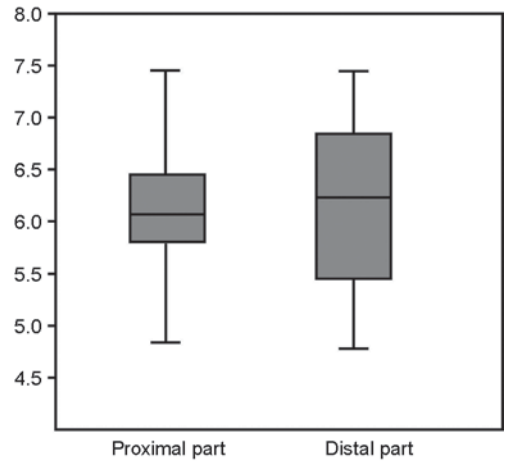

Fig. 6. Box plot of thickness values of two conventional fragments of the anthropomorphic sculpture made of shale.

to the lenticular cross-section of the figurine, wherein the thickness varies greatly in terminal parts. However, if we take into account the values of the parameter in the medial part of the figurine, the situation will be fundamentally different. We chose 10 such values, having excluded the measurements in the damaged parts, and arbitrarily divided them into two groups (Fig. 7, *2*). In this case, the size of the samples didn't meet the requirements of parametric tests anymore; therefore, we used the nonparametric Mann-Whitney test. It showed that the thickness of both conventional fragments was the same ($U = 21$, $p = 0.1$).

To check the possibility of applying the studied zoomorphic fragments, we took 16 measurements in the supposedly medial part of the elk figurine (see Fig. 5, *2*). The Mann-Whitney test showed no significant difference between the thickness values ($U = 19$, $p = 0.325$). As a result of this comparison, the null hypothesis is accepted.

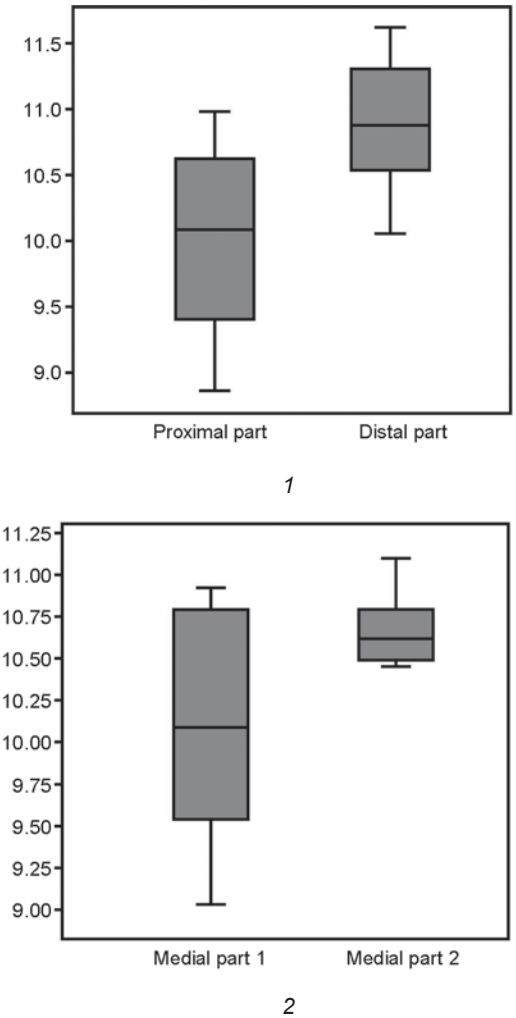

Fig. 7. Box plot of thickness values of two conventional fragments of the anthropomorphic sculpture made of burl. *1* – along the entire length; *2* – in the presumably medial part.

Conclusions

The developed method for assessing the probability of the belonging of non-applicable fragments to one artifact has demonstrated its effectiveness on the example of the tested sculptures, and at the same time showed its limitations. The analyzed fragments should have stable/similar metric parameters in one dimension. They can belong to flat sculptures, buckles, onlays, bone daggers, and certain parts of ceramic vessels (rim, bottom).

It is recommended to carry out measurements on scaled 3D models obtained as a result of scanning. The scaling accuracy of photogrammetric 3D models is not satisfactory for this method. All measurements must be taken at the same angle and the same distance from each other. Both conditions can be controlled in various software products. It is recommended to make a significant number of measurements both to apply parametric criteria (with a higher power than in nonparametric ones) and to reduce the likelihood of a type II error (the incorrectly accepted null hypothesis or incorrect determination of similarity).

As a result of applying the method, a researcher obtains the statistical probability of the fragments belonging to one artifact with an accuracy of 95 % ($p = 0.05$; if necessary, the probability can be increased). The method is very sensitive to changes in metric parameters; therefore, it is recommended to test the fragments that are supposedly the closest to each other, and to exclude measurements of areas

with any defects. It is possible to analyze more than two fragments, subject to statistical constraints, in order to reduce the probability of a type I error (rejection of the true null hypothesis or non-existent differences in the samples).

The technological similarity of flat anthropomorphic figurines from Tourist-2, similar tendencies in changing of their thickness, and the statistically identical distribution of the values of this parameter in two zoomorphic fragments indicate that initially they formed a single whole. At the same time, it is rather difficult to say which part of the sculpture was lost in size. But since the most extreme value of the parameter for the fragment with head is 4.8 mm, and in the terminal part of the fragment with croup the thickness is 4.11 mm, we assume that the lost part of the figurine was approximately 1 cm.

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Three Silver Dishes from Yugra

We introduce medieval silver dishes found near Peregrebnoye, Oktyabrsky District, Khanty-Mansi Autonomous Okrug–Yugra, Western Siberia. In our opinion, they are associated with the Peregrebnoye I fortified site, dating to the late first to early second millennia AD. They may also have belonged to an Ob Ugric sanctuary. A chronological and cultural attribution of the dishes is proposed. The dish likely representing an ibex is considered to be Sogdian, belonging to the second stage of School A, according to B.I. Marshak. It has several parallels among the medieval silver vessels from the Kama basin. The tripod dish, showing a lion clawing a deer against a background decorated with a circular stamp, is either Sogdian or eastern Iranian, dating to late 8th to 10th centuries. The one representing a king riding a horse and accompanied by two warriors is a somewhat simplified replica of Sasanian prototypes, and could have been manufactured in one of the trade centers of eastern Iran or Central Asia no earlier than the 8th century—likely in the 9th–10th centuries. The Peregrebnoye finds are analyzed with reference to the 8th–10th century Sogdian and eastern Iranian silver vessels from the Lower Ob region. Their distribution area includes the Severnaya Sosva and Synya Rivers, and the vicinity of Berezovo.

Keywords: *Silver, Peregrebnoye, Ob, Sogd, Iran, sanctuary.*

Introduction

It has been reliably established that imported metal (silver and bronze) items had already appeared in northwestern Siberia in the Early Iron Age—more precisely, in the late first millennium BC to the early first millennium AD. These artifacts testify to the important process of development of mainstream cultures based on social adaptation, according to A.V. Golovnev (2009: 22). The cultures from northwestern Siberia can be called "the cultures of war and trade" (Fedorova, 2019: 8). This process started at the turn of the eras; it was marked by the first imported metal items, and ended in the second half of the 16th century with the accession of this region to the Russian State. Imported items that reached Western Siberia later were relatively cheap products of Russian artisans (Baulo, 2013).

First imported items came to the North from the steppes of Siberia and Eastern Europe, the Black Sea region, and the Middle East. These were bronze cauldrons on trays, bronze mirrors of the Sarmatian circle, and glass or paste beads. Several silver plaques, which were cut from dishes or bowls manufactured in Western Asia, have been discovered. They show the direction of trade relations along the NS line, which had gradually declined by the mid first millennium AD.

Imported items of the Middle Ages were mainly silver and bronze dishes from Central Asia (Sogd), Middle East (Iran, Parthia, Byzantium and its provinces), and

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Western Europe. The direction of trade routes changed; apparently, they passed from the Cis-Urals through the Urals, and along the EW line via the Northern latitudinal course. These imported items were deposited mostly in hoards, less often in burial grounds of the Middle Ages. It can also be assumed that some amount of silver and bronze items got to various sacred places.

Thus, it is possible to reach a conclusion about the gradual development of trade routes connecting the Western Siberian North with the centers of ancient and medieval civilizations, as well as about the emergence of a special social stratum in that territory, whose representatives collected imported precious things in their treasuries, some of which have come down to us as hoards or cult attributes. Therefore, finds and publication of hitherto unknown imported items have become extremely important in this regard.

During the fieldworks in 2018 in the village of Peregrebnoye in Oktyabrsky District of the Khanty-Mansi Autonomous Okrug–Yugra, located on the right bank of the Ob River, one of the authors of this article had an opportunity to examine three silver dishes. They were in the possession of one of the inhabitants of the village and according to him, were found there by a relative of his long time ago.

A complex of archaeological sites dated to the Early Bronze Age to the Middle Ages has been discovered and partially explored near the settlement. The settlement of Peregrebnoye I belongs to the Middle Ages; the foundations of five log houses were uncovered, as well as remains of relatively powerful defensive structures. V.A. Mogilnikov dated that site to the late first to early second millennium AD (Yugoriya, 2000: 352). V.M. Morozov and S.G. Parkhimovich believed that there might have been a trading post in the early 2nd millennium AD (1985). Thus, accidental finding of three silver dishes in one place outside the monument complex, which well fit the history of interaction of the northwestern Siberia with the Urals, and through the Urals with the centers of medieval civilizations, raises doubts; although we do not have any evidence that the items belonged to the complex of the fortified settlement.

Fig. 1. Dish with representation of ibex (mountain goat?).

Description and attribution of dishware

Dish with representation of ibex (mountain goat?)

This round dish was made of silver in raising technique; the background of the central medallion was gilded; details of the decoration were processed by punching (Fig. 1). Its diameter is 25 cm. The rim has the shape of a convex band. The central medallion is encircled by a belt filled with hatched triangles; three lotus-buds extend from the belt towards the center. An ibex (?) lying with its legs bent is depicted in the center against the gilded background; its long horns are bent above its back; an almond-shaped eye with the dot-pupil is encircled by a wavy line; the beard was ornamented with strokes parallel to its outline. There is a ribbon with diverging, as if flying, ends on the neck of the animal.

Parallels to the dish are known among the medieval silver vessels from hoards discovered in the Kama region (Smirnov, 1909: Cat. 107, 108; Orbeli, Trever, 1935: Pl. 24, 25; Darkevich, 1976: 19, 38–39, pl. 5, *1*, *4*). B.I. Marshak analyzed these in detail and attributed them to the Sogdian artisans of School A from ca 7th century (1971: 21–23). He observed the similarities typical of this school to both Sasanian and Sogdian traditions (Ibid.: 38, 41). V.P. Darkevich considered such items to be of the Eastern Iranian origin, and dated them to the 8th century (1976: 19, 38–39). Notably, both hoards that included vessels with the image of an ibex (mountain goat?) were found in the Perm Territory, near the villages of Sludka and Tomyz (Ibid.). In terms of the style of representation and ornamental décor, for example the design of lotus-buds, the vessel from Sludka is closer to the dish from Peregrebnoye; but the ribbon

on the animal's neck is not shown on the former dish. The ribbon is depicted on the neck of the ibex from the village of Tomyz, although the rest of ornamentation looks somewhat different. Believing that the dish from Tomyz represented the third stage of School A, Marshak wrote thus about it: "…the expressiveness [at the third stage – **the Authors**] of the image is weakening, with simultaneous sophistication of ornamentation" (1971: 22). From our point of view, it is quite possible to attribute the dish from Peregrebnoye to the second stage of School A and consider it to be Sogdian in origin.

Tripod dish with the composition of a lion attacking a deer

This dish is round, with a small everted rim and a flat bottom (Fig. 2, *a*, *b*). Its diameter is 32 cm. It was made

Fig. 2. Tripod dish with the composition of a lion attacking a deer.
a – photo; *b* – drawing; *c* – back of the item.

of silver in raising technique. The central medallion is gilded. The legs are shaped like the legs of an ungulate (horse?); one leg was broken off and is lost now (Fig. 2, *c*); the legs are wrapped in narrow strips of birch-bark. The decoration is placed against a background of round punch imprints. Floral ornamentation consisting of tripartite leaves runs along the rim. The center of the dish is decorated. An ornamental pattern of tripartite leaves, similar to the pattern decorating the rim, is along the edge. An ornamental band filled with four figures of lying deer is closer to the center: the front legs of the animals are bent; one back leg is also bent under the belly, and the other leg is stretched forward. The deer have branched antlers; their bodies are decorated with imprints from a small triangular punch; three deer have four ribs each, and the fourth one has three ribs. A composition of a lion attacking a deer is depicted in the round central medallion against the gilded background covered with imprints from a round punch. The lion is depicted in profile; its head is turned full-face; the body is decorated with the pattern of small scales; the neck is filled with imprints from a triangular punch; mane is short; muzzle of the animal resembles a human face. The deer lies with its legs bent; its head is bent under the chest; its antlers are short. The ribs of the deer are also shown.

Parallels and attribution. A dish with legs having the form of hoofed horse-legs was a part of the Repyovka hoard found in the Kama region (Smirnov, 1909: Cat. 135; Darkevich, 1976: 13, pl. 11, *3*). Marshak identified it as a production of School B of Sogdian metal art. Darkevich considered the Repyovka dish to be the work of the artisans from the eastern regions of Central Asia, and dated it to the second half of the 8th to first half of the 9th century (1976: 13). Notably, similarities between the dishes from the Repyovka hoard and from Peregrebnoye are manifested only in the shape of the artifacts and, most importantly, in the presence of legs. On other dishes with similar decoration, the predator attacking a deer (as also the lying deer) were most often represented in side view. The lion attacking a bear is shown with its head turned full face only on one dish from the 7th–8th centuries (Trever, Lukonin, 1987: 118; Darkevich, 1976: 70, pl. 4, *2*). This is where similarities end. A lion standing in an unusual posture, with its hind legs on the croup of the deer, is depicted on the dish from Peregrebnoye. Most often, lions were represented standing behind the defeated animal. A composition with a lion attacking a fallow deer appears on a Sogdian dish belonging to the 4th stage of School A (Marshak, 1971: 22). It seems that the predator is drawing the deer's neck to itself. The deer lies with its legs bent; one hind paw of the lion rests on its croup (Ibid.: Pl. T 20). The artifact probably dates back to the mid 8th–late 9th century (Ibid.: 73).

The ornamental decoration on the Peregrebnoye dish looks overloaded. It should be emphasized that all of its elements were placed against a background of punch imprints, and images were decorated with ornamentation also using a punching tool—not round, but triangular. The decoration applied to the punched background is typical of Sogdian and Eastern Iranian toreutics: it often appears on buckets (Ibid.: Pl. T 20; Darkevich, 1976: Pl. 14) and cups (Marshak, 1971: Pl. T 20, 40, 42, 44, 46; Darkevich, 1976: Pl. 16, 17), or on a dish depicting a goddess with deer (Darkevich, 1976: Pl. 22, *1*). According to Darkevich, cups with such decoration could have been produced in Fergana–Semirechye in the late 8th–early 9th centuries (Ibid.: 34, 39). When Marshak analyzed the dish with the representation of a nude woman and deer, which he attributed to School B and later stages of School C, he observed "traces of three legs it used to have" (1971: 34). However, both floral ornamentation and figurative representations have nothing in common with the dish from Peregrebnoye. Deer in such quantities and postures as those on the band of the dish under discussion have not yet been found anywhere.

The background processed by a punching tool and legs do not give grounds for confident attribution of the dish as Sogdian or Eastern Iranian, although its dating to the late 8th–10th centuries seems acceptable.

Dish with representation of a king on a horse and two warriors

The dish is flat, with a low rim and a convex band along the edge (Fig. 3, *a*). Its diameter is 33 cm. The decoration was made with fine punching. There is a small hole at the top of the dish. The composition consists of three images—a king on a horse, and two warriors on the sides. A crown with fluttering ribbon at the back is on the king's head. The crown has the form of a hoop. On the hoop, there are stepped figures, having the wings with curls expanding. The top of the crown is rounded. The king is shown in side view, while his shoulders are turned full-face. The beard is tied up; long hair ends in a curl, also tied. King's hawkish nose and eyebrows are stylized as a T-shaped elevation; the ears are small and are pressed to the head. A torque or round collar is on his neck. The king wears a long caftan decorated with ornamentation of circles; the lap in the back is folded. Crossed straps decorated with round plaques are on the chest and shoulders of the caftan. The king wears boots with ornamentation of a five-part semi-palmette with a long upper petal; folds are shown on the back of the boots. The left hand of the king rests on his sword-hilt, the upper part of which is not visible; the lower part of the scabbard is heart-shaped. The king's right arm is raised; two fingers are extended. The horse moves to the left and is saddled. The saddle has small pommel with a bent end, and a raised cantle. The horsecloth is rectangular

Fig. 3. Dish with representations of a king on a horse and two warriors.
a – front; *b* – drawing of the composition in the lower part; *c* – inscription on the back.

with rounded edges. The bridle rests on horse's neck; the breastplate is decorated with pendant-bells. The horse's tail is tied with a ribbon; a brow-band and bit with round cheekpieces are represented on the head.

In front of the king, a bearded warrior stands, with his headwear looking like a tripartite hat or crown. He has long hair with a curl at the end, like the king. His facial features are also rendered as a stylized T-shaped elevation. The warrior is dressed in a long caftan, ornamented in the same way as the caftan of the king with the pattern of circles; a torque or round collar is shown on his neck; a belt is at his waist, and high boots are on his legs. In his right hand, the warrior holds a long staff, and in his left he holds a sword, the scabbard of which ends below with a heart-shaped figure.

Another warrior, wearing a helmet with conic top and a long aventail hiding his hair stands, behind the king's back. The facial features of this character, as of the others, are rendered as a T-shaped elevation. The warrior wears a long caftan (or caftan and wide pants) and high boots without ornamentation. In his left hand, he holds a small shield with a four-petaled rosette in the center and ornamentation of circles along the edge. In his right hand, the warrior holds a banner on a long shaft with points at the top and bottom. A rectangular panel with fluttering ribbons is below the upper point.

In the lower part of the dish, a pond with plants around the edges is represented. An aquatic monster with a fish-like muzzle and tail is shown in the water. Its ears and paws, which end with the head of a bird of prey with a beak, are marked. The monster holds the tail of a fish in its mouth (Fig. 3, *b*).

On the reverse side of the item, an inscription in Arabic, in Kufic script, is engraved: "four hundred and ninety" (Fig. 3, *c*). According to A.D. Pritula, who translated the inscription, this most likely means the date in Hijri, corresponding to 1096/1097 AD*, which is quite consistent with the forms of the letters.

Parallels and attribution. No parallels to the entire composition on the dish are known. One can find correspondences only to its individual elements on the items of toreutics of the Sasanian time. The king's clothing is clearly depicted according to the Sasanian canons. The crown is stylized after the Sasanian examples of the time of King Peroz (Trever, Lukonin, 1987: Fig. 17 (8)), Khosrow II, and Bahram (Ibid.: Fig. 18 (9); 27 (13)). The wings that adorn the top of the crown were borrowed from the examples of the Peroz period; the stepped figures on the top of the crown were adopted from other periods. A baldric decorated with round plates is shown on the caftans on the images of all these shahs; Bahram has a round torque on his neck (Ibid.). A sword with a pommel in the form of a heart-shaped figure was depicted on dishes with hunting scenes of the Sasanian kings, starting with Shapur III (Ibid.: Fig. 11 (4)). Banners similar to the one held by the warrior standing behind the king, as well as similar helmets with long aventails on warriors' heads,

*This opinion was expressed in a letter to the authors of the article.

are represented on the Anikovskoye and Nildino dishes (Darkevich, 1976: Pl. 24; Baulo, 2004: 128, fig. 1).

The raised hand of the king with folded fingers is noteworthy. Earlier, one of the authors of this article wrote about this feature on a dish from the Malaya Ob; in this manner, a speaking or even prophesying person was depicted (Baulo, 2000: 148). A similar image can be found on a Sasanian dish from the Baltimore Museum, where King Yazdegerd II is depicted with the queen (?), who sits with her left arm raised and her fingers folded (Lukonin, 1986: 176). One of the characters in a composition with noble Sogdians on a mural from Penjikent sits with a finger of his left hand raised, with which he points to his mouth (Frye, 1972: Fig. 135). The king on the dish described above and Azada on the Sasanian dish with the hunting scene of Bahram-e Gur are shown with the fingers of their right hands folded, but more often, both the female and male characters (the Nildino dish) have the fingers of their left hands folded. The raised fingers may indicate that the character is prophesying, but this explanation may hardly be applicable to Azada, the beloved of Bahram-e Gur, or to the warrior on the Nildino dish. Most likely, this gesture was supposed to draw attention to the speaker, and it probably did not matter whether one finger or two fingers extended together were raised. On an Early Byzantine dish of the 6th century with a composition of a dispute between Ajax and Odysseus over the weapon of Achilles, Athena is depicted with two folded fingers, while Odysseus is depicted with one raised finger, which points to the mouth, obviously calling for others to listen to him (Iskusstvo Vizantii…, 1977: 99, fig. 134).

Sasanian realia rendered with some simplifications* in the composition on a dish with figures of king and two warriors from Peregrebnoye, suggest that the item was made in some center of Eastern Iran or Central Asia no earlier than the 8th century, but more likely later, in the 9th–10th centuries. Such a conclusion was made by Marshak and Darkevich after analyzing the Anikovskoye dish, which is almost an exact copy of the Nildino dish (1974) and belongs to the same circle of silver-making centers.

It is extremely difficult to attribute the objects of toreutics, because with the exception of Sasanian dishes with the scenes of royal hunt, they cannot always (or can rarely) be unambiguously interpreted. It is helpful when more or less similar artifacts are available. For example, the dish with the ibex from Peregrebnoye can be considered a part of some set of things. It is more difficult with two other items: their place and time of manufacture can only be established with some degree of probability. Marshak wrote about this problem: "Silver dishware whose shape and ornamentation were closely related in different countries makes it possible to compare the contribution of these countries in the context of the same type of activities. Yet… the unit of comparison, along with the country, is also the artistic school, which moves from country to country while preserving its tradition even when taking different forms under local conditions" (1971: 90). In our case, precious dishware came from the trading Sogd, from the territories stretching from Semirechye to the Tang China. All this mass of items absorbed various influences and followed different models. In this case, the approximate dating of the Peregrebnoye dishes to late 8th–early10th century is important for us, just as equally approximate identification of their manufacturing place as Sogd or Eastern Iran.

*This technique was also used for depicting Kings David and Solomon by the artisans who created a dish discovered on the Malaya Ob (Baulo, 2000).

Dishes from Peregrebnoye in the context of silver Sogdian and East Iranian products of the 8th–10th centuries in the Lower Ob region

Until now, it had been believed that very few Sasanian and Sogdian objects of toreutics reached the region beyond the Urals. The catalog "Sokrovishcha Priobiya" ('Treasures of the Ob Region') mentions only the head of the monster (Simurgh), which Marshak considered a part of the throne of a Sogdian goddess and dated to the 8th century (Sokrovishcha Priobiya, 1996: 71). At the end of the 20th to the beginning of the 21st centuries, this list was supplemented with the Nildino dish, the dish from the Malaya Ob, and a rhyton in the form of a girl's figurine (Gemuev, 1988; Baulo, 2000, 2004; Baulo, Marshak, 2001), as well as a Sasanian dish with the composition of bull hunting by King Yazdegerd I (Baulo, 2002).

Three silver dishes discovered in the area of the village of Peregrebnoye significantly enrich this list. These dishes could certainly have belonged both to archaeological medieval site and to the relatively late sacral complex (sanctuary or cultic barn) of the local population—the Ob Ugrians. This assumption follows from the religious and ritual practice described in the literature in sufficient detail, and recorded by scholars in the 20th–early 21st centuries (Chernetsov, 1947; Baulo, 2000, 2002, 2004; Baulo, Marshak, 2001; Baulo, Marshak, Fedorova, 2004).

Eastern silver vessels were included into religious and ritual practice usually on the basis of their shape (for sacrificial food), material (sacredness of silver), and quite recognizable figures or plots depicted on the front sides of the artifacts.

In the North, silver dishes were most often used for sacrificial purposes. In a number of rituals associated with worshiping of protecting ancestors of the clan, it was forbidden to eat sacrificial meat from wooden bowls.

For example, among the clan of the Winged Old Man (eagle), the meat of the sacrificial animals brought from the sanctuary to the village was allowed to be eaten only from metal dishes. According to V.N. Chernetsov, the ban on using any other utensils except those made of metal during the ritual could not have emerged in Siberia, where household and cultic utensils were made of wood and birch-bark. Such a ban could have been closely related to the appearance of imported metal dishes in the region; most likely, it was brought into the Ob region from those places where cultic metal dishware was used (Chernetsov, 1947: 120). Metal artifacts with animal representations (goat, deer) from Peregrebnoye may have been associated with the tradition of offering sacrificial food on a dish to a local deity.

A rider—the character appearing in the myths of the Ob Ugrians—was almost unambiguously equated with Mir-Susne-Hum ('The Man Looking Around the World'), the youngest son of the Supreme God Numi-Torum (Gemuev, 1990: 182–195). In the 19th–20th centuries, when Mir-Susne-Hum was summoned in a shamanic ritual, four silver saucers, often with images of the sun, were placed at the back wall of the house (Gondatti, 1888: 13, 19). According to Chernetsov, some large clans used silver dishes and plates for this purpose. The scholar was told about two ancient cultic centers where a similar practice was observed—Kaltas-syan-paul (the location where the goddess Kaltas dwelled, located in the immediate vicinity of Peregrebnoye) and Troitsk Yurts (the largest place of worshiping Mir-Susne-Hum) (Chernetsov, 1947: 121).

Thus, the area where Iranian and Sogdian silver items of the 8th–10th centuries (only a dish with a hunting scene of Yazdegerd I belongs to the earlier period, dating back to the 5th century) were discovered in the shores of the Severnaya Sosva and Synya Rivers near Berezovo. The finds described above are associated with this area, although the village of Peregrebnoye is located south of Berezovo. Nothing of the kind has yet been found in the territories to the east or to the north of Berezovo. It appears that the early Iranian/Central Asian imports were concentrated in this region. In fact, most of the early Islamic artistic metalwork has also been discovered in that area (Sokrovishcha Priobiya…, 2003: 14). Bronze Iranian bowls are widespread throughout the entire Lower and Middle Ob region, and have also been found on the Yamal and Gydan peninsulas, which can be explained by the resumption of trade routes "across the rocks" (through the Ural Mountains) in the late first millennium AD.

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On Early Medieval Contacts of the Urals and Western Siberia with Central Asia: The Evidence of Ceramics

The study focuses on the Kushnarenkovo-type ceramics from sites in the Cis-Urals and those from sites of the Bakalskaya culture in Western Siberia (300–800 AD). This type was first described in the 1960s as an indicator of major migrations relating to Magyar origins. The analysis of forms, technology, and decoration makes it possible to identify imported ware from local replicas of the Aral ceramics. Certain vessels from the Dzhetyasar cemeteries Altynasar-4, Bedaikasar-2, Kosasar-2 and -3, and Tompakasar, owned by museums, can be attributed to the Bakalskaya culture, whereas others were prototypes for replicas manufactured in the forest-steppe zone. The statistical analysis of the burial rite of contemporaneous Uralian and Western Siberian cultures reveals no features correlating with Kushnarenkovo vessels. These facts, along with the analysis of decorated utensils, coins, prestigious ornaments, and belt sets, evidence intense caravan trade between the Urals, Western Siberia, and Kazakhstan. Rather than an indicator of a specific culture, then, the Kushnarenkovo ceramics indicate a subculture of upper social strata, served by itinerant craftsmen or by manufacturers at trade factories.

Keywords: *Ceramics, Early Middle Ages, Cis-Urals, Western Siberia, trade.*

Introduction

Discussions about the area, the time of development of the Magyar ethnos, and the exodus of the Magyars from the territory of their ancestral home usually refer to the early medieval materials from the Urals and Western Siberia* (Ivanov V.A., 1999, 2015, 2018b; Belavin, Ivanov, Krylasova, 2009; Türk, 2012; and others), which we agree with (Matveeva N.P., 2018). Following A.V. Komar, who suggests looking for the Magyar nomad territories in the Southern Uralian-Kazakhstan region, on the basis of the combination of Sogdian features of metal art, Cis-Urals belt decoration sets, and the Srostki elements of outfit and horse harness (2018: 251, 254), I would draw your attention to the Western Siberian and Central Asian contacts of the sought nomads recorded on the basis of ceramic studies.

It has been established that in the Early Middle Ages in the forest-steppe areas, pottery-making was developed on the basis of indigenous technologies and innovations brought by migrants (Botalov, 1988: 130; Vasilieva, 1993: 46; Ostanina, 1997: 181; Belavin, Ivanov, Krylasova, 2009: 151; and others). On both sides of the Ural Range, we observe significant differences in the forms and methods of pottery construction in ceramic assemblages of various archaeological cultures (Fig. 1), and sometimes also alien recipes for paste, which suggests imitation of imported samples and direct distribution of imported

*For a criticism of the primordialist approach to the ethnogenesis of the Magyars, attributing its start to the Bronze or Early Iron Age, see (Matveeva, Zelenkov, Dyeni, in press).

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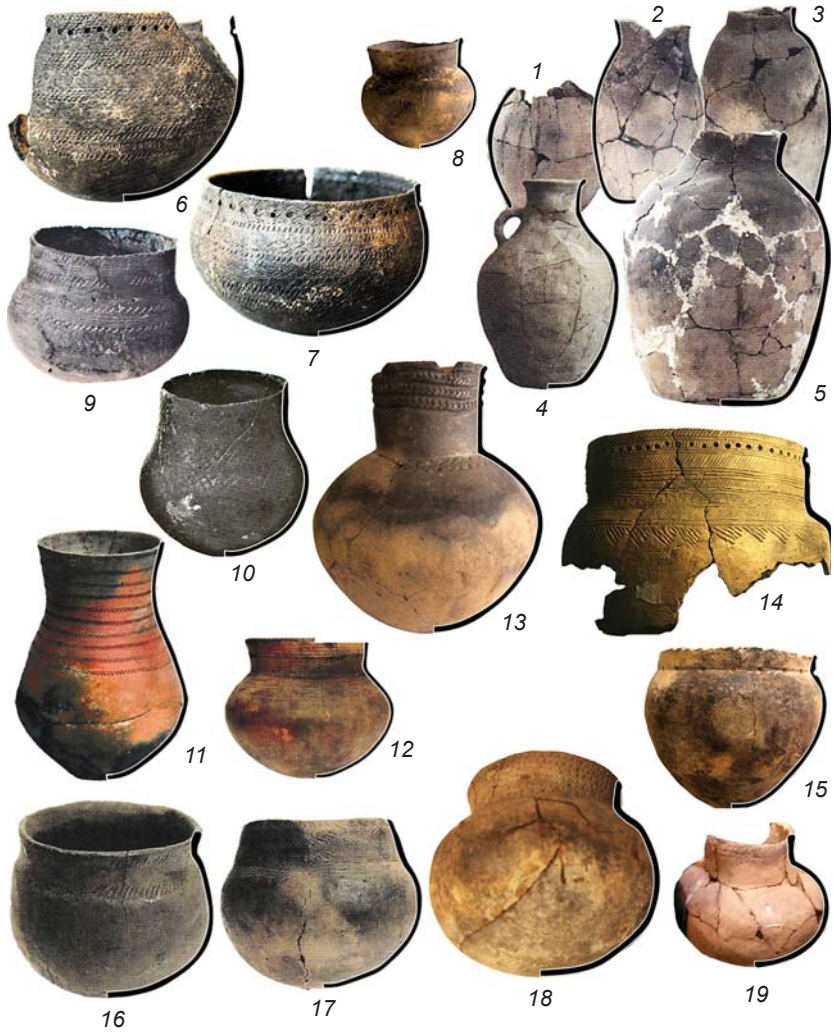

Fig. 1. Typical forms of ceramics from the medieval sites of the Cis- and Trans-Urals.
1–5 – from kurgans "with mustaches" (after (Botalov, 2009: Fig. 9)): *1* – Kara-Bie, kurgan 1, *2* – Novoaktyubinsk I, *3*, *4* – Kyzyltas II, *5* – Gorodishche IX; *6*, *7*, *14* – Potchevash: *6*, *7* – Okunevo-3 (after (Arkheologiya Omska, 2016: 272)), *14* – Kolovskoye, photo by A.S. Zelenkov; *8*, *13*, *15* – Bakalskaya, Ustyug-1; *9*, *10*, *16*, *17* – Kara-Yakupovo: *9*, *10* – Graultry (after (Botalov, 2000: Color pl.)), *16*, *17* – Bekeshevo kurgans (after (Fodor, 2015: 108)); *11*, *12* – Kushnarenkovo, Ufa, Sytyshtamak kurgan (after (Fodor, 2015: 105)); *18* – Bakhmutino, Birsk; *19* – Chiyalek, Bolshie Tigany.

utensils. The well-known practice whereby nomads buy dishes from a sedentary population makes it possible to clarify the directions of their links with adjacent territories.

Most controversial is the issue of the appearance of the Kushnarenkovo-type ceramics, broadly spread on both sides of the Urals. These are brown, red- and black-clay burnished, thin-walled pottery of forge-baking in the form of spherical pots and high-necked jugs, unornamented or with decoration made by metal ornamenting tools or figured stamps. As compared to the local hand-made low pots and bowls, made in the coil technique with fire-baking, these ceramics look very peculiar, and are perceived as foreign products. Initially, it was assumed that these ceramics were brought to the Cis-Urals from the east and are associated with the movement of nomadic groups of Pramagyars or the mysterious Sabirs, since the closest parallels to the forms, grooved and figured-stamped decoration of the Kushnarenkovo ceramics were found in the materials from the Potchevash and Upper Ob cultures (Matveeva G.I., 1968: 113–121; 2007: 75; Gening, 1972: 271–271; Mazhitov, 1977: 60–75). The Western Siberian roots of these ornaments are considered an unconditional proof of the migration of a large population to the west (Ivanov V.A., 1999: 66–68), especially because in recent decades in the Tobol-Ishim region new sites with Kushnarenkovo ceramics have been discovered, dating back to the 4th to 5th centuries—i.e. two to three centuries before the appearance of the above cultures (Matveeva N.P., 2007: 74, 2016: 153).

Sources

Comparisons of pottery from the forest-steppe of the Trans-Urals, Cis-Urals, and the adjacent regions of the Kazakhstan steppes (Fig. 2) were carried out on the basis of publications on the Kushnarenkovo sites (Botalov, 2009; Mazhitov, 1977; Mazhitov et al., 2011; Sultanova, 2000; Zelenkov, 2015, 2019). The authors indicate that Kushnarenkovo ceramics have been found at more than 120 sites in Bashkiria, Udmurtia, and Tataria. We have examined various collections of Kushnarenkovo, Kara-Yakupovo and Turbasly antiques from the excavations by N.A. Mazhitov, G.I. Matveeva, and other researchers, which are deposited in the Bashkortostan National Museum (Birsk fortified settlement and cemetery, settlements of Taptykovo-2–4, -6, -7, and -9, Kazanlar, Kara-Yakupovo, Stary Kalman, and Novye Turbasly; and cemetery of Novye Turbasly, burial mounds of Lagerevo and Ordzhonikidze, Kadyrovo-1); Nevolino

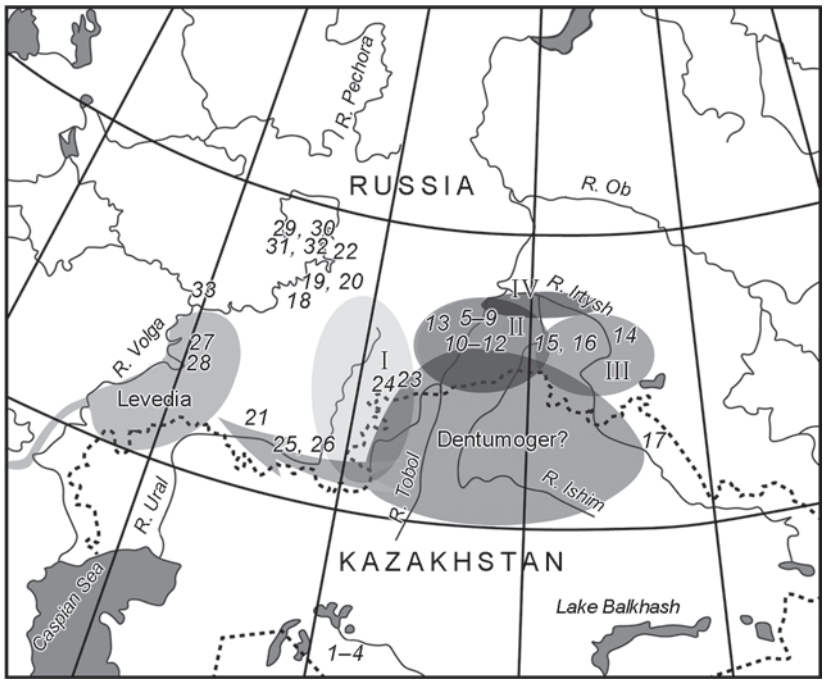

Fig. 2. Map showing location of the mentioned sites.
1–4 – Altynasar-4, Kosasar-2, Bedaikasar-2, Tompakasar; *5–9* – Ustyug-1, Kozlov Mys-2, Revda-5, Pereyminsky, Kolovskoye; *10–13* – Karasye-9, Ust-Tersyuk, Ust-Utyak-1, Bolshoye Bakalskoye; *14* – Ust-Tara-7; *15*, *16* – Loginovo, Likhacheva; *17* – Bobrovka; *18* – Birsk; *19*, *20* – Lobach, Verkh-Saya; *21* – Sakmara; *22* – Ufa II; *23*, *24* – Selentash, Kaynsay; *25*, *26* – Turganik, Imangulovo; *27*, *28* – Proletarskoye, Karlinsky; *29*, *30* – Varna, Tolyensky; *31*, *32* – Kuzebaevo, Blagodatskoye; *33* – Bolshie Tigany.
I – IV – areas of distribution of the Kara-Yakupovo (I), Bakalskaya (II), Potchevash (III), and the southern variant of the Karym (IV) cultures.

materials kept at the Archaeology Department of the Udmurt State University (Verkh-Saya and Elkino fortified settlements, and Brody). Comparisons were carried out with the ceramic assemblages of the Bakalskaya culture (fortified settlements of Kolovskoye, Krasnogorskoye, Ust-Tersyuk, Ust-Utyak-1, and Bolshoye Bakalskoye (Matveeva, Berlina, Rafikova, 2008; Botalov et al., 2013; Zelenkov, 2019); and cemeteries of Ustyug-1, Kozlov Mys-2; Revda-5, and Pereyminsky (Matveeva N.P., 2016: 138–153). The Potchevash ceramics have been described by B.A. Konikov (2007) and V.A. Mogilnikov (1987); samples for comparisons were taken from the collections of the Loginovo fortified settlement and Likhacheva cemetery belonging to the Tyumen Regional Museum Association, as well as from Bobrovka cemetery (Arslanova, 1980). The Dzhetyasar culture of the Aral Sea region was examined in the collections by L.M. Levina (Altynasar-4, Bedaikasar-2, Kosasar-2 and -3, and Tompakasar) from Moscow museums. Analysis of the entire materials of the Kushnarenkovo ceramics has not been carried out, because not all the materials have been described yet. We consider this to be the task for the nearest future.

