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The Peopling of Uzbekistan by *Homo sapiens denisovan*

This study continues a series of articles published in two last issues of this journal, exploring the split of the ancestral species *H. heidelbergensis* ~400 ka BP in the Levant and the subsequent origin of two filial species, Neanderthals and Denisovans. Certain members of *H. heidelbergensis* had moved to Europe, where a new taxon, *H. s. neanderthalensis*, emerged 200–150 ka BP. Others had migrated to Central Asia via Iran ~400–350 ka BP. Their assimilation of native populations of *H. erectus*, adaptation to changing environments, and natural selection led to the emergence of *H. s. denisovan*. In Uzbekistan, no Early Paleolithic sites are known. Based on archaeological evidence, one can presume that this territory was first peopled by Denisovans, who had migrated there from Tajikistan during MIS 6. At the final stage of the Karatau culture in Tajikistan, associated with pedocomplex 4 (MIS 11), new elements appeared in primary lithic reduction, types of stone tools, and the ways they were fashioned. In Uzbekistan, excavations of two key sites, Kulbulak and Obi-Rakhmat, have been ongoing for over five decades. Owing to long stratigraphic sequences, the evolution of the Middle Paleolithic industry of Denisovans has been traced over a long period spanning MIS 7–3. The only cave site excavated in Central Asia to-date, is Teshik-Tash in Uzbekistan, where Neanderthal fossils were found together with a Mousterian industry.

Keywords: **Early, Middle, Upper Paleolithic, *H. erectus*, *H. heidelbergensis*, *H. neanderthalensis*, *H. denisovan*.**

The early stage of peopling of Uzbekistan by *Homo sapiens denisovan*

The lack of information on Early Paleolithic sites in Uzbekistan is the result of insufficient archaeological studies of this area. The Pleistocene environmental and climatic conditions were beneficial for hominin dispersal. Early Paleolithic sites have been recorded in the adjacent regions of Tajikistan and Kazakhstan. Kulbulak, the oldest site in the territory of Uzbekistan, was initially attributed to that period. The site was discovered in 1972 and studied for many years by M.R. Kasymov, a talented Uzbek archaeologist (1972, 1973, 1990a, b; Kasymov, Tetyukhin, 1981; Kasymov, Godin, 1982a, b, 1984; Kasymov et al., 1985; Kasymov, Godin, Khudaiberdiev, 1992; etc.). In 1994–1995, the site was excavated by the Joint Uzbek-Russian Archaeological Expedition headed by U.I. Islamov and N.K. Anisyutkin (Anisyutkin et al., 1995). In 2001–2002, excavations were conducted here under the direction of U.I. Islamov (Islamov, Krakhmal, Ergashev, 2003). Since 2007, the site has been studied by the Joint Multidisciplinary Archaeological Expedition organized by the Institute of Archaeology and Ethnography of the Siberian Branch of the Russian Academy of Sciences (SB RAS) and the Institute of Archaeology of the Uzbekistan Academy of Sciences.

The site of Kulbulak is located on a high terrace of the southeastern slope of the Chatkal Range, on the right bank of the Akhangaran River. The surface of the terrace is heavily eroded and fissured into sections. The terrace is cut by two watercourses: the seasonal Dzharsay flows into the Kyzylalma River, a right tributary of the Akhangaran River. The Paleolithic site

is located close to the Kulbulak spring in the vicinity to the confluence. This was an ideal place for a long-term residence of hominins: permanent sources of water were available even in the driest periods; outcrops of siliceous rocks nearby provided inexhaustible sources of raw materials for stone tool manufacturing. The terrace slope is rather steep; mudflows often occurred here during pluvial periods.

Kulbulak is a unique site: in the course of the long-term works, M.R. Kasymov excavated a multi-meter trench in the loose sediments. In one of the excavation sections, the researchers reached a depth of 19 m below the surface. Owing to the hydrological conditions in the area, groundwater rises and floods some parts of the excavation trench in rainy years. Kasymov identified 121 lithological units (layers and interlayers) in the 19-meter thick soft sediments (1990a, b). The total excavation area at Kulbulak is 600 m^2; the depth of 19 m was reached only in a small test pit of about 2 m^2.

