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The Final Early Paleolithic of Azerbaijan (Based on the Garaja Site)

We describe new findings relating to an Early Paleolithic site of Garaja on the Mingachevir Reservoir coast, Azerbaijan. Geological and geomorphological position of the area, structure of the Early–Middle Pleistocene deposits, faunal remains, and chronology are discussed. On the basis of geological characteristics and paleofauna (large mammals, mollusks) we tentatively date the site to the Bakunian age (0.8–0.4 Ma years ago). Artifacts, some 350 in number, found mainly on the surface, but reliably associated with lithological units, are described in detail. Primary reduction is dominated by parallel flaking, with occasional radial and "citron" cleavage. Most tools, made on pebbles and large flakes, are large (handaxes, choppers, and side-scrapers). While the Garaja industry is generally homogeneous, the stratigraphic situation of the site and certain elements of technocomplex, such as solitary Levallois cores, a Quina scraper, and advanced forms of bifaces, indicate the presence of two chronologically and technologically successive complexes within the general Late Acheulean industrial tradition. Garaja correlates with other cave and open-air industries of the East and South Caucasus and adjoining regions dating to the first half of the Middle Pleistocene.

Keywords: *Azerbaijan, Early Paleolithic, paleontology, Bakunian age, Middle Pleistocene, handaxes.*

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Introduction

The study of the Caucasian Early Paleolithic began in 1934, when S.N. Zamyatnin had discovered the first Acheulean sites on the Black Sea coast and on the northern slope of the Caucasus (Yashtukh, Ignatenkov Kutok, and others). In the late 1940s, Early Paleolithic sites were discovered in two other regions: in Armenia and South Ossetia (Satani-dar, Lashe-Balta, and others). In the 1950s–1980s, multilayered cave sites (Koudaro I, Azykh, Treugolnaya, and others) and numerous open-air localities represented mostly by surface artifact assemblages were studied (Lyubin, 1989, 1998). After the hominin remains dating to ~1.8 Ma ago were discovered with stone tools in Dmanisi, Georgia, the Caucasus has been viewed as a key route whereby the early *Homo* groups migrated after their first exit from Africa (Dmanisi I, 1998). Until recently, however, in terms of Paleolithic, the western coast of the Caspian Sea was one of the least studied areas in the Caucasus. The Azykh Cave (Guseinov, 2010) remained for a long time the only stratified Early Paleolithic site known there. The situation changed in the 21st century: during the first two decades, more than a dozen Early and Middle Pleistocene sites were discovered in the Northeastern Caucasus (Derevianko et al., 2012; Anoikin, 2021). As the findings suggest, the Caspian coast of the Caucasus was a place where hominin populations had been present since the early Quaternary. Virtually all these sites belong to the open-air category (previously, only cave sites were excavated in the Caucasus). In the southern part of the western Caspian region, research headed by M.M. Guseinov was conducted in the 1960s–1980s, but then Paleolithic studies were ceased there. In the second decade of the 21st century, intensive investigations were resumed by the joint Azerbaijan-Russian archaeological expedition. In the course of studies, a new, internationally important Early Paleolithic site of Garaja was discovered. The purpose of this article is to introduce results of the archaeological and natural science investigations conducted at the site during the last decade.

History of studies

In 2012, Gyanja-Gazakh Paleolithic team of the archaeological expedition under the auspices of the Institute of Archaeology and Ethnography, Azerbaijan National Academy of Sciences, conducted field surveys in western Azerbaijan. The team examined Pleistocene deposits in the western part of the Kura-Aras lowland, specifically in the regions where bone-bearing lenses with Pleistocene fauna remains had been previously found (Lebedeva, 1978: 91; Geologiya…, 1997: 529). One of the reconnaissance routes ran along the southern coast of the Mingachevir Reservoir. There, approximately 1 km south-east of the hydroelectric dam, at the foot of the Garaja Ridge (the eastern extension of the Bozdag Ridge), the locality with joint occurrence of paleontological and archaeological remains was found within deposits of the Middle Pleistocene Bakunian stage (Fig. 1). The site named Garaja was examined by the joint Azerbaijan-Russian expedition from 2012 to 2021 with few interruptions (Kulakov, Zeynalov, 2014).

Geological context and stratigraphy

The site of Garaja is located at the foot of the eponymic ridge (absolute altitude +90 m) representing an anticlinal fold up to 200 m high and up to 3 km wide. Its west to east extent measures ~10 km. The Garaja Ridge is a structural prolongation of larger Bozdag Ridge, extending farther west for more than 100 km. In environs of the reservoir, some other anticlinal ridges are situated: Duzdag, Palantekyan, Kodjashen, etc.

In the Early and Middle Pleistocene, neotectonic evolution of the region was characterized by a long-term dipping. This is confirmed by concordant bedding of Akchagylian, Apsheronian, and Bakunian deposits, whose thickness in some places reaches several hundred meters. The Garaja area and adjacent Bozdag and Duzdag ridges were repeatedly described in geological literature as a typical location of deposits representing these stages (Lebedeva, 1978: 77; Geologiya…, 1997: 527).

The main feature of the paleogeography of the region in the Early and Middle Pleistocene was that the coastline of the Kura Bay, spanning various ancient basins of the Caspian, shifted within dozens of kilometers, whereas the sea level fluctuated within hundreds of meters. Fluctuations of this sort were described in detail for the Late Pleistocene (Yanina, 2012: 197). It is assumed that in the Early and Middle Pleistocene, duration of some transgressions and regressions was much longer (Svitoch, 2014: 234). The number of such fluctuations of sea level over the last 2 million years could be large, as indicated by numerous strata of sea and continental sediments within the limits of the Kura paleo-bay.

At the end of the Bakunian stage, a sharp inversion of the tectonic regime took place, and the folding process began (Milanovskiy, 1968) that determined the uplift of ridges and changes in sedimentation. The uplift of rocks was accompanied by severe erosion. After the filling of the Mingachevir Reservoir in the 1950s, the process was accelerated by intense coastal erosion of loose sediments in the surf zone and by

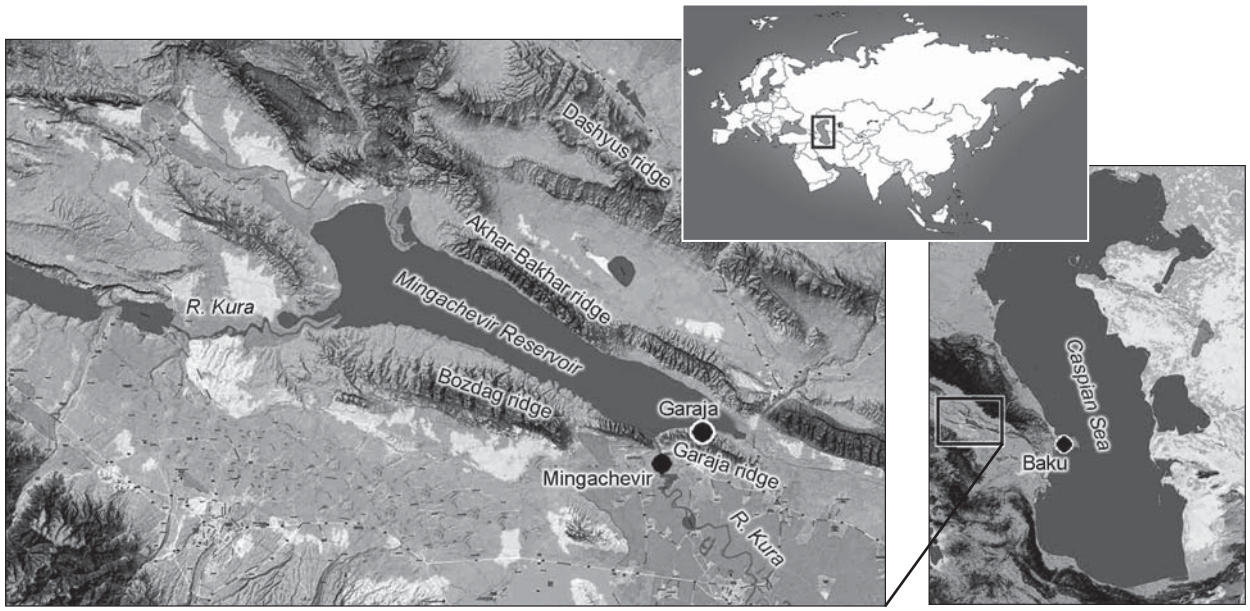

Fig. 1. Map of the study area.

exposition of Akchagylian and Apsheronian rocks near the Bozdag Ridge and of Apsheronian and Bakunian rocks near the Garaja Ridge. In the area where the latter rocks had been washed out, the site of Garaja was discovered (Fig. 2, *A*, *B*).

At the site, the sediments are represented by interbedding of various terrigenous rocks (pebbles, sands, silts, clays) with traces of numerous washouts. These beds form the northern limb of anticline. They extend from west to east and fall abruptly at a mean angle of ~60° in the north.

The lowest body of the section is formed by grayish-yellow silt more than 50 m thick (the lower marine series, Unit 1) (Fig. 2, *B*). It comprises a distinct layer of volcanic ash of a specific pink color. According to preliminary data, the ash got this color due to diagenetic changes in marine environment. The lower portion of the sediments contains mollusks of the Bakunian age (*Didacna parvula*, according to T.A. Yanina).

The beds with washout are followed by a complex series of gray sands ~30–35 m thick (the lower continental series, Unit 2). Massive gray sands at the base are overlain by cross-bedded sands with gravel lenses, and grayish-yellow clayey sand. The series comprises two thin (0.1–0.2 m) layers with Bakunian shells (Fig. 3, *4*) and a lens of grayish-yellow clay up 5 m thick, with paleontological remains (Fig. 3, *1*). The sands also contain well-preserved impressions of trunks and branches of large trees up to 0.7 m in diameter (Fig. 3, *3*). This series can be defined as continental. It is probably with this series that the lower archaeological level is associated (Fig. 4).

A series of stratified multicolored clays up to ~10 m thick overlays the described sediments. It extends over the whole section and serves as a marker. Its central portion comprises a 0.8 m thick layer with shells of Bakunian mollusks (*Didacna eulachia*, according to Yanina). The top of this unit shows traces of intensive washout. It is defined as the upper marine series (Unit 3).

A complex series up to 40 m thick lies above. It consists of interbedded sands, clays, and gravel. The sediments are mostly represented by cross-bedded gray sands with lenses of small and large pebbles. Some layers of sand are abundant in large impressions of tree trunks and paleontological remains (see Fig. 3, *2*). At some levels, massive stratified gray lacustrine clays with traces of washout are present. These sediments are identified as upper continental (Unit 4) and are associated with the middle (see Fig. 3, *5*) and upper archaeological levels.

Unit 4 with a washout is overlain by a series of yellow clays. The upper portion of the section is covered with water. In adjoining areas, similar sediments are overlain by sands with rare pebbles and paleofauna remains, which, in turn, underlay strata of grayish-yellow clays up to 100 m thick. According to N.A. Lebedeva (1978: 91), the upper portion in the section of the Garaja Ridge in its eastern part is composed of Khazarian alluvial gravel tens of meters thick.

Thus, the site of Garaja is associated with sediments of the Bakunian stage, which are represented by several series differing in structure and genesis (marine and continental). The feature of the area is that rocks are inclined at approximately 60°. Continental sediments, lying at two levels, are represented mainly by alluvial sands with lenses of pebbles and lacustrine clays. These lenses, stretching with gaps for tens of meters,

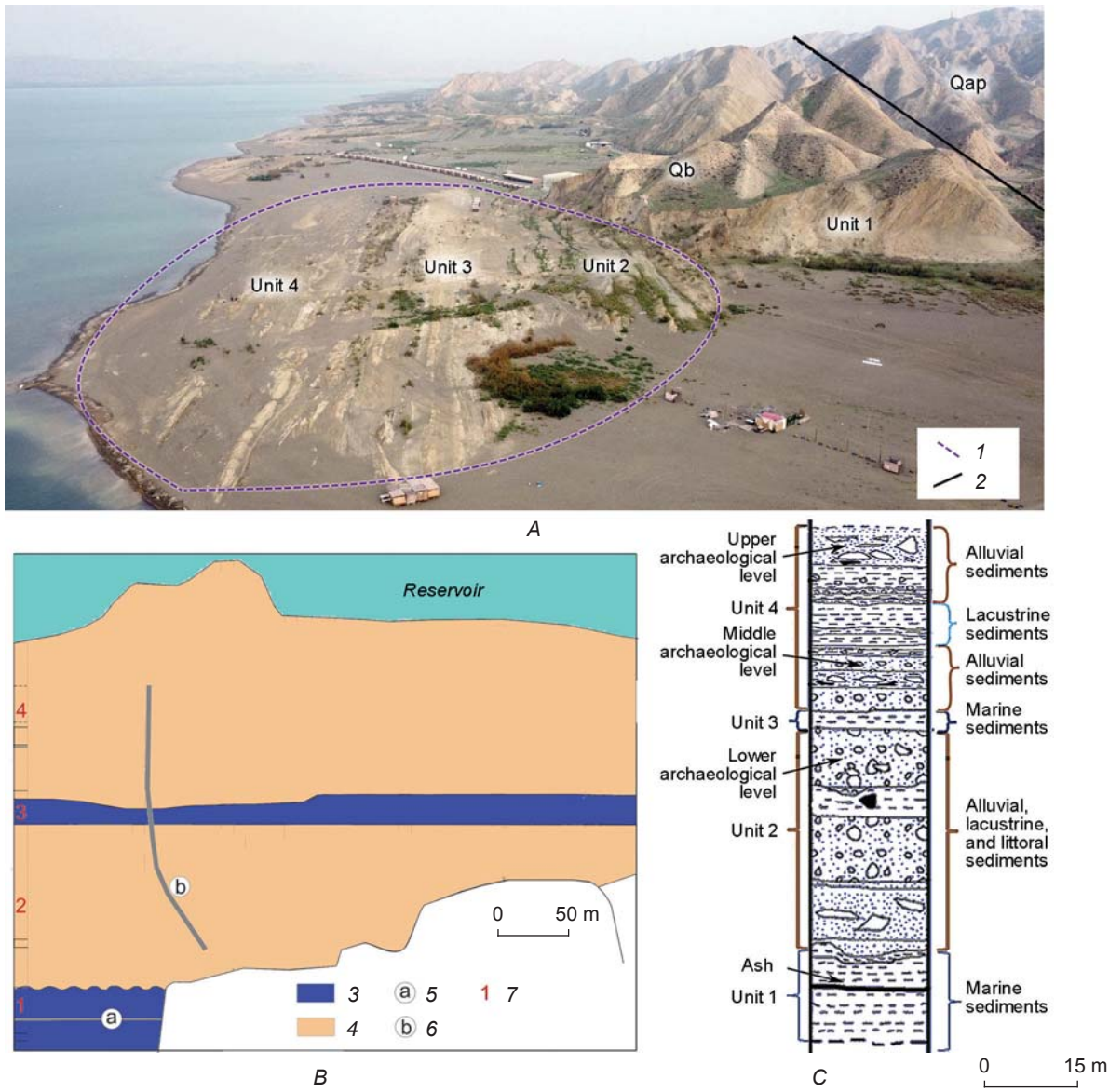

Fig. 2. Stratigraphic situation at Garaja.
A – upper view of the site; *B* – plan of the site area; *C* – combined stratigraphic column.
1 – limit of the main artifact concentration; *2* – limit of the Bakunian (Middle Pleistocene) and Apsheronian (Early Pleistocene) sediments; *3* – marine sediments; *4* – alluvial and littoral sediments; *5* – volcanic ash; *6* – trench; *7* – sedimentation unit.

contain the remains of trees and animals, as well as lithic artifacts. Marine sediments also form two series. They are composed of clays and auleritic sands containing malacofauna remains. All the series lie concordantly. Inside the continental sediments and in the zones where they contact marine series, numerous traces of washouts are present, some of them being large. The composition of the section is determined by complex dynamics of the sea level and by the changes of sedimentation regimes. According to natural science data (primarily the composition of malakofauna and large mammals), all sediments in this area correspond to a fairy long interval within the Bakunian stage in the Caspian Quaternary history, referring to the period between ~0.8 and 0.4 Ma years ago (Svitoch, 2014: 174–179).

Paleontological remains

In 2012–2021, a representative collection of Pleistocene fauna remains (196 spec.) was obtained at Garaja. Some remains were cemented into sand and gravel breccia forming thin interlayers within Unit 2, while most of them were collected from the surface, in washed areas of the continental series, within

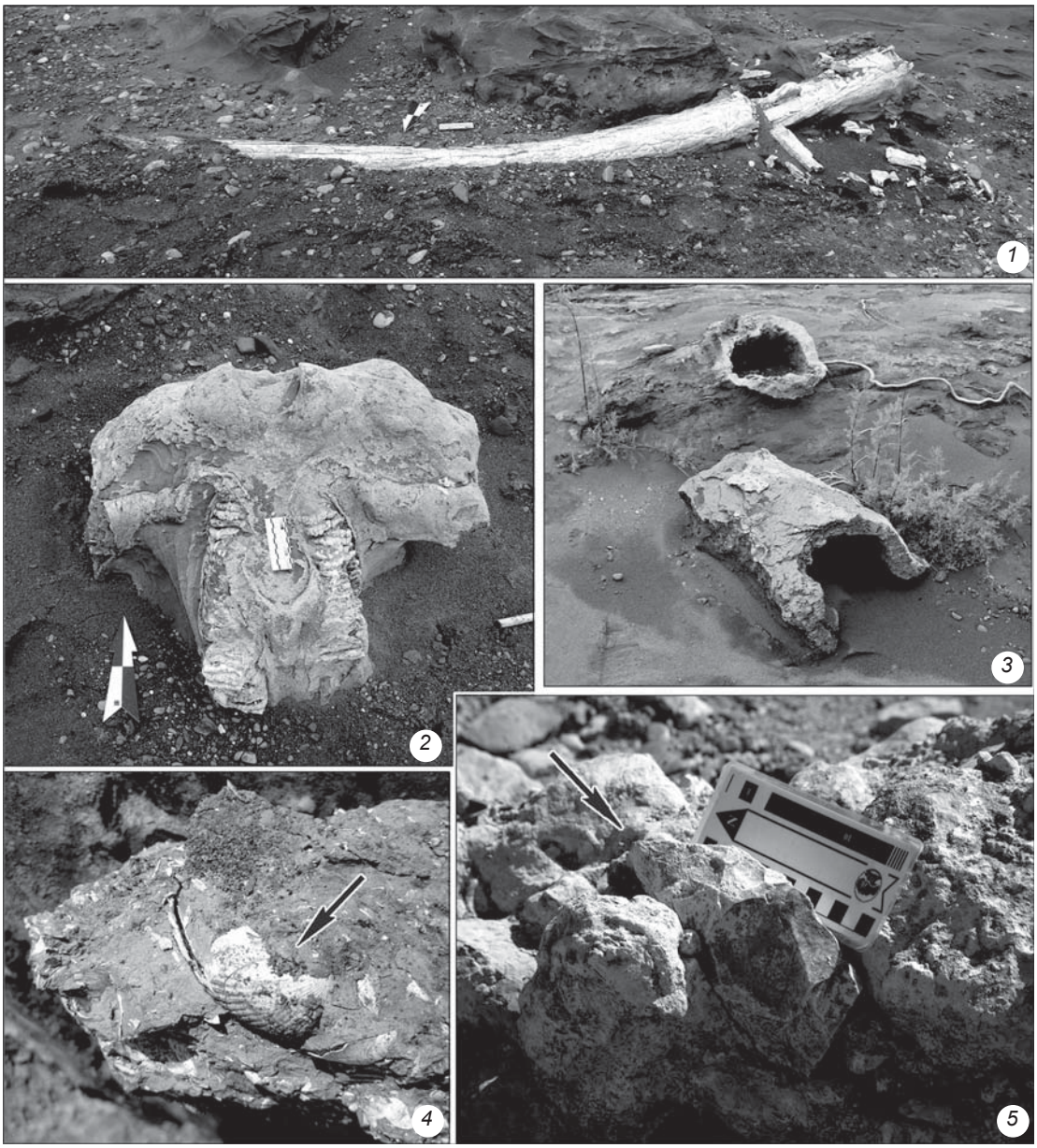

Fig. 3. Location of archaeological and paleontological materials at the level of the second continental series (Unit 3) at Garaja.
1 – tusk of a forest elephant (*Palaeoloxodon antiquus*); *2* – skull of a fossil elephant (*Archidiskodon* sp.); *3* – fragments of petrified tree trunks; *4* – shell of *Didacna eulachia*; *5* – handaxe, *in situ*.

the coastal strip. Identifiable finds (121 spec.) are dominated (~50 %) by the remains of fossil elephant (*Archidiskodon* sp.): a tusk, teeth, fragments of crania and postcranial skeleton (all paleontological identifications were made by T.M. Eybatov and V.V. Titov). Bones of southern (*Archidiskodon meridionalis*) and forest (*Palaeoloxodon antiquus*) elephants were also identified. The collection contains numerous bones of red deer (*Cervus sf. elaphus*) and extinct ox (*Bos* sp.). Remains of Merck's rhinoceros (*Stephanorhinus hundsheimensis/Stephanorhinus kirchbergensis*), extinct horse (*Equus caballus*), large-horned (*Praemegaceros verticornis*) and giant (*Megaloceros giganteus*) deer were found in small numbers. Coprolites (7 spec.) of ungulates (*Cervidae* sp.) and large unidentifiable animals are noteworthy.

Thus, the majority of species recorded at the site generally correspond to the Tiraspol fauna complex, which existed during the Bakunian stage of the Caspian Sea evolution (Middle Pleistocene).

Fig. 4. Location of archaeological materials at Garaja.
1 – scheme of conventional levels; *2* – distribution of artifacts at the levels in the main area of their concentration (collection of 2021).
a – artifacts of the lower level; *b* – artifacts of the middle level; *c* – artifacts of the upper level.

Archaeological remains

At Garaja, as mentioned above, archaeological materials were associated with sand and gravel layers in the continental sediments. They lay in washed out places, usually with a small horizontal displacement. According to the general geological situation, lithic artifacts were concentrated at three levels: the *lower level* associated with the earliest continental sediments; the *middle level* attributable to "continental series II" of Unit 4; and the *upper level*, where the finds originate from the top of the same unit, but can be registered only when the water level is lowest (see Fig. 4). During the excavations conducted in 2012–2021, several artifacts were found in the cemented sand at the *middle level*, i.e. they lay *in situ* (see Fig. 3, *5*). The total horizontal length of the lower continental series is ~40 m, that of the upper series is ~60.

All the artifacts were made from local pebbles (alluvium of the pra-Kura) abounding in sand and pebble lenses and in layers of the continental sediments. These normally are sedimentary rocks exhibiting various degrees of silicification; effusive rocks are less common; quartzites were used in isolated cases only. Almost all the artifacts display abraded surfaces. Well-rounded pieces with smoothed and hardly visible ridges, hampering the identification of artifacts, form a fairly high percentage. Thus, though the Garaja lithic

assemblage comprises over 350 artifacts, only 295 of them can be identified typologically.

Artifacts are nearly equally distributed among the levels described above. It is noteworthy that in the assemblage collected in 2012–2019, artifacts from the *upper level* amount to only ~10 %. This most likely can be explained by the high water level in the reservoir and, correspondingly, by the reduced area of excavations, as compared to 2021. Specifically, in 2021, during the lowest water level, when about 40 % of the artifacts were collected, their distribution by levels was nearly equal: 45, 47, and 44 specimens, respectively. The tentative analysis of the collection has shown that there were virtually no differences between the levels in terms of technology and typology of artifacts, with the share of tools and cores of specific types varying within 10–15 %. Given this fact and the relatively small number of artifacts, all the Garaja pieces can be considered as a whole, whereas probable differences with regard to levels can be mentioned separately.

In research, 136 artifacts discovered in 2021 and a sample of 250 typologically distinct implements from the combined collection of 2012–2019 were analyzed.

Core-like artifacts, including typologically distinct cores and core-shaped fragments, form ~20 % of the assemblage. The category of cores is dominated (~80 %) by simple single-faced cores with a parallel pattern of flaking, with or without minimal preparation (Fig. 5, *1*). Some of these cores are close to choppers and differ from them in the angle of convergence of edges (≥60°) not forming the working element. Almost all other nuclei represent in equal proportions the categories of radial cores (Fig. 5, *2*) and cores for "citrons". The assemblage contains two Levallois cores: one of them is a small, well-shaped piece for elongate convergent blanks; the other one is a typical tortoise nucleus for flakes. Both artifacts, with lightly abraded surfaces, were made of high-quality siliceous material and are quite distinct from the rest of the collection. The assemblage also comprises numerous (~10 %) split pebbles with traces of irregular flaking. They possibly represent the initial stage of raw material testing.

In the category of flakes (~20 %), large pieces prevail (Fig. 5, *2–4*). Small flakes are rare. Primary flakes or those resulting from shaping pebble tools constitute a large proportion (~40 %); more than half of their surface is covered with cortex (Fig. 5, *4*). Five pieces belong to the category of "citrons" (Fig. 5, *3*). Striking platforms are natural or flat; in single cases, they are dihedral.

Tools are most numerous, constituting ~50 % of the lithics. Such a high percentage is usual in surface collections, being mainly due to their easier visual identification.

The most common tools are pebble cutting forms—choppers (27 spec.) (Fig. 5, *1*; 6, *2*, *3*) and large bifacial implements (41 spec.) (Fig. 7, *1*, *3–9*). Partial bifaces and pieces with elements of bifacial treatment (10 spec.) also form a representative collection. All partial bifaces are semifinished products in the form of desired end tools, but with only one worked face. Handaxes are characterized by large variety of shapes. Almond-shaped (Fig. 7, *6*, *9*), cordate, (Fig. 7, *1*, *4*), oval bifaces, and limande (Fig. 7, *3*) are present in the assemblage. Approximately 50 % of implements have a pebble butt (Fig. 7, *1*, *7*, *9*). There are backed asymmetrical pieces (Fig. 7, *7*), including those resembling Keilmesser (Fig. 7, *5*, *8*). Biconvex bifacial tools predominate (Fig. 7, *1*, *3*, *4*, *6*, *7*, *9*).

Cleavers (see Fig. 6, *4*, *5*) are another category of tools regarded as cultural and chronological markers. In the Garaja collection, such implements total to 7 specimens: 2 finished products and 5 blanks.

Fig. 5. Tools and flakes from Garaja.
1 – chopper; *2*, *3* – "citrons"; *4* – primary flake.

These are made on very large (over 15 cm) elongate primary flakes. Tools of this kind are typical of certain Acheulean industries. They occur in Africa and South Eurasia from the Early Acheulean to the Early Middle Paleolithic.

Along with pebble chopping tools, the assemblage contains side-scrapers (11 spec.) fashioned on flakes or longitudinally split pebbles (see Fig. 6, *1*) and on pebble fragments. There are also a few denticulate and notched tools, irregularly retouched flakes, and a core-shaped endscraper—tool typical for the Early Paleolithic of the Caucasus (Lyubin, 1998: 172–173). Some implements are distinct from the rest of tools: a side-scraper made on a large flake and elaborately modified by various-sized, stepped retouch, similar to Quina retouch typical of the Middle Paleolithic (see Fig. 7, *2*), and two Levallois cores.

During investigations conducted on the southeastern coast of the Mingachevir Reservoir, in addition to the main area of artifact distribution, several other small locations of artifact concentrations were discovered 1 to 3 km east of Garaja. Some 50 implements were found there. Composition of the collection is similar to that of Garaja: split pebbles, single-faced cores for parallel flaking, large flakes, and tools including six choppers, six handaxes of various shapes, and three bifacial pieces (possibly, blanks).

The Garaja industry contains artifacts from two lithological units separated by marine deposits, possibly of vastly different age. However, the general variation within the industry does not exceed that within other final Early Paleolithic industries. This technocomplex fits well within the Caucasian context of Acheulean industries with bifaces, and corresponds to chronological

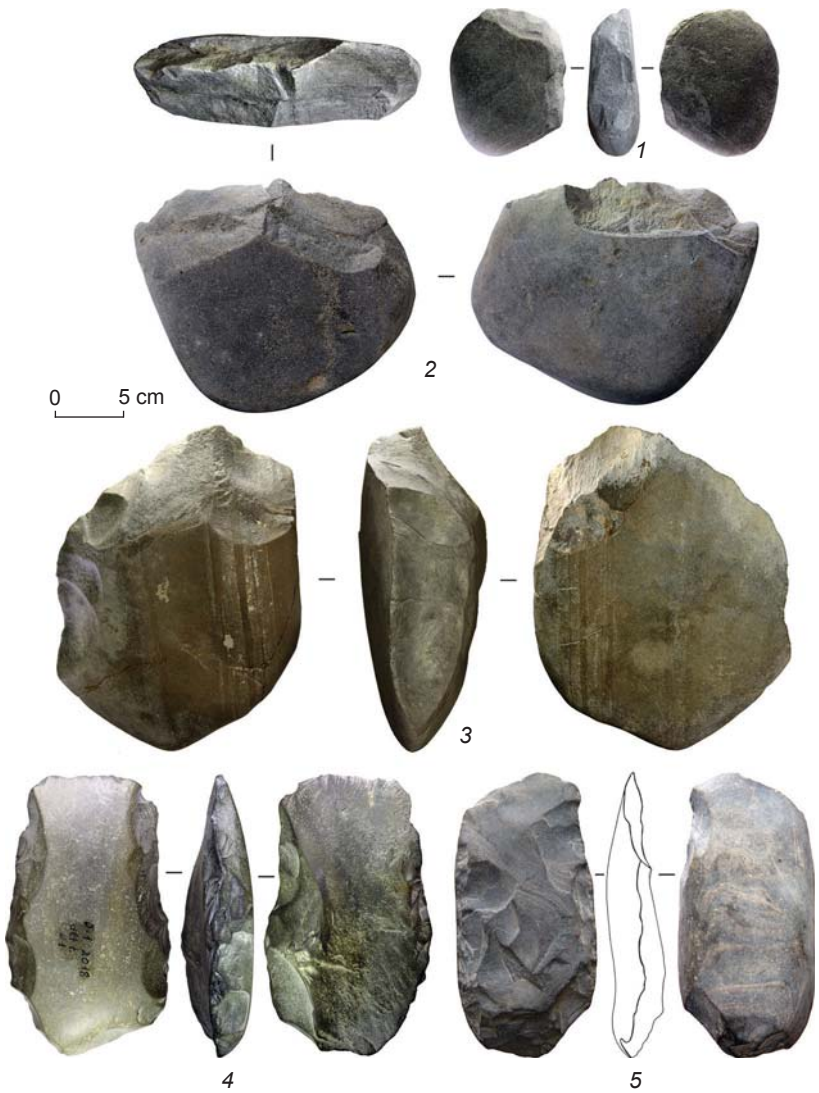

Fig. 6. Tools from Garaja.
1 – side-scraper on pebble; *2*, *3* – choppers; *4*, *5* – cleavers.

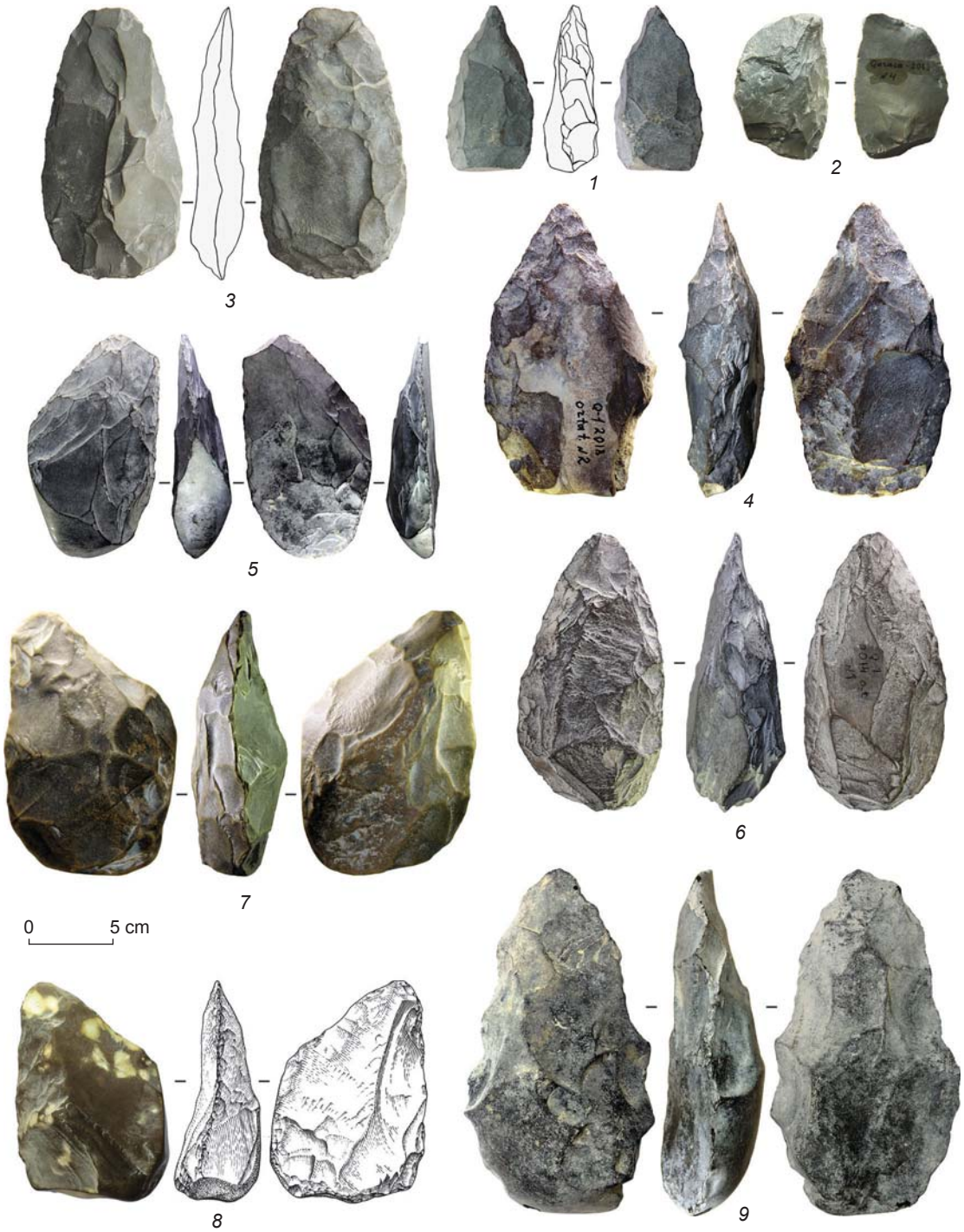

Fig. 7. Bifacial tools from Garaja.
1, *2*, *5–9* – handaxes (bifaces); *3* – limande; *4* – handaxe found *in situ*.

period determined by geological and paleontological data—to the Bakunian stage. The technocomplex has the following features. Primary reduction products are dominated by simple cores with parallel pattern of flaking; radial and "citron" flaking techniques were episodically implemented. Most tools were fashioned on pebbles or large primary flakes detached from them. Secondary treatment was accomplished by removing small or medium-sized flakes rather than by retouching. Large implements (handaxes, choppers, cleavers, and side-scrapers) prevail in the toolkit. Tools on flakes are scarce; they exhibit no traces of intense trimming. Large pieces predominate. It should be taken into account that 99 % of the artifacts were found lying exposed on the sand and

gravel beach, where large and robust tools have a much greater chance of being preserved and found. Solitary Levallois artifacts and a Quina scraper do not contradict the Early Paleolithic attribution of this assemblage either, since several Early Paleolithic sites with both large bifacial tools and those manufactured using the Levallois technique have been recently found in the East and South Caucasus (Darvagchay-Zaliv-4, Nor-Geghi-1) (Rybalko, Kandyba, 2021; Adler et al., 2014).

Discussion

First industries with bifaces (handaxes), which appeared in Africa approximately 1.8–1.5 Ma years ago, inaugurated the beginning of a long (over 1 Ma years) Acheulean period. Later on, the Acheulean spread to the Near East (~1.4–0.9 Ma years ago) and further to Eurasia (Derevianko, 2014: 173–177; Axe Age…, 2006; Semaw, Rogers, Stout, 2009). Some researchers distinguish Acheulean complexes proper and archaic assemblages with bifacial tools. According to this view, expansion of the Acheulean from the Near East to the east of Eurasia occurred not later than ~0.5 Ma years ago, and to the western part of the continent, including the Caucasus, ca 0.7–0.6 Ma years ago (Derevianko, 2014: 43–67). Supposedly, bifacial technique in those regions could appear much earlier. For instance, in the Caucasus it could exist ~1.4 Ma years ago, in India ~1.2 Ma years ago, in China ~1.6 Ma years ago, and on the Java ~1.2 Ma years ago (Shchelinskiy, 2021: 53–57; Larick et al., 2001; Paddayya et al., 2002; Zhou et al., 2004).

The analysis of lithic industries that existed in the South and East Caucasus during the Bakunian age reveals several sites that can be regarded as standard for reconstructing the evolution of final Early Paleolithic technologies in the region.

One of the best-known sites in the Caucasus, whose location is closest to Garaja (~150 km), is Azykh Cave in Azerbaijan. The cave contains strata with artifacts of the Acheulean type (layers VI and V), which, judging by paleontological and pollen data, can be attributed to the Middle Pleistocene (Guseinov, 2010: 185–188). ESR-date of 293 ± 23 ka years ago was obtained for the base of layer V. Culturally sterile sediments separate layers VI and V from layer III, containing younger archaeological materials (Azokh Cave…, 2016: 27–54).

In assemblage from layer VI (1890 artifacts), primary reduction is represented by several discoid (radial) and parallel single-faced cores. About a half of striking platforms are dihedral and facetted. Side-scrapers of various modifications, including convergent and angular forms, prevail in the toolkit. Denticulate-notched implements and atypical end-scrapers are numerous. Large tools on pebbles (choppers, cleavers, and bifaces) form 10 %. The assemblage also comprises several limaces and small points resembling Tayacian pieces (Guseinov, 2010: 189–196).

Lithic industry of layer V, which is thicker (~3 m) than the previous one, is less abundant (289 spec.). Primary reduction is represented by a few cores of the types similar to those found in layer VI; however, evidence of Levallois technique appears. Category of flakes includes target Levallois blanks; share of faceted striking platforms increases. Secondary treatment becomes more sophisticated; some blanks demonstrate basal thinning. Side-scrapers (mostly double-edged), choppers, and bifaces prevail in toolkit. Denticulate-notched implements are rare. Mousterian points, which are absent in other layers, occur along with singular point-like tools with trimmed bases (Ibid.: 197–202).

Owing to the Levallois technique employed, more sophisticated secondary treatment, and presence of specific Middle Paleolithic implements (Mousterian points, complex side-scrapers, etc.), the industry of layer V seems to be too advanced for the Early Paleolithic. Given the scarcity of artifacts and the stratigraphic position of the industry (the finds are scattered across the 3-meter-thick deposits), the material probably attests to multiple short-term occupation episodes by groups associated with various industries (Lyubin, 1998: 33–43).

In Armenia, assemblages from Dashtadem-3 and Nor-Geghi-1 are most informative among stratified Middle Pleistocene complexes. In Dashtadem-3 assemblage (~2500 spec.), single- and double-platform cores with parallel flaking prevail; radial and Levallois cores for points are also present. Bifaces (hadaxes), large beaked implements, and knives preponderate in toolkit. Side-scrapers, atypical end-scrapers, and notched pieces are inconsiderable in number. Levallois points are available. On the basis of geological and archaeological data, this assemblage can be attributed to the Late Acheulean, most probably, within the limits of the final Middle Pleistocene (Kolpakov, 2009).

According to a series of Ar/Ar-dates, the age of Nor-Geghi-1 artifacts is ~350–300 ka years ago. They are characterized by combination of parallel and Levallois flaking techniques. Levallois technique was applied in order to receive both flakes and elongate (including pointed) blanks. Flakes with facetted platforms form a fairly high percentage. Various side-scrapers, including déjeté and Quina, prevail in toolkit; bifaces varying in size and shape are also numerous (Adler et al., 2014).

In the Northeastern Caucasus, three stratified sites with representative industries of the Acheulean type are known. At Darvagchay-Zaliv-4 (South Dagestan), assemblages with bifaces were recorded in layers 5 and 3,

whose OSL-age is 370–330 and 250–220 ka years ago, respectively (Kurbanov, Rybalko, Yanina, 2021). These chronological assessments correlate well with geological and paleontological data. In the lithic industry of layer 5 (~300 spec.), primary reduction is characterized by the prevalent parallel flaking and episodic utilization of radial and "citron" techniques. Among tools, spur-like and notched implements are most numerous. There are many large pebble tools (picks, choppers, and handaxes). The assemblage also comprises simple side-scrapers, including a pebble variety, and atypical end-scrapers. Many tools are small in size, measuring 2–4 cm (Derevianko et al., 2012: 241–245; Rybalko, Kandyba, 2021).

In the industry of layer 3 (~1000 spec.), primary reduction is represented by parallel cores with one flaking surface. Radial cores are rare. The assemblage contains elements of Levallois technique (isolated cores for flakes and elongate blanks; Levallois flakes). Among tools, spur-like and notched implements predominate. If compared with the assemblage from layer 5, side-scrapers and atypical end-scrapers are more numerous, while large tools on pebbles are less common. The category of large tools on pebbles represented by the same types also includes core-like end-scrapers and numerous bifacial forms. Points occur. Some tools are small-sized (2–4 cm) (Derevianko et al., 2012: 238–241).

At Darvagchay-Zaliv-1 located nearby, artifacts of the Acheulean type (~600 spec.) were found in association with gravel and pebble sediments. Almost all cores are parallel with one flaking surface. Kombewa cores and Levallois nuclei for elongate blanks are represented by solitary specimens. Pieces of Levallois morphology occur. The composition of toolkit is similar to that discovered in layer 3 of Darvagchay-Zaliv-4 (Derevianko et al., 2012: 217–220; Derevianko, Rybalko, Kandyba, 2016).

A significant portion of Acheulean materials was found without a stratigraphic sequence in the East and South Caucasus: Satani-dar, Djraber, Chikiani, Lori Plateau, Lashe-Balta, and others (Lyubin, 1998: 136–155; Gasparyan et al., 2014). Large cutting tools of various kinds (bifaces, cleavers, picks, etc.) constitute the most typical and common element of these assemblages and serve as the main chronological marker.

Thus, the discussed Acheulean industries of that part of the Caucasus are characterized by great diversity of local variants. This opinion is shared by all experts on the Paleolithic of the region despite disagreement concerning the principles underlying the definition of those variants, their chronology, distribution areas, etc. (Lyubin, 1998: 168–175; Doronichev et al., 2007: 200–250; Derevianko, 2014: 43–67; Amirkhanov, 2016: 177–187).

Comparison of Garadja assemblage with materials from the mentioned sites revealed the following. Owing to the presence of implements such as handaxes, cleavers, and choppers, the predominance of pebble tools, absence of Levallois elements, and a rather archaic reduction technique ("citron" and simplest parallel cores, which are virtually unprepared), the Garaja industry appears to be earlier than those of other known final Bakunian sites in the Caucasus (0.4–0.3 Ma years ago). The complex is distinguished by the absolute dominance of large bifacial implements. Bifaces and similar pieces (51 spec.) form approximately 1/3 of the toolkit. This is the highest figure for the Early Paleolithic sites known in the Caucasus. In addition, Garaja bifacial tools demonstrate great variability in terms of shape, proportions, character of treatment, location of working edge, etc. Most probably, this was associated with several stages in occupation of the site by different groups and/or with specialization of bifacial implements (the shape and character of treatment were stipulated by their utilization function). It is noteworthy that similar variability of bifacial implements is observed in assemblages of the Darvagchay cluster of sites, where a wide spectrum of bifacial tools varying in age and location is present (Kharevich, Kolobova, Rybalko, 2022).

The Garaja assemblage, while generally falling within the variation limits of the Late Acheulean, reveals certain peculiarities caused by the fact that there were several occupation episodes during the final Bakunian. For instance, a great variety of bifacial implements is noted. These are represented both by large robust cutting tools with a pebble butt, and elaborate and thin pieces like Keilmesser and limande. Garaja assemblage contains at least two successive technocomplexes. The younger one comprises advanced forms of bifaces, together with implements made by Levallois technique and intensely retouched side-scrapers. Nearly contemporaneous collection from Darvagchay-Zaliv-4, demonstrating the evolution of handaxe technology (sophistication of techniques and standardization of shape), evidences the same processes (Ibid.). In contrast from Dagestan assemblages, Garaja industry does not abound in small notched and spur-like pieces. Given that small artifacts could get lost due to environmental or anthropogenic factors, these differences are not critical. The final resolution of this issue hinges on further studies at the site and a more accurate chronology.

Conclusions

After the discovery of Azykh Cave in 1960, there came a long hiatus in studies of the Early Paleolithic in Azerbaijan. For a long time, Azykh Cave reminded the only location in the Southeast Caucasus associated with the early

human occupation of this territory. Discovered in 2012, the site of Garaja provided an opportunity in studying the earliest history of the region at a new level. Despite the fact that archaeological materials were partially lost due to destruction of culture-bearing sediments, study of the site yielded important information about the Early Paleolithic and natural history of the region. Taking into account scarcity of open-air sites of this period in the Caucasus, representativeness of the archaeological assemblage, availability of paleontological materials, as well as the possibility to reliably correlate artifacts with lithological strata and to use absolute dating methods, it can be stated that Garaja, along with Azykh Cave, is the key site for understanding initial stages of peopling of both the South Caucasus and the western Caspian region as a whole. Evidence of primitive techniques of primary reduction and secondary treatment, a representative set of large tools, including the most numerous collection of handaxes in the region, testify to full conformity of Garaja assemblage to the industries of the first half of the Middle Pleistocene known in the Caucasus and adjoining regions. At the same time, certain elements of technocomplex, such as solitary Levallois cores, a Quina scraper, and advanced forms of bifaces, indicate the presence of two chronologically and technologically successive complexes within the general Late Acheulean industrial tradition.

Acknowledgments

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Late Acheulean Handaxes from Northeastern Caucasus: Morphology and Technology

We describe the variability of morphological and technological features of handaxes from two culturally and chronologically consecutive Acheulean assemblages of Dagestan, Northeastern Caucasus. The early one, dating to MIS 11–10, is represented by three sites: Darvagchay-Zaliv-1 (complex IV, layer 3), Darvagchay-Zaliv-4 (layer 5), and Darvagchay-Zaliv-2. The late complex, dating to MIS 7, includes the sites of Darvagchay-Zaliv-1 (complex IV, layer 2), Darvagchay-Zaliv-4 (layer 3), and Darvagchay-Karier. We examine analogies from other Acheulean sites in the Caucasus. Two-dimensional geometric-morphometric analysis was used to study the shape of tools from Dagestan. The findings suggest that the shape of unifacial tools is the same as that of bifaces. The comparison of tools from two cultural and chronological horizons, including those from contemporaneous sites in the Caucasus, indicates a higher variability in earlier tools. Based on the scar pattern analysis, three chaînes opératoires in manufacturing handaxes were reconstructed. Tools of the later complex had been subjected to a more thorough reduction than those of the early complex. Technological continuity was traced over a considerable timespan (MIS 11–7). It was manifested in the standardization of bifacial shape and the gradual sophistication of chaînes opératoires. Given the high morphological homogeneity of tools from Dargvachay complexes and other contemporaneous industries of the Caucasus, it can be suggested that these technological tendencies are characteristic of the entire Caucasus.

Keywords: *Acheulean, Caucasus, Dagestan, handaxes, geometric-morphometric analysis, scar pattern analysis.*

Introduction

Analysis of the morphological variability of stone tools underlies many Paleolithic studies. Understanding of the required standards of stone tool manufacture is important for the reconstruction of ancient hominin behavior. Bifacial tools, and handaxes in particular, constitute one of the ancient categories of lithic artifacts whose morphological variability has always been a focus of interest for researchers. Many scientific papers address the morphology of handaxes (see, e.g., (O'Brien, 1981; Vaughan, 2001; Beyene et al., 2013)).

There are several hypotheses explaining the significant morphological uniformity of handaxes over a wide area and over a long period of time. One of them is the hypothesis of cultural transmission (social/cultural learning): handaxes and bifaces are considered as cultural markers, the style and manufacturing technology of which were passed down from generation to generation. The hereditary transmission of the tradition of reproducing the tool shape ensured the preservation of its main models in the populations of *Homo erectus* and *Homo heidelbergensis* during the Middle Pleistocene (Foley, 1987). The transfer of technological knowledge was

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most likely dominated by imitative learning or imitation (Mithen, 1999; Shennan, Steele, 1999; Shipton, Petraglia, Paddayya, 2009; Bar-Yosef, 2006).

The cultural transmission theory, which does not allow us to imagine the mechanism of transmission of cultural information during several hundred thousand years, has been developed in the hypothesis of genetic transmission, which explains the transfer of the technology of handaxe production through genetic inheritance (Corbey et al., 2016).

In the study of the Acheulean tools, in addition to the traditional methods (linear measurements and visual evaluation of shape) (Roe, 1968; McPherron, Dibble, 1999), statistical and quantitative methods verifying the derived data began to be used, for determination of the morphology of items (Lycett, Cramon-Taubadel, von, Foley, 2006; Herzlinger, Goren-Inbar, Grosman, 2017; Weiss et al., 2018; Serwatka, 2015; Lycett et al., 2016). The use of various methods allowed researchers not only to identify a significant morphological similarity of the studied items, but also to explain the variability of bifaces and handaxes by their purpose, technological convergence, reduction of tools, quality and availability of lithic raw materials (Vaughan, 2001; McPherron, 2006; Li H., Kuman, Li C.-R., 2014; Lycett et al., 2009; Shipton, Clarkson, 2015).

The purpose of this article is to study the variability of the shape and the technology of handaxes from the Late Acheulean complexes from Southeastern Dagestan (Northeastern Caucasus), using geometric-morphometric and the scar pattern analyses (Rybalko 2017, 2019; Rybalko, Kandyba, 2019, 2020).

Materials and methods

Archaeological assemblages

The Late Acheulean complexes of Southeastern Dagestan include two stratified sites—Darvagchay-Zaliv-1 (complex IV, layers 2 and 3) and Darvagchay-Zaliv-4 (layers 3 and 5), and two localities with the surface exposed artifacts—Darvagchay-Karier and Darvagchay-Zaliv-2. On the basis of the analysis on archaeological materials, as well as the data on the relative and absolute dating, two cultural-chronological complexes have been identified (Rybalko, 2017, 2019; Rybalko, Kandyba, 2020). The early complex II has been recorded at the Darvagchay-Zaliv-1 (layer 3), Darvagchay-Zaliv-4 (layer 5), and Darvagchay-Zaliv-2. The finds occur in similar geochronological condition, their age has been determined to be within MIS 11–10 (380–330 ka BP) (Kurbanov, Rybalko, Yanina, 2021). The late cultural-chronological complex I contains the artifacts from Darvagchay-Zaliv-1 (layer 2), Darvagchay-Zaliv-4 (layer 3), and Darvagchay-Karier, which have been dated to 250–220 ka BP, corresponding to MIS 7 (Ibid.).

Macro-tools, including choppers, picks, core-like scrapers, and handaxes, are a characteristic feature of the lithic assemblages of the both complexes. Researchers of the Darvagchay archaeological district assigned to the category of handaxes not only classic bifacial tools, but also partial handaxes and unifacial handaxes (Rybalko, 2019, 2020; Rybalko, Kandyba, 2020). We included artifacts of this category into our study materials in order to expand the number of technological observations and enlarge the sample.

The collection of handaxes from the early complex II comprises 12 items (Fig. 1, *5–9*). In this set, there are 2 unifacial tools; the other tools are partial (9 spec.) or complete (1 spec.) bifaces.

The collection of handaxes from the late complex I includes 16 specimens (Fig. 1, *1–4*). As compared to earlier industries, the share of bifacial handaxes (5 spec.) is greater here, the main part again consists of partial handaxes (9 spec.), and unifacial tools are few (2 spec.).

Geometric-morphometric analysis

The standard procedure of geometric-morphometric analysis, which has been repeatedly described in the research literature (Costa, 2010; Serwatka, 2014, 2015; García-Medrano et al., 2020; Shalagina et al., 2020), was applied to study the handaxe morphology. The method is aimed at the study of the artifact shape through a multidimensional analysis of the coordinates of landmarks established on its surface at a given distance from one another (Herzlinger, Goren-Inbar, Grosman, 2017). In the course of the study, a two-dimensional geometric-morphometric analysis of the items outlines was used.

The XY-coordinates of the outlines of artifacts were taken in the TPS program (Rohlf, 2006). The contours of items were recorded through the graphic images of handaxes from the Acheulean sites of Darvagchay (25 spec.) and the Acheulean sites of the Caucasus region (25 spec.), described in the monographs by V.P. Lyubin (1998: 43, fig. 19, *1*; p. 103, fig. 53) and V.P. Lyubin, E.V. Belyaeva (2004: 105, fig. 47; p. 107, fig. 49, *2*; p. 149, fig. 70; p. 176, fig. 83). Bifacial tools were oriented along the longest axis of symmetry, in accordance with the technique proposed by S. McPherron and H. Dibble (1999).

The XY-coordinates of the items contours were taken automatically in the TPSdig program, using 60 landmarks, starting from the distal end in a clockwise direction. Under landmarks, as proposed by other researchers (Herzlinger, Grosman, 2018; Serwatka, 2014, 2015; Costa, 2010), we understand both types of marks, including semi-landmarks, which are established evenly

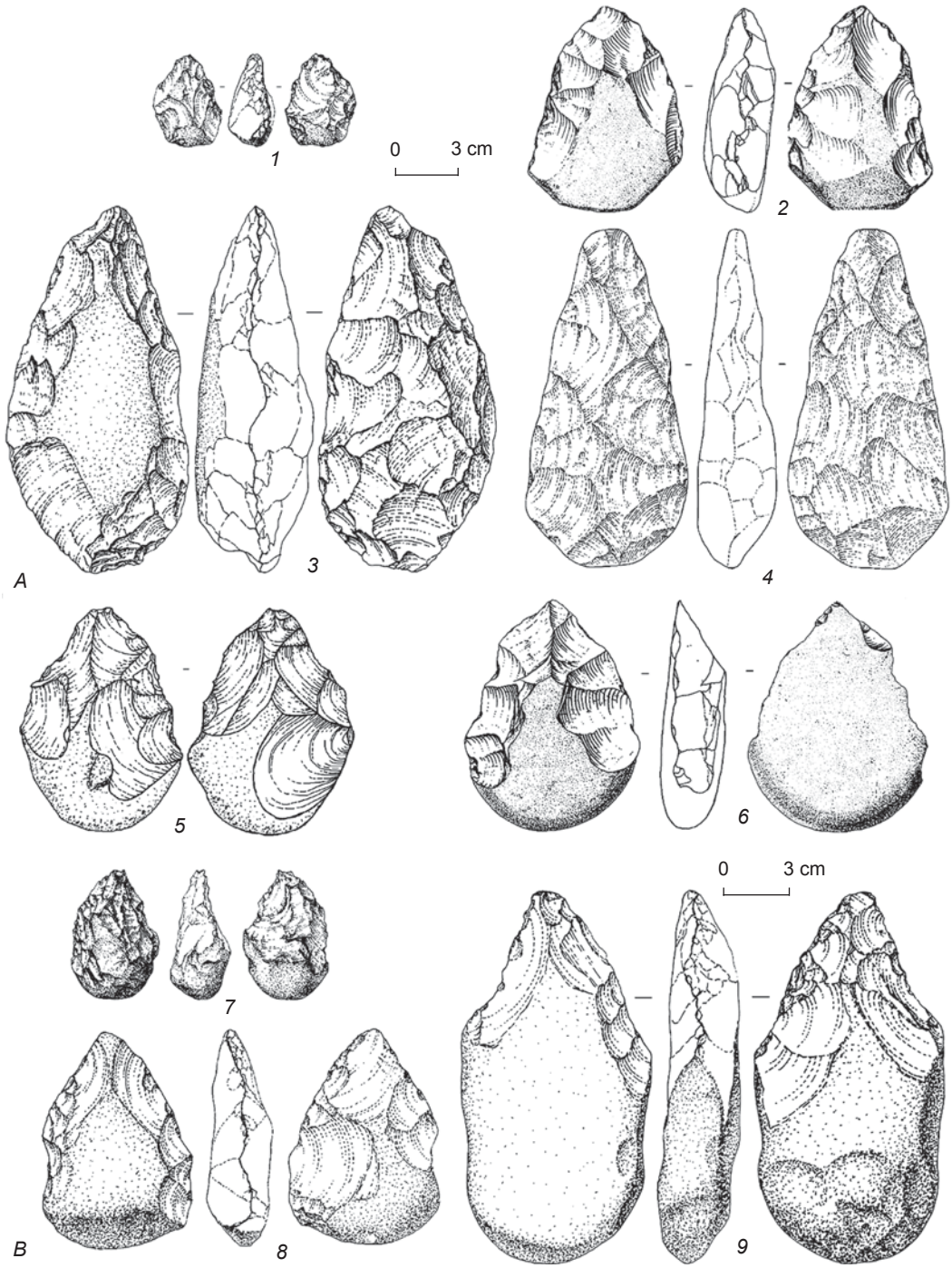

Fig. 1. Handaxes from the Acheulean complexes of Southeastern Dagestan.
A – cultural-chronological complex I: *1* – Darvagchay-Zaliv-1 (layer 2), *2* – Darvagchay-Zaliv-4 (layer 3), *3* – Darvagchay-Zaliv-1 (layer 2), *4* – Darvagchay-Zaliv-4 (layer 3); *B* – cultural-chronological complex II: *5*, *6* – Darvagchay-Zaliv-4 (layer 5), *7* – Darvagchay-Zaliv-2, *8*, *9* – Darvagchay-Zaliv-1 (layer 3).

at a given distance on the surface or along the contour of an item (Serwatka, 2014; Shalagina et al., 2020). The number of landmarks used in studies can vary from 28 (García-Medrano et al., 2020) to 75 (Costa, 2010) and 100 marks (Serwatka, 2014, 2015). The number of marks and choice of their location are determined by the researcher. Analyzes of Lower and Middle Paleolithic bifacial tools show that 60 landmarks are enough to record the handaxe contour (García-Medrano et al., 2020; Iovita, 2009).

The XY-coordinates of items contours were converted into a single system using Procrustean analysis in the PAST (PAleontological STatistics) program

(Hammer, Harper, Ryan, 2001). The same program was used to subject the transformed data to the principal component analysis.

Scar pattern analysis

Scar pattern analysis was carried out in order to reconstruct the technique of shaping the bifacial tools from the Acheulean complexes of the Darvagchay archaeological district. This method is based on a thorough study of all negative scars on the surface of a lithic artifact (Pastoors, 2000; Kot, 2014; Shalagina, Kolobova, Krivoshapkin, 2019). For each product, a flowchart was made reconstructing the succession of tool shaping operations. Each block in the chart corresponds to a group of negative scars similar in morphological characteristics (flakes from the same striking platform, in the same direction, etc.) and aimed at one technological stage. This article provides an analysis of the sets of flowcharts constructed on the basis of graphic images of the most typical tools. The scar pattern analysis was carried out for 18 items: Darvagchay-Karier – 2 spec., Darvagchay-Zaliv-1 – 4 spec., Darvagchay-Zaliv-2 – 1 spec., and Darvagchay-Zaliv-4 – 11 spec., of which 7 specimens belong to complex II, and 11 specimens to complex I.

Results

The two-dimensional geometric-morphometric analysis was carried out for 25 handaxes from the Darvagchay sites. In order to ensure the statistical representativeness of the sample and the possibility of comparing the Darvagchay complexes with other Acheulean industries of the Caucasus, our sample was supplemented by bifacial tools (25 spec.) from other Acheulean sites of the region that correspond to archaeological complexes of Southeastern Dagestan in terms of culture and chronology. These include the tools from the stratified sites of Koudaro I (11 spec.), Azykh, layer 5 (2 spec.), Tsona Cave (2 spec.) and from the surface collections of Satani-Dar (6 spec.), Kheivani (1 spec.), and Yashtukh (3 spec.).

Geometric-morphometric analysis of the tools outlines revealed a high morphological homogeneity of the sample: 74.92 % of the variability in the shape of handaxes are covered by the first two components—53.79 and 21.13 %, respectively. The first component describes a variety of tool shapes from wide and short to elongated, the second component deals with the range from symmetric leaf-shaped to asymmetric trapezoid (Fig. 2). The Darvagchay tools, as well as the artifacts from other Acheulean industries of the Caucasus, follow common morphological trends. On the plot, the tools from all the sites are distributed evenly, in accordance with the values of the two first principle components (Fig. 2).

The same method was used to compare the morphologies of unifaces and bifacial handaxes. Geometric and morphometric analysis has shown that the outline indexes of unifacial tools fully correspond to the range of variability of bifacial handaxes. On the plot of tools distribution by the values of the two principal components, the unifacial tools gravitate towards the center of the plot and show greater shape uniformity than bifacial tools (Fig. 3). That is, the artisans intentionally produced a convergent shape in unifaces, similar to the

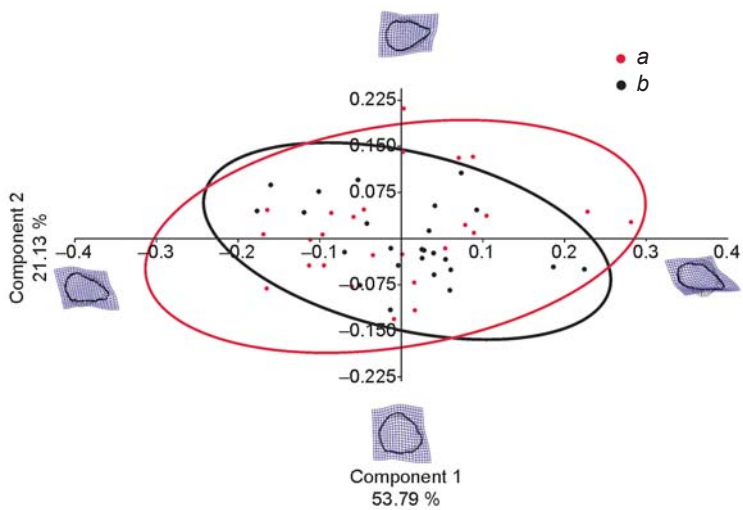

Fig. 2. Plot of distribution of handaxes from the Acheulean complexes of the Caucasus, according to the values of the first two principal components. 95 % variability ellipses include the groups of tools from Darvagchay complexes and those from other Acheulean industries of the Caucasus. N=50. *a* – Acheulean complexes from the Darvagchay archaeological district; *b* – Acheulean complexes from the Caucasus.