Discussion

It would seem that the red- and black-polished thin-walled (3–4 mm thick) ceramics of the Kushnarenkovo type (see Fig. 1, *11*, *12*), original in its jug shapes and figured-stamped ornamentation, should correlate with peculiar rites and lifestyle, which was implied in identification of this culture. The technological features of this pottery were analyzed by I.N. Vasilieva (1993: 44–45) and A.S. Zelenkov (2019). The techniques of its manufacture look foreign against the background of the traditions of the neighboring population groups of the Cis-Urals; because in contrast to the coiling technique, the molding was carried out using mold-models, including leather models, patch stamping, with careful smoothing and polishing; sometimes engobing was applied for final leveling of the surface (Vasilieva, 1993: 46). Some techniques show similarity with the Turbasly ceramics (Ibid.: 83); however, the type under consideration is distinguished by the presence of fine graded sand in the paste, and by its thinness.

It was noted that at all the settlements and cemeteries of the Cis-Urals, the Kushnarenkovo ceramics were found together with the Turbasly, Bakhmutino, Nevolino, or Kara-Yakupovo ones, and did not correlate with any type of burial (Mazhitov, 1977: 62, 72; Kazakov, 1981: 133). Since most of the sites have not been fully described, and no summary of the excavation reports has been made, we provide the data from digital and illustrative publications.

Kushnarenkovo ceramics are always few in number, in contrast to other pottery types (Gening, 1972: 266, 268; Kazantseva, Yutina, 1986: 122). Their share in the assemblages is from 1 to 16 % (see *Table*), which is determined very approximately, since the material was not distributed by the authors of publications by dwellings or horizons, and the ratios of various types are quite random, depending on the size of the exposed areas and the chronology of the objects. Notably, in the settlements, the Kushnarenkovo vessels are much smaller than the Kara-Yakupovo ones (Ivanov V.A., 1999: 50). General comparison of shapes and sizes led N.A. Mazhitov (1981: 27–28) and T.I. Ostanina (2002: 42) to the conclusion that this was tableware.

Occurrences of the Kushnarenkovo ceramics in the burial and settlement sites of the Trans-Urals and Cis-Urals

Site	Number of vessels / proportion, %	Source	Site	Number of vessels / proportion, %	Source
Verkh-Saya fortified settlement	16/0.69	(Pastushenko, 2008)	Novobikkino	1/?	(Mazhitov, 1977)
Verkh-Saya cemetery	1/0.84	(Ibid.)	Bulgar	1/?	(Ibid.)
Bartymskoye-1 site	2/0.18	"	Ufimsky	1/?	"
Morozkovskoye-4 site	1/0.07	"	Murakaevo	1/?	"
Antonovskoye fortified settlement	1/1.41	"	Sterlitamak	2/?	"
Khalilovo	1/?	(Mazhitov, 1977)	Karanayevo	3/?	"
Manyak	21/?	(Ibid.)	Khusainovo	3/?	"
Krasnogorsky	1/?	"	Ishimbay	1/?	"
Kushnarenkovo	2/8.69	(Vasyutkin, 1968)	Starokolmashevo fortified settlement	56/?	"
Bakhmutino	2/?	(Mazhitov, 1977)	Birsk	18/15.4	(Sultanova 2000)
Shareyevo	2/?	(Ibid.)	Novye Turbasly site	18/?	(Mazhitov, 1977)
Staroyanzigitovo	2/?	"	Birsk fortified settlement	10/?	(Ibid.)
Bekeshevo	10/?	"	Romanovskoye-2 site	9/?	"
Syntashevo	2/?	"	Turbasly fortified settlement	4/?	"
Lagerevo	16/?	"	Ufa II	100/?	(Mazhitov et al., 2011)
Novye Turbasly cemetery	1/?	"	Ust-Utyak-1	37/12.8	(Botalov et al., 2013)
Kolovskoye fortified settlement	40/7.47	(Matveeva, Berlina, Rafikova, 2008)	Kuzebaevo fortified settlement	201/16.19	(Ostanina, 2002)
Papskoye fortified settlement	7/10.4	(Matveeva et al., 2020)	Bolshoye Bakalskoye fortified settlement	21/11.1	(Botalov et al., 2013)

However, their colleagues did not support them, carried away by the ethnic interpretations of the types. Today, Kushnarenkovo ceramics have also been found in the steppe kurgans "with mustaches" (Selentash, Kaynsay, Turganik, Imangulovo) (Grudochko, 2018: Fig. 7; Kraeva, Matyushko, 2018: Fig. 11, 15), and at the seasonal sites in the Volga region (Proletarskoye fortified settlement, Karlinsky site) (Stashenkov, 2018: 258–259). The difference between the pastes of these vessels, including the presence of crushed shells in some of them (Kraeva, Matyushko, 2018: 187), suggests the transformation of the original recipes of paste under different conditions and in a different environment. The emergence of Kushnarenkovo ceramics reflects either the development of local specialized pottery production for high-status consumption, or active trade.

In one of his early communications, E.P. Kazakov noted that burials with Kushnarenkovo ceramics "stand out for their richness of beautifully made items of gold and silver, as well as for quite perfect iron tools and weapons" (1981: 115). Initially, researchers saw the differences in the existence time and orientation of the Kushnarenkovo and Kara-Yakupovo burials, which were classified by vessels of the corresponding type in the graves (Ivanov V.A., 1999: 55, 57; Botalov, 2000: 332); however, owing to the small number of samples, this conclusion turned out to be statistically unreliable. The opinion of V.A. Ivanov on the earlier date of most burials with the Kushnarenkovo ceramics, as compared to the burials with the Kara-Yakupovo pottery (2018a: 97), contradicts the data of A.G. Ivanov, according to which vessels of both types are represented in contemporaneous sites of the 6th to 7th centuries and exist until the 8th to 10th centuries, undergoing gradual transformations (2008: 149–150). Seeing no grounds for the spatial and chronological division of the Kushnarenkovo and Kara-Yakupovo sites, a number of researchers (Botalov et al., 2008: 22–27; Grudochko, Botalov, 2013; Ivanov V.A., 2015: 201, 209) began to use the term "Kushnarenkovo-Kara-Yakupovo culture", and divided or united the sites

Fig. 3. The Bakalskaya vessels (*1–6*) and Dzhetyasar parallels to the borrowed pottery forms (*7–10*) from the cemeteries of Altynasar-4 (*1–7*, *9*, *10*) and Kosasar-3 (*8*).

Fig. 4. Vessels of the Bakalskaya forms from the cemeteries of Kosasar-2 (*1–9*) and Bedaikasar-2 (*10*).

according to the existing situation. By the way, Vasilieva showed the difference in the pastes, reflecting the peculiarities of substrate pottery skills among the groups of producers of these types of ceramics: iron ductile clay tempered with manure and grog in the Kushnarenkovo tradition, iron oversanded clay, sometimes with mica, in the Kara-Yakupovo (1993: 44–45).

In Western Siberia, the Kushnarenkovo ceramics are found together with Bakalskaya pottery, in the early medieval sites dating to the 4th to 7th centuries. The study of the specifics of pottery-making based on the materials of the cemeteries of Kozlov Mys-2 and Ustyug-1 showed that the Trans-Urals population borrowed the forms of cups, mugs, jugs with handles, and cauldrons from the southern regions—the Aral Sea region and Semirechye: manufacture of imitation vessels, as well as the use of imported ware with original pastes; for example, tempered with burnt bone (Matveeva, Kobeleva, 2013).

During examination of the Dzhetyasar ceramics (Fig. 3, 4)*, we have discovered solitary specimens of the Bakalskaya culture

*Atlynasar-4 ceramics are deposited and displayed in the Institute of Ethnology and Anthropology RAS, ceramics from other sites in the State Museum of Oriental Art. We are grateful to I.A. Arzhantseva, S.B. Bolelov, and Z.S. Galieva for their assistance.

from several sites in the lower Syr-Darya River. For instance, in kurgans 245, 275, 294 and others at Altynasar-4, pottery of the Western Siberian appearance was found. This pottery differs from the flat-bottomed and thick-walled Dzhetyasar pots in its rounded bottoms, thin walls, presence of sand and grog in the paste, and short necks with straight cut or notched rim. The collections from the cemeteries of Kosasar-2 and Bedaikasar-2 contained similar ware: round-bottomed pots with short necks, hand-made and fire-baked mugs; some of the specimens show admixture of burnt bone in the paste and are light in weight (Fig. 4, *6*, *7*), similarly to some vessels from the Tobol region (Ibid.: 72). In all the collections we have examined, such dishes are in the minority (maximum one tenth) and are dissimilar to the main array, consisting of thick-walled flat-bottomed pots, cauldrons, bowls, and jugs of forge-baking. In addition, in the Bakalskaya assemblages, there are some rare forms, the origin of which had not previously been explained; namely, the high-necked red-clay jugs with grooved necks, including those with zoomorphic handles, polished bowls, and mugs with handles; these forms find complete parallels in the Aral Sea region (see Fig. 3, *7–10*; 5, 6). In general, the Trans-Urals pottery from the sites dating to the 4th–6th centuries imitates the forms of the Dzhetyasar I period, the earliest date of which was determined by L.M. Levina to be the 4th century AD (1971: Fig. 15, 17).

Comparison of the local Bakalskaya pottery (consisting of round-bottomed pots, cans, cauldrons, pans, cups and bowls (Fig. 6, *12–19*)), with imported ware (Fig. 6, *1–7*) and imitations (Fig. 6, *8–11*) has shown that the imported products are represented by flat-bottomed jugs and mugs used for ceremonial serving of drinks, probably kumis and milk vodka. Judging by the results of the analysis of charred deposits on the vessels from the burials, the pots and bowls contained soups and broths, and the jars water (Matveeva N.P., 2016: 143). This means that the ceremonial ware reflects some kind of ritual innovation or high-status consumption. Thus, ceramic materials testify to active trade relations in the meridian direction—possibly accompanied by marital links, since the Bakalskaya vessels were found in the Dzhetyasar burials.

Statistical analysis of the Trans-Urals burial sites showed that the graves with Kushnarenkovo vessels are not grouped into a separate cluster, but are distributed among the Bakalskaya and Potchevash burials (Zelenkov, 2017).

Let us consider the forms and decorations of the Kushnarenkovo ceramics. Ceramic materials from the Ufa II fortified settlement (ca 60 spec.) (Zelenkov, 2015: 1960) show that the predominant forms of Kushnarenkovo ware are medium-high and high round-bottomed pots. Such vessels also dominate in other assemblages (Fig. 7, *9–12*), while spherical vessels with low necks form a

Fig. 5. Specimens of Dzhetyasar tableware, imitations of which were noted in the Bakalskaya assemblages of Ustyug-1 and Revda-5 cemeteries.
1–5 – Kosasar-2; *6* – Altynasar-4.

separate group (Fig. 7, *4*, *7*), with a specific decoration made with figured stamps (triangles, rhombuses, brackets, "caterpillars"). The origin of this motif is associated with the southern version of the Karym culture, with migrants from the taiga zone to the Western Siberian forest-steppe (Fig. 7, *1*, *2*) (Zelenkov, 2015: 198). Burials in the Cis-Urals and Trans-Urals also yielded a significant proportion of high-necked jugs with carved and grooved or with figure-stamped ornaments (Fig. 7, *5*, *10*, *13*). The narrow-necked elongated vessels have parallels among the churns from Altynasar-4 (see Fig. 3, *7*). The decoration pattern of incised lines with a multi-row zigzag between them is also characteristic of ceramics from the sites of the 4th–7th centuries at the lower Syr-Darya River (Levina, 1971: Fig. 15, p. 72).

L.S. Kobeleva, having examined the sample from Ufa II under a microscope, concluded that some of the ceramics are replicas of Kushnarenkovo pottery. These ceramics are coarser and thicker-walled, their surfaces were processed with a denticulate tool and were neither completely smoothed nor polished. The imitation vessels were decorated carelessly, with frequent mismatches in the rapport; comb imprints were almost not used; in one case, the comb bracket was replaced by nail

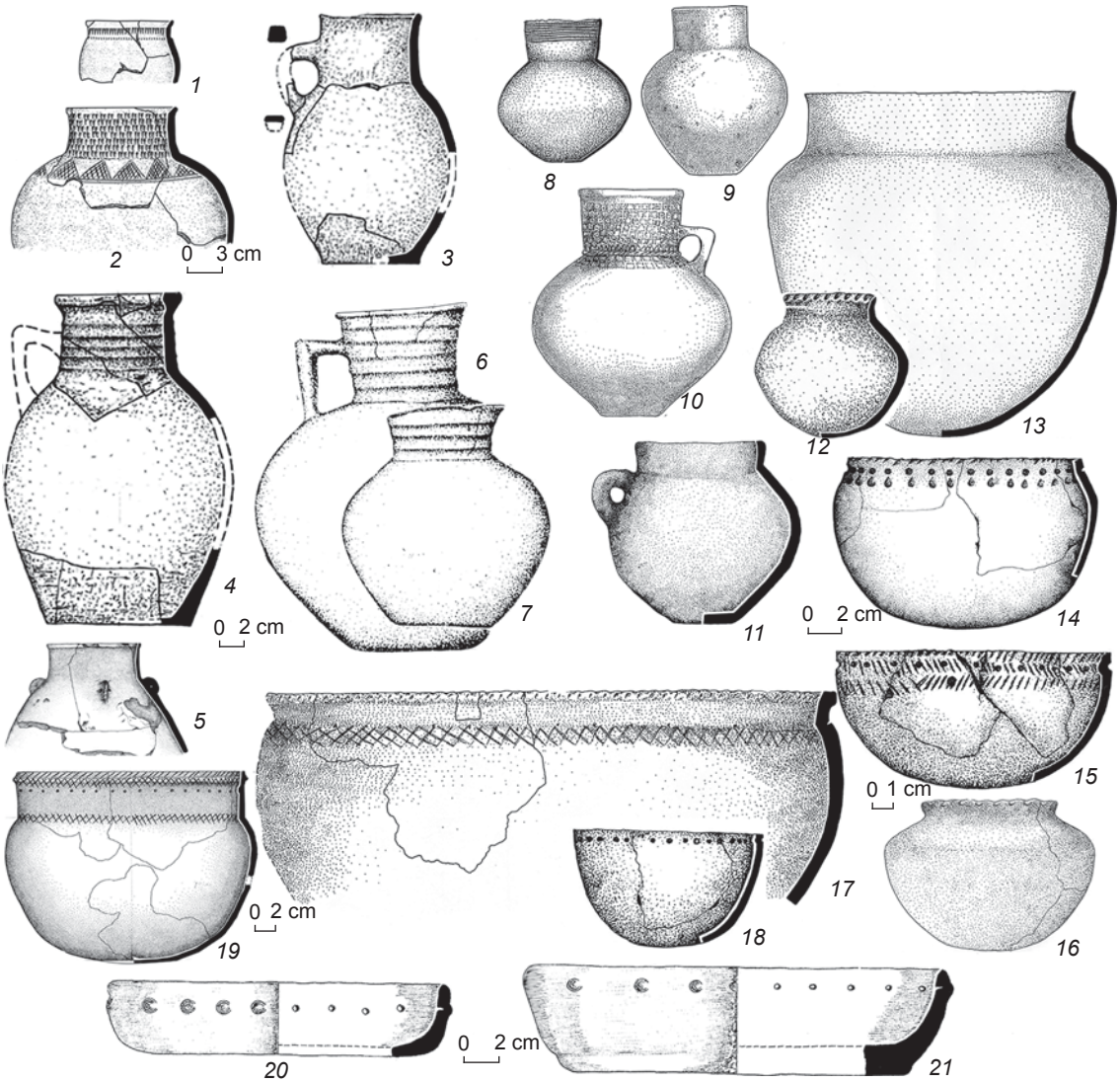

Fig. 6. Imported ware (*1–7*, *20*, *21*), imitations (*8–11*) and typical forms (*12–19*) from the sites of the Bakalskaya culture.

1, *2*, *14*, *15*, *18* – Kolovskoye fortified settlement; *3*, *4*, *20*, *21* – Ust-Tersyuk; *5* – Ust-Utyak-1; *6*, *7* – Karasye-9; *8*, *13* – Revda; *9–12*, *16*, *17* – Ustyug-1; *19* – Pereyminsky cemetery.

imprints*. There are specimens with a dense carved pattern, executed with a metal ornamenting tool and a plain stamp. The proportions of necks with sharply everted rims (see Fig. 7, *6*, *8*) in other Kama pottery are closest to the jug forms of the Dzhetyasar II period, hand-made on swivel stand (Ibid.: 73). Materials from archaeological sites in Udmurtia (Varna, Tolyensky cemeteries, Verkh-Saya, Lobach, Kuzebaevo, Blagodatskoye fortified settlements) give the impression that the Kushnarenkovo patterns were borrowed from that local environment for which the products were intended (see Fig. 7, *6*, *8*). It was noted that, over time, there was a change in forms that approached the spherical and miter-shaped local standards, and the decoration became more rarefied (Ivanov A.G., 2008: 156, 158), i.e., there was adaptation to consumer preference.

We believe that the abovementioned facts do not provide a good ground for regarding the Kushnarenkovo ceramics as an archaeological culture. Kushnarenkovo pottery was manufactured by artisans who still worked without potter's wheels, using something like the methods of pot-makers of the Sakmara fortified settlement, in the steppe of the left-bank Volga region. Vasilieva showed that the ceramics from this site do not belong to the Urals cultures; these were made *in situ,*

*Written communication by L.S. Kobeleva. The author is grateful for her consultation.

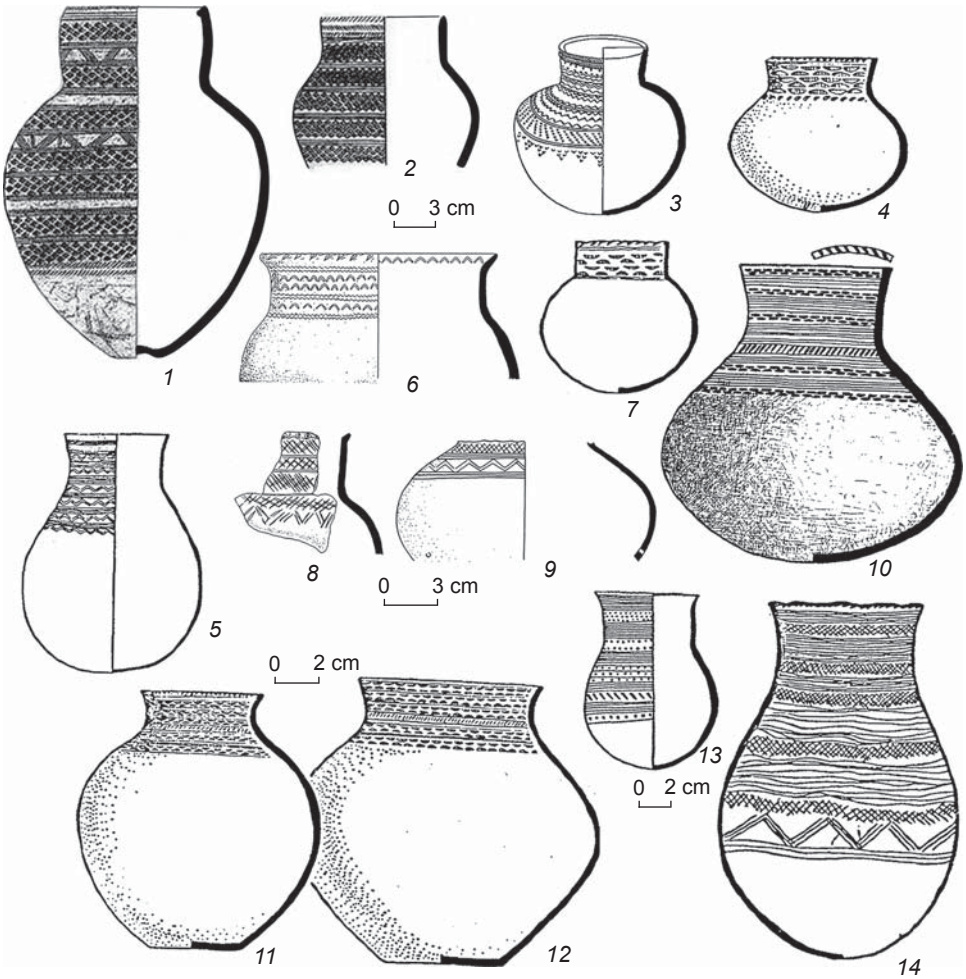

Fig. 7. Karym, Potchevash vessels and Kushnarenkovo ceramic forms from the Nevolino and Bakhmutino sites.
1, *2* – Ust-Tara-7; *3* – Bobrovka cemetery; *4*, *5*, *7*, *10–14* – Birsk cemetery; *6*, *8* – Lobach; *9* – Verkh-Saya.

in the traditions of the Dzhetyasar culture, by some group of the population that moved from the territory of Kazakhstan to the northwest (1993: 86).

Conclusions

The Kushnarenkovo and pseudo-Kushnarenkovo forms of ceramics on both sides of the Urals emerged under the influence of trade and demand for prestigious ware, the decoration of which was borrowed partly from the Karym and Potchevash population of the subtaiga zone of Western Siberia, and partly from the Kama and Aral Sea regions. Whether it was produced in sedentary settlements of the Kazakhstan steppes or in trade factories of the forest-steppe remains to be determined. We should move away from the definition of the Kushnarenkovo antiquities in terms of culture and consider them a type, with the possibility of interpretation as a subculture of some population group. Of course, a comprehensive analysis of all Kushnarenkovo pottery is required, clarifying its chronology and forms, highlighting originals and imitations; these topics are the goals of future studies.

The existence of trade factories and itinerant artisans in the Cis-Urals in the Early Middle Ages is evidenced by coin hoards and precious vessels found in the Sylva River area, in the middle Kama, the Kuzebaevo jeweler's hoard, and explicitly Central Asian imported products (Goldina E.V., Goldina R.D., 2010: 170, 172–173). There are similar finds in the Trans-Urals: a handle from a Central Asian vessel from the Bolshoye Bakalskoye fortified settlement (Botalov et al., 2008: Fig. 15), Chinese coins and mirrors from the cemeteries of Kip III and Likhacheva (Mogilnikov, 1987: 192), a silver bucket and mugs from the Iset River area, and other evidence of trade with medieval Sogdian settlements of Semirechye on the way from the Aral Sea region to the lower reaches of the Volga (Darkevich, 2010: 44–45, 146). These facts make it possible to consider the forest-steppe as a zone of intense interactions, which still remains insufficiently studied.

In the assemblages of the "Hungarian" toreutics that appeared later in the steppe zone, the Khazar, Byzantine, Sasanian, "Tang", and Srostki borrowings are noted. According to A. Türk, close Central Asian contacts began east of the Volga in the Early Middle Ages, and the preceding trade determined a set of components of cultural genesis in the 8th to early 9th centuries (2013: 236). Apparently, trade was also actively carried out in the Urals and Western Siberian region by the bearers of the Bakalskaya and Potchevash archaeological cultures.

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Composite Belt Ornaments with Bear Claw Pieces in Medieval Men's Costume of the Perm Region, Western Urals

Longstanding excavations at the Boyanovo and Rozhdestvenskoye medieval cemeteries in the Perm Territory revealed a new type of belt ornament—pendants with arch-shaped pieces carved from dorsal plates of bear claws. Each piece has two drilled holes in the central third, and they were strung on two cords in a "rope ladder" fashion. Pieces made of bear claws were interchanged with bronze beads or pipes. At the ends of strings, bells or pendants were attached. Such ornaments were worn exclusively by boys and men of all ages (from two to sixty). Silver artifacts and other "elite" items, suggesting that they were markers of high social status, accompanied the ornaments. The use of bear claws might indicate an apotropaic function. The available facts point to the use in funerary costume only, but the difficulty of manufacturing such ornaments obviates the possibility of a one-off use. Previously, such an ornament was found only at Zagarye, a cemetery dating to the final stage of the Lomovatovka culture. The pendants, then, were used during the late 9th to the late 11th centuries.

Keywords: *Perm Region, western Urals, Middle Ages, Lomovatovka culture, costume, men's belt ornaments, bear claw pieces.*

Introduction

As we know, "the final result of research in archeology is the reconstruction to some degree of historical processes, items, and facts" (Martynov, 2002: 4). The reconstruction of costumes is of particular interest, since it allows us to picture with more clarity the appearance of the people from past eras. Such research devoted to the costume reconstruction of the medieval population of the Perm Region in western Urals on the basis of sources from the 19th – 20th centuries has been undertaken before (Krylasova, 2001). The burial complexes that formed the basis of the reconstruction provide very scant information about clothing, footwear, and headgear. The small fragments of preserved textiles, leather, and fur allow us to evaluate only the materials from which the garments were made. In combination with a few medieval images, it is only possible to depict the basic structure of the costume in general terms. But the various additional elements of the costume made, as a rule, from inorganic materials, have been studied quite thoroughly. Their main material composition is determined, a specific place in the costume is identified, and the variety of the combination of accessories and ornaments specifically attributed to women's or men's costume outfits are traced.

For the first two decades of the 21st century, the range of sources for the reconstruction of the costume has significantly expanded owing to many years of

research on a number of medieval burial grounds. Moreover, the newly obtained information is more detailed, since the conclusions made earlier about its features prompts archaeologists to be more attentive to the slightest nuances and more accurately record the interposition of various elements during excavations. Given the objective limitations of our knowledge about medieval costume, its previously unknown elements are always of particular interest, especially those found in graves *in situ*, as a complete outfit, sometimes even on the remains of an organic base. For example, during the excavation of the Rozhdestvenskoye burial ground, in a number of male graves, the remains of textile belt bands with bronze spherical pendants along the lower edge were found. These ribbons, up to 10 cm wide, with a length reaching nearly to the knee, were attached to the belt on the left. They were probably dyed and served as a bright decorative element of the men's costume, which was significantly poorer in a number of decorations than that of the women (Krylasova, 2019). In addition, it was possible to analyze the composition of strings of metal beads, which were used as belt decorations, elements of hair braid and temporal ornaments (Krylasova, Danich, 2020). The stable traditions of assembling such strings are identified, and additional components in their composition are revealed. In particular, in women's costumes, in the composition of strings of beads, on which braid pendants were attached, besides metal beads, colored glass and stone beads are often present. In the male graves, belt pendants with elements carved from bear claws were found. This article is devoted to describing this original male jewelry, known so far only in the materials of the Lomovatovka archaeological culture.

Among the medieval inhabitants of the Perm Region in western Urals, as well as among other Finno-Ugric peoples, male costume contained significantly fewer additional details and ornaments than the female one. Among men's accessories, the most expressive was the belt. It was not only a utilitarian item, but also the most decorative detail of a man's costume. The belt, in addition to a buckle and a tip, was supplied with a set of metal overlays, pendants in the form of straps with overlays, and short strings of bronze beads with a bell at the end. A scabbard with a knife, a purse with a flint, a case with an awl, a comb, and other items, in particular amulets associated with household and hunting magic, could be attached to the belt (Krylasova, 2001: 205).

Natural amulets, which usually included various parts of animals, birds, and fish (jaws, teeth, claws, vertebrae, individual bones), as well as shells of mollusks, occupied a special place in the culture of the Finno-Ugric peoples. They were customarily used without any processing, other than the drilled hole for hanging. There are still only a few special studies devoted to such amulets, but even the available data make clear that there were certain territorial and chronological differences in the composition of the complexes of amulets, due to the peculiarities of economic activity and the ideological views of the population. Amulets from the bones of a beaver (talus, teeth, jaws) and a bear (teeth and claws) were almost universal in all Finno-Ugric cultures.

Evidence of the veneration of the bear appears in almost all of the animal's habitats (Tyanina, 2011: 164). Among the finds, the majority of amulets are made from bear fangs, whose function was protection against evil spirits, spoilage, the evil eye, as well as the benevolent value of increasing health and prosperity. The territory of the Perm Region in western Urals was the center of the spread of this animal cult, according to L.A. Golubeva, who based on the analysis of metal jewelry-amulets featuring the image of a bear (1979: 26–28, 62). Leading researchers of the region's medieval cultures mention exactly bear fangs from the entire array of natural amulets (Goldina, 1985: 151; Oborin, 1999: 280), although in reality this type of amulet was far from the most widespread.

Unlike fangs, amulets made from bear claws occur extremely rare on settlement sites. Single finds are known at the fortified sites of Rodanovo (Talitsky, 1951: Fig. 32, *11*) and Rozhdestvenskoye (Belavin, Krylasova, 2008: Fig. 194, *11*) in the Perm Region, western Urals, and Idnakar in Udmurtia (Ivanova, 1998: Fig. 80, *11*). A similar situation can be traced in the settlement monuments of Russia. For example, 188 natural amulets were collected in Novgorod, among which there were only two made of bear claws (Tyanina, 2011: 164). But in the grave monuments of the Slavs and their neighbors, the Finns of the Volga region, such amulets are extremely widespread. Bear claws are a typical find in female graves in the kurgans of the Ves people in Southeastern Ladoga area of the 10th–11th centuries (Golubeva, 1997: 157). E.A. Tyanina notes the semantic unity of bear claw amulets with another well-known category of cult objects—clay "bear paws", which are known from the Finno-Ugric and Slavic burials of the 9th–11th centuries, and believes that they relate exclusively to the funerary rite (2011: 164).

Of particular interest are composite belt pendants found in nine graves of the Boyanovo (9th to the first half of the 10th centuries) and Rozhdestvenskoye (late 9th to late 11th centuries) burial grounds. They include elements made from dorsal plates of bear claws (definition by P.A. Kosintsev). These elements, obviously, cannot be unconditionally put on a par with the above-mentioned amulets of bear claws. A distinctive feature of the latter is the lack of processing, with the exception of a drilled hole, and the elements of the considered belt ornaments are carefully cut products of a standard shape. Although the choice of such an unusual material for their manufacture as bear claws suggests that they could have had a special symbolic meaning.

Fig. 1. Belt ornament from the Zagarye cemetery of the 10th century (after (Spitsin, 1902)).

For the entire previous period of archaeological research on the territory of the Perm Region in western Urals, the only similar ornament was found in the destroyed part of the Zagarye cemetery of the 10th century (Spitsin, 1902: Pl. VII, 16) (Fig. 1)*. Judging by the fact that A.A. Spitsin, describing materials from the well-known archaeological collection of the Teploukhovs, mentioned this pendant when describing neck ornaments (Ibid.: 32), it was found out of context, or the finder kept silent about the circumstances of the discovery. Since such a find remained unique for a long time, none of the researchers specifically focused on it. The material from which the arc-shaped bars were made was not determined either. Probably, relying on the opinion of A.A. Spitsin, R.D. Goldina used this find as a basis for her judgment that bear fangs were part of necklaces (1985: 151), although in reality all the known amulets of bear fangs in graves were found in the waist area.

*Upon closer examination of the drawing, one can notice that parts of two pendants, probably originating from different destroyed graves, are stacked here.

Characteristics of pendants with bear claw pieces

The elements of composite belt ornaments cut from bear claws represent an arch-shaped bar 0.5–1.0 cm thick and 4–7 cm long. Its outer surface retains the structure of the claw, while the inner surface has a smooth cut (Fig. 1, 2). In the vast majority of products, a pair of holes is drilled in the central third. An exception is the lower bars of some ornaments that have additional holes in the center (Fig. 2, *5*, *6*). These extra holes were needed for fixing the ends of the cords on which the ornament was strung.

The bars of bear claws were strung on a pair of cords like a "rope ladder" with the curved side up. The pendants were hung vertically from the belt. The number of bone bars in different decorations ranges from 3 to 12; although, given the poor preservation of bones in the medieval burial grounds of the Perm Region in western Urals, it cannot be argued that in all cases their complete set is presented. When the first such ornaments were discovered, a version initially emerged about the use of claws from two paws of one bear to make the bars (probably the front ones, judging by the length of the bars). However, the bear has five-toed paws, and the best-preserved pendants (see Fig. 1; 2, *1*, *2*, *7*) contain 11–12 elements from the claws. Apparently, their number was determined by some special considerations. So far, owing to the limited range of sources, it seems premature to put forward any assumptions about this.

Only in two cases (graves 357 and 434 of the Boyanovo cemetery) was the main part of the ornament made exclusively of bear claws, without dividing elements (see Fig. 2, *3*, *4*). In all other pendants, one or two spherical bronze beads or short pipe beads with a pair of rounded bulges were strung on cords between the bone bars (see Fig. 1; 2, *1*, *2*, *5–9*).

Judging by the most fully preserved specimens, the upper part of the pendant was shaped as follows: one or two bronze beads were strung on cords above the end bar, and upward—spiral beads (see Fig. 2, *1*, *7*) or a set of bronze beads (see Fig. 2, *2*). The upper ends of the cords were attached to a waist belt. The pendants were usually placed on the belt at the front left (see *Table*).

In some cases, the lower ends of the cords were passed together through a hole in the center of the last bar, and then bronze beads or spiral pipe beads were strung on them (see Fig. 1; 2, *1*, *6*). In other cases, the ends of the cords were passed through a pair of holes in the lower bar, each one was strung with beads or spiral pipe beads, then the cords were connected and passed through several beads (see Fig. 2, *2*, *4*). In one of the pendants, immediately under the bar, the cords are brought together and a lunar pendant is tied to them (see Fig. 2, *8*). In another, also a single specimen, the cords are not connected, each of

Fig. 2. Men's belt pendants with bear claw pieces (excl. No. 10 with a bear fang).
1–8 – Boyanovo cemetery: *1* – grave 76, *2* – grave 128, *3* – grave 357, *4* – grave 434, *5* – grave 442, *6* – grave 459, *7* – grave 468, *8* – grave 479; *9*, *10* – Rozhdestvenskoye cemetery: *9* – grave 216, *10* – grave 388.

them has three bronze beads strung, fixed with bell-shaped beads in the lower section (see Fig. 2, *7*).

At the end of the pendant, which was hanging vertically on the garment, some kind of fixing element was needed. In its simplest form, it could be an ordinary knot of cords tied together. But for the carriers of the Lomovatovka archaeological culture, such a primitive fastening was not typical. They usually camouflaged the fixing knot by any volumetric beads, most often bells (see Fig. 2, *7*), or by tying a pendant from below (see Fig. 2, *8*); in the latest grave of the second half of the 11th century, a cross-cut bell was encountered (see Fig. 2, *9*). In those cases where nothing was preserved at the end of the string, it is more logical to assume that some kind of bone or even wooden amulet was tied there, rather than to admit the presence of an ordinary knot.

Judging by the data on graves where pendants with bear claw pieces were found (see *Table*), it can be argued that this was an element of an exclusively male costume, regardless of age. These were found in graves of children (from 2–4 years old), mature men (18–30 years old), and elderly (40–60 years old).

The composition of the accompanying grave goods suggests that the pendants in question were used among

Data on graves where pendants with bear claw pieces were found

Grave	Age of the buried person	Location of the pendant of the belt	No. of image at Fig. 2	Accompanying grave goods
BC76	20–30 years old	On the left	*1*	Mask, two temple rings, bracelet, finger-ring, three buckles, belt with overlays, knife, fire steel with flints, axe, arrowhead
BC128	40–60 years old	On the right (?)	*2*	Mask, two temple rings, pendant-horseman, fragment of belt with a bronze buckle and a fragment of bag, knife, saber, three bone and two iron arrowheads, bit
BC357	18–25 years old	On the left	*3*	Mask, two temple rings, bracelet, two finger-rings, belt (with overlays, buckle, and belt tip), knife, flint, saber, five arrowheads, bit, fragment of a wooden vessel
BC434	? (judging by the dimensions, a young male)	"	*4*	Mask (coins), two temple rings, bracelet, glass bead, pipe beads, belt (with overlays, buckle, and belt tip), knife, arrowhead
BC442	15–20 years old	"	*5*	Mask, two temple rings, bracelet, finger-ring, buckle, belt with overlays, knife, fire steel with flints, saber, axe, three arrowheads, bit
BC459	2–4 years old	"	*6*	Mask, bracelet, buckle, belt with overlays, knife, two arrowheads
BC468	5–6 years old	"	*7*	Mask, two temple rings, pendant-horseman, bracelet, finger-ring, knife, axe
BC479	?	"	*8*	Mask, two temple rings, bracelet, belt with buckle and overlays, knife, whetstone, small bag, four flints, axe, arrowhead, girth buckle
RC216	Adult	"	*9*	Belt set with overlays, fire steel, flint, axe, awl, hook knife, whetstone, two ceramic vessels, two horse teeth

Note. All the burials are male. BC – Boyanovo cemetery, RC – Rozhdestvenskoye cemetery.

the social elite. This is confirmed by both the presence of "wealth" (a significant amount of metal jewelry, including silver), and the presence of special "status" items. For example, in all the graves of the Boyanovo cemetery, where such pendants were found, there were funerary face covers with silver masks sewn onto them. In grave 216 of the Rozhdestvenskoye necropolis, the part where the skull was located was later destroyed by a village pit; therefore, it is impossible to discern the presence of a mask here. Most of the graves under consideration were accompanied by a saber or an axe, which are typical for the graves of the social elite, or by arrowheads. Sabers were present in graves 128, 357, and 442 of the Boyanovo burial ground, in combination with arrowheads and bits, and in the latter also with an axe. An analysis of the use of sabers in the funeral rite showed that in the Perm Region in western Urals they did not belong to the popular types of weapons, but rather were a confirmation of the high status of the owner. Elements of the horse harness indicate that those buried with sabers belonged to mounted warriors (Danich, 2012: 96, 104). Two graves at Boyanovo contained silver pendants in the form of a horseman's figure (in the literature, they are traditionally called "a horsewoman on a snake", but the materials of the Boyanovo cemetery convincingly indicate that this was a status ornament typical of the elite stratum of mounted warriors-vigilantes, and the pendants depict a horseman, not a horsewoman (Belavin, Krylasova, 2010)). In half of the graves, where pendants with bars of bear claws were found, there were elements of horse equipment (bit, girth buckle); in grave 216 of the Rozhdestvenskoye necropolis, horse teeth were found (see *Table*). The latter belongs to the number of male burials (which constituted 5.5 % of graves at this site), which contained special sets of household and industrial implements, usually located in the form of a compact accumulation at the feet of the interred. These burials belong to persons of special social status, possibly to the heads of families (Krylasova, Belavin, 2015).

As for the dating, at the Boyanovo burial ground, the pendants under consideration are presented in the graves of the late 9th to the first half of the 10th centuries. Grave 216 at Rozhdestvenskoye dates back to the second half of the 11th century. A similar decoration from Zagarye, as already mentioned, was dated by Spitsin to the 10th century (1902: 55, pl. VII, 16). Thus, it can be assumed that pendants with bear claw pieces were typical of the late 9th to 11th centuries. The final stage of the Lomovatovka culture belongs to this period, if we take into account the point of view of the need to transfer the border between the medieval cultures of the Perm region in western Urals from the 9th century to the turn of the 11th–12th centuries (Belavin, Krylasova, 2016). This

opinion was formed on the basis of the study of materials from the cemeteries of the 9th to 11th centuries, which were poorly studied by the time the periodization of the Middle Ages was developed, but were actively excavated in recent decades. In particular, one of the arguments in favor of extending the period of existence of the Lomovatovka culture is the consistent preservation in the funeral rite, up to the end of the 11th century, of items typical of its earlier stages; for example, wheel-shaped pendants (Demenki stage, late 7th to 8th centuries), or bottle-shaped beads (Urya stage, late 8th to 9th centuries) (Goldina, 1985: Fig. 16, *85*, *122*), etc.