In the cultural-historical sequence of sediments at Kulbulak, Kasymov identified 49 culture-bearing horizons, which he classified into stages. He attributed the materials from the low cultural layers (49–24) to the Acheulean, and the time of their accumulation to the Nanai period (the first half of the Middle Pleistocene); layers 23–13 to the Early Mousterian (formed during the Tashkent period—the second half of the Middle Pleistocene); layers 12–6 to the Middle and layers 5 and 4 to the Late Mousterian; layers 3–1 to the Upper Paleolithic (Kasymov, 1990a).

Some researchers have expressed doubts that the stratigraphic sequence of the Kulbulak was undisturbed (Ranov, Nesmeyanov, 1973; Nesmeyanov, 1978). They pointed to the possibility of Paleolithic artifacts sliding down from workshop sites located up the slope into the underlying layers either through the Dzharsay watercourse or by mudflows.

In 2007, a new stage of excavations at Kulbulak was carried out by the research team of the Institute of Archaeology and Ethnography SB RAS together with researchers from the Institute of Archaeology of the Uzbekistan Academy of Sciences (Derevianko, Kolobova, Flas et al., 2007). In the driest years (2007–2018), archaeologists managed to penetrate into the thickness of loose sediments to a depth of 22 m, identify the lowermost cultural layers, and reconsider the entire stratigraphic sequence at the site (Fig. 1). As a result of comprehensive studies, four main sedimentary units, representing various paleogeographic conditions of the sequence accumulation, and 24 cultural layers were established (Taratunina et al., 2020).

Unit 1 comprises layers 25–22. The lowermost layer was uncovered at a depth of 22 m. The unit is composed of loam with numerous inclusions of debris and small rubble. The researchers suggest the existence of a small water reservoir during the accumulation of this unit; abundant inclusions of rubble in the form of separate layers indicate the involvement of mudflow processes in sedimentation (Ibid.: 279). The terminal stage of the unit formation is marked by the activation of mudflows and erosion signs between layers 23 and 22. This unit is dated to the period corresponding to the second half of MIS 7.

Unit 2 comprises layers 21–18. It shows the alternating proluvial-mudflow sediments, with thin interlayers of lacustrine loams of gray and bluish color. These deposits were formed during the cooling period of MIS 6.

Unit 3 includes layers 17–12. The upper part of the unit shows alternating layers of loess-like loam and thick horizons of proluvial-mudflow deposits, which generally reflect the repeated fluctuations of climate and environmental settings in the region. The loess-like loam of layer 16 is dated to 111 ± 19 ka BP (UG-7094) (Pavlenok K.K., 2020).

The uppermost unit includes layers 11–1. It was formed under the strong influence of slope processes and mudflows of varying intensity (Pavlenok K.K. et al., 2018). The upper part of layer 12, as well as layers 11 and 10, correspond to the cold period of MIS 4 (Taratunina et al., 2020: 279). The stratigraphic sequence of Kulbulak demonstrate thin soil layers. Some culture-bearing layers of the site were significantly destructed by heavy mudflows.

Thus, the second stage of the Kulbulak field studies provided the data suggesting a different historical and cultural stratigraphic column confirmed by biostratigraphic and geochronological findings; additional layers were identified below the 19-meter mark, which was not possible for Kasymov owing to hydrological conditions in the area of the site. Layers 23 and 24 yielded lithic artifacts suggesting a different interpretation of the Kulbulak lithic industry as a whole.

Layer 24 was formed as a result of diluvial and minor aeolian processes involving groundwater. The layer thickness reaches 1.9 m. Researchers noted that archaeological materials were concentrated mainly at the depth of 20.60 m. Solitary artifacts were recovered above this mark. The total number of stone implements is 1761 pieces (Pavlenok K.K., Pavlenok G.D., Kogai et al., 2019: 198). Production waste (chips, chunks, shatters, small flakes, and

flake fragments) makes up the most numerous category of finds, over 90 % of the total number of lithics.