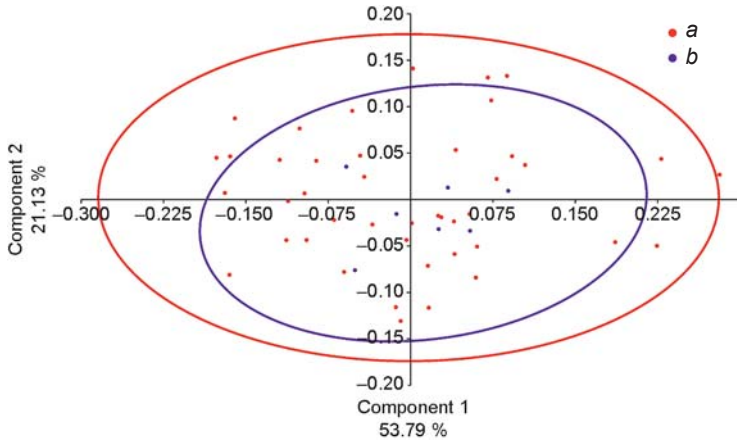

Fig. 3. Plot of distribution of handaxes according to the values of the first two principal components. The tools are grouped by the presence of signs of bifacial or unifacial working. N=50.
A – bifacially worked tools; *b* – unifacially worked tools.

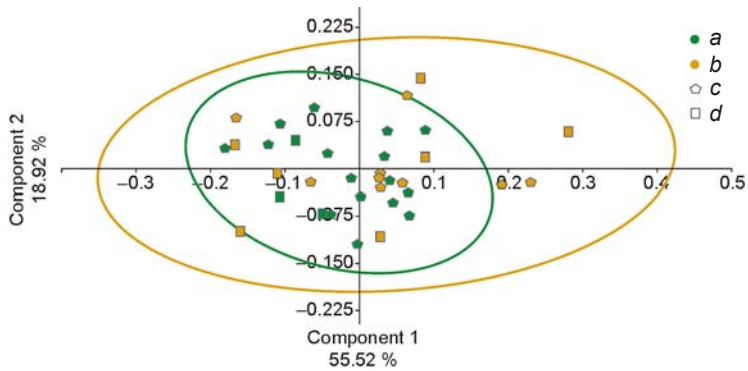

Fig. 4. Plot of distribution of handaxes according to the values of the first two principal components. The tools are grouped by their cultural-chronological affiliation. N=35.
a – cultural-chronological complex I and contemporaneous Acheulean complexes of the Caucasus (MIS 7); *b* – cultural-chronological complex II and contemporaneous Acheulean complexes of the Caucasus (MIS 10–11); *c* – handaxes from Darvagchay complexes (Darvagchay-Zaliv-1, -4); *d* – handaxes from Acheulean complexes of the Caucasus (Koudaro I, Azykh, Tsona Cave).

design of bifaces. This makes it possible to consider unifaces, partially worked handaxes, and classic bifaces within a single category in studies of the Darvagchay handaxe manufacturing technique.

The morphological variability of handaxes from two cultural-chronological complexes was assessed through the geometric-morphometric analysis. We analyzed the sample of tools (35 spec.) including the Darvagchay tools and the artifacts from Caucasian assemblages with a clear chronological attribution (10 spec.). It concerns the sites contemporaneous to the cultural-chronological complex I (MIS 7): Koudaro I, lenses X – 2 spec., and Tsona Cave – 2 spec.; and to the cultural-chronological complex II (MIS 10–11): Koudaro I, layer 5a/5b – 3 spec., Koudaro I, layer 5c – 1 spec., Azykh, layer V – 2 spec.

The plot of tools distribution by the values of the first two components shows that 95 % of the variability ellipse of the tools from complex I (MIS 7) falls within 95 % of the variability ellipse of the tools from complex II (MIS 10–11) (Fig. 4). In other words, the older the tools are, the more variable they are in shape. Tools from the later complex, showing uniformity, tend towards the center of the plot, i.e., to the unified shape (Fig. 4).

Four unifaces, four partial and three classic bifacial handaxes from complex I were studied using the *scar pattern analysis*. The selected artifacts show leaf-shaped, ovoid, or triangular shape. All the items have two working edges, with several of them showing continuous marginal retouch. The partial bifacial handaxes retain pebble crust covering up to 70 % of each face. Distal ends of the uni- and bifacial tools are metrically similar. Unifacial items of the sample show a distal end angle 115–140° in plan view and 50–60° in side view. Among the bifacial artifacts, this value varies from 80 to 140° in plan view, and 45–83° in side view. The angle of working edges for both unifaces and bifaces reaches from 60 to 85°.

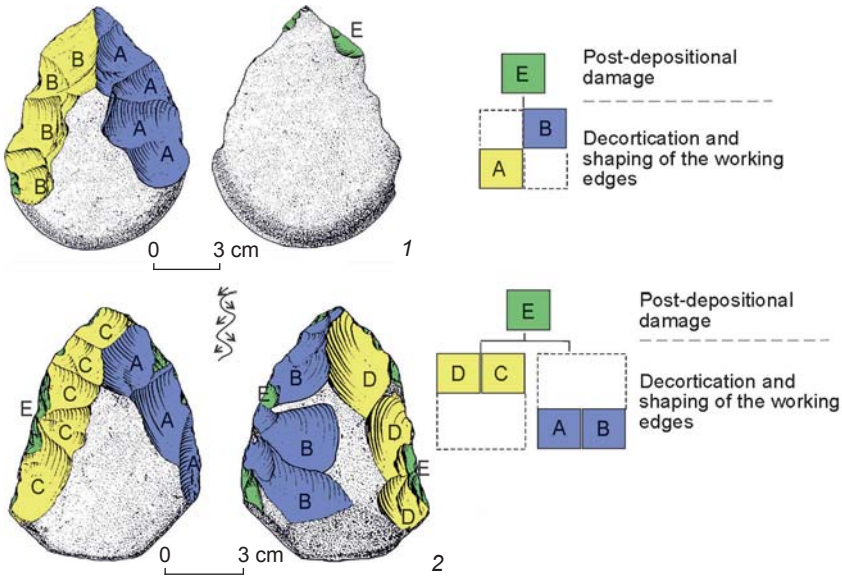

Fig. 5. Diagrams of shaping the handaxes from Darvagchay-Zaliv-4 corresponding to chaîne opératoire 1.
1 – unifacial tool from layer 5; *2* – bifacial tool from layer 3.

Two unifaces and five partial bifaces from the early complex II have been analyzed in detail. These are leaf-shaped and sub-trapezoid artifacts. All the items of the sample show two working edges with a length reaching 3/4 of the length of the product. There are no tools with marginal retouch in this complex. In partial bifaces, the share of pebble crust on each side reaches 50 %. In bifacial products, the angle of the distal end is 80–110° in plan view, 40–68° in side view; in unifaces, 80–90° and 35–50° respectively. The angle of the working edges is 48–70°.

Scar pattern analysis made it possible to identify several main trends in the shaping of handaxes from complexes I and II. In general, all the identified trends are typical of both unifacial and bifacial tools from the Darvagchay sites.

The analyzed tools show the signs of use of biconvex and plano-convex shaping techniques. The choice of technique depended on the shape of the blank. In the Darvagchay complexes, handaxes were mainly fashioned on pebbles of various morphologies, some of which had clearly plano-convex shapes. The plano-convex technique was usually used in shaping the plano-convex pebbles. In all other cases, biconvex technique was used; flaking was executed from two surfaces alternately.

Uni- and bifacial tools of complexes I and II show several chaînes opératoires, regardless of the technique used.

Chain 1 is the shortest; it corresponds to the technique of working the convergent-shaped tools with the help of consecutive centripetal spalls from one or two sides (Fig. 5). The working was minor, and no additional shaping was needed. Large spalls, which were also decortication spalls, ensured the convergent shape of the tool and formed two working edges. Among the tools analyzed, there are five items that were manufactured using this chaîne opératoire. The number of spalls from each of the flaking surfaces varies from 4 to 11. Judging by the size of the latest negative scars, the tools were shaped by the largest flakes (Fig. 6). This chaîne opératoire is typical for complexes I and II.

Chain 2 is longer; it consists of two main stages of shaping. The first stage was decortication, which simultaneously served as initial shaping; the second stage was additional working of edges with small detachments (Fig. 7). In some cases, minor basal or distal working was carried out. This chaîne opératoire was identified on nine artifacts. The number of negative scars on each of the prepared surfaces of the tools varies from 6 to 23. The dimensions of the negative scars are generally smaller than those of chain 1 (see Fig. 6). The signs of use of chaîne opératoire 2 have been recorded in both complexes.

Chain 3, the longest, is connected to the careful preparation of the faces. This chain included decortication, shaping of the working edges, shaping of the distal end, and sometimes also basal working (Fig. 8). The convergent shape was given to the tool mainly at

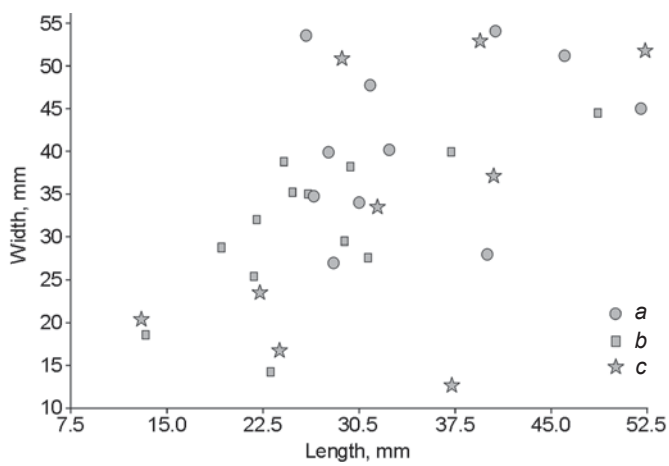

Fig. 6. Sizes of negative scars on the surface of handaxes from the Darvagchay complexes. The two latest and largest negative scars on the surface of the tools were taken into account.
a – chain 1; *b* – chain 2; *c* – chain 3.

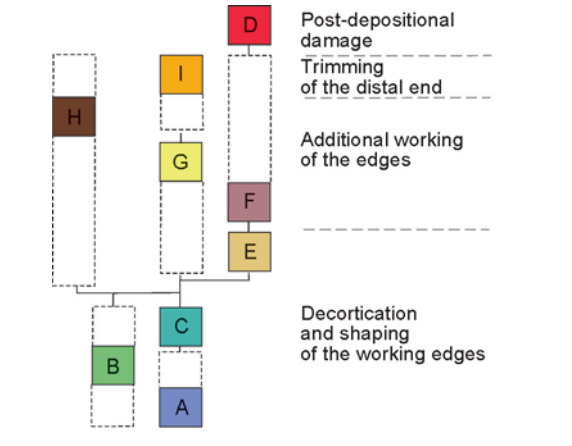

Fig. 7. Diagram of shaping the handaxe from layer 5 at Darvagchay-Zaliv-4, corresponding to chaîne opératoire 2.

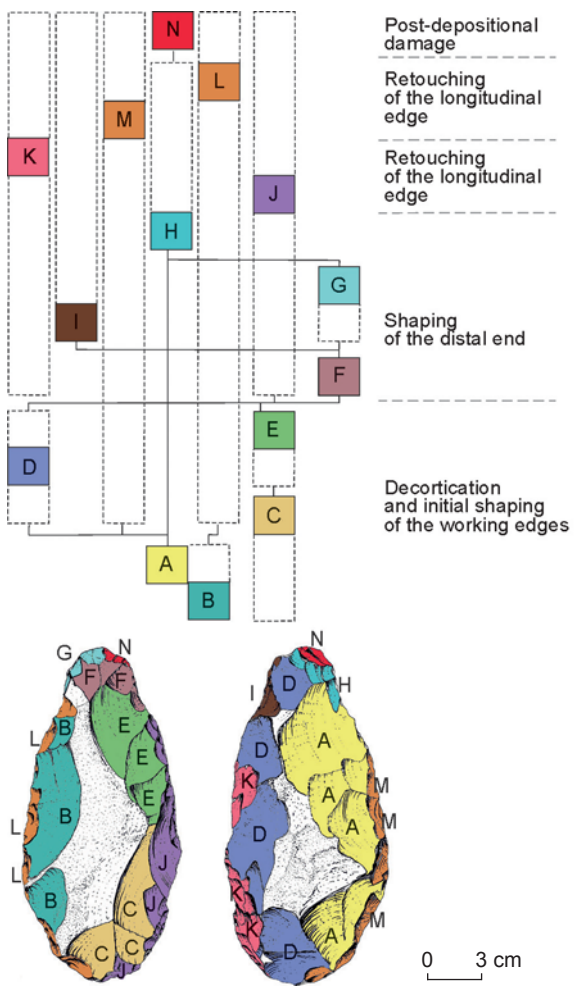

Fig. 8. Diagram of shaping the handaxe from layer 3 at Darvagchay-Zaliv-4, corresponding to chaîne opératoire 3.

the stage of shaping the working edges, and not at the initial stage of decortication. Chaîne opératoire 3 was traced on four artifacts. The number of flakes from each of the treated surfaces of the tools varies from 18 to 41. The dimensions of the negative scars are very diverse; both large and small spalls are recorded (see Fig. 6). The longest chaîne opératoire has been identified only on the tools of the late complex I.

Discussion

The Caucasus is traditionally considered a region where the Acheulean industries are widespread (Lyubin, 1998; Lyubin, Belyaeva, 2004). However, there is an opinion that the classic Acheulean industries with bifaces appeared here no earlier than the second half of the Middle Pleistocene (Doronichev, Golovanova, 2003; Doronichev, 2004), and they were preceded by the lithic industries without classic Acheulean bifaces (Doronichev et al., 2007: 200–250). This assumption is not unfounded: despite the large number of sites with various Acheulean bifaces in this area (Derevianko, 2014: 43–67; Amirkhanov, 2017), most of them are represented by the surface collected artifacts or by the stratified sites whose cultural and chronological affiliation is determined on the basis of relative dates (Lyubin, 1998: 13–96; Kulakov, 2020: 77–84). Accordingly, handaxes, namely their morphology and manufacturing technology, are of fundamental importance for the study of the Acheulean of the Caucasus.

The analysis of the Acheulean technocomplex of the Caucasus is based on assemblages from the stratified sites (Lyubin, 1998: 169–173; Kulakov, 2020: 77–84; Anoikin, 2016). Among the stratified Late Acheulean complexes, the industries of the Koudaro-1, Koudaro-3, Azykh, and Tsona cave sites are best known. According to biostratigraphic data and absolute dates, these sites were formed during the period corresponding to OIS 7–9/10 (Doronichev et al., 2007: 200–250). However, owing to the fact that many of these stratified sites were studied in the first half and middle of the 20th century, using the method of artifact recording, which is now considered outdated, it is not always possible to correlate the materials with the specific geological layer, and, accordingly, to identify the absolute age of the finds.

In this regard, the Late Acheulean industries of Southeastern Dagestan are unique: they were mostly recovered from stratified deposits for which the absolute dates are available. On the basis on these materials, two cultural-chronological complexes of the Late Acheulean have been distinguished. The occurrence of two technocomplexes in a limited area allows us to trace the development of the main methods of processing lithic raw material, including the basic technology of the handaxe manufacture.

The analysis of the scar patterns and morphology of handaxes from the two Late Acheulean complexes of Southeastern Dagestan made it possible to establish the continuity in the tradition of their manufacture. All morphological and technological tendencies that appeared in the late complex I originated in the early complex II. This inference was made on the basis of studying both the morphology of the tools and the pattern of their processing.

The results of the geometric-morphometric analysis has shown that in early industries handaxes were more diverse in shape than in late ones. They were characterized by asymmetric shortened contours and massive bases. The main techniques of shaping the leaf-like or symmetric tools have been recorded in the late complex and originated in the early one. In general, in the late complex, the shape of handaxes becomes more standardized.

The scar pattern analysis has shown that ancient artisans aimed at uniformity of the tools regardless of the number of operations in the chain. In all three chaînes opératoires, the main operations were associated with the shaping of edges, converging in a subtriangular or rounded end. The width and thickness of the distal ends of the tools fashioned using various chaînes opératoires are generally the same. A similar conclusion follows from the analysis of the angles of distal ends in plan and side views (Fig. 9).

The working edges were shaped either by large decortication flakes or were subjected to additional working. The scar pattern analysis shows that the converging edges and convergent shape of tools were formed during the purposeful actions of an artisan, starting from the stage of decortication, but not during utilization.

Comparison of the handaxe manufacturing technology of the two different complexes has shown that a more sophisticated tool-shaping technique including the stages of decortication, edge preparation, and trimming of the distal end, was typical for the late complex I. Chaînes opératoires 1 and 2 were recorded in both complexes. Thus, the younger industries testify to the sophistication of handaxe manufacturing technology.

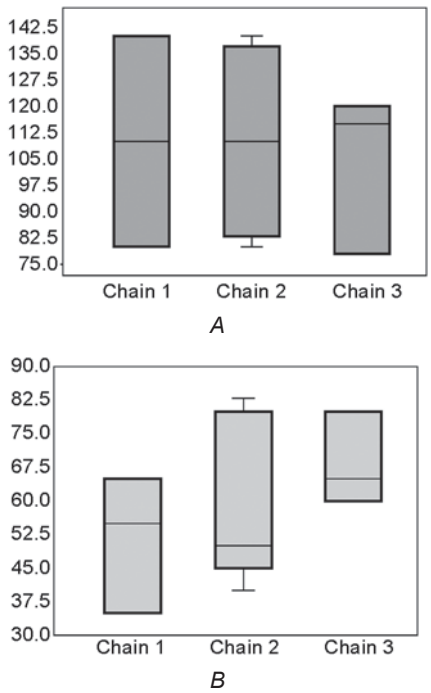

Fig. 9. Values of the angles of distal ends in the handaxes, corresponding to a certain chaîne opératoire. *A* – plan view; *B* – side view.

Conclusions

This study was aimed at deriving the answers to two main questions: whether the succession and development of handaxe manufacturing technology are observable in the Late Acheulean complexes of the Northern Caucasus, and how the technological features of handaxe manufacture in the Darvagchay complexes influence their morphological characteristics.

The findings of the geometric-morphometric analysis revealed the variability in the morphology of handaxes of complexes I and II. In early industries, the shapes of handaxes in plan view are more diverse than in later ones. Among the tools of the early complex, there are relatively symmetrical sub-leaf-shaped specimens, but the majority of handaxes are asymmetric trapezoid items, usually with a squat and massive shape. Handaxes from the late complex I are more uniform in morphology, tending to elongated, symmetrical, and sub-leaf-shaped forms.

Tools from complex I were subjected to more extensive working than tools from complex II. The process of tool manufacture became more and more multi-component. Tools from the late complex, along with short chaînes opératoires aimed at modification of the original shape of the blank, suggest the use of a more complex

sequence, associated with the extensive transformation of the original blank.

Thus, the morphological and technological continuity between the chronologically consecutive Late Acheulean complexes of Southeastern Dagestan is obvious. Both complexes showed the desire of artisans to create morphologically similar handaxes, i.e. elongated, symmetrical, sub-leaf-shaped items. The dynamics in the development of the technology have been recorded: in the late complex, they were focused on the unification of the shape of handaxes, and on the sophistication of the chaîne opératoire.

The issue of the shape and size of handaxes in the Acheulean assemblages is debatable. According to some researchers, the shape of handaxes is a cultural marker over an extremely long period of time. Other specialists argue that the morphological similarity of handaxes from technocomplexes geographically and chronologically distant from one another was the result of numerous remodifications (Iovita, McPherron, 2011). According to the results of the scar pattern analysis, tools of the Darvagchay industries do not bear traces of remodification, i.e. situational changes of shape. Consequently, by the example of Dagestan handaxes, we can observe the tendency towards a certain tool shape in chronologically consecutive complexes.

The quality and shape of lithic raw materials are the factors that could influence the shape of bifaces (White, 1998). Studies of assemblages from Gesher Benot Ya'aqov showed that bifaces made from raw materials of different quality, within the same industry tradition, differ, but not significantly (Herzlinger, Goren-Inbar, Grosman, 2017). These observations are confirmed by the results of a study of bifaces made from raw stone and tusk (Costa, 2010). In the studied assemblages, no stable relationship was noted between the features of the used raw materials and the morphology of the finished tools. In some cases, the shape of the raw material affected the size and intensity of the tool processing (Rybalko, 2021), but not the morphology of the product.

Unfortunately, we cannot discuss the functionality of the handaxes owing to the poor state of preservation of their surfaces.

It can be concluded that the results derived rather support the cultural transmission theory: populations followed a certain pattern of handaxe manufacture over a considerable timespan (from MIS 11 to MIS 7). It is possible that imitation was one of the important ways of transmitting cultural information. The dynamics in the development of handaxe manufacturing technology is manifested in the form of sophistication of technological methods and standardization of the tool shape. Taking into account the significant morphological similarity between the handaxes from Dagestan and the tools from the compared contemporaneous complexes, as well as a high degree of standardization of the shape of tools in the late complexes, which was determined through the geometric-morphological analysis, it is possible to extrapolate the results of this study to other complexes of the Caucasus. However, more ambitious conclusions require further study of the technology.

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A Late Paleolithic Housing and Utility Complex at Afontova Gora IV (Ovrazhnaya): New Findings (2020–2021)

The study focuses on a specific area of Afontova Gora IV (Ovrazhnaya)—a newly discovered Late Paleolithic site in Krasnoyarsk. We describe the diversity of cultural and utilitarian traditions at Afontova Gora and tackle the problem of detecting remains of dwellings in the structure of Paleolithic deposits. Brief information on the geomorphology and stratigraphy of the site and on the location of archaeological features in the paleorelief of Afontova Gora slopes is provided. We analyze the surface of the specific part of the site with remains of dwellings. Results of the statistical and typological analyses of lithics and bone artifacts are presented, along with information on microknapping and procession of stone, groups of rocks, species composition of fauna, and resource utilization. We reconstruct activities associated with various zones of the site. Results of surface (intrasite spatial) analysis are outlined. A dwelling with a single hearth and a utility zone are delimited and shown to be contemporaneous. Debitage connections are traced, places of individual activities are located, and directions whereby humans and artifacts had migrated are reconstructed. Ethnographic parallels are discussed; regularities in the distribution of cultural remains around the hearth in a radial fashion, with free deposition in certain places, are assessed. Drop zones, front and back toss zones, and microdeformations of the "floor" are pinpointed. The radiocarbon age of the complex is estimated at ~15.5 ka, based on several ^{14}C dates. It is concluded that habitation deposits with remains of a camp and one dwelling have been detected. Prospects for further studies are outlined.

Keywords: *Middle Yenisei, Afontova Gora, Late Paleolithic, housing-utility complexes, surface analysis, Late Pleistocene.*

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Introduction

Starting from the first excavations in the late 19th century (Savenkov, 1892), investigations of sites at Afontova Gora in Krasnoyarsk occupy a special place in Siberian Paleolithic studies. Archaeological, anthropological, and paleontological data, accumulated during a century and a half and characterizing elements of material culture, subsistence strategies, and environment of humans in the Yenisei part of Siberia, were amply documented in publications (Auerbach, 1930; Sosnovskiy, 1934; Gromov, 1948; Astakhov, 1999; Drozdov, Artemiev, 1997; Artemiev, Drozdov, Makulov, 2013; Derevianko et al., 2017). Before the early 1990s, sites at Afontova Gora, irrespective of the age of cultural layer and its location on the slope, were regarded as a typical "Afontovo" complex (Abramova, 1979; Astakhov, 1999) and as a standard of the eponymous culture.

The new stage in the study of Afontova Gora at the turn of the 21st century was associated with development of Krasnoyarsk infrastructure and construction of Nikolaeysky Bridge over the Yenisei. Rescue excavations, conducted in 2011–2021, encompassed both the already known sites (Afontova Gora I–V) and newly discovered locations: Krutaya, Afontova Gora II-Sklon, and Afontova Gora IV (Ovrazhnaya) (Artemiev, Razgildeeva, Prilepskaya, 2019; Geologiya paleolita Severnoi Azii…, 2020; Pozdnepaleoliticheskaya stoyanka Afontova Gora II…, 2021; Akimova, Novoseltseva, Stasyuk, 2021). The findings attest to the variation of cultural and subsistence traditions at Afontova Gora sites during the Late Karga to Late Sartan interval, allowing us to address the issue of dwelling remains in the surface structure of prehistoric sites.

Remains of Paleolithic dwellings in the Yenisei valley were previously recorded at Kokorevo I, Golubaya I, Nizhniy Idzhir, Maininskaya, Ui I (horizons 1 and 2, cultural layer 2), and Listvenka (cultural layers 16 and 19) (Abramova, 1979; Astakhov, 1986; Vasil'ev, 1996; Paleolit Yeniseya…, 2005). Field studies have demonstrated that in the places of ground frame structures, cultural layer did not always preserve the remains of hearths and outer linings.

As early as the late 1920s, P.P. Efimenko put forward a hypothesis about the presence of dwellings at the Afontova Gora mountain; however, it was not supported at that time (Gromov, 1934). Prospects of detecting structures of that type in the Final Paleolithic deposits became clear only in 2014, during the excavations at Afontova Gora II (Pozdnepaleoliticheskaya stoyanka Afontova Gora II…, 2021: 56–59).

Afontova Gora IV has been included into the cluster of Afontova Gora sites since the 1920s. Till the end of the 20th century, the site's area was provisionally attributed to the right and left slopes of Ivanikhin Log (ravine), "not far from its mouth" (Astakhov, 1999: 166). Modern boundaries of Afontova Gora IV were specified during pilot works in 2011–2019 and registered by the State Service for the Protection of Cultural Legacy of the Krasnoyarsk Territory (Novoseltseva et al., 2020: 24). In 2019, a new archaeological site of Afontova Gora IV (Ovrazhnaya) was discovered in the western part of the area (Akimova, Novoseltseva, Stasyuk, 2021: 106) (Fig. 1).

Rescue excavations at the site were headed by V.M. Novoseltseva (Institute of Archaeology and Ethnography SB RAS, Novosibirsk) in 2020 and by A.V. Barkov (OOO "Krasnoyask Geoarchaeology") in 2021. The total area of excavations exceeded 14 thousand m^2 (Fig. 1, *a*). Concentrations of archaeological remains were revealed on both sides of ravines traceable in paleorelief of the slope (Novoseltseva, Stasyuk, Akimova et al., 2020; Akimova et al., 2021). The findings shed light on specialized subsistence strategies and the structure of living areas of ancient human groups. One of these areas revealed traces of a Paleolithic dwelling.

Methodology

The study was focused on the spatial arrangement of Paleolithic sites within the paleorelief of Afontova Gora, discovery of housing and utility structures, and reconstruction of activity cycles in the life of ancient groups. During the excavations of Afontova Gora IV (Ovrazhnaya), a standard set of archaeological and natural-science methods, including modern recording techniques, was employed. Radiocarbon dating was performed in the Center for Accelerator Mass Spectrometry of the Novosibirsk State University and the Novosibirsk Science Center. The specificity of subsistence strategy and seasonality was revealed by faunal analysis. Skeletal fragments were attributed to specific carcass parts based on methods outlined by E.J. Reitz and E.S. Wing (2008).

Description of artifact assemblages was based on data obtained by techno-typological and morphological analyses (Abramova, 1979). Method of lithic artifacts refitting and analysis of groups of raw materials were employed. Composition of rocks

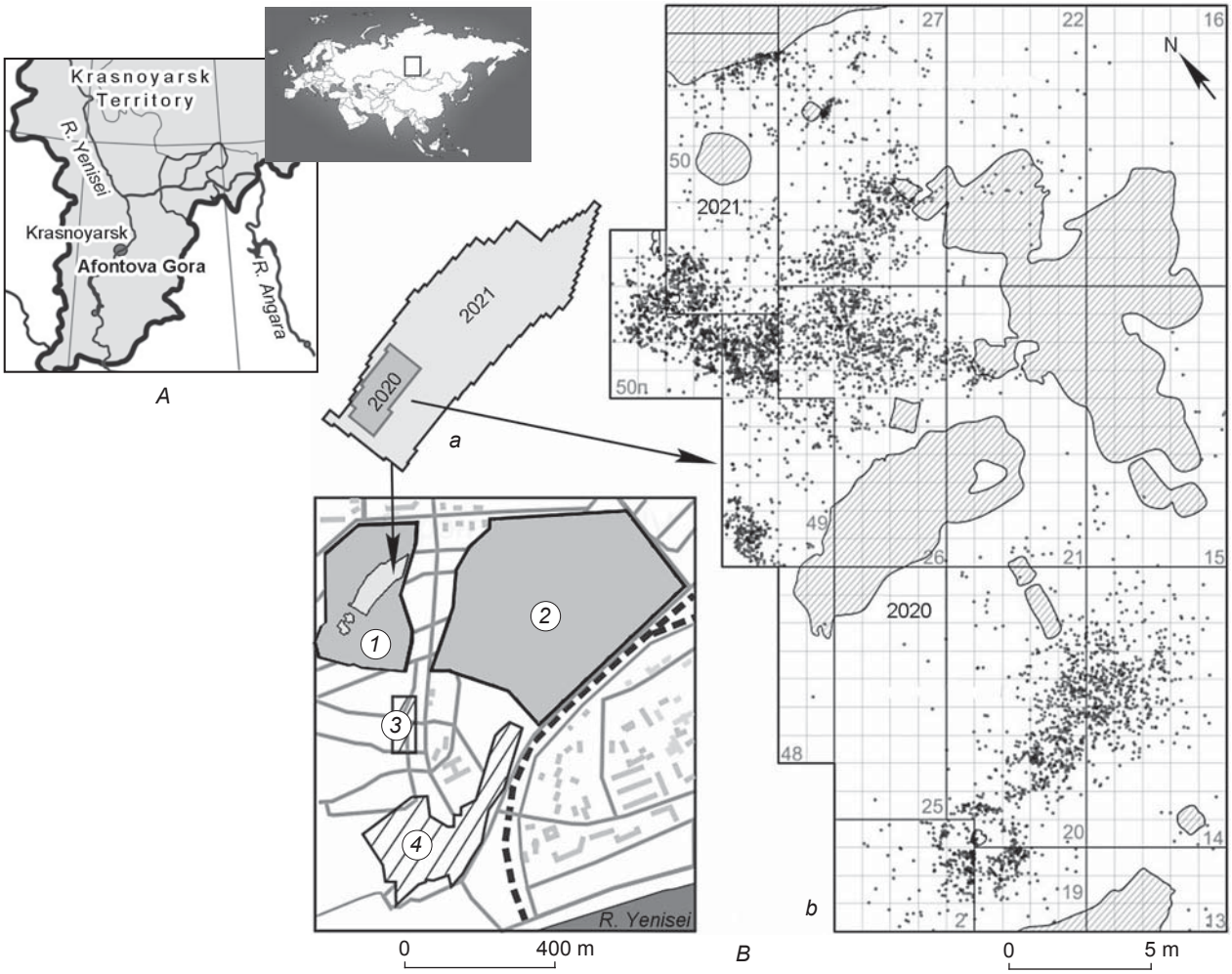

Fig. 1. Location of Afontova Gora IV (Ovrazhnaya).
A – scheme of the study area; *B* – situational plan: *1* – Afontova Gora IV (Ovrazhnaya) site, *2* – territory of Afontova Gora IV in the 1920s, *3* – Krutaya site, *4* – Afontova Gora II site. Boxes: *a* – areas excavated in 2020 and 2021; *b* – plan of excavations 3 and 4 (zones of the southern and northern complexes).

and sources of raw material were identified. Apart from traditional methods, the study of living areas included 3D-modeling of ancient relief and analysis of the concentric arrangement of artifacts (Leonova, 1989; Ineshin, Tetenkin, 2010; Leroi-Gourhan, Brezillon, 1972; Stapert, 1989; Larson, Kornfeld, 1997; Razgildeeva, 2008). Spatial analysis was used to detect housing and utility zones, their relationships, synchronicity or asynchronicity in the formation of features, reconstruction of activities, and cultural contexts with their chronology.

Geomorphology and stratigraphy

The western portion of the Afontova Gora IV (Ovrazhnaya) site is located on the plateau-like top surface of the Afontova Gora mountain, at hypsometric levels of 220–236 m according to the Baltic Height System. The site is situated within the covering sediments of 85–101 m a high Yenisei terrace that transits into a long gentle slope facing the southeast. Ravines, which are hardly visible in the modern city landscape, cross the slope. The streets of Ovrazhnaya, 1st Baikitskaya, and Yubileinaya actually run along the walls of the ancient ravines. Private houses and production facilities of the "Kraslesmash" Plant were also situated there.

During the 20th century, economic utilization of Afontova Gora was accompanied by anthropogenic impact on the slope's relief. As a result, the upper portion of covering sediments was destroyed all over the slope. The modern soil layer includes technogenic remains mirroring the historic construction

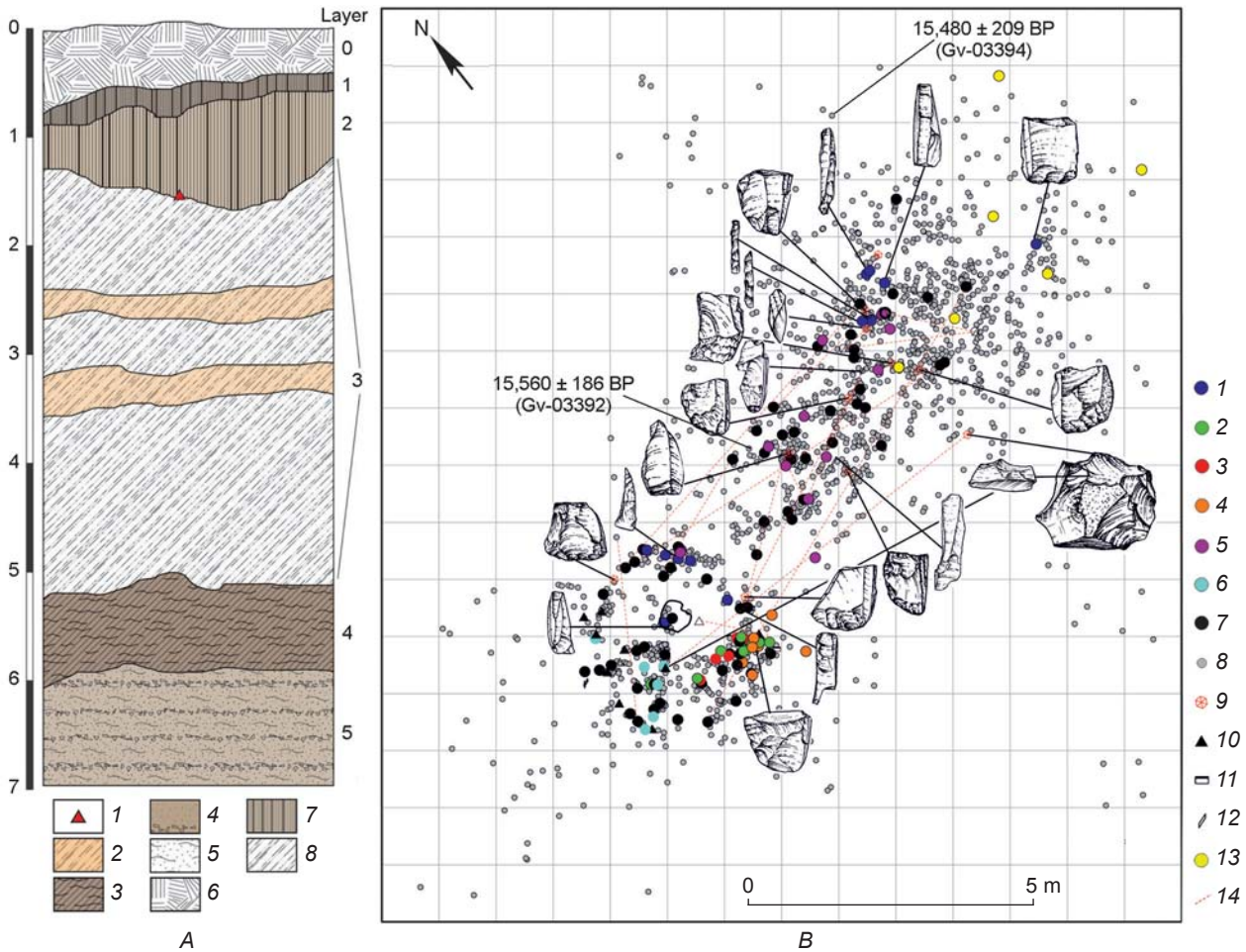

Fig. 2. Stratigraphy of the Late Pleistocene sediments excavated in 2020 (*A*), plan of the southern complex (*B*).
A: 1 – culture-bearing horizon, *2* – loess sandy loams with low humus content, *3* – humic loess loams, *4* – fine rock debris, *5* – stratified sandy loams, *6* – technogenic remains, *7* – humic sandy loams, *8* – loess sandy loams; *B*: *1–7* – groups of raw materials, *8* – find locations, *9* – core, *10* – retouched flakes, *11* – retouched blades, *12* – bladelets, *13* – tusk fragments, *14* – refitting patterns.

development and the subsequent reconstruction of the district.

The excavated covering sediments consist of subaerial sandy loams of deluvial origin (Fig. 2, *A*). Fragments of Middle Holocene soils were preserved in sediments filling the negative landforms. Early Holocene sandy loams with low humus content form a layer up to 0.4 m thick, with a thin bed of paleosol in its base. Sartan loess-like carbonated sandy loams with paleosol horizons lie below (Novoseltseva, Stasyuk, Akimova et al., 2020: 182–184). Late Paleolithic artifacts were found in the upper part of the Final Pleistocene sediments between the light brown and whitish carbonated loams.

At the site of Afontova Gora IV (Ovrazhnaya), a concentration of archaeological remains was recorded in the southwestern part of excavation 3 and in the adjacent portion of excavation 4. It was associated with the northern wall of a large ravine dissecting the slope in the W–NE direction. The examined part of the site measures ~75 m^2. It extends from west to east for 16.5 m (see Fig. 1, *b*).

Lithic and bone artifacts

The collections of archaeological (1315 spec.) and faunal (2257 items) materials are relevant to domestic and hunting-gathering activities of ancient groups, and their environment. Lithic artifact assemblage is dominated by microsized products of flaking: cores, spalls, flakes, chips, complete and fragmented microblades (Table 1). The main source of raw materials (sandstones, aleurites and argillites varying in degree of silicification, jasperoids, rhyolites, flints, fine-grained quartzites, and

Table 1. **Composition of lithic assemblage from Afontova Gora IV (Ovrazhnaya)*, spec.**

Excavation/area number	Cores	Flakes				Blades	Microblades	Flakes	Chips	Graphite	Fragmented pebbles	Tools							Total
		modification of microcores	blade	backed	core trimming							End-scrapers	Side-scrapers	Retouched flakes/blades	Chisel-like	Burins	Tool fragments	Pebble tools	
3-14	2	2	5	11	5	7	14	39	236	–	2	1	2	1	–	–	–	1	328
3-20	8	8	4	10	15	27	41	96	457	–	–	4	1	–	1	1	1	2	676
3-19	1	1	–	6	7	13	7	42	51	–	–	–	1	3	–	–	1	–	133
4-2	–	–	–	–	50	5	12	33	66	6	–	1	–	2	–	–	3	–	178
Subtotal	11	11	9	27	77	52	74	210	810	6	2	6	4	6	1	1	5	3	1315

*Tables 1–3 present the numbers of finds of specific categories from various sectors of the excavated area.

chalcedonies*) were pebbles scattered on the banks of the Yenisei and its tributaries, as well as local exposures of bedrocks (microsyenites) upstream of the Yenisei, near Nikolayevskaya Hill. As the analysis of flakes has shown, stones of at least 22 raw-material categories were used in the production cycle. However, not a single core for large- or medium-sized blades was found.

Negative scars of unidirectional removals and remains of cortex on dorsal faces of blades and blade spalls serve as evidence of primary reduction of single- and double-platform cores with one flaking surface. Refitting of two side-scrapers illustrates the technique of longitudinal knapping (Fig. 3, *10*, *14*).

The process of micro-knapping is characterized by nine wedge-shaped microcores (Fig. 3, *1–3*), complete and broken microblades, ridge and ski spalls. Microcores were manufactured on large flakes and fragments of blades. Microcores are small: the height of flaking face normally does not exceed 2.5 cm; at the stage of preform, core trimming elements are slightly larger than 3 cm. The width of removal negatives is up to 1.0–1.5 mm; the width of microblade-inserts for a slotted antler tool is 3 mm (Fig. 3, *12*).

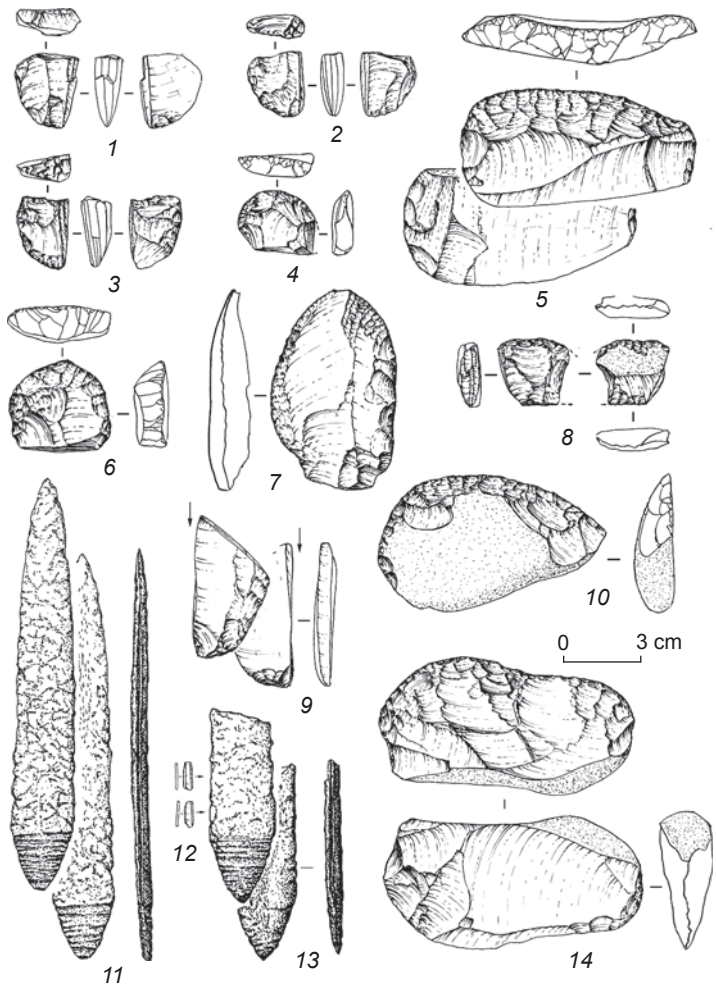

Fig. 3. Stone and bone artifacts from Afontova Gora IV (Ovrazhnaya).
1–3 – microcores; *4*, *6* – end-scrapers; *5*, *10*, *14* – scraper-like tools; *7* – knife-like tool; *8* – chisel-like tool; *9* – burin; *11*, *13* – antler insert tools; *12* – microblade-inserts.

*Identification of rocks by Y.M. Makhlaeva.

Table 2. **Taxonomic composition of the faunal assemblage from Afontova Gora IV (Ovrazhnaya), spec.**

Excavation/ area number	Rodents	Arctic fox	Extinct horse	Maral deer	Reindeer	Cervidae	Argali	Large ungulates	Medium ungulates	Unidentifiable	Mammoth	Total
3-13	1	–	–	1	4	–	–	–	15	1	–	22
3-14	–	1	–	–	199	37	1	–	853	85	11	1187
3-19	–	–	–	–	27	8	–	–	48	77	–	160
3-20	–	–	–	–	76	28	1	–	488	117	9	719
3-25	–	–	–	–	1	2	–	–	11	3	–	17
4-2	–	–	2	–	33	1	–	3	28	85	–	152
Subtotal	1	1	2	1	340	76	2	3	1443	368	20	2257

Tools were manufactured on spalls of various kinds: side-scrapers and knife-like implements were fashioned on large pieces, including blade-like; end-scrapers were made on flakes and blades. Scalar retouch was most common. Various types of retouch, from scalar multifaceted to narrow elongated, can be observed on one and the same tool. The striking angle determined the sharpness of working edges and the function of tools.

Tools form 2 % of all artifacts (Table 1). Stone tools number 26, including flakes and fragments of retouched blades.

Unifacial end-scrapers (6 spec.) (Fig. 3, *4*, *6*) and longitudinal side-scrapers (4 spec.) (Fig. 3, *5*, *10*, *14*) are typologically distinct. Wedge-shaped sharp working edge of one tool (Fig. 3, *14*) implies its use as a knife. Two other tools are also identified as knives (Fig. 3, *7*). Five implements are represented by fragments. The assemblage comprises a burin on a large blade's fragment (spall) (Fig. 3, *9*) and a chisel-like tool on an exhausted microcore (Fig. 3, *8*). Two planing tools and a hammerstone are included into the group of pebble tools.

A clutch-handle (14.5 × 2.7 × 1.5 cm) and two slotted points (Fig. 3, *11*, *13*) were made of reindeer antler. A complete specimen of an elongate symmetrical shape (15.0 × × 2.4 cm; width of the slot is 2 mm) has a wedge-shaped chipped base (angle ~60) and a series of horizontal straight lines along the both sides. A fragment (7.5 × 2.5 cm) is similar to the complete implement. The bases of the points are 2.3 and 2.5 cm long, respectively. Two inserts (medial parts of unretouched microblades) were found in association with the point fragment.

Spatial structure of the complex

Surface (intrasite spatial) analysis revealed the pattern in the distribution of archaeological remains. A hearth and accumulations of artifacts and fauna remains served as structure-forming elements of the occupation surface (Table 2). At the periphery of the utility zones, fractured bones and antlers (mostly reindeer) were scattered.

The hearth was represented by a round ash spot (0.65 m in diameter) with indistinct outlines. Small charcoals and grayish inclusions were found in the infill of the hearth. The lens with the burnt sediment was 5–7 cm thick. In the center of the spot's surface and near its northeastern boundary, two stone fragments were found. Several flakes and fragments of split bones, including those with epiphyses, lay in the western zone. Rounded coaly spots up to 0.1 m in diameter were detected on the background of light sandy loam, 0.15–0.20 m from the hearth, on three sides. Two of them were located northeast of the hearth, in line with the stones (Fig. 4, *B*).

According to the 3D-model of the layer surface, with generally unsegmented relief smoothly inclining in the southeastern direction, artifacts in the southwestern part of the dwelling area followed the concentric structure pattern (Stapert, 1989: 4–5). At a distance of 3.5–4.0 m from the hearth, in the microrelief of the layer, outlines of a circle with prominent "walls" were recorded. Locations of microdebitage and groups of tools formed a circle with a radius of 1.2–2.0 m from the center of the hearth (see Fig. 2, *B*). Excavations revealed no construction elements that could artificially form the boundaries for the accumulations of finds.

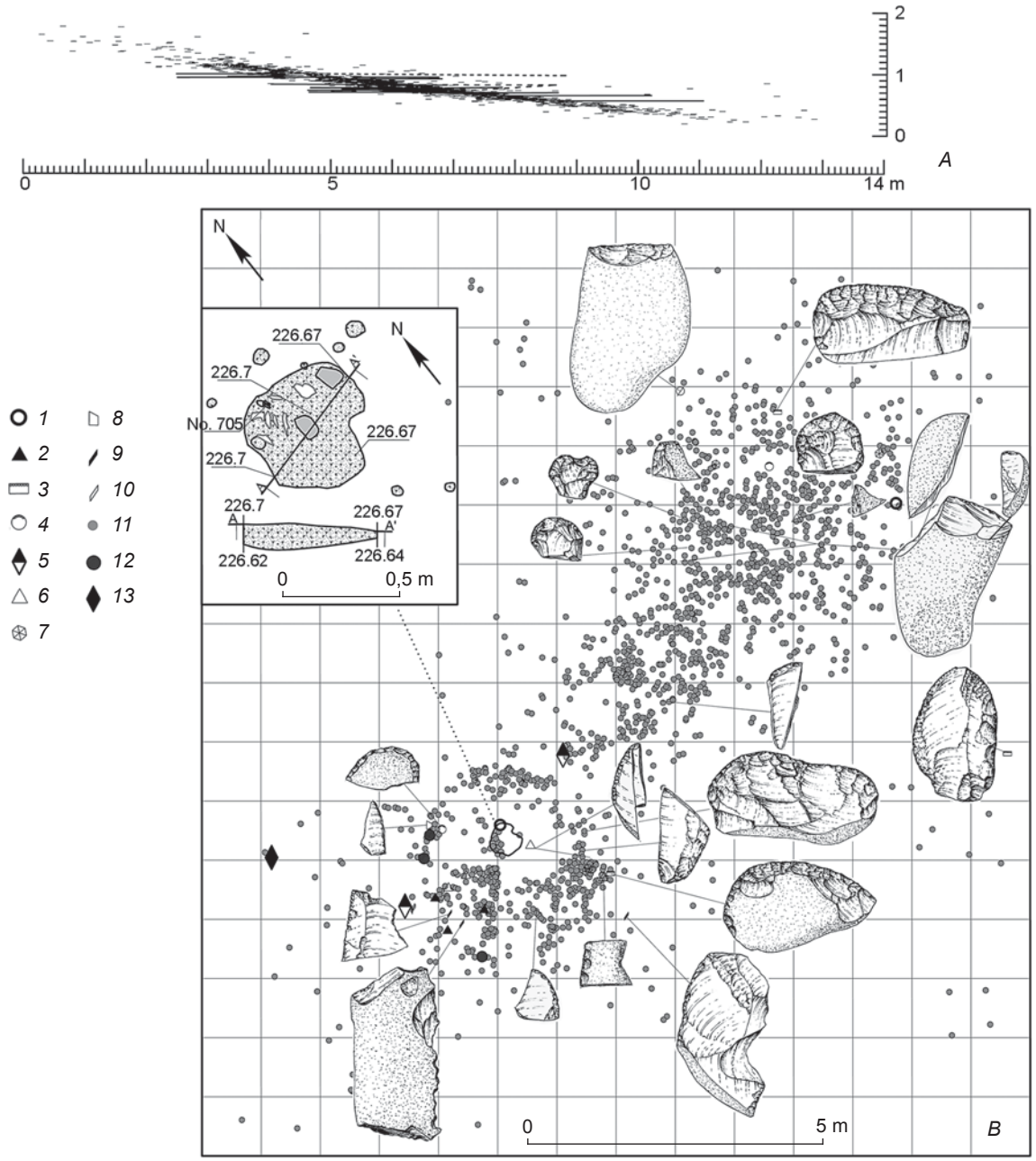

Fig. 4. Profile of find locations and refitting patterns (*A*), plan of housing and utility complex, arrangement of tools (*B*) at Afontova Gora IV (Ovrazhnaya). Box: plan and profile of the hearth.
1 – fragments of pebble tools; *2* – retouched flakes; *3* – retouched blades; *4* – end-scrapers; *5* – slotted tools; *6* – fragments of tools; *7* – cores; *8* – burin; *9* – retouched bladelet; *10* – bladelet; *11* – find locations; *12* – graphite; *13* – antler clutch.

The distribution and nature of finds provide an idea of their formation around the hearth during the domestic and subsistence activities resulting in the formation of toss zones showing radial structures (Binford, 1978; Leroi-Gourhan, Brezillon, 1972; Grøn et al., 1999; Oetellar, 2007). Cuplike microrelief of the "floor" indicates local compaction of the ground—a natural component of the layer.

In the concentration around the hearth, microartifacts prevailed: a chisel-like tool, two microcores, and flakes detached from such nuclei. The analysis of refuse categories* allowed us to detect knapping and utilization zones, including those

*We analyzed rocks differing from those of flakes in hardness, transparency, and color.

Table 3. **Categories of reindeer skeletal remains from Afontova Gora IV (Ovrazhnaya), spec.**

Excavation/ area number	Part of carcass								Joints		
	Antler	Cranium	Axial skeleton	Forequarter	Hindquarter	Foreleg	Hindleg	Hoof parts	elbow	carpal	ankle
3-13	2	–	–	2	–	–	–	–	–	–	–
3-14	41	45	1	8	14	3	83	4	2	–	6
3-19	15	2	–	–	2	–	8	–	–	–	–
3-20	11	10	3	12	8	5	24	3	2	1	3
3-25	–	–	–	–	1	–	–	–	–	–	–
4-2	4	1	2	6	2	6	8	1	–	3	–
Subtotal	73	58	6	28	27	14	123	8	4	4	9

that had not been revealed by excavations. These places, which we believe to be areas of individual activity, are associated with specific groups of tools (see Fig. 4).

In the sectors located to the south and southwest of the hearth, fragments of tools with thin edges prevailed. A part of an antler point with inserts was among them (Fig. 3, *13*). In the northwestern sector, the only fragment of an end-scraper's edge lay under a piece of long bone. A knife-like tool and pieces of graphite (see Fig. 4) were found nearby. East of the hearth, two side-scrapers (see Fig. 3, *10*, *14*), a burin (see Fig. 3, *9*), and a fragment of an implement on a primary blade were unearthed.

Subsistence and domestic activities near the hearth included several kinds of works associated with processing food resources. Judging by the composition of identifiable bone assemblage, meaty parts (fore- and hindquarters) of reindeer were butchered. The intensity of this activity is indicated by the crumbling of working edges and by the fragmentary nature of tools. All the tools found near the hearth, excluding side-scrapers, were broken. Composition of debitage corresponds to the final stage of reduction of flint and quartzite microcores.

Faunal remains found within 3.5–4.0 m from the hearth, at the outer border of depression in the microrelief of the circular structure, included cranial bones (2 spec.), antler fragments (15 spec.), and bones of lower limbs (ankle joints in anatomical order) of reindeer. These bones are associated with the first stage of butchering. The predominance of hind leg bones (Table 3) can be due to a large number of metatarsal bone shaft fragments, which are easily identifiable.

A tail-like accumulation of archaeological remains was recorded northeast of the hearth. Tool categories and refitting patterns suggest a single domestic and cultural context, and the direction in which items and humans involved in working operations had moved—from the hearth zone to the outer area (see Fig. 2, *B*).

Faunal materials correspond to primary processing of carcasses (Table 3). Concentration of antlers can probably be explained by their selection for further processing. Bones of reindeer prevail (92.6 % of attributable specimens); remains of other animals are rare.

Remains of skulls and distal parts of limbs dominate the collection of reindeer bones. They have been traditionally viewed as products valued by those who procured them, and they are heavily fragmented because they had been crudely opened to extract brain and marrow at the butchering place. Axial bones (vertebra and ribs) are few, probably because carcasses were being prepared for transportation. Fore- and hindquarters of carcasses were only partially used for food. It is hard to explain why phalanges are so few while being the most numerous among the distal skeletal parts.

The number of teeth of various categories (seven pd4 and two abraded m3) suggests that they belonged to at least two adult and seven juvenile reindeer. Judging by the attrition of deciduous teeth, individuals below one year of age were hunted from autumn to spring.

The analysis of clusters of faunal remains and associated groups of tools and microdebitage allowed us to locate the zones where apparently one or two persons worked simultaneously. One of them was

located 4.3 m east of the hearth. Faunal remains point to butchering of reindeer. Artifact assemblage comprises flakes detached from microcores of grayish-black and blacky-brown flint, and fine-grained green sandstone. Tools are represented by small unmodified flakes with utilization retouch and use-wear traces. Two wedge-shaped microcores are similar in design (see Fig. 3, *2*, *3*).

The second working place is located 6.3 m from the hearth. This place is characterized by statistical dominance of faunal remains and their irregular distribution. The assemblage contains bones of reindeer (including those of juvenile animals), phalanges of argali, and a fragment of red deer maxilla. Unmatched fragments of mammoth tusk lay compactly together with pieces of antlers (see Fig. 2, *B*). These probably represent the collection of raw material, since no mammoth bones were found there. Analysis of microflakes shows that nodules of black flint were knapped. Resulting microcores demonstrate the final stage of exhaustion.

Eight tools were typologically identified, including two implements on pebbles defined as chopping tools. Flakes refittable to one of them were found in the center of bone accumulation, near two end-scrapers (see Fig. 3, *4*) and a fragment of retouched blade. East of that place, a tool fragment, a rounded end-scraper of brown microquartzite (see Fig. 3, *6*), and a longitudinal side-scraper/knife on a blade-like spall of reddish-brown rock (microquartzite or microsyenite) (see Fig. 3, *5*) were found. A side-scraper/knife (see Fig. 3, *7*) and a fragment of retouched flake were made of the same rocks, though of another tint. Microflakes of these rocks were discovered in the utility zone among bone remains; isolated specimens lay near the hearth together with a burin and a microcore (see Fig. 2, *B*). Fragments of elongate pebbles, including refittable, were found in the bone accumulations. Given the surface wear, fractures, and robusticity of pieces of coarse-grained rocks, it can be suggested that these evidently had different purposes.

Discussion and results

Findings at the Afontova Gora IV (Ovrazhnaya) area are relevant to the functioning of a seasonal reindeer hunting camp. Refitting patterns, groups of raw materials, and spatial distribution of remains suggest a single context of human activities (see Fig. 2, *B*). The intrasite spatial analysis revealed two contextually related features within the habitation zone.

The first feature includes several circular structures, showing ethnographic parallels (Vasil'ev et al., 2007: 12). The heat radiated by the hearth determined the location of resting and domestic activity areas, affecting the formation of toss and drop zones.

Near the hearth, microdebitage contained point clusters of raw material elements corresponding to the places where specific operations were conducted. In the zone to the southeast of the hearth, the toolkit, comprising large side-scrapers, shows high variability. Zones to the south and southwest of the hearth contained more faunal remains and scattered microdebitage than the above one (see Fig. 2, *B*).

The back toss zone was formed by fragments of unidentifiable bones. Only in the outer border of the southwestern sector were the limb bones of reindeer found in anatomical order. An antler clutch-handle and fragmented antlers lay nearby.

The interpretation of the complex with the hearth is debatable. Judging by spatial distribution of the finds, a light above-ground construction (shed) with one hearth, resembling *chum*, could have existed at the site. In distinction from the utility zone, the space around the hearth is "clean" and has a distinct concentric structure. The absence of debitage in the area surrounding the hearth could have been due to a variety of reasons.

The following observations testify in favor of the assumption about the closed above-ground construction: location of the hearth in the center; a relatively regular shape of the infill lens; circular distribution of microdebitage in the front toss zone; proximity of places of individual activities to the hearth; concentration of bone remains representing "kitchen" waste near the hearth; agreement between the direction of the long axis of the outer cluster and the eastern sector of the hearth complex; cuplike depression in the "floor" microrelief, and the placement of refuse in the back toss zone within this depression.

The second feature in the structure of the site—a utility area with two butchering places—is located east of the hearth complex.

The subsistence cycle implied migration of the group to the hunting grounds; selection of place and construction of camp, recreation zone, and hearth; slaughtering of animals, transportation, and butchering of carcasses; preliminary processing of hides and bones; utilization of food resources. Ungulate mammals of at least three species were main objects of hunting. As the tools got worn, they were replaced by new ones.

The tentative interpretation of purpose of the tools is based on their technical and morphological characteristics, as well as on data of use-wear analysis of tools from Late Paleolithic sites in the Yenisei region (Shchelinskiy, 1972; Abramova, Shchelinskiy, 1973).

Slotted antler tools were defined as items of hunting inventory. They lay practically at an equal distance from the hearth (1.8–1.9 m): a point fragment with two inserts and a complete specimen were located to the west and to the east, respectively (see Fig. 4). Stone tools with scraping and cutting edges were used both for butchering and processing of various organic materials.

Fragments of flint and quartzite microcores and small flakes detached from them point to the need for high-quality tools. Judging by the composition of core trimming elements, microcores brought to the site in the finished form were repeatedly modified. The degree of their exhaustion indicates scarcity of resources.

Isolated, relatively large cortex flakes are the result of shaping the pebble tools at the site. River pebbles 10–15 cm long were used as blanks. Size of stones permits their transportation even for a fairly long distance.

The analysis of raw materials indicates the choice of rocks with hardness equaling 6.5–7.0 on the Mohs scale. The assemblage comprises cores and tools made of grayish-black, blackish-brawn, and black flint, as well as of grayish-blackish-orange, white, orange, and milky quartzite. Microquartzites of subdued red color with inclusions of feldspar with dark-colored minerals (pyroxene) are also represented.

The predominance (65 %) of microflakes among the primary knapping products is due to the wear of working edges of tools under a short cycle of primary knapping. An extreme exhaustion of microcores, the use of randomly shaped flakes, and the fragmentary nature of tools testify to intense exploitation. The entire material complex, including faunal remains, indicates a focus on butchering activities.

Faunal materials of the site under study show the composition of game typical of the Late Paleolithic of the Yenisei region (Klementiev, 2021), with the dominance of reindeer (*Rangifer tarandus*) (see Table 2). Bones of extinct horse (*Equus ferus*), red deer (*Cervus* sp.), argali (*Ovis ammon*), and arctic fox (*Alopex lagopus*) point to a wider spectrum of game animals. Bones of animals of these species are sporadic. They were deposited on the periphery of the utility zone. The exception is argali bones found inside the cluster in the utility zone.

Uncalibrated radiocarbon dates were generated on reindeer metatarsal bones: 15,480 ± 209 BP (GV-03394) and 15,560 ± 186 BP (GV-03392). A date of 15,570 ± ± 205 BP (GV-03391) was obtained for a reindeer pelvic bone found northwest of the complex under study, in the neighboring area of the site (see Fig. 2, *B*).

Conclusions

Excavations at Afontova Gora IV (Ovrazhnaya) have revealed a complex spatial structure of habitation areas during the periods of seasonal hunting. The spatial analysis of the cultural layer allowed us, for the first time at this site, to separate two interrelated features: a dwelling with a single hearth and a utility area. Regularities in the distribution of remains, refitting patterns, and the nature of raw material indicate contemporaneity of both features. Artifacts and faunal remains attest to hunting as the primary activity of human groups living on the southeastern slope of the mountain during the Sartan period. The study demonstrates that cultural deposits at Afontova Gora IV (Ovrazhnaya) are preserved *in situ*.

Acknowledgments

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Ceramic "Necklace": A Neolithic Ritual Artifact from the Lower Amur

This article continues a series of publications presenting the results of excavations, at sites exceptionally rich in archaeological finds associated with several Neolithic cultures, at Suchu Island in the Lower Amur region. We describe rare ritual sculptures, mostly bird-like and animal-like, from a sanctuary in a dwelling associated with the Malyshevo culture (late 5th to early 4th millennia BC). The most important of them is a "necklace" found in a small pit. We propose a reconstruction of the artifact. It included 17 tiny items—eight vessels, five figurines of birds (auks), and four double-ended phalli, each with a seal head at one end. All the items are pierced, suggesting that they were strung together. Such a "necklace" may have belonged to a shaman or sorcerer, who was in charge of the sanctuary. This suggestion is upheld by other ritual or ceremonial artifacts found in the same dwelling—stone labrets, which, as the ethnographic data suggest, could be fastened to decorative masks, and a ceremonial jug evidently destined for stimulating or intoxicating drinks. An important ritual role was likely played by a female figurine, found near the "necklace" and possibly depicting a progenitress, bringing wealth.

Keywords: *Lower Amur, Neolithic, dwelling, sanctuary, Malyshevo culture, "necklace", ritual items.*

Introduction

The large multicultural and heterochronous settlement site of Suchu Island in the Lower Amur (Ulchsky District of the Khabarovsk Territory) has been studied for many years and has become widely known. The underground remains of Neolithic dwellings allow for a graphic reconstruction of the interiors and the possible living conditions of the inhabitants. The collected materials (more than 93 thousand finds) clearly demonstrate the level of development of the material and the spiritual culture of gatherers, fishermen, and hunters of the Amur Region during at least the initial 6.5–7.0 thousand years of the Holocene.