In 2019, at both cemeteries under consideration, for the first time, lunar pendants were discovered, which are known in the Lomovatovka culture at the Demenki stage of the late 7th to 8th centuries (Ibid.: Fig. 16, *84*), in the Nevolino culture they are widely represented in the complexes of the Sukhoy Log stage of the late 8th to early 9th centuries (Goldina, Vodolago, 1990: Pl. LXIX, 54), and at the I Bolshiye Tarkhany necropolis of the late 8th to early 9th centuries (Kazakov, 1992: 51, fig. 13, *22*, *23*). In the Boyanovo materials, such a lunula completed the pendant with bars from bear claws found in grave 479, which dates to the late 9th to 10th centuries (see Fig. 2, *8*). At Rozhdestvenskoye, a similar pendant was found in the children's (2–4 year-old) grave 388. It completed the waist string of the bronze bottle-shaped beads, which became widespread in the 10th to early 11th centuries. Next to this string, there was an amulet made of a bear fang (see Fig. 2, *10*); therefore, symbolically, this complex can be partially compared with pendants containing bars from bear claws. In contrast to the early stages, which materials contained such lunar pendants mainly in the inventory of female graves, here they were part of the male belt accessories.

Conclusions

Unlike bear fangs, which are often mentioned in archaeological and ethnographic literature as being used among the Finno-Ugric population on both sides of the Urals, there is almost no information about bear claws. In settlement complexes, they occur extremely rare, and this situation is typical not just for the Perm Region in western Urals. In Eastern Europe, amulets made of bear claws are widely represented mainly in grave goods, which suggests that they were primarily an attribute of a funerary cult (Tyanina, 2011: 164). Taking this into account, it can be assumed that the pendants with elements carved from bear claws belonged exclusively to the male funerary costume. However, the difficulty of manufacturing, the complexity of composition of such pendants, their certain standardization, and at the same time, the individual characteristics due to subjective preferences of the jewelry maker, seem to be excessive for the production of a single-use item. Most likely, the rarity of these decorations can be explained by the rather limited period of their distribution (late 9th to the second half of the 11th centuries) and their use in a narrow social group.

Pendants with bear claw pieces certainly had some symbolic meaning, but it is difficult to say what exactly that was. It could have been a sign of a mythological relationship with a bear, a benevolent amulet to enhance certain qualities in a person, gain good luck and prosperity, or a talisman that protects against evil spirits, harm, and the evil eye.

Summing up, it can be argued that in the process of excavations in recent decades, a new type of belt ornaments has been identified, made according to a certain standard. These are characteristic of the final stage of the Lomovatovka culture, and were used by men (regardless of age) who belonged to an elite social group.

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Unfortified Settlements of the Cheptsa Culture (9th–13th Centuries): Ambiguity of Interpretation and Delimitation of Boundaries

Unfortified rural settlements have traditionally been detected by the presence of surface finds in tilled soil or of a cultural layer in test pits, by the conformity of the area to known landscape features, and by the absence of salient signs of defensive structures. The totality of these parameters is not always an unambiguous indicator of an unfortified settlement. Owing to intense tillage in the late 20th century, affecting many sites in Central Russia and the western Urals, their outward features have been obliterated, and erosion has resulted in a gradual displacement of habitation deposits from watersheds and slopes to negative landforms. Given these destructions and the resulting unreliability of traditional archaeological criteria, the most efficient way of revealing unfortified settlements, delineating their boundaries, and tentatively reconstructing their layouts, is to use multidisciplinary approach. This study focuses on medieval unfortified settlements in northern Udmurtia—Nizhnebogatyrskoye I, and Kushmanskoye II and III. Their outward features are virtually identical. They were explored using geophysical prospection, soil drilling, and archaeological excavations. On the basis of the results, types of settlement were reliably determined and boundaries of cultural layer were delimited. In all cases, preliminary interpretations were rejected. Kushmanskoye III is shown to be a fortified settlement, and Kushmanskoye II is likely to have been a medieval economic development zone without any structures. In the case of Nizhnebogatyrskoye I, its previously determined boundaries, deduced from the distribution area of finds and landscape features, were substantially corrected.

Keywords: *Medieval settlements, Cheptsa culture, settlement boundaries, defensive structures, geophysics, morphological/chemical soil properties.*

Introduction

Medieval settlements in the Cheptsa River basin were first systematically described at the end of the 19th century by A.A. Spitsyn (1893) and N.G. Pervukhin (1896). Starting from 1969, this region has been the main focus of research conducted by the Udmurt Institute of History, Language, and Literature of the Ural Branch, Russian Academy of Sciences. Over 300 archaeological sites are known there, including fortified and unfortified rural settlements, burial grounds, hoards, and isolated find localities (Arkheologicheskaya karta…, 2004).

At the turn of the 1st to 2nd millennia AD (Cheptsa culture), the center of settlement of the region was located in the middle reaches of the Cheptsa River, including its right and left tributaries. Over half the fortified settlements are concentrated on the high right bank of the river. Tributary streams and ravines cut the bank. This specific landscape situation was favorable

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Fig. 1. Settlements of the Cheptsa culture of the 9th–13th centuries.
1 – Kushman settlement of Uchkakar; *2* – Kushmanskoye III settlement; *3* – Kushmanskoye II settlement; *4* – Bogatyrka settlement of Utemkar; *5* – Nizhnebogatyrskoye II settlement; *6* – Nizhnebogatyrskoye I settlement.

to the construction of fortified settlements. The network of fortified settlements was developed there, and villages were established nearby. The latter were located on gently sloped hills or on fluvial terraces, near convenient descents to the river or brook. Rural Cheptsa settlements have been poorly investigated: small-scale archaeological excavations have been conducted at only two out of 34 settlements, and test pits have been made at 17 of them. At all other sites, artifacts have been collected from the ground surface. All that can be done with this amount of information is to confirm the presence of a cultural layer, attribute it to a certain culture, and assess its age. That is why archaeological methods must be supplemented by scientific analyses. Examined Kushmanskoye II and III, and Nizhnebogatyrskoye I, belonged to different settlement complexes (Fig. 1). Both are ambiguous despite having been excavated to a certain extent.

Kushmanskoye III

This site was discovered by G.T. Kondratieva (Otchet…, 1959). Animal bones and fragments of hand-made pottery were found on tilled ground (Arkheologicheskaya karta…, 2004: 202, 203). The settlement is situated 200 m east of the outer fortification line of Uchkakar (Mezhdistsiplinarnye issledovaniya…, 2018) and separated from its unprotected external part by a ravine. The absence of salient signs of defensive structures, as well as the proximity to the large fortified settlement, suggest an unfortified village. It is included into the Kushman complex of sites (Ivanova, Kirillov, 2012): the Uchkakar fortified settlement, three unfortified villages, and a burial ground. Deep gullies and the abrupt slope of the Cheptsa riverbank delimit the territory of Kushmanskoye III on the east, west, and south. In 2012, a test pit was made in the central part of the site, and a cultural layer up to 0.7 m thick containing artifacts from the 9th–12th centuries was revealed (Kirillov, 2012). This pilot archaeological survey confirmed the presence of a medieval settlement and its attribution to the Cheptsa culture. On the basis of landscape features, the site's boundaries were tentatively established (Kirillov, 2011), though its structure and layout remained unknown. The results of further multidisciplinary studies have been described in detail elsewhere (Zhurbin et al., 2019), so they are given here in a condensed form. Our research identified two lines of defensive structures, invisible in the relief. This has enabled us to define the structure of the settlement and to substantiate revision of the site's typological status in the register of state-protected archaeological resources. Multidisciplinary studies revealed clay platforms of houses, and round pits filled with material of different kinds (Ivanova, 2016, 2017). In the promontory part of the settlement, constructions were arranged in parallel rows oriented along the axis of the promontory. Before the inner fortification line and in the outer part of the site, the orientation of the rows changes: structures are parallel to fortifications (Zhurbin et al., 2019). The same linear layout was recorded at other settlements of the Cheptsa culture (Zhurbin, 2020; Ivanova, Zhurbin, 2014).

Kushmanskoye II

This site was also discovered by G.T. Kondratieva (Otchet…, 1959). Animal bones and fragments of hand-made pottery were detected lying on tilled ground. A ravine separates this site from Kushmanskoye III. Both settlements demonstrate similar external features. Natural boundaries delimit Kushmanskoye II on the south, east, and west (Arkheologicheskaya karta…, 2004: 202).

In the course of preliminary study (Kirillov, 2011), five test pits were made in different parts of the settlement (Fig. 2). A similar situation can be observed in test pits 1–4: the tilled horizon overlies soil-forming sediment consisting of Permian clays with limestone debris. A cultural layer is present only in test pit 5, located in a small valley, in the zone of accumulation of fine-textured soil. Here, the tilled horizon is underlain by the cultural layer of a recent village: grayish-brown heavy loam varying in color, with inclusions of stones and fine debris. This layer covers buried soil—dark gray, dense, and heavy loam. Even lower, directly above the soil-forming material, an inhomogeneous layer of gray loam with fragments of subsoil clay and numerous charcoal pieces can be observed. Exactly this layer indicates that this territory was inhabited during the Middle Ages. Archaeological remains were found only in test pits 1, 2, and 5. They are represented mostly by wheel-thrown pottery from the 17th–19th centuries. Only two fragments of hand-made ceramics of the 10th–12th centuries were unearthed. Thus, it has been found out that the medieval cultural layer is not present throughout the site. Cumulative elements of relief contain evidence of a settlement attributable to the 17th–19th centuries.

Obviously, these results do not rule out the possibility that underground parts of medieval structures have been preserved. To find these, geophysical methods, including resistivity and magnetometry surveys, ground-penetrating radar, and electrical resistivity tomography, were employed. At a rated depth of 0.44–0.60 m, georadar survey (Fig. 3, *a*) revealed two parallel linear anomalies intersecting the entire geophysical survey area from NW to SE (possibly, sides of the road or irrigation structures), as well as adjoining two compact groups of mutually perpendicular linear anomalies (possibly, strip foundation of buildings or earth fill along the walls). The shapes and locations of the anomalies

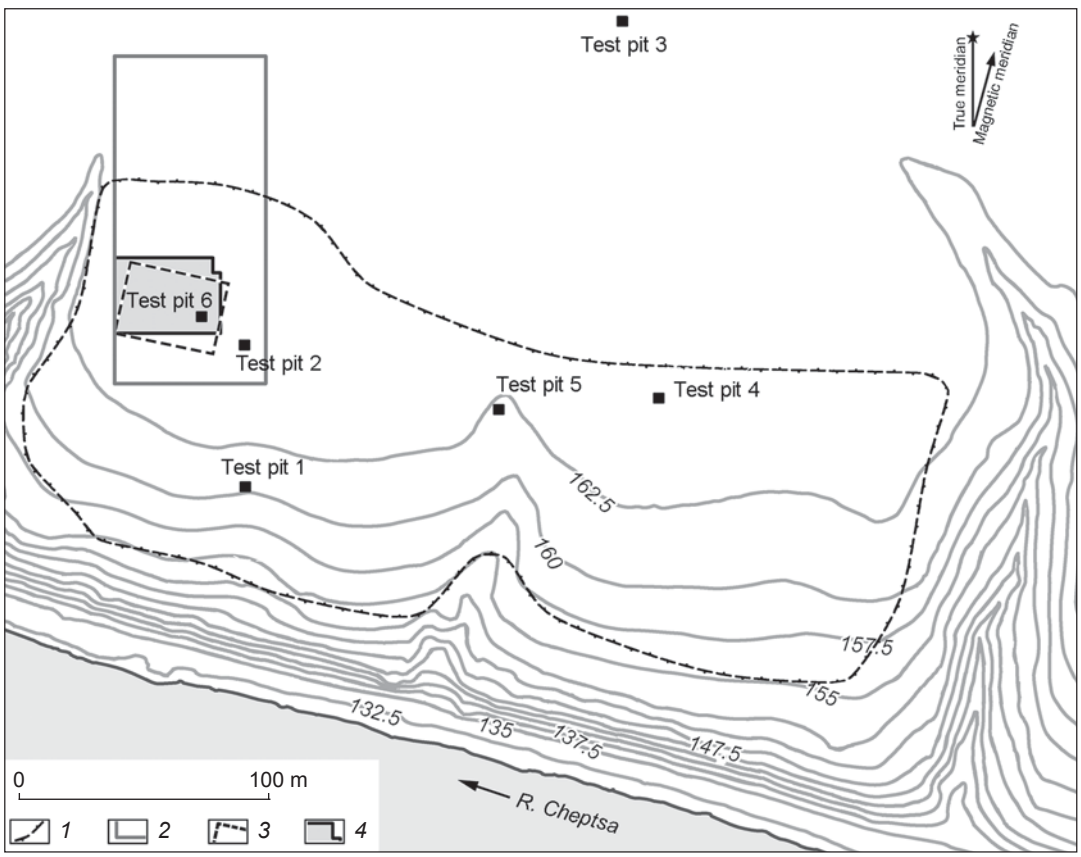

Fig. 2. Digital model of Kushmanskoye II landforms; location of archaeological and geophysical study areas (basis by N.G. Vorobieva, "Finko" LLC, supplemented by R.P. Petrov, Udmurt Federal Research Center, Ural Branch, Russian Academy of Sciences). The altimetric system is conventional.

1 – boundaries of the settlement according to landscape features (after (Kirillov, 2011: Fig. 79)); *2–4* – boundaries of areas examined by ground-penetrating radar (*2*), magnetic (*3*), and resistivity (*4*) surveys.

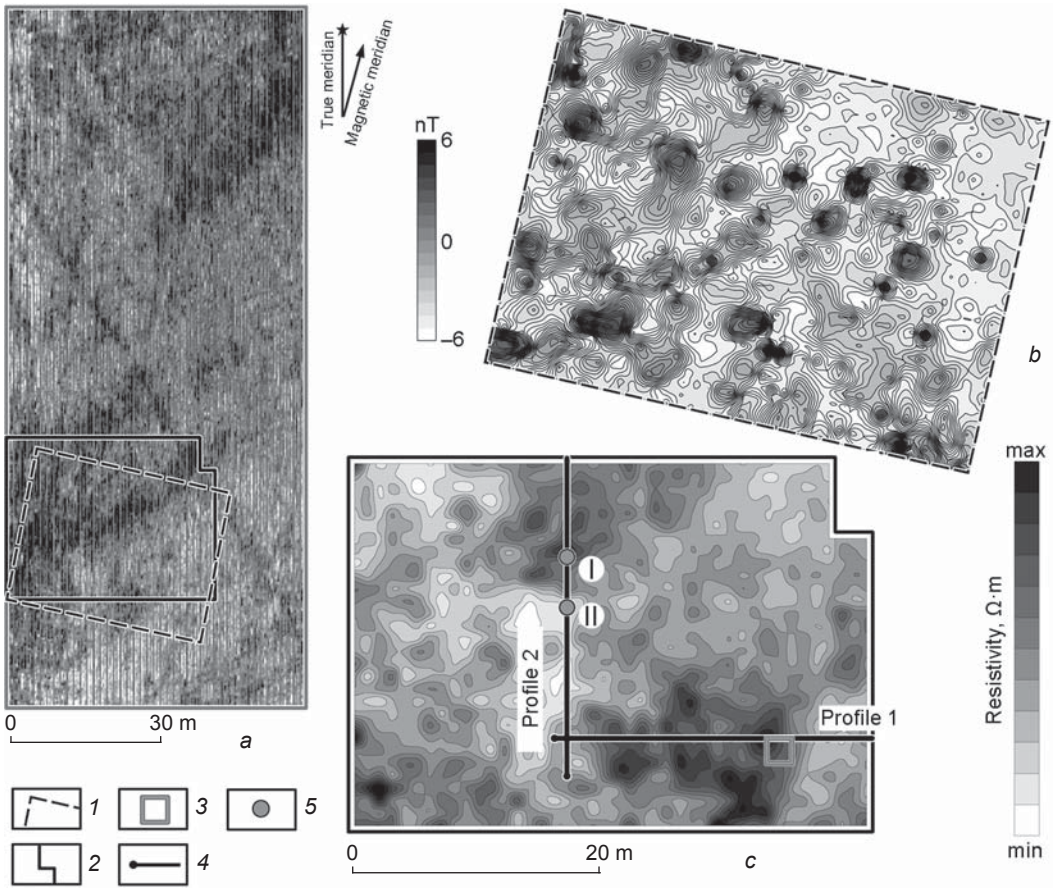

Fig. 3. Results of multidisciplinary studies of Kushmanskoye II.
a – ground-penetrating radar survey (rated depth 0.59 m; V.G. Bezdudny, Laboratory of Archaeological Geophysics, Rostov-on-Don); *b* – magnetogram (V.G. Bezdudny); *c* – resistivity survey.
1, *2* – boundaries of magnetic (*1*) and resistivity (*2*) surveys; *3* – test pit; *4* – line of electrical resistivity tomography profile; *5* – soil core.

suggest that these objects were not associated with the medieval settlement. Magnetometry and resistivity surveys were conducted in the area where structures of various types were located. The collation of ground-penetrating radar and magnetic maps demonstrates their similarity. The magnetometry survey (Fig. 3, *b*) revealed linear structures in the northwestern part of the prospected area, which coincided with linear anomalies shown by the radar. Three zones of high resistivity were recorded through resistivity survey (Fig. 3, *c*). Geoelectric profiles demonstrated contrasting upper layers associated with these anomalies, and an absence of humic soil layer between them (western and eastern parts of profile 1, Fig. 4, *a*; southern part of profile 2, Fig. 4, *b*). In most cases, the coordinate comparison of local anomalies on electric and magnetic maps reveals no correspondence. Therefore, the presence of medieval features is questionable.

Since the results seemed to be ambiguous, soil drilling was conducted in several places along the line of profile 2 (see Fig. 3, *c*), "crossing" one of the high resistivity zones. Test pit 6 was made in another zone (Ivanova, 2016). These anomalies were also revealed through magnetometry survey. As excavations and soil drilling (see Fig. 4, *c*) have shown, the geophysical anomalies are associated with local zones with high content of carbonates. In core I, a carbonate platform lies at a depth starting from 0.3–0.4 m. The situation is quite different in core II, so the resistivity is low in this place, contrasting sharply with the local zone of high resistivity. A similar picture can be observed in test pit 6 (see Fig. 3, *c*; 4, *a*): a layer of limestone lies in the northwestern corner under the tilled horizon. It is possible that geological peculiarities are responsible also for other local anomalies recorded at Kushmanskoye II. Archaeological remains from test pit 6 consist

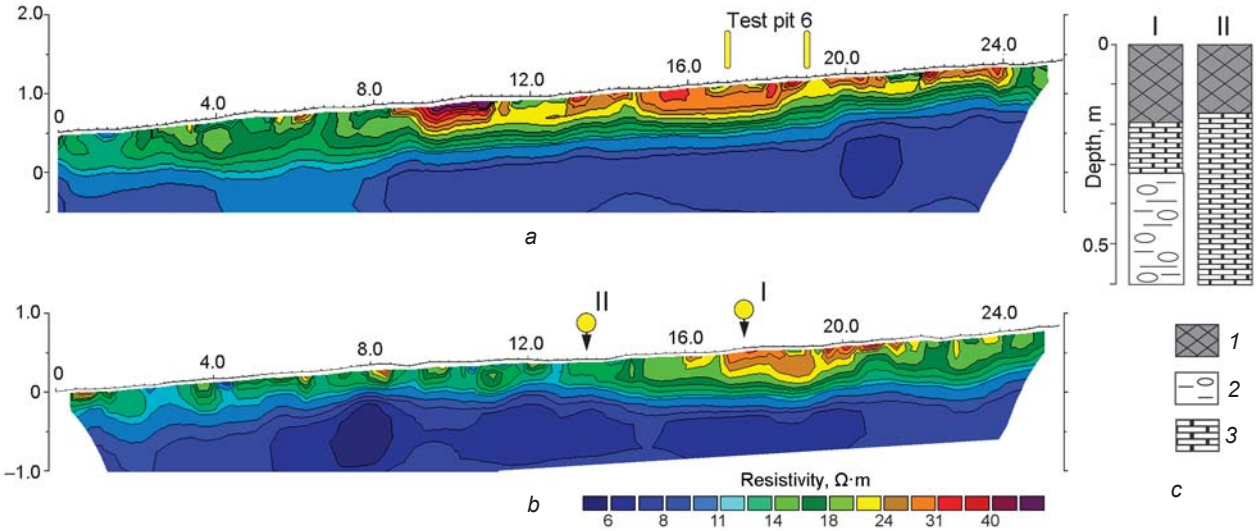

Fig. 4. Geoelectric sections along profiles 1 (*a*), 2 (*b*), and lithological structure of cores (A.V. Borisov, Institute of Physicochemical and Biological Problems of Soil Science, Russian Academy of Sciences, Pushchino) (*c*).
1 – tilled horizon (heavy loam); *2* – limestone slab; *3* – subsoil clay.

mostly of ceramic fragments (Ibid.). Only two of them are typical of the Cheptsa culture (9th–13th centuries), while the other ten are pieces of wheel-thrown vessels attributable to the 18th–19th centuries. Such a situation agrees with finds from other test pits. Consequently, the presence of a medieval site at that place is not supported. Isolated fragments of handmade vessels and the lack of structures likely suggest that the area was part of a manufacturing and trade zone associated with nearby settlements—rural (Kushmanskoye III) and fortified (Uchkakar).

Nizhnebogatyrskoye I

This site is situated on the right bank of the Cheptsa River, near Nizhnyaya Bogatyrka village (Arkheologicheskaya karta…, 2004: 157, 158). The settlement occupies a large promontory of the first terrace of the bedrock riverbank. The promontory is delimited by a ravine on the west, a steep bank of the Cheptsa on the south, and by the next steeper ledge of the terrace on the north (Fig. 5). Until recently, the surface of the site was tilled. A modern road passes between the northern boundary of the site and the southern base of the promontory part of the high bedrock river terrace, where the Utemkar fortified settlement was located (Ibid.: 142). Nizhnebogatyrskoye I, Nizhnebogatyrskoye II (Ibid.: 158), and Utemkar constitute a single archaeological complex.

N.G. Pervukhin, describing Utemkar (1896: 76–78), was the first to mention the site of Nizhnebogatyrskoye I, though he did not regard it as a separate settlement. The author assumed that this was the concentration place of habitation deposits, which had been "washed down the slope in the southeastern direction, across the road and toward the Cheptsa riverbank, where they had partly mixed with sand" (Ibid.: 78). Notably, Pervukhin mentioned a road as a landmark. Supposedly, the road ran farther south than the modern one (see below). Medieval artifacts were encountered throughout the slope, right down to the river. In 1959, Nizhnebogatyrskoye I and II were identified as separate archaeological sites (Otchet…, 1959). Further investigations concentrated on surveying and collecting artifacts from the surface.

The ambiguity of interpretation of Nizhnebogatyrskoye I required geophysical prospection. The results thus obtained were corroborated by soil drilling and archaeological excavations (Fig. 5). Magnetometry survey was the principal method employed. The northern boundary of the prospected area passed along the modern road. In its western part, where the highest density of magnetic anomalies was recorded, a resistivity survey and electrical resistivity tomography were conducted. The choice of the place for a geophysical survey was motivated by the distribution pattern of surface finds (Derendyaev, 2016: Fig. 6).

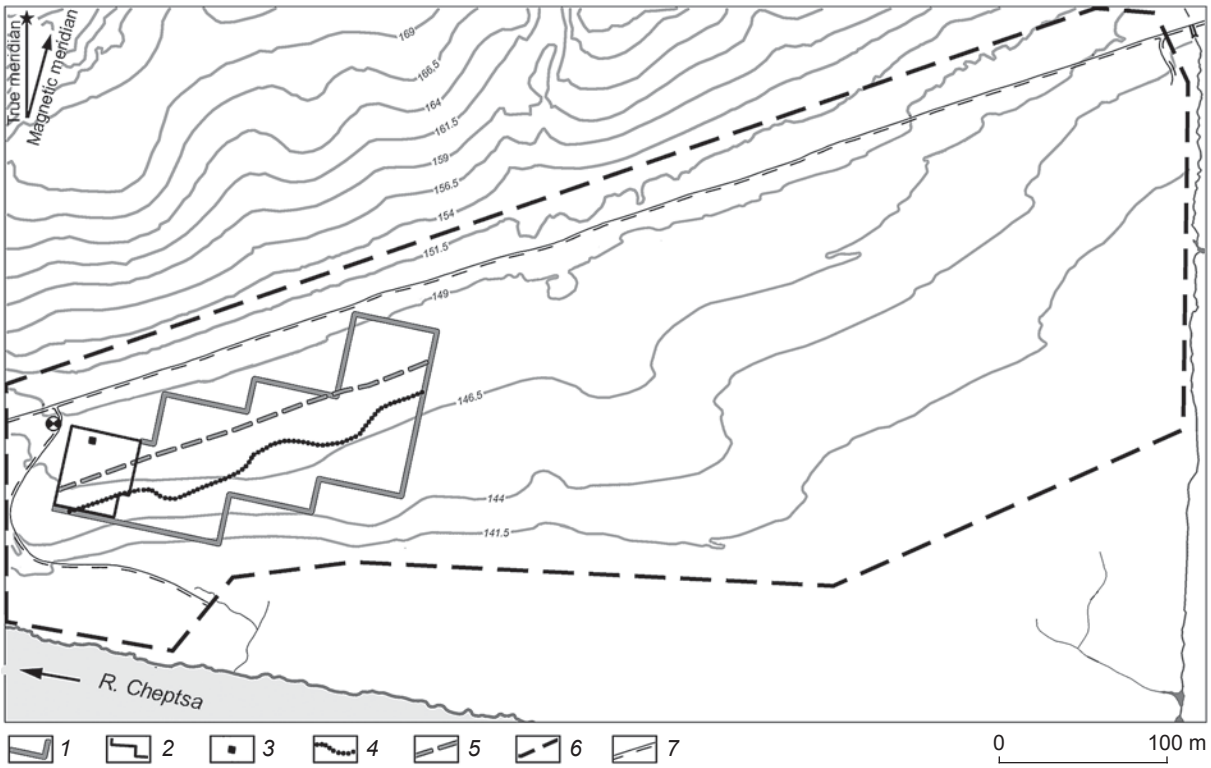

Fig. 5. Digital model of Nizhnebogatyrskoye I landforms; location of archaeological and geophysical study areas (basis by N.G. Vorobieva, "Finko" LLC, supplemented by R.P. Petrov, Udmurt Federal Research Center, Ural Branch, Russian Academy of Sciences). The altimetric system is conventional.
1, *2* – boundaries of magnetic (*1*) and resistivity (*2*) surveys; *3* – excavation; *4* – boundaries of the settlement according to geophysical data; *5* – presumable line of the 19th century road; *6* – boundaries of the settlement according to landscape features (after (Derendyaev, 2016: Fig. 5)); *7* – modern road.

The magnetogram (Fig. 6, *a*) demonstrates linear zones of high resistivity oriented along the SW-NE line. Their location and orientation clearly agree with relief changes. The area is flattened by modern tillage, though initially it had mesorelief in the form of riverbed-adjacent ridges typical for flood-plains. Therefore, most linear anomalies correspond to zones of accumulation of fine-textured soil transported into negative landforms. One of these, running along the whole area of magnetic survey, is apparently wider and more intensive than others. The geoelectric profile "crossing" this anomaly (range of 16–24 m; Fig. 6, *b*) also shows deposits of a different type. These facts allow us to associate the feature with the road, which was a topographic landmark in Pervukhun's description of the area with disturbed habitation deposits of Utemkar. Clearly, this suggestion must be tested by excavations.

The magnetic survey (Fig. 6, *a*) recorded a high concentration of anomalies in the areas adjacent to the modern road. Dipolar magnetic anomalies, possibly associated with deepened objects containing pyrogenically modified matter, as well as high-magnetization zones, are present there. They are traced on a heterogeneous background formed by numerous, chaotically located low-amplitude anomalies. A structure of this sort normally corresponds to a cultural layer containing artifacts with high magnetization (ceramics, slag, oven stones). Quite a different situation is observed closer to the Cheptsa River: rare areal positive anomalies are visible on a rather homogenous background. Judging by the past findings at sites destroyed by tillage, the boundary between these areas coincides with that of the habitation deposits (see Fig. 5; 6, *a*).

The resistivity survey revealed no local anomalies associated with layout features. Anomalous high resistivity zones of an indefinite shape may be connected with sections of a thick cultural layer. Two such sections correspond to dipolar anomalies recorded through the magnetic survey. Soil drilling revealed culture-bearing deposits of considerable

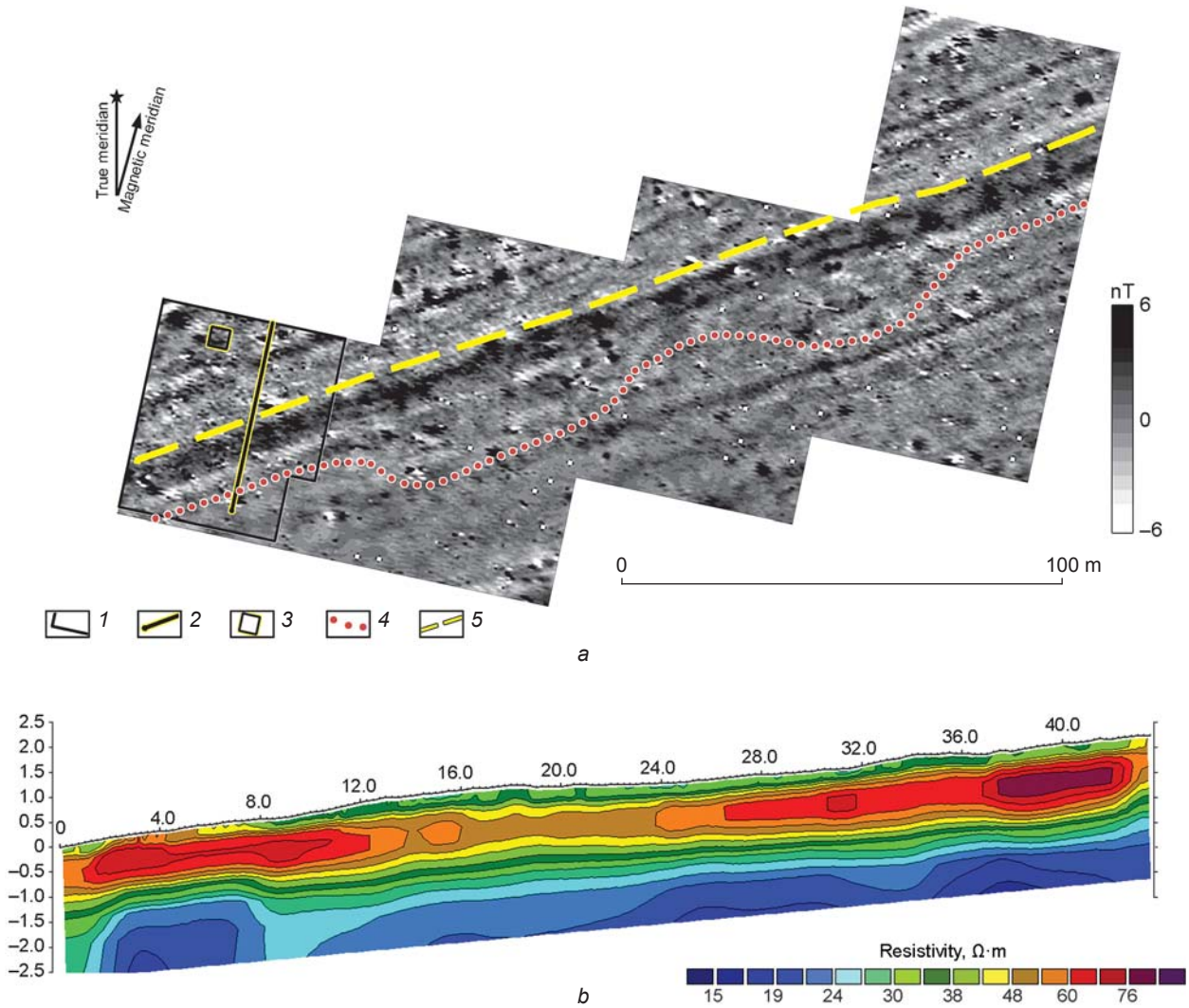

Fig. 6. Results of geophysical studies of Nizhnebogatyrskoye I.
a – magnetogram (V.G. Bezdudny, Laboratory of Archaeological Geophysics, Rostov-on-Don); *b* – geoelectric section.
1 – boundary of resistivity survey; *2* – line of electrical resistivity tomography profile; *3* – excavation; *4* – boundaries of the settlement according to geophysical data; *5* – presumable line of the 19th century road.

thickness (up to 1 m), containing a layer of loam at least 0.3 m thick with ceramics, fragments of charred clay, charcoal, and ash (Emelianova, 2018: Suppl. 4). The presence of dipolar anomalies was determined by the high concentration of such inclusions. Geoelectric profiles show no layout features either. Soil drilling confirms this observation. The differential characteristic is the absence of evidence of heating facilities or visible layers of baked and compacted clay typical of other sites of the Cheptsa culture. It is possible that in the study area, there were no permanent buildings with clay platforms under hearths or ovens. This may be explained by the floodplain character of the area and periodical flooding of the low terrace.

A test pit (see Fig. 6, *a*) was made for archaeological evaluation of the revealed situation. Regrettably, owing to limited time and adverse weather conditions, excavations were ceased at a depth of 0.5 m from the surface (Ibid.: 3). The collection of finds comprises 5731 artifacts. Most numerous are fragments of hand-made pottery, crucibles, and clay coating. There are also bone fragments, slag, and artifacts made of bone, stone, iron, and nonferrous metals. On the basis of the archaeological remains, Nizhnebogatyrskoye I can be tentatively attributed to the Polom and Cheptsa cultures of the 7th–12th centuries. Because the excavation is small and has not been examined in full, some features of its layout may have remained undetected.

Thus, the main result of the multidisciplinary research is allocation of the southern boundary of the cultural layer at the site (see Fig. 5). Our findings do not rule out the Pervukhin's idea that habitation deposits of Utemkar had accumulated in that place. If a separate site did exist, then the examined area was part of its fringes. The main feature differentiating Nizhnebogatyrskoye I from other examined settlements of the Cheptsa culture is the absence of traces of large permanent buildings.

Conclusions

Examination of three unfortified settlements of the Cheptsa culture produced unexpected results. Unfortified rural settlements have been detected by the presence of surface finds in tilled soil or of cultural layer in test pits, by the conformity of the area to known landscape features, as well as by the absence of salient signs of defensive structures. Multidisciplinary studies showed, however, that the absence of salient fortifications does not always indicate an unfortified site. For example, at Kushmanskoye III, two fortification lines, possibly destroyed by tillage, were detected. It was also shown there that the absence of layout features does not necessarily indicate the boundary of the site. The area of the household's periphery is evidenced by changes in the chemical and biological properties of the soil far beyond the outer fortification line of this newly discovered site. Studies at Nizhnebogatyrskoye I, where no fortifications were found, demonstrate that the landscape boundaries of the area do not always coincide with those of the site. Geophysical findings suggest that the habitation area was much smaller than the estimate derived from the pilot archaeological survey. Also, the presence of artifacts on the surface of the tilled field or in the test pit is not enough to conclude that there was a site. The totality of facts resulting from multidisciplinary geophysical, pedological, and archaeological studies at Kushmanskoye II does not support the idea that a medieval site was present in that area.

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Sections of the Early 18th Century Ditch at Fort Umrevinsky

This article describes identified sections of an early 18th century ditch at Fort Umrevinsky in the Upper Ob Basin. Such protective structures mark a certain stage in the evolution of military engineering in the era of Peter the Great (1694–1725) in southwestern Siberia. The design of the earliest parts of the preserved ditches allows us to address the influence of European fortification on Early Modern Russian defensive architecture. Several factors affecting the depth and profile of early 18th century ditches at Umrevinsky are discussed. They include seasonality of specialized trenching tools and the adoption and transformation of European fortification principles by 17th and early 18th Russian military engineers. At Umrevinsky, apart from the specific profile of the ditch, specialized tools were revealed, similar to those mentioned in documents on 18th century fortification. Also, specific features of the preserved parts of the ditch mirror the utmost irregularity in adoption of de Vauban's fortification principles of the Tsardom of Muscovy, including Siberia. Our finds at Fort Umrevinsky supplement the scarce descriptions of Siberian forts in Russian documents.

Keywords: *Russian forts in Siberia, fortification, Peter I era, earthen defense structures, colonization of the Upper Ob Basin by the Tsardom of Muscovy.*

Introduction

The time of Peter the Great (1686–1725) in Russia was distinguished by extremely uneven distribution of the European principles of fortification. In the early 18th century, in southwestern Siberia, including the Upper Ob region, the principles of fortification of the Tsardom of Muscovy still dominated in the construction of earthen fortifications in forts, including Fort (Ostrog) Umrevinsky. It was built in 1703 by settlers from Fort Urtamsky on the right bank of the Ob River, slightly upstream from the mouth of its tributary, the Umreva River (Shunkov, 1956: 66, 67; Emelyanov, 1981: 131). The subsequent long existence of Fort Umrevinsky and its repeated reconstruction throughout the 18th century resulted in problems with identifying the original earthen fortifications (ditches) in the course of archaeological research. Solving these problems was the main goal and objectives of this study, aimed at locating the earliest sections of the ditch, conducting their relative dating, and analyzing the reasons behind the specific features in construction and functioning of earth fortifications. Studying these elements in the fortification of Siberian forts can make it possible to identify the historical dynamics of interaction between various fortification traditions during the construction of these border points of the Tsardom of Muscovy in Peter I era.

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Identification of the parts of the early ditch at Fort Umrevinsky

During the field research in 2002–2018, it was possible to identify the corners of the southwestern ditch (Fig. 1, *1*), which most likely remained from the early 18th century. Their archaeological study was carried out in depth. First, the configuration of corners in defensive structures as the most effective firing points fully reflects the features of fortification traditions of the time. Second, owing to a number of factors, parts of ditches have survived in their original form precisely in these areas. Third, the foundations of the later corner wooden defensive towers were found at the corners. The location of the towers relative to the early ditches reflects the sequence of construction periods, as well as innovations in fortification methods (Fig. 1, *1*, *3*, *4*).