The layer contains 14 core-like artifacts. The researchers pointed that the flat blade cores (Fig. 2, *1*, *2*) were heavily exhausted (Pavlenok K.K., Pavlenok G.D., Kogai et al., 2019: 198–199). These cores share common morphological and technological features that can be associated with the Levallois technique (somewhat simplified due to the low quality of the raw materials used); this technique has been described in sufficient detail in a number of publications (see (Pavlenok K.K., Kot, Pavlenok G.D. et al., 2019; Kot et al., 2014)).

The parallel small blade and bladelet cores were classified into type 2 (Fig. 2, *3*, *4*). Flaking of these cores was carried out along a slightly convex arc, unlike the flat core reduction strategy. The elongated blanks were removed sequentially one after another in a subparallel direction. It is the technique of serial removal of target spalls (as an alternative to intensive rejuvenation of core after one or two target removals in the Levallois reduction strategy) that determines the technological variability of blade production in the lithic industry of layer 24.

The narrow-faced cores were included into type 3 (Fig. 2, *5*). In such cores, the crest was thoroughly shaped through fine flaking; the working edge was well-prepared.

The core-trimming flakes, according to the researchers, were well correlated with the two identified reduction strategies. These additional removals were often elongated, asymmetrical, and curved in side-view. They usually bore traces of irregular faceting and small, roughly prepared platforms (Fig. 2, *13*, *14*, *17*). The lithic tool-kit includes rather thick flakes with subparallel edges and traces of faceting used to widen the flaking surface and smooth its irregularities through the ordinary parallel reduction technique (Fig. 2, *12*, *15*, *16*).

The blades make up about 20 % of the collection (excluding the production waste). These are often asymmetrical, curved in the side view, and irregular in shape. The blades have striking platforms of various shapes, plain or with signs of minor working. The share of flakes (*n*=99) is three times greater than that of blades. The flakes are usually asymmetrical, rectangular in shape; many flakes are curved in the side view.