Rich materials obtained during excavations of the settlement site have been described repeatedly in monographs and journal papers (Okladnikov, 1981; Derevianko, Medvedev, 2002; Okladnikov, Medvedev, Filatova, 2015; Medvedev, Filatova, 2020; and others). However, for various reasons, not all the study results of the 20 dwellings nor of the several sanctuaries (the latter constitute a single cult center on the island (Medvedev, 2005)) have been published to date.

This paper is a kind of continuation of the article recently published in this journal and devoted to dwelling 1 (excavation area II) excavated at the site in 1973 (Medvedev, Filatova, 2020). That publication mainly presented the results of multidisciplinary studies of the stratigraphy, the structural features of

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the dwelling, and the abundant artifacts related to the life of its inhabitants—stone tools and clay pottery for everyday use. In the artifact collection of dwelling 1, a significant part consists of the items associated with the spiritual sphere—pieces of art and cult (portable art). These are well preserved, show unique characteristics, and deserve special consideration.

The dwelling was left by the Malyshevo people, likely in the late 5th to early 4th millennium BC. This is a semi-underground rounded structure typical of the Amur Neolithic, dug into the sandy loam virgin layer by 80 cm; it is rounded in plan view, with a floor of 55 m^2 and a hearth in the center. The foundation pit showed many small pits from posts supporting the roof. Household pits were also noted. The total of 3788 items (intact and fragmented) made of stone or ceramics were found in the dwelling and next to it, including ceramic pieces of portable art (most of them intact) bearing mainly ornithozoomorphic images (pieces of art and cult), and other non-utilitarian items. Only a few of these have been described (see, e.g., (Medvedev, 2000: 62, fig. 6, *4–6*, *8–10*)).

During excavations of Neolithic dwellings at Suchu Island, with and without domestic sanctuaries, a large number of samples of primitive art have been found, including undoubtedly unique ones, such as, for example, gynandromorphic three-dimensional sculptural images of women with phallic bodies and the same hairstyle, a three-dimensional figurine of a seal-phallus-vulva and a flat figurine of an owl-bear (Ibid.: 57, fig. 1: 59, fig. 3, *1*; 4; 2005: 52, fig. 19, 20). However, portable art pieces from dwelling 1, being cult items, still have no parallels in the known Neolithic assemblages of the Russian Far East. This is mainly true for the complex of miniature ornithozoomorphic figurines and other items that were elements of a kind of cult and ritual attribute—a "necklace".

Analysis of other items of specific purpose, which are most likely older than the "necklace", led to the conclusion that all together they constituted a certain single system—a domestic sanctuary with an altar at the western wall of the dwelling.

Location and composition of the "necklace" and other art and cult items in dwelling 1

The "necklace" consists of 17 ceramic items, which formed a compact cluster in a small pit on the floor near the western wall of the dwelling, or rather under it. There is no doubt that the items constitute a single set and were hidden (buried?) intentionally. The "necklace" includes eight small vessels, five figurines of flying birds, and four double-ended phallic figurines, each with the image of a seal head at one end.

The vessels, like all other objects, were sculpted from a single lump of paste, the same that was used in the manufacture of household ware found in the dwelling (clay tempered with sand, sometimes grus and grog). They were made without apparent care; in some places, small knobs and dents are visible on their walls. Both internal and external surfaces were poorly smoothed. The ceramic shard is dense, firing is uniform, the color is mostly light brown, although there are samples with dark spots. All vessels show one, most often rounded, hole with a diameter of 0.2–0.3 cm (the holes in two cup-shaped vessels are up to 0.5–0.6 cm). Holes were made before firing, by piercing with a rod from the outside inward. The holes were made in the upper parts of the vessels, 0.5–0.6 cm from the edges of the rims, which were not always neatly shaped; and in the cup-shaped vessels, they were made in the central part of the bottom. The thicknesses of the walls of the vessels vary: from 0.25–0.30 cm at the edge of the rim to 0.5–0.7 cm (in one pot-shaped vessel up to 1.5 cm) in the near-bottom and bottom parts; in cup-shaped 0.3–0.5 cm, with the bottom somewhat thicker. The bottoms of all the vessels are mostly flat, with some irregularities; there are items with slightly convex bottoms. The vessels are largely copies of ordinary household ware.

The vessels have been subdivided into three types: 1) situla-shaped – 3 spec. (Fig. 1, *2*, *5*, *6*; 2, *2*, *5*, *6*), 2.0–2.1 cm high, the rim diameter is 1.9–2.3 cm; two items have flat bottoms (0.9 cm); one item shows a convex bottom; 2) cup-shaped bowls like hemispheres – 2 spec. (Fig. 1, *7*, *8*; 2, *7*, *8*), 1.6 and 1.7 cm high, the rim diameter is 2.8 and 3.1 cm respectively, the bottom is 0.7 cm, the walls are even, smoothed, and the rim surfaces are bumpy with notches; 3) high pots – 3 spec. (Fig. 1, *1, 3, 4*; 2, *1, 3, 4*); these have well-defined bodies, the diameters of which are the same as those of the mouths, or slightly larger. The high pots look not as similar in shape to Malyshevo vessels of this type as the situlas and bowls/cups. This may indicate that the artisans producing copies paid more attention to the essential, practical side of the products rather than to their external, formal features.

Birds are depicted in a state of flight. All of them belong to the auk family of diving seabirds*. Three

*Bird identification was carried out by A.Y. Kharitonov, A.M. Mikhantiev, V.M. Chernyshov, S.N. Klimova, and V.A. Yubkin, researchers at the Institute of Systematics and Ecology of Animals SB RAS.

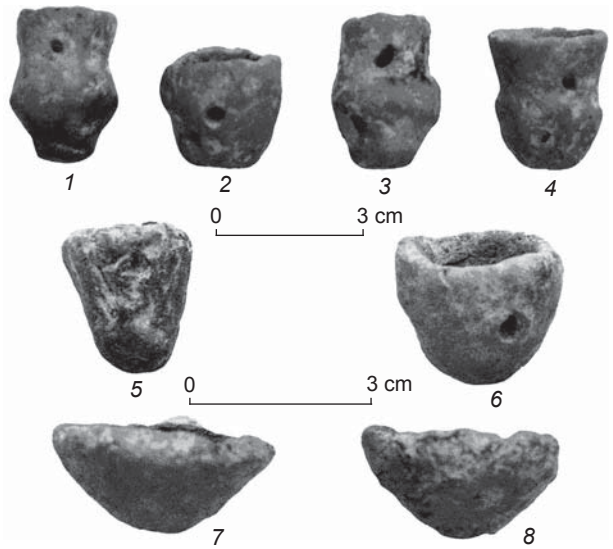

Fig. 1. Ceramic vessels constituting the "necklace".

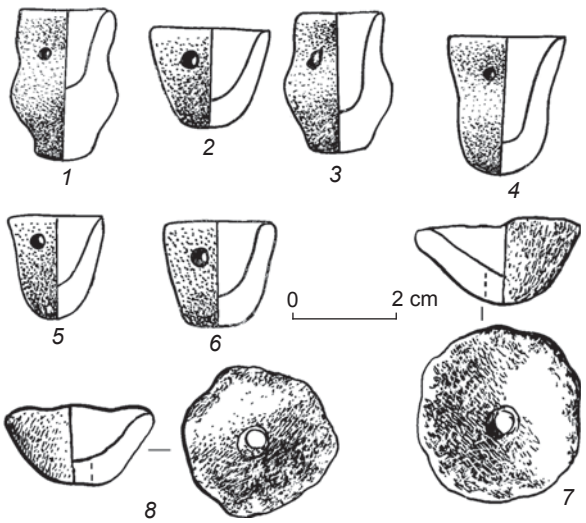

Fig. 2. Vessel drawings.

larger figurines, 3.6 to 4.1 cm long and 3.1–4.1 cm wide (wing spread), likely depict adults (Fig. 3, *1–3*; 4, *1–3*). They are relatively massive, the wings have rounded outlines, the edges and heads are noticeably lowered. In two figurines, the lower surface (from the side of the abdomen) is flat, and the upper one is rounded, while the third figurine shows convex and uneven surfaces, respectively. Smaller figurines (Fig. 3, *4*, *5*; 4, *4*, *5*) are 2.9 and 2.6 cm long (the tail of the second figurine is missing) and 2.5 and 2.4 cm wide, respectively. The edges of their wings are raised; the head is shown above the back. The tails of all the figurines are short, in the form of a rounded triangle. The beaks of three larger specimens are blunt, while those of two smaller specimens are pointed, and are shown in the open state, as when eating. The large figurines were shaped more carefully than the small ones. The surfaces of larger figurines are well-smoothed as compared to that of the smaller figurines. The color of the figurines is the same on both sides, varying from brown and grayish brown to dark, in some places black. The difference in the shapes and sizes of the figurines suggests that the artisan was well-acquainted with the features of birds' appearance; therefore, along with adults, he depicted young birds so naturally and professionally. All figurines had a through hole 0.2–0.3 cm in diameter made in the head using a round rod prior to firing. The bird figurines suspended on a cord or rope in this position looked as if they were flying upwards.

Four figurines of double-ended phalli, each depicting a seal head at one of the ends (Fig. 5) are

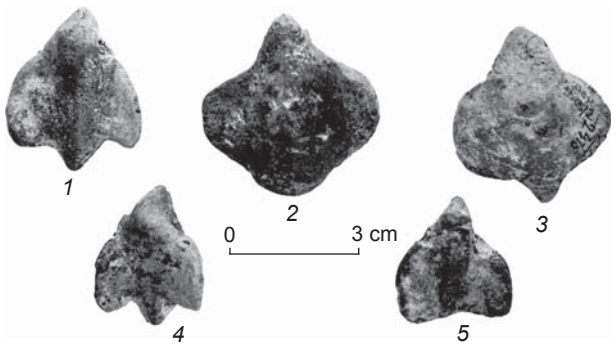

Fig. 3. Ceramic figurines of flying birds constituting the "necklace".

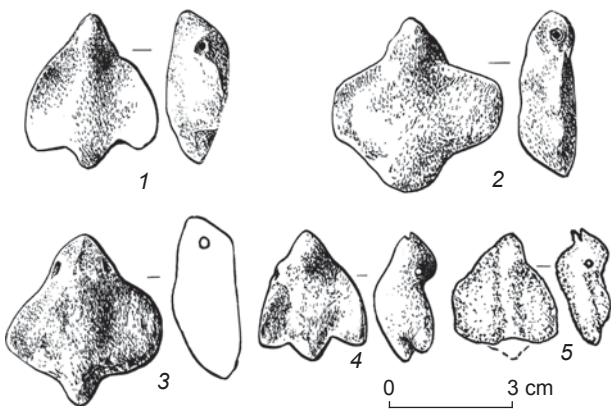

Fig. 4. Bird figurine drawings.

of different sizes: length 2.8, 3.2, 3.4, and 3.9 cm, the maximum thickness is 1.0, 1.1, 1.2, and 1.4 cm, respectively. Their color is dark gray and brown. The figurines are carefully modeled with the help of a thin

spatula and a rod. They are slightly curved. The heads of each figurine are of different sizes. The smaller one is thinner and slightly elongated; on its end, a seal head is rendered quite realistically, with eyes and a mouth depicted by rounded dimples. The opposite ends of the figurines, with more voluminous heads, have smoothed flat surfaces without any decoration. Round through holes (prior to firing), with a diameter of 0.20–0.25 cm, were made in the central parts of the items. Each hole is closer to the end with the seal head. Thus, when hanging figurines on a string or cord, the parts with the animal images turn out to be facing upwards.

Having presented a description of all 17 elements making up the "necklace" (Fig. 6, *A*), I cannot but express doubts about its completeness. This is due to the fact that three slightly smaller vessels (two pot-shaped and one cup-shaped) were found scattered on the floor of dwelling 1, a little away from the pit where the items constituting the "necklace" were found; these vessels are generally similar to those described above and each has one round hole in the body or bottom (Fig. 6, *B*). The pot-shaped vessels are roughly shaped. Their bottoms are uneven with bulges, the rim edges are bumpy from the inside, so the mouths are barely visible, the outer surfaces are only partially smoothed, and the inner ones were not treated at all. These three vessels could have been parts of the "necklace", but somehow got separated from it. However, the obvious incompleteness in the design of these items does not allow them to be included in a set where all the objects have finished forms.

The works at dwelling 1 showed that the sanctuary occupied a much larger space than the pit with the "necklace". It covered a stretch of ca 5 m along the western wall. Here, on the floor or slightly deepened into it, clay cult and ritual (sacred) items were randomly located (Medvedev, Filatova, 2020: 5, fig. 1, *B*). Among these, the following objects are noteworthy. A small vessel with an egg-shaped body and a narrow neck bears no traces of use for utilitarian purposes. Its rim is missing. Vessel height is 8.2 cm, body diameter 5.3, bottom diameter 2.3, that of the neck 1.9–2.1 cm, wall thickness 0.5 cm, bottom 0.8 cm thick (Fig. 7, *1*). Its color is reddish-yellow, the central part of the body is decorated with seven rows of rounded pit impressions; four rows of small vertical incisions are preserved at the top of the neck.

A disc-shaped item, 6.1 cm in diameter and 0.4–0.5 cm thick, with a small part missing, and one side partly exfoliated (Fig. 7, *2*). The item is convex-concave, dark in color. In the center of the disc, there is a through hole with a diameter of 0.5–0.6 cm. This item is similar in general outline to the well-known Neolithic spindle whorls of the Amur region. However, those spindle whorls are usually more robust and thickened in the central part. The ornament is often found only on their convex surfaces. The disc under consideration shows grooved-carved ornaments on both sides. Its convex surface bears a stylized syncretic face with large fish eyes, in which pupils are marked with round dimples 0.4 cm in diameter. Eyebrows converging on the bridge of the nose form a V-shaped figure (female childbearing symbol?). The phallus-shaped nose is superimposed on an exaggeratedly enlarged crescent-shaped mouth. The reverse side shows what appears to be a quadrangular figure resembling a rhombus, and a circle around the hole, both crossed by a vertical line. The disc-shaped item is a lamellar churinga. On its convex surface, it apparently shows a syncretic religious and mythological image of a bisexual anthropomorphic creature, and on the opposite

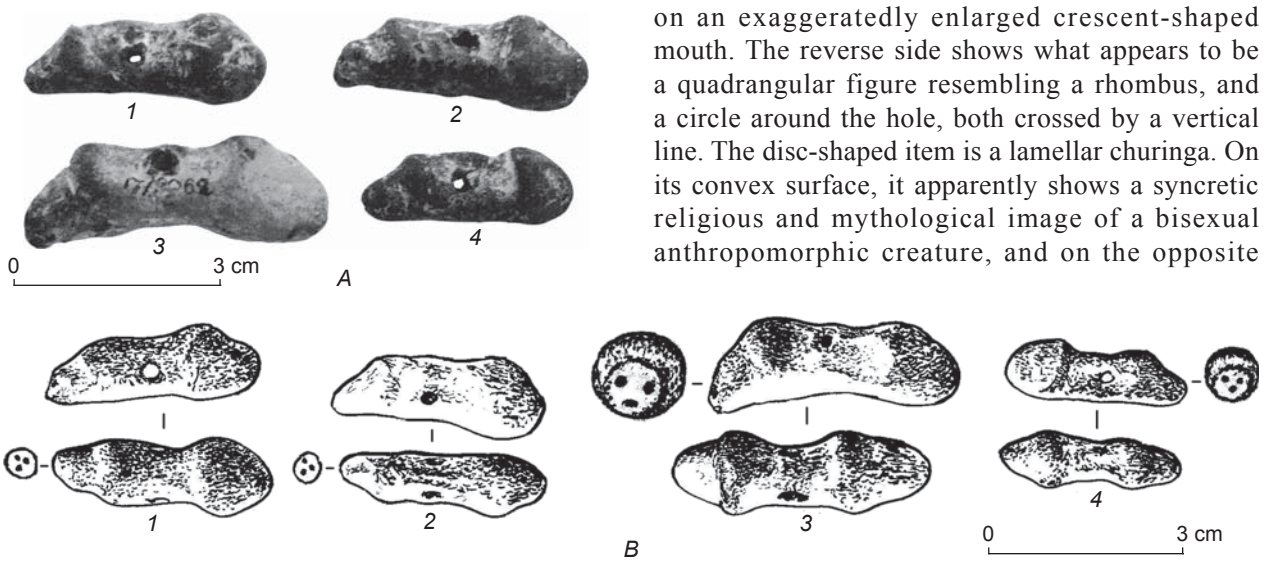

Fig. 5. Ceramic figurines of double-ended phalli, with the image of a seal's head at one end, constituting the "necklace" (*A*), and their drawings (*B*).

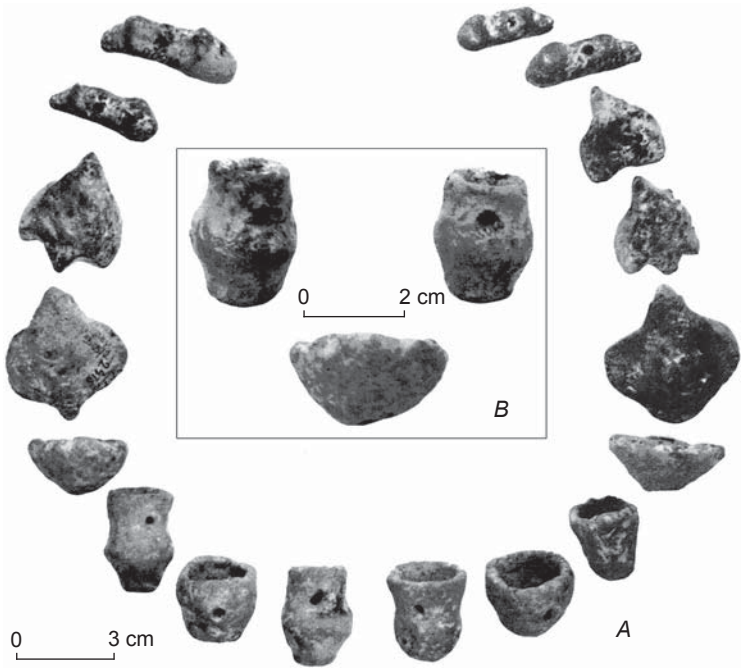

Fig. 6. The hypothesized look of the "necklace" (*A*), and ceramic vessels (*B*) found close to the accumulation of the "necklace" elements.

side, a circle and possibly a rhombus, which are traditionally interpreted as solar symbols. Churingas occurred in the Lower Amur region during the period of the Malyshevo culture; some items of this type were found on Suchu during excavations of several Malyshevo dwellings (Medvedev, 2000: 67, fig. 8; 2002: 13, fig. 1, *1–7*).

A figurine combining the images of a bear's head and a small animal, 2.9 cm long, 2.1 cm wide, and 1.7 cm high (Fig. 7, *4*). The characters are shown over equal parts of this miniature figurine. The muzzle, obviously, of a young bear is depicted. It is narrowed, slightly elongated, the forehead is steep, the eyes are in the form of round deep dimples, the nostrils are punctate depressions, the mouth is slightly open, the upper halves of the ears are missing. The opposite side shows the head of a small animal (possibly a squirrel or a chipmunk). From the ears, belonging to the both characters, it gradually narrows, turning into a narrow, pointed nose, which is not shown in details. Prior to baking, approximately in the place of the eyes of the animal, a neat round through hole with a diameter of 0.25 cm was made. The hole was possibly intended for threading a cord. The surface of the figurine is carefully smoothed and coated with red ocher, especially on top; the ocher coating is poorly preserved.

A sculpture of a bear in a static standing position, 5.5 cm long, up to 2.4 cm wide, and 2.9 cm high (Fig. 7, *3*). It is fairly evenly baked; the color is light brown on the surface, and dark gray in the fracture. The item shows artisan's fingerprints. The muzzle and the whole head of the animal are relatively robust. Two paws (the front left paw partially, the right one completely) and both ears (almost to the base) are broken off. The eyes and nostrils are marked with round deep dimples, the mouth is tightly closed. Before firing, two holes were made in the central part of the figurine: the axis of the first hole is horizontal (from one side to the other); the second is vertical (from the back to the belly). It is quite possible that the first hole was not good enough; therefore, the artisan made the second one. This fact suggests that all the non-utilitarian items found in the sanctuary and near it must have had proper holes.

In addition, the following ceramic items were found on the floor, some of them a little higher, in the low layer of the foundation pit filling, mainly in the western part of the dwelling. In a small depression, a female figurine with a realistically depicted face was found. The head, with a chignon hairstyle (the top was broken off in antiquity), is phallus-shaped in side view. A through hole was made in the head (Medvedev, 2000: 59, fig. 3, *2*). A small intact phallic rod, seven fragments with an oval-rounded cross-section, a broken sandstone phallic item with a female symbol on the end, and three

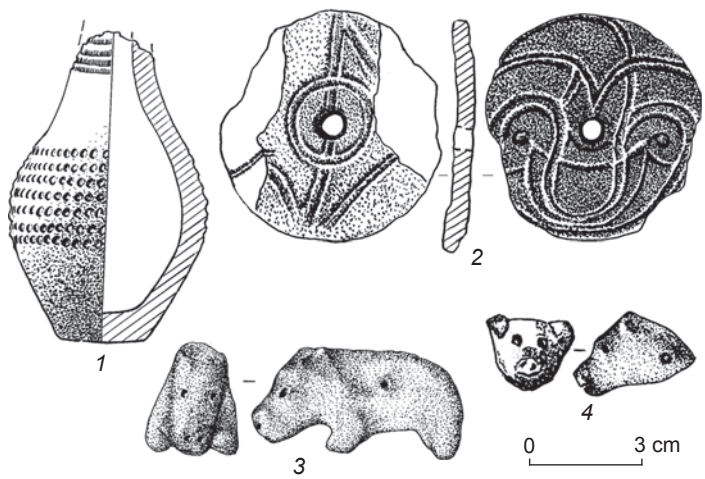

Fig. 7. Ceramic items from dwelling 1.
1 – vessel; *2* – disc (churinga); *3* – bear figurine; *4* – three-dimensional sculptural image combining the head of a bear and a small animal.

tripoli labrets were also found (Medvedev, 2005: 55, fig. 28, *3, 4*).

Notably, the above items, which were scattered away from the rather compactly formed sanctuary, have various ancient damages (broken off edges of the disc-churinga, ears and paws of animal figurines, the top of the chignon of a female figurine, broken rods). All the ceramic items (with the exception of a vessel apparently intended for storing some kind of drink, possibly alcoholic, and rods) have round through holes. It is quite possible that these items, which are not spatially connected with the central part of the sanctuary, where the "necklace" was located, could have been (before the appearance of the "necklace") a part of another complex ritual and ceremonial attribute, similar to the "necklace", or could have been used as sacral pendants on the clothes (belt) of the inhabitant of dwelling 1 who performed the rituals.

Interestingly, the things that I consider older showed, in addition to damage (probably intentional breakdowns, in contrast with the "necklace"), traces of long-term use in the form of wear and polish. This suggests that the figurines, the sculpture, the disc-churinga, and others, which served as the main sacred symbols for a long time, although they were kept in the dwelling, were replaced or supplemented with new objects of worship in the sanctuary. Perhaps, the replacement of the former important cult and ritual attribute occurred owing to the change (possibly death) of the performer of ceremonies. Most likely, the items of the "necklace" set became the main ritual objects.

Appearance and functional characteristics of the "necklace"

The name of the cult and ritual attribute under consideration is put in quotation marks, since it is more common to associate this name with a neck ornament made of precious pieces (mainly stones). But in this case, the set consisted of ceramic pieces, and was not a neck ornament in the literal sense; nevertheless, it was intended, apparently, to be put on the neck when necessary.

It is hardly necessary to dwell in detail on the issues of the existence of sanctuaries in the Lower Amur region throughout the entire period of the Neolithic cultures in the region, which had been developed from the Final Pleistocene for at least ten thousand years. It has been shown that in almost all identified cult centers (Sakachi-Alyansko-Gasinsky, Voznesensky, at Suchu Island, Takhtinsky), in semi-dugout dwellings or pseudo-dwellings, there were home sanctuaries. These were used not only as storage places for various cult, ritual, and sacrificial objects, but also, presumably, as places for seasonal holidays to venerate the forces of nature, with a focus on fertility. Productive rites, inherent to initiation rites—initiation of young men into the status of adults—were obviously important for the inhabitants of the studied Neolithic dwellings in the Amur region. More detailed discussions of the subject, which also includes the issues of the origin in the Lower Amur Early Neolithic and the long-term existence of polyeiconic and polysemantic art, the appearance of inherently archaic bisexual anthropomorphic, phallic, and anthropozoomorphic images reflecting the original ideology and worldview of the region's inhabitants, have been presented elsewhere (Medvedev, 2000, 2001, 2005).

Home sanctuaries (places of worship or secluded areas) have been discovered at random, as a rule. In the course of excavations, it is difficult to distinguish sanctuary attributes from the total mass of artifacts, which were not always located in the same places in the dwellings where they were situated during the life of the inhabitants. In addition, sacred objects did not often lie compactly but made up certain series. Researchers rightly note that sanctuaries could have been established in all or almost all ancient dwellings, but for the above reasons they are identified relatively rarely.

The artifacts from dwelling 1 at Suchu Island undoubtedly arouse considerable interest. Various impressive items described above have been preserved; moreover, an unusual "necklace" has survived almost intact after deposition in the sandy loam for millennia. The "necklace" is a set of 17 miniature items for ritual and ceremonial purposes (another possible use, for example, as children's toys, is hardly reasonable, because the entourage recorded during the excavations, the "range" of other objects of cult art, testifies to the sacred nature of this unique find).

Suggesting a possible version of the order of arrangement of the elements of the "necklace", I do not insist that it was exactly as shown in Fig. 6, *A*. However, this reconstruction is based on a number of reasons. The set is dominated by small vessels—imitations of the household ware of the Malyshevo culture, to which culture the inhabitants of the dwelling belonged. The vessels were most likely in the center of the "necklace".

The available data of historical and archaeological research inform us that ceramic vessels made with

the help of fire (a mysterious power) were given a special semantic content in primitive societies. The vessel was often regarded as a symbol of wealth and prosperity. Presumably, a similar conceptual religious-mythological idea, archaic in nature, was also popular in the Neolithic communities of the Amur region. Interestingly, the vessels in the "necklace" are rendered not schematically but with many details indicating their practical use: tall pots – for storing food and drinks; containers in the form of situlas – for cooking (on fire); cup-shaped vessels – for eating.

The second-largest category of images in the "necklace" is the figurines of birds, which, being strung on a cord, apparently adjoined the vessels. The presence of ornithomorphic sculptural images in a composite cult and ritual attribute is quite understandable. Since ancient times, the cult of birds has been widespread among many hunting and fishing communities of Siberia and the Far East. Various tribes and peoples considered both forest birds and waterfowl as their totems, to which ritual actions were dedicated. According to the data from excavations of dwellings with sanctuaries, the owl was revered in the Neolithic of the Lower Amur region. A fragment of a ceramic figurine of this bird was found in the Takhta cult center (Medvedev, 2005: 58, fig. 31, *2*), and a flat stone sculptural polysemantic image of an owl-bear (Ibid.: 52, fig. 20) was discovered in sanctuary 1 at Suchu Island. Both finds were attributed to the Voznesenovskoye culture. At Suchu Island, in dwelling B of the Malyshevo culture, a ceramic ornithomorphic figurine, possibly depicting a duck, was found (Okladnikov, 1981: Fig. 58). A flint figurine depicting a pine-forest bird found at the Sakachi-Alyan site (Lower point), in the destroyed layer of the Osipovka culture, can be listed among the earliest ornithomorphic pieces of portable art in the region. Its approximate age is at least 10 thousand years (Ibid.: Fig. 49; Okladnikov, 1971: 86). A shale figurine of an owl from the settlement of Gasya belongs to the same culture (Derevianko, Medvedev, 1995: 17, fig. 46, *1*).

Without discussing in detail the region-wide Far Eastern issue of the origin and development of ancient artistic and religious traditions associated with birds (this is a separate topic of study), I note that the finds from the residential sanctuary at Suchu Island show the great importance attached by the dwellers to birds of the auk family, the inhabitants of the sea coasts (by the way, Suchu is located 50–55 km from the Strait of Tartary). It is unlikely that these birds were among the prey of the inhabitants of the island and the banks of the Amur. The people were apparently fascinated primarily by the perfect features of the sea hunters. Therefore, the ancient artisan depicted auks so carefully and realistically. The birds in the "necklace" obviously performed the role of a magical influence and attractors of good luck in the vitally important pursuits of fishing and hunting.

The next-largest category comprises double-ended phallic figurines with the image of a seal head at one end. Their smaller number does not mean that these figurines were less important in the ritual and ceremonial attribute. The figurines expressively and substantively embody the wide-spread ancient idea of fertility and reproduction of game animals, namely the pinnipeds. These animals were the object of marine hunting in some areas of the Amur valley away from the Pacific coast as early as in the Middle Neolithic. The people of the Malyshevo and then Voznesenovskoye cultures admired their ability to swim and fish, and valued seals as a source of fat, meat, and skin.

Describing the "necklace" as a whole, we should pay tribute to the artisan, who expressed the religious and mythological ideas of primitive man about the prerequisites for his prosperous existence. This sacred affiliation is the quintessence of the existence of groups of people of a particular geographical area.

The above-mentioned artifacts scattered over the western part of the dwelling and at the wall deserve a detailed interpretation. All of them could have been connected with the main part of the sanctuary, where the somewhat younger "necklace" was found. These artifacts include a group of phallic items and a similar image on the churinga. The cult of the masculine principle, recorded among many cultures, is evidenced by the multiple finds related to this during excavations at Suchu and other Neolithic sites of the region.

The bear was a particularly revered animal in the Far East, as evidenced by its sculptural images found in the dwellings and sanctuaries in the Lower Amur basin. A hybrid figurine consisting of a bear's head and a small animal from dwelling 1 is unique; the figurine refers to an earlier time in the sanctuary use than that of the "necklace". This find is one of the confirmations of the existence of polysemantic art in the Lower Amur Neolithic.

In historical and archaeological studies of a wide geographical range, much attention is traditionally paid to the artistic and cult image of a woman, which originated in the Upper Paleolithic and developed in

the Neolithic and successive periods. In the Far East, the earliest stone figurines of bisexual hybrid images (phallus-woman) in the Lower Amur region are known from the Early Neolithic Osipovka culture materials at the sites of Sakachi-Alyan and Kondon (Pochta) (Medvedev, 2001: 78, fig. 1, 2; p. 80, fig. 5; p. 81, fig. 6), as well as at the settlement of Goncharka-1 (Shevkomud, Yanshina, 2012: Fig. 52, 71). Later, in the cultures of the New Stone Age of the region, this hybrid image was further developed. The greatest (than anywhere else) number of this ceramic sculptural image was found on the Malyshevo and Voznesenovskoye dwellings at Suchu Island. A figurine of this type was also found in dwelling 1 under study. Its phallus-shaped chignon has a through hole similar to that in all such sculptures in the Amur region.

My ideas concerning the origins and purpose of Neolithic sculptural images, mainly anthropomorphic and hybrid (bisexual), of the Lower Amur region, as well as about the traditional sculpture (dogu) of the Jōmon of Japan have been published in my previous papers. Here, I just want to comment on some of the conclusions reached by researchers relatively recently on the basis of my materials (see (Solovyev, Solovyeva, 2011)). A prominent place is given by the authors of the publication to the proof of the possible "dressing" of the Amur ceramic sculptures in clothes, i.e. using them as a kind of mannequins. While correctly noting the absence of limbs and tattoos in all sculptural images, the researchers point out that all of them allegedly have a through vertical hole in the body (Ibid.: 56–57). Most of the Amur figurines with phallic bodies do not have such holes (see (Medvedev, 2000: 61, fig. 6, *2*, *3*; 2011: 9, fig. 1, *2*, *3*; p. 10, fig. 2, *1*, *2*)). Therefore, it is needless to speculate about any "stick" stuck into the figurine from below to fix it "on a horizontal surface" (Solovyev, Solovyeva, 2011: 57). Notably, many dogu have not only arms, legs, and tattoos, but also various hairstyles, while the Amur sculptures show only one hairdo—a phallic chignon. As an argument in favor of "dressing" the sculptures, the authors cite, for example, clay people figurines found in closed underground chambers of Han China, whose articular cavities on their shoulders to secure flexible arms indicate that they wore clothes (Ibid.: 59). Amur figurines do not have such cavities. It should be added that anthropomorphic figures with phallic bodies without limbs in the Lower Amur Neolithic are typical not only of portable art, but also of petroglyphs (see, e.g., (Okladnikov, 1971: 209, pl. 73, *1*)). This fact suggests deep original artistic and religious traditions in the population of this region. Academician A.P. Okladnikov, who studied primitive art for a long time, noted: "Everyone who has come into contact with the art of the Lower Amur has been impressed by its creators' vivid originality and inexhaustible wealth of imagination. <…> The evidence of archaeology and ethnography shows the wealth and originality of the art of the Amur tribes over an enormous period of time" (Okladnikov, 1981: 10–11).

We can hardly agree with the opinion of the authors of the publication regarding the use of the through holes in the heads of the sculptures intended for fixing a "headdress or a false hairdo with a thorn" (Solovyev, Solovyeva, 2011: 58). First, the holes were made not only in the parietal part of the head, but also far below, at the level of the nose or mouth (Medvedev, 2000: 62, fig. 6, *1*). Second, the thorn does not need a through well-designed hole.

It is hardly necessary to discuss here the essence of comparisons of the Amur sculptures with anthropomorphic ceramic figurines of the Lidovka culture of the Bronze–Early Iron Age of Primorye. This topic was considered in detail by V.I. Dyakov. He noted some of the stylistic similarities and differences of regional, cultural, and chronological order between them. At the same time, the author rightly noted that there are no figurines similar to those of Lidovka in the collections of either of the other cultures of Primorye or Amur (Dyakov, 1989: 163–165). The stylized anthropomorphic (female) figurines from the Bronze Age Sopohang settlement in North Korea are the closer parallels. The Sopohang artifacts, like the Lidovka figurines, show some fundamental distinctions from the Amur sculptures. Their bodies are not phallic in shape, but are widened at the bottom and ended with a stand. There are no through holes in them. The turned up heads of the sculptures show some holes or depressions, which have been defined as eyes or ears; the faces are flat, not detailed, "a longitudinal groove-depression has been traced" in one case (Larichev, 1978: 58, fig. 36, *9*; p. 61; p. 68, fig. 41, *2*; p. 75, fig. 45, *6*) (the heads of the Lidovka figurines are trough-shaped (Dyakov, 1989: 163)).

Despite the brevity of the presented description of the figurines from Primorye and the DPRK, it is clear that neither the Sopohang nor the Amur figurines were used as mannequins. In any case, no sticks or rods were inserted into them from below; no thorns were used to secure a headdress or false hairdo on their heads. However, there is reason to believe that the tradition of manufacture of and worshipping female round sculptures endowed with magical properties, which embodied the cult of fertility in its broadest

sense, which was established in the early stages of the Neolithic in the Lower Amur region, survived in its basic features in the Early Bronze Age cultures in more southerly regions, although later this tradition definitely transformed.

Conclusions

At present, there is no doubt that the artistic and cult traditions of the Lower Amur Neolithic populations occupy a special place in the primitive art of Northern Eurasia. These early original traditions were expressed in various forms and versions, primarily in round three-dimensional sculptures and in religious and mythological petroglyphic images of the region. The identification of archaic polyeiconic and polysemantic art at the earliest stages of the Neolithic in the Lower Amur has become exceptionally important (for more details, see (Medvedev, 2001)). Noteworthy are the findings of studies of the Neolithic cultures of neighboring regions—the Middle Amur and Primorye. The Middle Amur region has currently yielded a rather modest number of pieces of art and cult; almost no parallels have been established with the Lower Amur. In Primorye, the main objects of art were representatives of the aquatic fauna, although flat sculptures of terrestrial animals and humans (stone, bone) were also found (Brodyansky, 2012). The advanced level of development of the material and spiritual spheres noticeably distinguishes the people of the Osipovka culture on the Lower Amur (12th–9th millennium BC) from their close and distant contemporaries, which makes it possible to consider the Osipovka tribes as the creators of the "fishing proto-civilization".

Although dwelling 1 at Suchu Island belongs to the Malyshevo culture, which is much younger than the Osipovka culture (late 5th to early 4th millennium BC), the figurines from the sanctuary clearly show the surviving ancient (Osipovka) style of rendering anthropozoomorphic images: three-dimensionality, polysemanticity, and bisexuality of phallic representations. The excavation yielded by no means all the artifacts that might have been stored in the dwelling when it was inhabited. But even the available items carry important information, some of which was previously unknown. First of all, this concerns the unique ceramic "necklace". It belonged most likely to the performer of religious ceremonies and the keeper of a sacred place—a sanctuary in a dwelling. It could be a shaman-sorcerer, as indicated by other cult and ceremonial items found—labrets and a small jug. According to ethnological data, labrets were attached to decorative masks during religious rites among some peoples of the Pacific North. The performer of rituals in dwelling 1 (sanctuary), in addition to the "necklace" around his neck (it is also possible that it was attached to clothes or a belt), could have worn a bark or wooden mask with stone labrets on his face. He likely also owned the miniature jug without traces of everyday use, intended for a stimulating or intoxicating drink, which was drunk by the performer of ritual actions.

An important religious and mythological function in the dwelling must have been assigned to a ceramic sculptural image of a woman, which, together with the "necklace", was placed in a secluded small hole in the sanctuary. Apparently, the sculpture was kept in the dwelling for a long time, possibly from the time of its construction. Obviously, the figurine personified a progenitress bringing wealth.

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Okunev Statues at Mount Uitag, Khakassia

This article presents two new steles discovered in 2021 during rescue archaeological works in the Askizsky District of the Republic of Khakassia. Both steles were part of Tagar funerary enclosures. One is a slab of Devonian sandstone with an anthropomorphic mask on its broad side. It was adjacent to the southern wall of the enclosure at Skalnaya-6 mound 1. Only the outline of the head in the chin region has been preserved, as well as the mouth, modeled as a depression, and three transverse lines between the nose and the mouth. The other stele, made of red sandstone, bears a human-like profile in the lower part, carved on the edge and extending to lateral sides. This stele, unusually well preserved, was part of the northern wall of the enclosure of Uitag-3 mound 5. The article describes and interprets this laconic, realistic image of a "male shaman" wearing a three-eyed animal mask and high headgear. The two Uitag slabs differ in the placement of the face (on the broad side in one case, and on the lateral sides in the other). However, the pecking technique and the method of rendering the facial features are the same. The general stylistic manner makes it possible to attribute both artifacts to a single cultural and chronological horizon—that of the Early Okunev culture. None of the sculptures has exact matches, but in terms of style, composition, and semantics they resemble those with realistic images in relief extending from one side of the slab to another. The fragment of the statue from Uitag-3 mound 5 is the earliest realistic representation of a mask, which can possibly be used as a reference for researchers.

Keywords: *Minusinsk steppe, Okunev art, mythology, statues, steles, masks.*

Grotesque masks stare at us from steles
with no exact parallels in artistic practices
of other ages and regions.

M.L. Podolsky (1997: 168)

Introduction

Monumental Okunev stele-like statues came to the notice of researchers of the Minusinsk steppe in the 18th century. They described and made drawings of over ten stones of "unclear chronological and cultural affiliation" (for more details on the initial stages of studying the sculptures, see (Vadetskaya, Leontiev, Maksimenkov, 1980: 38–39)). By the 1930s (Gryaznov, Schneider, 1929: 63), over a hundred such sculptures were known, and by the beginning of the 21st century, over five hundred stone steles and slabs with images had been found (Esin, 2009: 29). Most of these objects of ancient art

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are in museums; a smaller part has been left on the natural terrain of Khakassia, protected by the state and worshiped by the local population. A significant number of sculptures are known only from the field sketches by D.G. Messerschmidt, F.I. Strahlenberg, P.S. Pallas, and J.R. Aspelin (Messerschmidt, 1962; Aspelin, 1931). The corpus of data on stone steles with anthropomorphic imagery has been constantly growing due to archaeological excavations caused by economic development of the territories. The article introduces two new pieces of monumental art, which were discovered during rescue archaeological works in the Askizsky District of the Republic of Khakassia in 2021, and provides their historical interpretation.

Archaeological context of the slabs and their description

Both steles of the Okunev period were parts of enclosures of the Tagar burial mounds at the Skalnaya-6 and Uitag-3 sites. These complexes constitute one huge burial field on the slightly hilly part of the left-bank valley of the Abakan River, to the northwest of the peaks of Mount Uitag. The Askizsky District (especially in the basins of the Kamyshta and Uibat Rivers with their tributaries) is traditionally considered to be a "classic location of stone *babas*" (Gryaznov, Schneider, 1929: 63; Vadetskaya, Leontiev, Maksimenkov, 1980: 37), since this microdistrict is rich in sites of the Afanasyevo and Okunev cultures.

The stele with the image of an anthropomorphic mask at Skalnaya-6 is a Devonian sandstone slab adjacent to the southern wall of the enclosure (Fig. 1). This "ten-stone burial mound" is a classic example of an elite burial complex of the Saragash period (for more details, see (Bogdanov, Timoshchenko, Ivanova, 2021: 880–881)). All slabs of the enclosure were 1 m above the ancient surface and were set to form one straight line on the upper edge. Ancient builders took into account the pressure of the large mass of earth in the center of the mound, so nearly every element of the enclosure was reinforced on the outer side with a powerful buttress—a slab dug on its edge. The top of the stone (2.3 m high, 1.5 × 0.3 m in size), which had the mask on its broad side, was rounded (Fig. 2). Since the stone adjacent to the wall was set in the enclosure soundly and in a structurally correct manner (with its "face" outward), it may be assumed that builders of the Tagar burial mound treated it also "consciously", and possibly with reverence. According to N.Y. Kuzmin, such an attitude suggests preservation of religious traditions of the earlier periods among the Tagars (1995: 153). Notably, corner slabs that were taken from earlier (Podgornovo) burial mounds, were set in the enclosure of mound 1 at Skalnaya-6, ignoring the images pecked on them. The Okunev stele shows only the lower part of the anthropomorphic mask, with the head outline in the area of the chin, the mouth made in relief in the form of a pecked recess of crescent shape, and three transverse lines between the nose and mouth (Fig. 3). Unfortunately, most of

Fig. 1. Slab with anthropomorphic face from the enclosure of Tagar mound 1 at Skalnaya-6. *All photographs by the author*.

the image was eroded in ancient times and heavily weathered; the details are poorly visible even with special lighting.

The stele-statue with anthropomorphic face from Uitag-3 was made of red sandstone. It was a part of the northern wall (northwestern corner) in the enclosure of mound 5 (Fig. 4). The structure was made of slabs placed on their edge. Slabs were selected by size and were set either overlapping, or edge-to-edge while wedging smaller stone plates on both sides and filling with earth, with virtually no buttresses or attempts to keep the same height level (Bogdanov, Timoshchenko, 2021: 898, fig. 2). Individual elements from this structure were taken by ancient builders from earlier structures: the corner stones belonged to Early Tagar burial mounds; four walls belonged to stone boxes with polished edges from the Bronze Age. The fragment of the Okunev statue was placed in the enclosure on its edge, with its "face" up (Fig. 5). The size of the fragment was 1.4 × 0.47 × 0.26 m (the reconstructed initial height of the stele was not less than 2.5 m). The degree of weathering suggests that the stone lay in the steppe on its left side for quite a long time before ending up in the Tagar enclosure. The right half was poorly preserved. Initially, the slab was probably "saber-shaped" (or close to it), approximately the same

Fig. 2. Slab with anthropomorphic face from mound 1 at Skalnaya-6.

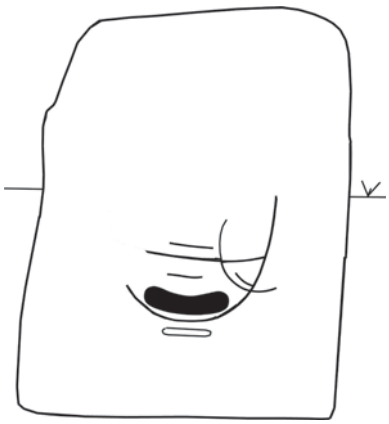

Fig. 3. Drawing of anthropomorphic face on the slab. Mound 1 at Skalnaya-6. *All trace drawings by E.A. Sazonova*.

Fig. 4. Slab with anthropomorphic face from the enclosure of a Tagar burial mound. Mound 5 at Uitag-3.

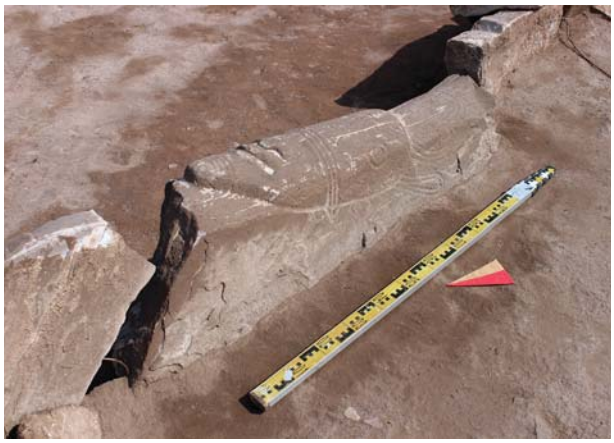

Fig. 5. Fragment of the slab-statue *in situ*. Mound 5 at Uitag-3.

as a stele with the image of a human face in relief found near the Bir River (Vadetskaya, 1967: Pl. 6). The anthropomorphic profile was located in the lower part of the stele, on its edge, with a transition to the lateral sides. The pecked lines are deep, precise, and clearly stand out against the red-brown background of the slab due to their light gray color. A talented artisan carved a male face, which narrowed towards the chin. The image is convex; the chin is emphasized in relief (Fig. 6). The neck area is marked by three facets, which were cut off and polished. A wide nose with nostrils and a mouth are highlighted. Eyes in the form of concentric circles, with a convex "dot" in the center, are shown in the area of transition to the lateral sides. Three horizontal lines, separating the lower part of the nose, cross the entire face ending up in a triangle beyond its outline. Four lines arranged in an arc "cut through" the chin. A third eye is shown on the forehead as a circle with a dot. Pointed, saber-like, narrow leaf-shaped horns are depicted in the upper part of the head above the third eye expanding to the lateral sides. Animal elongated ears are slightly lower on the lateral sides. The upper part of pecking above the face is hardly distinguishable due to fragmentation and severe degradation of the stone surface. Most likely, this is a part of the surviving representation of a high stem-like headdress with geometric ornamentation and "hair" along the edges (Fig. 7).

Interpretation of the evidence

"Stone idols" or "stone *babas*", as the first researchers of Minusinsk antiquities called them, serve today as a numerous, but very difficult historical source to interpret. Thus, it is not surprising that despite many articles and monographs (Vadetskaya, 1967; Vadetskaya, Leontiev, Maksimenkov, 1980; Leontiev, Kapelko, Esin, 2006; Esin, 2009), the internal chronology of the Okunev art remains unresolved, and semantics of its imagery causes heated discussions. Most trace-drawings of these pieces of art "roam" through the works of researchers as simplified drawings with inaccuracies and significant gaps, although modern equipment provides technical capacities for accurate reproduction of ancient pecked

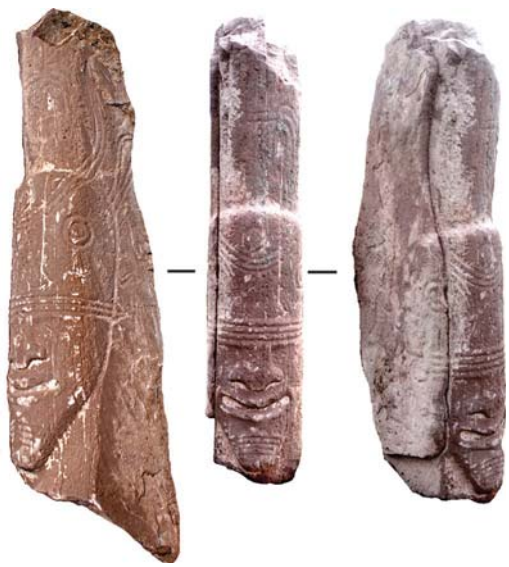

Fig. 6. Fragment of the slab-statue with anthropomorphic mask in relief. Mound 5 at Uitag-3.

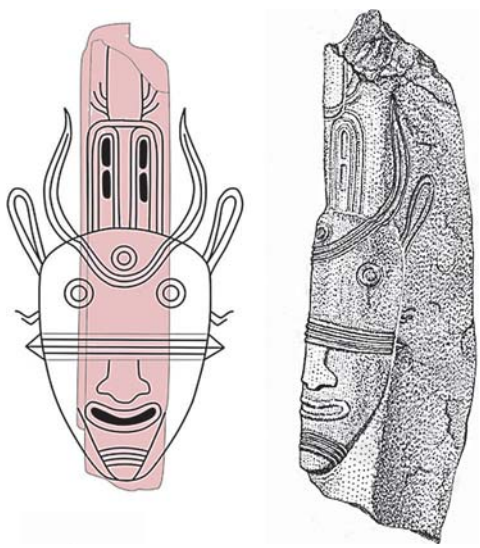

Fig. 7. Trace drawing of a fragment of the slab-statue with anthropomorphic mask in relief. Mound 5 at Uitag-3.

images (see, e.g., (Zotkina et al., 2021)). There is no generally accepted classification for the Okunev statues and pecked images, since it is difficult to formulate clear criteria for selection. The same images in the same pecking technique and manner of representation appear both on slabs and petroglyphs; they may be rendered in a realistic, stylized, or even abstract style. Taking into consideration realism and stylization of images, M.P. Gryaznov identified three groups—early, main, and transitional (1950: 131). E.B. Vadetskaya proposed the features of the mask, such as the headdress, and presence of bands on the face as a basis for classification, and also came up with three groups of images: simple, realistic, and complex non-realistic (Vadetskaya, Leontiev, Maksimenkov, 1980: 40–42; Vadetskaya, 1983: 89). Y.N. Esin distinguished two groups of images: slabs (or rock surfaces) with the images pecked on the broad side, and column-like stones with the images and multi-tiered compositions in relief (2009: 21). More sophisticated and cumbersome classifications, proposed by N.V. Leontiev (1978: 93–94) and D.A. Machinsky (1997: 272–273), with classification into groups and subgroups (variants), were based on a variety of stylistic and semantic features of the images. Notably, among all manifestations of ritualistic and artistic creativity, nearly all scholars distinguish the special group of stele-obelisks (statues) with pecked images (compositions) extending from one surface to another. Only such "column-shaped" stones were set in sanctuaries with certain sacrificial offerings*, but not in the context of funerary rituals. D.A. Machinsky agreed with the opinion of S.V. Kiselev that high "obelisks" with elongated-ovoid three-eyed faces in relief, transverse bands, and animal ears and horns were created by the Afanasyevo people (Kiselev, 1962: 58; Machinsky, 1997: 272–276). However, the statement of Machinsky that "no statues of this group have been found during construction of the Okunev graves" (1997: 276) can hardly be accepted as the main argument in favor of this identification. The opinion of M.L. Podolsky that flat slabs with pecked masks found in the Okunev graves simply "belong to a different functional category associated specifically with funerary rituals" (1997: 186) seems to be absolutely correct. Thus, two basic postulates can be used for the next level of interpreting the steles found near Mount Uitag: a) pieces of Okunev art from more ancient sanctuaries that had not been originally associated with funerary rituals were found in the enclosures of Tagar mounds, and b) the statues were a result of the individual creativity of ancient sculptors.

This problem should be resolved using the analysis of the structure of the discovered ritualistic and artistic objects of art as a system: through search and comparison of parallels, identifying their common and specific aspects. One can note that there are no exact parallels to the slabs found on Mount Uitag. The stele from Skalnaya-6 (see Fig. 3), in its configuration and size of stone, remotely resembles some slabs near Lake Solenoye and near the village of Ust-Byur (Leontiev, Kapelko, Esin, 2006: Cat. No. 169, 177). The outline of the head, mouth, and transverse bands above the mouth were rendered in a similar manner on a statue from the Uibat steppe (Ibid.: Cat. No. 85, pl. XXXVII), on the third stele at the Chernovaya VIII burial ground (Ibid.: Cat. No. 115), and on the slab from the Andronovo grave near Lake Solenoye (Ibid.: Cat. No. 137).

Several statues resemble the stele from Uitag-3 in their main compositional elements of the images: the three circular eyes, mouth, animal horns and ears, bands on the face, and high "headdress" (Fig. 8). However, a complete set of parallels to the entire image were not present on any of these. For example, most of the sculptures described in the literature have a narrow nose emphasized in relief, while a wide nose with nostrils was usually shown in a stylized manner*. The chin, together with the lower part of the anthropomorphic face, was always narrowed, but only on the statue from Uitag-3 was it emphasized in relief. One gathers the impression that the Uitag stele was a reference model for the subsequent "replica sculptures" made in accordance with certain traditions and mythological beliefs. Our statue is a brief, realistic image of a "male shaman" wearing a three-eyed animal mask and high headdress, without unnecessary details and additional symbols. The image on the Uitag statue should be viewed as a mask, which is an attribute of the material and spiritual culture as well as an intermediary between people and the other world (world of spirits). Bands on the mask and its "semi-animal" hypostasis are the keys to deciphering the semantic essence of the

*The fact that these stones acted as "sacrificial columns" was proven by I.T. Savenkova, E.B. Vadetskaya, and L.R. Kyzlasov by the excavations of the steles standing in their original locations (Vadetskaya, 1983: 87).

*E.B. Vadetskaya analyzed each element of the masks on 126 steles and presented their variants in tables (Vadetskaya, Leontiev, Maksimenkov, 1980: 42–46). Notably, she used data from 1/3 of all images known today.

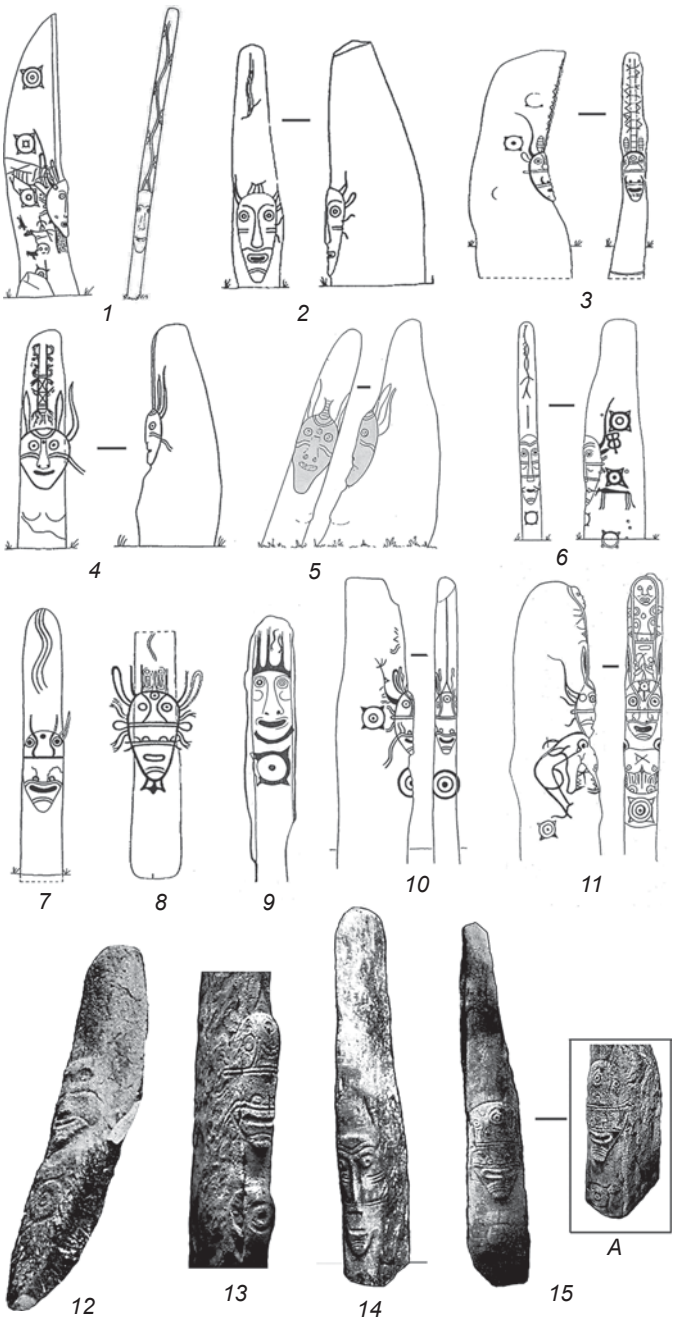

Fig. 8. Stone statue-steles found in the Minusinsk steppe. *1* – single red sandstone statue (trace drawing), bank of the Byur River, Ust-Abakansky District, Khakassia (Leontiev, Kapelko, Esin, 2006: Cat. No. 35); *2* – granite statue of "single stone placement", right bank of the Ninya River, up the sources of the Kamyshta River, Askizsky District, Khakassia (Ibid.: Cat. No. 26); *3* – statue (menhir) made of brown sandstone, burial mound of Tasheba Chaatas, near the city of Abakan (Ibid.: Cat. No. 86); *4* – single statue "Khys tas" made of red sandstone, Lake Chernoye, Shirinsky District, Khakassia (Ibid.: Cat. No. 36); *5* – single red sandstone statue, bank of the Belyi Yus River (Gryaznov, Schneider, 1929: Pl. II, fig. 11, *1*); *6* – statue made of red sandstone, sacrificial place, bank of the Es River, in the vicinity of the village of Ust-Es, Askizsky District, Khakassia (Leontiev, Kapelko, Esin, 2006: Cat. No. 108); *7* – statue made of red sandstone, Uibat River valley, Ust-Abakansky District, Khakassia (Ibid.: Cat. No. 53); *8* – sculpture made of gray granite (face painted red), the enclosure of a Tagar burial mound, Uibat River valley, Ust-Abakansky District, Khakassia (Ibid.: Cat. No. 76); *9* – statue, bank of the Baza River, Khakassia (Vadetskaya, 1983: Fig. 3, *1*); *10* – sculpture from the collection of the Minusinsk Museum (Vadetskaya, 1967: Fig. 5); *11* – statue, shore of Lake Shira, Khakassia (Vadetskaya, 1983: Fig. 14); *12* – sculpture made of gray granite, the "alley of stones" of Uibat Chaatas (Gryaznov, Schneider, 1929: Fig. 7); *13* – statue, bank of the Tasheba River, near the city of Abakan (Esin, 2009: 92); *14* – statue, bank of the Abakan River (Vadetskaya, 1967: Pl. 7); *15* – statue, bank of the Uibat River (Ibid.: Pl. 19).

image. Most scholars believe that the pecked lines render coloring elements of an anthropomorphic facial mask or shaman's face (Leontiev, 1978: 110; Vadetskaya, 1983: 90). According to Vadetskaya, 63 % of anthropomorphic faces on 126 steles had bands on the forehead, 83 % under the eyes, 63 % between the nostrils and mouth, and 34 % on the chin (Vadetskaya, Leontiev, Maksimenkov, 1980: 44, fig. 2). Podolsky suggested that ancient artisans specifically distinguished three zones with bands on the masks. Each zone corresponded to one of the sense organs. "The Okunev artist was interested in how it functioned rather than how an organ looked" (1997: 182). However, this is not entirely true for the Uitag statue. Moreover, lines crossing the face in the nose area form only two zones. According to Podolsky, bands or "braces" on the "heavy Habsburg chin" only emphasized elongation of the mask by "balancing the upper zone" (Ibid.: 183). It is possible that the point was not in the composition balance, but in a special "status" of the chin, which was customary marked with tattoos or coloring during rituals among many ancient and modern peoples. According to the statistics on the Okunev sculptures, the number of bands (from 1 to 4) and their shape (arcuate, wavy, or straight) varied greatly regardless of the sex or degree of realism on the masks in relief. As for the three horizontal lines in the center of the facemask on the Uitag statue, special attention is to be paid to their triangular "end" in the area of the ears. These ends strongly resemble the fasteners fixing the mask to the head. This element played a special role in image creation, since most of the Okunev masks in relief show lace-strings (Leontiev, Kapelko, Esin, 2006: Cat. No. 33, 35, 36, 45, 58, 62, 64, 65, 69, 76, 77, 86, 88, 103). There is usually only one carved line crossing anthropomorphic masks in the nose area on flat slabs, but also with "strings" behind the outline of the face (see, e.g., (Ibid.: Cat. No. 137)). From

the viewpoint of similarities of cultural stereotypes, V.I. Molodin has discovered interesting parallels to the Okunev imagery in the Xinjiang evidence of the Xiaohe culture, which was contemporaneous to the Okunev culture (2019). These consisted of wooden masks from grave goods, each with a relatively wide belt of thin ropes, dyed with red paint and tightly adjacent to each other, located on the "face" in the area of the bridge of the nose (Ibid.: 14, fig. 2–6).

The mouth on the Uitag mask is shown customarily as open (a continuous recess). Such a "frozen smile of bliss" (Machinsky, 1997: 273) appears on masks of various peoples of the Old and New World, both ancient and modern. This similarity results from the common principles of mythological and ritual artistic creativity rather than from cultural contacts. Various examples include the ceramic head mask of a "goddess" from the Hongshan culture (China, 4th millennium BC) or antique theatrical masks made of terracotta. It should be admitted that the Uitag mask most likely shows the mouth of a person or deity (spirit), and not the half-open mouth of an animal. A well-known expert on masks of different peoples of the world A.D. Avdeev observed that in most cases "mask-heads are made to be so large that nasal and especially mouth orifices are also exaggerated in size. <…> Due to the large size of the mask, the eyes of the masked person are not behind the eye holes (the need for which, therefore, disappears), but behind the nose and mouth openings of the mask, through which the dancer sees" (1957: 273). If an ancient sculptor, while pecking a mask, imagined a mask-head, it becomes clear why big, round eyes were shown in a stylized way on the lateral sides of the statue. Thus, the mask in relief on the Uitag statue is a reflection of three hypostases: human (lower part of the face), "otherworldly" (third eye), and animal (horns and ears). It was the third eye in the center of the forehead—the "sign of the Ajna Chakra" (Machinsky, 1997: 273), "solar symbol" (Kyzlasov, 1986: 235), and sign of "additional, superhuman sharpness of sight" (Vadetskaya, 1983: 90)—that symbolized the presence of another sense organ in the shaman, which was very important for performing various rituals.

Most Okunev anthropomorphic sculptures are distinguished by "correct" placement of animal ears and horns on the head. Such animal attributes extremely rarely appear on planar images of faces. On the Uitag statue, realistic pecking of details stand out (horns coming from the center of the forehead are above the ears, which are shown on the lateral sides), together with a long, "ornamented" vertical band going upwards from the head (see Fig. 7). The same "ornamental band" occurs on other masks in relief of the Okunev period (Leontiev, Kapelko, Esin, 2006: Cat. No. 76). According to most scholars, such a "strict and obligatory combination indicates that we have an adornment of some kind of high headdress crowning the heads in most of the Yenisei idols" (Vadetskaya, 1967: 36). A headdress with bullhorns and ears is shown on most of the sculptures of the realistic group. This may be associated with cattle breeding in the Okunev population (Leontiev, 1978: 110).