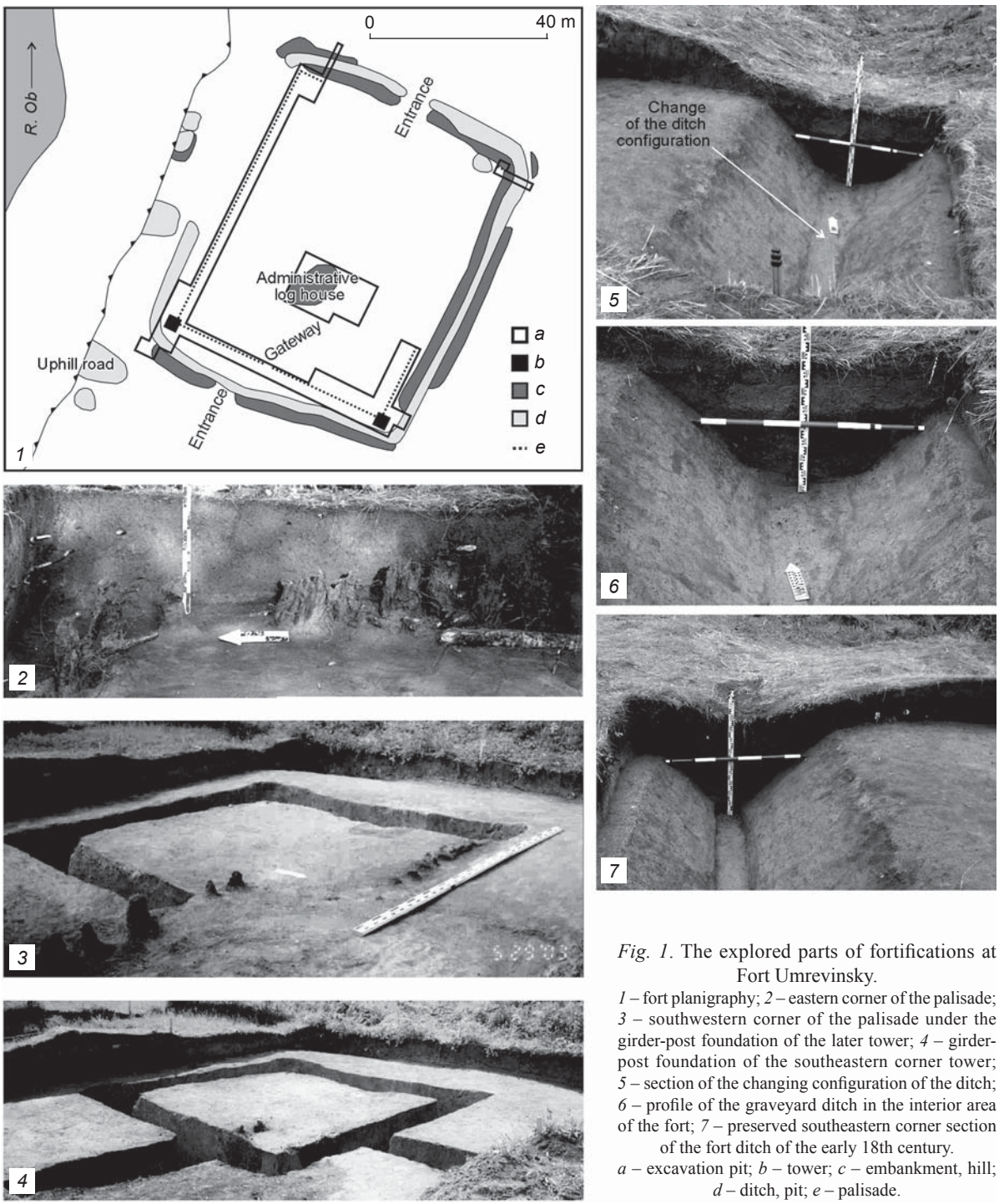

Fig. 1. The explored parts of fortifications at Fort Umrevinsky.
1 – fort planigraphy; *2* – eastern corner of the palisade; *3* – southwestern corner of the palisade under the girder-post foundation of the later tower; *4* – girder-post foundation of the southeastern corner tower; *5* – section of the changing configuration of the ditch; *6* – profile of the graveyard ditch in the interior area of the fort; *7* – preserved southeastern corner section of the fort ditch of the early 18th century.
a – excavation pit; *b* – tower; *c* – embankment, hill; *d* – ditch, pit; *e* – palisade.

According to stratigraphic observations in different parts of the fortification corners, discharged soil from the ditch did not cover the palisade ditch and palisade poles. An important fact was the presence of the foundation coin (denga of 1730), laid with its head up on the foundation of one of the corners in the girder-post foundation of the southwestern tower. The date minted on this coin correlates well not only with the frequency of repairing wooden structures (on average 29 years) (Varfolomeev, Shapovalova, 1991), but also with the renewal of Fort Umrevinsky, the need for which was indirectly mentioned in the written sources of the first third of the 18th century (State Archive of the Novosibirsk Region. F. D-105, Inv. 1, D. 6; see also (Messerschmidt, 1962: 78–79; Romanov, 2019)). Decay of palisade walls in other forts was also mentioned in this period (S.P. Krasheninnikov…, 1966: 51; Gmelin, 1751: 301).

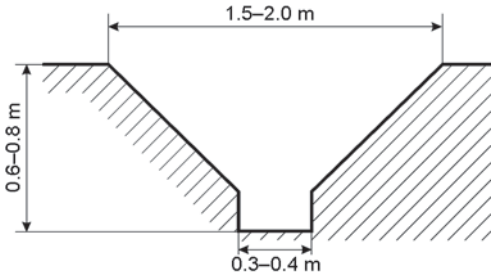

Fig. 2. Diagram of the cross-section of the ditch from the early 18th century in the southwestern corner part.

The southwestern corner of the ditch, excavated in 2002–2003, had a specific sub-trapezoidal profile with a deepening at the bottom (Fig. 2). The width of the ditch in the upper part was 1.5–2.0 m; the width gradually decreased towards its base to 0.35–0.40 m. The total depth was 0.6–0.8 m. Traces of intense burning were found in the stratigraphic cross-section of this part of the ditch (Fig. 3, *1*) (Borodovsky, Gorokhov, 2008: 73, fig. 5), which could have been caused both by anthropogenic factors and natural events. Such traces have been archaeologically observed in a number of Siberian forts (Bratsky, Albazinsky, Kazymsky, and Tobolsky). Another major extensive and powerful calcined spot was located near the girder-post foundation of the tower facing the river bank (Fig. 3, *1*).

A different stratigraphic situation was discovered at the opposite, southeastern corner of the earthen fortifications at Fort Umrevinsky (see Fig. 1, *1*, *5–7*). Two cross-sections of the ditch in this area (Fig. 4) reflected different periods of its construction and subsequent renovation. In its lower part, the filling of the ditch consisted of yellow loam interspersed with humus. It emerged from natural sliding of loam from the slopes into the ditch and its mixing with the sod layer, which

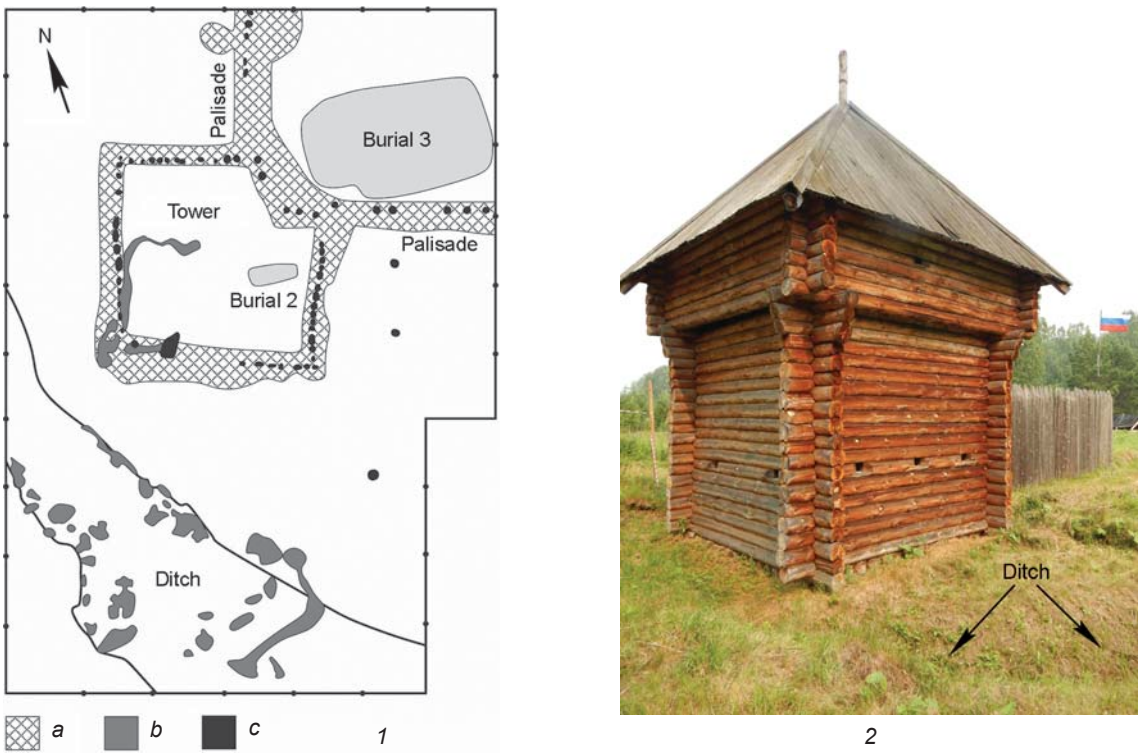

Fig. 3. Planigraphy of the southwestern corner of the timber-earthen fortifications (*1*) and the restored corner tower of the fort facing the river bank (*2*).
a – ditch of the palisade and tower foundation; *b* – traces of burning; *c* – wooden posts and slabs.

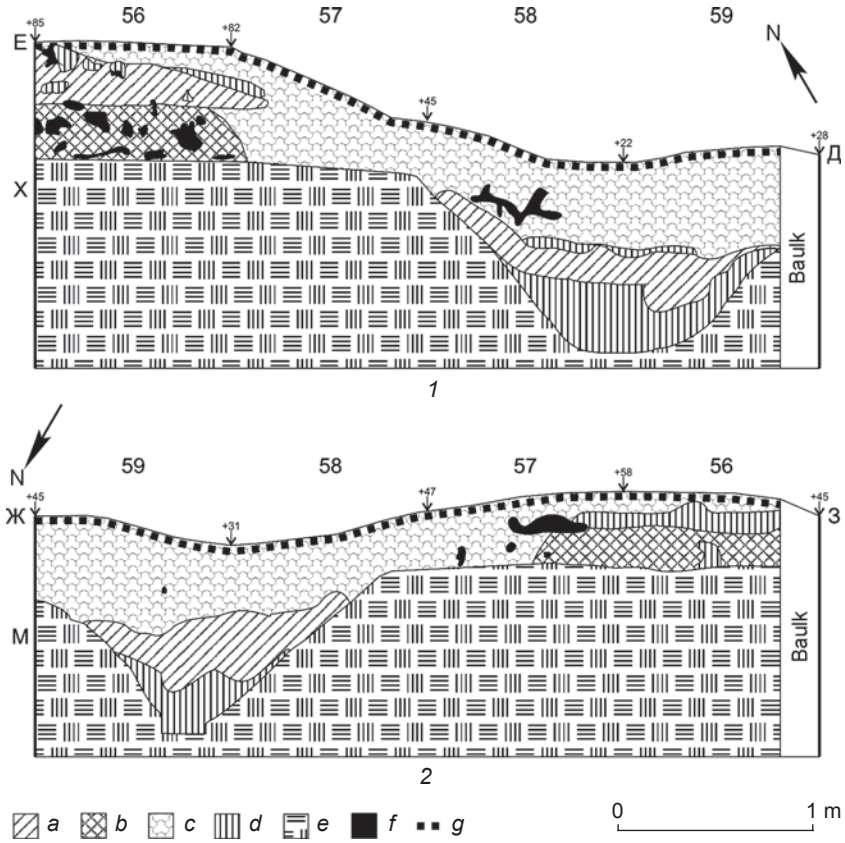

Fig. 4. Stratigraphic cross-sections of the graveyard ditch (*1*) and fort ditch of the early 18th century (*2*).
a – homogeneous mixture of humus and clay; *b* – dark gray humus; *c* – light gray humus; *d* – yellow clay interspersed with black humus; *e* – dark yellow clay (sterile surface); *f* – rootstalks; *g* – sod.

was formed on the surface of the ditch and embankment. The profiles of the ditch in two opposite sections differed significantly (Fig. 4). The profile was cup-shaped in the cross-section along the northern wall (see Fig. 1, *5*, *6*; 4, *1*), but was sub-trapezoidal with a small deepening at the bottom along the southern wall (see Fig. 1, *7*; 4, *2*) of the excavation pit. This part of the southeastern ditch was similar in size and profile to its southwestern corner (see Fig. 2). Such changes in parameters and outlines of the southeastern corner of the ditch might have occurred when it was deepened. This was needed for setting up the fence of the rural graveyard on the territory of the fort, which no longer existed since the turn of the 18th–19th centuries.

Discussion of the research results

In the 17th–18th centuries, fortification ditches in the European "Vauban" tradition were built according to pre-selected profiles (Vauban, 1744: 13). The presence of a small deepening in the base of the ditch at Fort Umrevinsky is notable, since the size of this element suggests that it resulted from the use of some type of earth-moving device.

Small "cut-off" iron shovels were of particular importance as entrenching tools of the 18th century intended for constructing earthen fortifications. They had sockets into which wooden handles were inserted. Fortification literature specifically mentions the mass of these earth-moving tools, which was 4–5 pounds (Ibid.: 18, 19). Given that the pound in Russia in the 18th century corresponded to 409.5 g (Shostyin, 1975: 258), the mass of the iron shovels could have ranged from 1638 to 2047.5 g. Notably, the working part of a small "cut-off" iron shovel was accidentally found in the vicinity of Fort Umrevinsky. In its design and mass, it was similar to the above-mentioned earth-moving tools of the 18th century. This makes it possible to suggest the possibility of having used such earth-moving tools in constructing ditches at Fort Umrevinsky in the early 18th century.

According to the present-day geological descriptions, soils in this area mainly consist of aeolian-deluvial loams distinguished by a not very high bearing capacity (Raiony…, 1996: 327). However, in the case of a relatively shallow ditch of the early 18th century, such soil relatively well preserved the original profile of the ditch until its subsequent later filling. At the

southwestern corner of the ditch, this process was almost instantaneous after the fire.

Comparison of the main characteristics of a ditch of the early 18th century with the standards of the previous 17th century (Ustav…, 1777: 121–125) demonstrates some differences in basic proportions, sizes, and depth. In the first quarter of the 17th century, difference in the width of the ditch on top and at the bottom was not so significant, and the depth was almost one third of the width along the upper edge. Steepness of walls in ditches was also greater with the ratio of the width of a ditch at its top to its bottom varying from 3 : 1 to 6 : 1 (Shor, 1958: 27).

Subsequently (the 1730s), construction of two corner towers on the southeastern side of the palisade defenses at Fort Umrevinsky led to significant changes in the original fortification (see Fig. 1, *1*). First, the corner towers protruding beyond the palisade wall received the function of bastions (see Fig. 1, *1*; 3). Such a fortification solution resulted in significant increase in fire sectors. Second, the distance from the corners of the southeastern defensive structures to the outer ditch, which was built in the early 18th century, decreased over four times. Proximity of the girder-post foundations of the towers to the corner sections of the ditch is one of the signs of various construction periods in the history of Fort Umrevinsky.

Thus, it can be concluded that the southeastern part of the timber-earthen fortifications acquired its "bastion" appearance only by the first third of the 18th century. However, these improvements were not reflected in the original outline of the ditch. The traditional wooden towers, widespread in Siberia from the late 17th to mid 18th century (Borodovsky, Gorokhov, 2008: 78; Gorokhov, 2020), were built on girder-post foundations instead of European corner elements of fortifications (bastions) (see Fig. 3, *2*), whereas judging by the second "version" of the existence of Fort Albazinsky (1685–1686), bastion-type ditches were built in the Amur region already in the late 17th century (Albazinsky ostrog…, 2019: 177; 179, fig. 2.4.8; 191, 192). Reliable information on the appearance of bastions in the Eastern European part of the Tsardom of Muscovy refers to the late 16th century (Nosov, 2002: 101). Construction of European-type bastions in southwestern Siberia is known from the early 18th century (the old Omsk fortress) (Borodaev, Kontev, 2015: 170–172), while the "bastion" placement of corner towers in the combined system of Old Russian and European fortification traditions can be clearly seen in the planigraphy of the stone Gostiny Dvor (indoor market complex) of the Tobolsk Kremlin, built by S.U. Remezov at the early time of Peter's reign (Kirillov, 1974: 63). Such facts clearly demonstrate the extreme unevenness in the spread of the European principles of fortification in Peter's time over Siberia as a whole. It is equally important that subsequently, throughout the 18th century, the distinctive feature of Siberian border fortified lines was a harmonious combination of the latest achievements of Western European fortification with the Russian experience of building defensive structures (Muratova, 2007: 113). This process is rather consistently manifested by the example of Fort Umrevinsky.

The first construction period (the early 18th century) corresponded to the appearance of a sub-rectangular wooden defensive structure made of round palisade posts in 1703. Its expressed geometric outline agrees well with recommendations for constructing and planning fortifications, presented by A. Radyshevsky as far back as the 17th century (Nosov, 2002: 168). As opposed to the right angles of the palisade fence at Fort Umrevinsky (see Fig. 1, *2*, *3*), the corners of its ditches in these areas were rounded (see Fig. 1, *1*; 3, *1*). The distance from the corners of the wooden defensive structure to the inner edge of the ditch was more than 1.7 m, which corresponds to a *makhovaya sazhen* (1.78 m), and reached 6 m from the southeastern wall (Shostyin, 1975: 256, 259).

The second construction period (first half of the 18th century) is associated with the functioning of Fort Umrevinsky as a defensive, administrative, and religious center in the north of the Upper Ob region. At that time, two corner towers and an administrative log house were built (see Fig. 1, *1*, *3*, *4*; 3). The distance from the corners of the foundations of the towers to the inner edge of the ditch was 0.4 m. This is closest to such a measure of length as the cubit, which was already an archaism for the 18th century (Ibid.: 256). Traces of periodic cleaning of the ditch have not been stratigraphically found in its explored sections. Such a procedure was necessary for the long-term functioning of ditches (Svistun, 2016: 369). The absence of traces remaining from cleaning the ditch can be explained both by its shallow depth and by the relative density of the soil in which it was dug. It was experimentally established that the inclined walls of such a ditch naturally acquired an original sod layer already seven years after they were unearthed by the excavations (Borodovsky, Gorokhov, 2008: 73).

The third and final construction period (late 18th to early 19th centuries) corresponds to the time when Fort Umrevinsky lost its importance; its wooden defensive structures decayed, and the main area turned into a graveyard. According to written sources, fortifications in the Novosibirsk Ob region underwent the process of destruction in the last third of the 18th century. For example, in 1773, Fort Chaussky lost its fortifications (Pallas, 1788: 7); in 1791, the defensive structures of Fort Berdsky were dismantled and sold (Minenko, 1990: 32). In 1794, Fort Umrevinsky disappeared from the maps of the Kolyvan-Voskresensk district for the first time (Russian State Historical Archive. F. 485, Inv. 5, D. 480, fol. 1). Not earlier than this time, judging by the archaeological evidence, the deepened ditch, which acquired a bowl-

shaped profile (see Fig. 1, *5*, *6*; 4, *1*), became an earthen border of the Umrevinsky graveyard. Embankments were formed on the outer and inner sides of the ditch. In some areas, the embankment covered the trench of the fort palisade with the already disappeared posts, but the corners of the early ditch of Fort Umrevinsky remained free, which contributed to preservation of their original appearance, as also did the possible presence of later, deteriorating corner towers in these areas.

Conclusions

The construction of Fort Umrevinsky in the north of the Upper Ob region was a part of the tremendous project of building fortifications over the vast Siberian territories of the Tsardom of Muscovy at the turn of the 17th–18th centuries (Ocherki…, 1979: 284). Uneven distribution of the European principles of fortification continued to be a distinctive local aspect of that period. It would seem that the date when Fort Umrevinsky was built (1703) correlates with the time of large-scale introduction of this military engineering phenomenon in Russia, associated with Peter I era (Kostochkin, 1962: 7; Maloletko A.A., Maloletko A.M., 2001: 89). However, precedents of an integrated combination of earlier defensive structures (Shlisselburg-Oreshek) with fortifications (bastions) of the early time of Peter's reign (1702–1703) are known from the westernmost boundaries of the Russian State (Iogansen, Kirpichnikov, 1974: 30, 46). In many ways, the forerunner of this phenomenon was the spread of the bastion system to the northwestern borders of the Tsardom of Muscovy long before the beginning of the 18th century, since the first timber-earth forts with bastions apparently appeared there from the second half of the 16th to the first quarter of the 17th century (Nosov, 2002: 60, 118). At the same time, in Siberia and the Far East in the 17th century, construction of sub-rectangular defensive structures surrounded by a ditch around the perimeter continued. However, in the late 17th century, during the restoration of Fort Albazinsky on the Amur River in 1686, a different ("Italian") fortification technique of the bastion type was followed (Artemiev, 1999: 7; Albazinsky ostrog…, 2019: 176). The outer ditches duplicated all protrusions of the corner bastions. In southwestern Siberia, such a fortification technique was first used for Fort Kashtatsky, which functioned from 1697 to 1703.

Such facts are of particular importance for Fort Umrevinsky primarily because its "parent fort" was Fort Urtamsky built in 1684. It should be emphasized that both forts were built upon official decrees and had a geometric layout of fortifications, whereas judging by the written sources, the palisade walls of Forts Mungatsky and Berdsky, built in 1715–1716, were oval in outline (Miller, 1996: 24). The reason for this unique layout, most likely, was that the latter defensive structures were built not upon decree from the center, but by the decision of the local authorities (Borodaev, Kontev, 2015: 186, 189). Notably, the bastion principle of fortification, successfully tested in Fort Kashtatsky, was implemented in Fort Umrevinsky only after building the girder-post foundations of the corner towers on its southern side in the 1730s.

On the basis of the above facts, the ditch of Fort Umrevinsky of the early 18th century should be considered to be a result of the previous development of Russian defense architecture in Peter I era. The earthen and wooden structures of this fortified site reflect the final stage of the "Old Russian" fortification tradition in Siberia, which was developed on the southern borders of Russia in the 10th–13th centuries (Morgunov, 2009: 241–250). This tradition of building timber-earthen defensive structures obviously experienced a certain influence of foreign fortification principles as far back as in the pre-Peter period.

Establishing construction periods for ditches in each of the Siberian fortifications that existed in the 18th century is of particular importance for reconstructing the historical pace of the development of the principles of European fortification in Peter's time in Siberia. Their archaeological identification makes it possible to establish unevenness in the distribution of features of European fortification over the vast Siberian spaces with more precision. Influence of foreign fortification experience for Fort Umrevinsky can be assessed as indirect and significantly "stretched out" in time (almost the entire first third of the 18th century).

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The Use of Natural Scientific Methods in the Study of Leather Items from Archaeological Excavations

This article outlines the results of analyses of footwear and other late medieval and recent leather items. Orthopedic diagnostics are used to assess an early 18th-century woman's shoe from the historic center of Kaluga. The insole, made of tightly fitted cords, suggests that the shoe had a corrective function. Infrared spectroscopy and liquid chromatography were used to analyze the leather of which the quiver found during the excavations in Moscow was made, and to evaluate the technique whereby its surface was processed. Natural scientific methods were used to study the various types of leather and threads, and to reconstruct the decorative techniques. Leather footwear from the medieval town of Galich, near Kostroma, is compared to that from other Central Russian towns, revealing local variations in footwear and the distribution areas of its types. It is concluded that natural scientific methods are helpful in the study of such finds.

Keywords: *History of costume, leather processing, footwear manufacture, archaeological finds, analytical methods, interpretation, multidisciplinary approach.*

Introduction

The daily life of a medieval town, the clothes of the townspeople, and their material culture form one of the main topics of medieval studies today. In Russian scholarship, the study of aspects of everyday life in medieval towns has become possible only with the accumulation of archaeological evidence, growing every year. Artifacts discovered during excavations are the main source also for studying leather production and shoemaking, since there are no manuscript illuminations, guild charters, or artisanal manuals available. The amount of archaeological leather in the moist humic layers containing the remains of Old Russian towns, with shoemakers' workshops or waste disposal sites, reaches tens of thousands of units. However, much valuable information becomes lost at the stage of describing and systematizing that category of archaeological finds. We have elaborated special methodological guidelines for preventing this from happening at that stage of researching footwear—the most common artisanal products (Osipov, Likhter, 2004).

Today, scholarly capabilities have significantly expanded through the use of natural scientific methods and the engagement of experts from other fields of science for obtaining various data that may assist scholars in solving a number of problems far beyond the development of leather production and shoemaking.

Use of natural scientific methods

Orthopedic diagnostics. The possibility of diagnosing orthopedic diseases by the wear-pattern on footwear details has already been mentioned in the literature (Osipov, 2003: 18–20; Kurbatov, Minchenko, 2013).

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Fig. 1. Sewn-in sole (*1*) and insole (*2*) of the first half of the 18th century, from the excavations in Kaluga in 2019.

When processing archaeological footwear, it is advisable to collaborate with orthopedic doctors, who can make the correct clinical diagnosis even from apparently insignificant signs.

While studying the collection of leather footwear of the first half of the 18th century from the 2019 excavations in the historical center of Kaluga, our attention was drawn to a fragmentarily preserved women's shoe. Its insole* turned out to be unusual: it was folded of tightly fitted leather cords molded along the contour of the foot (Fig. 1). The length of the detail, which was originally two-layered, was 23 cm, which corresponds to size 36**.

In other shoes discovered in the same layer, insoles were made of birch-bark or bast, which was typical of the footwear of the same period from other towns. We came across the shoe with the insole described above for the first time; most likely, the insole was manufactured (or adapted) for a specific customer. The need to create such a design, which it was very laborious to manufacture, was probably caused by physical defect of a human foot. For consultation, we invited an orthopedic surgeon*** and showed him the find. When he examined traces of wear on the upper (sewn-in) sole, he confidently diagnosed the owner of the shoe as having transverse flat feet and Hallux valgus*. The doctor agreed with our assumptions about the function of the insole: it served as a shock absorber, which helped the woman to reduce pain.

This orthopedic insole discovered in the deposits of the 18th century testifies to the existence of corrective footwear at that time; it was made by simple shoemakers; they also invented devices that alleviated the suffering of their customers. This example is confirmed by the following conclusion of the French medievalist R. Fossier: "Ignorance, conquered only in the 19th century by the popularizers of medicine, was not complete, since various therapeutic remedies still found the needed application thanks to experience or, if you like, intuition" (2010: 24).

It is known that the first orthopedic institute with a workshop for manufacturing custom-made corrective shoes was founded in 1816 by the German therapist I.G. Heine. In Russia, the teaching of orthopedics was first arranged at the Military Medical Academy of St. Petersburg, at the Department of Desmurgy**, which in 1895 was headed by G.I. Turner—the founder of the Russian school of orthopedics (Travmatologiya…, 2013: 7–9). It is possible that such footwear details will be also found in many earlier assemblages, although orthopedics had not officially existed in Russia until the very end of the 19th century.

*In the footwear of the Modern Age, an insole made of hard leather or bast was usually inserted between the sole and sewn-in sock.

**According to the Paris scale widespread in Europe, 1 point equals 2/3 cm.

***The author is grateful to R.N. Sonin, the orthopedic surgeon of the "Drevo-Orto" workshop, for his professional advice.

*Pathological reversal of the first metacarpal bone, which leads to curvature of the first toe outward. This pathology occurs most often in middle-aged or elderly women, is accompanied by pain, and leads to difficulties in walking.

**Desmurgy is a branch of medicine that studies techniques of applying dressings and bandages.

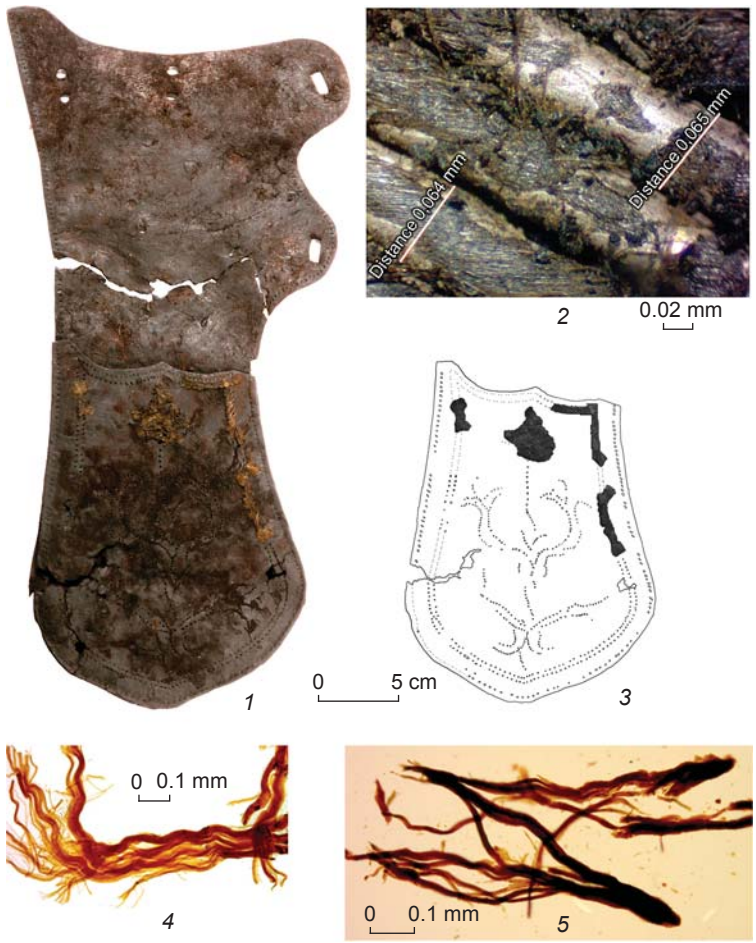

Fig. 2. Leather quiver of the mid to second half of the 17th century, from the excavations in Moscow (*1*), gold threads of embroidery (*2*), pocket with traces of embroidery made with gold threads (*3*), fibers of couching threads (*4*), stitching threads (*5*).

We applied various natural scientific methods to studying a leather quiver discovered by the employees of the OOO "Stolichnoye Arkheologicheskoye Byuro" in Moscow, near Bolshaya Ordynka Street. A unique find from the mid to second half of the 17th century (Osipov, in press) was a flattened case with a rounded bottom and symmetrically-convex sides, with a surviving metal plate and two adjusting buckles*. On the front side, there is a patch pocket decorated with gold embroidery (Fig. 2, *2*). According to A.F. Medvedev, a whip or flail could have been placed in such a pocket (1966: 23).

The publications about quivers kept in museum collections contain no information about the properties of the material from which these were made, types of connecting and decorative seams, composition of dyes, etc.; therefore, we used various methods for obtaining additional information about this find.

Macrophotographing of leather. This was carried out for establishing the species of the leather. The photo shows that the grain* is smooth; nevertheless, the shapes and locations of hair ducts on the surface indicate with a high degree of probability that leather from cattle or a horse was used for making the quiver. The unnaturally smoothed surface of the grain and the increased oiliness of the skin show additional processing of the raw material. In this regard, it is appropriate to recall that in order to increase the durability of leather, artisans subjected it to "boiling"** (Malinova, Malina, 1988: 38, 78; Cameron, 2000).

*To prevent arrow-shafts from interfering with steering the horse, the quiver was worn in an inclined position, with its neck back.

*Pattern on leather surface left from the marks of removed hair bags during the tanning process.

**This term should not be taken literally. The skin was "boiled" by immersing in hot (about 80 °C) liquid: wax, oil, rosin, or other resins (Folks, 2006: 120–127).

Infrared spectroscopy. Using this method* at the Vorozhtsov Novosibirsk Institute of Organic Chemistry (NIOC) SB RAS, ester bonds typical of fats and wax have been detected in leather samples taken for analysis. Their presence confirms the assumption that the "boiling" technique was used for additional leather processing.

Liquid chromatography. The leather was analyzed using the method of liquid chromatography at the Center of Spectral Investigations at NIOC SB RAS for establishing the composition of tannins and the original color of the leather, which had disappeared after a long stay in the soil**. The presence of tannins and ellagic acid in the leather confirmed that raw materials were processed with a tanning solution based on plant extracts. When determining the initial color of the sample belonging to the main detail, the spectra of plant dyes—indigotine (blue) and alizarin (red)—were identified. Depending on the ratio of the dyes, this combination could give a purple color, or when combined with tannins, a green color. No traces of dye were found in the sample of leather from which the pocket was cut. The leather was undyed, and its dark color set off the rich embroidery made with gold threads, on the front surface of the pocket.

RFA analysis. Study of the coating on gold threads, using a micro X-ray fluorescence spectrometer "Bruker M1 Mistral"***, revealed the elemental composition of the shell of gold threads—thin metal foil, which was wrapped around the couching threads (Fig. 2, *2*). According to the spectrometer data, this was silver of a fairly high purity (87.42 %).

Metal suspension loops and decorative onlays have been preserved on the quiver. Analysis of the composition of chemical elements made it possible to establish that the suspension attachment loops and decorative onlay were made of brass.

Study of stitching material. The nature of the stitching threads and couching threads, as well as the technological features of their manufacture, were identified in the Chemical Laboratory of the Restoration Department at the State Historical Museum****. As was discovered during the research, the core of the couching thread, entwined with bands of silver foil, was a spun silk thread twisted in an S-shaped direction (right-sided twisting) (Fig. 2, *4*).

Partially preserved stitching threads were made, not from plant fibers or secretions of the silkworm caterpillar, but from animal sinews (Fig. 2, *5*). It should be mentioned that in the Late Middle Ages and Early Modern Age, the armorers of Middle and Central Asia sewed leather items with sinew threads (Bobrov, Hudiakov, 2008: 195) Russian artisans preferred to use waxed thread—strong twisted linen thread soaked in wax or resin (Osipov, 2006: 62). In rare cases, they chose horsehair as stitching material (Osipov, 2014: 117).

Use of natural scientific methods has made it possible to obtain information about the techniques of decorating the quiver, and to establish qualitative characteristics of raw hides and stitching-material.

DNA-testing of raw materials. Research into the raw materials of urban leather working is very important for elucidating the development of craftsmanship in medieval Russia. Nowadays, the breed of the animal whose skin was used for making items discovered at archaeological sites is established visually by texture-related features on the outer side (grain) of leather, typical of each type of mammal, mainly by the shape and location of ducts remaining from hair shafts on it. Accurate identification is possible in the absence of abrasions on the leather's surface, which is not always the case.

A promising method for identifying the species composition of leather raw material is DNA-testing with a polymerase chain reaction (PCR). The method of molecular genetic diagnostics was invented in 1983 by the American biochemist K. Mullis, for which he was awarded the Nobel Prize in Chemistry. Today, PCR analysis is widely used in forensics and medical practice, as well as the modern food industry, for detecting substitutions of material in raw food. The method, based on multiple selective copying of a specific DNA region with enzymes, ensures a significant increase in small concentrations of certain nucleic acid fragments (DNA) in the biomaterial taken for analysis. Modern compact devices (amplifiers) for PCR analysis make it possible to carry out mass express tests for the identification of species in large batches of leather raw materials (Galkin, Trepalina, 2018: 36).

Identification of regional differences in footwear

The increase in the number of archaeological finds from different areas makes it possible to identify regional differences and establish the boundaries of the distributions of certain types of footwear. Important data were obtained after processing collections of archaeological leather from Galich Mersky, where systematic excavations have been carried out since 2009 by the Kostroma Archaeological Expedition (Novikov, Baranov, Novikova, 2014: 9–19).

*Infrared spectroscopy is a field of spectroscopy that studies the interaction of infrared radiation with substances. This method is based on the phenomenon of absorption of infrared radiation by chemical substances, with simultaneous excitation of molecular vibrations.

**The analysis was performed by E.V. Karpova, the Senior Researcher in the Optical Spectrometry Group, NIOC SB RAS.

***The study was carried out by A.O. Shevtsov, Researcher at the Archaeology Department of the State Historical Museum.

****The analysis was carried out by O.B. Lantratova, the Leading Expert of the Restoration Department.

In 2019, a collection of leather items and artisanal waste amounting to 3992 items was compiled from the finds discovered over an area of 257 m^2 in the deposits of the late 16th to early 18th centuries. The analysis of material evidence made it possible to reconstruct the cutout of footwear models that existed in Galich during the period under study. It was established that the most popular type was soft heelless shoes with one-piece upper parts connected to weakly-profiled soles of symmetrical cutout by means of hidden inserted seams (Fig. 3, *1*, *2*). A cloth or suede cover could be attached to the edge on the top of such a shoe (Fig. 3, *3*). Inside that lining, there was an *obora*—a woolen cord or thin leather band passing through the loop of the back piece, which was sewn above the heel. The top was made of soft leather with vegetable or oil tanning, 1.2–1.8 mm thick. The weakly profiled sole was cut of tougher leather, the thickness of which could reach 4.5 mm. Such footwear, called "kengi", "charyki", or "uledi", was widespread in the Russian North and Siberia, as confirmed by archaeological (Vlasova, 2001: 303; Oyateva, 1973; Vizgalov, Parkhimovich, Kurbatov, 2011: 42–43; Osipov, Chernaya, 2016: 142; Osipov et al., 2017: 114) and ethnographic evidence (Etnografiya russkogo krestyanstva…, 1981: 160).

Soft heelless shoes are almost absent from the materials of excavations in Moscow, Kolomna, Vladimir, Tver, Smolensk, Tula, Kaluga, and other cities of Central Russia. Such shoes have not yet been found even in Kostroma, located 108 km from Galich (Kabatov, 2006, 2011; Lazarev, Osipov, 2020). Mapping the distribution

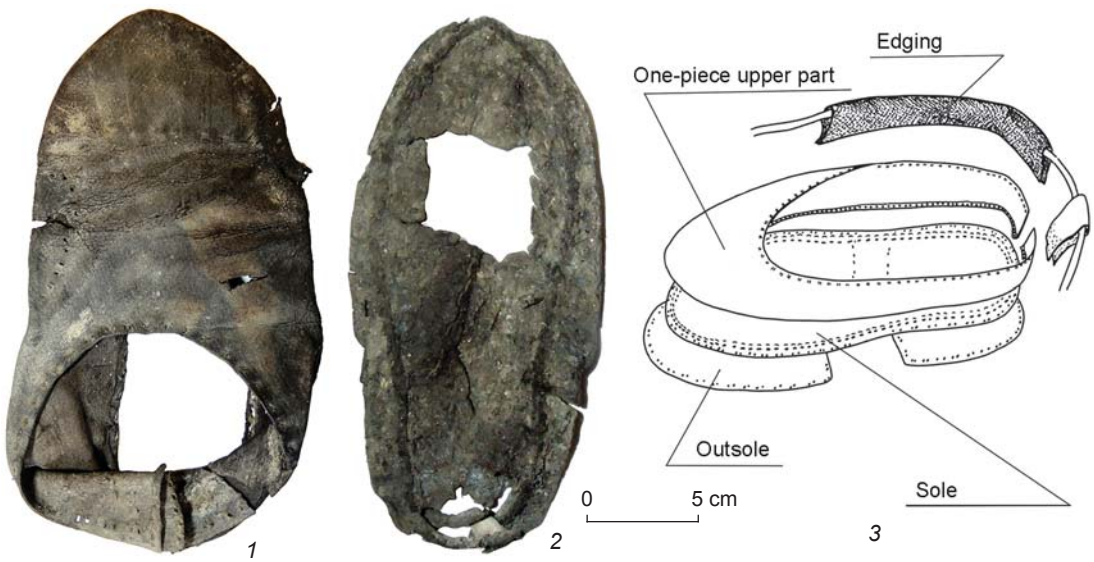

Fig. 3. Soft heelless shoes of the 17th century, from the excavations in Galich Mersky.
1 – one-piece upper part; *2* – sole, hidden seam; *3* – assembly diagram.