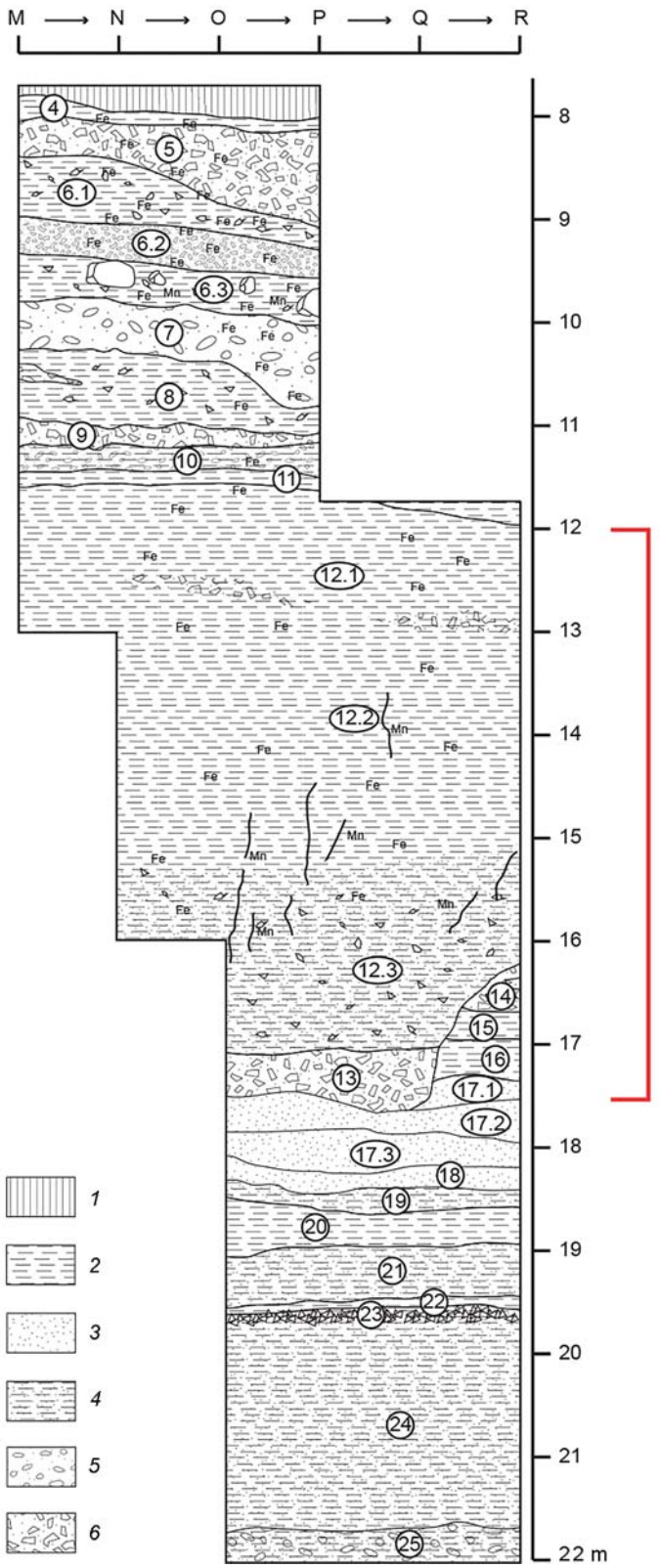

Fig. 1. Kulbulak stratigraphic column (after (Pavlenok K.K. et al., 2021)).

1 – technogenic sediments; *2* – loam; *3* – sandy sediments; *4* – sandy loam; *5* – pebble and boulder; *6* – blocks, rubble.