Interpretation of the mask in relief on the Uitag statue from the viewpoint of universal (and specific) rituals performed at sanctuaries is based on assumptions. Possibly, this is the head of a real (or deceased) shaman wearing a horned mask and high cap carved in stone; this suggestion is consistent with the assumptions of Vadetskaya and Leontiev (Vadetskaya, 1983: 94; Leontiev, 1978: 109) and well-known ethnographic evidence*. It can be assumed that this was a "deified Vedic character" called the "Soul of the Bull". He acted as an intermediary between the ancient cattle breeders and Ahura Mazda (Podolsky, 1997: 185). "The myth of a divine cow pregnant with a golden calf, which later became the life-giving sun, was widespread in ancient times among all peoples of the world", while cow horns were a "symbol of divine power" (Kyzlasov, 1986: 207). The high headdress in a mythological and ritual context can be considered as the embodiment of the idea of the "World Pillar" or "World Tree" in a number of beliefs about some main "axis of the universe".

Conclusions

Two new unique pieces of Okunev art were discovered during rescue excavations in the enclosures of Tagar burial mounds: a stone with fragmentarily surviving pecked mask and fragment of a "saber-shaped" slab with the anthropomorphic image of a facemask in relief. Analysis of structural features of the images has made it possible to formulate several conclusions. Some of them are consistent with the concepts commonly accepted in archaeology; others may clearly cause certain doubts and discussions.

*The fact that horns or animal attributes "assisted" the shaman in traveling between the worlds and striking enemies during rituals is well-known and is supported by many testimonies (see, e.g., (Devlet, 1997: 242–243)). Among the Evenki, images of dead shamans (masks) carved on tree trunks were given the role of advisers while performing ritual actions at sanctuaries (Leontiev, 1978: 109).

1. The archaeological context of the steles testifies to different attitudes of the ancient local population towards the Okunev "statuary" monuments at various chronological stages of the Tagar culture.

2. Both slabs from the grave field near Mount Uitag belong to different groups according to the principle of image placement (on the broad plane of the slab and on the edges), but they are similar in the same pecking technique (deep counter-relief) and same rendering of details on the "face". The general stylistic manner of representation indicates that both stones belonged to the same cultural and chronological (Early Okunev) stratum.

3. Neither of the slabs has exact parallels. In terms of stylistic, compositional, and semantic features, the obelisk from Uitag-3 shows some similarities to a group of realistic sculptures with images in relief extending from edge to edge. Obviously, this fragment of statue was the earliest and possibly "referential" example showing the embodiment of the realistic image of a "male shaman" wearing an animal mask and high headdress. The most important details convey the human (powerful chin and wide expressive nose), otherworldly (third eye and high headdress), and animal (expressive eyes, long horns and ears) hypostases of the image, reflecting the personal experiences and ideas of the ancient artisan who materialized the image of an intermediary between people and the other world, the world of spirits.

4. The sophisticated and diverse nature of Okunev art does not make it possible to give an unequivocal answer to the question as to why slabs with anthropomorphic images were set up near Mount Uitag. Excavations at the sites of ancient sanctuaries give scholars reason to consider stele-statues set there and oriented toward the sun as fragments of the "World Mountain" (Kyzlasov, 1986: 190) or "celestial pillars" (Leontiev, Kapelko, Esin, 2006: 44). Bloody sacrifice mysteries were performed around them on calendar days that were particularly important for nomadic cattle breeders. It is quite possible that there were many more such obelisks with various kinds of anthropomorphic and zoomorphic faces; they could have been made not only of stone, but also of wood. The Okunev "visual texts" performed the same social function as religious hymns (prayers) addressed to superhuman powers (Ibid.: 36). Therefore, ethnographic data on the Siberian peoples, evidence on the religious and mythological ideas of the Vedic Indo-Aryans, and sources reflecting the complex world of symbolic anthropomorphic images from the Far East and Ancient China may be used in interpreting these images. However, these will be only some of many interpretations of ancient ritualistic and artistic creativity.

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A Functional Analysis of Stone Tools from Bronze Age Burials in the Baraba Forest-Steppe, Based on Findings from Sopka-2

Lithics from chronologically diverse burials at Sopka-2, the Baraba forest-steppe, Western Siberia, were subjected to experimental use-wear analysis. We selected relatively well preserved specimens, suitable for microscopic examination and representing cultures such as Ust-Tartas, Odino, Krotovo, etc. Wear traces indicate the functions of tools and their places among the industries of the region. It was found that the tools had not been specially destined to be funerary items—they all display some wear and are well-suited for efficient use. Comparative characteristics of degree of wear are proposed. At the early stages, stone tools had been placed only in female burials, but at later stages they were distributed among burials of females, children, and males. The findings provide a basis for a functional and morphological typology of lithics used during that period.

Keywords: *South Siberia, Baraba forest-steppe, Late Bronze Age, burials, stone tools, functional analysis.*

Introduction

The Sopka-2 cemetery, containing chronologically diverse burials, is one of the remarkable archaeological sites in the Baraba forest-steppe. It is located in the Sopka area, in the Vengerovsky District of the Novosibirsk Region. Sopka-2 was excavated in the late 1970s to early 1980s by V.I. Molodin (Molodin, 1980, 2001, 2012; Molodin, Grishin, 2016, 2019; Molodin, Efremova, Solovyev, 2021; Molodin, Solovyev, 2004; etc.). The obtained materials illustrate several cultural formations of the ancient population of the Baraba forest-steppe over a fairly long period of time. The concept of the cultural and historical development of the ancient population of Western Siberia was proposed and published by Academician V.I. Molodin and his co-authors (Molodin, 1977, 1985, 2001, 2012, 2015; Molodin et al., 2013; etc.).

The archaeological assemblage from Sopka-2 includes relatively few, but diverse, lithic artifacts (Molodin, Grishin, 2016: 239–241). In addition to flakes, knife-like blades, and scraper-like tools, it contains abrasive stones, hammer-stones, grinders, and other tools. The study of this set of items from Sopka-2 burials seems to be a timely task today; the functional analysis of stone tools can serve as a basis for fruitful development of their typology, which will contribute to our understanding of the toolkit and the household activities of the people who inhabited the region during various historical periods. The purpose of the study is to identify and analyze specific use-wear marks on lithic artifacts and to determine the functional purposes of the tools.

Study materials

The functional analysis was carried out on selected artifacts with rather well-preserved surfaces suitable for microscopic examination, from the Bronze Age burials of

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Western Siberia. Finds with significant surface damage resulting from washing, crumbling, and other effects, were not considered.

The studies were focused on 17 artifacts registered as follows: artifacts of the Bronze Age Ust-Tartas culture – No. 1–4; the Odino artifacts – No. 5–10; the Krotovo – No. 11, 12, 14, 15; the Late Krotovo (Cherno-Ozerye) – No. 16, 17; the artifact attributed to the Mongolian period – No. 13. Notably, some of the studied artifacts constitute a complex (Fig. 1). Several graves yielded sets of lithic artifacts: burial 22 mound 44 (Ust-Tartas culture) produced No. 2 and 3; burial 40 mound 22 (Odino culture) – No. 6 and 7; burial 42 mound 25 – No. 8–10; flat-grave burial 652 (Krotovo culture) – No. 14 and 15.

Methodology and analytical techniques

Functional analyses of the selected lithic artifacts were based on the method of experimental use-wear analysis proposed by S.A. Semenov (1957) and G.F. Korobkowa (1999). We also applied the synthesized technique of use-wear analysis adapted for studying the materials from sites in North and Central Asia (Volkov, 2013: 94–154). Previous experimental studies, which contributed to the replenishment of the traceological collection of reference stone tools from Siberia and the Far East (Ibid.: 66–99), showed that the wear of the studied stone tools was generally standard (see (Semenov, 1957: 88–90, 170–174)). Experiments with abrasive stones of

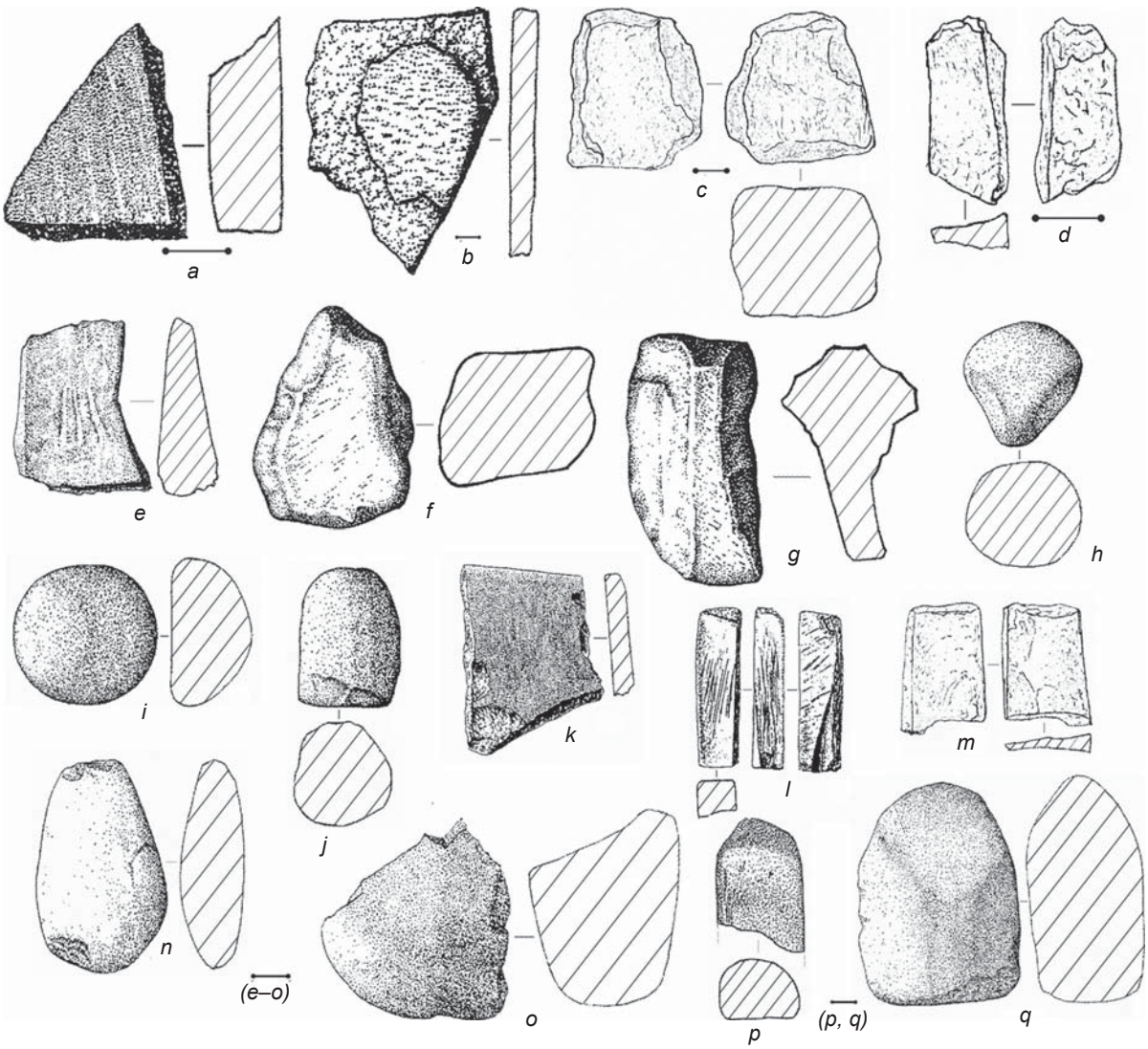

Fig. 1. The lithic assemblage from the graves at Sopka-2.
a, *b* – Ust-Tartas culture (4th to first half of 3rd millennium BC, Early Bronze Age); *c*, *d* – Comb-Pit ceramic culture (4th to first half of 3rd millennium BC); *e–j* – Odino culture (3rd millennium BC); *k*, *l*, *n*, *o* – Krotovo culture (3rd to early 2nd millennium BC); *p*, *q* – Late Krotovo (Cherno-Ozerye) culture (late 3rd to early 2nd millennium BC); *m* – Mongolian period (13th–14th centuries AD) (Molodin, 2001: 67, 32; 2012: 32, 47, 81; Molodin, Grishin, 2016: 64, 86, 210; 2019: 18, 42).

various grain-sizes that were carried out as part of this study enabled the authors to identify the characteristics of wear marks depending on the type of stone used, and to determine the relative degree of wear of some artifacts from the archaeological collection. With the help of experimental tools, the casting defects in the form of the turning edge of the bronze dagger's blade were removed. Differences between linear microtraces on abrasive stones, resulting from various operations, were noted: the signs of forming areas adjoining the blade and those of sharpening the blade-edges of various types of dagger. The studies of the surfaces of the coarse and fine-grained abrasive stones allowed us to reveal the origins of traces of efficiency loss in such tools: this occurred owing to formation of wear in the form of smoothness in their working zones; also, we identified the start and end of the development of a characteristic groove-like microrelief on the surfaces of rasps. Special attention was paid to the general deformation of the abrasive surfaces, the formation of linear microtraces, and the remains of materials processed on the abrasive stones. To study the wear resistance of tools made from local raw materials, experiments were carried out clarifying the features of the process of application of burnishers in skin processing.

Description of wear marks and functional characteristics of tools

Ust-Tartas culture

Object of study No. 1 (Fig. 2, *a*; 3, *a*), catalogue code S-2 k 31 p 15, skeleton No. 3. The artifact is a fragment. Use-wear marks were noted on its wide surface, which is the only working area of the tool. The natural surface of the stone in the working area of the tool was flattened as a result of wear. Linear microtraces are not noted. The tool belongs to the group of active abrasive tools. It was probably used as a grinder, polishing the areas adjoining the cutting edges of metal knives. The degree of wear* is relatively moderate. The tool was used for a single purpose (monofunctional), and was not applied for other operations.

Object of study No. 2 (see Fig. 2, *b*; 3, *b*), catalogue number S-2 k 44 p 22. The artifact together with object No. 3 were recovered from burial 22. The study object consists of two fragments of a single item. Wear marks are noted on a wide surface, which is the only working area of the tool. The natural surface of the stone in the working area is relatively lightly flattened as a result of wear. Linear microtraces are not noted. The tool belongs to the group of active abrasive tools. It was probably used as a rasp to remove irregularities on relatively wide surfaces of metal products. The degree of wear is relatively low. The tool was used for a short time, it was not used in other operations.

Object of study No. 3 (see Fig. 2, *c*; 3, *c*), collection code S-2 k 44 p 22. Artifact 22, together with find No. 2, was found in one burial. Wear marks are noted on a wide surface, which is the only working area of the tool. The stone working area is flattened by wear. Linear microtraces were not noted. The tool has been attributed to the group of active abrasive tools. It was probably used as a grinder for smoothing relatively wide surfaces of metal products. The artifact possibly served as a pestle for grinding relatively hard inorganic materials on a hard surface. The degree of wear is relatively moderate.

Study object No. 4 (see Fig. 2, *d*; 3, *d*), catalogue code S-2 p 626. This artifact was recovered from burial 626. Traces of wear are observed on its wide surface, which is the only working area of the tool. The concavity in the working area of the tool was formed during its extensive use. Linear microtraces are not noted. The tool belongs to the group of active abrasive tools. The processed material was not determined. The degree of wear is relatively high. The tool was used for a single purpose, it was not used in other operations.

Odino culture

Object of study No. 5 (see Fig. 2, *e*; 3, *e*). Catalogue code S-2 84 to 22 p 24. The artifact was found in burial 24. Traces of wear are noted on two wide surfaces. The surface of the stone in the working area of the tool is noticeably deformed by contacts with the workpiece. Linear macrotraces are relatively parallel; these are relatively deep and long channels with a U-shaped cross-section and smoothed sides. The tool belongs to the group of passive abrasive tools. It was probably used for processing the items made of solid organic materials (sharpening the points made from bone, horn, etc.). The degree of wear is relatively high. The tool is monofunctional, it was not used in other operations.

Object of study No. 6 (see Fig. 2, *f*; 3, *f*), catalogue code S-2 85 k 22 p 40. This artifact was found together with find No. 7 in burial 40. Traces of wear are observed over the entire surface of the artifact. The tool is

*Relative degrees of wear of all the considered stone tools was determined. An important result of the experimental work is the establishment of paired standard tools (wear-nonwear); they show the contrast between the working zones and the areas with an undisturbed stone structure on the tool's surface. Paired photographs of the main working areas of the objects of study cases No. 1–17 are designated sequentially by the letters "a"–"q" (see Fig. 3). Letter "r" marks the surface of object No. 17 (Late Krotovo (Cherno-Ozerye) culture) showing traces of metal.

Fig. 2. Artifacts of the Ust-Tartas (*a–d*), Odino (*e–j*), Krotovo (*k*, *l*, *n*, *o*), Late Krotovo (Cherno-Ozerye) (*p*, *q*) cultures and Mongolian period (*m*) bearing use-wear signs. The scale bar is 1 cm in all the images.

multifunctional. It was used mainly as a burnisher for processing fresh and non-rigid skins. Both surfaces are worn out; one of them shows more extensive wear. The relief of the stone working area is flattened; it is smoothed and burnished. The traces of wear are most visible on the protruding parts and edges of the stone tool. Linear microtraces are not noted. The degree of wear is relatively high. The tool is attributed to the group of active tools. It served not only as a burnisher, but also as an anvil (group of passive tools) for splitting solid, probably inorganic, materials. The degree of passive wear is moderate. At the narrow end of the tool, traces of use for crushing purposes (group of active tools) are noted. The degree of crushing wear is high.

Object of study No. 7 (see Fig. 2, *g*; 3, *g*), catalogue code S-2 85 k 22 p 40. This artifact was found in burial

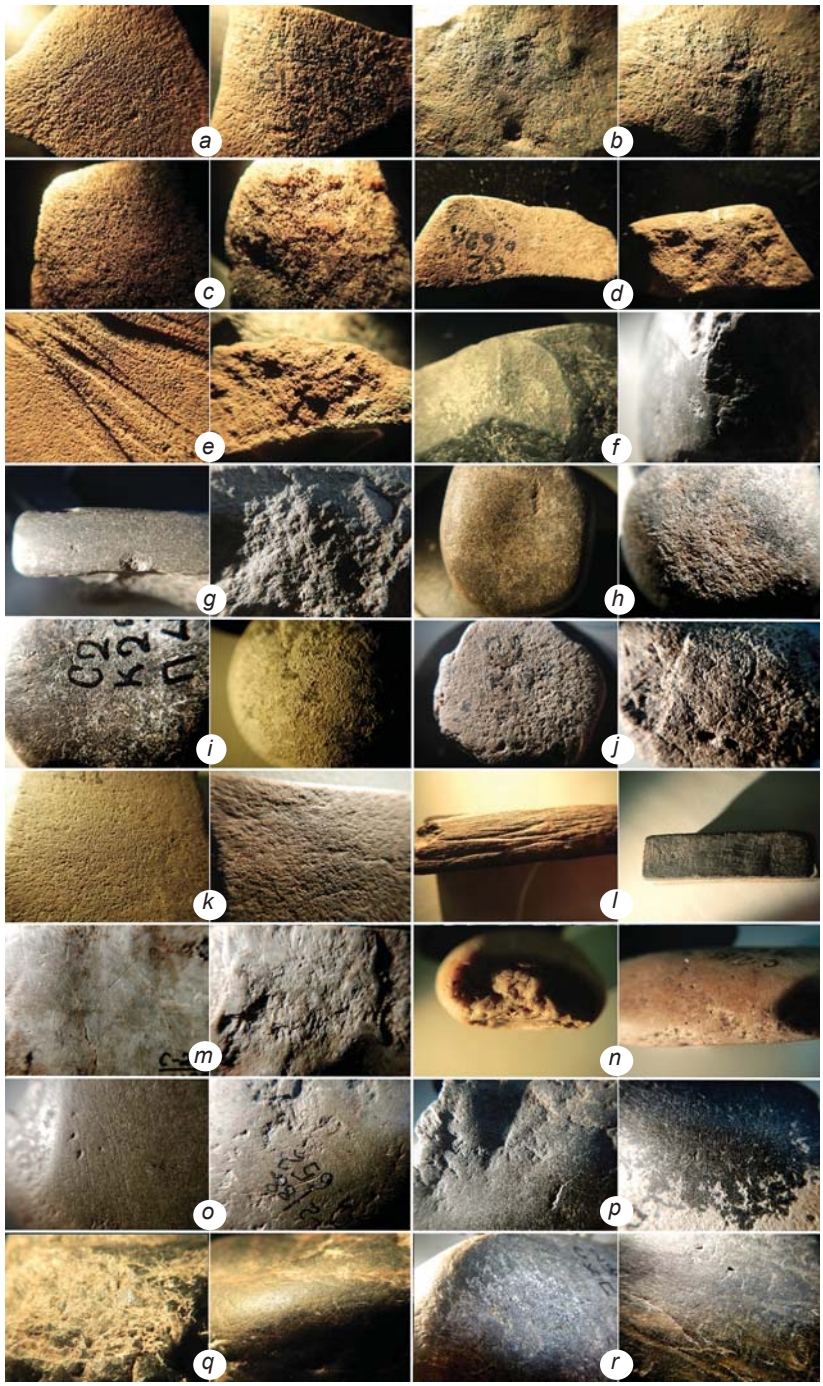

Fig. 3. Use-wear signs and natural surfaces of the tools. All the photos are taken at ×2 magnification.

40 together with find No. 6. Traces of wear are noted on the convex edge and the narrow face of the artifact. The relief of the stone working area is smoothed out by wear, the surface is slightly convex. Linear micro-traces of wear are not observed. The tool belongs to the group of passive abrasive tools for metal working. It was probably used as a grinder, smoothing the areas adjoining the cutting edge of a knife. The degree of wear is relatively high. The tool is monofunctional, it was not used in performing other operations.

Object of study No. 8 (see Fig. 2, *h*; 3, *h*), catalogue code S-2 k 25 p 42. This artifact was recovered from burial 42 together with finds No. 9 and 10. Traces of wear are noted over the flattened part, which is the only working area of the tool. It was used mainly as a burnisher in skin processing. Wear traces of the stone working area have

the form of smoothed spots with typical polish. The most distinct traces of wear are noted on the protruding parts of the stone and the edges of the tool. Linear microtraces are not observed. The degree of wear is relatively high. The tool is monofunctional, it belongs to the group of active tools.

Object of study No. 9 (see Fig. 2, *i*; 3, *i*), catalogue code S-2 k 25 p 42. The artifact was recovered from burial 42 together with finds No. 8 and 10. It is a solid tool, similar in morphology to item No. 8. Wear marks, the same as on the tool described above, are noted on the flattened part, which is the only working area of the tool. It was mainly used as a burnisher in skin processing. The relief of the stone working area is flattened by wear, smoothed and burnished. The most distinct traces of wear are observed on the protruding parts of the tool. Linear microtraces are not identified. The degree of wear is relatively high. The tool is monofunctional, it belongs to the group of active tools.

Object of study No. 10 (see Fig. 2, *j*; 3, *j*), catalogue number S-2 k 25 p 42. The artifact was recovered from burial 42 together with finds No. 8 and 9. Traces of wear are noted on the flattened narrow face, which is the only working area of the tool. It was used mainly as a pestle-grinder for working on flat and rigid surfaces. The relief of the stone working area is flattened and smoothed by wear. Linear microtraces are not observed. The degree of wear is relatively high. The tool is monofunctional; it belongs to the group of active tools for grinding relatively hard, probably organic, materials.

Krotovo culture

Object of study No. 11 (see Fig. 2, *k*; 3, *k*), catalogue code S-2 k 22 p 11. Traces of wear are noted over one of the wide surfaces, which is the only working area of the tool. The relief of the stone working area is flattened by wear. Linear microtraces are not observed. The artifact belongs to the group of active abrasive tools. It was probably used as a grinder, processing the areas adjoining the cutting edge of a knife. The degree of wear is relatively moderate. The tool is monofunctional, it was not used in performing other operations.

Object of study No. 12 (see Fig. 2, *l*; 3, *l*), catalogue code S-2 k 25 p 64. The artifact is a solid tool on a small tetrahedral stone block. Wear marks are noted on all the edges. Linear microtraces in the form of shallow grooves, relatively parallel to one another, are observed. Linear traces are oriented both along the long axis of the tool (on three faces out of four) and almost across the elongate-subrectangular working area on one of the faces of the tool. The artifact belongs to the group of active abrasive tools for metal working. It was probably used as a grindstone for forming and straightening the areas adjoining the cutting edge, removing notches, etc. The degree of wear on the two faces of the tool with longitudinally and transversely oriented linear traces of use is relatively high. Two faces with longitudinally oriented linear traces are identified as the main working edges of the tool; the other two faces are determined to be auxiliary working areas. The tool is monofunctional.

Object of study No. 14 (see Fig. 2, *n*; 3, *n*), catalogue code S-2 / 88 p 652. The artifact was recovered from burial 652 together with find No. 15. Traces of wear are noted on the two opposite narrow ends of an oval-shaped pebble. The original form of the stone has been destroyed and flattened by wear at the two working areas. Linear microtraces are not noted. The tool is attributed to the group of active tools. Judging by the characteristic crushing of the stone surface in the zone of contact with processed material, the item could have served as a percussion tool for crushing relatively fragile materials. Use of the tool as a hammer-stone for splitting stone is unlikely: no signs of short, differently oriented micro-splits typical of a hammer-stone have been traced in the zone of wear. The degree of wear is relatively moderate. The tool is monofunctional, it was not used in performing other operations.

Object of study No. 15 (see Fig. 2, *o*; 3, *o*), catalogue code S-2 / 88 p 652. This artifact was recovered from burial 652 together with find No. 14. The tool is a fragment of an original pebble. Traces of the most extensive wear are seen on the flattened part, which is the main working area of the tool. The tool was used as a burnisher for skin processing. The relief of the stone working area is noticeably flattened, smoothed and polished. Linear microtraces (several short tracks) were probably formed during short working of contaminated material. The degree of wear is relatively high. Notably, the artifact was used as a burnisher not only before, but also after fragmentation. At the second stage of using the tool, the zone of wear was formed on the other side of the artifact, opposite the first wear zone. The tool is monofunctional, it belongs to the group of active tools. At the second utilization stage, it was used for a relatively short time.

Late Krotovo (Cherno-Ozerye) culture

Object of study No. 16 (see Fig. 2, *p*; 3, *p*), catalogue code S-2 k 11 p 1. The artifact is a solid tool made of a split pebble. Wear marks are noted on the flattened part, which is the main working area of the tool. The tool was utilized as a burnisher for skin processing. In the working area, traces of smoothing and characteristic polishing of the protruding parts of natural pebble surface are observed. Linear microtraces are not recorded. The degree of wear is relatively moderate. Traces of wear were found

not only on the main working edge, but also on other parts of the artifact, retaining pebble crust. The tool is monofunctional, it belongs to the group of active tools.

Object of study No. 17 (see Fig. 2, *q*; 3, *q*), catalogue number S-2 k 18 p 9. The artifact is a solid pebble tool. Traces of wear in the form of surface micro-damage are observed on all protruding areas of the pebble. The narrow end is identified as the main working edge, judging by the extensive wear. Linear microtraces are not recorded. The tool presumably served as a hammer-stone (pestle) for crushing relatively hard materials. The degree of wear is relatively moderate. Microscopic examination of the unworn surface of the artifact revealed traces of metal (see Fig. 3, *r*), the origin of which was not determined. The tool is monofunctional, it belongs to the group of active tools.

Mongolian period

Object of study No. 13 (see Fig. 2, *m*; 3, *m*), catalogue number S-2 87 No. 601. The artifact is a single piece. Wear marks are found on a wide surface, which is the only working area of the tool. The surface of the stone working area is slightly flattened, owing to wear. Linear microtraces are not recorded. The tool belongs to the group of active abrasive tools. It was probably used as a grinder for smoothing the areas adjoining the cutting edge of a knife. The degree of wear is relatively low. The tool is monofunctional, it was not used in performing other operations.

Discussion

The presence of several stone tools in a single burial is recorded in the graves of the Ust-Tartas (burial 22), Odino (burials 40 and 42), and Krotovo (burial 652) cultures (Fig. 4). Notably, the share of tools for metal processing in these burials is only 1/3; moreover, one of the tools could also be used for working with other solid inorganic materials. The share of monofunctional tools designed for grinding or crushing solid inorganic materials is even smaller, about 1/5. Most of the tools in the studied sample are burnishers (44.44 %), which were used for skin processing.

Identification of the raw material's provenance is a complicated task, and was not the purpose of this study. However, one can hardly assume that the rocks were delivered to Baraba from the foothills of the Altai or the Ob riverbed; these areas are separated by hundreds of kilometers. Most likely, the pebbles found by chance on the banks of rivers or former riverbeds in the immediate vicinity of settlement sites were used as raw material. This is indirectly evidenced by the diverse mineralogical composition of the raw materials in the tool assemblages of the studied archaeological cultures.

Fig. 4. Abrasive stones for metal processing (*a*, *b*, *d*), tools for working other hard inorganic materials (*g*, *h*) and for skin processing (*c*, *e*, *f*, *i*). The scale bar is 1 cm in all the images.

The studied items do not show traces of the use as burnishers or other tools in making ceramics. Our findings do not support the assumption that pottery was subjected to abrasive finishing of surfaces as was traditional for the studied cultures.

One artifact (No. 6) of the Odino culture, one (No. 14) of the Krotovo, and two artifacts (No. 17 and 18) of the Late Krotovo (Cherno-Ozerye) were identified as tools for crushing the processed material (pestle-hammer stones). These were apparently used for crushing grog in the ceramic manufacture.

V.I. Molodin noted that the lithic artifacts at the Odino cemetery (Sopka-2/4A) were found only in female burials, while at the younger Krotovo cemetery (Sopka-2/4 B, C) three items were recovered from women's graves, two from men's graves, and one from the infant's grave (Molodin, Grishin, 2016: 242). The data from the Krotovo and Late Krotovo (Cherno-Ozerye) burials are as follows. Burial No. 158 (female, individual 50–60 years old) and burial No. 124 (male, individual 30–35 years old) did not yield any tools except for the above-mentioned items. The grave goods of burial No. 282 included a bronze celt, bone and stone arrowheads, four crucibles, four bone spatulas, a boar's tusk with traces of working, casting molds, a stone funnel, three bow end-caps, horse and elk incisors, a dog's tooth, and a stone end-scraper. Burial No. 652 (infant), in addition to the hammer stone and abrasive tool described above, yielded a disintegrated vessel, clay coating, ocher, a burnisher, and an unused flake. Burial No. 78 (female, individual 14–15 years old) contained a bone dagger, a spoon, an engraved blade, a pendant (a dissected phalanx of an animal), and a fragment of a horn handle.

Quite few stone tools were recovered from the medieval burial grounds of Sopka-2/11 and -13. At the former, one artifact was found in a female burial; at the latter, two lithic artifacts were found in two male burials (Molodin, Solovyev, 2004: 31).

Noteworthy are the occurrences of such tools as a grindstone for finishing a knife's cutting edge and an abrasive tool for relatively rough processing of metal products in the Ust-Tartas archaeological materials, which include a relatively small number of bronze artifacts (Molodin, 2019).

Conclusions

The functional analysis of lithic artifacts from the Baraba forest-steppe showed that the derived data can serve as a basis for the development of a functional-morphological typology of the tools used in the period under study. This will add to our knowledge of the household activities of the populations inhabiting the south of Western Siberia in the Late Bronze Age.

In the late 5th to the first half of the 3rd millennium BC, the toolkit of the autochthonous Ust-Tartas culture was dominated by stone and bone products of an archaic appearance (arrowheads, pendant ornaments, borers, needle cases and needles, etc.); more rarely, personal ornaments made from shells occurred; ceramic pieces were few, and metal items were singular. The population in the 4th to the first half of the 3rd millennium BC used pottery and characteristic bone and stone products. The Odino people (first half of the 3rd millennium BC) had a developed bronze-casting industry. Their assemblages include stone tools, numerous bone items (borers, needle cases, needles, knitting needles, combs, etc.), bronze artifacts (daggers, needles, awls), ornaments (earrings, tubular beads), and ceramics. The Krotovo material complex (mid-3rd to early 2nd millennium BC) shows similarities with the Odino toolkit. The Late Krotovo (Cherno-Ozerye) culture is characterized by tools made of bone and bronze, and ornaments, as well as specific pottery. A diverse toolkit of the medieval population consists of pottery, bone and metal (mainly iron) items (Molodin, 1977, 1985, 2001, 2012, 2019; Molodin, Grishin, 2016, 2019; Molodin, Solovyev, 2004; and others).

The present study has not revealed lithic any artifacts manufactured specifically for funerary purposes. All the studied tools display signs of wear and are quite suitable for further use.

Insufficiency of the available data hampers the identification of stable links between the burial rite and the composition of the grave goods including the studied stone tools. However, further field studies in the region and the expansion of the database on the use of stone tools will hopefully make this possible in the future.

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Seasonality of Sintashta Funerary Rites (Based on the Kamennyi Ambar-5 Bronze Age Cemetery)

Based on archaeological materials from the Kamennyi Ambar-5 cemetery, we test the hypothesis about the connection between the seasonality of pastoral practices and funerary rites during the Late Bronze Age (early 2nd millennium BC). We studied growth layers in the teeth of 24 cows, 19 sheep/goats, 14 horses, a dog, and ten humans from 17 graves. We combined samples from various species from the same contexts into eight assemblages. With regard to animals, differences in seasons of death were revealed only once. 70 % of graves were arranged in spring and 30 % in autumn. Therefore, the hypothesis about the seasonal use of the cemetery can be supported at least partially. The contemporaneous settlement of Kamennyi Ambar demonstrates a similar tendency in the seasonality of animal slaughtering. However, the reasons for slaughtering at the settlement differed from those in the cemetery. At the settlement site, it was motivated by practical needs, and in themortuary site, only by the seasonality of human deaths, specifically by a higher frequency of deaths in late winter and spring. Also, postmortem selection is possible, whereby kurgan burials were arranged only for some individuals. In practice, several of the above factors overlapped, resulting in an anomalous composition of the buried cohort (disproportion of sexes and a higher proportion of individuals who died at the peak of vital activity).

Keywords: *Bronze Age, Trans-Urals, Sintashta culture, funerary rites, burial season, animal sacrifices.*

Introduction

In recent decades, kurgan cemeteries, fortified and unfortified settlements and mine-workings of the Sintashta culture have been comprehensively studied in the southern Urals. Fortified settlements are found only in the Trans-Urals, in the basins of the tributaries of the Tobol and Ural rivers. Often, they form contemporaneous complexes with kurgan cemeteries. In the Cis-Urals and the adjacent part of Kazakhstan, only cemeteries areknown to date. A necropolis usually includes a relatively small number of kurgans, each of them up to 1 meter high. The space under the mound may contain from 1 to 40 grave-pits. Inhumation is a prevailing burial practice, but excarnate and intramural burials also occur (Gening V.F., Zdanovich, Gening V.V., 1992: 207–219; Vinogradov, Berseneva, 2013).

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The composition of the buried population usually includes all age cohorts, and a disproportion of sexes is often recorded. A comparatively small number of buried people is obvious at the Kamennyi Ambar-5 cemetery, as the number of buried individuals (at least 125 persons) sharply contrasts with the size of the contemporaneous settlement. The site comprises 1.8 ha, consists of 40–50 houses of 150–220 m^2 each. During the period of ca 100 years (Chechushkov, Epimakhov, 2021), with at least 500–600 people living at the same time, the number of deceased should be clearly higher. One way to explain this is to assume the seasonal use of the settlement and the cemetery.

The work program included selecting biological samples (teeth) for identification of the season of death of people and animals; analysis of annual layers of teeth; contextual analysis; and comparison of data on the season of death with previously obtained evidence of the seasonality of Sintashta burials.

Materials

The Bronze Age archaeological complex of Kamennyi Ambar is located in the Kartalinsky District of the Chelyabinsk Region (Fig. 1). The territory is characterized by a predominantly steppe landscape, with patches of forests. The fortified settlement is located on the first terrace of the left bank of the Karagaily-Ayat River. It was archaeologically studied in 1992 and from 2004 to 2013 (Multidisciplinary Investigations…, 2013; The Bronze Age…, 2021). According to stratigraphy and radiocarbon dating, four phases are distinguished at the settlement

Fig. 1. Location of the site.

(Koryakova, Kuzmina, 2017). The first three correspond to the early stage, with a closed layout and densely arranged buildings. Phase 4 is represented by separate buildings containing Alakul-Timber-Grave materials. At all stages of the settlement's use, the subsistence strategy was based on animal husbandry, supplemented by a foraging economy.

The Kamennyi Ambar-5 cemetery is located on the opposite bank of the river. Four kurgans (No. 2–4 and 8) are attributed to the Sintashta culture (Epimakhov, 2005). They contained from 1 to 17 grave-pits, which dimensions depended on the number of individuals buried (from one to nine). There are no reliable traces of the repeated use of the same grave-pit. The inner space of each grave was most often equipped with a wooden chamber with a ceiling 30–40 cm above the bottom level. More than half of the burials are disturbed or looted. Children's burials account for more than 60 %, age groups of 35–50 and 50+ years old are represented in a few burials. Sex was determined for 55 individuals; among them, 64 % are males. The total number of buried is 125 persons (Judd et al., 2018). The chronology of the Sintashta part of the cemetery is based on 17 radiocarbon dates corresponding to a duration of 70–80 years (Chechushkov, Epimakhov, 2021).

Animal sacrifices (complete skeletons, skulls, and limb bones) were found in 31 graves out of 38. The articulated state of the bones indicates a short time from killing the animals to placing them into the graves, i.e., the sacrifices were usually conducted during funerals.

To test the hypothesis about the seasonal use of the cemetery, an analysis of the dental cementum (from humans and animals originating from the same context) was carried out. The maximum possible number of samples was taken. The analysis was limited due to a small number of teeth with well-preserved cementum and the predominance of children's burials. All the teeth were removed from the jaws and found in an articulated state.

Methods and results

Methods for determining seasonality vary considerably and depend on the materials available. In particular, seasonality is studied using the data on the uneven growth of an organism during the year. The teeth of mammals are most commonly used.

Studies of seasons of burials for the Bronze Age of Northern Eurasia are scarce. The scholars who studied the burials of the northern Caspian region in the 5th–3rd millennium BC combined the results of the analysis of human dental cementum and the pollen data obtained from materials from closed one-time burial grounds (Klevezal et al., 2006; Shishlina, 2007: 395–397). The

reliability of the determination of the season of death by the layers of dental cementum was confirmed by pollen analysis.

In this study, the season of death was determined using a technique based on the study of growth layers in the teeth (cementum and secondary dentin). The growth layers consist of two elements: a wide element, which reflects the active growth of the organism in spring–summer, and a narrow one, which reflects a slowdown in growth in autumn–winter (Klevezal, 1988: 53). Determining the time of death is possible with an accuracy of the season because there is individual variability in layer formation.

The degree of development of the last layer of cementum was assessed in relation to the previous one. In controversial cases, layers in the dentin were studied additionally. The time interval when cattle and sheep/goats were slaughtered was determined to the season: spring, summer, autumn, or winter. The season of death of a horse, owing to the great variability in the formation of zones of active growth or growth slowing, can be identified within autumn–winter, early spring, or late spring–summer (Burke, 1995). However, in cases when narrow (autumn–winter) or wide (spring–summer) layers began to form, the time of death was determined within narrower limits (winter/spring). This conclusion was verified by comparing the findings on other animal species from the same context (if they were available).

In assessing the season of human death, we followed the same approach as for mammals (Klevezal et al., 2006). If along the edge of the cementum was an indistinct narrow layer, the formation of which falls on the winter period, the season of death of the individual was considered to be winter. A very clear winter layer is usually observed when the next wide (growth) layer has already begun to form behind it, but is not visible yet. This happens at the very beginning of spring. In such cases, the season of death of the individual was identified as late winter–early spring. If the very beginning of the growth of a wide layer was observed along the edge of the cementum, the season of death was interpreted as spring, and if this layer was formed by 70–80 % relative to the previous one, it was late summer–autumn.

Samples with an intact root system were selected to analyze the teeth of sacrificial animals. When selecting the teeth of cattle and horses, preference was given to the first upper/lower molars (M1/m1). In a cow, these erupt at the age of 5–6 months (Beasley, Brown, Legge, 1992), in small ruminants at 3–5 months, and in a horse at 9–12 months (Silver, 1969). This makes the first molars ideal for the identification of the season of death for animals from 1–2 years of age. However, other cheek teeth were also used for analysis in cases where molars were missing. The season of death of a human could be determined by this method only if the deceased was not older than 35 years of age (Klevezal et al., 2006). Therefore, the permanent teeth of individuals of this category were studied.

Teeth from 58 individuals older than one year were studied to determine season of death for animals. In some cases, the unsatisfactory state of preservation of the roots forced the selection of several samples from one individual. Therefore, the sample consisted of 72 specimens. However, owing to the poor preservation of the dental cementum, only 61 specimens (out of 58 individuals) turned out to be identifiable: 27 – sheep/goat, 19 – cattle, 14 – horse, 1 – dog (Table 1). Additionally, the state of the dental system of young individuals was taken into account. If teeth are present in the jaws at the eruption stage, it is possible to estimate the probability of animal slaughter in a certain season (Silver, 1969). Thus, the sample is based on materials from 17 grave-pits of three kurgans. Among the anthropological samples, permanent teeth were selected from 10 individuals, one from each (Table 2). In this work, we limited ourselves to determining only the season of death since this approach has shown almost 100 % effectiveness (Wedel, 2007).

The sample preparation procedure included the following steps. Each tooth was filled with epoxy resin. After that, polished transverse sections were made along the entire length of the tooth root (Fig. 2). Each of them was studied visually under a binocular in reflected light.

The sacrifices were localized in two variants: at the bottom of the grave-pit (8 samples from 4 graves) and on the wooden ceiling of the burial chamber (25 from 7). Animal bones were also found in the filling of grave-pits (25 from 9). A significant part of them was probably originally located on the ceiling.

In the final determination of the time of burial, priority was given to the season of animal slaughter. It cannot be ruled out that a human corpse could have been kept for some time, and sacrificial animals were immediately used in the funerary rite. We should also consider the technology of grave digging (the absence of traces of heating, and minimum use of metal tools) and the timing of the soil thawing (late April to early May).

The analysis of the remains of animals has shown that for 60 % of them the season of death was spring, and for 40 % of them the slaughter occurred during autumn. The predominance of the former was ensured by two types—the horse and the small ruminants. When grouped by grave-pits, the dominance of spring sacrifices is even more pronounced: only a quarter of the graves refer to the autumn period. In kurgan 4, there are burials of only one season (spring), while in kurgan 2 and kurgan 8 various seasons are present.

A discrepancy in the season of sacrifice within the same grave-pit was found only once (see Table 1,

Table 1. **Data on sacrificial animals**

No.	Kurgan/ pit	Localization	Type	Tooth	Season	Age, years	Context*
1	2	3	4	5	6	7	8
1 2 3 4 5	2/1	Filling " " " "	Cattle " " " "	m1 m1 M1 m1 M1	Spring " " " "	4 6 6 5 2–4	Highly disturbed, composition of buried unknown
6	2/3	"	Horse	m1	"	2	Highly disturbed, one individual (M 49–55)
7 8 9	2/5	Ceiling " "	" " "	m1 m1 m1	" " Spring?	5 7 4	Disturbed, eight individuals (M 15–18, M 9,5–12, M(?) 25–30, M 10–12, M 14–18, F 10–12, U 1,5–3, F Neonate)
10 11	2/6	" "	" "	i M1	Spring "	15–20 2	Highly disturbed, seven individuals (M 40–50, M 15–18, F 6–10, U 14–16, U 1–5, U <1, M Adult)
12	2/7	Filling	"	I	"	23–25	Highly disturbed, five individuals (F 45+, U 6–8,5, M 4,5–8,5, M 12–18, U 5–12)
13 14 15	2/8	Bottom " "	" " Cattle	m1 M1 m1	" " "	4.5 5 5.5	*In situ*, four individuals (M 30–44, F 7–11, F 2–4, U Neonate)
16 17 18	2/10	Ceiling " "	Sheep/goats " "	m1 m1 m1	Autumn " "	1.5 1.5 1.5	*In situ*, three individuals (M 7,5–12,5, U 1–2, U Adult)
19 20	2/12	Filling "	Cattle "	p2 p4	" "	5 10–11	*In situ*, four individuals (M 5–9, U 2–4, F 38–49, F 20–24)
21 22 23 24 25 26 27 28 29	2/15	Ceiling " " " " " " Bottom "	Sheep/goats " " " Cattle " " Horse "	m1 m1 m1 m1 M1 m1 m1 i3 i1	" " " " " " " " "	2 2 3 2 4 2 5 8 10	*In situ*, one individual at the bottom (M 16–18) and one at the ceiling (U 1–3)
30 31	2/17	Filling "	Cattle Horse	m1 i	" "	4 9–10	Disturbed, two individuals (F Adult, M 6–10)
32	4/1	Bottom	Sheep/goats	m1	Spring	2	*In situ*, one individual (F 12–18)
33 34 35 36 37 38 39 40	4/2	Filling " " " " " Bottom "	" " " " Cattle " Sheep/goats "	m1, M1 M3, p4 m1 p4 m1 m1 m1 Erupting m1	" " " " " " " "	1 7 3 3 7–8 7–8 2 3–5 months	*In situ*, eight individuals (F 7,5–12,5, U 7–11, M 3–5, M 3–5, M <1, M 3–5, U 7–9, U 1–2)
41 42 43	4/5	Filling " Ceiling	" " Horse	Erupting m1 " "	Spring? " Spring	3–5 months 3–5 months 4	Highly disturbed, six individuals (M Adult, M 12,5–17,5, U >5 , U infant, M 5–6, U 3–5)
44 45	4/8	Filling "	" Cattle	m1 M1	" "	5? 5	Highly disturbed, four (?) individuals (M? Adult, U 6–14, U 5–9, U 0,5–3)
46 47 48	4/15	Ceiling " "	Sheep/goats " "	m1 P2 m1, P4	" " "	1 4 4	*In situ*, one individual (U 2–4)

Table 1 (end)

1	2	3	4	5	6	7	8
49	8/2	Filling	Sheep/goats	m1	Spring	5	Highly disturbed, at least one adult, three children
50		"	Cattle	m1	Autumn	?	
51		"	"	M1	"	4	
52		"	"	P2	"	7	
53		Ceiling	Sheep/goats	p2	Spring	5	
54		"	"	m1	"	2	
55	8/3	"	Cattle	m2	Autumn	8	Highly disturbed, four individuals (M 25–30, F Adult, U 5–12, U <1)
56		"	Dog	C	"	4	
57		"	Sheep/goats	m1	"	2	
58		"	"	m1	Autumn?	4	

*Designations of the biological sex: M – male, F – female, U – unidentified.

Table 2. **Season of death of the individuals**

Item	Kurgan/pit, skeleton	Sex and age, years	Tooth	Season of death
1	2/5, 1	M 15–18	i1	Late winter – early spring
2	2/5, 3	M 20–25	p2	"
3	2/12, 1	M 5–9	i1	Late summer – autumn
4	2/12, 4	F 20–24	i1	"
5	2/15	M 16–18	c1	"
6	2/17, 1	F 20–25	m1	Late summer – autumn?
7	4/1	F 12–18	i1, i2	Spring
8	4/2, 2	F 7–12	i1	"
9	4/5, 1	M 20–30	m2	Winter
10	4/5, 2	M 12–18	i2	Late winter – early spring

No. 49–54). The altar in grave 8/2* could have been formed during two seasons. All sheep/goat individuals slaughtered in spring and cattle slaughtered in autumn lay at the same level. Almost all the skulls were connected to mandibles, and most limb bones were articulated. This clearly indicates a short time interval between the slaughter of animals and the placement of the parts of carcasses on the ceiling (Fig. 3). It can be assumed that there was access to the grave-pit both in spring and autumn (at least to the ceiling level). In other cases, there were no discrepancies in the season of sacrifice, even if the samples were taken from mandibles, which were found *in situ* at the bottom and on the ceiling of the same grave (pit 2/15).

The analysis of the human teeth sample showed that most of the ten individuals died in late winter–early spring, or late summer–autumn. We interpreted all deaths during the warm period (spring–summer) as deaths in spring, based on the context (data on the death of animals in closed complexes). A discrepancy in the season of death within one grave was observed once (see Table 2, No. 9, 10): one individual died in winter, and the other in late winter–early spring. Probably, the burial of the first one was delayed until the beginning of the warm season. Judging by the analysis of animal teeth, this burial was made in spring.

Thus, a comparison of zoological and anthropological materials did not reveal any discrepancies, and in two cases, it was possible to clarify the time of burials; the season of death of the individuals from graves 2/5 and 4/5 was determined as late winter–early spring, and the sacrificial animals from these graves died in the spring; consequently, the burials belong to the spring period (Table 3). The observed consistency suggests the relative simultaneity of the repose of people and the sacrifice of animals. An additional argument in favor of this conclusion is the results of the analysis of the internal structure of the grave-pits. Of the seven graves with data on the season of death of people and animals, simultaneity has been stratigraphically confirmed for four. In pits 2/12, 2/15, 4/1, and 4/2, there are no traces of disturbance of the original filling. In three of these graves, the remains of the buried individuals were found *in situ*, and in one of them, the bones had been partially displaced by burrowing animals (pit 4/2). In the latter case, the single-phased burial process is confirmed by the great depth of the pit (–220 from the subsoil) and the location of sacrificial animals on the ceiling 20–40 cm above the bottom.

*Hereinafter, the designation is in accordance with Table 1.

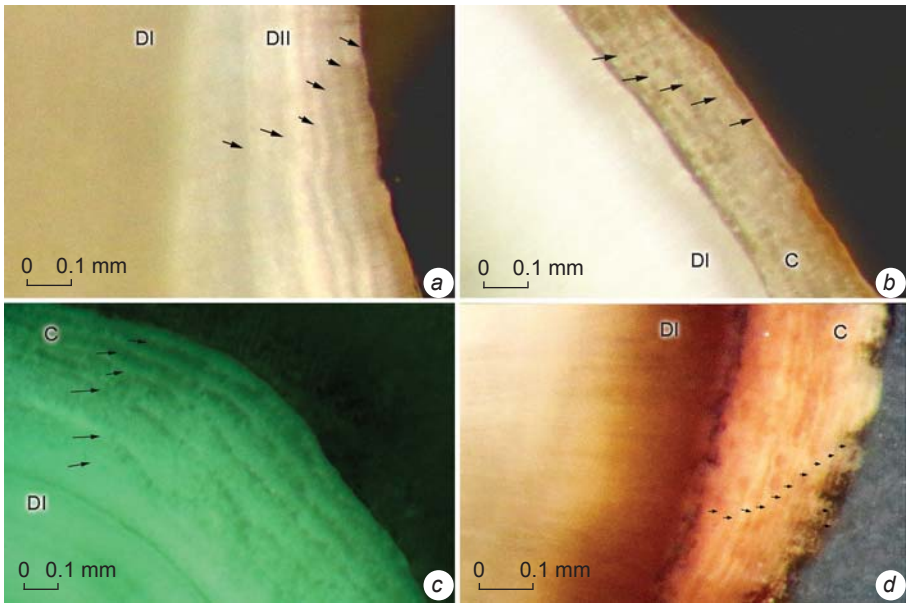

Fig. 2. Areas of transverse polished sections of animal and human teeth.
a – cattle, 6 years old, m1, the animal died in spring (Table 1, No. 2); *b* – small ruminants, 7+ years old, p4, the animal died in spring (Table 1, No. 34); *c* – cattle, 8 years old, P2, the animal died in autumn (Table 1, No. 52); *d* – human, died at the end of winter or in spring (Table 2, No. 1). Arrows indicate winter layers. C – cementum, DI – primary dentin, DII – secondary dentin.

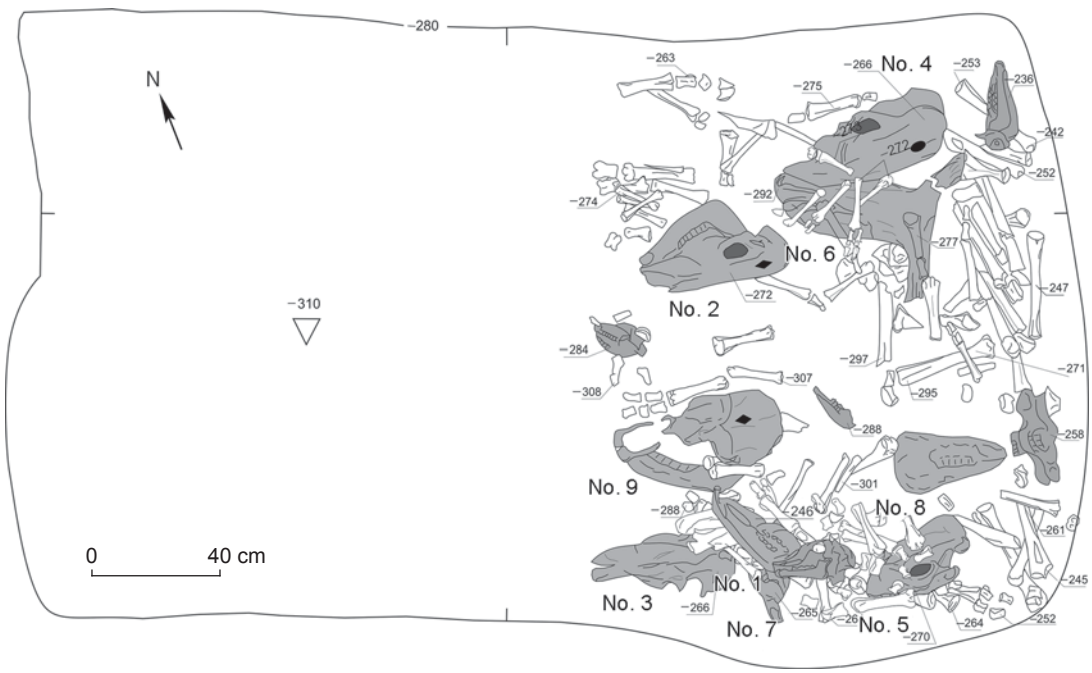

Fig. 3. The altar on the ceiling of grave 2, kurgan 8.

Sandy-loam soil rules out the possibility of any long-term leaving of the pit in the open state*. No differences in the season between the finds at the bottom and in the filling were revealed.

The situation in disturbed graves 2/5, 2/17, and 4/5 looks more ambiguous. Nevertheless, some of the bones at the bottom and ceilings were also found *in situ*. Considering the consistency of death seasons of

*During the excavation of the deep pits of this cemetery, which took up to two weeks in summer, one of the main problems was preventing the soil walls from sliding.

Table 3. **Results of the synthesis of information on the season of death of people and animals from closed complexes (grave-pits)**

Kurgan/pit	Animals		People				Season of burial*
	Spring	Autumn	Late winter – early spring	Late summer – autumn	Spring	Winter	
2/1	5	–	–	–	–	–	Spring
2/3	1	–	–	–	–	–	"
2/5	3	–	2	–	–	–	Early spring
2/6	2	–	–	–	–	–	Spring
2/7	1	–	–	–	–	–	"
2/8	3	–	–	–	–	–	"
2/10	–	3	–	–	–	–	Autumn
2/12	–	2	–	2	–	–	"
2/15	–	9	–	1	–	–	"
2/17	–	2	–	1	–	–	"
4/1	1	–	–	–	1	–	Spring
4/2	8	–	–	–	1	–	"
4/5	3	–	1	–	–	1	Early spring
4/8	2	–	–	–	–	–	Spring
4/15	3	–	–	–	–	–	"
8/2	3	3	–	–	–	–	Spring, autumn
8/3	–	4	–	–	–	–	Autumn

*The final conclusion was made taking into account the greatest possible narrowing of the interval.

individuals and animals, we can assume a funerary rite similar to that recorded in undisturbed burials.

Of the ten graves for which only the animal teeth analyses were carried out, the context of finds is reliably documented in five: three had not been disturbed (pits 2/8, 2/10, 4/15), and in two cases (pits 2/6 and 8/3) the finds were discovered on a partially preserved ceiling.

Discussion

Our results suggest the seasonal nature of the formation of the cemetery. More than 70 % of the burials were made in the spring, a little less than 30 % in the autumn, and no summer burials. The most obvious reason for the predominance of spring burials is the increased mortality during this harsh period of the year. Inadequate nutrition and decreased immunity weaken the body's natural defenses; therefore, the possibility of a rapid spread of infectious diseases arises. Infectious agents could have been especially contagious in the crowded living conditions of people in the settlement. A small number of diseases recorded from skeletal remains should not be misleading, since owing to the rapid course of the disease it may not leave characteristic markers in bone morphology but is detected upon the in-depth study (Mühlemann et al., 2018).

The absence of summer burials can be explained in different ways. The first version is based on the assumption that animal slaughtering was tabooed during the summer, in order to increase livestock number and the overall meat weight. The taboo could have also extended to the ritual sphere, which may explain the absence of altars in some burials*. The second version (which does not contradict the first) suggests the transhumance of livestock. Perhaps, most of the settlement's inhabitants lived there only during the cold period and moved to some remote pastures in summers. Accordingly, part of the community may have been buried near these hypothetical summer camps. However, to date, reliable evidence of such sites has not been found.

There are no traces of summer slaughter of animals among the kitchen remains at the settlement either. In addition, spring slaughter clearly predominates over autumn slaughter (Bachura, 2014). Most likely, the slaughter of livestock in the spring was a forced measure associated with the depletion of the fodder supply and the desire to maintain a viable part of the livestock. Autumn slaughter was focused on the procurement of the maximum amount of meat. The rapid degradation of

*Unfortunately, such complexes were not included in the analyzed sample.

pastures during their daily exploitation may have limited the possibilities of summer grazing near the settlement (Frikke, Chechushkov, Bachura, 2021). According to an alternative opinion, people of the settlement lived and kept cattle in dwellings or separate buildings all year round (Rassadnikov, 2020). Additional arguments in favor of nearby grazing are calculations of the ecological capacity of the surroundings (4–5 km) (Stobbe et al., 2016) and traces of animals living in buildings (Multidisciplinary Investigations…, 2013: 305–326; Chechushkov, Kalinin, Yakimov, 2021). Thus, the economic factor could have influenced seasonal fluctuations in the use of the cemetery.

One of the reasons for the seasonality of burials could have been the sharply continental climate of the southern Urals. Currently, the steppe and forest-steppe of the region are characterized by a significant difference (more than 30 °C) in the average temperatures of January and July. It was found that in the Late Bronze Age the climate was close to the modern one (Stobbe et al., 2016; Chechushkov, Valiakhmetov, Fitzhugh, 2021). Severe conditions in winter inevitably created serious difficulties in burying the deceased and could have influenced the cemetery composition.

The analyzed versions, however, do not clarify the causes of anomalies in the burial sample: sex disparities, a significant proportion of children aged 5–12 years, and adolescents (12–18 years old), for whom an increased risk of death is an unusual phenomenon. Thus, there is no reason to exclude the influence of socially and ideologically determined postmortem selection, which implies the inhumation in kurgans of only a part of the dead.

Conclusions

As part of the research, the odontological material from the Kamennyi Ambar-5 cemetery was studied. The analysis of the dental cementum of people and animals has allowed to ascertain the seasonal use of the burial ground. Most of the burials were associated with the spring period, and about one-third of the burials with the remains of sacrificial animals were made in the autumn. At first glance, this ratio is close to the pattern of the seasonal slaughter of animals at the settlement. But this correlation cannot be interpreted as a causal relationship in view of the obvious difference in the history of each sample formation and, most importantly, the motives for the activity.

It is difficult to assess the "contribution" of different factors to the overall distortion in the mortality structure, but it is clear that seasonality was one of them. Indirectly, the predominance of spring (including late winter deaths) burials, in the absence of summer ones in our sample, could have resulted from natural processes and transhumance. But for a rigorous argumentation for the latter, there is a lack of summer camps and burial grounds associated with them. Furthermore, seasonality was clearly not the cause of the disproportion of sexes of the buried and the significant share of those who died at the peak of vital activity. Most likely, we are dealing with a sum of various factors that influenced the composition of the buried cohort.

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A Late Krotovo (Cherno-Ozerye) Caster's Ritual and Memorial Complex at Tartas-1, Baraba Forest-Steppe

We describe a feature revealed at Tartas-1—a subrectangular pit No. 147, on the bottom of which a bivalve ceramic mold was found. A detailed description of the archaeological context and of the mold's technical properties is provided. It was destined for casting a socketed bronze chisel-celt. The process of manufacturing such a mold is reconstructed. The edges of the celt were reinforced by ribs, as in the Seima-Turbino specimens. As to cultural attribution, the pit belonged to the Late Krotovo (Cherno-Ozerye) part of the cemetery, closest to burials No. 120 and 155. The properties of these indicate a blend of Late Krotovo (Cherno-Ozerye) and Andronovo characteristics. This and related findings suggest that the mortuary ritualism of the Early and Middle Bronze Age cultures in the Ob-Irtysh forest-steppe focused on metalworking. This is especially evident at cemeteries where Seima-Turbino artifacts are present. Small memorial pits are located among the graves, or close to foundries, or within large sanctuaries. In Baraba, such autochthonous ritual practices are typical of the entire span of the Odino, Krotovo, and Late Krotovo (Cherno-Ozerye) cultures. They have not been affected by the Andronovo ritualism. A conclusion is made that rites related to metalworking mirror a progress in bronze-casting, a stage when the technological process had become specialized, and founders had acquired a special social status.

Keywords: *Baraba forest-steppe, ritual and memorial complex, Late Krotovo (Cherno-Ozerye) culture, bronze foundry, casting complex, reconstructions.*

Introduction

In Western Siberia, the Early to Middle Bronze Age burial sites associated with metallurgy reveal certain features that can be considered manifestations of the ritual and memorial practice of the relevant population (see, e.g., (Matyushchenko, Sinitsyna, 1988; Molodin, 1983; Durakov, Mylnikova, 2021; Molodin, Durakov, 2018; Molodin, Grishin, 2016, 2019)). This cult practice is best illustrated at the necropolises containing Seima-Turbino items. The features are most often represented by small memorial pits located either on the burial field or in the immediate vicinity of foundries. Sometimes, they are located on the territory of large sanctuaries, such as Lake Shaitanskoye (Korochkova, Stefanov, Spiridonov, 2020).

In the Baraba forest-steppe, similar features were noted at the sites attributed to the Odino and Krotovo cultures containing the items of the Seima-Turbino type (Durakov, Mylnikova, 2021: 43–48, 87–92). Apparently, the growing Andronovo influence in the Late Krotovo period did not change the production ritual practice developed in the Seima-Turbino time. The traits of this ritual practice were detected at Tartas-1, the largest cemetery of the Late Krotovo (Cherno-Ozerye) culture in Baraba (Fig. 1). The ritual complex located on this

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burial field (pit No. 109) contained a cache belonging to an ancient foundry man, and was described earlier in a special publication (Molodin, Durakov, Kobeleva, 2016).

This paper introduces a new similar feature located 22 m to the NW of the one described earlier.