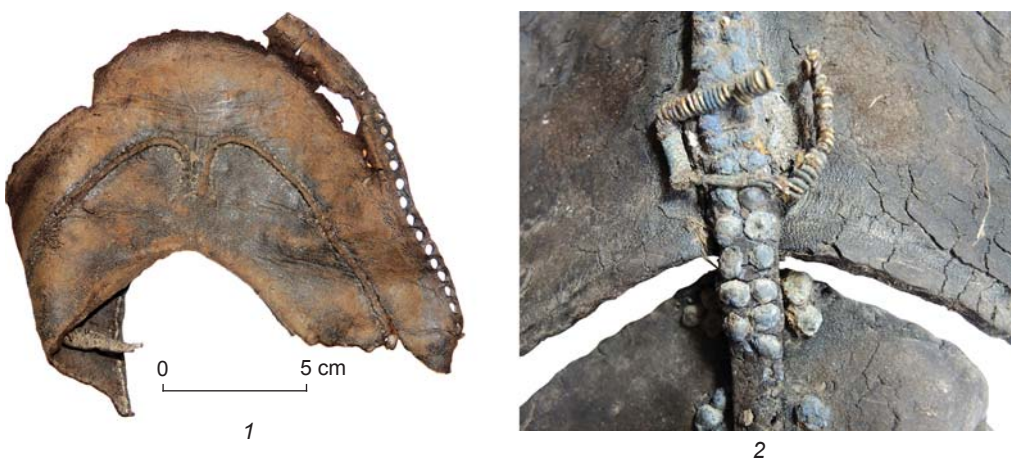

Fig. 4. Shoe crown with thread joint (*1*), gimp of brass wire (*2*), from the excavations in Galich Mersky.

zone of soft shoes has allowed us to establish that the border of the area where such shoes were used was located between Galich and Kostroma, the latter's material culture being more oriented to Moscow.

The specific nature of the Galich footwear was also manifested in the decorative finishing of festive models: as opposed to everyday footwear, people tried to decorate them in various ways. One decoration technique was thread embroidery of the shoe's crown in the form of two semicircles, which formed a protrusion directed towards the rise of the foot (Fig. 4, *1*). This type of decoration was not typical of the towns of Central Russia, but became widespread in Eastern and Western Siberia. The earliest footwear with such decor was discovered during the excavations of the first Russian polar town of Mangazeya (Vizgalov, Parkhimovich, Kurbatov, 2011: 53, fig. 63, *1–3*).

Metal wire fastened over the heel welt was widely used for decorating footwear in the Late Middle Ages. An RFA-analyzer has revealed that the wire was made of brass (Osipov, 2017: 214–217; Lazarev, Osipov, 2020: 316; Osipov, Chernaya, 2016: 144). The boots from the Galich collection were also decorated with cannetille* (Fig. 4, *2*), atypical of the decoration of Russian urban footwear.

A similar technique was used in the adjacent territories, as evidenced by the decoration on festive Kazan boots found in the Volga region (Sattarova, 2004: 21, fig. 11). It might have been borrowed by the Russians from the local population. In this regard, it is advisable to recall a large-scale military campaign conducted by the Moscow State in 1395 (or according to other sources, in 1399) to the Middle Volga region, which was led by the brother of the Grand Prince Yuri Dmitrievich Galitsky (Gorsky, 2003: 126). According to the Voskresenskaya Chronicle, the Russian warriors returned with great booty: "took the land of the Tatars into captivity; and after three months of fighting, returned to the Russian land with a great victory and much booty" (Polnoye sobraniye…, 2001: 72). Obviously, the captured Tatar artisans included shoemakers who had the skill of making metal gimp.

The use of modern methods for studying archaeological finds ensures that a greater amount of information is obtained. For example, analysis of material evidence from the excavations in Galich revealed their significant difference from the finds from other Russian towns and helped scholars to establish a conventional border of the area of northern apparel, including footwear. Differences are also emphasized by the method of embroidering the crowns of low shoes, which disappeared in Central Russia at the time of the Golden Horde.

*From *cañuto* – 'tube'; a thin metal thread twisted into tight spiral.

Conclusions

The rapid increase in the volume of archaeological evidence requires its thorough analysis. Archaeological leather cannot be stored for a long time; therefore, it is advisable to process such finds as quickly as possible. When working with this category of archaeological evidence, it is necessary to use all available methods that may increase the information content of the source and the objectivity of the data obtained, which are needed for subsequent substantiated generalizations.

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Cattle in Buryat Mythology and Ritual

This study addresses, on the basis of ethnographic, folkloric, linguistic, and field data, the role of cattle in Buryat myths and rites, with reference to their economic significance. Buryat words relating to the exteriors of animals, sex differences, etc. are listed. The bull image features in traditional Buryat systems of time calculation and in the tradition of giving protective names homonymical to words denoting the bull are described. Mythological beliefs concerning the cattle are analyzed. The Bulagats, a major Buryat subgroup, practiced the tribal cult of Bukha-noyon, to whom the bull alluded. This practice was connected with the idea of shape-shifting, whereby the bull symbolized the male principle. In terms of cosmogony, the bull was part of habitation spheres such as sky, earth, and water, and their elements such as celestial bodies and mountains, and fire. The positive attitude to the bull and the cow was mirrored by views regarding supernatural properties of bull hair and urine, cow's milk and placenta, and devices used for managing draft bulls (the yoke and the hair rope zele). At the same time, the cattle were associated with the Lower World and its inhabitants; they functioned as mediators and could symbolize death. A detailed description of the bull image in traditional Buryat ritualism is provided.

Keywords: *Buryats, traditional worldview, shamanism, cattle, folklore, ritual.*

Introduction

The domestication of cattle in the Trans-Baikal region began in the Late Neolithic. In the Chalcolithic, with the emergence of a productive economy, cattle-breeding spread to the northernmost territories in the forest-steppe belt of the subregion, which is evidenced by the finds from the settlements of Kharga I, Dvortsy, and Fofanovo burial ground (grave No. 20) (Tsybiktarov, 1999: 73, 94). By the beginning of the Late Bronze Age, cattle-breeding had become the main economic activity of the population inhabiting the steppe belt of the Trans-Baikal region. Later, the tradition of cattle-breeding spread into the Baikalia and Cis-Baikal region. In southeastern Siberia, it has survived until the ethnographically modern period.

The role of cattle in the economic life of the inhabitants of this region has always been significant, and became reflected in the traditional worldview and ritual practices of the Buryats. At present, mythological beliefs and rituals exist in the Buryat culture in a reduced form, which makes it relevant to reconstruct traditional knowledge: for example, concerning the interaction of humans with the animal world, a prominent representative of which is cattle. The images of the bull and cow have not yet been the topic of special study in Buryat ethnography. This article analyzes the images of cattle in the traditional

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culture of the Buryats, describes Buryat beliefs regarding bulls and cows, establishes the set of traditional Buryat concepts relating to these animals, and identifies the role of cattle in Buryat rituals. The sources are ethnographic, folkloric, linguistic, and field materials; in particular, ethnographic and folklore data obtained by S.P. Baldaev, P.P. Batorov, N.S. Boldonov, G.M. Osokin, Y.S. Smolev, M.N. Khangalov, and P.P. Khoroshikh. This research followed the structural-semiotic methodology.

General description of Buryat beliefs about cattle

The breeding of cows and bulls played an important role in the animal husbandry of the Buryats. The aboriginal (meat and dairy) cattle breed for pasture-keeping, which was distinguished by short stature, was traditional for the Buryats. With low milk-yield, cows of this breed gave milk of increased fat content, and when they were slaughtered, people obtained large amount of meat and lard. Keeping bulls and cows satisfied the main needs of the population not only for meat and milk, but also for raw materials for manufacturing clothing, footwear, horse equipment, utensils, etc. Selling live cattle and curried cow- and sheep-skins on the market was an important source of family income. Oxen were usually used as means of transportation; until the 19th century, the Buryats transported goods on a cart with two high wheels on a fixed axle *ukher terge* 'bull cart, araba'; later, on a four-wheeled peasant cart adopted from the Russians (Badmaev, 1997: 86). Cattle were not used as riding animals.

The traditional fuel among the Buryats was *argal*, 'dry cattle manure'. This was even preferred to firewood: it was believed that the smoke released during its burning had aseptic properties and purified the premises (FMA). For obtaining high grass stand, the Buryats fertilized *utug* (*uteg*, 'artificial grassland') with cow manure. Crushed *argal* served as warm bedding for women in labor, and for livestock when kept in its stall. Fresh cow manure was used as a coating in the construction of log yurts and utility buildings. Naturally, the important role of these animals in the economic life of the Buryats was reflected in their mythological concepts.

According to the Buryats, a family was prosperous if it had its own livestock. So, in the traditional Buryat society, wealthy families of cattle breeders were assigned a very high status. This mental attitude can be seen in epic poems, where warrior-heroes appear as owners of countless herds of cattle.

In the Buryat language, there are common names for domestic cattle – *mal* 'cattle' and *eber huulten* 'with horns and tail' (Buryaad-orod toli…, 2010: Vol. II, 645); the latter name reflects the main morphological features of cattle: *eber* 'horn' and *huul* 'tail'. The archaic meaning of the phrase *eber huulten* 'noble people of the family clan' indicates that livestock (cows, goats, and sheep) was the main wealth of a Buryat nomad, in addition to horses.

The vocabulary of the Buryats contains the words that convey the differences between animals by sex: *bukha* 'stud bull' and *yneen* 'cow'. Other meanings of the word *bukha*, such as 'mighty, huge' (Buryaad-orod toli…, 2010: Vol. I, 160), should be considered attributes of a bull; they show that the Buryats associated this animal with great physical strength. The Buryat language has a generic name for cattle—*ukher mal*. The word *ukher* was used in the narrow sense of 'cow, ox, castrated bull' (Buryaad-orod toli…, 2010: Vol. II, 358).

The Buryats especially appreciated such qualities of the local breed of cattle as strength, fearlessness (when wolves attacked, cows usually protected the calves), resistance to adverse conditions, and easy maintenance. The Buryat vocabulary mentions excessive stubbornness as a typical feature of these animals: *Ykherei shekhende uhashye shudkha, tohoshye shudha – sessenshye bolokhogui, tenegshye bolkhogyi* 'You may pour water or oil into the ears of cattle, they will still not become wise nor stupid' (Ibid.). Clumsiness and awkwardness in movement were associated with the image of the bull: *Ykher zhoroo* 'bull's racing pace' (Ibid.).

In riddles, the emphasis was placed on the presence of horns and ears in cattle: *Urayhan durben khun eree, khoyoryn dakhatai, khoyoryn dakhaugei* 'Four men came from the south, two of them wearing fur coats, two without fur coats (two horns of a cow and two ears)' (Folklor…, 1999: 118, 120); *Urdahaa durben khun erebe: khoyoryn duutai, khoeryn duugui nyusegeen* 'Four came from the south, and with them two with voices, and two without voice and naked (cattle, its ears, and horns)' (Boldonov, 1949: 122–123). Cattle were identified with needle (obviously, an indication of the presence of horns) and heart: *Khukhe ukher dureee sheree* 'gray bull drags its rope' (needle with thread) (Folklor…, 1999: 118, 121); *Ulaakhan buruu sagaan boltorgotoi* 'red calf with a white collar' (heart) (Boldonov, 1949: 124–125).

The Buryat language includes words that designate various sounds made by cattle: *zokhodoon* 'shrill, lingering mooing (of a bull)', *mooroon* 'mooing (of cows and calves)'.

The important economic and symbolic role of cattle is reflected in the popular calendar. The Buryats adhered

to a twelve-year cycle, with each year corresponding to specific animal—sign of the zodiac; the cycle included *ukher zhel* 'year of the bull/ox'. Their calendar, which took into account changes of lunar phase, distinguished *ukher hara* 'month of the bull/ox'; the time of the day included *ukher sag* 'hour of the bull/ox' (hence, in the space of the yurt, divided into twelve zones, according to the astrological signs, there was a specific area under the sign of the bull).

It was customary among the Buryats to give children protective names homonymous with names of cattle, while performing the ritual of naming. The circle of such nominations is quite extensive: *Moorogshoon* 'mooing (bull)', *Boodee* 'cow', *Bukha* 'bull', *Buruu*(*n*) 'one-year-old calf', *Tugal* 'calf', *Yneen* 'cow'; *Ykher*, *Nalbai* 'cow that ceased to give milk', and *Mukhar* 'hornless cow' (Mitroshkina, 1987: 60, 79–80).

Cattle in the mythological beliefs of the Buryats

Ethnographic evidence indicates that the Buryats had an archaic cult of the bull associated with veneration of *Bukha-noyon* 'Lord Bull', who was one of the shamanic "thirteen northern rulers", especially revered by the main ethnic subdivisions of the Buryats—the Bulagats, Ekhirits, Khongodars, and Khori Buryats. This mythical character is present in the genealogical tradition of the Bulagats; as a legend says, their ancestor was nourished by a divine animal: "The boy was named Bulagat (Bulagat found in the pit of a stud bull)" (Baldaev, 2009: 40).

The Buryats believed that cattle could be conductors of the celestial dwellers' will. This is mentioned in one of the legends: "In the upper part of the Murin valley, they (the Buryats) came across the tracks of a cow and a stud bull. Following the tracks, they came to the valley of the Buguldeika River, where they found them. Kheree and his relatives considered this a special indication of the *tengrins* [*tengeri* 'celestial dweller' – **A.B.**]" (Ibid.: 56). This function of cattle is manifested in the ritual of dedicating an animal to the mythical master-spirit or deity: the will of the supreme being and his benevolence towards the local ethnic community was revealed through a specially selected bull (or horse).

According to the beliefs of the Buryats, the bull symbolized the mythical progenitor of the Bulagats Bukha-noyon; therefore, a dream in which a person saw himself riding a bull was perceived as a good sign (Khangalov, 1958: Vol. I, 395).

The idea of shape-shifting was also associated with Bukha-noyon: initially, this character was in human form, but when he was bitten on the leg by the yellow dog Gurab shara, as instigated by the daughter of Tayzhi-khan, he "became defiled, unclean, and thereby lost the ability to become a human again" (Baldaev, 2009: 330). Notably, the shamanic poetry of the Buryats contains some plots about the transformation of a shaman into a bull, for a mystical fight with another shaman. However, in the Buryat tradition, the bull, unlike the horse, eagle, and some other animals, was not an assisting spirit—a riding animal for shaman's travels to the other worlds.

The image of bull among the Buryats was a symbol of the masculine principle, great physical strength. It is no coincidence that military valor was associated with this animal. For example, in the epics of the Buryats, the fighting of warrior-heroes is usually compared with the fighting of bulls:

> He circled around with the mangadkhai…
> They spin one after another,
> They squint at each other,
> Like bulls ready to butt each other
>
> (Sharakshinova, 2000: 152).

When describing the struggle of epic heroes, the expressions "bull's neck" and "bull's throat", emphasizing their power, are often used:

> In Shar Khasar, the warrior and knight,
> The heart leaped,
> His body became lax and sleepy,
> His thick neck is about to bend down,
> His bull's throat is about to tear apart…
>
> (Geser…, 1986: Vol. I, 57).

The cosmogonic concept of the connection between the bull and various spheres of habitation and their objects is manifested in the traditional worldview of the Buryats. The celestial symbolism of this animal is reflected in the myth of the struggle between two stud bulls, earthly incarnations of the sons of the celestial polar powers—Bokho-Muya (revered as Bukha-noyon), the son of the western celestial dweller Zayan-sagan-tengeri, and Bokho-Teli, the son of the eastern celestial dweller Khamkhir-bogdo. According to Khangalov, the blue stud bull, which Bokho-Muya turned into, personified the daytime sky and was associated with the sun, while the multicolored bull, the hypostasis of Bokho-Teli, symbolized the night, starry sky, and another luminary—the moon (1958: 322). The very confrontation between the bulls was associated with a natural phenomenon—the solar eclipse (Ibid.: 323), and the victory of Bukha-noyon over the enemy was perceived as a triumph of the forces of light.

The motive of the bull's relation to earth can be observed in the folklore of the Buryats; in particular, in the riddle of snow and earth: *Sagaan ukheryn yaby gee, khara ukheryn baiey gee* 'the white bull called to go, the black bull asked to stay' (Folklor…, 1999: 117, 120). In addition, the image of this animal was identified with a mountain. This idea was most vividly embodied in the image of Bukha-noyon, who, as a legend says, turned into a two-horned mountain near the village of Tory, in the Tunkin Depression (Potanin, 1883: 264). In the 18th century, the Bulagats performed collective rituals of sacrifice at such a shamanic stone, addressing Bukha-noyon as the supreme judge (Miller, 2009: 171). This mythical character was associated with the two-horned mountain *Ykher Mankhai* 'bull's head' in the Kuda River valley (the Lower Angara region), which was the place of tribal sacrifice of the Bulagats after their forced migration from Tunka. Obviously, these mountain peaks were not chosen a sacred place at random—in their shape they remotely resembled a bull's head with horns.

The image of a bull—the spirit of the earth—is quite widespread in the culture of the peoples of Eurasia. For example, in the folklore of the Altaians, it is represented as follows:

> A horse with its winged back
> Crouched to the ground, and instantly appeared
> The master – spirit of the native land –
> Seven-year-old bull, red bull
>
> (Altaiskiye geroicheskiye skazaniya, 1983: 233).

In one Buryat riddle, the image of a lying bull is associated with the fire element: *Khukhe ukher khebten targalaa* 'the lying gray bull grew fat' (ash) (Folklor…, 1999: 117, 119).

Changes in the behavior of the cattle were perceived by the Buryats as signs of approaching bad weather. On the basis of observations, popular signs emerged: "If cattle wander sadly around the field or huddle under trees, it will be rain and thunderstorm"; "If cows wave their tails, it will be thunderstorm"; "If cows stand all day in the bushes, it will be hail" (Osokin, 1906: 224–225); "If calves run with their tails raised, rain is expected" (Smolev, 1900: 30). It seems that the Buryats, although not directly, associated cattle with the water element. This may explain their practice of using cows in searching for groundwater (Baldaev, 2010: 48–49). The mythological consciousness of other Mongolian peoples also reveals some idea of cattle's belonging to the water element, for example, the Khalkha people: "The Khalkha believe that the water cow *usunai argamyk*, who screams at night, lives in large lakes, such as Ubsa and Tirzhin-Tsagan (from which the Chilotu flows)" (Potanin, 1881: 98).

In the epics, fairy tales, shamanic poetry, and rituals of the Buryats, special importance was given to the symbolism of an animal's color. Among the Cis-Baikal Buryats, this symbolism manifested itself in dedicating bulls of different colors to celestial dwellers who belonged to opposite camps: red-colored bulls were intended for black, eastern *tengerias* (probably, this color was a hint of the "nine bloody skies"—habitation place of these celestial dwellers in the epics), while gray bulls were intended for white, western celestial dwellers (Khangalov, 1958: Vol. I, 294, 359). In the epics "Geser", this symbolism is shown using the example of stud bulls of the heads of western and eastern skies:

> Bluish-multicolored bull of Khan Khurmas…
> Brownish-red bull of Atai Ulaan
>
> (Geser…, 1986: Vol. I, 45–46).

Notably, the requirements for the color of the bull-*seter* (*seter*(*tei*) 'dedicated animal') varied among different groups of the Buryats: among the Cis-Baikal Buryats, any two-year-old bull, with the exception of a piebald one or one without a brand, was accepted as a *seter* (Batorov, Khoroshikh, 1926: 59); while in the ritual of dedication among the modern Sayan Buryats, the color of the animal is irrelevant (FMA), most likely because of the partial loss of tradition. The dedicated bull was regarded as a driving animal for the deities and a talisman for the household livestock.

In the fairy-tale prose of the Buryats, the color of the bull often identifies it with a specific area of habitation. For example, in the fairy tale "Tugal Masan", the contrasting colors of bulls opposed in a fight signify their belonging to opposite worlds: white bulls make up the army of the celestial king, while black bulls make up the army of the sea lord Khara Lusan-Khan (Buryatskiye volshebnye skazki, 1993: 199).

The positive connotation of the bull and cow is manifested in beliefs concerning the supernatural properties of bovine wool and urine, and the cow's milk and placenta, as well as household items associated with these animals. For instance, the Buryats believed that bull's wool had a protective function. According to the materials of Khangalov, "the soul can take refuge… in the wool of a stud bull dedicated to Bukha-noyon" (1958: Vol. I, 396). Notable in this case is the person of Bukha-noyon, who, as a mythical patron, could give a person's soul a refuge from evil spirits.

According to Buryat beliefs, milk from domestic animals, including cows, possessed sacred properties: it was a part of the ritual "white food", which was

offered to guests, and was a sacrifice to the gods and master-spirits, including the mythical masters of the home fire; the milk was sprinkled to the sacred birds flying by (eagle, swan, etc.). This drink was associated with the life principle and fertility; therefore, it was incorporated into childbirth and wedding ceremonies. The white color of milk, among the Buryats, symbolizes purity and sinlessness, a connection with white western celestial dwellers, and carries celestial semantics.

In the Buryats' beliefs, the natural secretions of bulls could also be endowed with sacred qualities; in a mythologized form, this was manifested in the image of Bukha-noyon, from whose urine silver-fir forest and juniper grew (Khangalov, 1958: Vol. I, 324) (in the Buryat culture, silver-fir and juniper have a sacred meaning). The cow's placenta (*khag*) was considered a protective talisman for cows; it was hung in yurts, so the cows would always find their way home (Batorov, Khoroshikh, 1926: 59).

It is worth mentioning that the peoples of Central and South Asia use cow's milk and dairy products, as well as cattle manure, for various purposes. Hinduism distinguishes *panchagavya*—five useful products obtained from a cow—milk, cottage cheese, clarified butter (or *ghee*), urine, and manure, which, among other things, have religious and medicinal purposes (Krishna, 2010: 83). The Hindus consumed milk and these dairy products as *prasada*—ritual food, a symbol of divine grace. Apparently, both the Indian tradition of *panchagavya* and the similar practice of the Buryats discussed above originated from the Bronze Age, when cattle-breeding became widespread in various regions of Eurasia.

The image of the bull was identified with fertility, the symbol of which was considered to be a piece of harness, such as wooden yoke. It is associated with a belief: if a woman steps over the yoke, she will become pregnant. "Today, the Buryats consider it a great sin if a girl or married woman steps over a yoke of the cart" (Khangalov, 1959: Vol. II, 124).

In popular consciousness, magical protection was provided by the *zele*—a horsehair rope, decorated with black and white ribbons, to which calves were tied. According to Buryat beliefs, horses carried solar symbolism; the horse's mane and tail, from which the rope was made, were believed to protect cattle from evil spirits and chthonic creatures (e.g., snakes). The mythical patron of such a rope was called the owner of the "multicolored" taiga Zerlik-noyon (Khangalov, 1958: Vol. I, 307). According to the materials of Khangalov, the keeper of such a hair rope was also considered to be *Zeleshe-khatun* 'lady of zele', who was believed to be a patron of dairy farming among the Buryats (Ibid.: 228).

Since the Buryats believed that cattle were a guide to the other world, they developed some beliefs about cattle's demonic nature. Notably, the word *ukher* is derived from *ukhekhe* 'to die' (Buryaad-orod toli…, 2010: Vol. II, 359). In this regard, it should be pointed out that shamanic poems mention *Ykher khara* 'black bull/ox' (although one may assume another spelling of the name of this character—*Ykheer khara* 'black dead man') among the "scribes" of the ruler of the afterlife Erlen-Khan. In shamanic folklore, the demonic creature *oroolon* 'shape-shifter, ghoul, vampire' (Ibid.: 44) turns at nights into an erect, hornless, and tailless cow, and attacks the lonely traveler. Belonging to the Lower World was emphasized by the presence of bull's features in the character. For example, Erlen-Khan was described as a creature with human body, but with bull's head (Mify…, 1980: 1123–1124). According to a legend, the black shaman Som-Sanan-noyon after his death became the servant of Erlen-Khan, and acquired a new appearance: "He remained a man, but horns grew on his head, and large hooves grew on his feet" (Khangalov, 1959: Vol. II, 123). Similar ideas have been recorded among other peoples of southern Siberia and Central Asia. For instance, the Khakass evidence shows the bull symbolism of the ruler of the underworld Erlik-Khan and his servants (Burnakov, 2019: 16).

According to Buryat beliefs, the cow as a guide to the afterlife was endowed with the gift of foreseeing impending danger. The people said: "If a cow moos at night, there will be thieves" (Smolev, 1900: 28). Moreover, the cow carried the symbolism of death, as the following popular signs show: "If a cow jumps over a fur coat hung on a fence, death will come to the person whose fur coat it is"; "If cows butt and their horns become entwined, someone will die"; "If a cow butts a yurt, the deceased will be the housewife" (Ibid.: 27–28). As one may see, these signs reflect strange behaviors of the animal, which is more typical of the animal of the opposite sex—the bull. A cow's habits that went beyond normal behavior were viewed as a bad sign: "It's bad when a cow walks behind a bull or jumps on it" (Natsov, 1995: 114).

Buryats treated the birth of a pair of calves from a cow with contempt: "If a cow brings forth two calves, there will be trouble; for getting rid of this, one needs to slaughter one calf at the place where *two or three roads* converge [my italics – **A.B.**], and then bury it in the same place" (Smolev, 1900: 28). Obviously, one of the newborn calves was viewed as unclean creature and was subject to mortification. Noteworthy is the burial

place of such an animal—a crossroad. According to the beliefs of the Buryats, the rampant servants of Erlen-Khan *albans* (‘demons, evil spirits’) or “the three road ones” (spirit-messengers of the lord of the underworld) moved along the road at nights, and meeting with them allegedly ended up with death of the person. In addition, crossroads were perceived as a kind of passage to the Lower World.

The Buryats considered the mythical character *zayaashan* ‘savior, miracle worker’ to be a protector of the household livestock: “Rich people have also a rich zayashi. He rides a good horse, wears good clothes, and holds a lasso (bugulya) in his hand, and looks after the herds of horses and cattle, so they will not get lost and killed by the beasts” (Khangalov, 1960: Vol. III, 44). Apart from *zayaashan*, the following local protectors of cattle are known among the Buryats of the Cis-Baikal clans: Buzele, Bizyale, Atuikhan, Shatuikhan, Ishegikhen, Orhogkhen, Nugan-Ezinud (*Nuga Ezenuud* ‘mistresses of the meadow’). Image-*ongons* (Boronkhi ongon, Tugal-buruunei ongon, Gerei ongon, Nuga Ezenuud ongon, etc.) and feeding-rituals were dedicated to them (Batorov, Khoroshikh, 1926: 57, 58, 59). Ukhaa Solbon was considered to be celestial patron of cattle and horses (Geser…, 1986: Vol. I, 52), Guzhir-tengri (*Guzher tengeri* ‘tireless celestial dweller’) was protector of bulls (Batorov, Khoroshikh, 1926: 59), and Bukha-noyon was keeper of the corral. All this indicates the emergence of a hierarchy of mythical protectors of bulls and cows among the Buryats.

The pantheon of patrons of cattle among the Buryats reflects the habitation of these animals—in the warm season, they were grazed on pastures (in the steppe, in the meadow, sometimes at the edge of the forest, or in a grove); in cold weather, they were kept in corrals or in a stable. Since birth, calves were in the people’s cultural space: at first, in the front part of the yurt, then in a warm calf shed. Adult animals were also in the domesticated space (corral or stable), but their pastures belonged to alien, undomesticated space. The Buryats “coordinated” the presence of bulls and cows in each of the indicated locations with the master spirit of this place: they honored him by offering periodic ritual treats.

Cattle in Buryat ritual

Cattle were included in the traditional family and clan rites of the Buryats, performing the functions of an attribute of gift exchange in the childbirth or wedding ritual, a posthumous riding animal, an animal dedicated to master-spirits and deities, and sacrifice.

Having symbolic meaning and material value, cattle were an important object of gift exchange. In the rituals of the life cycle, cattle acted as gift (*kharyuu*) requiring a gift in return. For example, in the *milaanguud* rite, when a child was one month or one year old (age definitions differed among different groups of the Buryats), the guests presented him with calves—personal cattle. In wedding rites, cattle were an obligatory part of the traditional bride-price and dowry (*enzhe*) of the bride.

These cattle were also included in the burial rituals of the Buryats: during the burial of a poor man, the bull (ox) replaced the *khoilgo* horse on which the deceased was usually taken to the burial place (Khangalov, 1958: Vol. I, 224). In the old days, such animal was killed at the grave; it was believed that it would accompany the deceased in the afterlife.

In traditional clan rituals of the Buryats, bulls acted as animals dedicated to the gods or as a sacrifice to them. As was mentioned above, such animal had to be of a specific color. Furthermore, attention was paid to its physical condition (integrity of hooves and horns), and to the absence of a property brand-mark tamga on its body.

We should mention that unlike other farm animals, adult bulls and cows were not sacrificed among the Buryats. According to Khangalov, among the Cis-Baikal Buryats, the ritual of *Ylgyde oruulkha* ‘put into the cradle (of a child)’ was known, in which a bull-calf was sacrificed to Bukha-noyon (Ibid.: 213). This rite corresponded to an old tradition that is mentioned in the legend about Bulagat: only by slaughtering a two-year-old white bull was the shaman lady Asuikhan able to open the cradle with a newborn Bulagat, fettered with iron belts (Potanin, 1883: 268). Some of the Upper Lena Buryats have a custom of eating *uusyn myakhan* ‘meat from the autumn slaughtering’ (beef saved for the winter) as a ritual food (Khandagurova, 2008: 73–74), but this meat and the sacrificial animal’s meat are not the same thing.

Different groups of Buryats had rituals associated with magical protection of cattle. During the anthrax epidemic, the Cis-Baikal Buryats performed the ritual of fumigating the cattle with the smoke of juniper, driving the cattle past the fire—*Shurge shuukhe* ‘to purify through the gates’, based on the views of the cleansing power of fire (celestial fire) obtained by friction, from a tree broken by lightning (Batorov, Khoroshikh, 1926: 54–55).

For preventing the death of cattle, the Buryats of the Ekhirit-Bulagat clans performed the sacrificial ritual *Khara, uta, boro mongolnuudte* ‘to the black, long, and gray Mongols’ (Ibid.: 55)—to master-spirits

living in the posts of fences and in various places of the courtyard. It was believed that if one did not make a sacrifice to these spirits, they would torment cows and calves, and even send diseases to family members (Khandagurova, 2008: 40). In case of illness of bulls or cows, Buryat shamanists make image-ongons to the mythical patrons of cattle and dedicate the rituals of feeding "white" food—dairy products, milk vodka, and *salamat* (boiled wheat flour porridge)—to them.

For treating cattle, the Buryats used magic techniques. It was believed that for curing a cow of bloating, a whisk should be put to its stomach and rotated, and a special incantation should be pronounced. For healing mastitis, one had to scratch the inflamed place with a right front bear paw and growl like a bear (Batorov, Khoroshikh, 1926: 52). The items used in this "treatment" performed an apotropaic function; healing was based on the idea of the supernatural properties of a whisk and a bear's paw (bear was a revered animal in Buryat culture).

The use of the image of bull in the ritual practice of Buryat shamans is explained by the fact that people believed in the supernatural abilities of this animal. Shamanic attributes included the image of bull on the ongons dedicated to the mythical ruler of the waters Ukhan-Khan and to other master-spirits—*Zuraktan* 'painted'. They also contained the figures of camel, eagle, frog, and snake (Khangalov, 1958: Vol. I, 327). These zoomorphic characters personified the three habitation realms—sky, earth, and water—and were regarded as shaman's assisting spirits.

During the clan sacrifice (*tailagan*) of the Bulagats, when invoking white, western celestial dwellers, the shaman performed the ritual of *ongo oruulkha* 'let the spirit enter': entering into ecstasy, he "let in himself" the spirit of Bukha-noyon and at the same time he got down on all fours and behaved like a bull (Ibid.: 521–522).

Conclusions

This study has shown that the semantics of the images of cattle among the Buryats is quite diverse. In the mythological beliefs of the Buryats, bull and cow an possess ambivalent connotation. There is a respectful attitude towards these animals due to their positive connotation. Manifestations of such attitude are the cult of Bukha-noyon—the mythical ancestor of the Bulagats; concepts about the connection of cattle with sky and earth, as well as their objects (celestial bodies, mountains), water and fire elements; beliefs about cattle as conductors of the will of benevolent celestial inhabitants and about the bull as a symbol of fertility; sacralization of bull fur and urine, cow milk and placenta, bull yoke and hair rope *zele*; motive of shape-shifting of a human into bull; rituals aimed at protecting and curing cattle; and perception of bulls as animals dedicated to gods. At the same time, cattle also had negative connotations. They were associated with the Lower World and its inhabitants, acting as a mediator between the worlds, as a predictor, and carried the symbolism of death. For this reason, the bull was included in shamanic rites, and its images were a part of shamanic ritual attributes.

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Evenki Reindeer Riding Saddle: Certain Principles of Mobility in the Taiga

On the basis of museum collections, field records, photographic and video recordings made in the 20th to early 21st centuries, a reindeer riding saddle with flaps, typical of the eastern Evenki, is analyzed. Its construction and types of fastening are described in detail. Manufacturing technologies are discussed in the context of modern theories of material culture as adaptations to changing natural and social environments under a mobile lifestyle. The key principles underlying mobility in the taiga include the use of a wide range of materials and techniques, modularity (assembled construction with mutually complementary and interchangeable parts), a technological cycle adapted to natural rhythms, adherence to traditional knowledge, the use of artificial materials along with products of nature (since the mid-1900s), etc. In the nomadic culture, the esthetics of an artifact are intrinsically related to function, harmony, and social significance. The manufacture of reindeer riding saddles has been affected by changes in the social structure of nomadic groups.

Keywords: *Eastern Evenki, museum collections, reindeer riding saddles, technology, esthetics, mobility principles.*

Introduction

Some things tend to fall out of ethnographers' sight (Baranov, 2018); this is what happened with the reindeer saddle. Thanks to archaeological research, the scope of evidence associated with saddles (albeit mainly horse saddles) among the population of Siberia of different periods has been increasing (Hudiakov, 2005; Tkachenko, 2009; Stepanova, 2011; and others). However, ethnographic studies of reindeer saddles have not been carried out in recent decades. This article analyzes reindeer saddles with flaps [*sedlo s krylyshkami*, sometimes also translated as "saddle with wings" – *translator's note*] from Russian museums, and aims at making a contribution to research in this aspect of material culture. Saddles are described following the phenomenological approach. Photographs, video, and field evidence from the archives of MAE RAS are used for studying the principles of mobility among the Evenki in the 20th to early 21st century (Lavrillier, Gabyshev, 2017: 369; Sedlo, (s.a.)). Interest in material culture significantly increased in international anthropological studies in the 1980s and 1990s, owing to the adoption of a number of philosophical and sociological concepts (for more details, see (Hahn, 2018)); but its general theory has not yet been developed. In this article, saddles are studied from the viewpoint of the anthropology of mobility and ethnic technological knowledge, with particular attention to such aspects as adaptation to a changing natural and social environment in the context of mobile lifestyle;

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usefulness, practicality, and ergonomics of a particular thing, and plurality of meanings of the thing and changes in their contexts.

Almost all studies of reindeer saddles among the Evenki and other peoples of Siberia who practice pack-and-riding reindeer breeding and lead a nomadic (mobile) lifestyle, date back to the 1950s–1970s (Vasilevich, Levin, 1951, 1961; Veinstein, 1971; etc.). These were carried out as a part of the projects on the ethnogenesis and ethnic history of the peoples of Siberia and the problem of the origin of reindeer breeding in Eurasia. Studying specific aspects of this branch of animal husbandry among the peoples of Siberia (use of riding or sled-driven transportation, design of sleds, saddles, and harnesses, methods of mounting and managing reindeer, castration, presence or absence of milking female reindeer, specific features of grazing, etc.) revealed the Lapp, Samoyed, Tungus, Chukchi-Koryak, and Sayan types of reindeer breeding (Vasilevich, Levin, 1951: 77). By the early 1960s, ethnographers had identified the types and subtypes of reindeer riding- and pack-saddles, and mapped the areas of their existence (Vasilevich, Levin, 1961). On the basis of comparative analysis of reindeer saddles of the Sayan and Tungus types, S.I. Veinstein came to a conclusion about the domestication of the deer by the Sayan Samoyedic people (1971: 47, 51). The Sayan and Siberian (Tungus) types of pack-and-riding reindeer breeding show significant differences. Reindeer saddles and harness of the Tofalars and the eastern Tozhu Tuvans, similar to horse equipment, correspond to the Sayan type. In the reindeer husbandry of the Siberian (Tungus) type, which is practiced by the Evenki, Evens, Dolgans, Northern Yakuts, Oroks (Uilta), and in the past also by the Negidals (Vasilevich, 1964), saddles were placed on reindeers' shoulder blades, and not on the middle of the back. A rider mounted the deer from the right and constantly used a staff while riding. An important feature of the riding saddle is the absence of stirrups. Flapped saddles, saddles with "side-bars", and saddles without flaps and side-bars have been identified.

In the mid 20th century, the typology of saddles was built in accordance with an evolutionary and typological approach predominantly as a linear typology. For example, Veinstein regarded the emergence of a riding saddle with flaps as a sequential evolutionary series: as a result of the sporadic use of small pack-bags to support the rider's thighs, the reindeer packsaddle (in common with the Sayan packsaddle) was transformed into the saddle with side-bars, saddle with side-bars with the oval ledge, "and finally, these side 'wings' of the side-bars began to be made in the form of curved arches with supports, lighter and more durable" (1971: 44). In his opinion, the riding saddle with flaps, which is common among the Tungus peoples of southeastern Siberia, could only have reached them from Northern Siberia, where the saddle with side-bars, which served as basis for the saddle with flaps (Ibid.: 45, 47), has survived to this day. Not all groups of the Evenki had reindeer breeding; versions of saddles among those who practiced reindeer breeding also varied. This might have happened because borrowings did not occur simultaneously, and were associated with more than one ethnic group. The development of saddle forms was not linear; there was a diffusion of cultural elements. Saddles of the same type are distinguished by variability.

The distribution area of saddles with flaps in the mid 20th century included the Amur Region, southeastern Yakutia, Khabarovsk Territory, and Sakhalin. Such saddles were used by the groups of the Aldan, Uchur, Zeya, Bureya, Amgun, Chumikan, Ayan, and Sakhalin Evenki, Oroks (Uilta), Negidals, and Yakuts who lived in the adjacent areas (Istoriko-etnograficheskiy atlas…, 1961).

The riding reindeer saddle among the groups of Ayan, Aldan, Zeya, Maya, Tokkin, Tommot, Olekma, Sakhalin, Urmian, Uchur, Chulman, and Chumikan Evenki, as well as Oroks (Uilta) was called *nēme*. It was called *nama* among the Tokkin and Vanavar Evenki, *namakan* among the Tokkin Evenki, and *nāme* among the Negidals (Sravnitelniy slovar…, 1975: 621). The related word *nama*, similar in sounding, means a pack, saddle with a pack (among the Podkamennaya Tunguska and Tokkin Evenki), or a small women's pack-bag for an expanding fur saddle (among the Podkamennaya Tunguska, Tokkin, Tokmin, Nep, and Sym Evenki) (Ibid.: 580).