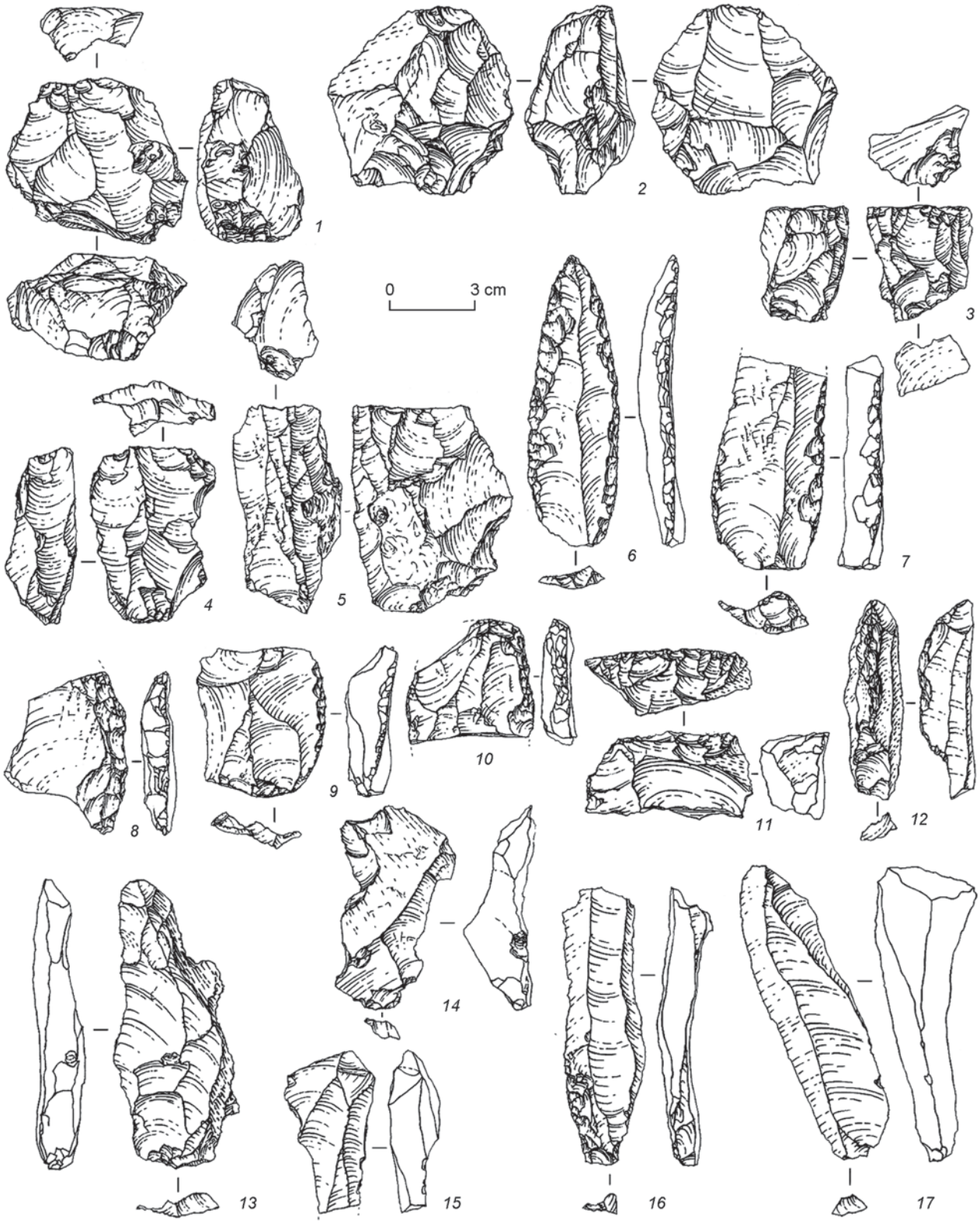

Fig. 2. Lithic artifacts from Kulbulak layer 24 (after (Pavlenok K.K., Pavlenok G.D., Kogai et al., 2019)).

1, *2* – flat blade cores; *3*, *4* – small blade and bladelet cores; *5* – narrow-faced bladelet core; *6* – elongated point on blade; *7* – fragment of a blade with irregular marginal retouch; *8* – single longitudinal convex side-scraper; *9* – Levallois flake; *10* – double longitudinal-transverse side-scraper; *11* – transverse straight side-scraper; *12*, *15*, *16* – spalls for widening the flaking surface and smoothing its irregularities; *13*, *14*, *17* – spalls for shaping/rejuvenating the flaking surface.

The striking platforms are plain, dihedral, and coarsely faceted.

The abundance of core-trimming elements and chips indicates that the core shaping and reduction, as well as tool manufacturing, were executed by hominins at the site.

Layer 24 yielded a small number of tools (*n*=7). Mostly blades and blade flakes were used as blanks, which was a characteristic feature of the lithic industry. The category of tools comprises an elongated point on a blade (Fig. 2, *6*) and a proximal fragment of a large blade with finely retouched longitudinal edges (Fig. 2, *7*). Side-scrapers are single longitudinal convex (Fig. 2, *8*), transverse straight (Fig. 2, *11*), and double longitudinal-transverse (Fig. 2, *10*). Among the flakes, a Levallois flake with its edge shaped by fine marginal retouch (Fig. 2, *9*) is noteworthy. The tool-kit also includes an unidentifiable fragment of a retouched flake.

The finds from Kulbulak lowermost layer 24 suggest several important conclusions. The industry as a whole belongs to the Middle Paleolithic. Layer 24 is dated to the second half of MIS 7 (ca 200 ka BP). The Middle Paleolithic industry of this region is similar to that from the Khonako-3 site in Tajikistan in terms of age and technical and typological features. At both sites, the primary reduction technique was based on the Levallois and blade flaking aimed at the production of blanks. The researchers believed that the lithic collection from layer 24 illustrated one of the most ancient techniques of narrow-face flaking for obtaining blades and microblades.