Description of the feature and results of the study

The ritual and memorial complex was located at Tartas-1, on the southeastern slope of the terrace, where the Late Krotovo (Cherno-Ozerye) burials are concentrated, in a row of pits No. 148 and 149 associated with the Late Krotovo (Cherno-Ozerye) tombs No. 120 and 155 that were located in line with the Andronovo (Fedorovo) burials. The feature is a subrectangular pit (No. 147) elongated along the E-W line (Fig. 2). Its dimensions are 0.9 × 0.95 m. The walls are almost sheer. The depth from the virgin land level is 0.14 m. The pit's floor is flat; there are low steps in the NW and SE corners of the pit. The pit is filled with loose homogeneous dark grayish-brown sandy loam with inclusions of yellow loam. At the bottom level, 0.2 m from the western wall of the pit, there was a bivalve ceramic mold (Fig. 3). The total length of the item is 18.7 cm, the width of the halves is 5.6–6.2; the walls' thickness is 3.0–3.7 cm.

The assembled mold lay on its side. The halves were put together along the parting line, the core was missing

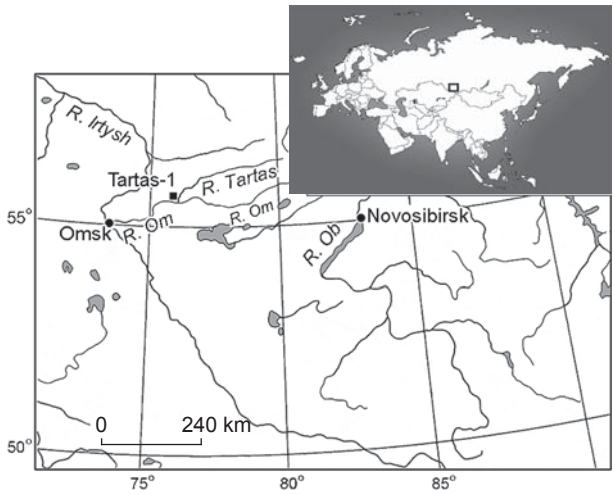

Fig. 1. Map showing location of Tartas-1.

(Fig. 4, *1*). Notably, this element of mold survives extremely rarely, because most often it is locked by the hardening metal and removed in pieces. The mold's halves were reused many times and stored in the toolkit of the ancient artisan; the core was disposable and made specifically for each cast.

The walls of the working chamber show signs of a strong thermal effect; clear traces of baking are visible on the surface. Metal intrusions were noted in the micropores of the mold's body (Fig. 4, *2*), which suggests significant

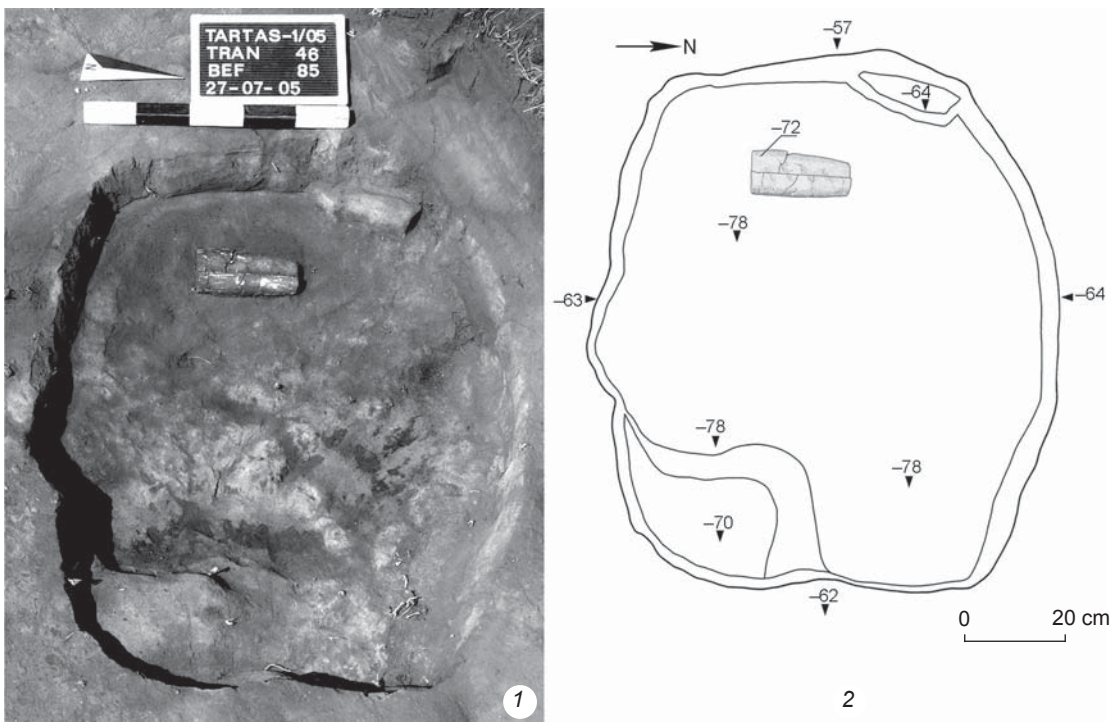

Fig. 2. Ritual and memorial complex (pit No. 147).
1 – photo; *2* – draft showing the ceramic mold location.

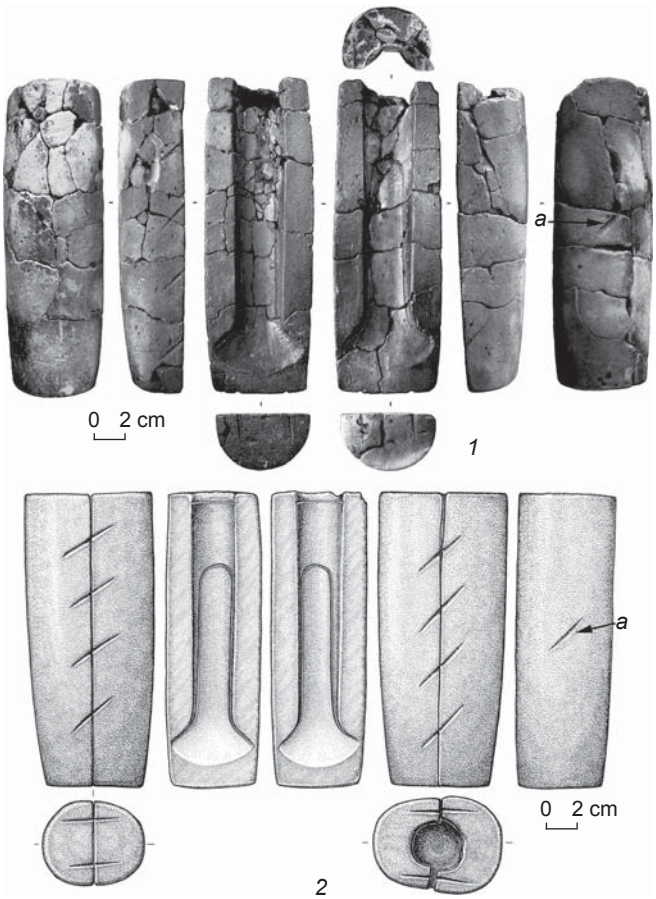

Fig. 3. Bivalve ceramic mold.
1 – photo; *2* – drawing.
a – an additional mark on the half of the mold.

overheating of it during pouring. The item was probably used many times before it was buried in pit No. 147.

The mold was made from a template; the parting edges are even, without signs of grinding. The molding mixture was composed mostly of ferruginous sandy clay, apparently taken from the Tartas banks: inclusions of small mica particles are clearly visible. The additives were dry clay, organic matter, and solitary inclusions of grog (Fig. 4, *3*; 4, *a–d*). A similar formula for molding compound of technical ceramics was used in the Ob-Irtysh forest-steppe as early as from the Odino period (Durakov, Mylnikova, 2021: 51). Such molding mixtures were also used by artisans of the classic Krotovo culture (Ibid.: 118–119, tab. 2).

The mold was designed for casting a socketed bronze chisel-celt (Fig. 4, *5*). Judging by the imprint of the working chamber, a finished tool with use-wear signs served as a template. This is indicated by the deformation typical of the template, and dents from forging of the tool visible on the imprint of the blade.

The mold making process is reconstructed as follows. At first, the tool that served as a template was half-embedded in some kind of ductile material (for example, raw clay or wax). After that, small patches of clayey paste were superimposed thereon, to form the half of the mold. The excess material was cut off from the outer side, to make the semicircular shape of the half. The surface was carefully smoothed and compacted. When the half was dried, it was turned over together with the template, and the operation was repeated to form the other half.

Upon removing the template, the surface of the working chamber was evened with a wet brush; there remained traces of the brush in the form of long parallel scratches. Most likely, several non-through punctures with a diameter not exceeding 0.8 mm were made in the mold to increase gas removal (Fig. 4, *6*). The surface of the imprint of the working chamber was smoothed, then stiffening ribs were made on its raw surface with a thin tool: this is indicated by relief lines, which are uneven in depth and width.

Four oblique lines are drawn through the parting line of the halves, on both sides of the mold; two more similar lines are drawn at the base and at the neck (see Fig. 3). This was done to facilitate centering when connecting the halves of the mold. This method of mold-centering was used by casters in the Early Bronze Age; their products were found at the sites of Saigatino (Surgut Region of the Ob) (Koksharov, Chemyakin, 1991: 46–47, fig. 2, *1*, *d*; 3, *1*, *c*, *f*) and Samus-4 (Tomsk region) (Matyushchenko, 1973: Fig. 7, *7*; 11, *1*, *2*). The Late Krotovo molds with centering marks were recovered from burial No. 91 of the Sopka-2/5 cemetery (Baraba forest-steppe) (Molodin, 1985: Fig. 28, *1*, *5*; Molodin, Grishin, 2019: 93–94, fig. 138, *2*; 140, *3*) and from grave No. 323 at Tartas-1 (Molodin, Durakov, 2018: 31, fig. 9). Among the Krotovo artifacts, such marks were recorded on a ceramic mold from the settlement of Abramovo-10 (Baraba forest-steppe) (Molodin et al., 2018: 50–51, fig. 2).

The mold under study, which currently has no analogs, shows one more oblique line scratched on the back side of one of the halves (see Fig. 3, *1*, *a*; 2, *a*). The line was probably a sign of marking of an interchangeable part, given a general standardization of production.

A celt-axe cast in the mold under consideration should have had a round socket decorated with a convex roller along the upper edge, and a broad arcuate blade (see Fig. 4, *5*). The total length of the tool is 17.2 cm; the width of the working part is 5.3 cm. The socket gradually increased in diameter from 2.8 to 3.1 cm. On the front side, the edges of the celt are reinforced with side stiffeners, which converge in the upper part forming an arch. The presence of stiffening ribs brings this item closer to the Seima-Turbino type celts, and apparently suggests the continuation of the Seima-Turbino trend of development. Evidence of the survival of the technology of making

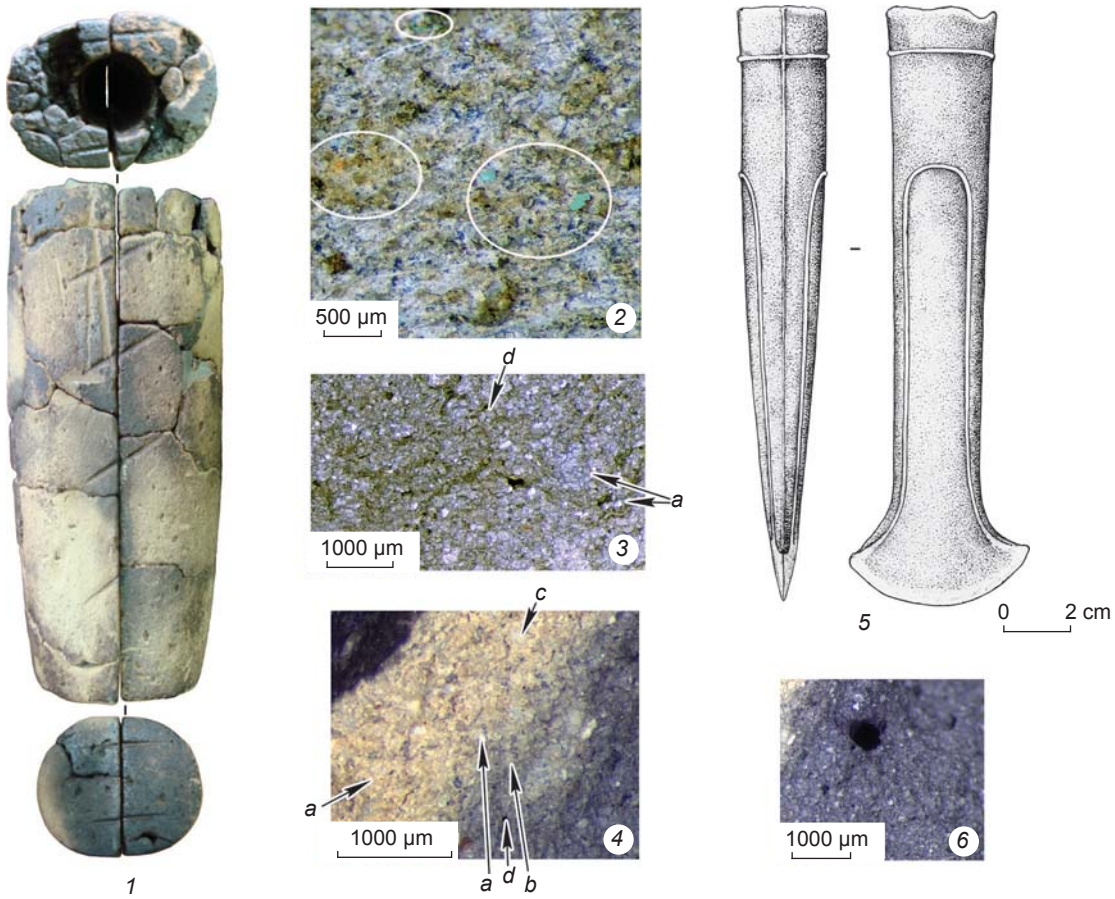

Fig. 4. Bivalve ceramic mold.
1 – assembled; *2* – micrograph of the molding-mixture sample showing metal intrusions in the micropores; *3*, *4* – micrographs of the molding mixture sample showing lumps of dry clay, organic matter, and solitary inclusions of grog: *a* – mica particles, *b* – dry clay, *c* – grog, *d* – traces of burnt out organics; *5* – reconstruction of a socketed bronze chisel-celt on the basis of the bivalve ceramic mold; *6* – micrograph of the molding-mixture sample showing a non-through puncture in the mold body.

celts of the Seima-Turbino type among the Late Krotovo (Cherno-Ozerye) people is a casting mold found in burial No. 323 at Tartas-1 (Molodin, Durakov, 2018: 31, fig. 8, *9*).

Notably, the arcuate facet formed by stiffening ribs makes this cast product similar to the Dancu-Jesenice (Florentin) type celts from the Danube-Carpathian region (Dergachev, 2011: 92–94, fig. 50, *1–12*). The overall proportions of the item (ratio of width and height) and the oval section throughout its length do not correspond to the Seima-Turbino standard; i.e. we can assume the elimination of this tradition.

Celt-adzes of elongated shape, with wide straight blades, have been reported from the Andronovo sites in Central Asia (Kuzmina, 2007: Fig. 53, *28*; 77, *12*). Apparently, they were used for specific purposes. A similar tool, re-forged from a grooved chisel, was contained in the Balandino cache, found on the left bank of the Irtysh River (Moshinskaya, 1957: 144–145, fig. 61, *4*).

The cultural affiliation of the studied complex is indicated by its location in the Late Krotovo (Cherno-Ozerye) part of the Tartas-1 cemetery. Pit No. 147 was located in the immediate vicinity of the Late Krotovo (Cherno-Ozerye) burials No. 120 and 155 set up in line with the Andronovo (Fedorovo) burials. Parallel to this row, there was another distinct line with at least 11 graves, four of which—No. 105, 110, 107, and 115 (Fig. 5)—represent the Late Krotovo (Cherno-Ozerye) culture. The funeral rite recorded in these and in graves No. 120 and 155 reflects merging of Late Krotovo (Cherno-Ozerye) and Andronovo features. For example, in burials No. 105 and 120, the dead were laid in an extended supine position (the Krotovo feature), while the grave goods included vessels of the Andronovo culture.

As noted above, ritual complexes associated with metalworking production were typical of the funeral practice in the Ob-Irtysh forest-steppe in the Early and Middle Bronze Age. Such ritual activity persisted throughout the Odino, Krotovo, and Late Krotovo (Cherno-Ozerye) periods. Two variants of funeral rite can be distinguished: the first—the ritual cache was placed

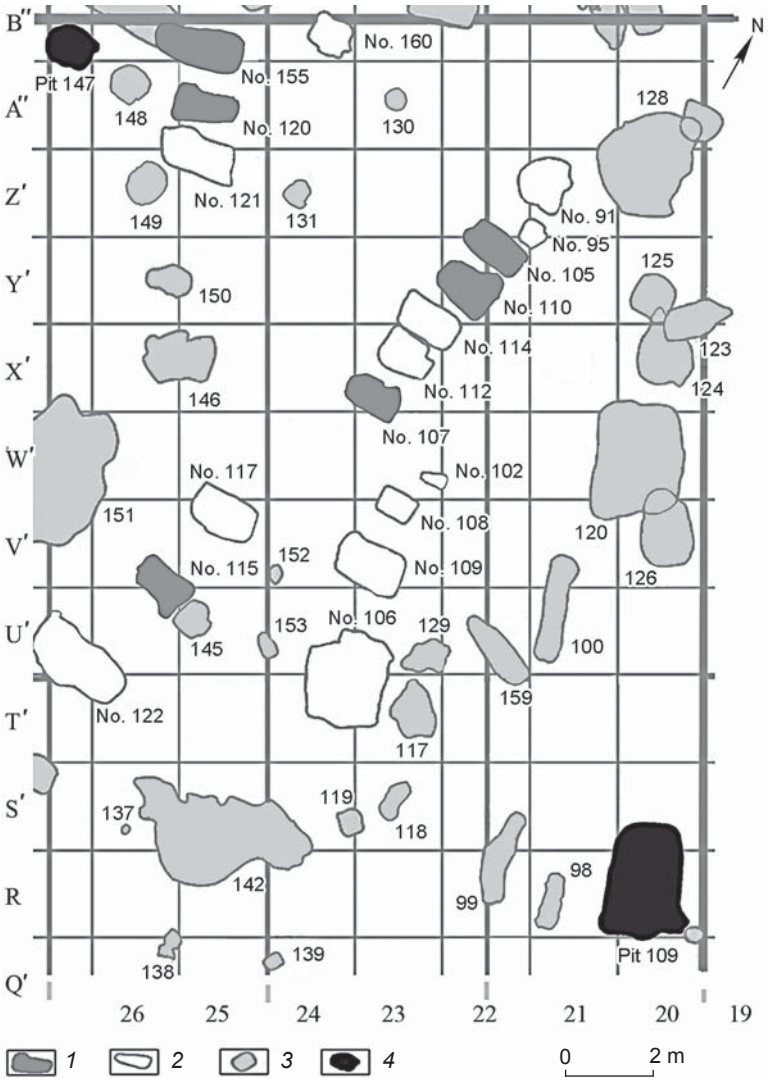

Fig. 5. Plan of the section of the Tartas-1 excavation area showing ritual pit No. 147 location.

1 – Late Krotovo (Cherno-Ozerye) burial; *2* – Andronovo (Fedorovo) burial; *3* – pit; *4* – ritual pits associated with bronze casting.

on the edge of the grave, under the turf, at the level of the virgin land; the second—a shallow pit was dug in the virgin land, into which sacrificial items were placed either all together at the bottom level, or in several stages as the grave was filled.

The connection of these structures with ideas about the other world is emphasized by the placement of the features on the sacred territory of necropolises and by similarity with burial features in design (subrectangular shape of the pits), orientation (they are parallel to the graves), and their inclusion in the rows of burials or memorial pits. Because of these peculiarities, such features were often perceived by researchers as cenotaphs. For example, "conventional burial" No. 4, found at the Rostovka cemetery, despite the absence of human remains therein, was interpreted as a grave-pit with fragments of foundry equipment (Matyushchenko, Sinitsyna, 1988: 10, fig. 11, *a*, *b*). The Late Krotovo (Cherno-Ozerye) burial No. 91 containing molds, at the Sopka-2/5 cemetery, can be considered a close parallel to the complex under discussion (Molodin, Grishin, 2019: Fig. 24).

Importantly, objects related to such ritual actions are epochal markers and are reported from a wider area than the distribution area of the Krotovo culture. For example, at the Turbino cemetery, most of the bronze tools were found in small pits under the turf, or in cenotaphs. Grave goods included items related to foundry production—sprues and semi-finished castings (Bader, 1964: 93, fig. 80, *A*; 83, *D*]. The same way of offering was recorded at the sanctuary of Lake Shaitanskoye (Korochkova, Stefanov, Spiridonov, 2020: 37–50). Foundry waste, sprues (casting bowls filled with metal, revealing remains of the gate), and small ingots were found over the sacral area at this site (Ibid.: 82, fig. 31, 38–40, 44–47).

The interment of foundry equipment at the territory of necropolis apparently symbolized the association of these items with the realm of the dead. Burying in the ground is the most ancient and common way of "moving" an object to the other world. In the ethnographically modern period, such rituals were practiced by most of the aboriginal peoples of Siberia (Kosarev, 2003: 145–146). Ideas about the relations of metalworking with the other world were widespread. In the general Turkic religious tradition, the lower realm is often associated with a forge (Lvova et al., 1988: 109–110). Similar ideas are typical, for example, among the Maasai and Wachaga (Chaga) in East Africa (Cline, 1937: 114–117].

The casting mold from the ritual and memorial complex in pit No. 147 at Tartas-1 can be considered either grave goods intended for the nearby buried casters, or the rite of disposal of a sacred object—a casting mold.

Traditional peoples familiar with metalworking used to bury obsolete blacksmith equipment until the ethnographically modern period. Wafipa tribes in East Africa perceive the forge as a living being experiencing cycles of birth, life, and death (Schmidt, 1931: 25). The sacralization of metallurgical equipment and its use as amulets are recorded among the Wachaga, Banyankole, and Bakitara peoples (Cline, 1937: 115–

119). Veneration of the main blacksmith tools and the sacralization of metallurgical waste have been noted among the Abkhazians (Ardzinba, 1988: 263; Adzhindal, 1969: 234–235; Chursin, 1957: 67). In the Buryats and Yakuts ideology, the blacksmith and his tools are associated with magic and otherworldly forces (Lygdenova, 2013: 63).

Conclusions

Scholars argue that the functions of intermediaries between the world of people and either the upper world of the gods, or the chthonic lower world, or between both of these worlds, were typical of blacksmiths (Metallurgiya…, 2018: 88). "In the archaic perception, the fact of mastery… brings the craftsman closer to the gods" (Ibid.). In early traditional societies, sacred activity was an integral part of production, and the ritual ceremony accompanying this production was a key factor for the success of an artisan (Schmidt, 1931: 1). Investigation of ritual pit No. 147 at Tartas-1 has allowed for the conclusion that the indigenous population of the Baraba forest-steppe in the Middle Bronze Age retained the ancient ritual practices, despite the arrival in this territory of the Andronovo (Fedorovo) people, who changed the history of the population of the region. The burial complexes of the Late Krotovo (Cherno-Ozerye) culture are built into the same rows with the Andronovo (Fedorovo) burials, while being (as earlier) accompanied by ritual complexes (see Fig. 5); the cultural affiliation of the ritual complexes is determined (as in the case of pit No. 147) by the features of the foundry-equipment manufacturing technology.

The casting mold found in the Late Krotovo (Cherno-Ozerye) ritual complex (pit No. 147) marks the cultural processes that took place among the population of that time. The progressive development of bronze casting is evidenced, for example, by an increase in the temperature of pouring metal, the complication of molding methods (changes in the design of the mold improved its performance—gas removal and heat capacity). The progress was ensured by a combination of Krotovo and Andronovo production traditions: casting the products of the Timber Grave-Andronovo types was carried out with maintaining the advanced Krotovo methods of making the molds. The irrational attitude towards foundry production also persisted among the indigenous population. The evidence of ritual practices associated with metalworking among the population of the Baraba forest-steppe in the Middle Bronze Age suggests a high level of separation of blacksmiths-casters within the community, and specialization of their activities.

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Star-Shaped Pendants from the Perm Region, Western Urals: Hunnic Polychrome Ornaments Reanimated

The set of personal ornaments of the Lomovatka culture, western Urals (AD 800–1000), includes star-shaped pendants with a copper or silver plate as a base decorated by medallions with inserts, bordered by gold elements with granulation and filigree and by silver details with filigree and embossment. Analysis of the items suggests that the central medallions of such pendants significantly differ from the other constructive elements such as the base, stamped silver wire, and embossed tripartite rosettes, not only in the composition of the metal, but also in terms of technical sophistication of the medallions—the use of fine filigree, calibrated fine granulation, cabochons, etc. Other elements of star-shaped pendants include pegs having no practical function. It was found that the central medallions with inserts were once part of other personal ornaments. For secondary use, they were soldered to the base in their final form. The search for parallels has led to the conclusion that these elements were parts of ornaments of the 5th–6th century polychrome style. Their exact source remains a mystery, but local jewelers made excellent use of them by setting them off with silver. Star-shaped pendants are rather standard, they are few in number, and the time of their manufacture was likely limited. Judging by the burials, they were used as women's pectoral ornaments.

Keywords: *Middle Ages, Perm Region, western Urals, Lomovatka culture, star-shaped pendants, jewelry techniques, Hunnic polychrome style.*

Introduction

Most of the researchers of medieval antiquities from the Perm Territory have agreed that all the precious metal jewelry discovered in the region was imported. Yet, a more detailed approach to analyzing such items has led to a conclusion in favor of domestic jewelry production in the Perm Cis-Urals, which was notable in its own set of technological methods and stylistic originality (see, e.g., (Podosenova, 2021b)).

So far, the studies have focused on the most numerous category of jewelry—temporal ornaments (Podosenova, 2021a). Analysis of techniques used in their manufacture has revealed that local jewelry production emerged already in the 8th century AD. By the end of that century, the Kama artisans mastered the skills of embossing, drawing metal, soldering, and decorating items with stamped wire and granulation. Starting in the 9th century, they commanded the use of gilding backgrounds, making inlays with different materials, and chasing; from the 10th century, they produced filigree by twisting, and from the 11th century they mastered the niello technique. The Kama jewelry production further evolved in the Rodanovo archaeological culture (12th–15th centuries). These techniques were rather labor-consuming, and their widespread use indicates

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a relatively high level of skills possessed by the local jewelers (Ibid.: 178).

The period from the 9th to the first half of the 10th century was a special time in the development of the Kama jewelry craftsmanship. The borrowing of technical methods and structural elements increased in that period, which resulted in expansion of typological diversity (Ibid.: 129, 147) throughout the entire assortment of jewelry.

Distinctive star-shaped pendants of sophisticated structure stand out among the products of local jewelers, combining different jewelry techniques and materials like no other (Fig. 1). For a number of reasons, they were not commonly used. Despite the fact that these ornaments were definitely a typical element of the Lomovatka culture, little is known about them, although individual items (or their elements) have long ago been published (Spitsyn, 1902: Pl. II, 4, 6; XXXI, 10; Talitsky, 1940: Pl. V, 60; Belavin, 2000: Fig. 39). Judging by the evidence from burials, these pendants were women's pectoral ornaments (Fig. 2).

Description of the finds

Twenty-one star-shaped pendants have been identified in published materials and archaeological collections. Although only two of them were found outside the area of the Lomovatka culture, they appeared at sites with marked influence of this culture—the Kochergino cemetery in the Vyatka River basin, and the Kheibidya-Pedar sacrificial site on the More-Yu River. None of the collected items has survived without losses. Since the soldering of elements made of various metals is very undurable, the vast majority of items were found in a disassembled state and required restoration. This made it possible to focus on the technological features and composition of materials of the available items. The results of analysis turned out to be completely unexpected and gave rise to many questions related to the emergence of this category of jewelry.

Generally, the items under discussion are star-shaped plates (4-, 6-, or 8-pointed) made of copper or a copper-based alloy. Elements soldered to the plate were assembled separately and included a setting with stone insert framed

Fig. 1. Star-shaped pendants and their elements.
1 – Redikar hoard (State Hermitage, No. 535/48); *2–9* – Bayanovo cemetery: *2* – burial 389, *3*, *4* – burial 61, *5*, *6* – burial 136, *7* – burial 480, *8* – burial 101, *9* – sector A 2017; *10* – burial 51 at the Redikar cemetery.

by filigree work (*drobnitsa*, according to A.A. Spitsyn (1902: 27)) made of precious metals, as well as embossed elements (Fig. 3). Since composite star-shaped pendants included elements differing significantly in manufacturing technique, we should discuss them group-by-group.

Elements with inserts, made in the filigree technique, differ in shape, material, and technological features (Fig. 4).

Type 1, *oval* (see Fig. 1, *1*, *2*, *5–10*; 2, *1*; 3, *1*), 10 items (Redikar hoard, burial 51 at the Redikar cemetery, burials 101, 136 (2 items), 389, 480, and sector A of 2017 at the Bayanovo cemetery, the Verkhne-Berezovsky settlement, and Trubensky cemetery). The central medallion measuring from 11 × 14 to 24 × 27 mm was assembled on a separate silver plate (76–90 % Ag*). Its elements—filigree decor and setting for the insert—were made of an alloy based on gold and silver (53–80 % Au, and 27.5–14.4 % Ag). The oval setting made of a thin metal strip placed on its edge was soldered to the plate at a right angle. The inserts were cabochons of amber (see Fig. 1, *1*, *6*, *10*; 2, *1*) and carnelian (see Fig. 1, *5*; 3, *1*), or a colorless translucent stone (see Fig. 1, *7*), rising above the top of the setting. The insert was fastened by the tight rim of the setting holding it, bordered by a thin stamped wire (up to 0.5 mm), on which regular transverse notches were made, imitating granulation. A small "equatorial" incision was made on the "grains", which gave the wire even greater decorative effect (see Fig. 4, *1*, *a*, *c*, *2*, *a*, *c*, *e*, *4*). On some items, such wire was also placed along the outer perimeter of the central medallion (see Fig. 4, *2*, *a*, *c*) or along the outer perimeter and between "braids" of filigree (see Fig. 4, *4*). Rows (2–4) of thin (up to 0.3 mm) filigree wire with multidirectional twists, which created the effect of a "braid" (see Fig. 1, *1*, *a*, *5–9*; 4, *1*, *a*, *c*, *2*, *a*, *c*, *e*, *3*, *4*), ran along the outer edge of the medallions or between the rows of "granulated" wire. An exception

Fig. 2. Star-shaped pendants and their elements.
1 – Verkhne-Berezovsky settlement (*a* – after (Spitsyn, 1902: Pl. II, 6), *b* – photo from the exposition of the Perm Museum of Local History); *2*, *3* – Kheibidya-Pedar sacrificial site (after (Drevneye svyatilishche…, 2016: No. 364, 690)); *4* – burial 51 at the Redikar cemetery; *5* – burial 103 at the Bayanovo cemetery; *6* – Pitersky (Stepanovo Plotbishche) cemetery.

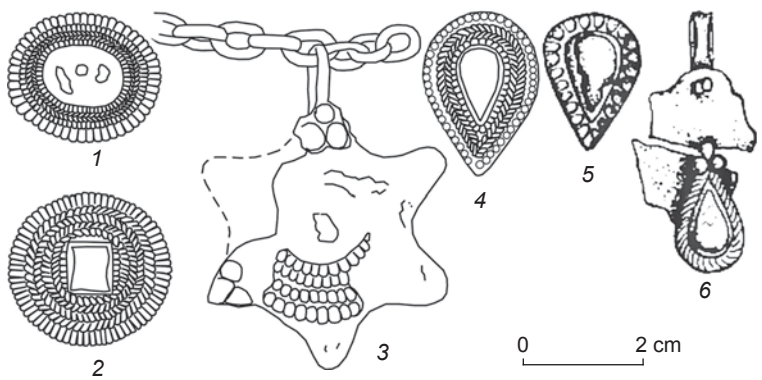

Fig. 3. Star-shaped pendants and their elements.
1 – Trubensky cemetery (after (Spitsyn, 1902: Pl. II, 6)); *2* – village of Kharino (after (Spitsyn, 1902: Pl. XXXI, 10)); *3* – burial 5 at the Kochergino cemetery (after (Talitsky, 1940: Pl. V, 60)); *4* – burial 92 at the Averino cemetery (after (Goldina, Kananin, 1989: Fig. 45, *38*)); *5* – Malo-Anikovskoye cemetery; *6* – burial 102 at the Ogurdino cemetery (after (Belavin, 2000: Fig. 39, *8–9*)).

*Chemical composition of metal in all cases was established using X-ray fluorescence analysis. The measured surface was not subjected to mechanical cleaning owing to the fragility of the items.

Fig. 4. Structural elements and technological features of manufacturing star-shaped pendants.
1–3, *5*, *8* – Bayanovo cemetery: *1* – burial 480, *2* – sector A 2017, *3* – burial 136, *5* – burial 101, *8* – burial 389; *4*, *6* – Redikar hoard; *7* – burial 51 at the Redikar cemetery.

was the medallion on the item from the Verkhne-Berezovsky settlement, where the setting was bordered with fine granulation and two rows of fine filigree wire laid in a "braid" (see Fig. 2, *1*, *b*).

There are indications that these elements were once a part of other ornaments, and were reused. For example, many items show the remains of pegs under the settings, which have no practical purpose in the pendants under discussion. In this regard, a medallion that has a missing insert, found at the Bayanovo cemetery, is noteworthy (see Fig. 1, *9*). On its front side, in the center of the setting, there is a square hole; and on the reverse side, a round hole and traces of a cut peg (see Fig. 4, *2*, *b*, *c*). The head of the peg under the insert was covered with beading of a multicomponent alloy (Ag-Sn-Au-Cu-Pb, where Ag was 40.2 %, Sn was 24.8 %, and Au was 21 %), which served as a substrate for the insert (see Fig. 4, *2*, *a*, *d*). A hole with remains of a bronze peg in it (see Fig. 4, *1*, *b*) appears on the reverse side of the central medallion on another item from that site, yet neither the exit of the peg nor the hole are visible through the translucent stone on its front side (Fig. 4, *1*, *a*), which means that there must be a similar substrate under the insert. The pegs were not always cut in the same plane as the plate, and in such cases a hole was made in the plate, where the rest of the peg was inserted, so that the medallion would tightly adjoin to the base of the pendant (see Fig. 1, *1*, *b*; 2, *1*, *b*; 4, *6*). The end of the peg was often left without planishing.

The central medallion was framed by one to three rows of thicker (1–2 mm) silver stamped wire (79–92 % Ag) with a "granulation" effect, soldered directly onto the figurate plate base of the pendant. This wire was coarser in execution: the "grains" were irregular, of various sizes; they did not have "equatorial" notches; there were manufacturing defects in the form of non-stamped areas (see, e.g., Fig. 4, *8*). Along with "granulated" wire, stamped wire was used, containing straight deep notches, between which were located less deep regular notches. Rows of silver wire usually survive soldered together; in an item from Bayanovo (see Fig. 4, *1*, *e*), remains of the soldering of a tin-based alloy (78.7 % of Sn, 5.95 % of Pb, and 15.3 % of Cu) have remained on its reverse part.

Type 2, *round* (see Fig. 2, *5*, *6*; 3, *2*), 3 items (Pitersky (Stepanovo Plotbishche) cemetery; burial 103 at the Bayanovo cemetery; village of Kharino). The most informative item is the pendant from the Pitersky cemetery (see Fig. 2, *6*). The cast central medallion with square setting and insert of dark glass is bordered by rows of pseudo-filigree wire (owing to the large amount of patina, it is visually difficult to establish the material and manufacturing technique, but two rows of "braids" made of pseudo-filigree wire are clearly visible) and silver stamped wire (Fig. 2, *6, a*). A peg is visible on the reverse side of the item (see Fig. 2, *6, b*).

A medallion similar in appearance was found in the village of Kharino (see Fig. 3, *2*). According to Spitsyn, the item consisted "of large *skan* filigree, large incised filigree, and was equipped with an insert" (1902: 44, pl. XXXI, 10). Another similar item comes from the Bayanovo cemetery (see Fig. 2, *5*). The decoration was

remodeled due to the loss of the central element. An oval setting with amber insert has survived in fragments. Four embossed elements, similar to those used in decoration of the points on a star-shaped base, but cut off and fitted to the setting, were adjacent to it. The lost central medallion was framed by two rows of stamped silver wire.

Type 3, *teardrop-shaped* (see Fig. 2, *3*, *4*; 3, *4*, *6*), 4 items (burial 51 at the Redikar cemetery, Kheibidya-Pedar sacrificial site, burial 92 at the Averino cemetery, burial 102 at the Ogurdino cemetery). On the ornaments from the Redikar cemetery and the Kheibidya-Pedar sacrificial site, the medallions have a base made of a silver plate to which a bezel setting of a thin gold band placed on its edge was soldered. A teardrop-shaped amber insert was fastened by bending forward the rim of the setting. The setting was framed by gold, stamped "granulated" wire; the "grains" had small "equatorial" incisions (see Fig. 4, *7*, *b*, *c*). The teardrop-shaped elements were bordered by stamped silver wire with "granulation" effect (see Fig. 4, *7*, *a*), soldered to the base of the pendant. As opposed to the gold wire, the "grains" on the silver wire were large and irregular. A hole was punched on the reverse side of these elements, and remains of a bronze peg, which had no practical purpose in this item, could be seen (see Fig. 4, *7*, *d*).

According to the drawing (see Fig. 3, *4*), the teardrop-shaped element from Averino was designed like oval pendants: a setting with a teardrop-shaped stone insert was framed by thin and thicker stamped "granulated" wire, with a "braid" of filigree between them. The material was not indicated in the publication. The item was interpreted as an element of a temporal pendant that rotated freely (Goldina, Kananin, 1989: 62, fig. 45, *38*).

Judging by the description, the teardrop-shaped item from the Malo-Anikovskoye cemetery (see Fig. 3, *5*) had a bronze base, a setting framed by imitation of granulation, and an insert of blue glass (Belavin, 2000: Fig. 39, *8*). Another item of similar shape with remains of a plate with a loop (see Fig. 3, *6*) comes from the Ogurdino cemetery. The base of that item was cast in bronze. The teardrop-shaped amber insert in the setting is framed by cast imitation of stamped wire. A triangle of pseudo-granulation is located at the sharp end of the "teardrop" (Belavin, Krylasova, 2012: 133, fig. 59, *20*). The teardrop-shaped element was detached from the plate base. The drawing shows a variant of its location in comparison with the pendant from Redikar. However, judging by the triangle of pseudo-granulation, it is possible that it was a pendant similar to the one found in the sanctuary on the More-Yu River.

Embossed elements made of silver were used in decoration of the points in star-shaped pendants; with one exception (see Fig. 2, *5*), when similar cut elements were used in the central part of a decoration in place of a lost filigree medallion.

Type 1 (see Fig. 1, *2*, *7*, *8*; 3, *3*), 4 items (burials 101, 389, and 480 at the Bayanovo cemetery, burial 5 at the Kochergino cemetery). The triangular figure was formed by three dots. The imprinted elements were cut out with a bit of excess metal for their subsequent soldering to the base.

Type 2 (see Fig. 2, *6*, *a*), 1 item (Pitersky (Stepanovo Plotbishche) cemetery). Embossed triangles with nine bulges most likely imitated granulated triangles.

Star-shaped pendants, including the elements described above, with one exception, had for their base a figurate plate made of copper or a copper-based alloy. The elements were soldered to the plate blank, which was then carefully trimmed so that the copper base was not visible from under the precious elements. For attaching the pendants, a loop, which was made by bending copper plate, was soldered to the back. Such loops have survived only on the items from the Pitersky (see Fig. 2, *6*) and Ogurdino (see Fig. 3, *6*) cemeteries, but some items show distinct traces of them with solder residues (see Fig. 1, *1*, *b*; 2, *4*, *b*; 4, *6*). An exception is the pendant from the Kheibidya-Pedar sacrificial site, which was equipped with a cast loop (see Fig. 2, *3*). According to the shape of the base, the items can be divided into three types.

Type 1 with eight points (see Fig. 1, *1*, *2*), 2 items (Redikar hoard, burial 389 at the Bayanovo cemetery). One large pendant (5.8 × 5.4 cm) was almost intact (see Fig. 1, *1*). The oval medallion in the center was elongated horizontally. Solder residues from the wire frame remained around the medallion. The points showed distinct traces of non-surviving embossed elements*. Another similar pendant was heavily fragmented (see Fig. 1, *2*), but the location of the preserved points shows that it was also eight-pointed, similar in size to the one described above. The central medallion was missing. Three rows of stamped silver wire bordering it, as well as individual embossed elements of type 1, were preserved on the base. Traces of solder from the lost embossed elements were visible on the points of the base.

Type 2 with six points (see Fig. 1, *3–8*, *10*; 2, *3*, *5*, *6*; 3, *3*), 11 items (burial 61 (2 items), 101, 103, 136 (2 items), and 480 at the Bayanovo cemetery, burial 51 at the Redikar cemetery, Pitersky cemetery, burial 5 at the Kochergino cemetery, and Kheibidya-Pedar sacrificial site). The size of the figurate plate base ranged from 2.7 × 2.7 to 5.3 × 5.5 cm. Burial 61 at Bayanovo contained two six-pointed plates without decorative elements (see Fig. 1, *3*, *4*); however, judging by the traces of solder, they were the same as decorative elements on most of the pendants

*In addition to the eight-pointed star-shaped pendant described above, the Redikar hoard included "a bronze plate in the form of a star with a maximum length of 4 cm, oxidized, dented, with some points broken off, and torn edges" (State Hermitage Museum, No. 535/49, inventory).

of that type. The decor included a horizontally elongated oval medallion (with an insert and filigree decoration) in the center of the base, and embossed elements of type 1 on the points of most items. The pendant from the Pitersky cemetery showed embossed elements of type 2.

The pendant from the Kheibidya-Pedar sacrificial site stands out among other items (see Fig. 2, *3*). It has a bronze plate base with cast loop. A round medallion with a diameter of 1 cm and a gold setting, with amber insert, framed with a "granulated" stamped wire, is in the center. The collection from that site contains a similar item with a lost insert, but with a surviving peg and disc (see Fig. 2, *2*). This item was interpreted as a belt onlay (Drevneye svyatilishche…, 2016: Fig. 2.2.12, *14*). Teardrop-shaped elements—gold settings with amber inserts, edged with gold "granulated" stamped wire—were placed on the points of the star-shaped pendant. A frame made of stamped silver "granulated" wire with three granules at the end has survived on one point. Traces of solder indicate that all the teardrop-shaped elements and the round one were framed with similar wires. Judging by the figuratively carved ends, granules were also on all the points.

Type 3 with four points (see Fig. 2, *1*, *4*), 2 items (burial 51 at the Redikar cemetery and Verkhne-Berezovsky settlement). These two pendants are very different. The item from Redikar measures 2.8 × 2.8 cm and is the only one with a hanging loop attached not to one of the points, but between them (Fig. 2, *4*, *b*). Teardrop-shaped elements (two survived, but judging by the traces of solder these were on all the points) were placed with their pointed ends towards the center.

The ornament found in the Verkhne-Berezovsky settlement (see Fig. 2, *1*) had a base made of a cross-shaped silver plate (6.5 × 6.5 cm) with rounded arms. Oval medallions have survived on three arms and in the center; on one arm, the medallion was lost (the item is kept in the main exposition of the Perm Museum of Local History; see Fig. 2, *1*, *b*), although on the drawing in Spitsyn's album, it was still in place (1902: Pl. II, 6). Notably, during restoration, the gold oval medallions with inserts were attached in a different manner than is shown in the drawing, where (judging by the traces of solder) they were located correctly. The drawing contains an important structural element—a frame made of large filigree (probably stamped) wire around the lost medallion (see Fig. 2, *1*, *a*).

Discussion

At the present time, it is difficult to say anything definitive about the origin of these items. So far, no prototypes have been identified. It is possible that the design of the star-shaped pendants was chosen by local jewelers for using elements with inserts and gold filigree decor in a most spectacular way. A detailed study of these items shows that individual structural elements differ significantly in terms of workmanship.

The medallions with gold settings and filigree decor were manufactured perfectly, on a high professional level. This is observed in the correct shape of the inserts and accuracy of the fitting of ornamental stones, careful bending of the rim of the cast inward, well-conceived granulation effect of stamped wire, use of very thin filigree wire (up to 0.3 mm) and fine calibrated granulation, absence of streaks and excesses at the joints of parts, as well as in the variation of metals (silver, gold). It is noteworthy that gold was not typically used in the manufacture of filigree by medieval Kama jewelers. They widely used gilding; and when they produced solid gold items, these items were technologically simple (for example, wire temporal rings). In addition, real filigree was not used at the time when the star-shaped pendants were produced in the jewelry industry of the Perm Region of the western Urals. Instead, stamped wire and later twisted wire was used, creating an effect that outwardly resembles filigree (Podosenova, 2021b: 84–89).

The feeling of high professionalism disappears when we turn to the figurate bases of the pendants and to the silver filigree and embossed elements soldered to them, which are of completely different quality. The details are large; the cross-section of the filigree elements is 1–2 mm; they have flaws manifested by irregularity of notches on the wire and different gaps between them; external seams are crudely filled with solder, with streaks and excesses.

In general, the central medallions seem to formerly have been parts of other artifacts, and were soldered to the base in their final form. Remains of pegs testify to their secondary use. These were neatly cut off. If the pegs were on the reverse side of the artifact, they had no practical purpose and were polished, trimmed to the base, but not even planished. Most likely, these were formerly the elements of a belt set.

There is no doubt that the gold elements with inserts were the products of jewelry workshops with deep artisanal traditions and specialized tools. Typologically and technologically similar items could not be identified among the contemporaneous evidence. However, the search for parallels ended with an unexpected result. Specific chemical-technological and formal features, observed in the analysis of the items, were typical of the jewelry in the polychrome style of the Hunnic and post-Hunnic periods (Zasetskaya, 1994: 60). According to differences in inlay technique, such items can be divided into two groups: artifacts with inserts in soldered sockets and those with inserts in cloisonné cells (Zasetskaya, 1982: 14). The elements under consideration belong to the first group, which shows a combination of a gold

background with bright inserts of red semi-precious stones and onlaid wire ornamentation (Ibid.: 16). "Items of this group have a bronze plate base covered with a thin gold or electrum sheet, the edges of which are bent and fit tightly to the bronze base. Sometimes, the upper sheet was attached to the base with pins and rivets located under the inserts" (Zasetskaya, 1994: 69). The design of sockets for inserts was the most common: a folded narrow band was soldered to the surface on its edge, and the base of the socket was decorated with a border of granulation or wire (Ibid.: 70). The similarity of the elements under discussion to artifacts in the polychrome style is suggested by the use of two alloys—silver as a substrate and gold for the manufacture of decorative details (the setting, filigree elements) (Morskoy Chulek…, 2007: Pl. VIII, 1, 2, p. 166, No. 19, p. 167, No. 20, 21), by the presence of copper fastening pegs in silver and gold items (Ibid.: 81, pl. VIII, 3, p. 167, No. 21), substrates under stone inserts in the form of foil or metal ("cement") poured into the sockets (Ibid.: 60, 155), the use of stamped wire with regular granulation effect, real filigree (Ibid.: 79), etc. The item found at the Kheibidya-Pedar sacrificial site (see Fig. 2, *2*), and the insert from a similar item on a star-shaped pendant (see Fig. 2, *3*, *a*) find their direct parallels in horse harness decorative elements from the Morskoy Chulek cemetery (Ibid.: Fig. 28, *3–9*).

Scholars express different opinions on the places where the items in the polychrome style were produced. These could have been Bosporan (Zasetskaya, 1982: 24), Byzantine (Morskoy Chulek…, 2007: 62), or Central Asian workshops (Ibid.: 80). After mapping the Ural sites with artifacts in the polychrome style, I.E. Lyubchansky concluded that these were located on the northern branches of the Great Silk Road, and their location may indicate penetration of these items from the production centers of Central and Western Asia (2009: 16).

The use of "antiques" by the people of the Lomovatka culture was by no means a rare occurrence. It is sufficient to recall the unique belt of the "Byzantine type", dated to the 8th century, from the burial of the 10th century at the Bayanovo cemetery; and chalcedony discs typical of the Azelino and Mazunino burials of the 4th–5th centuries AD, found in the burials of the 9th–10th centuries at the Demenki and Bayanovo cemeteries (Danich, Krylasova, 2014). Incidentally, chalcedony discs were typical of the same period as the items in the polychrome style. For example, the material evidence from the Kudash cemetery in the south of the Perm Territory included both chalcedony disks and items with oval or rounded inserts framed with gold filigree and/or granulation (Bykova, Kazantseva, 2012: Fig. 1, *13–19*; Naslediye…, 2007: Fig. 66, 67), similar to those used as central medallions in star-shaped pendants. However, the use of early artifacts or their fragments in new jewelry is an unusual phenomenon.

Conclusions

The time when the star-shaped pendants of the Lomovatka culture were widespread can be established from the chronological framework of the burials where they were discovered, and corresponds to the 9th–10th centuries. The relatively small number of such items, stylistic and technological unity shown by the majority of the items, and the secondary use of much earlier items as a central element may indicate that they were produced over a limited period of time. Now we can only speculate about the source of the items of the polychrome style (hoards, looting of early burials, etc.), but it is clear that it was not unlimited, which explains the relatively small number of star-shaped pendants at the sites of the Lomovatka culture. The items discussed above also include pendants entirely made by the local jewelers, such as pendants with round central medallions and cast teardrop-shaped elements with inserts. This suggests that after depletion of the source of gold items in the polychrome style, the artisans attempted to continue production of star-shaped pendants, but judging by the small number of finds, this did not become widespread.

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An Oirat Sphero-Cylindrical Helmet and Arming Cap from the Central State Museum Collection of the Republic of Kazakhstan

We describe an unusually shaped riveted sphero-cylindrical iron helmet and an accessory arming cap made of fabric (Cat. No. 2067/8), owned by the Central State Museum of the Republic of Kazakhstan. On the basis of museum documents, we reject the former geographic attribution—Semirechye, southeastern Kazakhstan. Instead, we demonstrate that the items come from the former Cossack village Magnitnaya (presently Magnitogorsk, Southern Urals). Typological analysis indicates that the helmet falls within the interval between the 1610s to early 1700s. The closest parallels are from Western Mongolia, Tibet, and Southern Siberia. We hypothesize that artisans who manufactured such helmets were inspired by the idea of the Buddhist stupa ("suburgan" in Kalmyk). The likely customers were Oirat Buddhist warriors. This is the first helmet of such type that may be attributed to the Volga Kalmyks—people of the westernmost Oirat enclave in Eurasia. This modifies our views on the Kalmyk armor of that period. The specimen could have got to the Southern Urals as a trophy, diplomatic gift, or barter. It could also have belonged to a Kalmyk warrior who had settled in the land of Bashkir or Kazakhs. The accessory headgear, with a white woolen padding, is shown to be an arming cap. This is the only known original Oirat headgear of such type, dating to the 17th or 18th century.

Keywords: *Kalmyk Khanate, Dzungaria, Oirats, Oirat armor, Kalmyk armor, Kalmyk helmet.*

Introduction

The historical period spanning the 17th century to the first half of the 18th is often called in academic literature the period of the small Mongol (Oirat) invasion (Kocheviye imperii Yevrazii…, 2019: 365). For a century and a half, the tribes of the Western Mongols—the Oirats, who were known as Olyots in China, as Kalmaks among the Turkic peoples, and as Kalmyks among the Russians, played an important role in the life of the peoples inhabiting the Great Steppe. In the 17th century, the Oirat expansion spread to the steppes of Eastern Europe, Kazakhstan, and Mongolia, as well as the Northwestern Caucasus, Southern Siberia, Eastern Turkestan, and Tibet. In the middle of that century, four main military and political groups of the Oirats emerged: the "Kalmyk" (with the

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center in the Northern Caspian Sea region), "Chakar" (in the south of Western Siberia), "Khoshut" (on the Kukunor Plain) and "Dzhungar" (in Southeastern Kazakhstan and Western Mongolia) (Bobrov, Ryumshin, 2015; Kocheviye imperii Yevrazii…, 2019: 365–367).

The military and cultural heritage of various Oirat groups has not been studied equally. The weaponry of the Dzhungars, Chakars, and Khoshuts of Kukunor has been studied in sufficient detail, while the study of the weaponry and armor of the Volga Kalmyks has just begun. In this regard, one of the important tasks is to describe the Kalmyk weaponry kept in Russian and foreign museums, as well as in private collections. Without its comprehensive analysis, it is not possible to identify the main trends in its evolution, regional features, or the general dynamics of weaponry development among the Mongolian-speaking nomads of Eurasia during the final period of its existence as an independent military and historical phenomenon.

The collection of the Central State Museum of the Republic of Kazakhstan contains an iron riveted helmet of unusual sphero-cylindrical shape and a quilted headgear lined with wool (Cat. No. KP 2067/8). Although its images (drawings, photographs in one projection) and brief descriptions have been published before (Akhmetzhan, 2007: 153, fig. 131, *7*; 154, fig. 132, *2*, *d*: 155; 2015: 78; Bobrov, Hudiakov, 2008: 445, 460, fig. 190, *4*), this combat helmet has not yet become the object of focused scholarly research. Information about the headgear stored together with the helmet is introduced for the first time.

This article provides a detailed description of the helmet's design, and clarifies the place of discovery, date, and attribution of the helmet and cloth headgear from the collection of the Central State Museum of the Republic of Kazakhstan (Fig. 1, 2).

History of research into the helmet

Information provided in the literature about the helmet under discussion was given by a Kazakhstan scholar, K.S. Akhmetzhan. He attributed the helmet to a special group of headpieces, "the crown of which was made of eight plates, which overlapped each other… The upper part of the top and the bottom of the helmet's crown are attached together with narrow fittings" (Akhmetzhan, 2007: 155). The description was illustrated with a small photo and a drawing of the piece of protective armor (Ibid.: 153, fig. 131, *7*; 154, fig. 132, *2*, *d*). Akhmetzhan identified the helmet as a "Kazakh military headgear" (Ibid.: 132).

In 2008, the helmet from the collection of the Central State Museum of Kazakhstan attracted the attention of Russian scholars L.A. Bobrov and Y.S. Hudiakov. In their monograph on the weaponry and tactics of the nomads of Central Asia and Southern Siberia in the Late Middle Ages and Early Modern Age, the helmet was discussed together with other sphero-cylindrical headpieces (Bobrov, Hudiakov, 2008: 445, 460, fig. 190, *4*). It was established that such helmets were used by the Oirat nomads in the period under consideration (Ibid.: 440–445, 459–461, 722, 725). According to scholars, the original helmet from the Central State Museum of Kazakhstan could have been "provided with a simple or 'box-shaped' visor and aventail" (Ibid.: 445). The headpiece was dated to the 16th–18th centuries and attributed to the weaponry complex of the "Western Mongolian" (Oirat) warriors (Ibid.: 445). The description of the helmet was illustrated by its drawing (Ibid.: 460, fig. 190, *4*).

In 2015, Akhmetzhan resumed his research on helmet KP 2067/8 from the collection of the Central State Museum of Kazakhstan. He noticed that some mausoleums in Western Kazakhstan had a dome, whose shape resembled the helmet under consideration (Akhmetzhan, 2015: 78, fig. 32, *4*). Generally, Akhmetzhan agreed with the opinion of Bobrov and Hudiakov that helmets of similar designs belonged to the Oirat weaponry complex, but believed that helmets resembling in shape the domes of Kazakh mausoleums could also have been made by the Kazakhs themselves (Ibid.: 75). Akhmetzhan attributed the headpiece under discussion to "remodeled Dzhungar helmets used by the Kazakh warriors in the past" (Ibid.: 78, fig. 32, *1*).

Thus, helmet KP 2067/8 had already attracted the attention of scholars in the past. However, detailed photos and sizes have not been previously published. The helmet was discussed in the context of military headgear used by the Central Asian nomads, but never became the object of a special scholarly study. Further, the place where this item of protective weaponry was discovered and its "museum history" have not been reliably established, although this information is very important for dating and attributing the headpiece. Finally, the first publication about the helmet did not take into consideration the headgear associated with it, which is of undoubted scholarly interest.

Description of the helmet and arming cap

In terms of its material, the helmet belongs to the class of iron helmets; in terms of the design of the crown, to the class of riveted helmets; and in terms of the shape of the dome, to the class of sphero-cylindrical helmets. Its height is 25.5 cm. Since the helmet is relatively strongly deformed (see Fig. 1, *1–4)*, the frontal-occipital diameter of the headpiece (19.5 cm) is much smaller than the temporal (22 cm) diameter. Before the damage to the crown, the diameter of the helmet could have been about 20–21 cm. The weight of the headpiece (excluding the missing pommel, visor, and aventail) is 0.92 kg.

Fig. 1. Oirat helmet, Central State Museum of the Republic of Kazakhstan (KP 2067/8), 1610s to early 18th century. *Photo by L.N. Agibaeva, D. Kezdikbaev; drawing by L.A. Bobrov*.
1 – front view; *2* – left side view; *3* – right side view; *4* – rear view; *5* – pommel, top view; *6* – junction of the helmet hoop.

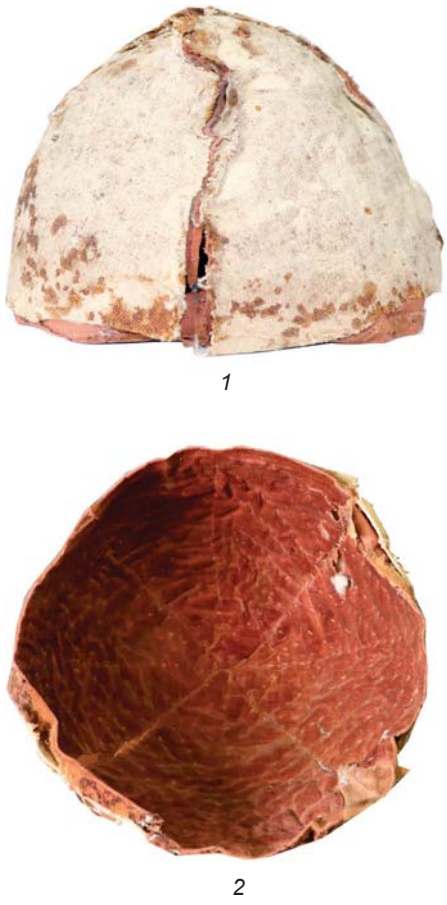

Fig. 2. Arming cap. *Photo by L.N. Agibaeva, D. Kezdikbaeva*.
1 – general view; *2* – bottom view.

The helmet top was riveted of eight S-shaped sector-plates, including four main plates and four onlays, which are almost similar in size. The upper ends of the plates on the crown did not survive (see Fig. 1, *5*). However, we can assume that initially, the onlays had elongated trapezoid shapes, and main sector-plates were elongated subtriangular. Judging by other helmets of this type, pointed blades of the plates, bent at a right angle, served as a base for a lid-shaped interior part* of the pommel in the headpiece (Bobrov, Orlenko, 2020a: 75, 86, 89, 93; 2020b: 1195, 1200). This shape and the S-shaped profile of the crown plates allows the assembled helmet to have a sphero-cylindrical shape.

Notably, the plates forming the crown of the helmet were placed in a peculiar way. On most other sphero-cylindrical headpieces, onlay-plates were arranged symmetrically on four sides of the dome, along the forehead-ears-occiput line (Bobrov, Orlenko, 2020b: 1192, 1193, 1196, 1197). Not onlays, but the main plates of the helmet's crown were placed on four sides of the helmet under discussion, which contributed to the distinctive appearance of the headpiece.

Each onlay-plate slightly overlaps the edges of two adjacent plates and is connected to them using two pairs of symmetrically located iron rivets with rounded caps 0.3 cm in diameter. Some rivets have been lost (see Fig. 1, *3*).

The main holder of the plates in the lower part of the crown is a wide iron hoop fastened to the back of the helmet with three vertical rivets*. The short edge of the hoop was decorated with an angular cut (see Fig. 1, *4*).

*This was a plate-base used for fastening and attaching the plates of the crown in their upper part, and for attaching a tube-socket for the plume.

*The lower rivet could have been inserted into the hole much later than other rivets.

The helmet was crowned with a pommel, of which only the interior metal plate-base of a distinctive lid-like shape has partially survived. The central (flat) part of the base has been lost (see Fig. 1, *5*). A horsehair tassel was inserted into the hole (4.8 cm in diameter)*. The vertical ledge of the base was supplied with a convex band along the lower edge. The top of the helmet was connected to the base with iron rivets.

The surface of the crown is covered with rust, cracks, scratches, abrasions, and holes. Some rivets are missing. The edges of onlay-plates on the forehead part of the helmet (see Fig. 1, *1*), as well as the upper edge of the hoop in the headpiece (see Fig. 1, *1*, *4*), have been partially broken. The lid-like base has survived fragmentarily. The occipital part of the crown suffered the most: it has a through hole with torn edges (see Fig. 1, *2*, *4*). Currently, most of the helmet is covered with rust, which gives the crown a dark color. However, in the places where the rust has been removed, a light gray iron surface is clearly visible (see Fig. 1, *2*, *4*).

Rounded through holes were punched along the lower edge of the helmet hoop. Rivets with flattened caps were pegged into some of them. Initially, these holes were probably used for hanging the aventail, which protected the ears and neck of a warrior.

A visor of conventional or "box-like" design (a "box-like" visor consisted of a horizontal "shelf" and vertical "shield") was often an important element of helmets similar to the one under consideration. The helmet from the Central State Museum of Kazakhstan shows two holes punched in the temporal zones of the hoop. In the original configuration of the headpiece, the holes could have served for fastening the rivets, which connected the crown with the side panels of the visor. Currently, a rivet is inserted into the right hole; the left hole is empty. We can assume that, at the final stage of its operation, the helmet no longer had a visor. During this period, the holes could have served for attaching chin straps.

Together with the helmet, the Central State Museum of Kazakhstan collection contains a headgear, which can be identified as an arming cap (see Fig. 2). A low rounded crown (17 cm high and 22 cm in diameter) was made of two layers of fabric, with fine milk-colored wool placed in between. The "cover" of the headgear was made of a faded light yellow canvas-like fabric of fine weave (see Fig. 2, *1*). Expert restorers of the Central State Museum of Kazakhstan D.T. Ibraeva and O.B. Perova identified traces of rust on its surface (probably resulting from the contact with the inner surface of the helmet dome). The headband is lined with terracotta-colored and light brown cotton velour. Both the "cover" and lining were sewn of four triangular wedges; the lining was quilted with small, frequent stitches (see Fig. 2, *2*).

*According to the available information, the tassel was inserted into the hole at a time when the helmet was already in the museum's collection.

Dating and attribution

It has been previously established that riveted sphero-cylindrical helmets composed of four main plates and four onlay-plates were atypical of the Central Asian nomads of the Early and Advanced Middle Ages, but quite commonly occur among the evidence of the Late Middle Ages and Early Modern Age (Bobrov, Orlenko, 2020b: 1198).