Analysis of the evidence

This study analyzes Evenki reindeer saddles with flaps from the collections of the Peter the Great Museum of Anthropology and Ethnography (Kunstkamera) of the Russian Academy of Sciences (MAE RAS), Amur Regional Museum of Local Lore (ARML), and Science Museum of the Amur State University (SM AmSU) (see *Table*).

Collection No. 6465 of the MAE RAS consists of three items: a riding sled (No. 6465-1), a finished saddle with flaps (No. 6465-2), and a saddle-frame with flaps (No. 6465-3), received in 1958. In the accompanying inventory description, G.M. Vasilevich mentioned that the riding saddle, just as the riding sled, was widespread in the east of the Olyokma River, including Sakhalin, not only among the Evenki, but also among the Negidals and Oroks (Book of Acquisitions of the MAE RAS, coll. inv. 6465, fol. 4). The simultaneous existence of two types of transportation (pack-and-riding and sled-driven) evolved among the Evenki historically, with the pack-and-riding reindeer breeding preceding sled-driving (Ermolova, 1995: 176).

These items were made especially for the museum upon the request of Vasilevich in the Evenki collective

Reindeer riding saddles with flaps described in this article

Storage place	Inv. No.	Category	Place of manufacture	From whom and when was received	Dimensions, cm		
					length	width	height
MAE RAS	6465-2	Adolescent?	Evenki collective farm named after Stalin on the Tynda River, Dzheltulaksky District, Chita Region (modern Amur Region)	From G.M. Vasilevich, 1958	40	32	17
MAE RAS	6465-3	Adolescent?	Ditto	From G.M. Vasilevich, 1958	36	26	14
ARML	7015	Male?	Unknown	From V.V. Goskov, 1904	61	50	N/D
ARML	NV 6126/6	Male?	Mazanovsky District, Amur Region	From Yakovlevykh, 2005	61	50	Ditto
ARML	NV 6126/2	Female?	Ditto (Artisan S.I. Yakovlev, 1942)	From L.S. Yakovlev, 2005	59	42	23.5
SM AmSU	439 OF 143/3	Female	Ust-Nyukzha village, Tyndinsky District, Amur Region	From E.S. Gusakova	63	44	21.5

farm, which was located in Dzheltulaksky District of the Chita Region*, and were never used. They make it possible to see the saddle at the intermediate and final stages of manufacturing and to examine the frame in detail (it is impossible to see it when the item takes the finished form). The idea of this collection belonged to Vasilevich.

The rigid frame (tree) of the riding saddle *nēme* with flaps consists of two side-bars *danna*, pommel (cantle) *iye* made of antler, and two flaps *deptylē*. Noteworthy is the pairing of the main parts of the saddle, corresponding to the principles of symmetry and balance (Fig. 1).

*Side-bars "danna"***, *dānne* (the Podkamennaya Tunguska and Zeya Evenki), *dandi* (Ilimpiysky, North Baikal, and Uchur Evenki), *dande* (Northern Baikal Evenki (?)), *danni* (Nep, and Urmian Evenki) (Sravnitelniy slovar…, 1975: 196) are two thin, sturdy, smoothly planed sub-rectangular planks measuring 36 × 9 cm. Close to the center, these get wider and thinner (in this item, about 0.5–0.7 cm). Closer to the transverse edges, the planks become rounded and thicker, reaching 0.8–1.1 cm, because the antler pommel and cantle are attached to them at the edges of the side-bars. The attachment points undergo greater stress and need more durability, which is provided by the additional thickness of the side-bars. When riding, especially at the beginning and end of the movement, the rider rests on the pommel.

*Pommel and cantle "iye"****. The saddle consists of a pommel and a cantle, with the pommel slightly higher than the cantle. Pommel and cantle are made of antler, with a natural outward slope and with specially selected forks. They resemble an isosceles triangle, with a pointed apex and widely diverging "legs". Pommel and cantle fit tightly to the side-bars, and each of them has five through-holes for fastening.

Flaps deptylē. Their main function is to raise the level of the rider's hips and take on their weight while riding a reindeer. The flaps are made of decorticated willow with diameter of about 2.5 cm, attached in an arch to the outer surface of the side-bars. The maximum width of the flaps is 9 cm; their length is 17 cm. The space of the semicircle of the flaps is filled with deerskin straps.

Fastening methods. Similarly to nomadic peoples of the tundra (Arzyutov, Okotetto, 2018), the Evenki widely employ tying techniques. However, their algorithm for using ropes and knots has its own specific features, owing to the abundance of wood with different properties in the taiga. Since deer are tamed in small herds, the Evenki do not use ropes or nets to fence the herd during counting, as the Taimyr Dolgans or the Nenets do. For temporarily restraining the movement of reindeer, the Evenki build small fences or use the features of the terrain. Wood, being the raw material that is in short supply among the tundra Nenets reindeer breeders, is more frequently used in manufacturing the fastening elements. The tying techniques of the taiga Evenki involve widespread use of not only knots, but also seams, with initial and final knots and holes of different diameters for pulling the rope through. The technique of "sewing" the pommel, the cantle, and the side-bars may have been based on the Evenki traditions of sewing, including birch-bark items.

If one looks at the saddle side-bar from the "inside", it all looks as if "stitched" with large stitches of deerskin

*In 1961, this area became a part of Amur Region.

**This name was recorded by Vasilevich.

***This name was recorded by Vasilevich; *ije* – antler; arch of a reindeer saddle among the Aldan, Zeya, and Uchur Evenki (Sravnitelniy slovar…, 1975: 298–299).

Fig. 1. Saddle with flaps from the collection of MAE RAS, No. 6465-3. *The author of the 3D image is G.A. Ityaksov*.

straps (Fig. 2). Each side-bar has 16 holes: eight rounded (0.8–1.0 cm in diameter) ones are located near the ends (four at each end) and are intended for attaching the pommel (cantle); two subsquare holes (0.5–0.7 cm in diameter) are in the middle part; the ends of arcuately bent and decorticated willow are inserted into them, making the base of the flaps, and six rounded holes (0.5–0.7 cm in diameter) in the central part, which serve for attaching the system of straps, forming the shock-absorbing surface of the flaps, to the side-bar. Nails (eight in total; four nails per a side-bar), reinforcing the structure, are used for attaching the pommel and the cantle to the side-bars. Thus, the side-bars are the structural element that carries the main load of the fasteners.

Two through-holes are made on the frontal side of each "leg" of the antler pommel (cantle). The fifth hole in the form of a tunnel is located in its upper part. The strap connecting the pommel and cantle with the side-bars passes through that hole from one "leg" of the pommel (cantle) to the other. The pommel (cantle) is "sewn" to the side-bar using "seam over the edge" and "stitching" methods, which are also used by the Evenki for sewing clothes and footwear. There is an initial and final knot in attaching the pommel (cantle) to the saddle's side-bars; other intermediary fasteners are absent, which ensures the strength of the attachment. The knot is made on the outside of the pommel (cantle), closer to its edge. It does not come into contact with the body of the animal or person. The fastened strap goes through the hole in the side-bar and, after making a stitch, comes out through the second hole. Then it wraps around the "leg" of the pommel (cantle), passing to its other side, is pulled through the hole on the side-bar, comes out of it onto the "leg" of the pommel (cantle) and, turning out to be passed under the first "stitch over the edge", goes up along the long narrow plane of the pommel (cantle). In its upper part, it passes through the "tunnel" hole to the other "leg" of the pommel (cantle) and is attached by repeating the movement in reverse order. To ensure the strength of the structure, the strap is intertwined on the pommel (cantle) and is attached to the board as this is done in sewing.

The ends of the arches forming the flaps are attached to the saddle with a groove joint. The flaps are attached to the side-bars at different lines of the plane at a distance of 3–4 cm. On female saddles, the flaps are steeper, that is, installed at a sharper angle to the side-bar than on male saddles (Mazin A.I., Mazin I.A., 2003; Evenki Priamurya…, 2012). Out of four connections between the straps and edge of the flaps, two "starting" fasteners are located on the frontal surface of the edge. The strap is fastened without knots: it is wrapped around the edge, and the end of the strap is pulled through the slit specially made in it. The straps are attached to the side-bar with three "stitches". The extreme strap is pulled through the hole on the side-bar, is returned to the space of the flap, intertwines with the previously stretched strap, and goes to the edge of the flap. It is wrapped around it, twisted around itself twice, and is pulled through the second hole in the side-bar; passes under the plane of the stretched strap and goes to the rim, where it is attached. The second "starting" strap is attached to the side-bar with one stitch. The strength and shock-absorbing flexibility of flap design is ensured

Fig. 2. Saddle with flaps from the collection of MAE RAS, No. 6465-3. Bottom view. *The author of the 3D image is G.A. Ityaksov*.

by straps "sewn" to the side-bar at different distances and by their mutual interweaving.

Artisans use different materials for making a pommel (cantle), and follow different methods for their attachment to the side-bars. The technique of attaching the pommel (cantle) to the side-bar, which was used in creating the saddle from AmSU No. 439 OF 143/3, was the same as technique used for making a packsaddle: there is no hole in the form of a tunnel; the number of holes increases up to three on each leg of the pommel (cantle) and up to six on the side-bar. In the late 1940s, the Evenki from the Tokarikan collective farm (modern Neryungrinsky District of Yakutia) made pommels (cantles) of flapped saddles for reindeer out of two pieces of wood, fastening them crosswise at the top (Fig. 3). Gold has been mined in this area since the late 19th century. It is possible that riding saddles of this type were made in Evenki collective farms not for their own use, but for geologists.

The "Historical and Ethnographic Atlas of Siberia" reports: "The 'wings' are fastened vertically or slightly obliquely outward in the middle of the side-bars. They constitute arches with vertical support or plates, cut to receive the oval shape" (Istoriko-etnograficheskiy atlas…, 1961: 22–23). It can be argued that there were at least three methods of attaching the flaps to the side-bars. It is not possible to establish what kind of fastening method was used to create other saddles that I have seen, because of the prohibition on performing any manipulations with museum's exhibits. When I probed one of the saddles with my hand, I had a feeling that there were two flaps in the form of planks on the side-bar. The photo from the MAE RAS collection (I 1475-95) shows a variant of flaps in the form of arches with vertical supports (Fig. 3).

The second item from the collection in MAE RAS (No. 6465-2) is a finished saddle with flaps (Fig. 4). The side-bars are covered with hand-curried winter reindeer hide with fur inside, and are additionally stuffed with reindeer hair (the covers may also be stuffed with elk hair or *khaikta* marsh grass (Sedlo, (s.a.); FMA, 2002)). The seam runs along the skin that wraps around the side-bar, and on the sides of the saddle. A blanket cover with fur outside, sewn from the curried skins of two deer heads, is attached on top. Along the edges of the cover, the saddle is decorated with bunches of white and red fur and trimmings. The cover is stretched over the sharp tops of the pommel and cantle, and covers the entire structure (Fig. 4).

Very interesting observations from Southern Yakutia and the Amur Region were mentioned by A. Lavrillier and S. Gabyshev: in these areas, packsaddles are covered and sheathed with the skin of a pregnant deer, turned with its fur inwards. Such products are sewn from wet skin in heavy rain, so that when it dries out it will stretch well on the wooden frame of the saddle (Lavrillier, Gabyshev, 2017: 213). Two points deserve attention here. First, the saddle is covered with the skin of a pregnant deer (this datum is the first, and so far the only one, in the scholarly literature). During that period of a female animal's

Fig. 3. Negative on glass. A Tokarikan collective farmer is making saddles for the deer of the collective farm. The Evenki (Tunguses). Yakutia (Sakha). 1947–1948. © MAE RAS.

Fig. 4. Saddle with flaps from the collection of MAE RAS, No. 6465-2 (front part of the saddle is on the right on the photograph). *Photograph by A.A. Sirina*.

life, its skin is probably the most capable of stretching, yet it retains its strength. Second, the saddle is covered with skin in a certain season—in the summer, with high humidity. Precisely in these conditions, skin can be properly stretched, avoiding tears. When it dries, such a cover wraps tightly around the saddle (Brandishauskas, 2017).

The design of a saddle has from one to three pairs of straps for tying the lariat, wild fowl caught on the way, or the rein of a pack deer. In the item from the collection of Vasilevich, two pairs of straps are attached to the pommel. The saddle stored in ARML (NV 6126/6), has three pairs of functional straps 30 and 19 cm, 15 and 22 cm, and 37 and 35 cm long, in the rear of the saddle.

Principles of mobility technologies

Structural lightness. As nomads, the Evenki have always followed the principle of investing less energy in life support and avoiding unnecessary labor costs. In everyday life, light-weight things are used. This is very important because things are often carried along or transported on reindeer: "…The Evenki do not like to carry heavy things", an old Evenki man explained to G. Fedoseev, "they always make a thin knife, a light-weight cauldron, and a short gun. When we looked carefully at the footprint of the boot, we saw that the edge of the sole on them was cut off around with a knife. Only an Evenki could have done this, so the boots would be lighter, but *you* would not cut them" (Fedoseev, 1958: 177).

Light-weight raw materials, such as wood, wild deer antlers, deer or elk hair, marsh grass, well-curried deer or elk skin, tendon threads, and deer suede, are used for manufacturing a saddle. Straps for fastening saddle elements together are made of elk or wild deer hide. The weight of the riding saddle is about 2.5 kg. The saddle is adapted to the weight and height of a particular riding deer *uchak* and an adult Evenki. According to anthropological data, the Evenki used to be small; their weight was usually 45–60 kg*. Today, unneeded things, for example, sleds or "Buran" snowmobiles, which are not used in summer, are left in storage platforms of piles. On the one hand, this makes it easier to migrate; on the other, it forces people to return to these places again.

Modularity and reusability. A saddle is a real work of Evenki technical art; it is filled with design solutions. Its frame can be assembled and disassembled, yet it constitutes an integral system of fasteners—strong and flexible at the same time, which is necessary for the objects experiencing constant loads and deformations. It also provides the opportunity for repair. This modular structure is made in such a way that a saddle cannot break completely. If any part fails, it can be fixed with the help of materials at hand, and riding can be continued.

The modern world is focused on single use of a mass-consumption product; therefore, it is of low quality and cannot be repaired. Traditional possessions of hunters and reindeer breeders manifest a different attitude towards their creation: "Craftswomen never used to hurry before, just to get the thing finished somehow; they sewed things in such a way so they would not be thrown away after that" (Odezhda…, 2018: 39). The amount of labor invested increases the quality and value of the thing. After the end of the service life, the thing, if it has a modular design, is disassembled into its constituent parts, which can be used in a new product. When making saddles, the Evenki, saving themselves unnecessary and laborious work, use old, durable and beautiful pommels and cantles made from the butt-ends of birch, larch, or a fragment of antler with ornaments that indicate family clan or other type of affiliation. Such design solutions also testify to the continuity in traditions of nomadic life in specific territories. The Evens transfer beaded decorative bands from old festive fur clothes to new clothes (FMA, 2002). Thus, they not only save labor costs, but also pass on the codes of their culture to their descendants. Transferring

*The optimal weight of cargo for transporting by pack is 40 kg. Modern innovations in riding have also been caused by anthropological changes.

the elements of old to new things is typical of nomadic cultures. V.N. Davydov even suggested viewing things in the culture of nomads "not as a formed result of technological operations, but as a constantly created and updated material object" (2019: 104).

S.M. Shirokogorov emphasized the love of the Evenki for beautiful and well-made old things: "I know hundreds of cases when the Tunguses refused things of low quality… According to many of them, good and expensive things are more durable and therefore turn out to be less expensive than cheap things" (2017: 507–508). In nomadic lifestyle, a minimum of things are used, but these things are of the highest quality; they are designed to be used for the longest possible time.

In traditional culture, a thing bears not only the functional load, but is intimately connected with the person who created it and who owned it; it seems as if a part of the person is contained therein. This explains various bans on using things that belonged to deceased people and were left, for example, in barns in the taiga (Sirina, 2002). The deceased was "accompanied" by his saddled reindeer *uchak*. In this case, the Evens put a saddle on it backwards and made a short bridle, "so it could only reach the saddle" (FMA, 2002). When the status of the thing changed, the attitude towards it also changed (Kopytoff, 2006: 137). Previously, sacred and personal belongings of the deceased were left in the taiga; in recent decades, they have often been handed to museums.

Individuality and variability. The principle of individual production of things is based on the principle of variability, because people differ from each other. In nomadic culture, a thing is made for specific person, taking into account his physical features and preferences. In this sense, the attitude of the Evenki to things and their quality is essentially the same as that of people living in cities who have a lot of money or are aristocratic in origin—for whom things such as, for example, customized clothing, are produced to order by professional tailors. However, for hunters and reindeer herders, the quality of a thing is primarily its compliance with all traditional standards of safety and preservation of human life in the harsh conditions of nomadic life in the taiga. In addition, it should bring positive emotions, for example satisfaction from riding mounted on a well-made saddle, which the neighbors will definitely notice.

The principle of variability works as a mechanism for culture translation (Shchepanskaya, 2011) and manifests itself in technological solutions. For instance, riding- and pack-saddles corresponding to the Tungus (Siberian) type of reindeer herding (Istoriko-etnograficheskiy atlas…, 1961), despite the manufacturing canon, reveal significant variability, which results from the features of the raw materials used and the ability to access them, the goals and skills of the manufacturer, etc.

Gradualness of manufacturing and traditional knowledge. Making a saddle is a work extended in time and space. It is possible and needed only in the context of a hunting and reindeer herding lifestyle, with the aim of sustaining it. Saddle-making, like sewing clothes, is planned in advance and is correlated with the rhythms of nature and the life of a particular community. The principle of gradual production of a thing is associated with access to resources and the functioning of natural objects in different seasons of the year. Nature does a significant part of the work for people. Depending on the season, a deer's hair coat changes, and accordingly changes the quality (fluff thickness and strength) of the skin; there are also seasonal changes in the landscape, which open up new opportunities for humans. Knowledge of natural laws (traditional ecological knowledge), obtained from experience and from older generations, is indispensable for the nomads in manufacturing things (Davydov, 2019; Strakach, 1962; Lavrillier, Gabyshev, 2017).

In the process of seasonal movement in the taiga, the Evenki, possessing the necessary knowledge, find the raw materials they need. For example, deer antlers that are suitable for making a pommel (cantle) in their shape. The butt-end of larch or birch, required for making a pommel (cantle) of a packsaddle, is sought in places with fallen trees, such as steep bank of a river with a promontory—*emker* (Lavrillier, Gabyshev, 2017: 124; Brandishauskas, 2017). Making saddle parts requires knowledge of the properties of different tree species. The Evenki make side-bars out of birch, and the edges of flaps out of willow. The skin from the head of a deer or elk, distinguished by its high strength and beauty, is used for manufacturing covers for riding saddles and *kumalan* rugs. It is customary to cover the saddle side-bars with winter deer skin with long fur. Threads are traditionally made of reindeer- or elk-tendons from the back of the animal; after drying, they are softened, disassembled into fibers, then twisted on the knee with the help of the palm of the hand and the fingers, which produces a strong thread withstanding moisture well. Owing to its tubular structure, deer hair is a good heat insulator. As compared to other fillers for a saddle cushion, it has better shock-absorbing properties (Kotschwar, Baltacis, Peham, 2010) (the Pazyryk people already used it as filler for horse saddle cushions (Mylnikov, 2015: 338)). Suede was made by hand from the skin of a wild deer or elk in the traditional way, and was smoked for moisture resistance (Brandishauskas, 2017: 49–51); it is used for making saddle straps, which fasten pommel and cantle to the side-bars. In old packsaddles, the function of fastening was performed by the roots of bird cherry or Siberian pine. Materials, technologies, and the very idea of the saddle correspond to the modern fashionable and expensive environmentally friendly and energy-efficient trend of urban "green architecture", which, among other

things, is distinguished by the use of natural raw materials found in places close to the inhabitant and manufacturer/builder. In the recent past, the use of available natural materials for the Evenki was the only condition that allowed them to adapt to nomadic life. For manufacturing some parts of riding saddles, the Evenki purposefully selected raw materials obtained from hunting, and not from reindeer breeding.

In the 20th century, in a situation of expanding economic and cultural contacts in manufacturing and repairing saddles, the Evenki more and more often have started to use used nails, metal plates, and insulating tape; plus tarpaulin, woolen cloth, and nylon thread for saddle sheathing, and mouliné threads for embroidery. Deerskin was replaced with rope made from natural or artificial materials. Soldier's uniform belts, parachute lines, etc. were used for saddle girths along with traditional bands. The use of modern materials in manufacturing saddles in new conditions of mobility reduces the energy consumption of reindeer breeders, facilitates their work, and testifies to their creative adoption of borrowings.

Fig. 5. Saddle with flaps from the collection of ARML, No. NV 6126/6. *Photograph by A.A. Sirina*.

Aesthetic value. In the Evenki culture, this is closely related to the convenience of using the object; by the appearance of a thing, people judge the skills and capacities of the artisan. As an attribute of a nomad, the saddle is always in sight. Judging by the ornamentation on the wooden pommel (cantle) of a packsaddle, the Evenki can identify the representative of which clan or territorial group is carrying the cargo.

If one looks at a saddle with flaps from the side and from above, it resembles a bird's nest or a waterfowl (Fig. 4, 5). A bird's figure is rendered by the outlines of the pommel of the Kyrgyz and Uzbek saddles (Kurylëv, Pavlinskaya, Simakov, 1989: 142). It is curious that the connection between migratory birds and deer is reflected in the traditional beliefs of the Evenki and Evens (Sirina, 2012: 491–493). Beauty is an important criterion for evaluating a thing among the Evenki. "Two skins from a deer's head are put on pommel and cantle, then they are sewn around, and it looks so great, it looks very nice. The greatest masters make it" (Sedlo, (s.a.)). In Southern Yakutia and Amur Region of today, riding saddles with flaps and antler pommel and cantle are not always covered with a blanket, which changes their appearance.

The aesthetical value of a saddle is expressed in its quality and the quality of leather or fur currying, sewing, and decoration (alternation of pieces of fur of different colors; bright, often red fabric or embroidery on the lower edge of the saddle's cover, red inserts in the places of sewn-in slots from reindeers' eyes and ears on the cover). Traditionally, saddles are sewn around and repaired by women, but today "almost all men know how to make saddles and sew on their own" (Sedlo, (s.a.)).

In principle, any thing in a mobile culture is multifunctional. For example, an Evenki may use a reindeer saddle for transporting small loads, and as headrest during an unforeseen overnight stay in the taiga (Fedoseev, 1958).

Conclusions

Using the example of the northern nomadic peoples living in the tundra (the Saami, Nenets, and Chukchi), A.V. Golovnev and his co-authors identified the following principles of northern nomadism: fused space-time, nomadic transformer, techno-animation, effect of movement, minimalism of possessions, mobile module, and northern aesthetics (Golovnev, Kukanov, Perevalova, 2018: 343). These principles are also typical of the taiga nomads. As opposed to migrations of tundra inhabitants associated with the needs of large-herd reindeer breeding, the movements of the Evenki have always been distinguished by greater variability in their choice of routes, which were determined by several goals simultaneously (Mertents, 2016), as well as the composition of the nomadic collective, which could change depending on the objectives of life support (Sirina, 2012). The principles of polyfunctionality, sufficiency (minimalism), and seasonality in the use of materials, which have been identified using the Evenki evidence (Davydov, 2018; 2019: 101; Simonova, 2016; Sirina, 2002: 259), are confirmed and supplemented by

the analysis of the technological features of saddles. The principles of nomadic technologies included variability, lightness and durability, modularity (capacity to be assembled and disassembled, and interchangeability), the staged/gradual nature of manufacturing things, coupled with natural and economic rhythms, and aesthetic value.

Mobility entails synergy of activities: joint labor efforts, knowledge, and skills of family and/or community members and representatives of different sexes become embodied in a new quality of a created thing. Saddle-making presupposes initial agreement on joint movement, a nomadic lifestyle. A saddle results from the labor of a man and woman. The man, using a minimal set of tools (axe, knife, drill), works on wood and antler; he makes the frame of the saddle. The woman makes skins, cuts, sews, and wraps around the frame of the saddle. The saddle is a symbol of their joint labor: man cannot make a good saddle without a woman, and vice versa.

Reindeer transport was used during the existence of collective farms. Reindeer drivers served exploratory expeditions; riding and packsaddles were in demand. This might have caused the emergence of new versions of saddle structures, their simplification and interchangeability of materials. Saddles made in the second half and in the late 20th century, when there were fewer women in the nomadic camps and men partially took over their duties, look less aesthetically perfect than those created by joint labor.

The Evenki (hunters and reindeer breeders) still use traditional things and master the technologies of making the objects that ensure their mobility and autonomy. As contemporary Evenki admit, making a horse saddle is "laborious work; it cannot be done by everyone, but only by great experts, of whom only a few remain" (Sedlo, (s.a.)). Under these conditions, museum collections acquire a new role, and studies of material culture and technologies become particularly important, since they can be used not only by scholars, but also by the Evenki themselves.

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The Consecration of Altars in 17th–21st Century Siberian Orthodox Churches: The Neurosymbolic Aspect

This study explores the ways the symbolic aspects of the consecration of altars are manifested in 17th–21st century Siberian Orthodox churches. I focus on altars of Sophia the Wisdom of the Word of God, and the Holy Great Martyr Barbara of Heliopolis. Sources include diocese registers published in the early 1900s, 17th century documents, works of Old Russian literature, church indexes, and the "Temples of Russia" (temples.ru) database. On the basis of a neurosymbolic approach to completely record reference data, a conclusion is made that the consecrations of altars dedicated to Sophia Wisdom were elitist, whereas altars in the name Holy Great Martyr Barbara were rare, but were re-energized in the late 20th and early 21st century, after this saint had become the patroness of Russia's strategic missile forces. Specific cults of saints have a chance to re-emerge when biographical or historical events of a local, regional, or state level come to be associated with episodes in the history of Christianity and hagiographic vitae. Everyday life is thereby linked to a religious context, and numerous repetitions account for the fact that consecrations of altars become traditional. Temples become material symbols, and memorial dates relating to saints turn into verbal symbols functioning as mental labels.

Keywords: *Symbols, Orthodoxy, churches, consecration of altar, Sophia the Wisdom of the Word of God, St. Barbara, neurosymbolic approach.*

Introduction

One of the most significant types of symbols in Orthodoxy is the consecration of church altars. They can be viewed as psychological labels that form a multilevel mentality in society, from the individual to the state. In this case, the term "label" does not have a negative connotation, but denotes the inherent ability of a person to give names to elements of the surrounding world, which determine certain properties and characteristics. Labels make it easier to take decisions and communicate, and help you understand what's going on. I have already dealt with the topic of consecration of altars (see, for example, publications of recent years: (Mainicheva, 2019a, b)), and the one of neurosymbolic approach (Mainicheva, 2016, 2017). This study is a continuation of research in this direction.

This article analyzes the historical experience of realizing the symbolic aspects of consecration of altars in Siberian Orthodox churches on the basis of neurosymbolic approach. The boundaries of this research and its sources have been significantly expanded. The neurological aspects of human activities are considered in a historical retrospective, which required referring to specific historical examples from the 17th to 21st centuries.

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Source base and research methodology

The sources consisted of diocese registers, published at the beginning of the 20th century (Spravochnaya kniga Tobolskoy eparkhii…, 1913; Kratkoye opisaniye…, 1916; Spravochnaya kniga Omskoy eparkhii, 1914; Spravochnaya kniga po Tomskoy eparkhii, 1914), a collection of documents of the XVII century (Pervoye stoletiye…, 1996), "Church Indexes…" (1916), a collection of works of Old Russian literature (Uspenskiy sbornik…, 1971), as well as the electronic resource "Temples of Russia". The relevance of the first types of source has been established and verified many times. The reliability of the information of the electronic resource in the form of a working database, which has existed since 2004 and contains information about more than 23,000 churches and chapels, is based on its source base, which accumulates published reference materials of the dioceses, data provided by the dioceses themselves, the clear authorship of the registration cards of the temples, the high qualification of the team of authors, including professional historians, art historians, programmers, as well as repeated verification of the information posted on the resource. Since it is impossible to cover all of the numerous examples of consecrations (there are more than 900), along with the peculiarities of their realization, in one article, the methodological techniques included a continuous review of reference data and a case-study approach with the allocation of the altars of Sophia the Wisdom of the Word of God and the Holy Great Martyr Barbara of Heliopolis, which was due to the peculiarities of their distribution in Siberian settlements. In order to more fully identify the characteristic features of the naming of altars, it was necessary to attract a large amount of comparative material going beyond the Siberian territories, which is quite legitimate, since the religious life of Orthodox Siberians proceeded in the cultural and religious context of the entire state. This technique allows us to understand the patterns of the naming of altars in Russian Orthodox churches in Siberia.

Altars in the name of Sophia the Wisdom of the Word of God

The identification of the names of altars in the Siberian dioceses showed that ever since the altar in honor of Sophia the Wisdom of the Word of God, consecrated in the 17th century in Tobolsk (which then became the center of the Trans-Ural territories), no other church had altars consecrated in that name in Siberia until recently. This is surprising: it would have been more logical to widen this particular consecration to imitate the capital city. The wooden Sophia Church in Tobolsk has existed since 1621 (consecrated on October 21, 1622); after a fire in 1677, it was rebuilt in stone in 1683–1686. The idea of dedicating this main altar to Sophia is connected with Metropolitan Cyprian, who was sent from Novgorod to head the Tobolsk diocese in 1620. Apparently thanks to him, in honor of the St. Sophia Cathedral in Novgorod, the Tobolsk church acquired an altar of the same name, although a letter missive from Moscow ordered the consecration of the church in the name of the Ascension of the Lord (Mainicheva, 2000: 8–14). In the history of Siberian Orthodoxy, the former place of residence of the clergy often dictated a preference for the holy shrines' objects and names. For example, much later, in the Omsk Church of Elijah the Prophet (1789), a copy of the Abalatskaya Icon of the Mother of God was placed, which became famous in the district thanks to the efforts of the priest Vladimir Speransky, who previously served in Tobolsk, at the Abalatsky Monastery, the home of the original Abalatskaya icon (Spravochnaya kniga Omskoy eparkhii, 1914: 21–22). Noteworthy is also the fact that the Church of the Ascension in the Moscow Kremlin (early 16th century), which can be considered the architectural prototype for the temple in Tobolsk, had five cupolas/domes. Perhaps, Archbishop Cyprian, following the principle of continuity of architectural images of churches, wanted to see the Tobolsk Sophia with five domes, like its prototype, the Sophia Cathedral in Veliky Novgorod, insisting, however, on the consecration of its altar to Sophia the Wisdom of the Word of God. Another significant temple—the stone tent-roofed Church of the Ascension in Kolomenskoye, built in the first third of the 16th century—could also have been an analog to the temple in Tobolsk, but did not become it; the choice was made in favor of the five-dome architectural style. Nevertheless, somewhat later, in the mid-17th century, the forms of the Church in Kolomenskoye were embodied in the wooden tent-roofed Trinity Church in Tomsk (1654).

The stone Sophia Cathedral in Tobolsk has already traditionally been made in the five-dome architectural style. In a letter missive dated April 28, 1680, the Tobolsk governors were instructed to build a church "according to the pattern, which is in Moscow in the Kremlin, in a nunnery… The dimensions and blueprints of this Ascension church we are sending you…" (cited after (Kopylova, 1979: 20)). Again, we are talking about an example of a five-domed temple, because the monastery Church of the Ascension in the Moscow Kremlin had five domes.

Notably, the time of construction of the stone Sophia Cathedral in Tobolsk, already under another bishop, Metropolitan Pavel, occurs during the period of the actual reign of the regent Sophia (1682–1687), the sister of the future Emperor Peter I. In the history of Orthodoxy in Siberia, it is traditional to dedicate altars in honor of

saints or guardian angels of historical figures and people who donated money for the construction or renovation of a temple. One of the first documented pieces of evidence is a petition addressed to Tsar Alexei Mikhailovich, Tsareviches Alexei Alexeevich and Fyodor Alexeevich, by the Ket service people for the relocation of the Trinity Church, dated 1663. It explains the name of one of the altars: "…and for his royal all-blessed angel of light and righteous Alexei, the man of God…", i.e. in honor of their heavenly patron (Pervoye stoletiye…, 1996: 110). One of the many examples in which both of the traditions of consecration of altars were manifested is the Krasnoyarsk Cathedral of the Nativity of the Mother of God. They began to build it thanks to the gold miners who donated money for the construction in the provincial town of a church in memory of the birth of Tsesarevich Nikolai Alexandrovich on September 8, 1843. As a result of poor-quality work, the domes of the almost completed building collapsed and the walls cracked. The temple was nevertheless erected thanks to funds donated by the merchant Isidor Shchegolev. Initially, they wanted to call it Nikolaevsky, but the main altar was consecrated as the Nativity of the Mother of God, while the lower one honored the holy martyrs Isidor and Tatiana; and the name of Saint Nicholas was assigned to the left side-altar (Kratkoye opisaniye…, 1916: 5–6).

Considering the above and many similar examples, it is not surprising that an attempt was made to connect the construction of a new, stone building of the Tobolsk Sophia temple with an appeal to the ruler through her name, because the permission for the construction of the church and the funding had to come from her. In the same period, several religious and philosophical works appeared, interpreting the philosopheme of Sophia Wisdom; for example, Ioannikii and Sofronii Likhud, or Archimandrite Ignatius, who already connects it with the name of Peter the Great (Gromov, Kozlov, 1990: 254–256). In these images, we clearly see the vicissitudes of political life during the reign of the regent Sophia, her displacement, and transfer of power to Peter the Great. The idea of consecrating the altar in honor of Sophia Wisdom appeared long before the regent Sophia entered the political arena, but during her reign it acquired special relevance. The Tobolsk cathedral, built in 1686, was consecrated in memory of the Dormition of the Mother of God, apparently as a response to the prevailing situation, so that there would be no associations with the displaced Sophia. However, worldview symbols and psychological labels are much broader in content and philosophically deeper than the transitory reality, and to this day the temple bears a double name—St. Sophia-Assumption Cathedral (Fig. 1).

Not only in Siberia, but in Russia in general, the consecration of altars to Sophia the Wisdom of the Word of God was extremely rare. According to the dioceses registers that are included in the "Temples of Russia" database, from the 11th to 21st centuries their total number was 21, which is noticeably small as compared, for example, to the altars in honor of St. Nicholas the Wonderworker (more than 5000) or the Intercession of the Theotokos, and the Life-Giving Trinity (ca 2000). Nevertheless, the dedication of altars to Sophia Wisdom was highly valued and had an elitist character, as evidenced by the fact that such altars were the main in the cathedrals of large centers of Orthodoxy: Constantinople, Sofia, Kiev, Polotsk, Novgorod, Vologda, and Tobolsk.

Altars in the name of Holy Great Martyr Barbara of Heliopolis

Another rare consecration of the altars in churches built at an early stage of the conquest of Siberia are those in honor of the Holy Great Martyr Barbara of Heliopolis (commemorated December 4 according to the Julian Calendar, December 17 according to the Gregorian Calendar). One appeared in the Tobolsk diocese in the middle of the 18th century during the construction of a stone church of the Epiphany in Tobolsk (Fig. 2); its wooden predecessors, erected in the 17th century, did not have such an altar (Mainicheva, 2005). Some Siberian churches, in the absence of altars in the name of St. Barbara, are nevertheless presented with the icons of the Great Martyr Barbara; for example, the Resurrection church in Yeniseysk, built in 1747, had the icon, which was brought there in the 1790s (Kratkoye opisaniye…, 1916: 201–202). Pskov icons of the 14th–15th centuries are also known. One of them was located in the Varvarinskaya church of Pskov (Fig. 3). Notably, in the 14th–15th centuries, the Pskovians had broad trade and professional contacts with western neighbors, and they often mastered construction skills abroad, and invited foreign specialists to build churches (Voronin, 1934: 9–14), which means that they also experienced cultural influence in the spiritual sphere, which led to the emergence of interest in the worship of St. Barbara.

The "Temples of Russia" database contains approximately 200 churches of the 17th–21st centuries with altars dedicated to Holy Great Martyr Barbara, including side-altars. In the 17th century, the main altars of St. Barbara were rare; for example, in Pskov (1618), Yaroslavl (1668), and the village of Yandomozero (1650). In the 18th century, they appeared in Moscow, St. Petersburg, Smolensk, Galich, Nerekhta, and in some villages (seven in total). In the 19th century, 64 churches were built with altars to St. Barbara (none in Siberia), at the end of the 20th century and the first decade of the 21st century there were 36, of which 11 in Siberia.

Fig. 1. St. Sophia-Assumption Cathedral in Tobolsk, 2009. *Photo by E.I. Ermolaeva.*

Fig. 2. Church of the Epiphany in Tobolsk, 1912. *Photo by S.M. Prokudin-Gorsky.*

Fig. 3. Saints Paraskeva Pyatnitsa, Varvara, and Ulyana. Last quarter of the 14th century. Pskov. From the collection of the State Tretyakov Gallery, Moscow, Russia. Inv. No. 28758 (https://www.icon-art.info/masterpiece.php?lng=ru&mst_id=515).

In Russia, the life of St. Barbara is known from registers of the 14th century (Tvorogov, 1990: 204), but as early as the 11th century the author of the "Tale of Boris and Gleb| compares the death of Boris (who was killed at his brother's command) with the death of Barbara, executed by her father (Uspenskiy sbornik…, 1971: 11). The veneration of this Great Martyr was more widespread among the Catholics, who considered her one of the 14 holy helpers. It is known that in Raphael's painting "The Sistine Madonna", to the right of the figure of the Mother of God, St. Barbara is depicted. Perhaps, distancing it from Catholicism led to the later spread of her veneration in Orthodoxy.

Traditionally, the veneration of St. Barbara is associated with the acquisition and transfer of relics. According to Orthodox tradition, in 1108, the daughter of the Byzantine emperor Alexios I Komnenos, Princess Barbara, before her leaving for Russia, asked her father for the healing relics of St. Barbara. Her husband, Grand Duke Svyatopolk Izyaslavich (Mikhail), who founded the Mikhailovsky Golden-Domed Monastery, donated these relics there. The existence of the princess is not documented (Bugaevsky et al., 2003: 558–560); however, in the religious-mythological system of thinking, this does not really matter. In the 17th century, veneration of St. Barbara spread throughout Russia in connection with the glorification of her relics. At the beginning of the 18th century, Metropolitan Joasaph of Kiev compiled an akathist for the St. Barbara, which is sung in churches today. According to legend, thanks to the miraculous properties of the relics of the Holy Great Martyr Barbara, the plague and cholera epidemics that raged in the 18th century bypassed the Kiev Mikhailovsky Monastery (Fig. 4). St. Barbara is considered to be the protector against sudden death or the threat of suffering from fire; she is also the patroness of miners and artillerymen (Ibid.: 563).