On the basis of its combination of features, helmet KP 2067/8 can be attributed to a special group of headpieces exhibited in Russian and international museums and private collections. We are currently aware of 14 such helmets. The crowns of all these sphero-cylindrical headpieces were riveted of S-shaped sector-plates. Their joints were covered with onlays with smooth edges. Numerically, wide onlays, which are practically no smaller than main plates of the crown, are predominant. However, there are also narrower samples supplemented by reinforcement ribs. Most helmets in this series are provided with a hoop and visor of a box-like design. The pommel usually consists of a lid-like base, socket for the plume, and figurate pieces, which adorn the dome and at the same time connect the crown with the base of the helmet's top. All headpieces of the series belong to protective armor of the Oirat nomads of the 17th to mid-18th centuries (Bobrov, Hudiakov, 2008: 440–445, 459–461; Bobrov, Orlenko, 2020b).

The closest parallels to our helmet are the "small Kolmyk cap" (Or-4645) from the Moscow Kremlin Museums (Fig. 3), and the helmet (VO-69) from the arsenal of the Tatar servicemen Kulmametyevs, which is kept in the collection of the Tobolsk Historical and Architectural Museum-Reserve. All the three headpieces are not only similar from the structural point of view, but also have almost the same weight and size. The helmet from the Armory Chamber corresponds to the Oirat armament complex and dates back to the 1610s to mid-1680s (Bobrov, Orlenko, 2020a: 74, 90, 91). The headpiece from the Tobolsk Historical and Architectural Museum-Reserve was ordered by a wealthy Oirat warrior of the 17th–early 18th centuries. The helmet possibly reached the Tobolsk Tatars as a military trophy, diplomatic gift, or commodity brought for trade exchange (Bobrov, Hudiakov, 2008: 441, 442, 460, fig. 190, *3*). The certain typological similarity of these helmets with the headpiece from the Central State Museum of Kazakhstan suggests that they all were made approximately in the same historical period.

The reasons that prompted the craftsman to give the helmets of this series an unusual jug-like shape are of interest to our discussion. Experimental studies have confirmed the validity of the previous assumption that a sphero-cylindrical crown has no noticeable functional advantages over sphero-conical or hemispherical crowns. Moreover, in the case of a strong horizontal blow, it creates additional risks for the helmet user (Bobrov, Orlenko, 2020b: 1208–1209). The main functional advantage of a high sphero-cylindrical helmet was its visibility on the battlefield*. A unit commander wearing such helmet was clearly visible to his subordinates during fast-moving cavalry battle, which probably made it easier to control the unit during the fight (Ibid.).

Extensive use of such headpieces among the Oirats in the 17th to 18th centuries could also have resulted from cultural and religious considerations. In the second half of the 16th to the early 17th century, Buddhist teachings spread among the Mongols and Oirats, which led to important changes both in the spiritual life and in the material culture among the nomads of Central Asia. Buddhist symbols became increasingly widely used in the design of the Mongolian and Oirat protective armor (LaRocca, 2006: 75–78, 80–81, 83–84, 88–91; Bobrov, Hudiakov, 2008: 433, 440–446, 452, 454, 460–462; Bobrov, Ozheredov, 2010; Bobrov, Orlenko, 2020b: 1209). In our opinion, the phenomenon of the Oirat sphero-cylindrical helmets should be viewed in this "religious weaponry" context. As a special study has shown, the silhouette of the sphero-cylindrical headpieces resembles traditional Buddhist stupas known among the Mongols as *subarga*(*n*), or *suvarga*, and among the Kalmyks as *suburgan*. It is one of the important symbols of the "yellow faith" (Mongolian *shar*[*a*] *shashin*)** and the Buddhist doctrine in general. This assumption is confirmed by the similarity of ornamentation on sphero-cylindrical helmets and Buddhist stupas of the Late Middle Ages and Early Modern Age (Bobrov, Orlenko, 2020b: 1209–1212). It is possible that such a "suburgan" helmet not only indicated the adherence of its wearer to the precepts of the "yellow faith", but also was meant to protect the warrior from hostile magical influences.

The helmets of this series are a variety of the highest combat headgear of the Oirat nomads. The total height of some of them (including the plume socket) reached ca 0.5 m (Bobrov, Orlenko, 2020a: 86–87). It cannot be ruled out that precisely such helmets were compared by Kazakh storytellers to *mūnara*—a minaret or high and narrow tower (Bekmūhametov, 1977: 121). For example, a description of the appearance of the mighty "Kalmak" (in this case, "Dzhungar") warrior Sharysh—the opponent of Sabalak (the future Khan of the Middle Zhuz Ablai)—mentions: "A wrist-thick braid wound around the waist; his helmet looks like a mūnara" (Babalar sözı, 2006: 31)*. In another legend, a "helmet similar to a mūnara" is mentioned as a combat headgear of the "Kalmak" Khan Karanai (Babalar sözı, 2010: 112). The high cylindrical part of the crown in the helmets of this type might have resembled a tower or a minaret for the Turkic nomads. Notably, both the minaret and suburgan belonged to cultic religious structures.

Fig. 3. Oirat helmet, Moscow Kremlin Museums (Or-4645), 1710–1780s (Bobrov, Orlenko, 2020a).

Note that the Oirats, who lived in various regions of Eurasia, used sphero-cylindrical helmets similar in design and decoration. Quite similar headpieces originate from the south of Western and Central Siberia, Southeastern Kazakhstan, Western Mongolia, Tibet, etc. (LaRocca, 2006: 88, 89; Bobrov, Hudiakov, 2008:

*We should recall that the height of our helmet's crown reaches 25.5 cm. Taking into account the length of the unpreserved tube-socket, as well as the feather sultan, small flag, or tassel inserted into it, the total height of the headpiece could have reached 35–45 cm.

***Shar*[*a*] *shashin* is the Mongolian name for the tradition of Buddhist monastic education and ritual practice, which is also known as the Gelug (Gelugpa) School. It was founded in Tibet by Lama Je Tsongkhapa (1357–1419). When adopting Buddhism, the vast majority of the Oirats became the followers of the Gelug School.

*Hereinafter, translation from the Kazakh language into Russian by U.M. Agatai.

433, 440–446, 452–454, 460–462; Bobrov, Orlenko, 2020b: 1199, 1202). In this regard, for the attribution of our helmet, it is very important to establish the place of its discovery. The main difficulty is that the available information is contradictory.

In the second half of the 2000s, the employees of the Central State Museum of Kazakhstan told one of the authors of this article that the helmet was "found near Malaya Stanitsa of Alma-Ata (Verny)". The same information was provided in the catalog of weaponry stored in the museum's collection* and in the monograph "Combat Helmets of the Kazakhs" by Akhmetzhan (2015: 75). However, this information is refuted by the documentation of the Central State Museum of Kazakhstan. The text of the museum inventory, dated March 26, 1999, indicates that helmet "2067(8)… was found in the area of Magnitnaya Stanitsa" (Central State Museum of Kazakhstan. Main Cat. Book No. 2 of the main collection, p. 106). This refers to the fortress (since 1743) and Cossack village (since 1865) of Magnitnaya in the Southern Urals (presently, the city of Magnitogorsk). The fortress was founded on the initiative of I.I. Neplyuev, the Governor of the Orenburg Governorate, near Mount Magnitnaya (Atach), where rich deposits of iron ore were discovered. Taking into account this information, the museum history of our helmet may be reconstructed as follows. After it was discovered near Magnitnaya Stanitsa (that is, in the southwest of the present-day Chelyabinsk Region of Russia), the headpiece was sent to the nearest major museum collection—the Museum of the Orenburg Territory (founded in 1830). In the 1920s, a part of its collections was transferred to the Kazakh Central Regional Museum (founded in 1920). Initially, the museum was located in Orenburg, but in 1929, it was moved to Alma-Ata, the new capital of the Kazak Autonomous Soviet Socialist Republic. According to U.A. Ashim, the Head of the Department for Collection Storage at the Central State Museum of Kazakhstan, our helmet was one of the items transferred to the Kazakh Central Regional Museum (currently the Central State Museum of Kazakhstan).

If helmet KP 2067/8 indeed came from the area near the village of Magnitnaya, it could have belonged to the complex of protective armor of the Volga or Chakar Kalmyks. The helmet could have appeared in the Southern Urals as a result of one of numerous clashes, between the Kalmyks and either the Bashkirs or the Kazakhs, from the 1620s to the first third of the 18th century. During the warfare, the Bashkirs captured a large number of trophies, and our helmet might have been one of them. It is also possible that the headpiece belonged to one of the Kalmyk warriors who lived in a Bashkir or Kazakh ulus. In the second half of the 17th to the first third of the 18th century, individual groups of Kalmyks were becoming a component of the Bashkir people. For example, in the early 18th century, a fairly large group of the "Ayuka Kalmyks"* settled in Tersyak Volost, in the eastern outskirts of historical Bashkiria. Over time, the Bashkir clan Kalmak emerged on the basis of this group (Istoriya…, 2017: 31–35, 188–190).

The assumption about the use of sphero-cylindrical helmets in Western Kazakhstan can indirectly be confirmed by the domes of local mausoleums of the 17th century, whose outlines resemble the headpieces similar to our helmet (Akhmetzhan, 2015: 75, 78, fig. 32, *4*). Such helmets were possibly worn by the Oirat migrants, who took service with the local Turkic rulers after settling in this region.

The classification of the helmet from the Central State Museum of Kazakhstan as a combat headpiece of the Volga Kalmyks corrects the prevailing perception of the panoply used by this westernmost group of the Oirat nomads. Taking into account this attribution, it can be argued that even after settling in the steppes of the Northern Caspian Sea region, the Kalmyks continued to use defensive armor of the Central Asian type. The high degree of similarity between the helmets among the Mongol-speaking nomads of the Volga region, Western Mongolia, Southern Siberia, and Tibet suggests a certain typological proximity of weaponry and armor complexes of the Oirat nomads inhabiting various regions of Eurasia at the initial stage of the "period of the small Mongol (Oirat) invasion" in the 17th to the first half of the 18th centuries.

At present, the main hypothesis is the Kalmyk origin of the helmet from the Central State Museum of Kazakhstan. However, if, contrary to the data of the museum inventory of 1999, the headpiece was found in Semirechye (as was previously thought), it might have belonged to the armor complex of the Dzhungars—the eastern relatives of the Kalmyks. In any case, the helmet was originally made for an Oirat Buddhist warrior between the 1610s and the first third of the 18th century. The lower chronological boundary is associated with the beginning of the widespread dissemination of Buddhism among the Oirats; the upper boundary is associated with the structural features and design of helmet's crown.

The arming cap of the headpiece under discussion is of considerable interest, since original arming caps

*As far as we know, this catalog has never been published.

*The name comes from the name of the Kalmyk ruler Ayuka (1672–1724). Most likely, the emergence of the group of "Ayuka Kalmyks" among the Bashkirs was associated with the migration of Sandzhip, the son of Khan Ayuka, to Dzungaria in the early 18th century. About two hundred Kalmyk wagons were intercepted by the Bashkirs and began to roam with them (Istoriya…, 2017: 32).

of the Mongolian-speaking nomads of the Late Middle Ages and Early Modern Age were known before only from the written and visual sources*. In terms of cut and color solution, our arming cap differs significantly from its Qing counterparts. Its cut generally corresponds to the description of an arming cap of the former Muslim vassals of the Oirats from Dzungaria, which was given at the beginning of the second half of the 18th century by the Qing authors of "Qingding Huangyu Xiyu tuzhi": "Duyulega (Mongolian *duulga*, Kalmyk *duulkh*) is a helmet. Inside, there is a cap (which) covers (the head) from the front, reaches the forehead, spreads out from behind, reaches the neck hanging down from the left and right, and reaches both ears. It is called tu-bo-bei-er-ku (Turkic *töbe börık*)" (Bobrov, Pastukhov, 2021: 203). Considering the size of the arming cap from the Central State Museum of Kazakhstan, its lower edge ran along the line of forehead-ears-back of the head, as was mentioned by the compilers of the Qing source.

The color palette of the arming cap from the Central State Museum of Kazakhstan is hardly accidental. A yellow-and-red palette was typical of the headgear of the Oirats in the 17th–18th centuries. The crown of the Oirat caps and hats (as in the items under consideration) was traditionally covered with yellow cloth, while the tassel *ulan zala*, and sometimes lining, were made of red cloth (Bobrov, Ozheredov, 2021: 185, 186–187, fig. 90, *1*).

Conclusions

The analysis of museum documentation has revealed that the helmet KP 2067/8 does not come from Semirechye, as it had been previously thought, but from the area of the village of Magnitnaya in the Southern Urals. Considering their state of preservation, the helmet and cloth headgear associated with it were not found at archaeological sites nor belonged to accidental finds. Most likely, they were purchased from the members of a family of local nomads who kept these items for several generations. Initially, the combat headpiece entered the Museum of the Orenburg Territory, from where it was transferred to the Kazakh Central Regional Museum.

The helmet from the Central State Museum of Kazakhstan is a part of large series of Late Medieval Oirat sphero-cylindrical headpieces. The craftsmen who forged the helmets of the series under consideration probably wanted to render the image of a Buddhist stupa known among the Kalmyks under the name of *suburgan*. It is probably this kind of Oirat headpieces that was mentioned in Kazakh folk tales as a "Kalmak" helmet, similar to a *mūnara*—a narrow and high tower or minaret. Unlike other sphero-cylindrical headpieces, the helmet from the Central State Museum of Kazakhstan retained the original arming cap made of organic materials.

The structural features and design of the helmet make it possible to date it to the 1610s to early 18th century. This determination is confirmed by the dates of sphero-cylindrical helmets with similar design from the Moscow Kremlin Museums and Tobolsk Historical and Architectural Museum-Reserve. Judging by the place of discovery, the headpiece was made for an Oirat Buddhist warrior from among the Volga or Chakar Kalmyks. The Dzhungarian origin of the helmet is less likely. It could have reached the Southern Urals as a military trophy, diplomatic gift, or a commodity brought for exchange. It is also possible that the helmet belonged to one of the Kalmyk warriors who settled on the territory of the Bashkir or Kazakh possessions in the mid-17th–first third of the 18th century.

Helmet KP 2067/8 is of interest to historians of weaponry, military historians, and ethnographers, as well as religious scholars and culturologists studying the military and cultural heritage of the Eurasian nomads. Its scholarly value derives from the fact that this is the first sphero-cylindrical Oirat helmet, most likely associated with the armor complex of the Volga Kalmyks. This significantly expands our understanding of the panoply among the westernmost group of the Oirat nomads who moved to the Northern Caspian Sea region in the first half of the 17th century. The arming cap, which was a part of the set with the combat headpiece, is the only example of an Oirat arming cap from the Late Middle Ages and Early Modern Age known today.

*Mongolian arming caps of the 18th–19th centuries from the museum collections of Mongolia and China were made by the Qing craftsmen or local artisans according to Qing models.

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Log Cabins of Ust-Voikary, a Fortified Settlement in Northwestern Siberia: Dendrochronological Analysis

Ust-Voikary is a stratified settlement complex associated with the indigenous population of Northwestern Siberia and spanning the period from the Middle Ages to the recent centuries. It is one of the few sites in the region with the habitation layer preserved in the permafrost. Architecturally, it is marked by the prolonged coexistence of two types of wooden buildings—frame-and-post constructions and log cabins. Wood from nine log cabins excavated in 2012–2016 was subjected to dendrochronological analysis. The findings suggest that the earliest structures of that type date to the late 1400s. The proportion of types and the chronology of structures suggest that log cabins predominated by the mid 18th century. In the late 18th century construction activity at the site ceased. Later stages in the history of Ust-Voikary largely correlate with those of other indigenous stratified sites such as the Nadym and Polui promontory forts. However, at the latter sites, archaic frame-and-post buildings predominate.

Keywords: *Northwestern Siberia, Ust-Voikary, log cabins, dendrochronology.*

Introduction

The Ust-Voikary fortified settlement is located in the Shuryshkarsky District of the Yamal-Nenets Autonomous Okrug, about 130 km southwest of the city of Salekhard, on the left bank of the Gornaya Ob Channel, which is one of the branches of the Malaya Ob River. Since 2003, the site has been studied by the team from the Institute of Archaeology and Ethnography of the Ural Branch of the Russian Academy of Sciences and the Shemanovsky Yamal-Nenets District Museum and Exhibition Complex (supervised by A.G. Brusnitsyna and N.V. Fedorova) (Brusnitsyna, 2005; Fedorova, 2006). At the last stage (2012–2016), the archaeological works of the team from the Institute of Archaeology and Ethnography SB RAS were led by A.V. Novikov (Novikov, Garkusha, 2017).

Archaeological study of the site has revealed that it was a stratified settlement complex inhabited by the indigenous dwellers of northwestern Siberia. The excavations focused on its visually distinctive part—a hill formed by accumulated woodworking waste. Thus, the conclusions about various aspects of the settlement's history from the literature should be correlated with this particular part of the site (Garkusha, 2020).

The dendrochronological study that was initiated by M.A. Gurskaya from the Institute of Plant and Animal Ecology of the Ural Branch of the Russian Academy of Sciences was carried out simultaneously with archaeological works. Most of the wood was obtained from the objects located on the top of the hill; another part was sampled from those at its foot. The fact that the material evidence belonged to extreme (in terms of stratigraphy) cultural layers has made it possible to

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Data on log cabins investigated in 2012–2016

No. of building*	Number of samples	Number of undated samples, %	Length of TRC, years	Chronological interval	Glk, %	TBP	CDI	r
1	48	16	336	1354–1689	68	13.1	92	0.57
2	19	10	149	1431–1579	63	6.4	45	0.44
3	20	30	53	1461–1513	72	3.3	29	0.57
3A	12	16	132	1335–1466	77	11.0	87	0.80
5	2	–	194	1274–1467	70	8.8	57	0.67
7	52	13	185	1561–1745	68	10.4	73	0.70
9	12	–	210	1539–1748	62	4.8	34	0.43
9A	14	14	299	1443–1741	65	7.9	51	0.50
10	12	16	176	1567–1742	69	10.3	74	0.69

*The alphanumeric designation of buildings was used during field works in the cases when it was difficult to separate them into tiers. Such designation continues to be used in further work with the evidence from the site, in order to avoid confusion with information already given in publications and reports.

establish the overall period of economic activities in this part of the settlement, which lasted from the late 13th to 19th century (Gurskaya, 2008).

This article presents the results of dendrochronological dating of log structures investigated in 2012–2016*. Over the entire period of excavations, seventeen such structures were discovered at the site. Eight of them were identified in 2012–2016; in the same period, the study of another building, which was partially excavated and conserved during the first stage of research, was completed. Typical single-chamber log cabins were made of logs (unless otherwise specified) with overlapping corners.

From 2 to 52 wood specimens were sampled from each structure, depending on their space, degree of destruction, and preservation of the wood (see *Table*). The wood was represented by coniferous species, including 63 % Siberian spruce (*Picea obovata* Ledeb.), 30 % Siberian larch (*Larix sibirica* Ledeb.), and 7 % Siberian pine (*Pinus sibirica* Du Tour). Wood species were established using specific identifying features (Benkova, Schweingruber, 2004). In terms of age composition, the specimens were divided into six groups: I – up to 50 years of age, II – 51–100, III – 101–150, IV – 151–200, V – 201–250, and VI – over 250 years of age (Chernykh, 1996: 36).

Methods

A LINTAB-6 semi-automatic unit (with accuracy of 0.01 mm) was used for measuring the growth ring width. The obtained growth series were compared using the cross-dating method with the specialized program TSAP-Win Professional (Rinn, 2013), which ensures parallel visual control of comparison between growth graphs* and the calculation of statistical parameters for each variant of their combination.

The cross-dating quality was established by means of standard statistical indicators used in the TSAP program:

– TBP coefficient—t-statistics adapted according to the algorithm of M. Bailey and J. Pilcher, aimed at reducing the low-frequency trend in the initial data (Baillie, Pilcher, 1973);

– Glk coefficient (Schweingruber, 1988: 83), indicating the degree of similarity between two chronologies, which is established from the percentage of coinciding increases and decreases in growth;

– Cross-Dating Index (CDI)—an integral indicator calculated using a set of parameters.

The studies by Gurskaya have shown that the larch tree-ring chronology (TRC) developed using evidence from the southern part of the Yamal Peninsula can be used for dating archaeological coniferous wood from the Voikary settlement and for comparing with the growth series obtained from "local" coniferous wood of various species (2006b). This has made it possible to use the local VKL larch chronology, which we designed using the specimens of archaeological wood, as the main tool for absolute dating of growth series, and to form a generalized TRC for each building by coniferous wood**.

*They had their own numbering. For avoiding confusion, the previously identified objects are marked with an asterisk (*).

*Growth graphs of individual series in this work are presented as semi-logarithmic curves. This format is used to minimize the age trend and facilitate visual comparison of the curves (Kolchin, Chernykh, 1977: 20).

**Statistical characteristics of generalized series for each building are presented in the Table.

The VKL chronology was developed primarily using growth series that were visually and statistically consistent with the Yamal larch master-chronology (Briffa et al., 2013). The series that were in good agreement with the created chronology were added to the generalized scale formed on their basis. The COFECHA program was used for controlling the quality of absolute dating; the quality was based on the values of the correlation coefficient *r* (Holmes, 1983; Grissino-Mayer, 2001).

The length of the VKL tree-ring chronology was 446 years; the chronological interval was 1302–1747. The quality of cross-dating of the VKL chronology with the Yamal tree-ring chronology was confirmed by high values of statistical indicators: Glk was 70 %; TBP was 15.5; CDI was 108, and *r* was 0.59.

Before using the chronology for dating, it is recommended to carry out a standardization procedure that minimizes the impact of non-climatic factors. This procedure was performed using the ARSTAN program (Cook, Krusic, 2005). The smoothing spline method was chosen for standardization (Cook, 1985: 76–87). This method is distinguished by flexibility as compared to other standardization methods, and is used quite widely despite the fact that it has some disadvantages (Klesse, 2021).

While working with historic wood, any element that can be dated is a local source of information on construction activities (see, e.g., (Jansma, Haneca, Kosian, 2014; Haneca, Debonne, Hoffsummer, 2020)). In this regard, the dating procedure included some specimens that have been usually excluded from studies aimed at constructing various kinds of generalized chronologies. These traditionally include specimens with less than 50–60 rings, as well as those containing abnormal eccentric growth layers (compression wood). The validity of such an approach (provided that a number of conditions are followed) is confirmed by successful examples of dating the evidence from the sites along the northern boundary of the forest zone (see, e.g., (Shiyatov, Hantemirov, 2000; Omurova et al., 2013: 191)).

For analyzing the data, the individual growth series were combined into groups according to the position of specimens in certain structural elements of the buildings. In this context, the additional information obtained from undated specimens (species and age of wood, type of building material, etc.) was also taken into account. This approach fosters a more complete reconstruction of building activities.

Results

Building 1. Groups of specimens representing the main structural elements of the building: "log layers", "facing", and "stacking"*. The rest of the specimens are associated with various filling areas. Most of the specimens were spruce; only 6 % (mainly from the "facing" group) belonged to larch. Wood over 100 years old made up 35 % of the entire sample. Trees of age groups III and IV served as material for the log layers and "facing". Most of the specimens were taken from logs and partly from poles (various fasteners, posts, and floor beams). Planks were found exclusively among the elements of "facing".

Comparison of growth series within the groups demonstrates generally high values of statistical indicators. For instance, the following values were obtained (the overlapping area between growth series was 53–181 years) for the group of "log layers": Glk – 69–74 %; TBP – 4.6–7.2, and CDI – 32–86. Unambiguous results of relative dating are demonstrated, for example, by larch specimens from the "facing" elements (overlapping area 61–183 years): Glk – 67–84 %; TBP – 5.2–13.1, and CDI – 31–103 (Fig. 1). Values close to the maximum suggest that some elements could have been made from a single tree trunk.

The quality of dating according to the VKL chronology was manifested by acceptable values. The main range of change in the *r* coefficient was 0.41–0.66; in isolated cases, it was 0.38–0.40.

The sample contained 18 % of specimens with 50 rings or less; 18 % of them could not be dated. Absolute dating, with a few exceptions, showed statistical significance acceptable for this category of series: Glk – 65–71 %; TBP – 4.1–6.8; CDI – 30–45, and *r* – 0.48–0.66.

Timber for the log layers was mainly harvested in the autumn–winter of 1689/90. Dates of peripheral rings** in a part of the specimens from this group slightly lag behind that period. Thus, we can assume the simultaneous procurement of building material for the log layers. A case of reused wood was established: the tree had been cut down 22 years earlier.

The dates of the specimens with subcrustal rings are generally in the range of 1501–1689, which looks extraordinary for a building of about 7 m^2. The distribution of dates of the elements, in terms of their functional purpose, suggests that some of them could have belonged to previous structures, whose remains were used to build the log cabin. The construction practice when individual structural elements of a previous building were reused in a new building was repeatedly observed during the excavations. This was facilitated by their layered location

*The "facing" consists of fragments of vertically set planks located under the lower log layer. The "stacking" is made up of five threshold logs stacked on top of each other under the front wall of the log cabin.

**A peripheral ring is the last measured ring, which may not coincide with the subcrustal ring.

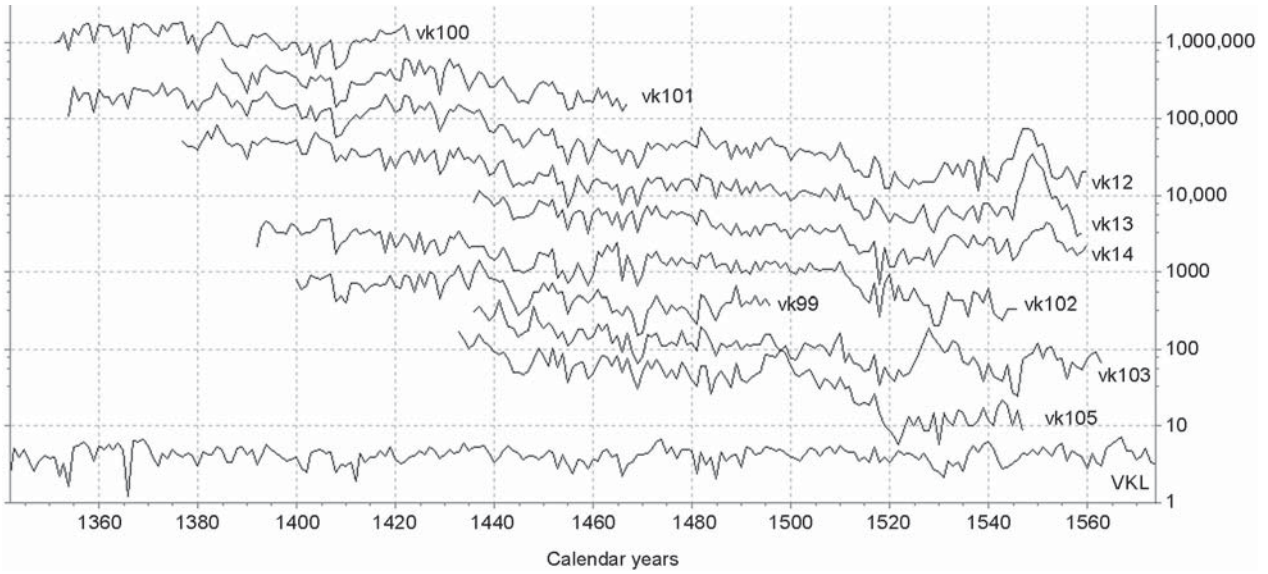

Fig. 1. Cross-dating of individual series based on specimens from the "facing" group of building 1.

directly on the ruins of past structures. Hence, it was difficult to establish clear stratigraphic markers between adjacent structures. Some elements of an earlier structure, while maintaining relative architectural integrity, often acquired a new purpose. For example, based upon analogy with other similar contexts, the "facing" consisted of the remains of vertically-set outer walls belonging to the previous frame-and-post dwelling. In their new capacity, they served to strengthen the walls of the recess along the perimeter of which the log cabin was set (Fig. 2). This assumption is also supported by the fact that the dates of the elements in each group constituted chronologically similar sets. Therefore, the difference in dates did not only result from arbitrary reuse of timber. For example, the dated elements of the "stacking" were from 1627–1650, which corresponds to their stratigraphic position; a relatively large part of the dates of the specimens in the "facing" group gravitated towards the 1560s, etc. According to the totality of data, fewer elements actually belonged to building 1, erected at the end of the 1680s–beginning of the 1690s, than were attributed to it at the stage of field research.

Building 2. The specimens were divided into groups of "log layers", "platform" (a row of short logs located under one of the walls), and also according to various areas of the filling. About 60 % of the specimens belonged to spruce; the rest belonged to larch. In the sample, 42 % of the wood was over 100 years of age. Wood belonging to age group II made up 42 %, whereas that of group I was 16 %. Timber of both species of about 120 years of age was used for the log layers. Trees of groups I–III were used for making the elements of the "platform". The vast majority of building material was logs; half-logs were sporadic.

After comparing the growth series, the best values of statistical indicators were: Glk – 62–77 %; TBP – 4.0–6.8, and CDI – 31–44. Absolute dating showed relatively high values: Glk – 68–72 %; TBP – 5.0–8.2; CDI – 35–60, and r – 0.41–0.55. Trees for the log layers were harvested in the autumn–winter of 1553/54. The dates of the elements of the "platform" (1552–1553) are consistent with that period, which makes it possible to reliably associate them with that building. A series of later dates (the 1560s) was obtained from the specimens in the filling.

Building 3. This building was covered by building 2. This building (about 5.5 m^2) contained unusual material for dating (Fig. 3). Almost all the specimens (19 out of 20) were obtained from log layers. Young spruce wood was used for making the log cabin: the trees were no more than 54–55 and mostly 35–42 years of age; the youngest tree was 24 years of age. Only a single specimen (from the filling) had 114 rings. Various elements included a partially square log (a log hewn on two opposite sides) and half-logs.

The specific composition of building materials associated with the same structural element implies a purposeful and simultaneous harvesting of the timber from a limited forest area. In addition, radial growth of trees in a given dendroclimatic region is determined mainly by the impact of a single external factor (summer temperatures) (Shiyatov, Hantemirov, 2000). The combination of these conditions is considered sufficient for dating elements made of young wood.

A generalized growth series with a length of 53 years was constructed using the specimens with a maximum number of rings. The series selected for designing the chronology were synchronized by one year. The statistically best calendar matching corresponds to 1513:

Glk – 72 %; TBP – 3.3; CDI – 29 (the significance level calculated using the TSAP program was 99.9 %), and *r* – 0.57. This date is consistent with the stratigraphic position of the structure between dated buildings. Statistical evaluation of graphical comparison between other growth series and the chronology obtained from the log layer has shown that the best dating variants fit the same year. The specimen from the tree of the oldest age group could not be dated.

Thus, the time when the trees died was the autumn–winter of 1513/14 (Fig. 4). The specific composition of the material suggests that all the timber for log layers from this sample could have been harvested at that time.

Building 3A. The remains of this building were directly under building 3. All the specimens, with the exception of one (from a post that supported one of the walls), were obtained from log layers. Spruce elements were predominant; the rest of the elements were made of larch. The trees belonged to age groups II and III, most of which were about 100 years of age. The specimen from the post belonged to group I.

The series of specimens with surviving subcrustal rings (which were the majority) were synchronized by one year. The series of specimens whose surface condition hampered the identification of such a ring were synchronized by the same year. This suggests that the death of trees from this sample occurred at the same time. The values of statistical indicators revealing the quality of relative dating of growth series form two sets (the overlapping area was 66–110 years): 1) Glk – 65–74 %; TBP – 4.3–9.5, and CDI – 32–74; 2) Glk – 53–71 %; TBP – 3.9 or less, and CDI ranged from 10 to 29. Nevertheless, absolute dating mainly showed high values: Glk – 65–81 %; TBP – 4.2–9.0; CDI – 35–73, and *r* – 0.44–0.55 (the minimum value was 0.38). Thus, the trees were cut in the autumn–winter of 1466/67 (Fig. 5).

Fig. 2. Mutual position of the lower layer and the elements of "facing" in building 1. *Photo by Y.N. Garkusha*.

Fig. 3. Western wall of the log cabin in building 3. *Photo by A.V. Novikov*.

Building 5. This building was not excavated; its outline appeared on a slope outcrop. Two specimens were taken from the top log layer. They belonged to the larch of age group IV.

Comparison between the growth series showed significant values: Glk – 70 %; TBP – 8.2, and CDI – 61. The ends of the series corresponded to the same year. The peripheral rings were defined as subcrustal. The calendar matching gave an unambiguous result: with high probability, the trees were harvested in 1467 (Fig. 5).

Building 7. This was the most spacious structure among the investigated log cabins, with an area of about 49 m^2. The specimens were divided into the following groups: "log layers" (6 spec.), "inner walls" (8 spec.), "deckings" (34 spec.), and "hearth structure" (2 spec.); two specimens were associated with the upper level of the filling. Wood of the oldest age made up 73 % of the sample; trees of age group II accounted for 20 %; the share of trees of group I was 7 %. The log layers were made of larch of groups III–V, most of which belonged to group IV. The inner walls were made of logs laid horizontally

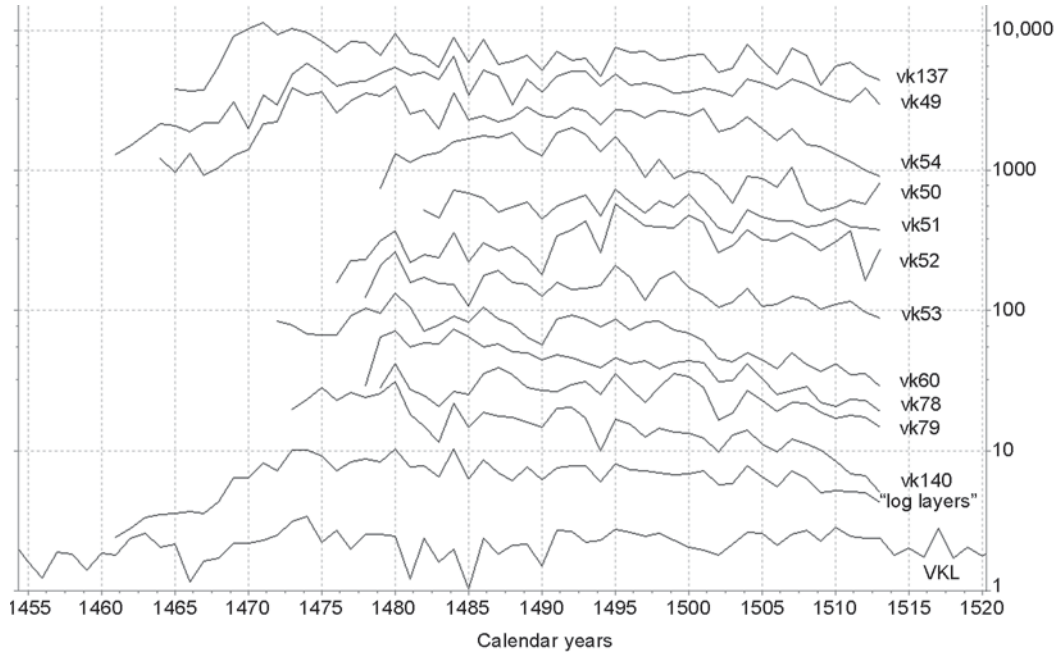

Fig. 4. Cross-dating of individual series based on the specimens from building 3.

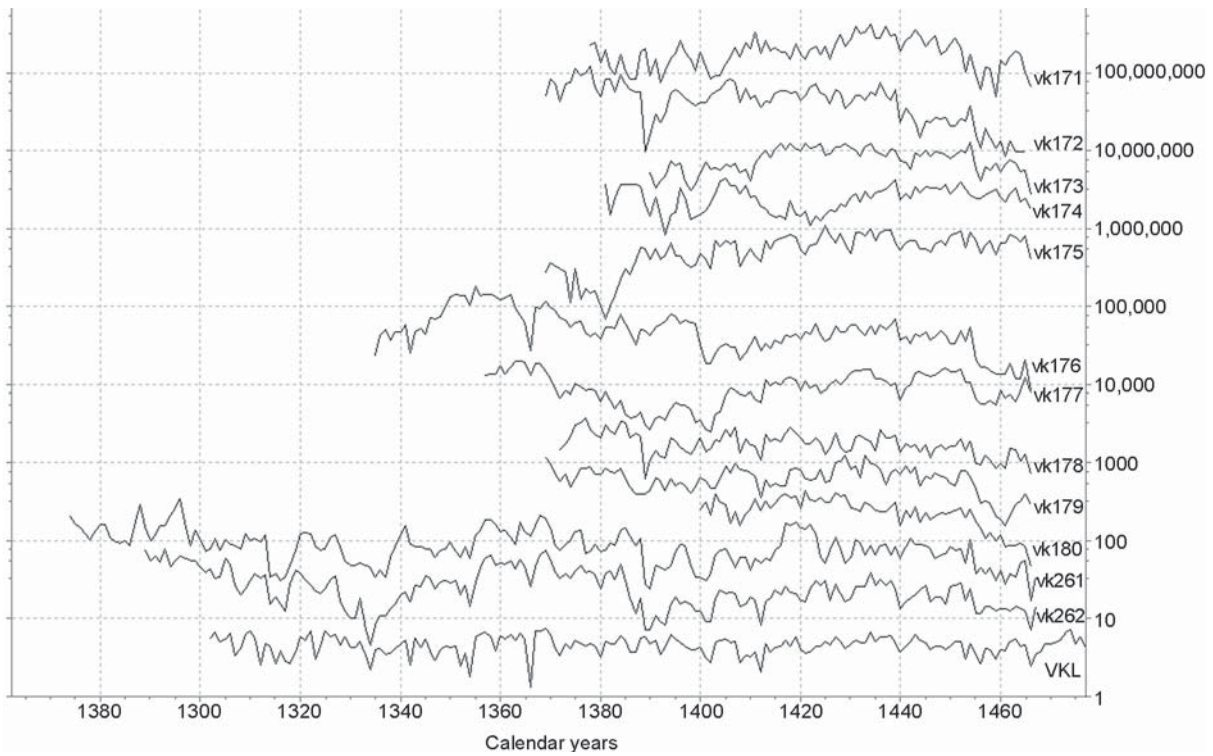

Fig. 5. Cross-dating of individual series based on the specimens from buildings 3A (vk171–vk180) and 5 (vk261, vk262).

between posts; they consisted of wood of various types and ages, with the predominant age belonging to group III. The posts were partially square logs made of larch of group III. The wood of the decking was represented by diverse species, ages, and assortment.

Comparison of growth series for the specimens from the log layers has shown two sets determined by the quality of the statistics: 1) Glk – 68–79 %; TBP – 8.4–11.9, and CDI – 32–47 (the overlapping area was 110–186 years); 2) Glk – 65–72 %; TBP – 5.1–7.9, and CDI –

15–28. Nevertheless, the calendar matching was not an issue, since almost all growth series from this group were a part of the VKL chronology. The specimens with subcrustal rings (4 spec.) were synchronized by one year. Their dates corresponded to the autumn–winter of 1738/39. The dates of two specimens with peripheral rings lagged behind by one year and 46 years.

Comparison of growth series based on specimens taken from the elements of the inner walls has mainly shown high values of statistical indicators (the overlapping area was 49–123 years): Glk – 66–82 %; TBP – 4.2–13.5, and CDI – 33–104 (Fig. 6). Synchronization of a pair of growth series based on specimens from the posts (the overlapping area was 122 years) showed maximum values: Glk – 80 %; TBP – 13.5, and CDI – 104. This means that the posts were made from a single tree trunk. Absolute dating was ensured by the presence of most of the growth series from this group in the VKL chronology. For the rest of the series, the results were also unambiguous, with statistical indicators of CDI amounting to 45–64 and *r* in the range of 0.64–0.76. The elements with subcrustal rings revealed a scatter of dates in the range of 1636–1709. The latest date (1747) corresponded to a specimen with a peripheral ring.

In the "decking" group, good indicators of cross-dating were manifested by specimens from the most intensely used central and pre-entrance parts of the room, where the builders chose to use wood of older age: Glk – 63–87 %; TBP – 4.4–14.8, and CDI – 31–130. The growth series formed a chronologically compact group in which, with a few exceptions, the dates of the last rings corresponded to the same year. This suggests a purposeful and simultaneous harvesting of wood. Values close to the maximum (CDI – 88–130) indicate that some parts were made from the same tree trunks. Seven series from this group were included in the VKL chronology. Unequivocal results were also obtained for the rest of the series (CDI – 40–56). Thus, the main array of dates corresponded to the autumn–winter of 1738/39, which is consistent with the results of the dating of the log layers. The extreme dates of some individual specimens corresponded to 1727/28 and 1745/46.

When comparing the series based on the specimens from the elements of decking along the walls, where places for rest were traditionally located, relatively acceptable statistical indicators of synchronization were obtained only for some, because of predominantly young and reused wood in these areas. A limited number of growth series also had calendar matching (*r* – 0.48–0.63). The dates were in the range of 1676–1745; the main array was in the range of 1727–1736.

Comparison of growth series based on the specimens from the hearth structure revealed confident statistical parameters (the overlapping area was 69 years): Glk – 74 %; TBP – 6.1, and CDI – 37. The calendar matching was also beyond any doubts: one growth series was a part of the VKL chronology; for the other series, *r* was 0.74. The date of the only specimen with a subcrustal ring corresponded to the autumn–winter of 1738/39. The dating results for two specimens taken from the elements from the upper part of the filling showed that they occupied chronological positions of not earlier than 1738 and 1745.

Field observations have led us to the conclusion as to the close relationship between the identified structural elements of the building. Thus, the most likely explanation for the scatter in the dates of the elements, as was the

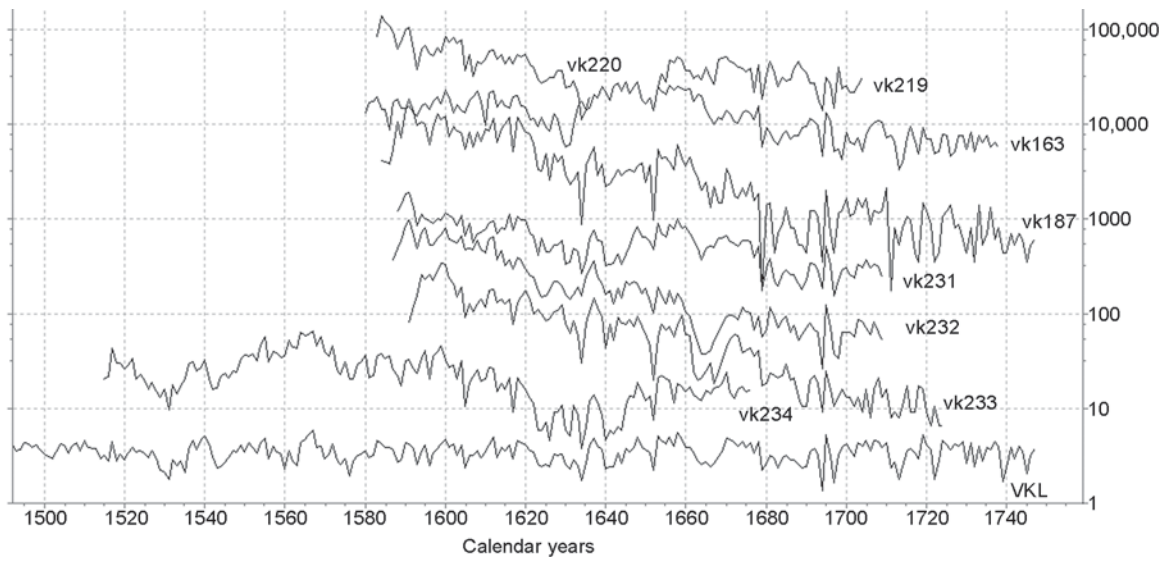

Fig. 6. Cross-dating of individual series based on the specimens from the "inner wall" group in building 7.

case with building 1, is selective inclusion of structural elements of the previous frame-and-post dwelling into the new structure. The remains of the frame of inner walls, as well as individual sections of wooden flooring, which demonstrate the chronological closeness of the elements during the period preceding the construction of the log cabin, can be correlated with the previous structure.

The time of harvesting trees for the log layers corresponds to the autumn–winter of 1738/39. The dates of most of the specimens from the elements of the decking in the central and pre-entrance parts of the room, as well as the hearth structure, were consistent with this period. This means that wood harvested for this purpose was mainly used for constructing the house. The latest dates (1745–1747) were obtained for several details from various elements of the structure, associated with local repair works.

Building 9. This is the conserved building 6*, which was discovered in the first years of studying the site (Fedorova, 2006: 14). Specimens were sampled from the log layers and decking. The sample consists mainly of wood of older age. Individual specimens belonged to age group II, close to group III in terms of the number of rings. Spruce and Siberian pine were used. Log layers and most of the decking elements were made of wood of groups III and IV.

After comparing the growth series, two sets of relatively high and low values were identified (the overlapping area was 77–169 years): 1) Glk – 64–78 %; TBP – 4.5–8.6, and CDI – 30–55; 2) Glk – 63–75 %; TBP – 3.4–8.1, and CDI – 10–29. Calendar matching showed low values: CDI – 13–27 and *r* – 0.34–0.54. To resolve doubts about the dates, a comparison with other dated individual and generalized series was made. One result of the search for correspondences was provided by synchronization of the generalized series of "log layers" with values confirming reliability of dating results (the overlap area was 185 years): Glk – 73 %; TBP – 10.4, and CDI – 79. Taking into account the ratio of dates of subcrustal and peripheral rings, the year of 1748 is considered as the time of death for most of the trees. The earlier dates of peripheral rings, which was only among the decking elements, lagged 50–74 years behind.

This building has already been dated. It was reported that "the northern wall of building 6 was unearthed. Two logs taken from the building were larch". The dates of the specimens corresponded to the autumn–winter of 1676/77 and 1678/79 (Gurskaya, 2008: 219), which does not agree with our results. The reason for this discrepancy may be that these elements might have belonged to different parts of the building.

Building 9A. The remains of this building were under building 9 (Fig. 7). Specimens were sampled from the elements of log layers and deckings. The log layers were made of spruce and Siberian pine; the trees belonged to age groups III and IV. Some decking elements were made of larch, although spruce was predominant. Most of these elements were made of trees of group II.

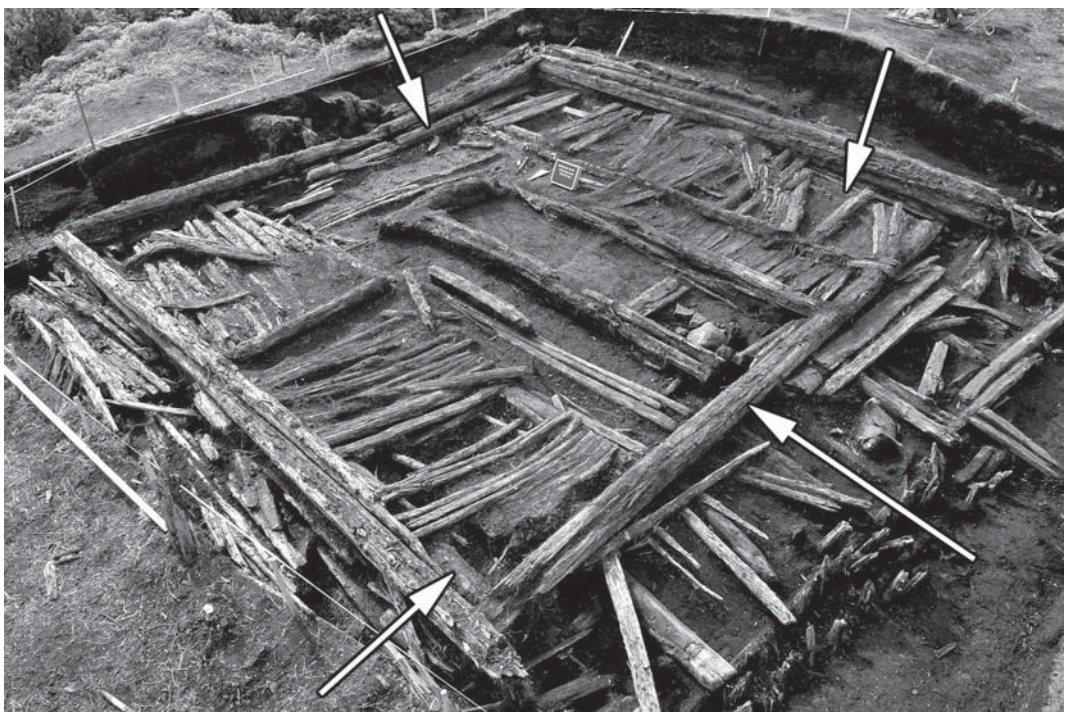

Fig. 7. Mutual position of buildings 9 and 9A (arrows indicate the elements of the log layers of building 9A). *Photo by A.V. Novikov*.

According to the results of the relative dating, only the growth series based on specimens from the log layers showed sufficiently high values of indicators: Glk – 71–80 %; TBP – 4.9–7.3, and CDI – 36–48. Subcrustal rings were not reliably identified. Comparison of other series, both with each other and with series based on the log layers, showed ambiguous results, which might have been largely caused by the predominance of specimens from relatively young wood. Acceptable values of indicators showing the quality of synchronization were as follows: Glk – 67–80 %; TBP – 4.3–7.1, and CDI – 30–48.

Absolute dating has shown low values (CDI – 26–40, *r* – 0.39–0.52), except for a single series (CDI – 84, and *r* – 0.76). A comparison with other dated series was made to resolve doubts about the dates. The dates of log layers were confirmed by greater values (CDI – 56–72). Taking into account the fact that subcrustal rings were either absent in the specimens from the log layers, or their presence was doubtful, the estimated time of death of the trees for the log cabin was the turn of the 17th–18th centuries (the latest date was 1698). Timber for some of the decking elements was harvested in the autumn–winter of 1701/02. The latest dates (1741–1742) were manifested by the elements of decking in front of the entrance, which resulted from the renovation of this part of the room.

Building 10. Seven specimens were obtained from log layers; two were taken from the filling; three more specimens belonged to a conventional "lower" log cabin, of which the corner of the lower log layer and a log supporting it have survived under the walls of the main structure (Fig. 8). Specimens from the elements of the main structure belonged to spruce; specimens from the "lower" log cabin were larch. Trees of age groups II–IV were used; the vast majority of them were about 90 years of age.

Comparison of growth series for the main structure demonstrated relatively high values of indicators: Glk – 65–84 %; TBP – 4.5–8.3, and CDI – 33–65. Five series based on specimens from the log layers were synchronized by one year. The dates of the peripheral rings lagged behind by one and three years. This sample contained specimens both with and without subcrustal rings. However, the narrow interval of distribution of dates suggests that all the timber for the log layers was harvested at the same time. A high degree of similarity was revealed by individual series based on the specimens from the "lower" log cabin (CDI – 45–65). They were synchronized by one year, 65 years earlier than the main group of dates.

Absolute dating of elements from the "upper" log cabin has revealed relatively low values of indicators (Glk – 61–67 %; TBP – 4.3–6.2, and CDI – 19–40), but was confirmed by the data of the COFECHA program (*r* – 0.47–0.61). Unambiguous results were obtained for the "lower" log cabin: CDI – 62–72, and *r* – 0.74–0.79.

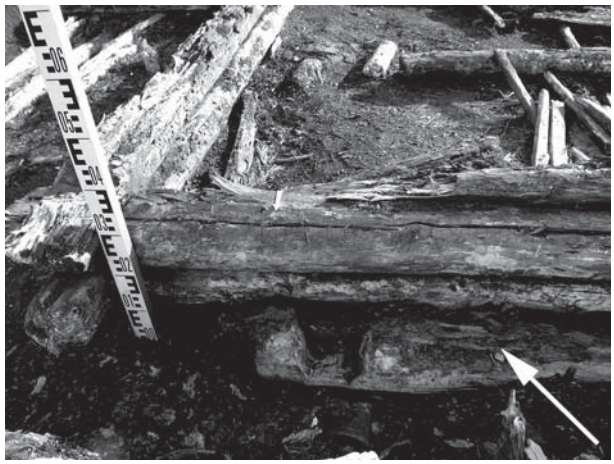

Fig. 8. Mutual position of the wall in building 10 and log layer of the "lower" log cabin (indicated by an arrow). *Photo by Y.N. Garkusha*.

Thus, most of the trees for the layers of the "upper" structure were harvested in the autumn–winter of 1742/43, while the trees for the "lower" structure were felled in the autumn–winter of 1677/78 (Fig. 9).

Discussion

When interpreting dendrochronological dates, the degree of reliability is established from the representativeness of the sample. In the case of archaeological structures that have been preserved fragmentarily, the judgments proposed *a priori* are accompanied by various assumptions. Analysis of the distribution of dates of specimens from the sample under discussion indicates the purposeful harvesting of the timber for construction. This primarily applies to wood used for the log layers. The degree of incorporation of reused material into other structural elements was probably chosen directly during the construction.

If the date of tree death falls during the autumn–winter period*, the end of the winter season is traditionally taken as the felling time. Thus, if the date of the subcrustal ring is suggested to be "the autumn of year *n* – winter of year *n* + 1", the year "*n* + 1" can be justifiably taken as the cutting time. This is important for interpreting dendrochronological dates.

We assume that freshly cut wood, that is wood harvested in the year "*n* + 1" corresponding to the dates of the main part of the elements, in particular log layers, was used for construction. This was the common practice in building traditions used in various cultures from the

*Based on the structure of subcrustal rings, the vast majority of trees from the sample under discussion were cut during that period.

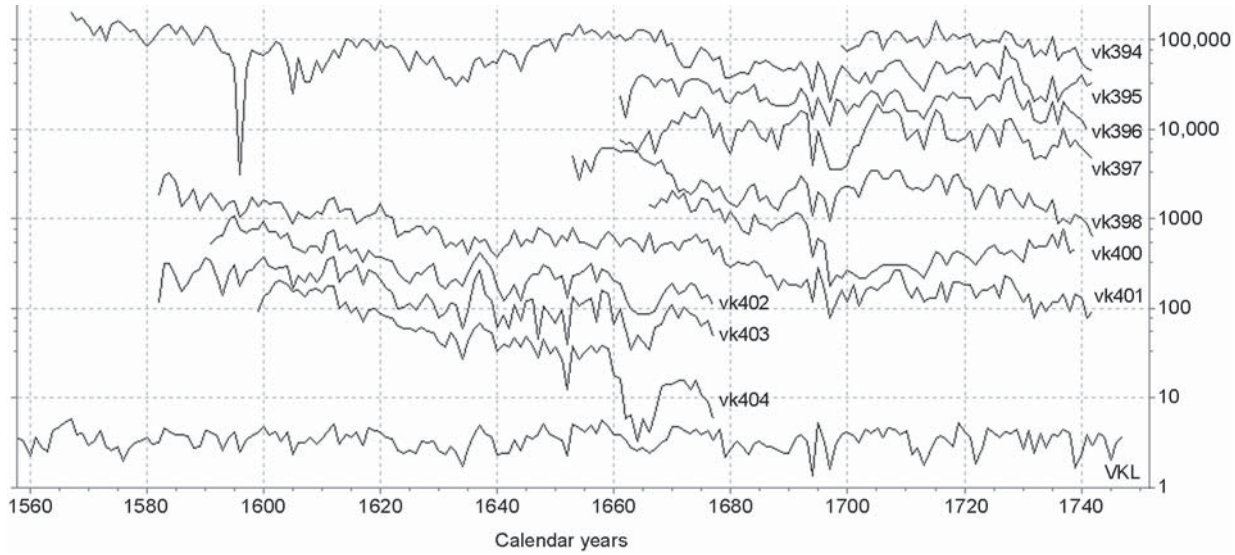

Fig. 9. Cross-dating of individual series based on the specimens from the "upper" (vk394–vk398, vk400, and vk401) and "lower" (vk402–vk404) log cabins in building 10.

Middle Ages to the Modern Age (Chernykh, 1996: 58–59). For example, most of the landmarks of Russian wooden architecture of the 17th–18th centuries were built using raw timber*. This is confirmed by the comparison of dendrochronological data and information from the written sources, as well as by construction techniques (Chernykh, 2001: 117–118; Maltsev, 2005).

Occurrence of parts (primarily from the log cabin walls) made of wood that was harvested during different seasons of the same year in the same building was a sign of such a practice at the Ust-Voikary settlement. A vivid example was building 8*: the dates of eight out of 15 specimens from the layers fell during the autumn–winter of 1639/40, while seven specimens were dated to the summer of 1640 (Gurskaya, 2008: 219). This approach to construction among the peoples of Western Siberia, in particular among the Ob Ugrians, is still practiced even today (Perevalova, Karacharov, 2006: 258, 268). Considering all the above, we will offer some arguments as to the time of constructing the buildings under discussion.

Building 1 was made in 1690. Specimens with later dates have not been found.

Building 2 was erected in 1553–1554. A later date shown by the wood from the filling was 1569. This gives grounds for assuming the time when this building functioned. This building was covered by a structure in the late 1570s.

Building 3 was presumably made in 1514. Specimens with later dates have not been identified. This structure was covered by building 2.

Building 3A was made in 1467. Specimens with later dates have not been identified. This structure was covered by building 3.

Building 5 was probably made in 1467 or a little later. There were no specimens with later dates in the collection.

Building 7 was made in 1739. The latest date of 1748 was revealed by a series of specimens.

Building 9 was probably made no earlier than 1748. Specimens with later dates have not been found.

Building 9A was built at the turn of the 17th and 18th centuries. The latest dates of 1741–1742 were revealed by a series of specimens. This structure was covered by building 9.

Building 10 was made in 1743. Specimens with later dates are absent in the collection. This building was probably located on the remains of an earlier log cabin presumably made in 1678.

Gurskaya obtained the following dates for other log buildings at the Ust-Voikary settlement (2008): 3* – ca 1666, 4* – 1647, 8* – 1640 (existed until the late 1680s, possibly until the beginning of the second third of the 18th century), and 9* – 1640 (before the beginning of the 1670s). The comprehensive publication of 2008, which was mentioned above, has no information on the dating of building 5*, but this information was available in an earlier article by Gurskaya, where larch specimens from the wall were dated to 1600. Other information was not provided (Gurskaya, 2006a). The publication of 2008 on building 7* reported that 19 specimens were sampled, but it was not possible to obtain reliable dates for them (Gurskaya, 2008: 219). However, in the article of 2006, this building was dated to 1652. Its filling contained wood with the cutting date of 1542 (Gurskaya, 2006a).

*The emergence of log construction technology in northwestern Siberia is traditionally associated with the influence of the population from the European part of Russia.

The list of dated buildings shows that log cabins in the settlement have been known from the second half of the 15th century. Most structures date back to the end of the first half of the 17th century. The distribution of dates, which has been determined, only demonstrates a significant irregularity in studying different stratigraphic levels.

The correlation of types, chronology, and the excavated area of buildings make it possible to conclude that by the end of the first half of the 18th century, log architecture replaced stationary frame-and-post buildings, and already in the second half of the 18th century intense construction activities at the settlement ceased. Only two buildings on the hilltop are known which are dated later than the mid 18th century (according to archaeological data, not earlier than the early 19th century) (Fedorova, 2006: 15–16). Therefore, their emergence is associated with another page in the history of this settlement.

Conclusions

The Ust-Voikary fortified settlement, a stratified site of the Middle Ages/Modern Age, left by the indigenous population from northwestern Siberia, is one of the few archaeological sites known in the region with a cultural layer preserved in permafrost. The results of its in-depth study provided in the literature and in this article are only relevant for a limited part of the settlement on a hill of artificial origin, where excavations have been carried out.

Log buildings were the object of this study. Using the method of dendrochronology, dates were obtained for nine structures examined in 2012–2016. When interpreting the dates, the author proceeded from the assumption that freshly cut wood was used for construction. Generalization of dendrochronological data has shown that already in the second half of the 15th century, log buildings coexisted with frame-and-post buildings in the structure of the settlement. New evidence has made it possible to clarify the upper boundary of active construction at the settlement—the end of the first half of the 18th century. After that, construction activities began to decrease.

The architecture of the final stage of the history of the settlement makes it possible to speak about the replacement of stationary frame-and-post buildings with log cabins. Gradual and probably complete transition to log construction distinguishes the Ust-Voikary settlement from two other well-known, large settlements in the region—the Nadym and Polui fortified settlements. The later stages in the history of all these settlements were generally synchronous. However, log construction in the Nadym and Polui fortified settlements in this period was not well developed. It was used only for building small dwellings, forming territorially isolated and relatively small peripheral areas in the structure of the settlements (Kardash, 2009: 65–67; 2013: 130–131).

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"Salt Turn"—A Toponym in the Middle Irtysh Basin: Historical and Archaeological Evidence

This study addresses the "archaeology of salt" on the Middle Irtysh, where the Irtysh defense line was situated, as well as the routes whereby lake salt was transported in the 18th and 19th centuries. The main question concerned the historical causes underlying the toponym "Solyanoi Povorot" (Salt Turn) in the Cherlaksky District of the Omsk Region, southwestern Siberia, in the 18th century. This name had been given to one of the redoubts of the Irtysh defense line, linked to a transportation route to the Baraba forest-steppe. Apart from the salt-related toponymy, which spread mostly along the salt transportation routes, artifacts relating to the mining of evaporated lake salt were found in the region. Archaeological data correlate with the historical sources suggesting that this industry existed in southwestern Siberia in the 1600s and 1700s. However, it is rather scantily reflected by Russian toponymy. The singularity of the name Salt Turn is explained by a short-term functioning of that part of the salt route near the respective place. Later, the name changed to Solyanoye—referring to a village and having lost any connection with salt logistics. The analysis of sources suggests that lake salt mining and the routes by which it was transported were key factors in the construction of Russian defense lines (forts, outposts, redoubts) in southwestern Siberia. Moreover, this was one of the key factors in the colonization of that region first by Muscovy and then by the Russian Empire.

Keywords: *Salt-related toponyms, Irtysh defense line, Salt Turn redoubt, lake salt mining, salt transportation, southwestern Siberia, Early Modern Age.*

Introduction

The steppe territories of the south of the Middle Irtysh basin have always been the place of active and diverse economic activities (Kosarev, 1981: 21, 22). One of the industries was the extraction and transportation of deposited salt from the lakes of the Baraba forest-steppe and the Kulunda steppe (Volchek, 2006; Gefke, 2014; Vaskov, 2019, 2020). Notably, around the Irtysh river, according to the written documents of the 17th century, "there are so many salt lakes all over the area, they are countless" (Titov, 1890: 76). Generally, the number of salt lakes increases from north to south (Zapadnaya Sibir, 1963: 134). The presence of lakes in the southwestern Siberia largely determined the socio-economic specifics of this region (Kosarev, 1981: 231). In the 16th–18th centuries, during the development of this territory by the Russians, salt, along with furs, was an important resource factor for the Tsardom of Muscovy, and later for the Russian Empire. This is clearly reflected in the historical toponymy of the southwestern Siberia.

In the first quarter of the 18th century, the Solyanoi Povorot (Salt Turn) redoubt (modern-day Solyanoye village, Cherlaksky District, Omsk Region) was one of the points closely associated with the delivery of salt from the

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Middle Irtysh basin to other regions of Western Siberia. Comprehensive approach to studying the specifics of the Siberian salt industry, with its comparison to the similar experience of other countries, allows us to raise the question of the short-term existence of several transport routes for the delivery of salt, including one through the Baraba forest-steppe.

Materials and sources

The first campaigns for harvesting lake salt in southwestern Siberia began to be planned in the late 16th century; in particular, we know of Tsar's order of 1594 to Prince A.V. Eletsky, the founder of the city of Tara (Miller, 1750: 277–278). However, this "salt" expedition did not take place. At the beginning of the 17th century, expeditions for the salt from Tara did become more or less regular (Miller, 1941: 93; 2000: 108; Vaskov, 2019), and from the mid-1620s on, southwestern Siberia was fully self-sufficient in providing salt for its needs. The main source of salt was Lake Yamyshevskoye (Fig. 1). At this deposit, salt mining was not only a resource industry, but also a factor determining the international relations of the Russian State (Kamenetsky, Rezun, 2010), as well as an incentive for its domestic fiscal policy (Volchek, 2006). By the end of the 17th century, in the "Description of New Lands, that is, the Siberian Kingdom" (1683), the first description of the harvesting process of lake salt by Russians in Siberia was introduced (Titov, 1890: 76).

Fig. 1. Map of the south of the Middle Irtysh basin.

At the beginning of the 18th century, several conflicting trends emerged in relation to the salt industry on Lake Yamyshevskoye. First, according to the decree of Peter I of September 9, 1701, it was supposed to significantly increase salt production "in order to replenish the treasury". Second, in 1705, a state monopoly on the sale of salt was established in Russia, which led to its rise in price. Third, in 1707, a royal charter was sent from Moscow to Tobolsk, according to which "it is prohibited to go to Lake Yamyshevskoye on small boats for salt harvesting" (Polnoye sobraniye…, 1987: 355; Vaskov, 2020: 84).

In 1716, the formation of the Irtysh defense line began (Evseev, 1974; Muratova, 2007) (Fig. 2). With the advancement of the equipped Siberian border far to the south in the first two decades of the 18th century, Lake Yamyshevskoye, the main source of salt in the southwestern Siberia, happened to be located within the borders of the Russian State. In 1722, an imperial decree was issued on the regulation of the salt industry, which laid the foundations for the state monopoly on salt in Siberia. In the first quarter of the 18th century, fortification infrastructure of the Irtysh defense line was initially designed. In the register of Major General K.K. Kinderman, compiled in the autumn of 1745, the defense line was supposed to be equipped with signal beacons not only in the midway between various fortifications (fortress, outpost, redoubt, camp), but also at each fortification point. In this document, published by G.N. Potanin (1867: 15), the toponym Salt Turn is mentioned for the first time: a tract where a post station and a lighthouse should have been established. The Russian State Military Historical Archive contains the "Map of the Irtysh River from Omsk to Ust-Kamenogorsk Fortress. Composed in 1745" (RGVIA. F. 420, Inv. 1, D. 4) (Fig. 3). In its lower right corner, there is an autograph "Engineer Lieutenant Andrey Seliverstov"; on the back of the sheet, there is an entry: "According to general register No. 24. Sent upon a report from Major General K.K. Kinderman with Sergeant Sokolov on May 17, 746". The "Register sent to the High Government Senate on the map of the Irtysh River and on its fortresses and redoubts", signed by the same Andrei Seliverstov, lists the map, design plans for the redoubts and the lighthouse, "Inventory of the fortresses designated on the Irtysh River map", an estimate, an opinion, and two statements (RGADA. F. 248, Inv. 113, D. 1584, fol. 619). Comparison of the inventory with the map from the RGVIA suggests that these belong to a single set of documents. The legend of this cartographic documentation indicated "where postal yards, defenses, lighthouses, and others were determined to be built"; and among them was the Salt Turn tract (Borodovsky, Chibyshev, 2021a: 29; 2021b). In the late 18th century, the Salt Turn was marked on several other maps. In

particular, on a map “Peasant dwellings under the jurisdiction of the office of the Kolyvano-Voskresensky mining authorities, at what distance they are from factories and mines, and at what positions they are situated” of 1771 (RGIA. F. 485, Inv. 5, D. 478, fol. 1) and on the map “Kolyvano-Voskresensky factories and mines located in the Kolyvan governorate, composed from various special maps…” of 1794 (Ibid., D. 480, fol. 1). In 1771, Academician P.S. Pallas, who visited the Irtysh defense line, left a fairly detailed description of the Salt Turn (1786: 123, 124) and gave his explanation of the origin of this toponym: “The village of Solyanoi Povorot [Salt Turn] is so called, because in this location the wagons sent for salt from the Irtysh River to the Baraba steppe to the salt lakes of Vishnevoye and Karasukskoye… take a turn” (Ibid.: 125).

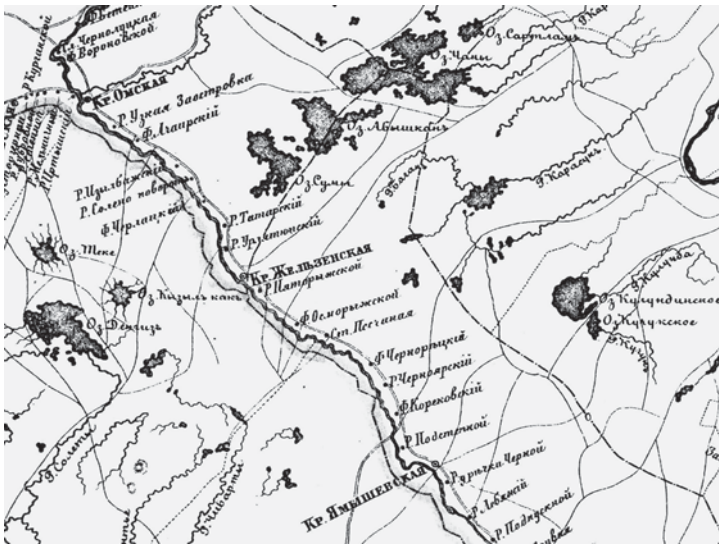

Fig. 2. Map of the Irtysh defense line of the late 18th to early 19th centuries.

Fig. 3. Map of the Middle Irtysh basin in 1745.

The establishment of the station, redoubt (*stanets*)*, and the village of Salt Turn, according to indirect data, can be attributed only to the first quarter of the 18th century (Borodovsky, Chibyshev, 2021a: 34). The assumptions that this fortified point existed in the initial period of the formation of the Irtysh defense line have not yet been evidenced by the documents. In 1771, the location of the Salt Turn village was described by Academician P.S. Pallas as follows: “The place preceding the village is rather low… there are two deep gullies (*bueraks*) that go from here to the Irtysh River” (1786: 123). The actual location of this fortified point was unknown for a long time, until in 1984 a school teacher P.V. Chibyshev from the Solyanoye village found on the right bank of the Irtysh, 1.2 km north-west of the Solyanoye village, a subrectangular area 100 × 70 m, enclosed by a ditch 1.2 m wide, up to 0.4 m deep (Fig. 4). It is located at the southern edge of the ravine Maly Log, which adjoins the bank edge of the Irtysh. Downstream the river, there is another ravine—Bolshoi Log. These ravines is correlated with the two gullies (*bueraks*) described by Pallas in the late 18th century (1786: 123), since the word *buerak* of Turkic origin means ‘ravine’ (Ozhegov, 1960: 126). The location of the enclosed area identified by P.V. Chibyshev is quite comparable with the description of the village of Salt Turn given by Pallas in 1771: “It [the village] lies on a small breakthrough of a high river bank… In this location, there are no islands on the Irtysh River. The bank rises from Solyanaya along with the steppe and is very steep” (1786: 123, 124). Tacheometric survey of this territory, carried out in the spring of 2021 by R.V. Davydov, made it possible to reveal a significant elevation difference from the side of the steppe to the bank edge of the Irtysh (Fig. 5).

The correctness of localization of the redoubt, *stanets*, and the village of Salt Turn can also be clarified by the “Description of the Tobolsk, Ishim, Tarsk, Irtysh, Kolyvan, Kuznetsk lines” dated 1785. In accordance with this document, the village of Salt Turn

**Stanets* was a redoubt with a side of 10 sazhens (22 m), ledges at the corners, and a ditch of 10 feet (3 m) (Muratova, 2013: 113) (RGVIA. F. 349, Inv. 1, D. 93, fol. 15–28).

Fig. 4. Orthophotomap of the Salt Turn redoubt (compiled by R.V. Davydov, S.A. Epler).

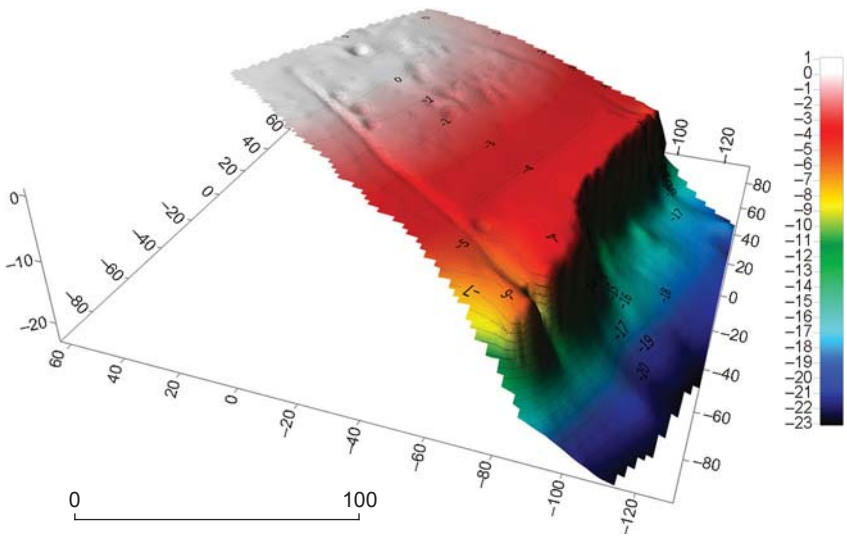

Fig. 5. Plan of the Salt Turn redoubt based on the tachometric survey (compiled by R.V. Davydov).

was located at a distance of 18 versts (19.203 km) and 100 sazhens (220 m) up the Irtysh River from the *stanets* of Izylbashsky, and at a distance of 25 versts (26.670 km) and 300 sazhens (660 m) to the next outpost of Cherlakovsky (Muratova, 2013: 109). It should be noted that today the distance indicated in the geographical description of the Irtysh defense line from 1785 from the Salt Turn fortifications to the edge of the Irtysh River bank (15 sazhens (33 m) from the bank) (Ibid.) does not correspond to reality. As a result of bank erosion, the profiles of the ditches of the fortified area adjacent to the Irtysh River were exposed (Fig. 6, 7). Notably, written documents of the late 18th century already mentioned a significant erosion of the Irtysh bank near some defensive structures (Ibid.). Nevertheless, it was precisely this bank spatial distribution that was most characteristic of the typical redoubts of the Irtysh line (RGVIA. F. 418, Inv. 1, D. 936, fol. 1) (Laskovsky, 1866: Fol. 12, im. 14; Muratova, 2013: 112) (Fig. 8).

After localization of the Salt Turn redoubt according to historical sources of the 18th century, it is necessary to correlate modern archaeological data with this written evidence. In 1771, Pallas gave the following description: "This village, as also the one previously mentioned (Izylbashskaya), is not fortified…" (1786: 123). There is also no information about earth structures for a number of fortifications in the geographical description of the Irtysh line of 1785 (Muratova, 2013: 109). This fact can have different interpretations. First, the earth defensive structures of the Salt Turn redoubt may date back to an earlier period of its existence. It should be noted that in 1771 Pallas described in sufficient detail the earthen ditch of the Omsk fortress and the Uzko-Zaostrovskaya village (1786: 115, 117–119). Perhaps this was both due to the larger size of this fortification, and to its periodic renewal. The version about the earlier origin of the ditches of the Salt Turn redoubt is confirmed by their subtrapezoid profile, typical of the fortification of the early 18th century (Borodovsky, 2021: Fig. 1, *7*; 2; 4, *2*) (see Fig. 7, 8). Second, the lack of description of the earthen fortifications of many *stanets*, redoubts, and outposts of the Irtysh line from the Omsk fortress to the

Fig. 6. Profile of the northern ditch of the Salt Turn redoubt in the bank edge of the Irtysh (*photo by A.P. Borodovsky*).

Fig. 7. Profile of the southern ditch of the Salt Turn redoubt in the bank edge of the Irtysh (*photo by A.P. Borodovsky*).

Cherlak outpost in 1771 and 1785 could be due to the fact that these had not been renovated for a long time, were not upgraded, and fell into disrepair (Pallas, 1786: 123; Muratova, 2013: 109, 110).

Salt-related toponymy in this territory was not accidental. It corresponds primarily to the tradition of the Tsardom of Muscovy to equip fortification points near salt mines and salt transport routes. For example, the letter missive to the Tara voivode I.V. Koltsov-Mosalsky, dated February 27, 1608, contains the following words: "And near the salt lakes up the Irtysh River, without a prison and without a fortress, there is no fortification for the Kolmak people" (Russko-mongolskiye otnosheniya…, 1959: 25).

The universal motivation for the use of words associated with salt as a topo-element was the fact that throughout the history, the economy of many Austrian, Dutch, Italian, German, Russian, Swiss and other settlements was based on the extraction, purification, and sale of salt. This is reflected in the semantic structure of many toponyms: these included words meaning salt from various languages (Gataullin, Fatykhova, 2018: 543–545). Notably however, in the salt-related toponymy, such an important logistic process as the transportation of salt was ignored. An example is the former name of the village Solyanoye of the Cherlaksky District, Omsk Region: Solyanoi Povorot (Salt Turn). This toponym is rather curious. First, it is unique in the territory of its location. Second, there is a transformation over time in the name of the settlement, which reflects the historical dynamics of transportation and harvesting of lake salt in the south of Western Siberia. Third, the interpretation of the meaning of such a toponym is ambiguous. The last point deserves special attention. First of all, it must be emphasized that from a geographical and historical point of view, the Irtysh River in its middle and upper reaches is the natural boundary of the southwestern Siberia. Therefore, it is no coincidence that in the 18th century it was here that

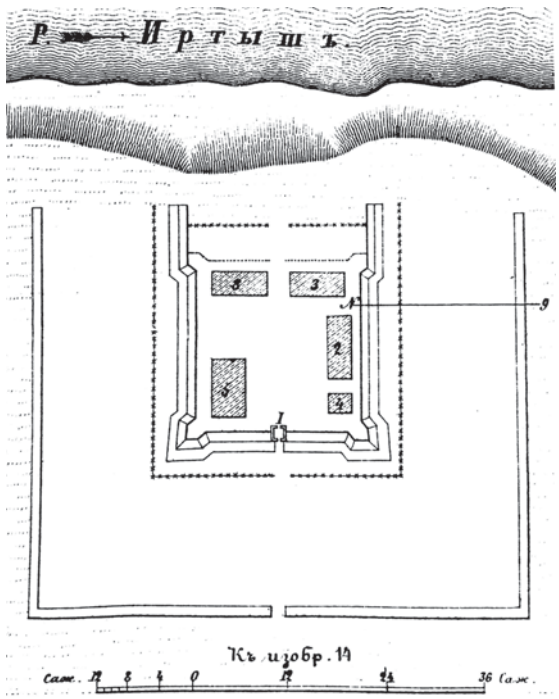

Fig. 8. Plan of a typical redoubt on the Irtysh defense line (Laskovsky, 1866: Fol. 12, im. 14).

the Irtysh defense line began to form (Muratova, 2013), which was in use more than one and a half centuries. Another important thing was the transportation along the Irtysh River of the salt from Lake Yamyshevskoye. The presence of such "salt" logistics in the Middle Irtysh basin largely determined the appearance of the toponym Salt Turn (station, redoubt, village) (Borodovsky, Chibyshev, 2021a: 35). It should be emphasized that Pallas, who in 1771 gave the above explanation of this toponym, described in detail the salt industry in the south of Western Siberia in the 18th century (Vaskov, 2020). Consequently,

he thoroughly investigated the salt industry in the region, and all his remarks regarding the organization of this production and also the logistics of the final product are extremely important. Of course, the toponym Salt Turn belongs to the widespread group of names of settlements on the so-called "salt roads". They are known in many countries of Eurasia (Spain, France, Germany, Poland, Russia). However, the Pallas's explanation of the origin of the toponym Salt Turn contains an important indication: this road didn't serve to the most important salt deposit of that time—Lake Yamyshevskoye (from which the salt was delivered along the Irtysh), but to the salt lakes Vishnevoye and Karasuk, located 50 versts east of the main river (Pallas, 1786: 142–145). The salt in these lakes was of very high quality, but was deposited on the bottom in layers up to one cubit (48 cm) thick (Shostyin, 1975: 256).

Discussion

At present, the hydronyms mentioned by Pallas (1786: 125, 142–145) are localized as follows. In the south of the Ob-Irtysh interfluve, there is only one lake on the border of the Baraba forest-steppe and the Kulunda steppe with an accordant name: Krasnovishnevoye (Kipriyanova, 2020: 50, fig. 1, *57*). Most likely, it is this that corresponds to one of the lakes described by Pallas (1786: 145) (see Fig. 1). However, this salt deposit was clearly not the main one. Therefore, it cannot be argued that such a "salt" road was a priority. The main transportation of salt was carried out by water. First, its main source, Lake Yamysh (now Tuzkala) was located only 5–6 versts from the Irtysh. This greatly simplified the transportation. The easiest way to get to the lake was to go up the Irtysh River on ships from Tobolsk past Tara. Also, the waterway provided the best protection from the unpredictable nomads. Second, the salt from Lake Yamyshevskoye was of high quality. However, periodically the thickness of the salt deposit was significantly reduced (or the reserves of the deposit were not restored), which probably required the use of other, lower quality salt deposits in Baraba. In fact, this was the "reserve" variant, which was probably used only episodically, and this was reflected in the singularity of the toponym Salt Turn for the area where it was localized (see Fig. 2, 3).

Long-term "salt" roads are characterized by the seriation of such toponyms. This version is indirectly confirmed by the geographical description of lakes where salt extraction is possible, in a book devoted to Western Siberia, which was published at the beginning of the last century (Rossiya, 1907: 343). Notably, Vishnevoye and Karasuk lakes are not mentioned in this book. In our opinion, this suggests the historical situatedness of the appearance of the toponym Salt Turn, which was associated only with a certain episode of salt logistics in southwestern Siberia. No less important is the fact that even in the publication of Pallas, there is a variability in the interpretation of the toponym associated with salt in the Middle Irtysh. At the beginning of the description of this settlement, he uses the name Solyanoi Povorot (Salt Turn) (Pallas, 1786: 125), while further in the text the name "Solyanoye" (Salt) occurs (Ibid.: 126). It is this "truncated" version of the toponym that has survived up to the present, having finally lost its connection with the "salt" road to the Baraba forest-steppe and Kulunda, which was used in the 18th century.

The presence of salt-related toponymy in the Middle Irtysh basin indirectly points to archaeological objects associated with extraction, storage, and use of salt in this region (Burchard, 1957). For the area under consideration, such a feature was noted as early as the late 18th century (Pallas, 1786: 126). In this regard, it should be noted that study of the salt issue with consideration to archaeology involved a certain algorithm that was formed back in the middle of the last century. The first stage of such work was the collection and generalization of data from medieval written sources, topographic data, as well as mapping of areas where salterns were supposed to be located in the past. The next stage included the localization of the salterns in specific areas on the basis of archival materials and archaeological surveys. The final stage was the purposeful large-scale archaeological studies in the most promising areas, for which there were written historical sources about salt extraction or transportation, geological data on salt deposits and their type, and archaeological materials related to salt industry (Burchard, 1957: 186). Judging by these features, it should be noted that a number of areas in southwestern Siberia are extremely promising for conducting such comprehensive studies. Salt works, which originally implied salt gathering, eventually led to the formation of an extractive industry in the West Siberian region.

Artifacts associated with salt

One of the artifacts associated with the use and storage of salt in the Middle Irtysh basin, found on the territory of the modern Solyanoye village, is a small ceramic vessel of a specific shape (Fig. 9). At the base of its conical body, there were three legs protruding in different directions, not more than 2 cm in size. The vessel was hand-made and well-fired. The total dimensions of the container were 10 × 8 cm; and it could hold up to 60 g of coarse salt. This amount of substance corresponds to *shkalik* (62 ml)—the traditional Russian measure of volume of liquids and bulk substances. By its size, the vessel most closely corresponds to salt shaker, since up to the present time dishes for salt are represented exclusively

by small containers, from 6.5 × 6.8 × 6.5 to 10.0 × 10.5 × × 10.0 cm, intended for storage and serving of this product. The morphology of the item from Solyanoye—a conical body and three supporting legs—is very close to the traditional forms of ceramic dishes for salt. Such vessels of the Bronze Age are widely known in Western Europe (Burchard, 1957, 1959, 1963; Kostrzewski, 1968; Jodłowski, 1969, 1972, 1976) (Fig. 10). Three protruding legs at the base of the vessel from Solyanoye show a certain similarity to the ceramic supports used for salt-making tanks. Such items were widespread (from Britain to Italy) in the Late Bronze Age (Ibid.) (Fig. 10, *2–9*). Despite such analogies, the relative dating of the ceramic vessel from Solyanoye is rather difficult and corresponds to the Bronze Age. Notably, in the vicinity of the village of Solyanoye and on its territory, there are quite a lot of different archaeological sites of that time. The first mention of such facts dates back to the late 18th century (Pallas, 1786: 130). In the middle of the last century, in the village of Solyanoye, a bronze dagger-acinaces of the Early Iron Age was discovered (Borodovsky, Chibyshev, 2021a: 9). However, regardless of its attribution to a certain chronological period of the Bronze Age, this ceramic vessel with a conical body on three legs is very close to the clay utensils associated with salt. This is what allows us to consider the artifact in the same historical context with written evidence and toponymy associated with the salt industry in the Middle Irtysh basin.

Conclusions

A comprehensive study and reconstruction of the history of the salt industry in the southwestern Siberia is quite relevant. The earliest evidence of systematic salt mining and transportation in Eurasia dates back to the Neolithic (Nenquin, 1961: 11, 158; Weller, 2004; Weller et al., 2009). Numerous high-quality natural salt deposits in the southwestern Siberia were a valuable and attractive resource of the region. On the territory of Poland, Romania, Hungary, Slovakia, and Western Ukraine, salt mining during the Bronze Age (Burchard, 1957, 1959, 1963; Kostrzewski, 1968; Jodłowski, 1969, 1972, 1976; Kadrow, Nowak-Wlodarczak, 2003; Przybyła, 2010; Dzięgielewski, Szczerba, Chudzińska, 2011; Kavruk, Georgie, 2011, 2012) was a much more labor-intensive activity as compared to the southwestern Siberia.

Fig. 9. Ceramic vessel from the Solyanoye village (Cherlaksky District, Omsk Region), in the vicinity of the Salt Turn redoubt.

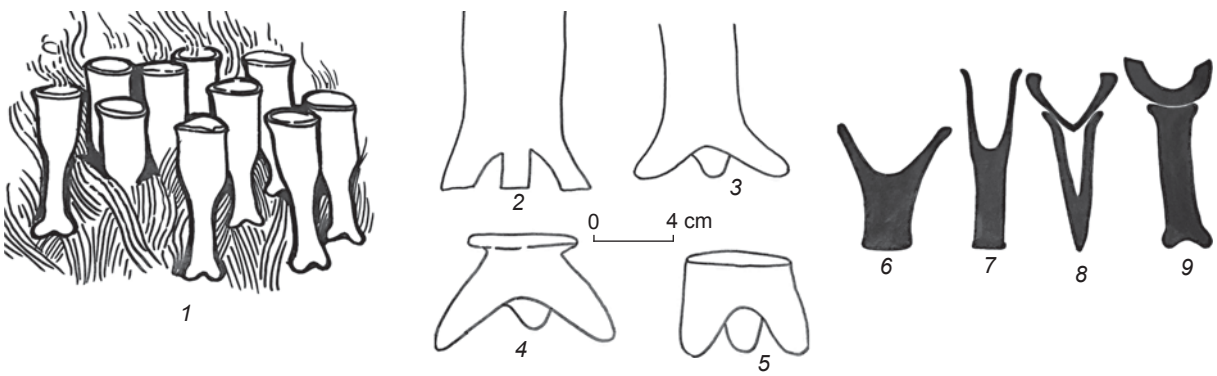

Fig. 10. Pottery associated with the salt industry of the Late Bronze Age and Early Iron Age, from Western Europe (after (Jodłowski, 1976: Rys. 20, 21)).

1 – reconstruction of the process of salt evaporation in conical vessels; *2–9* – forms of supports for conical vessels used in salt making.

In general, in the course of the archaeological study of "salt" issue, a certain algorithm for solving a number of problems has been developed: 1) formation of a source base of research; 2) establishment of chronological sequence of facts from the history of salt mining; 3) identification of archaeological materials serving as confirmation of data from written sources and vice versa; 4) attempts to synthesize new knowledge about the historical past, which in its final form is not present in any of the sources, and is not a simple set of data. Taking into account the very initial stage of the study of the historical past of the Siberian salt industry at the archaeological level, all these tasks are extremely relevant for further research involving the entire complex of geographical, geological, historical, toponymic, and archaeological data.

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Literacy and Numeracy Skills of the Inhabitants of Tara and its Rural Districts in the 17th and 18th Centuries

On the basis of archaeological, written, and historical sources, we assess the extent to which 17th–18th century Russian inhabitants of the town of Tara and of its rural periphery (Tarsky District, Omsk Region) were able to read, write, and count. We analyze archaeological sources suggesting that those living in western Siberian towns, such as Mangazeya, Tobolsk, etc., were literate and able to count. This is evidenced by artifacts from the town of Tara and the adjacent village of Ananyino, indicating literacy: inkpots, penknives, quills, a wooden trade label with inscription, and clay balls, possibly for counting boards—predecessors of Russian abacuses. A bone case, found at the house of a 17th century junior commander in Tara, might have been destined for letters. Such artifacts are described in detail. According to written documents, just 3.4 % of those belonging to the service class of Tara and of its rural periphery were literate. They were members of various social strata: governors, Boyar scions, clerks of government office, Cossack and army commanders of various rank, reiters, mounted Cossacks, and cannoneers. Educated ones were priests and icon-painters. Stationery available at the Tara market included paper, ink, and raw materials for their manufacture. Books and candles were sold too. Relative advantages and disadvantages of documents versus artifacts as sources of knowledge about literacy are discussed. A combined approach helps to reveal key archaeological indicators of literacy and numeracy skills and to assess the approximate share of literate individuals in various social strata.

Keywords: *Literacy, archaeology, written sources, Russians, reconstructions.*

Introduction

First Russian towns in Siberia were founded as military and administrative centers of the Russian State for defending the newly acquired lands and bringing under control the indigenous population. This mission would have been impossible without economic and civilizational progress. For successful achievement of these objectives, two governors were appointed to towns in the 17th century: one was responsible for military functions, and another for economic issues. Such administrative system also appeared in the decree on founding of Tara (Miller, 1999: 347–353): "And as Prince Andrew leaves Tobolsk… and comes to the new place, and builds and strengthens the town, then truthfully write about that to the sovereign. And let him draw town places, and town itself, and fort on the map, and write down all fortifications… so the sovereign

knows about everything…" (Ibid.: 348). Tax control was also arranged: "And all volosts should take their tribute books in Tobolsk from the Governor Prince Fedor Lobanov—how much tribute was taken from them to Tobolsk… And whatever kind of tribute each would send to the sovereign <…>, he should send the report to Tobolsk to Prince Fyodor. And all kinds of tribute should be personally recorded in the books separately according to kinds" (Ibid.: 350). A special person was nominated to check the fulfillment of orders: "And the Governor Prince Andrew should take with him clerk Kryank Ivanov, who was sent with him from Moscow, to the new town for keeping records. And order him to be the clerk at the sovereign's office for all cases, and to record all sorts of sovereign's affairs" (Ibid.).

As a military town, Tara ensured stability on the southern borders of Western Siberia for two centuries. The town, as well as villages around it, were inhabited by the servicemen. In the 17th century, about 80 % of the servicemen of the Tara garrison participated in "distant assignments". They delivered the "tribute treasury" or documents of local offices to Moscow and accompanied delegations at negotiations with leaders of the Kalmyks and Dzungar people, which required knowledge of foreign languages (Tara v XVI–XIX vekakh…, 2014: 98–99). Soldiers, Cossacks, commanders, and Boyar scions received state salary for their service. Information about it was recorded in salary books and "records of sovereign's salary to the servicemen".

Location in the Irtysh valley, with the trade routes going from Central Asia to the north, up to the lower reaches of the Ob River, fostered the destiny of Tara as a trade center.

Tara needed educated people for performing its military, political, and economic functions; skills of literacy and numeracy were acquired by representatives of both urban and rural population of the Tarsky Uyezd.

Making no question of the importance of the written sources in studying the topic, we should analyze the relevant archaeological evidence of the 17th–18th centuries.

This study intends to establish the level of literacy among the inhabitants of Tara and its rural districts in the 17th–18th centuries, using a comprehensive analysis of archaeological, written, and historical sources.

Literacy markers among the urban population of Western Siberia in the 17th–18th centuries

It is challenging and time-consuming to study the spiritual culture of the population in various historical periods from the archaeological point of view. Interpretation of an archaeological source of the Modern Age is based both on the available excavated finds and historical information contained in written, ethnographic, and other sources (Tataurova, 2021).

The issues of literacy among the Russian population of Siberia were rarely studied using archaeological sources; the research is mostly limited to the evidence from Mangazeya. The described finds from the excavated households show that the town dwellers were literate, since they carried out trade business, and their children also studied reading and writing (Vizgalov, Parkhimovich, 2013: 16). Finds evidencing the knowledge of the alphabet and writing skills include wooden boards with the alphabet, dishware, containers, such as barrels, barrel staves, and bottoms, labels of goods, birch-bark fragment with the inscribed beginning of a petition to the tsar, parts of leather goods with letters, words, and texts (Vizgalov, Parkhimovich, 2008: 129, 130, 291–294; 2013: 16, 24; 2017: 94–95, 99, 114, 115, 120, etc.), as well as thin wooden board with carved text of a promissory note (Vizgalov, Parkhimovich, 2017: 118).

A collection of items indicating numeracy skills includes counting sticks, labels on goods (Vizgalov, Parkhimovich, 2008: 129, 130, 291–294; 2017: 94–95, 99, 114, 115, 120, etc.); writing accessories, such as bronze (Vizgalov, Parkhimovich, 2013: 16, 24) and ceramic (Vizgalov, Parkhimovich, 2013: 16; 2017: 135–136) inkpots, as well as details of a wooden wax tablet for writing (Vizgalov, Parkhimovich, 2017: 118).

Pens and cases for keeping them have also been found (Vizgalov, Parkhimovich, 2013: 16, 24; 2017: 143). Noteworthy is a writing pen made of goose feather with paintbrush made of squirrel tail hair at the upper end (Vizgalov, Parkhimovich, 2017: 143). Such paintbrush could have been used for writing in gold and silver or coloring miniatures and initials (Gudkov, 2014: 23).

In the 16th–17th centuries, Tobolsk residents used clay inkpots varying in shapes and designs (Balyunov, 2014: 52).

According to oral report of the excavations' head O.M. Anoshko, the cultural layer of the town (the First Gostiny excavation area near the Indoor Market, Bazar excavation area, trading quarter) contained counting sticks and glass inkpots. A metal pen with gold plating from the layer of a household of the late 17th to the first third of the 18th centuries was found in the excavation area at the trading quarter (dated by the coins of Peter I period)*.

The range of goods at the Tobolsk market of the 17th century shows the needs and demand for stationery and other items indicating literacy of the population. First of all, it included paper, which was imported to Tobolsk throughout the entire 17th century (see *Table*). The amount of paper was measured in stacks. A stack included

*The authors express their deep gratitude to Oksana Anoshko for the information she provided.

Stationery and other items from the range of goods for literate people at the Tobolsk market of the 17th century

Year of arrival of goods	Copper inkpots, pcs./rubles	Nut galls, pound/rubles	Paper, stack/rubles	Books, pcs./rubles
1639/1640	31/11.8	80/16	58.9/58.9	173/46
1655/1656	–	150/30	119/119	–
1668/1669	–	80/16	124/124	–
1686/1687	–	–	208/208	1/6.5
1694/1695	–	10/0.9	70/70	–

Compiled after: (Vilkov, 1967: 91, 95, 110).

24 *dests* (sheafs); *dest* included 24 sheets (Belovinsky, 2007: 168; Stolyarova, Kashtanov, 2010: 116). Thus, one stack consisted of 576 sheets of paper, most likely of the *dest* format (full sheet measuring 50 × 70 or 30 × 50 cm). Each of them was subsequently cut into three parts along the longer side, depending on the document size (Gogolev, (s.a.)).

According to customs books, paper occupied the seventh place in the structure of goods brought to the Tobolsk market; but by the late 17th century, its supply declined despite of the increasing demand. According to O.N. Vilkov, this decrease in import resulted from the establishment of domestic paper production (1967: 120). However, paper production in Tobolsk emerged only in the mid-18th century. In 1745, a paper factory was created 15 versts from the town, for manufacturing writing and wrapping paper (Zapiski…, 1824: 399).

In addition to paper, the range of goods needed by literate people included writing utensils (inkpots), raw materials for preparing an aqueous solution used for writing (nut galls), and books imported in the second and last quarter of the 17th century (Vilkov, 1967: 91, 95, 110), as well as glasses that entered the market in 1668/69 in the amount of 108 items, with a total value of 6.1 rubles (Ibid.: 108).

The fact that the residents of Tomsk governor's estate knew how to write is confirmed by such finds as clay inkpots. M.P. Chernaya points to signet rings intended for sealing papers and goods as items related to office administration (2015: 192, 193).

Literacy among the inhabitants of Tara and its rural districts

The document analysis identified the differences in education level among the population of Tara and its rural periphery in the 17th–18th centuries. There were illiterate persons, such as "Andreev Grigory—a Tara soldier, illiterate. In 1652, he had no 'trade or production', D. Matveev would sign for him [while receiving salaries – *the Authors*]" (Sluzhiliye lyudi Sibiri…, 2019: 26). However, there were also educated people, for example, the one who signed for G. Andreev while receiving his salary—"Matveev Danila—a Tara mounted Cossack of the reiter hundred military unit, literate <…> On September 16, 1660, he brought a letter from Moscow; on December 29, 1665, under the orders of commanders of a ten soldiers units A. Dobrynin and O. Bogdanov, he was sent with the sable treasury to Moscow" (Ibid.: 553).

Analysis of written sources has revealed that 87 persons were literate among the 2580 servicemen and other officials who lived in Tara in the 17th–early 18th centuries*, that is 3.4 %. These were servicemen of various ranks who lived in Tara, including the Boyar scions such as Pavel Kosteletsky**, who spoke the Tatar language and, in addition to his service, performed the duties of a clerk (Krikh, 2016: 20, 21; Sluzhiliye lyudi Sibiri…, 2019: 453). His son Semen, promoted to the class of Boyar scions in 1645 (Krikh, 2016: 250, app. 3), was literate; he signed for other persons while receiving salaries (see, e.g., (Sluzhiliye lyudi Sibiri…, 2019: 61, 302)). The servicemen included the clerks of the government office and indoor market Alexey Ivanov, Petr Kolpev, Ivan Konakov, Boris Nevorotov, Mikhailo Ivanov Ostrovsky, and others (Ibid.: 339, 431, 435, 613), as well as governor deputy and Cossack commander Fedor Elagin and Nazar Zhadobsky (Zhadobskoy, Zhedobsky, Zhedovsky) (Ibid.: 282, 301), Cossack and army commanders of a hundred soldiers' units I. Vatov and Nefedya Matveev (Ibid.: 154, 554), commander of

*Calculated based on the materials from the encyclopedia "Sluzhiliye lyudi Sibiri kontsa XVI – nachala XVIII v." (2019). The sources do not mention literacy for most of the servicemen, but those who were literate or illiterate are separately noted. Our statistics include all people who were marked as "literate", as well as clerks, employees of the government office, interpreters, and representatives of other classes who signed for the illiterate while receiving salaries. The authors do not claim absolute results of the calculations, but consider the information obtained to be representative.

**Only some names of literate servicemen and representatives of other classes are provided as examples.

a fifty soldiers' unit Oska Kuznetsov, commander of a ten soldiers' unit Andrey Varfolomeev, cavalry captain Voin Volkonovsky (Ibid.: 143, 176, 480), reiters Alexei (Oleshka) Ivanov, Duma Krishtopov (Ibid.: 338, 464), mounted Cossacks Aleksey Goisky, Aleksey Ivanov, Ivan Nefediev, and cannoneer Andrey Rezin (Ibid.: 213, 338, 624, 750).

Literate were church officials, who were invited by the servicemen to sign for them after receiving money. They included Fr. Savva (Sava)—the "spiritual father, priest" of St. Nicholas Church (Ibid.: 108, 491, 568, 570, etc.). Savva Antipin lived in the fortified part of the town; in the late 17th century, his household passed to his grandson, mounted Cossack Petr Popov (Ibid.: 715). The following priests were mentioned: priest Anton (Ibid.: 130, 615), reader of St. Paraskeva Pyatnitsa church (*pyatnitsky dyachok*) Fr. Goiskov (Ibid.: 128, 556, 754). Icon-painter O. Nefedov also signed for the servicemen (Ibid.: 128). Notably, by the mid-18th century, there were four icon-painters in Tara (Tara v XVI–XIX vekakh…, 2014: 126).

It is known from written sources that in the late 16th century, immediately after construction of the town was completed, it was ordered to bring "2 stacks of writing paper… Books, Hexameron, and Psalter with the selected psalms" (Tsvetkova, 1994: 8), along with necessary supplies and ammunition from Moscow.

In the 17th century, paper for writing would come to the Tara market mainly from Tobolsk (Krikh, 2016: 42; Tara v XVI–XIX vekakh…, 2014: 106). In the 17th to the first half of the 18th century, ink and materials for its manufacturing were imported along with paper, since only in the early 1760s A. Bekishev designed "vitriol ink". He boiled up to 50 puds of ink a year and sold it for 2 rubles per pud, but this production lasted for no more than five years (Tara v XVI–XIX vekakh…, 2014: 122).

In addition to paper, birch-bark might have been used for writing texts and religious books both in the State Orthodox and Old Believer traditions (Gudkov, 2014: 29), but so far no birch-bark documents have been found in Tara.

The "documentary" evidence mentions counting sticks (Fig. 1, *1*), trade seals, and wooden trade label with the inscription "hops" (Tataurov S.F., 2017). According to written sources, in the 17th century, servicemen of various ranks were actively engaged in the sale of hops "of their own production". For example, the commander of the fifty soldiers' unit Ivan Timofeev Nedopeka sold half a pud of hops in 1637. On December 18, 1647, he "brought for sale" 2 puds of hops for 6 rubles. On February 20, 1648, mounted Cossack Grigory Sumyanin brought for sale 10 puds of hops. On March 10, 1687, the Cossack son Petr Filimonov brought 10 puds of hops of his own production to Tobolsk (Sluzhilye lyudi Sibiri…, 2019: 614, 823, 917).

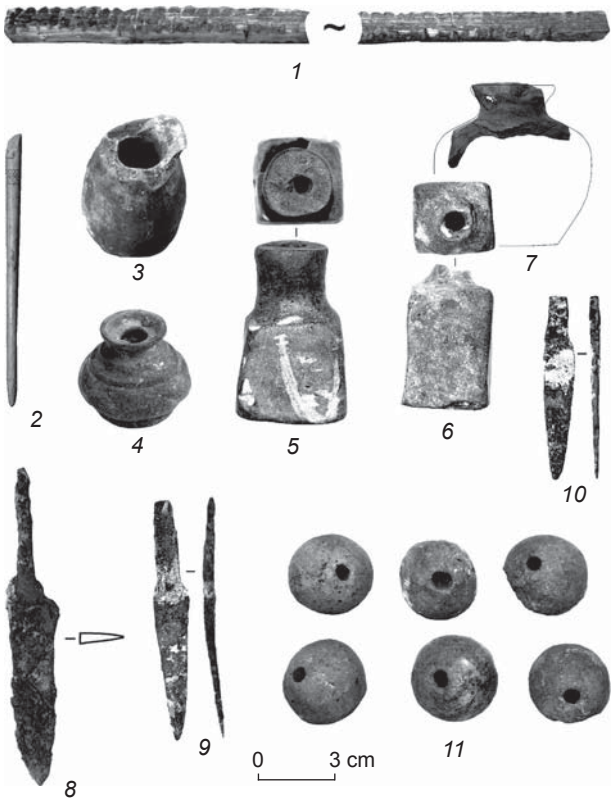

Fig. 1. Archaeological finds from the town of Tara (*1–4*, *8*) and the village of Ananyino, Tarsky District, Omsk Region (*5–7*, *9–11*).
1 – counting stick; *2* – stylus; *3–7* – inkpots; *8–10* – penknives; *11* – beads from abacus. *1* – wood; *2* – bone; *3*, *4–7*, *11* – ceramics; *4*, *8–10* – iron.

Most of the servicemen of Tara and its rural districts participated in trading "goods from Russia" and selling livestock, hunting products, fish, butter, "huts with courtyard", etc. The Tara trade flourished in second half of the 18th century, when a tea route ran through the town (Tataurov S.F., 2017).

Wax tablets were known to be used in teaching literacy in Mangazeya and Tara. These items have not been found, but a bone stylus (*pisalo*, lit. 'writing tool'), decorated with two lines of netlike ornamentation, was discovered in the cultural layer of Tara Fortress (Fig. 1, *2*). Styluses were also used for writing on birch-bark (Gudkov, 2014: 22).

Stationery from the cultural layer of Tara included inkpots made of clay and metal (Fig. 1, *3*, *4*); the latter item was similar to the Mangazeya find (Vizgalov, Parkhimovich, 2013: 24). The inkpot from Tara was dated to the 18th century (Tataurov S.F., Fedotova, 2018: 30), but since it was similar to the Mangazeya inkpot, it could have probably been used at an earlier time.

Goose quills, which were sharpened with penknives (Fig. 1, *8*), were apparently used for writing. These knives differed from similar tools by the small size of their blades

(Slovar…, 1980: Iss. 7, 165; 1988: Iss. 14, 309). Precisely such penknives have been found in the cultural layer of the village of Ananyino, located near the lake of the same name, on the right bank of the Irtysh River, 10 km southeast of Tara. Their total length was 9.5 and 7.0 cm; blade length was 6.5 and 5.3 cm; blade width was 1 cm (Fig. 1, *9*, *10*). The knives were made using the technique of welding a steel blade onto a soft iron base, and were subjected to soft hardening (Zinyakov, 2017: 428). A penknife from Tara was somewhat larger. Its total length was 12.6 cm; blade length was 8 cm; blade width was 1.8 cm. Such knives were found both in the area of the fortress in one of administrative buildings of the second half of the 17th to the first half of the 18th centuries, and in a building of the first third of the 17th century on the territory of the fort.

The written sources have no information on literacy among the dwellers of Ananyino. The village of Ananyina (Ananyino) was mentioned for the first time in historical documents in the "Book of Records of the Tarsky Uyezd" for the year of 1623/24. In the 17th–18th centuries, several family clans—the Moseevs, Neupokoevs, Skuratovs, and Popovs (Tataurova, Krikh, 2015: 479–483)—lived in the village. The encyclopedia "Servicemen of Siberia" has very brief information about these people: "I. Popov was a Tara soldier. In 1701, he lived in the village of Ananyina up the Irtysh with Moseev, Neupokoev, and Skuratov" (2019: 712). However, they all came from Tara, which means that there must have been some literate persons among them. For example, Stepan Afanasiev Skuratov, a commander of the fifty Cossacks' infantry unit, and since 1634 a chieftain, in 1638 sent a petition to receive a grassland near the village of Ananyino, which was satisfied (Krikh, 2016: 73).

Owing to the specific features of the cultural layer in Ananyino, preservation of organic materials was quite poor: only clay inkpots (Fig. 1, *5*–*7*) and penknives have been found therein. Ornithological collections at the site are indicative of domestic geese breeding and wild geese hunting (Tataurova, Nekrasov, 2021: 77), and suggest that feathers of these birds might have been used for writing.

Signet rings of noblemen, which were found in Tara (3 spec.) and Ananyino (1 spec.), were associated with literacy and office administration. The shields of two Tara bronze rings were inlaid with colored glass. One ring depicts Latin letters and an inverted shield (Fig. 2, *1*); another ring shows a shield with a rider on top (Fig. 2, *2*). A crown with four leaves and four teeth with pearls on the hoop (Fig. 2, *3*, *4*) appears on the halves of silver rings from Tara and Ananyino. In the 17th century, such image was typical of Russia and Northern German lands (Chernaya, 2015: 205). Signet rings were used for facsimiles; they were a symbol of power and attribute of the social class (Tataurov F.S., 2020).

A ring, inkpot (see Fig. 1, *5*), set of clay balls (see Fig. 1, *11*), which we interpreted as parts of abacus, as well as a set of "high status" items (iron two-pronged fork, counting token with inscription "Corneliusa Lauffera") and other artifacts found in Ananyino, belonged to the same residential complex where a military commander with writing and numeracy skills might have lived (Tataurova, 2018). According to the inventory and results of dendrochronological analysis, the dwelling can be dated to the second half of the 17th century, and according to the coins, to the early–mid-18th century (Tataurova, Sopova, 2021).

A set of 14 clay balls flattened on one side, 3.0–3.5 cm in diameter, with a hole in the middle (0.5 cm in diameter), which were found in the dwelling mentioned above, will be discussed in more details. These balls differed in shape and weight from spindle whorls; they were too small and light to be fishing sinkers, and they have not occurred in the cultural layer of the site before (the area of the excavation was 2500 m^2). These items can be identified as "beads" of abacuses, although they were somewhat larger than usual beads.

Fig. 2. Archaeological finds from the town of Tara (*1–3*, *6*) and the village of Ananyino, Tarsky District, Omsk Region (*4*, *5*).
1, *2* – rings with inserts; *3*, *4* – rings with "crowns"; *5* – candlestick; *6* – case for letters. *1*, *2* – bronze, glass inserts; *3*, *4* – silver; *5* – ceramics; *6* – bone.

Peter van Haven, a Danish mathematics enthusiast and professor of theology, who had lived in Russia for three years, wrote in his book published in 1747: "…all Russians, down to the poorest peasants, are very skilled in the counting art. They use a counting board for this <…> it is so commonly used that it can be even found with all kinds of pocket mirrors, writing boards, or calendars attached to it" (cited after (Spassky, 1952: 360)).

Board abacus (Ibid.: 305; Simonov, 2010: 136) was the forerunner of Russian abacus, which has been used by many of our contemporaries until recently. The abacus was a quadrangular wooden frame with transverse bars/cords, strung with beads. The description of P. van Haven mentions that "beads can be made of horn, ivory, glass, wood, metal, or of peas, etc." (cited after (Spassky, 1952: 363)). Abacus beads could have also been made of ceramics. During the excavations of a pottery workshop of the 17th century in Moscow in 1946–1947, "a collection of clay rings was discovered. Their outer diameter is 1.9–2.2 cm; inner diameter is 0.6–0.7 cm; thickness is 0.5–0.6 cm. In shape, these rings resemble whorls; they were much smaller than clay whorls. The rings are most similar to beads used in our time in abacuses. Some rings, made of light clay and well baked, do not have glaze, but most of them are covered with green or yellow glaze" (Rabinovich, 1949: 28). According to M.G. Rabinovich, these items were intended for manufacturing board abacuses, which at that time were in great need in numerous offices of Moscow (Ibid.). The Moscow finds differ from the abacus "beads" from Ananyino in size and presence of glazing.

In Siberia, board abacuses were known and were in demand in the taxation system related to agriculture (allocation and control of arable land, hayfields, and other lands). They might have been used in 1689 by Boris Nevorotov, the Tara clerk of the government office, when together with Y. Cheredov and V. Kulichkin he conducted a census of lands owned by the servicemen, which were sold to the Siberian Bukharans (Sluzhiliye lyudi Sibiri…, 2019: 613).

A board abacus that M.A. Zeiger dated back to the 17th century (Lokhnesskoye chudo…, (s.a.)) is kept in the Tobolsk Historical and Architectural Museum-Reserve. In our opinion, the collection of clay balls from Ananyino can be considered to be a part of a similar device for counting, which was made by village craftsmen. The sizes of such board abacuses most likely depended on the circumstances of their use.

The need to write letters, petitions, and other documents required "workstations" for scribes, and provision of acceptable lighting. Insufficient lighting affected vision, which may probably explain the arrival of a large batch of glasses to the Tobolsk market in 1668/69 (Vilkov, 1967: 108).

Lighting residential, administrative, and church premises of Tara and its rural periphery have already been discussed (Tataurov S.F., 2019; Tataurova, 2017). The main illumination tools were rushlight holders of various types. However, candle lighting was more convenient, especially in administrative offices. This is confirmed by pictorial sources, such as illustrations of the Gospels of 1681 (Evangeliye, 1681) and Psalter of 1636 (Psaltyr, 1636), as well as paintings (Chernaya, 2015: 190). Metal candlesticks and tweezers for removing soot have been found in Tara. Candles were used in everyday life mainly by governors and their entourage (Tataurov S.F., 2019: 41–42). In the late 16th century, wax was brought to Tara from Moscow: "2 buckets of church wine, 2 puds of wax, 4 pounds of incense, 5 pounds of thyme" (Tsvetkova, 1994: 8). In the 18th century, wax was not mentioned among the imported goods; only ready-made candles—colored and ornately shaped—were indicated (Tataurov S.F., 2019: 42). In the mid-19th century, Tara already had two candle factories of its own (Tara v XVI–XIX vekakh…, 2014: 143).

Availability of a clay candlestick in the filling of the dwelling in the village of Ananyino (see Fig. 2, *5*) described above suggests an extraordinary social status of its owner and probably his literacy. The item was made of clay and was polished, which made it look like metal. The candlestick has been broken into two parts; the upper part was in the form of a narrow glass on high stem, with a platform below the bottom of the container for melted wax. The height of the preserved part was 9.1 cm; height of the bowl was 5 cm; diameter along the top was 3 cm; diameter of the platform was 4.5 cm. The thickness of the wall was 0.3 cm. The lower part was 3.5 cm high; it had remains of a stem (0.8 cm in diameter) and base (8 cm in diameter) in the form of a saucer with low, slightly expanding walls. The total height of the candlestick could have been 14–15 cm.

Another item, which may be related to the topic under discussion, is a bone case looking like a round tube with the thread for caps at the ends (see Fig. 2, *6*), which was discovered in Tara. Its length was 8.7 cm; inner diameter was 1.4 cm. Together with caps, its length could have exceeded 10 cm. The surface was covered with ornamentation of zigzag lines most likely carved with a knife. This item has become obsolete due to abrasion of the thread from one edge and possibly loss of one cap.

Such a small case could not store large scrolls, but was suitable for storing notes on 10 × 10–11 cm sheets*.

*In order to clarify the size of the "scroll", we conducted an experiment. A sheet of modern Whatman's drawing paper 0.2 mm thick was rolled into a tube and inserted into the case; so, we established that it could accommodate a tube 16 cm long and 11 cm in diameter. The thickness of paper sheets in the 17th–18th centuries certainly differed from the modern Whatman's paper; these could also have been square in shape.

The case was found in a dwelling (closed complex) dated to the 17th century by the coins of Tsar Mikhail I (Tataurov S.F., Tataurov F.S., 2021). Taking into account sabers, parts of firearms, and combat arrowheads also discovered there, the authors of the excavations suggested that the dwelling belonged to a junior military commander. He could carry out orders for delivering reports, which is confirmed by a penknife and bone case described above (Ibid.: 672).

It is unlikely that this case was used for keeping other items. For example, sewing needles are short, and they had special needle cases, which were widespread among the indigenous population and are available in the Tara collection as soldered bronze or silver tubes (Tataurov S.F., Tikhonov, 1996: 77). Knitting needles were made of bone at that time, and they had different lengths and thicknesses. In addition, knitting needles were widespread products which didn't not require careful storage. A possible alternative related to literacy was storing writing pens, such as those found in Mangazeya.

Thus, the accumulated archaeological evidence and currently available historical sources make it possible to draw a conclusion about literacy and numeracy skills in the 17th–18th centuries both among the inhabitants of Tara and its rural districts, and among the Russian Siberian population as a whole.

Conclusions

Throughout the 17th century, the level of literacy among the subjects of the Muscovite State, excluding the clergy and tsar's officials, was generally not very high. The share of literate persons among the noble servicemen in various regions was 25–45 % (Lapteva, 2010: 509–511). This situation persisted until the mid-18th century despite the attempts of Peter I to introduce secular "elementary schools" for the representatives of different social classes.

Siberia was no exception, although its population class structure comprised servicemen of different nationalities and social statuses, including people from the European countries, such as Germans, Poles, as well as Baltic peoples, which were generically called "the Lithuanians". They were not only well-familiar with military affairs, but were also quite educated (Goncharov, Ivonin, 2006: 23–30).

It is challenging to assess the actual literacy level of the Siberian population even in a particular region. Written sources provide information on the needs and provision of the Tara population with stationery supplies (ink, paper). It is supplemented by archaeological evidence of inkpots, wax tablets and styluses, paper, quills, and ink needed for writing. There is evidence demonstrating the tendency to improve the "working conditions" and use a more progressive way of lighting.

Archival documents contain rich data on various aspects of life and occupations of the Tara residents. For example, the Tobolsk nobleman, Dmitry Rukin, who was appointed in 1728 the governor of Tara, was no stranger to the "fundamentals of education". Along with religious books, his personal library contained two books of secular nature: "The Book of Moral Stories" and "The Book of Theatron"* (Sluzhiliye lyudi Sibiri…, 2019: 768). However, these sources do not answer the question of how the main part of the servicemen, except for the literate and those for whom other persons signed, acknowledged the receipt of their salary.

Archaeological finds discovered both in Tara and Ananyino disclose social features for individual representatives of the service population and raise some questions about the purpose of items that can be associated with board abacuses, and the item that we identified as a letter case. Notably, earlier, a leather case for a compass was found in Tara (Osipov et al., 2017), which testifies to the knowledge of navigation.

This comprehensive analysis of archaeological, written, and historical sources has revealed the level of education among the inhabitants of Tara and its rural districts in the 17th–18th centuries. The study has also shown the material markers of literacy and numeracy in the cultural layers of the sites, approximate number of literate people in different strata of society, their social function, degree of representativeness of the written documents, as well as role and importance of archaeological evidence.

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Aborigines or Migrants? A New Stage in the Okunev Origin Debate

New arguments put forward by advocates of the migration theory of the Okunev origin are discussed and found unconvincing. A cultural impulse from the Late Yamnaya and Yamnaya-Catacomb populations of the northeast Caucasian steppes is quite probable; in fact, a migration is possible too, but not on a mass scale. The western pulse was single and limited in size, and its effect on Okunev origin was likewise limited. Eventually, it was overlaid by a much more powerful local tradition—a fact that is supported by both craniometry and genetics. The belief that "brachycranic Caucasoid males"—alleged militant migrants from the west—played a critical part in Okunev origins is erroneous. Even if it proves possible to single out such males among the newly discovered skeletons from burials of the early, Uybat, stage (thus far, such attempts have been unsuccessful), their contribution to the Okunev gene pool was much smaller than that of the autochthonous population of South Siberia. According to A.V. Gromov and other members of the Saint-Petersburg school of cranial nonmetric studies, new crania from the Uybat burials don't reveal the "Native American" tendency peculiar to other Okunev samples and to certain other ancient groups of South Siberia. This is especially evident in the frequency of infraorbital pattern type II. However, no inequality is observed either in the number of Uybat males and females or in the distribution of nonmetric traits between them, disproving the idea of a military campaign allegedly causing a population turnover whereby, as migrationists claim, Afanasyevo people were destroyed or displaced. Genetics provides no indication that the source of the western admixture in Okunev people was some post-Afanasyevo migrant group from the western steppes rather than Afanasyevans themselves. This idea is more plausible with regard to the Chaa-Khol people of Tuva.

Keywords: *South Siberia, Okunev culture, Yamnaya culture, Catacomb culture, migrations, relict populations.*

Introduction

The debate around the Okunev culture has not subsided. Recently, I tried to demonstrate that Okunevans were aborigines of South Siberia, a relict group that survived for many millennia in the place whence some of its remote ancestors had migrated to the New World (Kozintsev, 2020). This theory (this, as I believe, is what it may be called today rather than just a hypothesis) was initially based on cranial data (Kozintsev, Gromov, Moiseyev, 1995, 2003; Kozintsev, Gromov, Moiseyev, 1999; Kozintsev, 2004; Vasiliev et al., 2015: 323–325). It did not receive any attention in Russia, but was 20 years later supported by geneticists in Denmark (Allentoft et al., 2015; Zacho, 2016), France (Hollard et al., 2018), and the USA (Kim et al., 2018), and was eventually supported by Russian geneticists as well (Balanovsky, 2015: 312). It would appear that the issue has been finally settled, and one might move on. Therefore, in the last publication on Okunevans, I adduced no further proofs, concentrating instead on their ties with other groups. I touched on the problem in a later article, addressing main patterns in the population

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dynamics of North Eurasia (Kozintsev, 2021). As it turned out, however, my arguments did not convince some of my Russian colleagues. The question, then, has to be revisited.

Migrants from the west: New arguments?

In the last years, the traditional view that the Okunev culture was autochthonous, held by archaeologists (Maksimenkov, 1975: 36–37; Vadetskaya, Leontyev, Maksimenkov, 1980: 26; Sokolova, 2009) and physical anthropologists (Chikisheva, 2012: 88, 123, 180; Kozintsev, 1976, 2004; Kozintsev, Gromov, Moiseyev, 2003) was countered by the hypothesis that this culture had been introduced by some militant group related to Late Yamnaya and Yamnaya-Catacomb populations—the "brachycranic Caucasoids"—who had migrated from the northwestern Caspian to South Siberia. As a result, the Afanasyevans were rapidly destroyed or displaced (Lazaretov et al., 2012; Polyakov, 2017; 2022: 83, 132, 154; and others).

That Yamnaya-Catacomb tribes played a critical role in the origin of the Afanasyevo culture has been demonstrated more than once (see, e.g., (Kozintsev, 2009)). Theoretically, of course, one cannot rule out the possibility that one of those tribes, marked by brachycrany, tracked their dolichocranic relatives to Siberia, having eventually caught up with and disposed of them (Polyakov, 2022: 128). But such a scenario is somewhat akin to romantic tales of 19th-century anthropologists about the rivalry between brachycranic and dolichcranic races. In modern physical anthropology, the cranial index is deemed a relatively unreliable indicator of migrations owing to its environmental lability.

Arguing with me, A.V. Polyakov is less than consistent. In his words, "the principal discussion involves mainly archaeological materials. The evidence from physical anthropology and especially paleogenetics was employed much later, after it had become clear that it does not contradict the migration theory [and if it did? – *A.K.*]. Therefore, it plays a purely subsidiary rather than a key role, clearly demonstrating a radical population turnover in the Minusinsk Basin at the transition between the Afanasyevo and Okunev cultures" (Ibid.: 132–133). But if the role of physical anthropology is indeed so modest, then why are mentions of "brachycranic Caucasoids"—alleged migrants from the west—so frequent in his writings? "A highly distinct brachycranic Caucasoid type represented in male series of the Uybat stage sharply distinguishes them from all known local samples" (Ibid.: 83); further on: "At the very beginning of the Okunev culture, there appear brachycranic Caucasoids, which cannot be derived from the local Neolithic by any stretch of the imagination" (Ibid.: 132); and again: "The earliest stage (Uybat) mirrors the initial process of emergence and subsequent consolidation of cultural traits. It is marked by a peculiar sexual dimorphism—the division between brachycranic Caucasoid males and a highly heterogeneous group of females, some of whom have a distinctly Mongoloid appearance" (Ibid.: 315).

First of all, it is strange to hear that the evidence from physical anthropology was adduced as a purely secondary source, when it was needed to support the migrationist theory. The review of the scholarship definitely suggests otherwise: long before the Okunev culture was considered independent and separate from Afanasyevo, the physical features of those associated with it had struck the eye (Lipsky, 1952). It is precisely to the early (Uybat) stage that the Askiz cranium belonged—the first cranium to provide an idea of how the Okunevans looked (Ibid.: Fig. 28; Polyakov, 2022: 114, fig. 63, *21*). The specimen is male and indeed brachycranic, but in no way Caucasoid. According to M.M. Gerasimov, who reconstructed the individual's appearance, it is a "robust, coarse type of a brachycranic proto-Mongoloid" (1955: 537–538, fig. 222). His facial flattening is no less pronounced than in members of the Baikal and Central Asian types, and only a strong nasal protrusion is suggestive of possible admixture (Alekseyev, 1961: 139). A.N. Lipsky was quite right when, apart from mentioning the resemblance of such individuals to the Neolithic people of the Yenisei valley, he noted a certain archaism in their appearance, supporting the idea of deep local roots (1952: 74, 75, 77).

Contrary to Polyakov's claim, not the slightest stretch of imagination is needed to derive such individuals (or even less Mongoloid ones) from the local Neolithic. Only those whom their preconceptions prevent from seeing apparent facts can regard them as "brachycranic Caucasoids" and migrants from the west. Generally, using such typological labels in the era of computers and multivariate statistics makes no sense at all. Here, as in most other cases, racial typology is a much less efficient tool than populationist thinking and statistics (see, e.g., (Kozintsev, 2017)). A.V. Gromov (1997, 2002) was unable to separate the alleged "brachycranic Caucasoids" from the total mass of Okunev males either typologically or statistically; whereas Mongoloid females, who do contrast with others, are singular. This agrees with the conclusion that the Okunev sample is genetically homogeneous (Zacho, 2016: 38). The situation may change after male crania from the Uybat stage have been measured, and this is what Gromov and his students are doing now.

Polyakov does not regard a marked similarity between Okunev crania and Neolithic ones from the Krasnoyarsk-Kansk forest-steppe across the entire set of measurements (Gromov, 1997; 2002: 74; Kozintsev, 2009, 2020, 2021) as a weighty argument in favor of relationship, because this series is small and insufficiently documented. For instance, it included an Okunev cranium from Bateni, erroneously attributed to the Neolithic. This, however, does not concern my studies: I used only male crania,

whereas the Bateni specimen has been diagnosed as female by V.P. Alekseyev (1961: 115) and by all later specialists. Also, it had long ago been excluded from the Neolithic sample (Tur, Solodovnikov, 2005)*. One of the male Krasnoyarsk-Kansk crania, from Bazaikha, has a radiocarbon date of 4700 BP. This admittedly corresponds to the Early Bronze Age rather than the Neolithic, but still the Bazaikha specimen predates the Okunev sample while revealing genetic ties with it (Yu et al., 2020). His genome can be modeled as consisting of two components: Botai and Baikal Late Neolithic and Early Bronze Age (Ibid.).

Apart from that, the Neolithic and Early Bronze Age people of the Krasnoyarsk-Kansk region can no longer be regarded as the only or even the best candidates for the role of Okunev ancestors. As recently turned out, strong contenders are Neolithic and Copper Age inhabitants of a far more westward area—the Middle Irtysh (Solodovnikov et al., 2019; Kozintsev, 2021: 126–127, fig. 1). Ascribing two such parallels to coincidence is less easy. Morphologically, the Irtysh group is even closer to the Okunev sample than is its Krasnoyarsk-Kansk counterpart. Moreover, Okunev individuals from burials of the Tas-Khazaa type and Uybat**, where "brachycranic Caucasoids" should predominate, are actually closer to it than to any of the 45 Yamnaya and Catacomb groups of the western steppe. True, the Irtysh sample is likewise small, but this is to some extent compensated for by a representative battery of informative traits. If migration from the Irtysh to the Yenisei did take place, this was clearly not the "migration from the west" envisaged by Lazaretov and Polyakov.