The chronicle of 1514 reported about one of the Moscow township temples erected under the direction of the Italian architect Aleviz Fryazin: "Raising a brick church to Barbara" (cited after (Palamarchuk, 1994: 47)). The Varvarinskaya church has become one of the most revered in Moscow. She gave the name to the street and tower of Kitay-gorod—Varvarskaya. In 1796–1804, on the site of the demolished ancient church, a new one was erected, according to the project of the architect R. Kazakov. The construction of the church was funded by the artillery major I. Baryshnikov and Moscow merchant of the 1st guild N.A. Samgin, whose wives were healed by believing in the miraculous powers of the relics of the Great Martyr Barbara (Ibid.: 49). In 1555, in the church, there was an icon of St. Barbara, famous for miracles of healings, as well as part of her relics (Ukazatel tserkvey…, 1916: 10–11). In 1733, in his Fountain House in St. Petersburg, field marshal B.P. Sheremetev, an associate of Peter I, in memory of his late wife Varvara Alekseevna, built a house church, consecrated in honor of St. Barbara. Here, in a silver

Fig. 4. Shrine with the relics of St. Barbara in the Golden-Domed Mikhailovsky Monastery, 1872. *Photo by D.G. Birkin.*

ark (the work of the famous jeweler F.A. Verkhovtsev), the relics of saints were kept, including those of Holy Martyr Barbara (Antonov, Kobak, 2010: 174–175). In 1838, a new refectory was built at the expense of Varvara Chelishcheva and Varvara Nerskaya in the Moscow church of the Nine Martyrs of Kyzikos near the Novinsky Val, where the chapel of St. Barbara was created (Palamarchuk, 1995: 149–150). All these examples reflect the reasons for the construction of temples and the realization of the Great Martyr veneration, connected with the names of women who had St. Barbara as their heavenly patroness, or who believed in the healing powers of her relics.

The modern realization of the veneration of Holy Great Martyr Barbara takes on an unexpected aspect. The official date of the formation of strategic missile forces of Russia is December 17, 1959 (Raketnye voiska…, (s.a.)). At the end of the 20th century, against the backdrop of a return of attention to religious values, this date coincided with the date of commemoration of Holy Great Martyr Barbara. This led to the fact that in 1995 St. Barbara was chosen as the heavenly patroness of these troops, and in 1999, with the blessing of Patriarch Alexy II, her icon was put aboard the "Mir" orbital space station (see (Bugaevsky et al., 2003: 563)).

There were several reasons for the construction of the churches of St. Barbara at the turn of the 20th and 21st centuries, among which were private considerations, and the veneration of the saint as a deliverer from diseases, as well as the construction of temples of the same name to replace the old or the lost ones. For example, in the city of Klin, Moscow Region, the church is located at the Central District Hospital. In the village of Zolotets of the Republic of Karelia, a new temple was consecrated in memory of the destroyed one in the village of Vygostrov. In the city of Rzhev, by the initiative and at the expense of OAO "Elektromekhanika", a wooden, single-altar church was built to replace the one destroyed at the All Saints Cemetery. The chapel at the Stavropol Building-Trade Secondary School was consecrated in memory of the Varvarinsky cemetery with a temple, which had been located here earlier. Noteworthy is also the intention to emphasize the special patronage of the saint to miners, artillerymen, and missile forces in general: such is the wooden one-domed single-altar church of Holy Great Martyr Barbara at the Kirov mine in the Murmansk Region, built at the expense of the PhosAgro Company and consecrated on December 17, 2017. Illustrative examples include churches of St. Barbara in the city of Gagarin, Smolensk Region, the birthplace of the first cosmonaut (1999–2002) and in the village of Kokovka, Plesetsky District, Arkhangelsk Region, not far from the Plesetsk Cosmodrome (2011). In Siberia, there are two such churches: in the village of Sibirsky (Altai Territory) and in the city ofNovosibirsk.

All the data reviewed indicate that consecrations of altars to Holy Great Martyr Barbara are rare, but not elite. At the turn of the 20th–21st centuries, these became rather narrowly specialized.

Conclusions

The main principle for realizing the veneration of Sophia the Wisdom of the Word of God and the Holy Great Martyr Barbara can be attributed to the emergence of interest in them, when the events of modern life (including episodes of biographies, historical events of a local, regional or national scale) come to be associated with episodes from the history of Christianity, hagiographic vitae, and significant dates. Realization serves to fit real events into the context of religious life. Repetition and analogy create a tradition in the consecrations of altars. Temples become materialized symbols, dates of commemoration of saints and miraculous events, as well as their very names and titles, become verbal symbols that act as mental labels.

Symbolic motifs in architecture act as a kind of neuro-labels that help a person to think and operate with concepts and images, without going all the way from initial sensation to understanding the deep essence. At the same time, it is not at all necessary that all members of a community have all the knowledge about the meaning and importance of church images and symbols; understanding accompanies each individual case at its own level, which allows one to sensually and mentally master reality. Mental models based on symbols and signs provide us with the ability to structure experience and simplify reality, which satisfies the need to control the situation and predict the future. In the system of figurative-symbolic thinking, historical parallels play an essential role, since they direct the mentality of a person and a community from the singular to the meaningful common, as well as to what happened in the past. The idea of a cycle, repetition, and return to the past is clearly expressed by the proverbial Old Testament phrase: "What has been will be again, what has been done will be done again; there is nothing new under the sun" (Ecclesiastes, 1: 9).

The historical example of the use of Orthodox symbols in the realization of the consecrations of altars allows us to raise the question of the psychological and mental aspects of the formation of traditions on the basis of specific neuro-labels, with the help of which mental activity is carried out.

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The Peopling of the Baraba Forest-Steppe in the Neolithic: Cranial Evidence

On the basis of statistical analysis of craniometric data relating to Mesolithic and Neolithic samples from northern Eurasia, we discuss the peopling of the Baraba forest-steppe in the Early Holocene. This region is represented by samples from Sopka-2/1 (early sixth millennium BC), Protoka (late fifth to early fourth millennia BC), Korchugan (early-mid sixth millennium BC), and Vengerovo-2A (late sixth millennium BC). The results of the principal component analysis are interpreted in the context of debates over the role of autochthonous traditions in the Neolithic. During the Preboreal period (10 ka BP), large parts of the Baraba forest-steppe were flooded by the transgression of lake systems during climatic warming. This may have caused depopulation, lasting for at least a millennium. The Early Holocene people of Baraba were an offshoot of Meso-Neolithic populations of the northwestern Russian Plain. On that basis, the Early Neolithic populations of Baraba were formed. Direct population continuity is traceable only through the Chalcolithic. Since the late sixth millennium BC, however, the local population had incorporated migrants from the Pit-Comb Ware area in the central Russian Plain and, indirectly (via the Neolithic Altai), from the Cis-Baikal area.

Keywords: *Holocene, Neolithic, Baraba forest-steppe, migrations, craniometry, prehistoric reconstruction.*

Introduction

The earliest traces of human occupation of the Baraba forest-steppe, as evident from the radiocarbon dates for the mammoth bones from Volchya Griva, fall into the period between 14–11 ka BP (Zenin, 2002; 2003: 23). At this site, among bone remains of large mammals—mainly the mammoth—thirty-seven bone tools were found. Some lithic artifacts were also excavated at sites with faunal remains of Novy Tartas (8 spec.) and Vengerovo-5 (10 spec.), whose age is estimated to be similar to that of Volchya Griva (Zenin, 2003: 16). It is suggested that the archaeological layers of those sites containing the fauna had formed at the location of a natural mineral animal salt lick, which attracted animals coming to compensate for the deficiency of important macro- and microelements and dying from natural causes. Such a source of nutrients and valuable mammoth bone could attract Paleolithic humans, and ancient hunters were likely visiting the site as well.

This time was a part of the late glacial period that followed the Sartan glaciation, whose maximum stage is dated to the 23–16 ka BP, while its peak occurred between 20 and 18 ka BP (Arkhipov, 1997). A modern reconstruction of the environmental conditions of the Sartan period in the central West Siberian Plain has shown that lakes of thermokarst origin were an

important component of the terrain. Such lakes were formed, not owing to the retreat of glaciers, but as a result of the melting of underground ice-sheets (Kuzmin et al., 2006). It is plausible that during this period the vast wet plain provided good living conditions for large herbivores—an important resource for human subsistence.

In the territory of Baraba, no Early Holocene sites containing traces of human presence have been detected. Probably, the change of climate from cooling (Younger Dryas) to warming (Preboreal period) led to a transgression of lake systems and flooding of vast territories, which resulted in migration of the population to other areas (Orlova, 1990: 100).

The climate of the central West Siberian Plain in the Boreal period, 9–8 ka BP, was similar to the modern. During the whole Boreal period, the proportion of birch in the composition of the woody vegetation was increasing (up to 85–95 %), and birch forest-steppe was forming (Ibid.: 112). This was the time of the first appearance of humans in the region.

The beginning of the Neolithic can be dated to the 7th millennium BC, according to radiocarbon dates obtained for the Neolithic assemblage of the multilayered site of Tartas-1 (Molodin, Reinhold, Mylnikova et al., 2018; Molodin, Nenakhov, Mylnikova et al., 2019). Similar archaeological artifacts were excavated at Ust-Tartas-1 (Molodin, Kobeleva, Mylnikova et al., 2017). Studying those items has led to the separation of an Early Neolithic Barabinskaya archaeological culture, which is specific to the southern West Siberian Plain. An important marker of the culture is flat-bottomed ceramic vessels.

The pottery from Tartas-1 and Ust-Tartas-1, according to the researchers who studied the sites, finds direct parallels in the ceramics found at the Avtodrom-2/2 settlement, located in close proximity to Tartas-1 and Ust-Tartas-1, on the very same terrace of the Tartas River. However, Avtodrom-2/2 was assigned to the Boborykino culture of the Tobol-Ishim region and is considered as evidence of infiltration of populations from the middle Trans-Urals to Baraba (Bobrov, Marochkin, Yurakova, 2012). The radiocarbon dates obtained from the carbon deposits on the pottery from Avtodrom-2/2 fit into the period from the early 5th millennium BC to the middle thereof (Mosin, Bobrov, Marochkin, 2017). According to V.I. Molodin, these dates are biased (too late) because of the imperfections of the dating method. He considers the origin of flat-bottomed vessels in Baraba as autochthonous and convergent. This view is based on the wide prevalence of this pottery tradition throughout Neolithic Eurasia (Molodin, Kobeleva, Mylnikova et al., 2017: 175; Molodin, Reinhold, Mylnikova et al., 2018: 49). The upper dates of the Early Neolithic complexes of the Baraba forest-steppe reach the turn of the 6th millennium BC. No Early Neolithic human skeletal remains have been found in Baraba to date.

A marked similarity between artifacts (stone, bone, and pottery) from Baraba and from the Tobol-Ishim region was noticed by V.A. Zakh (2018: 25). This author admits the possibility of attributing the Boborykino-Koshkino finds to the second half of the 7th millennium BC on the basis of the dates obtained from the human and animal remains and pottery found at the Mergen-6 settlement (Ibid.: 26). This confirms the hypothesis of the existence of genetic connections between the populations of Baraba and the Tobol-Ishim region.

The following development of the Neolithic traditions in Baraba had been taking place from the 6th to the 5th millennia BC (Marchenko, 2009; Molodin, Mylnikova, Nesterova, 2016). The cultural attribution of archaeological sites belonging to this period remains a matter of debate. Human skeletal data were excavated at Protoka, Sopka-2/1, Korchugan, and Vengerovo-2A cemeteries. According to N.V. Polosmak, the Protoka site can be attributed to the Middle Irtysh culture (Polosmak, Chikisheva, Balueva, 1989: 29). Molodin upholds the view according to which the synthesis of elements typical of the archaeological cultures of Baraba reflects their composite nature (2001: 27). But he considers all the cultural traditions to be parts of the same historical and cultural community ranging from the Trans-Urals to the Ob region. The Protoka, Sopka-2/1, and Korchugan sites, according to Molodin, display a similarity to Neolithic sites of the Ob region, and might belong to the Upper Ob culture (Molodin, Chikisheva, 1996: 186). The Neolithic Vengerovo-2/A burial site has been the subject of a complex multidisciplinary survey, including studies of its burial tradition, grave goods, skeletal morphology and mitochondrial genome of the deceased. Nevertheless, the cultural affiliation of the site has not yet been clearly determined and is only considered as a result of the interaction of different cultural traditions (Molodin, Mylnikova, Nesterova, 2016).

At the Avtodrom-2 settlement in Baraba, manifestations were detected of the Artyn culture, which existed in the middle to late 5th millennium BC. Its area also included the Middle Irtysh and the southern part of the Vasyugan region (Bobrov, 2008;

Bobrov, Marochkin, 2011; Bobrov, Marochkin, Yurakova, 2017). No cranial data representing the population of this culture are available for study.

Thus, the differentiation between indigenous and introduced cultural traditions has always been the focus of the discussion about the formation of the Neolithic cultural system in the Baraba forest-steppe. An ethno-cultural peculiarity of this region is that it was populated late as compared to many other parts of Eurasia, owing to the flooding that lasted at least a thousand years. Humans undoubtedly migrated to Baraba from the outside, bringing with them cultural traditions formed in their places of origin. These traditions, including pottery-making, were then transformed under new conditions. The dominating thesis of the conception of the genesis of Mesolithic and Early Neolithic cultures of Western Siberia is the indigenousness of the populations making flat-bottomed pottery (Molodin, Reinhold, Mylnikova et al., 2018) If this thesis is viewed at the scale of Western Siberia as a whole, it is almost indisputable. The first groups of people that began to populate Baraba during the Boreal might have come from neighboring areas of Western Siberia, where ecological conditions did not preclude human occupation. However, migrations from other Eurasian regions that were not depopulated in the Mesolithic and not separated from Baraba by impenetrable geographical barriers were potentially feasible as well.

The formation of the ethno-cultural and anthropological (racial) structure of the population of the Baraba forest-steppe during subsequent phases of the Neolithic might have been based on the interaction between relatively isolated local populations originating from the Early Neolithic people (i.e. autochthonous component) and migrants. Those migrations might, in turn, have had stable or varying origins. In the present study, we aimed at reconstructing the picture of human colonization of Baraba employing methods of analysis of complexes of cranial metric traits in the samples from the Neolithic sites of the region. Such morphological complexes are chronologically stable. This thesis is confirmed, first, by the observed temporal dynamics of the modification of traits. Substantial changes require a long time to occur. For instance, the trend towards gracilization (i.e. decrease in the robustness of cranial vault and the total size of facial skeleton) is evident when Mesolithic and Neolithic cranial samples are compared with those of the Late Medieval period. But another trend, towards the spread of brachycephalization (i.e. increase in cranial index), can only be traced from the Middle Ages to the Modern period (Alekseev, 2007: 495–505). Second, it is established that migration itself cannot lead to a change in the physical type of a population if the migrating group has not experienced a substantial gene flow from other populations (Khrisanfova, Perevozchikov, 1991: 289). Also, a small group of migrants cannot seriously affect the gene pool of an indigenous population owing to a number of social barriers (Alekseev, 1976). On the basis of these patterns, we hypothesize that the human groups that migrated to Baraba could have retained the anthropological type of their father populations during at least the whole Neolithic period. Placing craniometric data for these groups into the context of modern radiocarbon dates of Eurasian Neolithic sites and the results of recent archaeological studies will make us closer to understanding the system of population affinities of the Neolithic Baraba people, which system is the key to describing the process of peopling of this region of Western Siberia.

Material and methods

Any analysis of paleoanthropological samples from the Neolithic sites of the Baraba forest-steppe is complicated by the fact that the specimens are highly fragmentary. Only single skulls are preserved enough to measure a sufficient set of variables. A possible solution could have been to combine all the specimens into one sample and then compare this sample with other cranial series compiled in a similar way, or with representative samples from large burial grounds. But such an approach does not match up to the purpose of our study, which is aimed at exploring the vectors of connections of the populations of the Neolithic archaeological cultures in chronological and territorial aspects. Taking into account these issues of preservation, we decided to use principal component analysis (PCA), which is well suited for studying individual variation. The analyses were carried out in Statistica 8.

Our comparative analysis included previously published data on the Neolithic sites from northern Eurasia more or less synchronous with the samples from Baraba. Unfortunately, not all of the Mesolithic and Neolithic sites from different regions contained human cranial remains. The output of PCA is a scatter plot where each specimen has particular coordinates (PC scores), and morphologically similar individuals lie close on the plot and form clusters. In

order not to overwhelm the plots with excessively numerous units of analysis, we employed sample means of the variables for large samples. The choice of variables for the analysis was dictated by the state of preservation of the material, including single skulls, as cranial morphological features of individual ancient specimens are often extrapolated onto populations of vast areas. The set of variables employed in the present study includes: cranial index, minimal frontal breadth, forehead profile angle, bizygomatic breadth, upper facial height, nasal index, orbital index (from *maxillofrontale*), nazomalar and zygomaxillary angles, and general facial angle.

An important aspect of the anthropological study of ancient humans who created archaeological cultures is the reconstruction of their facial appearance. In this paper, the appearance of representatives of the Neolithic cultures of Baraba is illustrated in two different ways: by contour sketches of the skulls, and by graphical reconstructions using the method of M.M. Gerasimov.

Included in the statistical analysis were well-preserved skulls from four Neolithic sites from Baraba: Sopka-2/1, the first half of the 6th millennium BC (Marchenko, 2009); Protoka, the second half of the 5th to the first half of the 6th millennium BC (Orlova, 1995: 214); Korchugan, the second quarter to the middle of the 6th millennium BC (Molodin, Novikov, Chikisheva, 1999; Marchenko, 2009); and Vengerovo-2A, late 6th millennium BC (Molodin et al., 2012). Full craniometric data for the samples from those sites have been published previously (Chikisheva, 2012: 200–208; Chikisheva, Pozdnyakov, Zubova, 2015).

Reference data representing several regions were compiled from the literature. The Volgo-Ural region is represented by measurements of a male from a burial of the Elshanka culture at Lebyazhinka IV (Khokhlov, 2017: 219–220), and a female from a burial on the Mayak mountain, belonging to the transition between the Paleolithic and Mesolithic. Calibrated dates for these burials are 7475 ± 213 years BC (Timofeev et al., 2004: 32), and 11,175 ± 75 years BC (Khokhlov, 2017: 219–220), respectively.

Samples from several Mesolithic and Neolithic sites from northeastern Europe were published. The earliest burials, according to calibrated radiocarbon dates, were detected near Lake Lacha (Kargopolsky District of the Arkhangelsk Region): Popovo, 9300–9200 years BC (Oshibkina, 2007: 44), and Peschanitsa, 10,785–10,662 years BC (Saag et al., 2020). The individual measurements of these skulls were published earlier (Gokhman, 1984; Gerasimova, Pezhemsky, 2005: 16–17). Representatives of the Pit-Comb Ware culture were buried at the Karavaikha-1 camp site (Vologda Region, Lake Vozhe basin, about 80 km to the south of Lake Lacha). The only radiocarbon data for this burial, obtained from charred remains on a ceramic fragment, matches the calibrated interval between 4486 and 4353 years BC (Kosorukova et al., 2016). Craniometric data for this individual were published by Akimova (1953). At a distance of ~100 km to the west of Lake Lacha, at Yuzhny Oleny Island of Lake Onega in Karelia, there is a cemetery dated to the late 6th millennium BC (Oshibkina, 2007: 38). This site is represented in our analysis by sample means (Yakimov, 1960; Alekseev, Gokhman, 1984). The cemetery at Zvejnieki (Eastern Baltic, Latvia) includes burials from various epochs, from the Mesolithic to the present. Two cranial samples from Zvejnieki were employed in our analysis: Mesolithic and Early Neolithic (Denisova, 1975: Tab. 1–3). The Mesolithic burials are dated to the 5th millennium BC, according to analogs in archaeological artifacts (Oshibkina, 2007: 46). Among those burials, there are even older ones belonging to the Late Boreal (Ibid.). One of the burials has a radiocarbon date of 5428–5262 cal years BC (Timofeev et al., 2004: 108). The Early Neolithic burials at Zvejnieki are dated to the interval from 4960 to 3998 years BC (Ibid.).

The reference samples of the Early Neolithic population of the central Russian Plain (Volga-Oka interfluve) represent the Upper Volga (Ivanovskoye VII) and Lyalovo (Sakhtysh II, IIa, Lovetskoye Ozero) cultures. We employed individual measurements of the skulls from these samples (Alekseeva et al., 1997: 34–41). The earliest radiocarbon dates fit into the calibrated intervals between 6016 and 5960 years BC for Ivanovskoye VII (Timofeev et al., 2004: 93), 6106 to 5884 for Sakhtysh II, and 5610 to 5360 for Sakhtysh IIa (Ibid.: 91). A burial at Berendeyevo Boloto, according to the results of radiocarbon dating (4447–4259 years BC (Saag et al., 2020)), belongs to the same group of burials. This individual has been measured and described by N.N. Mamonova (1969).

The Neolithic burials in the Middle Trans-Urals include: Shigir peat-bog, Dozhdevoy Kamen, and Omskaya site. Individual measurements of well-preserved skulls from these sites were employed in the analysis (Bagashev, 2003; Chikisheva, 1991). No radiocarbon dates are available for these sites, but the above-mentioned authors refer to archaeological publications suggesting their Early Neolithic age.

According to the results of direct dating, neighboring Neolithic complexes from the Trans-Urals were created between 6500 and 4100 years BC (Chairkina, Kuzmin, 2018).

In Altai, Neolithic burials belong to the final stage of the epoch (early to middle 4th millennium BC). In our analysis, we employed measurements of individuals from the following sites: Kaminnaya (female) and Nizhnetytkeskenskaya (male) caves in the Altai Mountains (Chikisheva, 2012: 200–208); Solontsy-5 and Ust-Isha (Ob Plateau) (Ibid.; Dremov, 1986), Vaskovo-4, Lebedi-2, and Zarechnoye-1 (Kuznetsk Basin) burial grounds (Chikisheva, 2012: 200–208; Dremov, 1997).

The Neolithic cranial samples from the Cis-Baikal area employed in the present study originate from burials belonging to the Kitoi and Serovo cultures dating to the 6th and 4th millennia BC, respectively (Mamonova, Sulerzhitsky, 1989). We used means for a composite sample of the Kitoi culture skulls from the Upper Lena basin and the Angara region (Mamonova, 1973); Serovo culture skulls from the Verkholensky burial ground (Levin, 1956); and a composite sample from the Angara region (Mamonova, 1980) were employed.

Results and discussion

The method of principal component analysis employed in the present study allows the combining of a large array of correlated variables into several integral indicators (factors) via transformations of the correlation matrix. The structural elements forming the factors (factor loadings) are the correlation coefficients between original and new variables. Using this method, it is possible to interpret the meaning of each factor on the basis of its respective loadings. The positions of objects of the comparative analysis in the coordinates of the first and second factors (PC1 and 2) were depicted in scatter plots. The two factors described about 50 % of the total variance: 46.8 % in males and 46.4 % in females (see *Table*; Fig. 1, 2).

Except for two angles (forehead profile and general facial), all the original measurements displayed similar modules of loadings on PC1 in both male and female samples, while the signs of the loadings were diametrically opposite in the two sexes. In males, the following variables exhibit high positive correlations with PC1: cranial index, upper facial height, nasal index, zygomaxillary and forehead profile angles. In females, equally high but negative coefficients are observed for cranial index, bizygomatic width, upper facial height, nasal index, and nasomalar angle. In both cases, an increase in cranial index is associated with a decrease in upper facial height, an increase in nasomalar angle, and an increase in nasal breadth. In addition to these, a decrease in forehead profile angle is observed in males, and increase in bizygomatic breadth in females.

In our interpretation of the PC1 loadings, we take into account that analysis deals with representatives at an early stage of racial differentiation who display some unconsolidation of trait combinations from the point of view of modern anthropological typology. It is possible, however, that the factor differentiates the objects according to the two directions of the subsequent transformation of their craniometric complexes: one towards a Mongoloid combination of features, and another towards a Caucasoid combination.

Factor loadings of the principal components analysis

Variable	Males		Females	
	PC1	PC2	PC1	PC2
8 : 1. Cranial index	0.704	0.367	–0.799	0.245
9. Minimal frontal breadth	0.167	0.302	–0.444	–0.062
45. Bizygomatic breadth	0.122	0.751	–0.614	–0.595
48. Upper facial height	–0.728	0.452	0.658	–0.569
54 : 55. Nasal index	0.583	–0.499	–0.659	0.164
52 : 51. Orbital index (from *maxillofrontale*)	–0.101	0.518	0.347	0.412
77. Nasomalar angle	0.272	0.334	–0.502	–0.652
∠ zm. Zygomaxillary angle	0.681	0.373	–0.447	0.053
32. Forehead profile angle (from *nasion*)	0.752	–0. 305	0.113	–0.649
72. General facial angle	0.344	0.440	0.249	–0.352

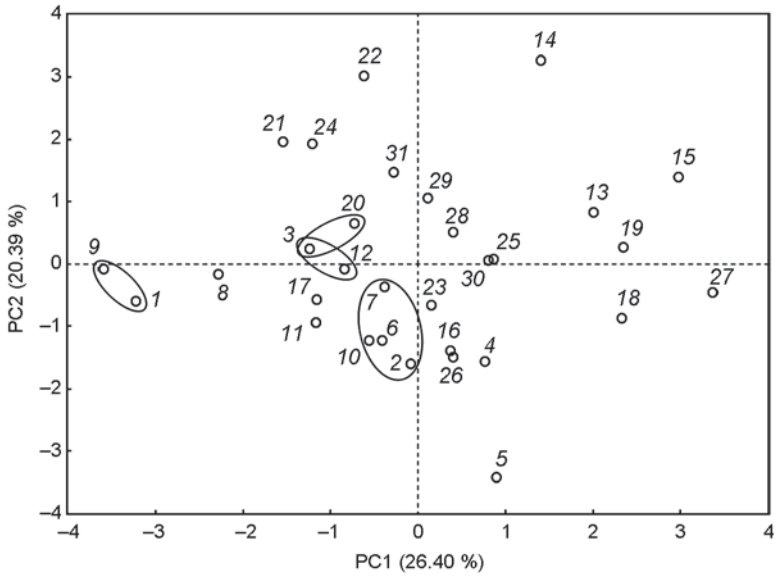

Fig. 1. Scatter plot of the Neolithic cranial data in the coordinates of PC1 and PC2. Males.
1 – Sopka-2/1, burial 51; *2* – Sopka-2/1, burial 61E; *3* – Protoka, burial 4B; *4* – Vengerovo-2A/2, burial 1, skeleton 17; *5* – Vengerovo-2A/2, burial 2, trench; *6* – Lebyazhinka IV; *7* – Yuzhny Oleny Island; *8* – Popovo, burial 1; *9* – Peschanitsa; *10* – Zvejnieki, Mesolithic; *11* – Zvejnieki, Early Neolithic; *12* – Berendeyevo Boloto; *13* – Lake Lovetskoye; *14* – Sakhtysh II, burial 19; *15* – Sakhtysh IIa, burial 22; *16* – Sakhtysh IIa, burial 42; *17* – Omskaya site, burial 3; *18* – Shigir peat-bog, No. 1-841; *19* – Nizhnetytkeskenskaya Cave; *20* – Ust-Isha, burial 4; *21* – Ust-Isha, burial 8; *22* – Ust-Isha, burial 9; *23* – Solontsy-5, burial 3; *24* – Solontsy-5, burial 4; *25* – Vaskovo-4, burial 3; *26* – Zarechnoye-1, kurgan 1, burial 1; *27* – Zarechnoye-1, kurgan 4, burial 6; *28* – Kitoi culture, Upper Lena basin; *29* – Kitoi culture, Angara region; *30* – Serovo culture (Verkholensky burial ground); *31* – Serovo culture, Angara region.

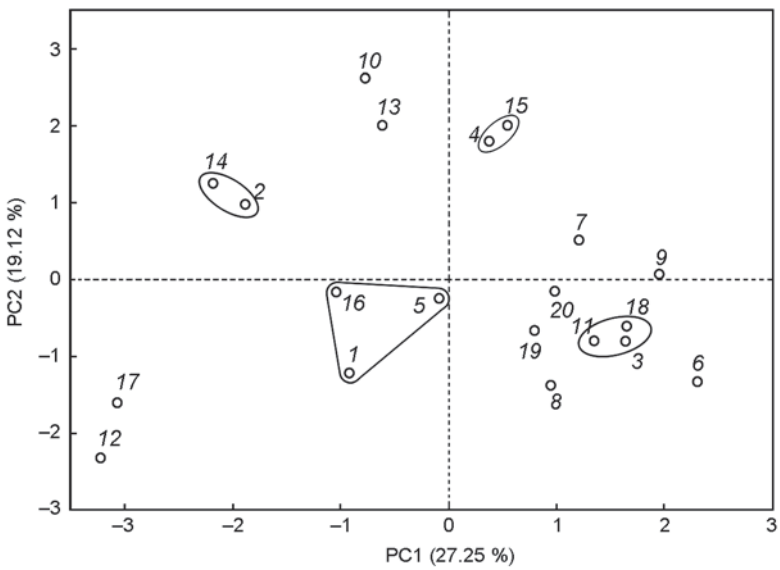

Fig. 2. Scatter plot of the Neolithic cranial data in the coordinates of PC1 and PC2. Females.
1 – Korchugan, burial 7; *2* – Vengerovo-2A/1, burial 1; *3* – Vengerovo-2A/2, burial 1, skeleton 2; *4* – Vengerovo-2A/2, burial 1, skeleton 10; *5* – Vengerovo-2A/2, burial 1, skeleton 12; *6* – Mayak mountain; *7* – Yuzhny Oleny Island; *8* – Popovo, burial 4; *9* – Zvejnieki, Mesolithic; *10* – Karavaikha, No. 9788; *11* – Karavaikha, No. 8763; *12* – Sakhtysh II, burial 20; *13* – Sakhtysh IIa, burial 11; *14* – Sakhtysh IIa, burial 61; *15* – Omskaya site, burial 2; *16* – Kaminnaya Cave; *17* – Solontsy-5, burial 9; *18* – Kitoi culture, Angara region; *19* – Serovo culture (Verkholensky burial ground); *20* – Serovo culture, Angara region.

In males, PC2 is positively and significantly associated with bizygomatic width. The other variables, except for nasal index and forehead profile angle, display correlations of the same sign, but of much lower values. It can be suggested that the second factor in the male sample differentiates the most consolidated Mongoloid combinations of craniometric variables. In females, PC2 exhibits high negative correlations with bizygomatic width, upper facial height, and nasomalar and forehead profile angles. Such a combination distinguishes a Caucasoid component in the female sample. The presence of a low negative correlation between this factor and general facial angle might suggest that a tendency towards prognathism was a specific feature of this particular Caucasoid variant.

In the morphospace of PC1 and PC2, the male skulls from Sopka-2/1 cluster together with Mesolithic specimens from Peschanitsa (Sopka-2/1, burial 51), Lebyazhinka IV, Yuzhny Oleny Island, and Zvejnieki (Sopka-2/1, burial 61E). The part of the plot where those individuals are located (see Fig. 1) represents negative values of both factors, i.e. is associated with western (European) cranial morphological patterns. The skull from Protoka also displays negative values of PC1, but is shifted to a positive area of PC2, thus exhibiting a tendency towards the complexes with eastward vectors of connections. The individuals

from the burial at Berendeyevo Boloto and burial 4 at Ust-Isha lie close to the specimen from Protoka. The skulls from Vengerovo-2A are specific in displaying positive values of PC1 and negative of PC2. These are similar to the specimens of Lyalovo culture of the Volga-Oka interfluve (Sakhtysh IIa, burial 42), and to the Late Neolithic individuals from the Altai region (Salairsky Kryazh, Zarechnoye-1 – kurgan 1, burial 1).

Thus, our analysis of the male cranial sample using PCA has demonstrated that the vector of biological affinities of the earliest Neolithic inhabitants of Baraba (Sopka-2/1, the first half of the 6th millennium BC) exhibits a northwestward direction, pointing to the Mesolithic specimens. This result implies colonization of the Baraba forest-steppe at the early stage of the neolithization of the region by migrants from northwestern areas of the Russian Plain. But during the second half of the 6th millennium BC (Vengerovo-2A), the anthropological composition of the Baraba population became more complex owing to the infiltration of people of the Pit-Comb Ware culture from the central Russian Plain, represented by the Lyalovo populations from the Volga-Oka interfluve. Male individuals from Baraba dated to the 5th millennium BC (Protoka) displayed features of eastern anthropological complexes. This does not necessarily mean direct infiltration of populations or single individuals of the Neolithic cultures from the Cis-Baikal to Baraba. Their indirect influence via the Neolithic populations of Altai seems more plausible.

The arrangement of the female Neolithic skulls from Baraba in the PCAS scatter plot (Fig. 2) reflects, in general, the same vectors of population connections as in males. The female sample is composed only of specimens from burials dated to the second half of the 6th millennium BC (Vengerovo-2A, Korchugan), which suggests that the influence of the eastern anthropological component relating to the Kitoi populations of the Cis-Baikal began even earlier than the 5th millennium BC.

The possible vectors of the peopling of the Baraba forest-steppe were mapped (Fig. 3). As there are no substantial natural barriers to human dispersal between the Russian Plain and Siberia, the migration routes might have passed through the Polar Urals. The typical features of the relief of this part of the mountains

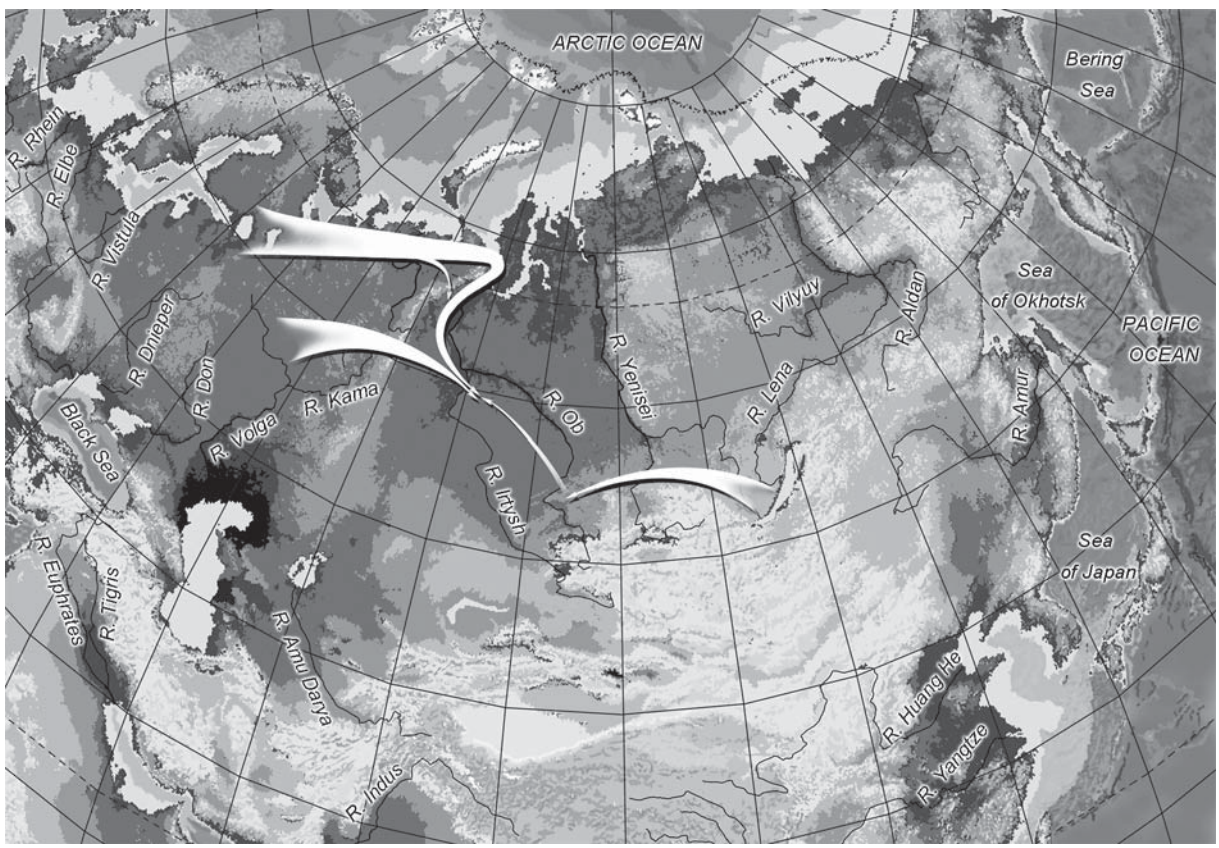

Fig. 3. Schematic map of possible routes of Neolithic migrations to Baraba forest-steppe.

are a deep cut of their ridges by transverse valleys abounding in rivers and lakes, and low elevation of passages. Today, the Transpolar Mainline of the Northern Railway passes through the Polar Urals. During summer, the valleys are used by the Nenets, Komi, and Khanty for reindeer grazing. The eastern slope of the Polar Urals is gentle, gradually descending to the West Siberian Plain, ending in a wide strip of ridges. The way to the south along the eastern slopes of the Northern Urals is quite convenient, as numerous rivers of this region (tributaries of the Severnaya Sosva and Ob) are completely crossable. The rivers are fast but shallow and abound in fish, they flow along rocky channels and have numerous rapids. The middle Uralian Mountains are low, with convenient passages; their eastern slopes and the neighboring area of the Trans-Urals don't have any insurmountable barriers. The Northern Altai Mountains, with ridges and foothill plateaus, are open to the steppe and forest-steppe areas of the West Siberian Plain. Thus, these directions were permeable for ancient migrants as well.

It is of note also that the landscapes of the regions of origin of the migrants and those of the Baraba forest-steppe in the Early Neolithic were similar in major features: in both cases, there were plenty of lakes and rivers tending to get waterlogged. Routes of migratory waterfowl passed through the lakes abounding in fish. The swamps provided a variety of vegetation, including berries and medicinal plants. The modern faunal composition of Baraba can be cautiously extrapolated to previous archaeological epochs, though some species are highly endangered at present because of human activity. The Neolithic population could use animal meat for food and fur for clothing, and the environmental conditions were in general quite favorable for small groups of people. Baraba remained an attractive place to migrate to during the archaeological epochs following the Early Neolithic, since this region could provide ample natural resources for subsistence.

The prevailing craniometric complex of the Neolithic population of Baraba includes the following features: dolichomesocrania; high skull vault; wide and moderately tall face; mesognathia of the facial vertical profile; heteroprosopia of the facial horizontal profile (i.e. platyopia or mesopia of the upper level is combined with mesognathia or clynognathia of the middle level); weakly profiling nasal bridge; and small nasal protrusion angle. This complex of traits was described more than 30 years ago in a study of the first Neolithic skeletal samples excavated in Baraba from the Sopka-2/1 and Protoka cemeteries (Polosmak, Chikisheva, Balueva, 1989: 95; Chikisheva, 2012: 49–51). Subsequent research has shown the ubiquity of the complex in all the Neolithic skulls discovered later in Baraba (Chikisheva, 2012: 49–51; Chikisheva, Pozdnyakov, Zubova, 2015). The results of the comparative analysis of the cranial morphology of the Early Neolithic inhabitants of Baraba suggest that the peopling of the region during the Early Holocene was initiated by some groups of the Mesolithic and Neolithic populations from the northwestern Russian Plain. The Chalcolithic Age populations of Baraba were forming on the base of this anthropological layer, which can be called indigenous only with respect to these populations.