There is, however, reason to think that what we deal with here is not migration, but conservation of a very ancient genetic legacy in South Siberia. T.A. Chikisheva (2012: 57, 153, 169) termed it the "South Eurasian Anthropological Formation". Its considerable age and stability are evidenced not only by craniometric data (Ibid.; Kozintsev, 2021) but by cranial nonmetrics as well. "The most striking trait peculiar to the Okunev population", Gromov et al. (2021: 152–153) write, "is the low frequency of IOP II*** (about 30 %). Sometime ago, based on this peculiarity, it was hypothesized that ancestors of Okunevans were related to those of Native Americans (Kozintsev et al., 2003). However, newly examined materials from the Bronze Age suggest that low frequencies of IOP II were typical of populations spanning vast territories of South Siberia at least from the Baraba forest-steppe to the Minusinsk Basin (Gromov, 1997, 2002)". All of this is true except for the word "however", since a wide distribution of the South Eurasian Anthropological Formation in South Siberia makes it likely that not only Okunevans but several other ancient populations of this region too might be "collateral relatives" of Native Americans.

The study of human crania from newly excavated burials of the earliest (Uybat) stage of the Okunev culture may provide unexpected answers to some critically important questions raised here. This study is ongoing, and thus far only the findings of nonmetric studies are available. In the first of the recent publications by Gromov and his students, they mention the low frequency of IOP II as a peculiarity of most previously examined Okunev samples, and go on: "All the more amazing was it to find that the occurrence of this trait in the pooled series of the Uybat chronological horizon was quite high—70.4 %, and this type of the infraorbital pattern was equally frequent in samples from both cemeteries of that group. If the reason is migration from the west, then the idea of a military campaign* does not stand up to scrutiny, because sexual dimorphism in that series is absent both in the proportion of males and females and in the frequencies of IOP II" (Gromov et al., 2021: 153). In the second publication, which appeared after additional materials had been studied, the following statement is made: "In sum, nonmetric studies of crania from burials of the Uybat chronological stage demonstrate that those people differ from other Okunevans. This primarily concerns a very high frequency of IOP II. But the results of the principal component analysis, too, picture the earliest Okunevans as a European rather than Siberian group. The analysis of craniometric traits might clarify the origin of this peculiar skeletal population" (Gromov, Kazarnitski, Lazaretova, 2022: 259). Importantly, as before, no sex difference in cranial nonmetrics has been found (Gromov's personal communication, for which I thank him).

But even though the idea of a military campaign is not upheld by cranial data, the role of the western component in Okunev origins cannot be denied, if only because of an appreciable Yamnaya-Afanasyevo admixture (see below). That Okunevans are "Americanoids" admixed with Europeans was demonstrated long ago (Kozintsev, Gromov, Moiseyev, 1999). In a recent study (Kozintsev,

*I thank K.N. Solodovnikov for this information.#

**These terms and the measurements of respective groups were taken from Gromov's (1997) publication. In his dissertation (Gromov, 2002) he renamed the Tas-Khazaa series to Uybat, but this time he used the latter term not in the geographic sense, as in the publication, but with reference to the chronological stage introduced by Lazaretov and Polyakov. Later, however, Lazaretov separated the Uybat stage from that which he now termed Tas-Khazaa. All these changes resulted in a tremendous confusion, which Polyakov, for no apparent reason, imputes to me.

***This is a definite configuration of infraorbital and adjoining sutures, which I termed Infraorbital Pattern Type II—specifically, the situation where the infraorbital suture is overlaid by the zygomatic bone.

*They imply the idea that a group of males associated with the Yamnaya-Catacomb tradition had migrated from the northeastern Caucasus to Siberia, exterminating or displacing the Afanasyevans (Polyakov, 2022: 128).

2020), I noted that among the Yamnaya and Catacomb series from the western steppe, one closest to Okunev is the Catacomb sample from Stavropol (Romanova, 1991). Strange as it is, the resemblance is caused not only by the "western" tendency of Okunevans, but also by a slight "eastern" shift of the Stavropol Catacomb population. This group takes a peculiar position with regard to Siberian samples, being the western steppe population closest to the Andronovo people of the Upper Ob and to the Karasuk people. Okunevans are admittedly less similar to it than to the Krasnoyarsk-Kansk Neolithic sample, but still the parallel cannot be ignored. Male crania of the Stavropol Catacomb people, unlike female ones, are mesocranic rather than brachycranic (78.0 versus 81.5 in Okunevans, according to Gromov), making it even more doubtful that brachycrany in Okunevans has a western origin. That the Catacomb component is likely present in the Afanasyevo sample has already been demonstrated (Kozintsev, 2009).

Migration of Caucasoids marked by a somewhat elevated cranial index, originating from the Yamnaya-Catacomb tribes of Kalmykia, to the steppes of Kazakhstan and South Siberia is by no means a fantasy. It did take place, but later, and those people were ancestors of Andronovans, not Okunevans, as I also demonstrated long ago (Ibid.). Unlike the situation with Okunevans, the western ties of Andronovo are beyond doubt.

An interesting question concerns the typically Okunev cranial deformation, resulting in the so-called obelionic flattening. I noticed its identity to the one practiced by the Pueblo Indians (Nelson, Madimenos, 2010). A.V. Gromov and A.A. Kazarnitski (2022) discard this parallel because its acceptance would imply that this custom had been practiced by the presumed common ancestors of Okunevans and Native Americans and had survived for several millennia. Theoretically, such conservatism of tradition is possible, given, for instance, Native American parallels to Okunev art (see below). The problem, however, is that obelionic flattening is typical only of the late stages of the Okunev culture, and this indeed detracts from the value of the parallel. The early (Uybat) type of deformation resembles that in Yamnaya-Catacomb samples of Kalmykia, but this is an ordinary occipital flattening, which is rather common worldwide (Ibid.). Its frequency is no lower than 20 % in 14 out of 65 rather diverse series from various parts of the world, i.e., at least in every fifth (Kozintsev, 1988: 17). The deformation data, then, support neither the autochthonous nor the migrant origin of the Okunev culture.

The genetics of Okunevans has already been discussed in my previous publication (Kozintsev, 2020). It points to the deep, possibly Upper Paleolithic, roots of this group and to its collateral relationship with Native Americans. The reason why I focused on the work by Claus Zacho (2016), the student of Morten Allentoft, is that to date, this is the only monographic study addressing Okunev genomes. His findings were ignored by Polyakov in his summary (2019), and the true reason is now clear: they could in no way be used as a "purely subsidiary" source for illustrating the correctness of the migrationist hypothesis. In his book, Polyakov justifies the omission by saying that at that time Zacho was too young and inexperienced (Ibid.: 134). This ad hominem argument is invalid. True, Zacho's work is only a master's thesis, but his supervisors would hardly recommend it for defense if it contained serious mistakes. In the joint paper by Eske Willerslev's team, published after Zacho's defense, there is indeed no reference to his thesis. This was unnecessary, since Zacho himself is listed among the co-authors, and so, incidentally, is Polyakov (Damgaard et al., 2018). I am glad that Polyakov (2022: 134) deems the conclusions of this study "much more balanced and founded". They are as follows. Three Copper and Early Bronze Age samples—people of the Botai culture, Okunevans, and an individual from a mid-3rd millennium BC Yamnaya type burial at Sholpan-4, Eastern Kazakhstan, are genetically close to one another, and their genomes can be modeled as a mixture of two autosomal components. One of them, ANE, was presumably inherited from Upper Paleolithic South Siberians, represented by the Mal'ta boy; the other is eastern, similar to that present in the Early Neolithic (Kitoi) group from Shamanka, southwestern Baikal area*. In the presumed common ancestor of all the three groups, who lived 10–13 thousand years ago, the share of both Siberian components was approximately equal. Okunevans, in addition, have a western component in the amount of 10–20 %, originating from populations of the western steppe or from their Siberian descendants**. The latter was male-derived and received about 4600 years ago (Damgaard et al., 2018; Allentoft et al., 2022), which corresponds to the lower date of the Okunev culture (Polyakov, 2022: 184). In the geneticists' view, the source of admixture was the Afanasyevo population (Damgaard et al., 2018; Allentoft et al., 2022). This is the most natural explanation, since contacts between Afanasyevo and Okunev people are beyond doubt. There are no indications that the admixture stemmed from hypothetical post-Afanasyevo migrants from the west***. Such an assumption is much more plausible with regard to the Chaa-Khol people of Tuva (Kozintsev, Selezneva, 2015).

Affinities between Okunevans and the ancestors of Native Americans have not been touched upon in the 2018

*According to newer calculations, the agreement between empirical and theoretical data is better if the Baikal Neolithic sample is replaced by another one, representing the native population of more westward areas of the Siberian forest-steppe (Allentoft et al., 2022).

**Genetically, the Yamnaya, Catacomb, and Afanasyevo people are almost indistinguishable (Wang et al., 2019).

***The analysis of mtDNA results in the same conclusion (Pilipenko et al., 2022).

publication by the Copenhagen team (Damgaard et al., 2018), since this had already been done in their previous study. To recap: "Intriguingly, individuals of the Bronze Age Okunevo culture from the Sayano-Altai region (…) are related to present-day Native Americans (…), which confirms previous craniometric studies (Kozintsev, Gromov, Moiseyev, 1999). This finding implies that Okunevo could represent a remnant population related to the Upper Palaeolithic Mal'ta hunter-gatherer population from Lake Baikal that contributed genetic material to Native Americans." (Allentoft et al., 2015: 169). Therefore, when Polyakov claims that local roots of Okunevans cannot be demonstrated, that "attempts at reconstructing them through the genetic profile of the Mal'ta boy, who lived 20,000 years earlier, look somewhat strange" (2022: 134), and when he refers to the Y-chromosome haplogroups, his doubts should be readdressed to the geneticists.

Archaeology, physical anthropology, and genetics: Is a compromise possible?

Not being an archaeologist, I am not going to dispute the archaeological facts on which the migrationist theory is based; moreover, I find them convincing. What I wish to do instead is to point out two things. First, disagreement between archaeological and biological data is in no way exceptional. I have already mentioned two such cases here: the Botai culture is not at all similar to the Okunev, despite the genetic affinities between the people associated with them, and the Yamnaya individual from Sholpan is an apparent native of Eastern Central Asia. One more example is the Chemurchek culture, which is related to the Okunev. Its western, in fact Western European, origin has been convincingly documented in A.A. Kovalev's numerous publications (see, e.g., (2011)). The physical type of the Chemurchek people, on the other hand (as far as one can judge from two crania), is Mongoloid, close to that of the Neolithic and Bronze Age Baikalians (Solodovnikov, Tumen, Erdene, 2019; Kozintsev, 2021). Genetically, the Chemurchek people are a mixture of various components, the principal of which, ANE, could have been inherited from the Botai people, indirectly supporting the affinities between Chemurchek and Okunev populations (Jeong et al., 2020; Wang et al., 2021). This subtracts nothing from the Western European parallels listed by Kovalev. One should only keep in mind the well-known rule: cultural traits, unlike genes, can be borrowed. Both categories of data are independent, and none of them is "subsidiary" with regard to the other. Using biological facts merely to illustrate the correctness of archaeological theories rather than to test them is a faulty principle, and this is precisely what the case of "brachycranic Caucasoids" demonstrates.

Second, archaeological facts themselves can hardly be considered unambiguous. How, for one thing, could one reconcile the claims of migrationists with the Okunev artistic style, which has no parallels in Europe (Polyakov, 2022: 122–127)? How, for another, could one ignore the view of Y.E. Berezkin, a leading expert in prehistoric art? In his words, Okunev maskoids "can without any doubt be associated with the imagery typical of the pre-Shang cultures of China" (Vasiliev et al., 2015: 469)*. To this, one might add the resemblance between Okunev petroglyphs and the rock art of the Angara, and between Okunev ceramics and Neolithic ones from the Angara and even the Late Pleistocene ones from the Amur (Sokolova, 2007). As Berezkin notes, the artistic canon related to that of the Okunev and pre-Shang China was introduced from East Asia to the northwestern coast of North America, specifically to Eskimo and Tlingit cultures and eventually to those of Mesoamerica and the Andes (Vasiliev et al., 2015: 489–538). Nothing remotely similar is found in western Eurasia.

Let me ask my opponents in conclusion: should one really be so steadfast? As for myself, I do not in the least cling to the idea that all Okunev groups were native to Siberia. On the contrary, I am eager to hear the findings of Gromov and his students, who are scrutinizing the origin of the earliest Okunevans—those of the Uybat stage. And should they actually turn out to be migrants from the west, which can in no way be ruled out, I will only be glad, since this would make our reconstructions more accurate and eventually bring my opponents and myself closer to a compromise, which perhaps only seems unattainable.

Instead of a summary

No actual summary can be formulated at present—one must wait for the new findings concerning the Uybat people. If the idea of their western origin is supported, one should agree with Gromov and partly with Polyakov: the migration was a one-time event, limited in scope. The migrants, who had been vastly outnumbered by the local population, eventually dissolved in it. And this means that migrationist and autochthonist approaches to Okunev origin are mutually complementary rather than incompatible.

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*The sources of this style should probably be sought in the Neolithic of the Amur Basin and China (Bokovenko, 1995: 37).

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Planigraphic (Spatial) Distribution of Mitochondrial DNA Variants at the Andronovo Time Cemetery Tartas-1: Preliminary Results

The most informative funerary site documenting the Andronovo (Fedorovo) migration to the West Siberian forest-steppe is Tartas-1, where more than 600 burials of that period, associated with Late Krotovo (Cherno-Ozerye) and Andronovo (Fedorovo) cultures, have been excavated to date. On the basis of skeletal remains from these burials, we have formed and successfully analyzed 256 samples of mitochondrial DNA, uniformly covering the entire area of the cemetery. This approach is a genetic counterpart of the continuous area method, which is used to excavate Tartas-1. The article opens a series of publications addressing the analysis and interpretation of this sample. We present the findings of the first stage in the analysis of spatial distribution of mtDNA lineages over the cemetery area under a simplified model that disregards the archaeological differentiation of the Andronovo time burials other than their spatial distribution. The analysis was performed at several resolution levels: from crude (at the level of the West Eurasian and East Eurasian clusters of mtDNA haplogroups) to high-resolution (at the level of specific structural variants). The information potential of each of those levels is evaluated. Data on the pattern of individual mtDNA lineage distribution are analyzed with regard to clusters on the cemetery area, indicating a considerable role of kinship across the site. The most promising areas for revealing groups of close relatives are identified. The findings enable us to minimize the effect of close kinship on assessing the population structure of Tartas-1.

Keywords: *Paleogenetics, mitochondrial DNA, spatial (planigraphic) analysis, Bronze Age, Andronovo time.*

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Introduction

Large burial sites containing hundreds of funerary complexes of one or several historic periods are the bases for comprehensive study of the ancient population of the forest-steppe zone of Western Siberia. The abundant archaeological and skeletal collections excavated at such sites can be used for complex interdisciplinary research. The Sopka-2 cemetery in the Baraba forest-steppe is one of the basic sites of this type where most of the funerary complexes are dated to various periods of the Bronze Age, mainly pre-Andronovo. The results of excavations at this site were employed by V.I. Molodin for substantial enhancing and clarifying his classification and periodization of the ethnic and cultural groups of the Neolithic and Bronze Age in the West Siberian forest-steppe (Molodin, 2010). Another multilayered site, "key" for this region, is the flat-grave burial ground of Tartas-1, located at the above-floodplain terrace on the right bank of the river of the same name, close to Sopka-2 (Vengerovsky District, Novosibirsk Region). During the 2003–2022 field seasons, the main part of the site, containing more than 800 burials of various times, has been excavated by the West Siberian team of the IAET SB RAS, led by Molodin (see, e.g., (Molodin, Durakov, Kobeleva, 2018; Molodin et al., 2020)). Most of the complexes studied at Tartas-1 are dated to the period of the Andronovo (Fedorovo) people migration to the Western Siberia in the first half of the 2nd millennium BC, including the Late Krotovo (Cherno-Ozerye) and Andronovo (Fedorovo) burials. An important feature of the necropolis is the presence of numerous syncretic burials displaying combinations of traits typical of the funerary traditions of the Andronovo migrants with those of the aboriginal (Late Krotovo or Cherno-Ozerye) population. Thus, at present, Tartas-1 is the basic site for the reconstruction of the ethnic and cultural processes accompanying the Andronovo (Fedorovo) migration to the Baraba forest-steppe. The excavations at Tartas-1, as well as at Sopka-2 earlier, were carried out using the continuous area method, which provides the most complete representation of a burial site. In addition to the overall high representativeness of the obtained materials, this approach makes it possible to comprehensively account for the spatial distribution pattern of the site when analyzing not only the objects of material culture but skeletal samples as well.

The first stage of the paleogenetic study of the samples from Tartas-1 was carried out in 2006–2011 and included an analysis of a diachronic sample from the Bronze Age Baraba consisting of approximately 30 mtDNA specimens (of both the Andronovo and Late Krotovo cultures) (Molodin et al., 2013: 27–35, 178–181; Molodin et al., 2012). Recently, the research was resumed at a new level: besides the widening of spectrum of the studied genetic markers (Y-chromosome, markers of sex and kinship of skeletal individuals), there emerged a possibility of analyzing the mtDNA variation across the whole space of the site. Together with the other research areas, sampling mtDNA specimens from the whole burial ground (a kind of a "paleogenetic continuous area method") provides the great potential of a comprehensive study of the genetic structure of the populations that were using the necropolis. This is achieved through exploring and interpreting the paleogenetic data with respect to the internal spatial distribution of the complexes, sophisticated features of the material culture and funerary rites, craniometric data, kinship, and other factors.

The present study begins a series of publications outlining the findings of the paleogentic studies of the Andronovo specimens from Tartas-1. At the moment, the sample includes 256 mtDNA specimens from Late Krotovo (Cherno-Ozerye) and Andronovo (Fedorovo) burials. The aim of this study is the spatial analysis of the distribution of mtDNA variants across the main part of the site in the frame of a simplified model not accounting for the details of the archaeological context.

Material and methods

All the studied specimens were obtained from the archaeological skeletal collection of the IAET SB RAS (Novosibirsk). The sampling was carried out by a paleogeneticist from the IC&G SB RAS (A.S. Pilipenko) together with archaeologists

and anthropologists from the IAET SB RAS (headed by V.I. Molodin). The specimens were extracted from postcranial bones and teeth of 310 individuals from the Andronovo cemetery Tartas-1. Only macroscopically well-preserved skeletal material of each of the skeletons was sampled. For preliminary processing and extracting samples of the total DNA, the methods detailed in previous works of the authors (Pilipenko et al., 2018) were employed.

The analysis of the mtDNA structure included the determination of the sequence of the first hypervariable segment of the control region of mtDNA (HVR I). Amplification of the mtDNA HVR I was performed using two different protocols: 1) four short overlapping fragments, using one-cycle PCR (Haak et al., 2005); and 2) one long fragment, using two-cycle nested PCR (Pilipenko et al., 2008).

Sequencing was carried out using ABI Prism BigDye Terminator Cycle Sequencing Ready Reaction Kit (Applied Biosystems, USA; v.1.1 – for the short fragments, v.3.1 – for the long fragment). Sequencing extracts were then analyzed on an automatic capillary ABI Prism 3130XL Genetic Analyser (Applied Biosistems, USA) at the Center for Collective Use "Genomika" of SB RAS (http://sequest.niboch.nsc.ru).

All procedures with the skeletal specimens were carried out in a specially-equipped paleogenetic lab of the inter-institutional sector of molecular paleogenetics of the IC&G SB RAS. The infrastructure and equipment used meet all the modern requirements for paleogenetic laboratories. The description of the anti-contamination measures and verification of the results can be found in our previous publication (Pilipenko et al., 2018). The conditions of the research, study protocols, and the obtained findings unequivocally confirm the high reliability of our paleogenetic data.

Results and discussion

Forming the model sample of mtDNA specimens. The informative value of large necropolises for reconstructing population history of ancient groups via a multidisciplinary approach is without doubt. But studying large amounts of data, including vast skeletal collections, is associated with numerous difficulties. For a paleogenomic study, such difficulties are the high costs and laboriousness of an analysis of a large sample of DNA specimens necessary to get a representative overview of the features of genetic structure of the population buried at a cemetery and/or its parts. Therefore, in most cases, only a limited sample of specimens selected on the basis of a "vivid" archaeological context (and the degree of preservation sufficient for a genetic analysis) is studied. The authors were following this approach at the earlier stage of studying the Andronovo specimens from Tartas-1 included in the diachronic mtDNA sample of the Bronze Age population of the Baraba forest-steppe (Molodin et al., 2013: 27–35, 178–181; Molodin et al., 2012). The new stage implies the formation of a large sample of DNA specimens covering all the parts of the burial ground. We consider this sample as the model that will show if studying large or limited samples from vast cemeteries is efficient for various research purposes. Thus, the formation of the model sample from Tartas-1 is a necessary step for carrying out a number of studies aimed at the analysis and interpretation of the paleogenetic data in different contexts in the near future.

The following requirements were respected when forming the sample: 1) materials from funerary complexes of the Late Krotovo (Cherno-Ozerye) and Andronovo (Fedorovo) cultures (according to the cultural attribution made by Molodin so far for all the burials studied between 2003 and 2022) were employed; 2) specimens of a fairly good degree of macroscopic preservation (i.e. where a descent preservation of ancient DNA might be expected) were selected; 3) in order to fully cover the area of the necropolis, specimens from all the parts of the burial ground, as well as from all of the spatially observed groups of the Andronovo burials (rows, etc.), were selected; 4) the number of selected specimens was related to the spatial concentration of funerary complexes (inhumations); burials with cremated remains were disregarded, because bones from such burials are in most cases unsuitable for a molecular genetic analysis; 5) both adult and sub-adult individuals were sampled; no preference was given to male versus female remains (the selection criteria

followed the general sexual composition of the skeletal sample); 6) for double and collective burials, specimens from all the individuals were collected when possible.

More than one third of the 600 Late Krotovo (Cherno-Ozerye) and Andronovo (Fedorovo) burials from Tartas-1 was unsuitable for sampling for the following reasons: cremation (more than 100 burials), absence of human remains, or their very poor preservation (typically in sub-adult or supposedly secondary burials). Form the rest of the burials, a sample of more than 300 specimens was acquired. From these, DNA was extracted, its preservation was evaluated, and an analysis of the mtDNA structure was performed, resulting in 256 individuals with reliable data on the structure of mtDNA. Thus, more than 80 % of the specimens included in the sample were suitable for the analysis, which once again confirms the high degree of DNA preservation in the Andronovo skeletal specimens at Tartas-1 (though, the degree of preservation was varying across different spatial parts of the cemetery). For all of the sampled specimens, the haplotypes of the mtDNA HVR I were determined, and the phylogenetic affinity of each of the variants was identified. Thus, a highly representative sample of mtDNA specimens was obtained for the large burial ground of Tartas-1 (more precisely, for its main part dating to the Andronovo time). To our knowledge, this is one of the largest samples from contemporaneous complexes of a single necropolis published to date. The availability of such a representative sample provides great opportunities of studying it via the methods of phylogenetics, phylogeoraphy, and with statistical tools of population genetics. This research can be carried out at both intra- and interpopulation levels, with account for the archaeological and anthropological contexts of the studied materials.

Spatial distribution of mtDNA variants across the burial ground. At present, we do not take into account the data on the detailed cultural attribution of the funerary complexes (only their association with the period of the Andronovo migration to the south of Siberia) or various nuances of the funerary rites detected by archaeologists (this is the aim of the prospective studies). Thus, the space of the burial ground is conventionally considered as culturally (archaeologically) homogeneous.

Specimens from all of the main spatial groups of the necropolis were included in the sample. Notably, the specimens from the southern part of the cemetery substantially outnumber those from the northern part, which is explained by the decrease in the density of the burials from the south to the north of the necropolis. Another reason is a higher proportion of cremated burials in the northern part (where the cremations are prevalent in some areas) as compared to the southern part (where the percentage of cremations is negligible). So, if the number of successfully studied mtDNA is adjusted for the number (density) of the burials containing human remains suitable for the analysis, then the samples for the northern and southern parts of the necropolis are equally representative.

Though a full-scale analysis of the phylogenetic and phylogeoraphic features of the described mtDNA variants was not among the aims of the present stage of the study (these will the subject of another publication), we evaluated the informative potential of the spatial analysis of phylogenetic components of different levels. The following categories were employed: the groups of variants of the West and East Eurasian clusters of mtDNA haplogroups; single haplogroups and particular structural mtDNA variants (determined from the structure of the HVR I haplotype).

Our model sample exhibits similar representation of variants of both West and East Eurasian mtDNA clusters. Such a mixed composition is typical of other populations of the Baraba forest-steppe of the preceding and subsequent chronological periods as well. Notably, at the present stage of the study, we do not consider the composition and proportion of particular haplogroups in samples, which is expected to provide much more information. The spatial distribution of the West and East Eurasian mtDNA variants shows that both are widely represented in all the main parts of the burial ground, i.e. if it is crudely divided into northern and southern areas. Such a result was expectable based on the admixed structure of the mtDNA pool in the region and our earlier hypothesis (Molodin et al., 2012; Molodin et al., 2013: 27–35, 178–

181) stating that the genetic composition of the population inhabiting the site had been formed in the process of active interaction between the autochthonous groups and Andronovo migrants. But such a coarse approach cannot reveal the mechanisms and patterns of the formation of the burial ground. It is of note, however, that at the level of small spatial groups (i.e. rows or other separated aggregations of burials), a substantial variation in the proportion between the West and East Eurasian mtDNA variants is observed: in some groups either West or East variants are prevalent, while in other groups the proportion is equal. This is the first evidence supporting the idea of the difference between the mtDNA genetic composition between various spatial groups.

The next level of the study is the analysis of spatial distribution of mtDNA haplogroups (not considering their structural variants). Such an analysis must be based on the spatial distribution of the haplogroups represented in the sample by numerous specimens and at least several structural variants. Otherwise, the low number of specimens can produce a stochastic pattern of spatial distribution (the "small sample effect"), while the analysis of the haplogroups represented by only one structural variant is equivalent to a spatial analysis of this particular haplotype (see below). Such prevalent haplogroups in the sample are the East Eurasian C and the West Eurasian U2e and U5a. Each of these haplogroups is among the main components of the total sample, and is represented by dozens of specimens and by several structural variants. Notably, some of the haplogroups are unevenly distributed across the burial ground: the variants of the East Eurasian haplogroup C (in total) are more prevalent in the southern and central parts of the area, as well as in its eastern outskirt, as compared to the western part. Most of the individuals carrying haplogroup U5a (in total) are concentrated in the central part of the cemetery. The interpretation of these patterns of spatial distribution from the point of view of the formation of different areas of the burial ground will require the detailed consideration of the archaeological context of the burials from those areas, as well as the information regarding presence or absence of the respective haplogroups in the gene pools of the pre-Andronovo population and Andronovo migrants. Such an analysis is the aim of the next stages of research. So far, it is evident that the main (i.e. the most prevalent) haplogroups of the gene pool of the Tartas-1 population are unequally represented in different parts of the necropolis.

The next level of the analysis is the estimation of the spatial distribution of the individuals carrying identical (in terms of the HVR I sequence) mtDNA variants, which is also informative only for the variants detected in more than one specimen. Only 20 out of 256 individuals from Tartas-1 were carrying mtDNA haplotypes unique for our model. An analysis of such haplotypes is also of some value. Their concentration in a particular discrete part of the burial ground can suggest that this spatial group had been formed by multiple various population groups during a short period of time and without long-term interaction between them. Under this scenario, the individuals were buried close to each other accidentally, not due to kin relationship between them. However, the spatial analysis of the 20 unique mtDNA sequences has shown their relatively even distribution across the area of the necropolis; thus, this analysis was of low informative value for the aims of the present study.

The bulk of the sample (more than 90 %) includes series of specimens with identical mtDNA haplotypes, each represented by 2–3 to 20 skeletal individuals. Under our simplified model (not accounting for fine aspects of archaeological context), a spatial analysis of distribution of mtDNA variants (haplotypes) across the burial ground is expected to be the most informative approach. This analysis includes the following steps: 1) mapping the burials with a particular mtDNA variant; 2) detecting accumulations of individuals carrying a particular mtDNA variant; by accumulation we mean the presence of identical mtDNA variants in three or more individuals (two for rarer variants) forming spatial groups relatively isolated from other similar groups (e.g. rows of burials clearly present in many parts of the Tartas-1 cemetery); 3) analysis of the position of the accumulations (for each variant) with respect to each other, combining small accumulations according to their spatial

distribution; 4) comparing the spatial patterns for different mtDNA haplotypes for detecting cases of overlapping accumulations.

The potential informative value of such an analysis is that the presence of identical mtDNA variants in individuals buried in one collective or in neighboring graves is indicative of their maternal kinship. Thus, the concentration of a particular mtDNA variant in a spatially restricted group of burials suggests a possible (but not necessary) role of kinship in the emergence of the group (burial of potential relatives). If accumulations of two or more mtDNA variants overlap in a particular area of a burial ground, a family cluster might be potentially detected. The relatives of such a cluster can be connected through both maternal and paternal lineages, and the presence of several sub-clusters of various maternal origins is possible as well. The overlap of the accumulations can also lead to extending the area of a cluster of genetically related individuals. Thus, the analysis provides an opportunity of detecting spatial clusters of burials most perspective in terms of further molecular genetic research, for the assessment of the degree of kinship and evidential determination of groups of relatives. Such a laboratory analysis is both costly and time-consuming, and will only be carried out for the most informative specimens.

It is well known that the representativeness of a sample for a population genetic study can be biased if it comprises closely related individuals. This is another application of the analytical approach described above. The influence of kinship on compiling a population sample can be avoided if, first, representatives of various groups of potential relatives are proportionately included in the sample and, second, evidently unrelated individuals from different parts of the burial ground are sampled.

An important aspect of an analysis of this type is accounting for the prevalence of the mtDNA of interest in both the studied sample and region as a whole: the rarer is a variant the higher is the probability that the presence of this variant in different individuals reflects their maternal kinship. Thus, the criteria for delimiting accumulations were more liberal for rarer variants: more distant (scattered) burials were considered as possibly related. Exactly such rare mtDNA variants should be first taken into account when searching for kin groups of burials.

Considering the above, we have carried out a spatial analysis of our model mtDNA sample and arrived at the following conclusions:

1. The substantially better spatial resolution of the analysis of particular haplotypes as compared to haplogroups was predictably confirmed: variants of the same mtDNA haplogoup in most cases are differently scattered across the burial ground. For instance, the areas of concentration of the three main variants of U5a (represented in our model sample as series) are located in different parts of the cemetery and almost do not overlap. A similar situation is observed for the haplotypes of haplogroups U2e and A, as well as for some haplotypes of haplogroups U4 and C.

2. The great majority of the serial mtDNA variants from our sample are found at the burial ground in one or several accumulations rather than scattered evenly across its space. This confirms the important role the kinship has played in formation of the spatial groups of burials (mainly rows).

3. For many numerous mtDNA variants, two or more accumulations can be detected. This is observed for the haplotype of haplogroup U5a, with a transition in the 16239 position, for the single variant of haplogroup G2a, for the basal haplotype of haplogroup T, as well as for most of the variants of haplogroups C and U2e. In our opinion, the individuals carrying identical mtDNA variants and belonging to the same accumulation can be close relatives through the maternal lineage. But if such individuals were buried remotely form each other (e.g. in the northern and southern parts of the necropolis), they were likely of different origins and not closely related.

4. For some mtDNA variants from our sample, only one accumulation, besides single scattered individuals, was detected; for instance, for the haplotype of haplogroup H, with a substitution in the 16311 position, for rare (in this region) variants of haplogroups Z1a and A12a, etc. Interestingly, the detection of the accumulations of rare variants in the western periphery of the burial ground suggests the presence of kin groups there, though the burials with skeletal remains suitable for a genetic analysis are not arranged in clear rows or groups in this part

of the cemetery (unlike most of the other parts). Also, many of those mtDNA variants are almost absent in other parts of the burial ground, probably suggesting some genetic specificity of the people buried at some areas of the western outskirt of the necropolis.

5. The presence of the accumulations and their overlaps made it possible to determine a number of areas of the cemetery that are potentially the most promising in the search for closely related individuals, using additional kinship markers. An objective evaluation of our hypothesis of the presence of kin groups of burials requires experimental research, which is being carried out at present as the next stage of the development of our model.

6. The distribution pattern of the accumulations suggests that a large number of the funerary complexes in the northern periphery of the necropolis was created by the populations not directly related to the groups that buried their deceased in the southern and the bulk of the central part of the burial ground.

Conclusions

An unprecedentedly large and chronologically uniform (Andronovo time) sample of DNA specimens from a single necropolis was obtained in the course of the present project. This opens avenues for a comprehensive analysis of the findings in the context of the genetic structure of the populations of the forest-steppe zone of Western Siberia, including the Baraba forest-steppe, during the period of Andronovo (Fedorovo) migration. The mechanisms of the interaction of the migrants with the autochthonous groups of the Late Krotovo (Cherno-Ozerye), and the issues related the funerary rites of that population and its family/kin structure can be explored as well. At the present stage of the analysis, employing a simplified model that does not take into account many nuances of the archaeological context of the studied funerary complexes, we were able to demonstrate the informative value of our approach and to obtain a number of important results related to the spatial distribution of the mtDNA variants across the burials of Tartas-1. Prospective research includes: sampling and analysis of the additional mtDNA specimens from the groups of burials most promising in terms of kinship, employing a wider range of genetic markers of kinship to models of various scale—from double and collective burials to spatial groups/rows; comprehensive phylogenetic and phylogeographic analysis of the findings on the mtDNA gene pool of the studied population; creating a similar model sample for the Y-chromosome for males of the population (or populations) buried in the main part of the Tartas-1 cemetery; comparing the results obtained for the Y-chromosome and mtDNA; widening the spectrum of the molecular genetic research via genotyping of phenotypically and physiologically important markers such as polymorphisms of the system of the pigmentation genes, and others. Another important direction of future work with the model will be the development of optimal tools for the visualization of our results and conclusions, using GIS technologies.

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On the Mongoloid Component in the Pazyryk Population

The Mongoloid trait combination displayed by two Pazyryk crania can be identified as Paleosiberian. Using the method elaborated by leading Russian specialists, the appearance of those individuals was sculpturally reconstructed. Sculptured faces support the diagnosis based on craniometric data. We discuss the advantages of a typological approach over a population approach to small and poorly preserved cranial samples. Judging by the skeletal materials from the Neolithic to the modern centuries, the Paleosiberian trait combination is distributed in the Baikal region, where mountainous taiga and tundra landscapes predominate. Those environmental conditions caused the scattering and isolation of hunting-fishing populations. This trait combination apparently originated among the Xiongnu of the southern Trans-Baikal region (Ivolga archaeological complex), when the natives had been involved in the activities of the border outpost—a center of trade, administration, craft, and agriculture in the northern fringes of the Xiongnu Empire. Individuals with Paleosiberian features could have reached the Altai Mountains at the early stages of the Xiongnu tribal union, correlating with the final stage of the Pazyryk culture. However, the share of the Paleosiberian component in the Pazyryk population was evidently minor.

Keywords: *Pazyryk culture, Altai Mountains, facial reconstruction, Paleosiberian trait combination, typological approach.*

Introduction

Before the advent of molecular genetics, the biological history of humanity has been mainly studied using the traditional methods of physical anthropology: anthropometric and, in particular, craniometric. These methods study features of the skeletal anatomical structures that are not correlated physiologically but associated in a geographic and ethnocultural space. Such correlations are referred to as historical, while the morphological complexes singled out on the basis of those correlations describe anthropological types: racial (based on the somatological features of the head and face) or cranial (based on the skeletal dimensions). The correlation-based morphological criterion of an anthropological type is not the only one. Specialists also take into account the geographical and historical principles dealing with the area, time of formation and lasting of the type. Thus, racial variants are not viewed as static and timeless categories but rather as evolving systems. The presence of an anthropological type, which is sharply different from the main variant of the population of some area, unequivocally points toward a migration of a new group of people to this area. Moreover, the origin and time of such migration can be determined as well.

The anthropological typology has been actively developed during the 50s and 60s of the 20th century. By the end of this period, a trend was formed toward negative attitude to the classic anthropological research based on

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metric and macroscopic descriptive approaches to the study of ancient and modern hominins. This was mainly due to the achievements of modern genetics: the results of the study of polymorphisms of biochemical markers of human blood (group factors, serum immunoglobulins, erythrocyte enzymes), as well as DNA loci (autosomal, mitochondrial, Y-chromosome) (Lewontin, 1972; Barbujani et al., 1997; Jorde et al., 2000)*, have shown that the bulk of variation of these markers (ca 85 % of the total genetic variation) is distributed at the intrapopulation level. Interpopulation difference only accounts for 15 % of the total variation, and just 5 to 10 % of these can be related to the differentiation of geographic (continental) groups, or races (Brown, Armelagos, 2001). Similar levels of inter- and intrapopulation variation of gene systems were calculated for craniometric variables by a number of researchers applying similar methods (Relethford, 1994, 2002; Roseman, Weaver, 2004).

The main conclusion of the geneticists interpreting the apparent trends of the variation of human biological traits is that neither racial nor conventional geographic groupings are genetically meaningful. In other words, racial classifications deal only with a negligible proportion of the human genetic diversity. Importantly, there is no consensus among geneticists regarding the importance of the small genetic differences between human populations for building historical models of migrations and admixture. Some studies show that the classification of populations based on frequencies of alleles of numerous loci matches the ethnic self-identification of individuals (Rosenberg et al., 2002), and the reliability of such classification increases with the number of loci employed. Thus, not only the diversity inside the loci is important but also the correlation between them (Edwards, 2003).

The correlation between morphometric characters of the human body (as well as any other biological object) means that the traits distinguishing anthropological types are inherited not in a discrete way but as a complex, which can be observed in a single individual. Such a hypothesis (not proven, but also not refuted by modern genetics) led a Polish anthropologist Jan Czekanowski in the beginning of the previous century to the formulation of a theoretical basis for the individual-typological definition of a race stating that a race is a sum of individuals (for the main points of the theory and a polemical presentation of counterarguments, see (Alekseev, 1961)). As a result, in some paleoanthropological works, the racial type of an individual was determined in terms of the individual typology; this approach is often employed today as well. When an archaeological culture or even a historic-cultural community is represented only by the remains of one or a few individuals, their anthropological type is nolens volens extrapolated to all the population of those cultures or communities.

Since the 1960s, the conception of race as a system of populations has become increasingly popular. According to this theory, changes of the anthropologic makeup of a population occur not only due to extrinsic influence (e.g. migration or admixture) but also as a result of interpopulation genetic drift (Alekseev, 1974: 22–24). The great majority of Russian anthropologists support the population conception of race as the main theoretical approach to the assessment of variability of anthropological traits (racial diagnostic complex) in human samples. The typological approach as a conception of the differentiation of humanity into discrete groups (races, anthropological types) based on complexes of morphological traits remains in Russian anthropology in opposition to the population approach, and has been criticized. The sharpest criticism regarding the typological approach can be found in early works of V.P. Alekseev written when the ideas of "populationism" in explaining the morphologic variation in man have been most actively developed in world science (see, e.g., (Alekseev, 1962)). In our opinion, a contradiction in the theoretical basis of the racial polytypism of our species has emerged. On the one hand, the objectiveness of types is supported (Problema…, 2002: 73–75), on the other hand, hypertrophied attention is brought to the population level of variation, which does not imply the existence of race as a discrete unit.

The root of the problem goes back to the imperfection of racial classifications, which are arbitrary to a great extent, since diagnostic traits are combined into historically correlated complexes only as trends, while the complexes themselves do not cover the whole typological diversity. But this does not mean that a single individual, based on his characteristic combination of morphological traits, cannot be assigned to some unit of the anthropological systematics of one or another classification. In his later works, after analyzing critically the anthropological studies adhering exclusively to the population "school", Alekseev became less categorical. He admitted the limitations of the consistent population approach, as well as the acceptability of various forms of typological (including individual-typological) analysis, according to the aims of a particular study; for instance, for assigning of singe skulls to "big" races (Alekseev, 1978: 8; 1980).

*We only refer to the pioneering works that have triggered the study of the variation of genetic markers at various levels of the demographic and geographic differentiation of our species. The publications dealing with various aspects of this issue are numerous, and their review is out of scope of this study. It is of note, however, that those works stimulated skepticism about racial classifications as one of the most important tools for building a rational system of biological diversity of modern man.

This article outlines the results of typological diagnostics of the anthropological composition of a group of individuals of the Pazyryk culture from the Ukok Plateau in the Altai Mountains. Irrespectively of the theoretical settings, it must be admitted that a "moment slice" through a population (or local-territorial group) represents a sample of individuals with a unique racial and ethnic history each. The cranial samples from local burial sites of the Altai Mountains, including Ukok, were previously compared with a broad range of Eurasian samples of the Bronze and Early Iron Ages. The results of that study have shown the complexity of the anthropological makeup of the Pazyryk culture population from the point of view of the three main taxonomic units of the racial systematics (Chikisheva, 2003a: 115–116; 2012: 169). The bulk of the population was made up of the autochthonous protomorphic anthropological component—the Southern Eurasian anthropological formation, which is phenotypically intermediate between the Caucasoids and Mongoloids. The influence of the Caucasoid component was substantial, but it was, in turn, typologically heterogeneous due to the genetic connections of the Altaian population with the people of the Bactria-Margiana cultures, which began at least at the second half of the 2nd millennium BC, and also due to the contacts between the populations of the Scythian-Saka ethnic-cultural community. Some Pazyryk individuals were classified as Mongoloids; thus, the analysis of this component in the Pazyryk population (including typological identification and reconstruction of the routes of infiltration of such individuals to the ethnic environment of the early nomads of the Altai Mountains) is the subject of the present study.

Material and methods

Two individuals from the authors' craniometric database (Chikisheva, 2003b), representing the local group of the Ukok Plateau (a female from burial 2, mound 1 at Ak-Alakha-3 and a male from mound 5 at Ak-Alakha-5), display the trait combination belonging to the Mongoloid anthropological type. The craniometric diagnostics of the type was accompanied by creating sculptural portraits of these individuals by the method of facial reconstruction. Values of craniometric variables are the "talking" data for physical anthropologists, but tell almost nothing about the appearance of ancient individuals to researchers from other fields. The method of facial reconstruction provides a visual representation of faces. The portraits of the Pazyryk individuals were created according to the protocols by the leading specialists of the Russian school of facial reconstruction (Gerasimov, 1949, 1955; Lebedinskaya, 1998; Balueva, Veselovskaya, 2004; Veselovskaya, 2015; Nikitin, 2009).

As the female cranium is deformed in the dorsal part of the cranial vault and the right half of the facial skeleton, partially covered with preserved soft tissues, and firmly articulated with the mandible and cervical spine, a hard copy of the 3D-model of the skull was printed. The correction of the deformed areas was carried out according to this copy. The male skull, damaged post-mortem, was glued with mastic, while the lost parts were reconstructed with plasticine. His 3D-model was developed and printed as well, in order to take the measurements and create the portrait.

Outlines of the skulls made using a dioptrograph were employed for making contour profile reconstructions of the faces (Fig. 1). Then the skulls were fixed at a cylindrical stand and oriented according to the

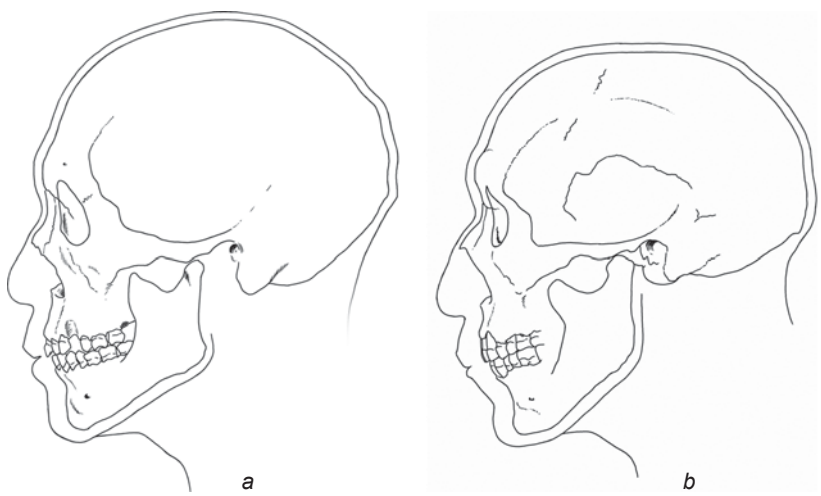

Fig. 1. Contour profile reconstructions of the female from burial 2, mound 1 at Ak-Alakha-3 (*a*) and the male from mound 5 at Ak-Alakha-5 (*b*).

Frankfurt horizontal plane. The masticatory muscles (m. masseter and m. temporalis) of both sides were reconstructed with plasticine taking into account the bone relief at the mandibular angles, development of the entheses of m. masseter in the frontal and parietal bones, depth of the temporal fossae, as well as the shape of the zygomatic arches. The eyeballs were molded according to the type and size of the orbits and placed with respective protrusion (Nikitin, 2009). One side of the skull was covered with plasticine ridges, the size of which reflected the thickness of soft tissues in different areas of the facial skeleton and neurocranium (Gerasimov, 1949, 1955; Lebedinskaya, 1998; Balueva, Veselovskaya, 2004). The central (profile) ridge was placed taking into account the shape of the frontal and nasal bones, piriform aperture margin, maxilla, the size and direction of the alveolar process and teeth, and, finally, the shape and size of the mental prominence. The correction was carried out based on the contour reconstruction made before.

After this, the eyelids were modeled according to the shape of the orbit, pattern of the orbital margins, and the position of the reference points of the eyes' corners. A half of the nose was molded afterwards based on the shape, size, and the pattern of the margins of the piriform aperture, position of the lower turbinate, shape and direction of the nasal bones and anterior nasal spine. A half of the lips was reconstructed taking into account the size and direction of the alveolar processes and teeth, size and shape of the alveolar arch, as well as the type of occlusion. A half of the chin was molded based on the shape and size of the mental eminence. Finally, the auricles were placed with respect to the shape of the mandibular ramus and the size and shape of the mastoid process.

The second half of the face was reconstructed taking into account the asymmetry of the skulls, where parts of the left half being molded have been compared with the parts of the right half already molded. The neck was modeled according to the position of the sternocleidomastoid muscles. At the next stage, the portraits were corrected with the aim to account for age changes and the information regarding their possible illness and trauma. The sculptural reconstruction of the male from burial 5 at Ak-Alakha-5 was complemented by a fur coat—the main type of male shoulder wear of the Pazyryk culture (Polosmak, Barkova, 2005: 51).

Results and discussion

Female from Ak-Alakha-3 (burial 2, mound 1), 28–30 years. The mummified body found in a well-preserved "frozen" burial (Polosmak, 2001: 67–86) has been the subject of numerous multidisciplinary studies. Facial reconstructions of this individual were also made previously but not published. One of her first sculptural portraits by T.S. Balueva has been exhibited at the Museum of History and Culture of Peoples of Siberia and the Far East of the IAET SB RAS. Photographs of that reconstruction hit the media; thus, the public impression of the appearance of the Pazyryk people was mainly shaped by this portrait. But the craniometric pattern of the individual published later (Chikisheva, 2000; 2003b: 221–224) did not match perfectly with the reconstructed complex of somatological traits.

Such a discrepancy, in our opinion, was due to the post-mortem damage to the skull. Soft tissues in the left side of the skull covered the upper surface of the zygomatic process of the temporal bone, lateral surface of the frontal process of the zygomatic bone (as well as a half of its anterior surface). In the right side, they covered a part of the parietal bone, a half of the maxilla, and the whole zygomatic bone. The cervical vertebrae were firmly articulated to the skull base. The posterior part of the cranial vault was deformed by the pressure of freezing water. This area of the skull was also the subject of manipulations during embalming of the body. A trepanation aperture (40 × 50 mm), with irregular margins, had been made in the lower part of the occipital squama. Through this aperture, the cranial cavity of the skull was filled in with fillers used by the Pazyryk people for embalming. A network of fractures surrounds the aperture. All these taphonomic factors led to lateral compression of the occipital region and the skull base. The right parietal bone is slightly deformed as well. A fissure is passing through its whole surface, from the level of the parietal boss downwards, reaching the occipital squama but not the trepanation aperture. A part of the parietal bone lateral to the fissure is slightly pressed inside the skull. The right half of the facial skeleton, while being articulated with the skull base through soft tissues, is shifted to the right and medially relative to its normal anatomical position. The development of the techniques of replication of 3D virtual images brought about the possibility of eliminating those deformations.

The skull is large, the outlines of the vault are smooth, the main tubercles are not strongly bossing, the cranial length and height are large as well, the transverse-sagittal index displays mesocrany. The occipital part of the sagittal arch of the vault is shortened, the occiput is weakly bossing. The frontal bone is inclined, slightly convex, weakly bossing, wide, flat in the transverse plane. The zygomatic processes of this bone are fairly robust and embossed. The supraorbital area is quite massive though not exceeding the range of variation typical for females. The mastoid processes are long, the supramastoid ridge is moderately developed. The external acoustic meati are small. The ears of the individual were likely small and weakly protruding.

The facial skeleton is large relative to the braincase. It is of an ellipsoid shape, very tall, wide at the upper and zygomatic levels, but apparently narrowing at the zygomaxillary level. The combination of the angles of the horizontal profile is heteroprosopic: platyopic and klinognathic. The canine fossa is of moderate depth. The vertical facial profile is orthognathic (according to the general angle), with the protruding alveolar region. The zygomatic bones are smooth, with no prominent relief. The nasal process of the frontal bone is low, wide, and trapezoid. The nasofrontal angle is flat.

The orbits are vertical, wide, low, enclosed, rounded (following M.M. Gerasimov (1949: 39)). The lower margin of the orbit is blunt, while the upper margin is sharp and overhanging in its lateral part. The orbital tubercles are weakly pronounced. The frontal processes of the maxilla are frontal. The morphological features of the orbits suggest an oblique-medial direction of the line of the palpebral fissure, a medium-sized eyeball, shallowly located in the orbit, and the presence of an epicanthus (Nikitin, 2009; Veselovskaya, 2015).

The nasal bones are long and wide, and display a sharp narrowing near the root. The nasal bridge is undulated. The angle of nasal protrusion is small. The piriform aperture is very tall and wide, with a blunted inferior margin and a very weakly developed anterior nasal spine (grade 1). Such a combination of anatomical structures suggests a weak protrusion of the nose with respect to the general facial profile, a very low nasal bridge, and a slightly elevated base of the nose (Gerasimov, 1949: 25–31; Lebedinskaya, 1998: 99–100; Nikitin, 2009; Veselovskaya, 2015).

The alveolar part of the maxilla is tall, moderately wide, and smooth. About a half of the height of the tooth crowns is worn down; therefore, estimation of the difference in size between the central and lateral incisors is impossible. The dental occlusion line is strait, psalidontic. The absence of bossing of the alveoli of the central incisors suggests that the filtrum was weakly modeled. The mandible is very large, with a tall and weakly inclined ramus, but with a small angular width and moderate relief of the masticatory tuberosity. The mental eminence is not strongly protruding anteriorly; consequently, the chin was small, oblique, and rounded. The combination of the features listed above implies reconstructing a mouth of a middle width, with procheilia and a slightly swollen colored part of the lips of a medium height (Gerasimov, 1949: 31–38). An additional factor supporting the impression of a strong lip protrusion is the vestibular position of the upper lateral incisors, which occurred, in our opinion, due to some excessive "pulling" masticatory loadings likely related to a specific occupational activity. The same factor could probably explain the strong dental wear of the upper incisors, which does not match up to the biological age of the individual and the pattern of attrition of buccal teeth.

Summing up, the combination of craniometrical and somatological traits of the female reconstructed in her sculptural portrait (Fig. 2) points towards her affiliation with the Mongoloid race. This notion is supported by such features as a very large, flat at the upper level face, with a weakly protruding nose, an elongated shape of the cranial vault, with an inclined, weakly bossing forehead, and the presence of an epicanthus.

Male from Ak-Alakha-5 (mound 5), 45–50 years. The bones of both neurocranium and facial skeleton, as well as the lower margins of the nasal bones, of the right half of the skull were damaged post-mortem. The destructions of the facial skeleton have substantially restricted the diagnostic complex owing to the exclusion of the angles of the horizontal profile. Craniometric data on this individual were published previously (Chikisheva, 2003b: 216–220).

The skull is large, moderately robust, dolichocranic, the skull vault is very low. The shortest component of the sagittal arc of the vault is the occipital arc, while its frontal part is the longest. The facial skeleton is large relative to the braincase. The frontal bone is of middle width, inclined, moderately bossing. The frontal bosses are smooth, the supraorbital area is moderately protruding. The superciliary arch development is grade 3. The temporal line is smooth. The sagittal suture relief is weakly pronounced. The parietal tubers are not bossing,

Fig. 2. Facial reconstruction of the female from burial 2, mound 1 at Ak-Alakha-3.

while the uniform convexity of the lateral walls of the parietal bones gives the skull a vaulted shape. The masticatory muscles entheses are weakly developed. The facial skeleton is of a pentagonal shape, it is very tall and wide at all levels, moderately protruding in the horizontal plane. The canine fossa is shallow. The general vertical profile of the face is orthognathic, while its alveolar part is protruding (alveolar prognathism). The zygomatic bones are rugose. The nasal process of the frontal bone is of a moderate height, wide, and subrectangular. The nasofrontal angle is flat. The zygomatic processes of the frontal bone are massive and embossed. The mastoid processes are not large, but exhibit well-pronounced relief. The external acoustic meati are large. The supramastoid ridge is strongly developed. The ears of the individual were likely quite large and strongly protruding in the upper part.

The orbits are wide and tall, open, rounded, the margins are blunt. The rounded upper margin suggests a fair development of the fold of the upper eyelid over its whole length, with some overhang in the lateral part. The morphological features of the orbits suggest an oblique-medial direction of the line of the palpebral fissure, a large and slightly protruding eyeball, and the absence of an epicanthus (Nikitin, 2009; Veselovskaya, 2015).

The nasal bones are long, wide, and display substantial narrowing near the root. The nasal bridge is undulated. The angle of nasal protrusion is small. The piriform aperture is of a medium width, the prenasal sulci are weakly developed, the anterior nasal spine is only slightly protruding (grade 1). The profile of the soft tissue nose can be reconstructed based on these features (Gerasimov, 1949: 25–31; Lebedinskaya, 1998: 99–100; Nikitin, 2009; Veselovskaya, 2015): medium wide, convex, weakly protruding, with a low nasal bridge and an almost horizontal base of the nose.

The alveolar region of the maxilla is of a medium height and width, and fairly rugose. About a half of the height of the tooth crowns is worn down; so, estimation of the difference in size between the central and lateral incisors is impossible. The dental occlusion line is strait, psalidontic. The alveoli of the central incisors are quite large, suggesting a fairly developed filtrum. The combination of the features listed above implies reconstructing a mouth of a middle width, with mild procheilia and a slightly swollen and low colored part of the lips (Gerasimov, 1949: 31–38). The mandible is wide at the angles, with a very low and inclined ramus. Relief of the masticatory tuberosity and the lower border of the body is quite prominent. The mental eminence is not strongly protruding anteriorly, which suggests a fairly small and rounded chin.

Thus, the sculptural portrait (Fig. 3) displays the face of a representative of the Mongoloid race, which is clear even in the absence of the epicanthus. The face is large, with wide cheeks, and moderately flattened. The shape of the nose is noteworthy due to the combination of weak protrusion of the nasal bones with respect to the vertical profile line, and strong protrusion relative to the horizontal profile. The low and inclined forehead, with smooth frontal tubers and moderately developed supercilliaray part, is a characteristic physiognomic feature as well. These are accompanied by pronounced dolichocrany.

The complexes of craniological and somatological traits observed in the facial reconstructions of these male and female make it possible to identify them as representatives of the Paleosiberian type of the Mongoloid race. The specific complex of traits of this type includes a large dolichocranic vault, an inclined ("receding") forehead, large dimensions of the face, as well as its flatness though not as extreme as in the modern Baikalian and Central Asian types of the Mongoloid race. The nasal protrusion is weak, but, again, it is not extremely flat.

The Paleosiberian type was first described by G.F. Debets in cranial samples of the Neolithic time from the Northern Cis-Baikal region (1948: 59). Debets considered the type as "an ancient form not present in the modern population" (1951: 95). Moreover, he arrived at the following conclusion: "…with respect to all the modern Mongoloid types of the Siberian population, the Paleosiberian type occupies approximately the same position as the Cromagnoid, or Protoeuropean, type in relation to the modern types of the Caucasoid

Fig. 3. Facial reconstruction of the male from mound 5 at Ak-Alakha-5.

race" (Ibid.). Thus, the question of the incompleteness of the morphological differentiation of the Neolithic humanity into consolidated complexes of the main races—Mongoloid and Caucasoid—was for the first time raised in Russian anthropology. At the present stage of the development of science, owing to the manifold increase in the amount of cranial samples, it is getting more and more evident that in the Neolithic North Eurasia, there also existed other morphological complexes unconsolidated from the point of view of the modern racial typology, which show continuity through the time and the succession of archaeological cultures.

The Paleosiberian type was prevalent in the Cis-Baikal region during the Neolithic. Then it appeared in the Hun-Sarmatian time among the Xiongnu burials in the South and East of the Cis-Baikal region and Mongolia (Debets, 1948: 59; Gokhman, 1960; Mamonova, 1974; Tumen, 1985). This type was also detected in the Tungus of the Northern Cis-Baikal (in the family clans having nomad camps in the Upper Angara basin) studied by Y.Y. Roginsky and M.G. Levin in 1927 (Roginsky, 1934). The three small family clans of hunters and reindeer-herders were likely one of the last representatives of the Paleosiberian anthropological type.

According to N.N. Mamonova, who studied the cranial samples from the Sudzhi and Cheremukhovaya Pad burial sites, among the individuals of the Xiongnu tribal union, a Mongoloid component of the Paleosiberian type related genetically to the Neolithic population of the Cis-Baikal region was present (1974). These sites are a part of the Ivolga archaeological complex with the core at a fortified settlement of the 2nd century BC to the 1st century AD, which was a border outpost, a trade, administrative, craft and agricultural center at the northern outskirt of the Xiongnu Empire (Davydova, 1985: 83–88). This suggests that the people displaying the features of the Paleosiberian type could have come to the Altai Mountains from the ethnic groups of the Xiongnu tribal union at an early stage of its formation, contemporaneous to the final stage of the Pazyryk culture. As the morphological complexes of a few studied skulls were assigned by Mamonova to the Paleosiberian type, she suggested that this type was the main in the anthropological composition of the Xiongnu (1974). I.I. Gokhman, who studied another small cranial sample from the burials at the Ivolga fortified settlement, came to the conclusion that the aboriginal Mongoloid component was represented in the sample by the Baikalian type (1960) typical of the Slab Grave culture. Racial components of both Mongoloid and Caucasoid types were detected in the numerous cranial samples from Mongolia studied by Tumen (1985). These observations emphasize the unique complexity of the anthropological composition of the population of the Xiongnu union.

Without touching the complicated question of the formation of the Xiongnu ethnic group, we would note that people of the Paleosiberian type were likely neither a part of the demographic core of the nomads nor a part of their elite stratum. The area of this type, according to existing Neolithic and modern anthropological data, was in the Baikal region, where mountain-taiga or mountain-tundra geosystems are prevalent in the landscape structures (Rakovskaya, Davydova, 2001: 258). Such ecological conditions determined the lifestyle of local people: during the Neolithic, people lived in relatively isolated small groups mainly engaged with hunting and fishing (Okladnikov, 1970). In the early 20th century, the Tungus population was subdivided according to the kin principle, and their occupation activities included hunting (e.g. Baikal seal), fishing, and reindeer-herding (Roginsky, 1934). The Baikalian aborigines have clearly kept the base of their lifestyle unchanged for several thousands of years*. But by the end of the 1st millennium BC, some of those aboriginal groups were involved in the sphere of influence of the Xiongnu state.

There can be very different reasons why individuals displaying the traits of the Paleosiberian race appeared in the Pazyryk population of the Altai Mountains not only as ordinary members but also as elite (female from "frozen" burial 2, mound 1, Ak-Alakha-3). But most likely, those people had some skills and knowledge of particular value for human groups. The anthropological and genetic diversity of the Pazyryk population suggests that it was their ability to accept these traditions that allowed the migrants to become full members of the Pazyryk society.

Conclusions

The first point to be noted that the subject field of discussion between consistent proponents of the population and typological approaches to the units of anthropological classification are the principles operating on the theoretical model of an isolated group of populations of a common origin. In real life, such a model is rather an exception, if exists at all. Migration fluxes initiated by the logic of historical events, environmental and social factors of restructuring of populations, and even stochastic events changing the fate of single persons—all affect the anthropological composition of populations. Therefore, careful attention to the pattern of individual variation of racial diagnostic complexes in cranial samples must remain an immutable rule of their analysis and interpretation of the results. The method of facial

*According to one of the recent series of radiocarbon dates, the Early Neolithic settlements from the Lake Baikal shore are dated to 7214–6123 BP (8160–6910 cal BP) (Goryunova, Novikov, 2018).

reconstruction, providing a visual representation of the appearance of a person, becomes particularly important in this context. The use of this method, in combination with archaeological data, written sources (whenever these are available), myths, and the results of paleopathological research, provides an opportunity to create portraits of ancient people in their local environment, thus, to "animate" the theoretical reconstructions of ethnogenetic processes.

The differentiation of cranial samples into anthropological types has helped us to understand that the Pazyryk culture of the mountain valleys of the Altai has emerged not only as a result of the evolution of the local substrate, but also under the influence of Iranian and Central Asian civilizations through the migration of the individuals carrying their traditions. The role of the Eastern component identified as Paleosibirian via its craniometric and racial (somatological) features was likely not a systematically important factor of the Pazyryk culturogenesis.

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AN SSSR – USSR Academy of Sciences

CNRS – Centre National de la Recherche Scientifique

GIM – State Historical Museum (Moscow)

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)

IC&G SB RAS – Institute of Cytology and Genetics, Siberian Branch, Russian Academy of Sciences (Novosibirsk)

IEA RAN – Institute of Ethnography and Anthropology, Russian Academy of Sciences (Moscow)

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

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

KSIIMK – Brief Communications of the Institute for the History of Material Culture

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

MAR – Materials for the Archaeology of Russia

MIA – Materials and Investigations on Archaeology in the USSR

PNAS – Proceedings of the National Academy of Sciences

RFFI – Russian Foundation for Basic Research

RGADA – Russian State Archives of Ancient Acts

RGIA – Russian State Historical Archives

RGVIA – Russian State Military Historical Archives

RUDN – Peoples' Friendship University of Russia (Moscow)

SMAE – Papers of the Peter the Great Museum of Anthropology and Ethnography (Kunstkamera)

TIE – Transactions of the Institute of Ethnography

UrO RAN – Ural Branch of the Russian Academy of Sciences

YaNAO – Yamal-Nenets Autonomous Okrug

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