Gerasimov's method of facial reconstruction based on cranial data is an important way of visualizing the appearance of the Neolithic individuals from Baraba (Fig. 4–11). Most of these individuals display an angular shape of the contour of the cranial vault, which is large and tall and dominates over the face. The general impression of robustness is further emphasized by a greatly developed relief of the frontal and occipital bones, large mastoid processes, and a strongly pronounced bone ridge above the mastoid process. The faces of the individuals are of rectangular shape: vertically short, with wide cheekbones and angular mandibles. Their low, enclosed, and rectangular orbits form a marked overhanging of the fold of the upper eyelid and a deep position of the eyeball. Some anterior protrusion of the alveolar region is evident in the profile view, which might be explained by a general alveolar mesognatia (and even prognathism in some cases) and an intermediate protrusion of the relatively small nose. In addition, the labiodontic type of dental occlusion prevails in the population; thus, the lower lip is typically protruding. The features listed above are most clearly pronounced in the individuals buried at Sopka-2/1 and Protoka (see Fig. 4–6). These features are more smoothly manifested in the individuals from Vengerovo-2A; the cranial robustness is less pronounced, and the psalidontic type of dental occlusion is more common (see Fig. 7–9).

The two individuals from Korchugan display some specific morphological features. The shape of the frontal processes of their maxillary bones and nasal bones suggests the presence of an epicanthus. In combination with a more protruding zygomatic region, this gives the individuals a somehow Mongoloid appearance (see Fig. 10, 11).

The physiognomic similarity of all the portraits is due to the angular contour of the head in the frontal view, large size and rectangular shape of the face,

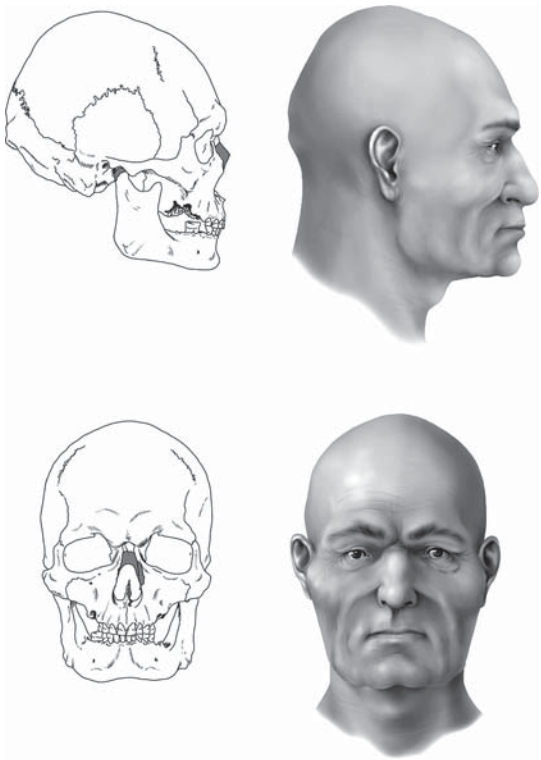

Fig. 4. Graphic reconstruction of the appearance of a male, 50–60 years old. Protoka, kurgan 5, burial 4.

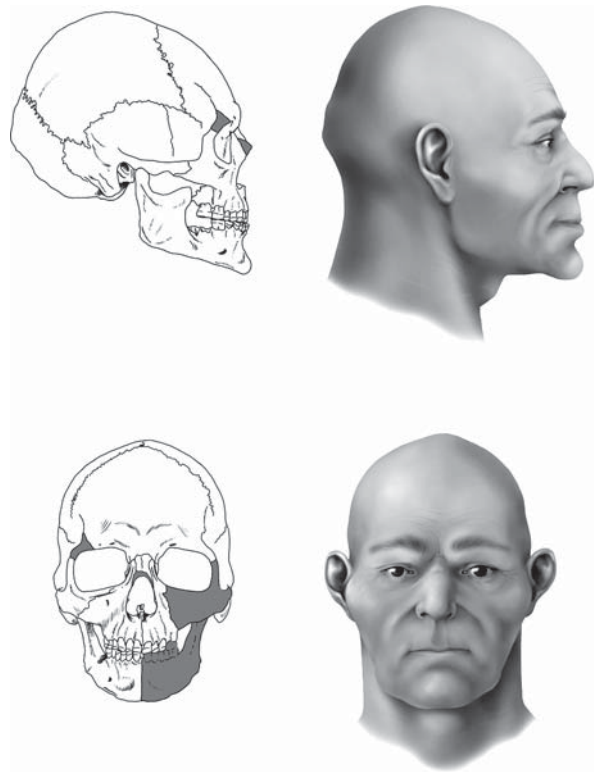

Fig. 5. Graphic reconstruction of the appearance of a male, 30–40 years old. Protoka, kurgan 5, burial 11.

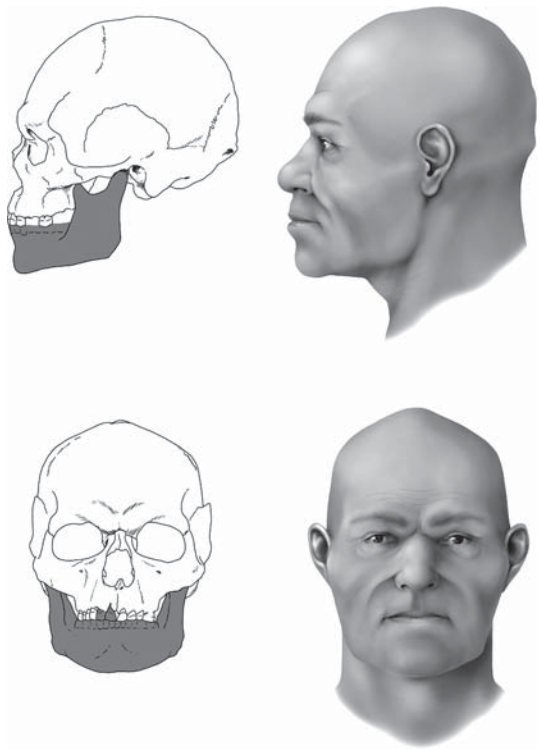

Fig. 6. Graphic reconstruction of the appearance of a male, 40–45 years old. Sopka-2/1, burial 61E.

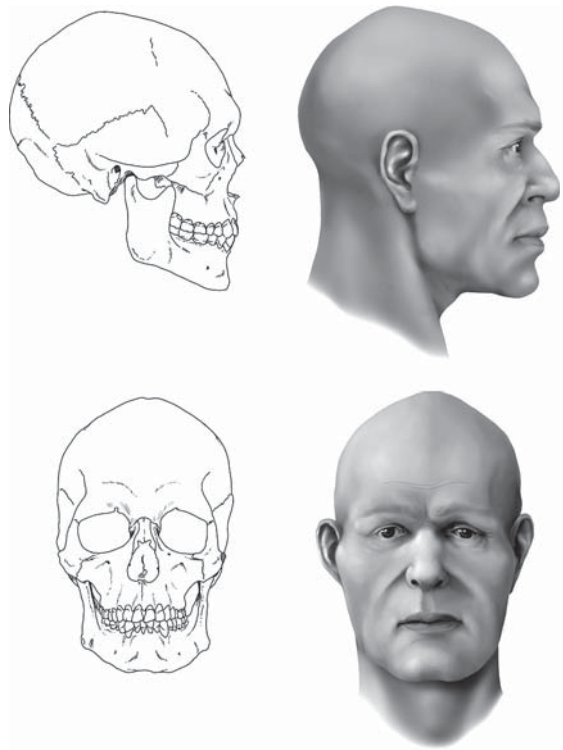

Fig. 7. Graphic reconstruction of the appearance of a male, 30–35 years old. Vengerovo-2A, funeral complex No. 2, burial 1, skeleton 17.

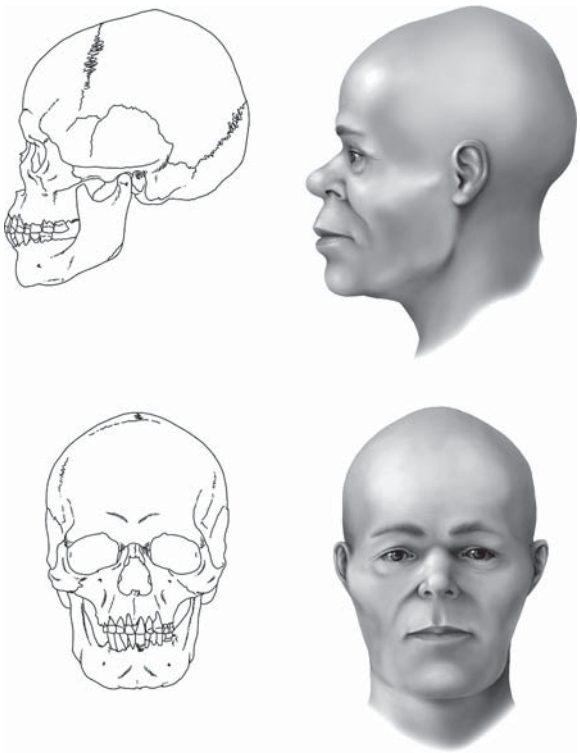

Fig. 8. Graphic reconstruction of the appearance of a female, 30–40 years old. Vengerovo-2A, funeral complex No. 1, burial 1.

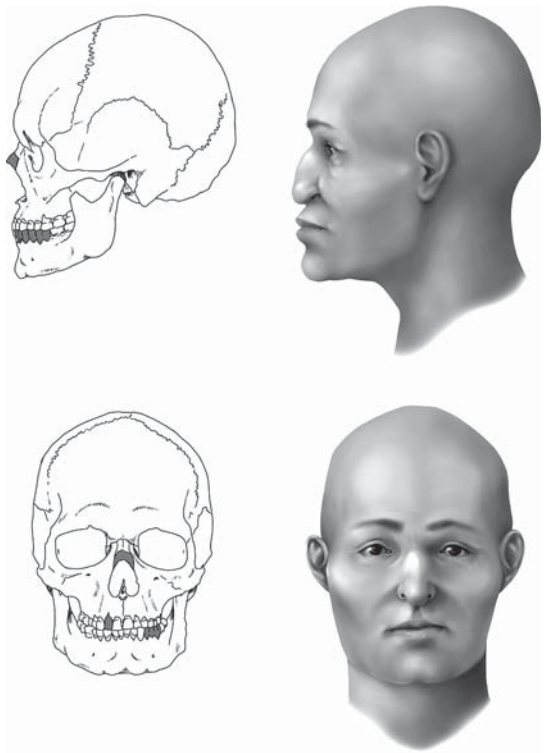

Fig. 9. Graphic reconstruction of the appearance of a female, 25–30 years old. Vengerovo-2A, funeral complex No. 2, burial 1, skeleton 12.

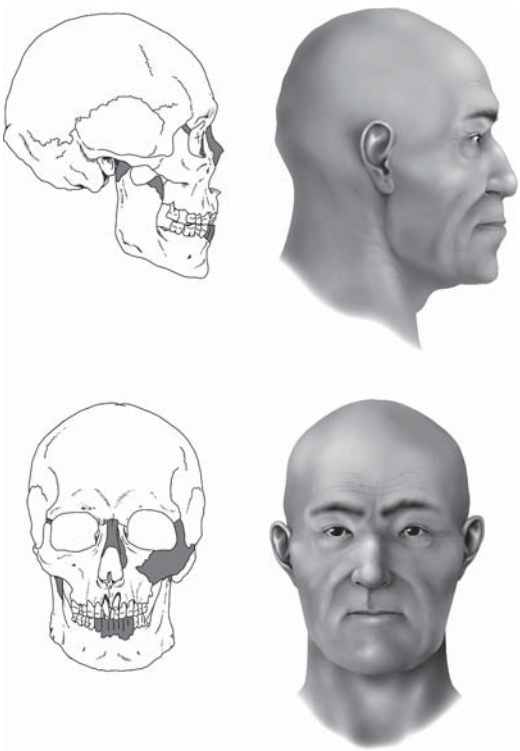

Fig. 10. Graphic reconstruction of the appearance of a male, 40–50 years old. Korchugan, burial 3.

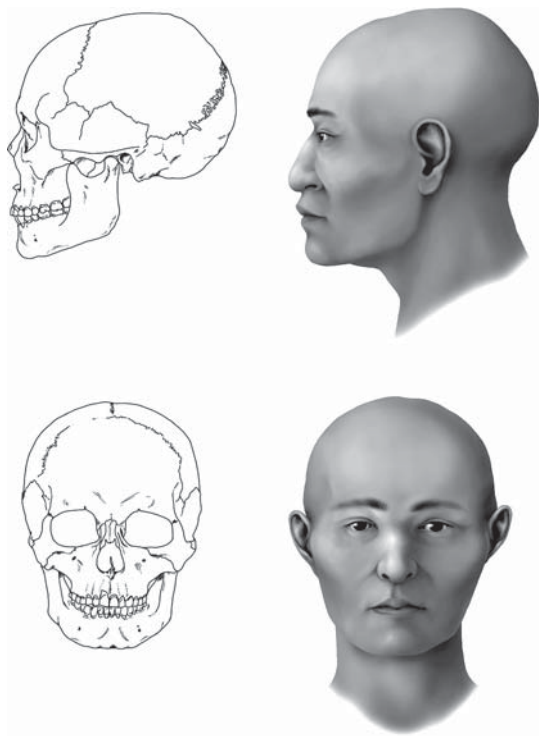

Fig. 11. Graphic reconstruction of the appearance of a female, 25–30 years old. Korchugan, burial 7.

strong protrusion of its parts (nose and lips), small and deep-set eyes, and the robustness of the chin (see Fig. 4–11). At the same time, different burial complexes exhibit their specific features. This applies mostly to the individuals displaying some Mongoloid traits in the shape of the upper face: a pronounced fold of the upper eyelid and epicanthus, and high cheeks, abundantly covered with soft tissues (Korchugan).

Conclusions

Our analysis of the craniometric data for the representatives of the Neolithic cultural traditions that existed in the Baraba forest-steppe has revealed the main vectors of the biological affinities of those ancient populations. The vectors were changing their directions during the transition from the early to late periods of the Neolithic epoch. The earliest inhabitants of Baraba (Sopka-2/1; first half of the 6th millennium BC) were morphologically similar to the individuals from Mesolithic burials in the northwestern Russian Plain. The hunters and fishers of that region, which was fairly similar to the Baraba forest-steppe from the landscape and biocenotic points of view, found a favorable ecosystem for their subsistence in Baraba. They arrived here in the Boreal period, between 9 and 8 ka BP, and formed the anthropological base (autochthonous substrate) for the developing population structure during the Neolithic. This substrate is particularly evident in the facial reconstructions of those people. The visualization of the appearance of people buried at the Neolithic Baraba cemeteries enables illustration of the conclusions arrived at during the study of cranial data to a wider circle of specialists. This is important, since the specific craniological approaches are aimed at describing skulls, not faces. Starting from the second half of the 6th millennium BC, the anthropological composition of the Baraba population began to get more complex, owing to the infiltration of migrants from the Pit-Comb Ware area in the central Russian Plain and, indirectly (via the Neolithic Altai), from the Cis-Baikal area. The craniometric and reconstructed somatological variation of the skulls inside the common anthropological type according to the affiliation with particular funeral complexes is important as well. This variation is in good agreement with the dates of the burials, and can be thus considered as a reflection of the migration from different regions in the process of human colonization of Baraba during the Neolithic.

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Morphofunctional Characteristics of Mongolian Children and Adolescents Living in Different Ecological Zones

In 2014–2015, 13,477 Mongolian schoolchildren (5833 boys and 7644 girls from different regions of the country), aged 8–17, were subjected to a comprehensive biological study. The program included 50+ anthropometric and anthroposcopic traits. Out of this set, bodily dimensions and functional parameters were used for the present paper. Their analysis was carried out among residents of mountain-taiga, steppe, and desert zones, which are still the main ecological niches of Mongolia. The urban sample (the best known Mongolian population, which included only subjects born and living in Ulaanbaatar) was used as a control group. The urban children and adolescents, as well as those living in the mountain-taiga zone, are characterized by maximal average values of the parameters. In the capital, these parameters are mostly affected by the living conditions, which are the best, confirming the results of previous studies. At the same time, the stressful urban factors account for higher indicators of the hemodynamic system in urban schoolchildren. The resemblance of these characteristics in steppe and desert dwellers results from relatively similar climatic conditions and physical stress patterns.

Keywords: *Anthropology, growth/development processes, Mongolia, ecological zones, functional parameters.*

Introduction

The study of the influence of geographic environment on human growth and development has always been the focus of interest for Russian anthropologists. Among previous studies, the series conducted by team of Moscow auxologists led by N.N. Miklashevskaya, wherein children and adolescents from different regions of the former USSR were studied, stands alone. One of the main conclusions of these works was that varying climatic conditions do not substantially affect growth and sexual maturation as long as the conditions are not extreme (Miklashevskaya, 1985: 270; Miklashevskaya, Solovyeva, Godina, 1988: 66).

Mongolia, owing to its combination of widely varying climatic and geographic features and an ethnically homogeneous population, provides great opportunities for carrying out studies of the ecogeographic variation of human growth and development. The natural zones present in Mongolia

include taiga forests, mountain-steppe forests, steppes, semi-deserts, and deserts. According to the range of temperatures, both diurnal and annual (maximum yearly amplitude in Ulaanbaatar reaches 90 °C), Mongolia displays one of the most sharply continental climates in the world (Natsionalniy atlas…, 1990: 55). Such climatic and landscape diversity makes it possible to perform large-scale surveys of the effect of climate-geographic factors on the formation of the somatic status of children and adolescents.

The first such study was carried out in the 1960s by C. Chultemdorj (1967). He compared the main parameters of the physical development of the 8–18-year-old inhabitants of the Mongolian capital with those of children and adolescents of the Central aimag, and did not find any significant differences between them. Further, a comparative analysis of the physical development of children and youth of Ulaanbaatar, mountainous (Zavkhan aimag) and desert (South Gobi (Ömnögovi) aimag) areas also did not reveal substantial differences in the rates of growth of the inhabitants of different geographic zones (Lkhagvazhav, 1972).

The anthropological features of peoples of Central Asia have been extensively studied by Russian anthropologists (Chikisheva, 1982; Antropoekologiya…, 2005: 6–126). The classic studies by T.I. Alekseeva and V.P. Alekseev addressing the issue of interaction between human populations and the environment have been carried out in different ecological zones of this region, including Mongolia. These studies have shown that the intergroup differentiation of physical parameters is associated with climatic influences. In particular, the desert inhabitants from Bogd sum displayed retardation of growth processes, an elongated trunk, narrow shoulders (while pelvic width was medium), and a flattened chest. The highest growth rates were typical for the steppe population (Khalkhgol sum), while the studied physical parameters in this population were similar to those of the inhabitants of the mountain-taiga zone (Jargalant sum). Children and adolescents from these groups exhibited the largest values of relative arm length, circumference and sagittal diameter of the chest, shoulder and pelvic widths, and trunk length. The population of Bat-Ulzii sum (mountain-taiga zone) displayed more dolichomorphic body proportions, and relatively longer legs, while the trunk and arms in this group were short, and the transverse diameters were minimal (Antropoekologiya…, 2005: 140–147). In terms of their morphological status, children from Bogd sum were assigned to a desert type, children from Khalkhgol and Jargalant to a continental type, and from Bat-Ulzii to an alpine type. These results supported the view according to which the typical features of different adaptive types emerge early in ontogeny (Alekseeva, 1986: 190).

The collaborative works of Mongolian scholars (M. Erdene and D. Tumen) and Russian anthropologists carried out in the 1980s have also detected manifestations of adaptation to different environmental zones in the complex of morpho-physiological features of Mongolian children. A comparison of urban and rural children demonstrated retardation of the latter in values of the morpho-physiological features (Erdene, Tumen, 1998).

This study sets out to explore the association between the morphofunctional characteristics of Mongolian children and adolescents, and environmental conditions, employing vast recently collected samples.

Materials and methods

This study is based on the results of the cross-sectional comprehensive survey of Mongolian children and adolescents from Ulaanbaatar and other regions of Mongolia, carried out in 2014 and 2015. The data were collected in compliance with the rules of bioethics: each of the subjects signed an informed consent protocol, and the data were depersonalized. In total, 13,477 individuals (5833 boys and 7644 girls), from 8 to 17 years of age, representing different ecological zones, were employed in the study (Table 1). The sample was divided into age cohorts according to the conventional anthropological principle: e.g. 7-year-old children included those aged from 6 years and 6 months to 7 years 5 months and 29 days.

All anthropometric measurements were taken according to standard techniques (Bunak, 1941). The protocol included a vast array of measurements (more than 30 in total), including: statures, and heights of main anthropometric points, measured using Martin's anthropometer (precision up to 0.5 mm); transverse diameters of the shoulders, pelvis, and chest; circumferences of the chest, waist, buttocks, shoulder, forearm, hip, and shin, measured using a measuring tape (precision up to 0.5 cm); and bone (joint) diameters, measured by a sliding caliper with a nozzle (precision up to 0.5 mm). Skinfold thickness at eight locations on the trunk and limbs was quantified following a standard protocol (Lutovinova, Utkina, Chtetsov, 1970) using a skinfold caliper with a precision of up to 0.1 mm. Body mass was measured on a digital floor scale with a precision of up to 0.01 kg. As was noted above, only the data on total body dimensions are explored and discussed further. The body mass index (BMI) was calculated following

Table 1. **Age distribution of the studied children and adolescents, depending on environmental conditions**

Age, years	Total	Geographic zone			Urban
		Mountain-taiga	Desert	Steppe	
Boys					
8	310	58	43	40	169
9	442	39	91	69	243
10	478	70	87	37	284
11	592	152	32	60	348
12	678	173	43	57	405
13	773	189	55	54	475
14	777	168	54	56	499
15	595	90	56	55	394
16	684	217	23	26	418
17	504	138	27	29	310
	5833	1294	511	483	3545
Girls					
8	523	89	58	24	352
9	531	61	33	38	399
10	599	88	40	44	427
11	779	139	25	50	565
12	915	176	60	37	642
13	1025	208	65	59	693
14	1155	204	64	72	815
15	868	160	47	42	619
16	669	140	47	35	447
17	580	138	36	34	372
	7644	1403	475	435	5331

Quetlet (1870: 92): BMI = m/h^2, where m – body mass in kilos, h – body height in meters. Some functional parameters were quantified as well: systolic and diastolic blood pressure (SBP and DBP), and heart rate (HR) measured with an electronic tonometer MBO Digimed 16 (Germany); grip strength of each hand, quantified by DK-50 and DK-100 dynamometers; and the peak expiratory flow rate (PEFR), measured with a Spirometric peak flow meter (USA).

Estimates of the main statistical parameters (X, S) of the raw data were performed. In order to compare intragroup differentiation across age cohorts, the original values of the variables were also converted into z-scores for each of the cohorts (Cole, 1997). One-way analysis of variance (ANOVA) was used to assess the significance of intergroup differences in physical development between children and adolescents from different environments. The Holm-Bonferroni method for multiple pair-wise comparisons was employed for controlling for type I errors. All the calculations were carried out with the Statistica 10.0. software package.

Results

An analysis of the anthropometric and physiological parameters was performed to explore the influence of environmental conditions on the formation of the morphofunctional status of Mongolian children and adolescents from the ecological zones, contrasted in terms of climate-geographic features: mountain-taiga, steppe, and desert (Natsionalniy atlas…, 1990). The most thoroughly studied urban sample of the Mongolians, from Ulaanbaatar, was employed as a reference. Only the individuals born in the city and

Table 2. **ANOVA results for total body dimensions**

Parameter	Zone	♂				♀			
		1	2	3	4	1	2	3	4
Body height	1		0.000	0.000	0.118		**0.000**	**0.000**	**0.000**
	2	**0.000**		0.007	**0.000**	**0.000**		**0.031**	**0.000**
	3	**0.000**	0.007		**0.000**	**0.000**	**0.031**		0.633
	4	0.118	**0.000**	**0.000**		**0.000**	**0.000**	0.633	
Body mass	1		0.000	0.000	0.077		**0.004**	0.660	0.076
	2	**0.000**		0.050	**0.000**	**0.004**		0.323	**0.000**
	3	**0.000**	0.050		**0.000**	0.660	0.323		**0.024**
	4	0.077	**0.000**	**0.000**		0.076	**0.000**	**0.024**	
BMI	1		0.000	0.000	0.281		0.170	0.377	**0.000**
	2	**0.000**		0.571	**0.000**	0.170		0.990	0.223
	3	**0.000**	0.571		**0.000**	0.377	0.990		0.116
	4	0.281	**0.000**	**0.000**		**0.000**	0.223	0.116	
Chest circumference	1		0.000	0.000	0.534		0.053	0.310	0.181
	2	**0.000**		0.726	**0.000**	0.053		0.936	**0.000**
	3	**0.000**	0.726		**0.000**	0.310	0.936		**0.009**
	4	0.534	**0.000**	**0.000**		0.181	**0.000**	**0.009**	

Note. 1 – mountain-taiga zone, 2 – desert, 3 – steppe, 4 – urban. Parameters that differ in inhabitants of different zones and reach the level of statistical significance are marked in bold.

living there at the moment of the study were included in the analysis*.

Total body dimensions. According to the results of the ANOVA (Table 2), the boys from Ulaanbaatar and the mountain-taiga zone display significantly larger values of all total body dimensions. Pair-wise comparisons between these two, as well as between the two other samples (from the desert and steppe zones), did not reveal any significant differences. The results for the female sample were not as clear. For example, the girls from the mountain-taiga and desert zones exhibit significantly the largest and the smallest values of stature, respectively, while between the other groups no significant difference was detected. The maximum values of body mass and BMI are found in the urban girls. The difference between them and girls from desert and steppe zones is significant for body mass, and between them and girls from mountain-taiga zone for BMI. The largest values of chest circumference were observed in urban and mountain-taiga schoolgirls, though intergroup differences were not significant (Table 2, Fig. 1).

Functional parameters. According to the ANOVA results (Table 3), the boys from the city and mountain-taiga zone demonstrate the highest values of PEFR. The differences between the two groups mentioned above, as well as between the samples from the desert and steppe zones, were not statistically significant. The same applies to the values of grip strength of each hand. Turning to the hemodynamic parameters, the urban boys exhibit the highest blood pressure as compared to the rural samples from various zones, but none of the intergroup differences were significant. The hemodynamic parameters, PEFR, and grip strength of each hand display the highest values in the urban girls. Other parameters do not exhibit intergroup differences (Table 3, Fig. 2).

Discussion

The effect of ecological factors on the biological status of the Mongolian sample becomes evident during the growth and development of the most biologically vulnerable population group—children and adolescents. Our results confirm the conclusions arrived at by T.I. Alekseeva and co-authors (Antropoekologiya…, 2005: 140–147): urban and mountain-taiga schoolchildren display the maximum average values of

*A general comparison between urban and rural Mongolian children and adolescents, disregarding environmental conditions, can be found elsewhere (Godina, Gundegmaa, Permyakova, 2019).

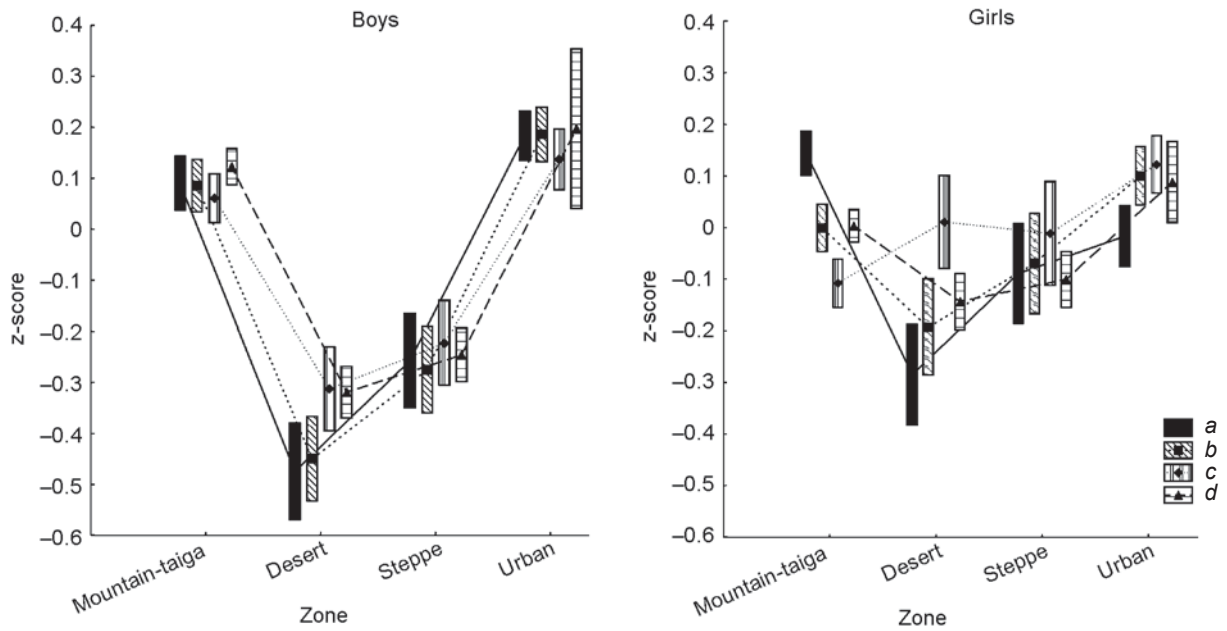

Fig. 1. ANOVA results for total body dimensions.
a – stature; *b* – body mass; *c* – BMI; *d* – chest circumference.

Table 3. **ANOVA results for z-scores of the functional parameters***

Parameter	Zone	♂				♀			
		1	2	3	4	1	2	3	4
PEFR	1		0.000	**0.000**	0.418		0.256	0.942	**0.000**
	2	**0.000**		0.798	**0.000**	0.256		0.756	**0.000**
	3	**0.000**	0.798		**0.000**	0.942	0.756		**0.000**
	4	0.418	**0.000**	**0.000**		0.000	0.000	0.000	
Grip strength of the right hand	1		0.000	**0.000**	0.502		0.418	0.480	**0.000**
	2	**0.000**		0.832	**0.000**	0.418		0.079	**0.000**
	3	**0.000**	0.832		**0.000**	0.480	0.079		**0.000**
	4	0.502	**0.000**	**0.000**		0.000	0.000	0.000	
Grip strength of the left hand	1		0.000	**0.000**	0.154		0.855	**0.000**	**0.000**
	2	**0.000**		0.879	**0.000**	0.855		0.048	**0.000**
	3	**0.000**	0.879		**0.000**	**0.000**	0.048		**0.000**
	4	0.154	**0.000**	**0.000**		**0.000**	**0.000**	**0.000**	
SBP	1		0.566	0.897	**0.000**		0.062	0.622	**0.000**
	2	0.566		0.955	**0.000**	0.062		0.769	**0.000**
	3	0.897	0.955		**0.000**	0.622	0.769		**0.000**
	4	**0.000**	**0.000**	**0.000**		**0.000**	**0.000**	**0.000**	
DBP	1		0.669	0.337	**0.000**		0.062	0.622	**0.000**
	2	0.669		0.979	**0.000**	0.062		0.769	**0.000**
	3	0.337	0.979		**0.000**	0.622	0.769		**0.000**
	4	**0.000**	**0.000**	**0.000**		**0.000**	**0.000**	**0.000**	
HR	1		0.696	0.342	0.999		0.126	0.219	**0.000**
	2	0.696		0.974	0.767	0.126		0.998	**0.000**
	3	0.342	0.974		0.420	0.219	0.998		**0.000**
	4	0.999	0.767	0.420		0.000	0.000	0.000	

*See note to Table 2.

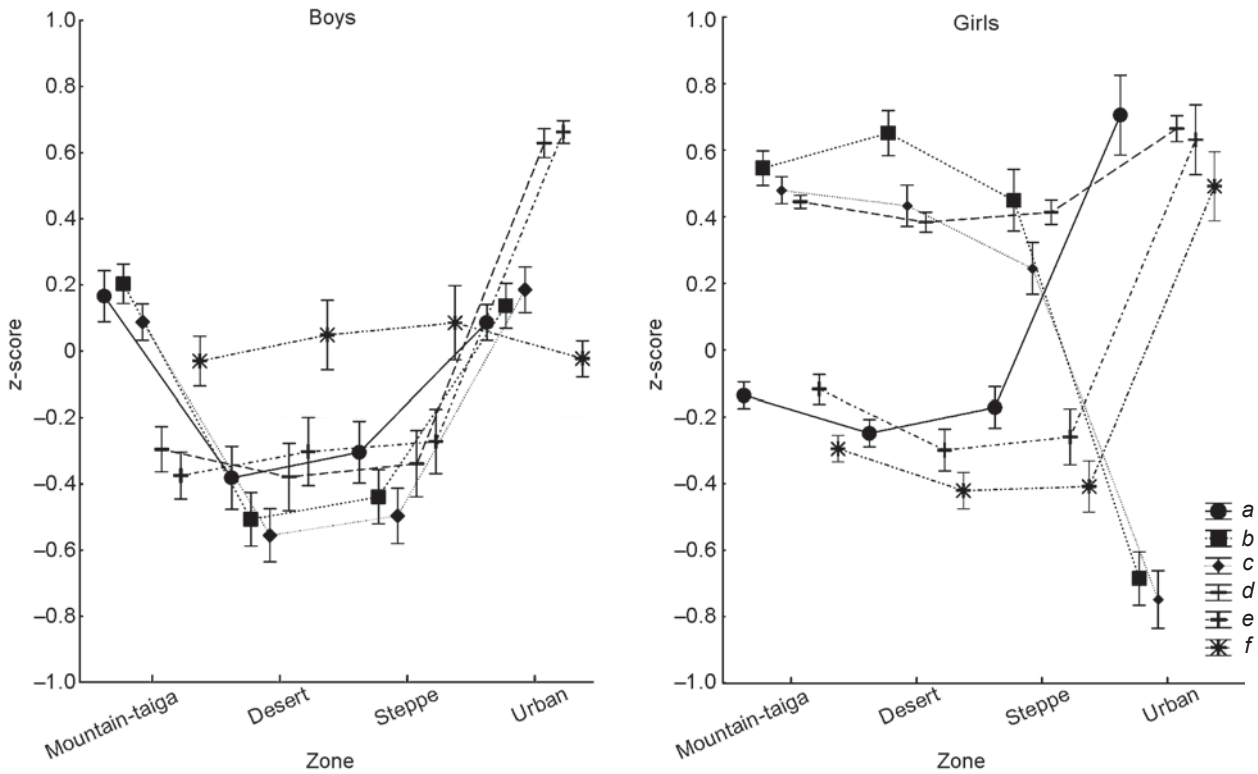

Fig. 2. ANOVA results for z-scores of the functional parameters
a – PEFR; *b*, *c* – grip strength of the right and left hands, respectively; *d* – SBP; *e* – DBP; *f* – HR.

most anthropometric parameters. Our study has revealed the same picture for total body dimensions. Our results also corroborate the conclusions based on the study of Mongolian schoolchildren in the early 1990s, before the positive economic changes in the country (Choibalsan, 1991). An assessment of harmony in the development of urban and rural Mongolian children during following decades reveals the same trend: lower values of stature, mass, and BMI are more often observed in less urbanized regions: in particular, in boys (Amgalan, Pogorelova, 2015: 89; Pogorelova, Amgalan, 2016: 1200). However, brachymorphic proportions of adolescents from rural regions determine their denser physique irrespective of body weight and sex. Among the rural groups, the inhabitants of the Gobi desert display the smallest total body dimensions, while the population of the mountain-taiga zone exhibits the largest (Gundegmaa, 2009: 15).

The most interesting trend for the functional parameters is a higher level of grip strength observed in the urban and mountain-taiga samples as compared to other groups. A possible explanation for this trend is the changes in living conditions of rural children, which leads to the loss of their main peculiar feature—physical strength (Liu et al., 2012: 446). But this observation is only true for the boys, while the urban schoolgirls display minimal grip strength of each hand, which can be explained by the retention of the traditional gender labor division in less urbanized regions. The similarity in the parameters in the populations from the steppe and desert zones might be due to the similarity of climatic conditions of their habitats. The environment can affect physique in this case not only directly, but also indirectly: the populations of both parts of the country are predominantly nomadic.

The distribution of the hemodynamic and respiratory parameters in the Mongolian schoolchildren from various climate-geographic conditions demonstrates that SBP is higher in urban children of both sexes, which is undoubtedly explained by a higher stress load in more urbanized areas (Kalyuzhny, 2017: 92; Smagulov, Azhimetova, 2013: 58; Sukhanova, Maksimov, Vdovenko, 2014: 13; Negasheva et al., 2018: 47). The intergroup differences for DBP and HR are not significant, but both parameters are higher in the urban population. The results for the 17-year-old urban schoolchildren can be compared with the outcomes of previous studies, according to which, average SBP and DBP in males from Ulaanbaatar were 116.4 and 76.5 mm Hg, respectively (Dashdavaa, 1991). In our sample of young males, the respective values were

115.6 and 70.5 mm Hg, i.e. fairly close to that of the males from Ulaanbaatar. This means that substantial differences between urban and rural Mongolian schoolchildren existed before the acceleration of urbanization in the country. Higher values of PEFR are also found in the urban and mountain-taiga populations. This observation can be explained as a compensatory reaction of the respiratory system on low temperatures in the mountain-taiga zones and air pollution in the capital (Altantsetseg, 2015: 94).

Conclusions

The results of the present study confirm the hypothesis about a substantial influence of ecological conditions on the growth and physical development of Mongolian children and adolescents. Schoolchildren from the mountain-taiga zone display maximum mean values for total body dimensions and functional indicators, while their peers from the steppe and desert zones lag behind in most parameters. Children and adolescents from the Mongolian capital display the highest level of physical development as well. But in this case, socioeconomic rather than ecogeographic conditions play the lead role, as confirmed by the results of previous research (Godina, Gundegmaa, Permyakova, 2019). At the same time, the stressful urban factors account for a higher indicators of the hemodynamic system in urban schoolchildren. The elevated values of PEFR observed in the urban and mountain-taiga samples can be explained as a compensatory mechanism of the respiratory system providing an adaptive response to environmental conditions: air pollution or cold. The similarity of most studied parameters in the populations of the steppe and desert zones is a result of both similar climatic conditions and the pattern of physical activities in these predominantly nomadic regions of the country.

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AN RT – Tatarstan Academy of Sciences

AN SSSR – USSR Academy of Sciences

BAR – British Archaeological Reports

BNC SO RAN – Buryat Science Center, Siberian Branch, Russian Academy of Sciences (Ulan-Ude)

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)

IIMK RAN – Institute for the History of Material Culture, Russian Academy of Sciences (St. Petersburg)

IKMZ UR – Historical and Cultural Museum of the Udmurt Republic Idnakar (Glazov)

KSIA – Brief Communications of the Institute of Archaeology, Russian Academy of Sciences

KSIE – Brief Communications of the Institute of Ethnography of the USSR Academy of Sciences (Moscow)

MAE RAN – Peter the Great Museum of Anthropology and Ethnography (Kunstkamera), Russian Academy of Sciences (St. Petersburg)

MIA – Materials and Investigations on Archaeology in the USSR

PF IIiA UrO RAN – Perm Branch, Institute of History and Archaeology, Ural Branch, Russian Academy of Sciences (Perm)

SAI – Collection of Archaeological Sources

SAIPI – Siberian Association of Prehistoric Art Researchers

TIE – Transactions of the Institute of Ethnography

UdmIIYaL UrO RAN – Udmurt Institute of History, Language, and Literature, Ural Branch, Russian Academy of Sciences (Izhevsk)

UrO RAN – Ural Branch, Russian Academy of Sciences

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