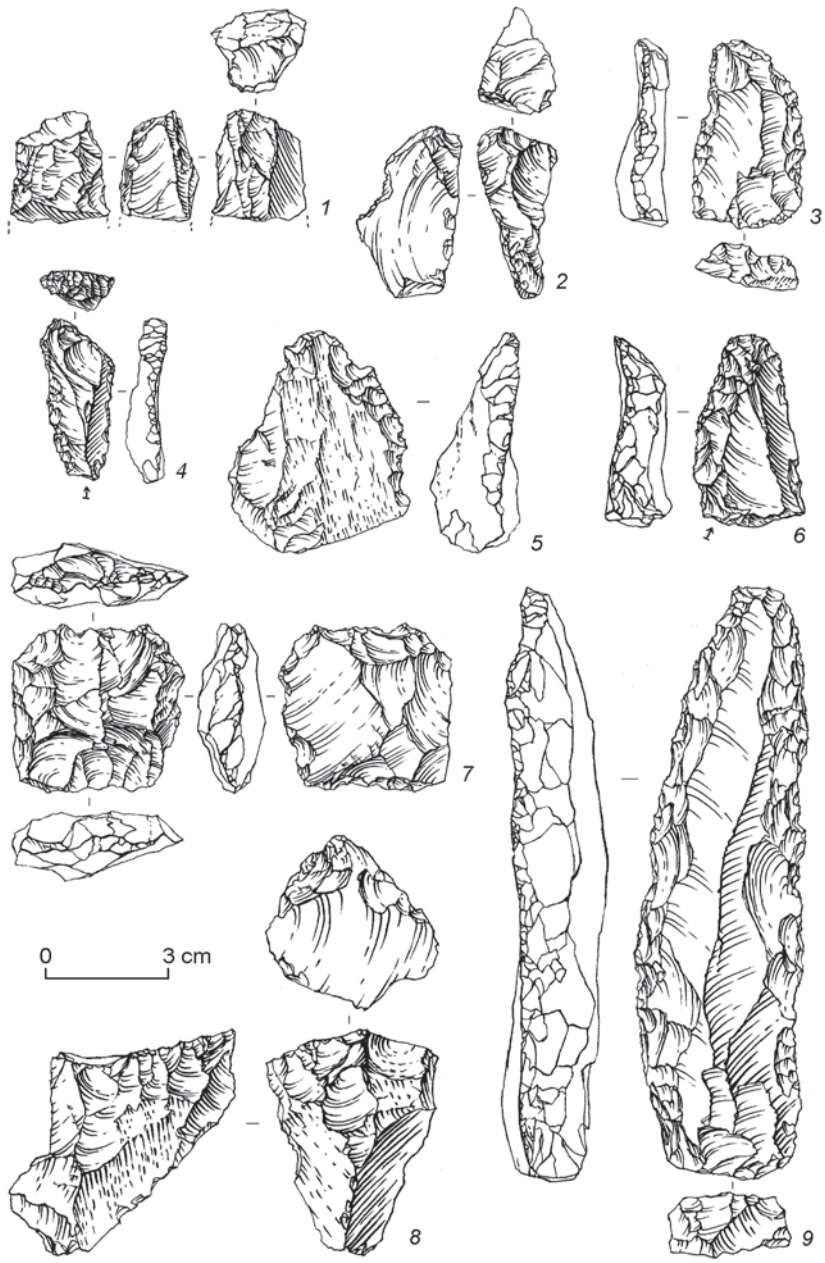

Fig. 3. Lithic artifacts from Kulbulak layer 23 (after (Krivoshapkin et al., 2010)). *1*, *2*, *7*, *8* – cores; *3*, *4*, *6* – end-scrapers; *5* – backed knife; *9* – side-scraper-like tool on blade.

The excavations of layer 23 at Kulbulak in 2010 yielded 4995 lithic artifacts. Among them, 4302 specimens (86.1 %) were identified as production waste (chips, chunks, shatters, and flakes up to 3 cm in size) (Krivoshapkin et al., 2010; Kolobova et al., 2016), 25 specimens (3.6 % excluding production waste) were identified as cores, including 19 typologically identifiable pieces, which were subdivided into two types.

Flat cores (*n*=12) were attributed to two subtypes. Subtype 1 includes single-platform, unifacial cores with a parallel flaking pattern for the production of flakes (*n*=6); subtype 2 includes multi-platform, unifacial cores with a longitudinal-transverse flaking pattern for the production of flakes (*n*=6). Heavily exhausted cores were recorded, which were modified into flat cores through the "truncating-faceting technique" (Fig. 3, *7*).

Volumetric cores (*n*=7) were also subdivided into two subtypes. Subtype 1 includes narrow-faced cores for the production of blades, bladelets, and microblades (*n*=6). These cores show the following varieties: single-platform unifacial, with elongated-triangular (wedge-shaped) flaking surface (*n*=3) (Fig. 3, *1*, *2*) and double-platform showing bidirectional knapping (*n*=3). Subtype 2 is represented by a core exhibiting prismatic knapping for the production of bladelets and microblades (*n*=1). This core is similar to carinated products in technical and typological characteristics (Fig. 3, *8*).

In the layer 23 collection, primary reduction was aimed mainly at detaching elongated blanks—blades and blade flakes. Among the total of 668 blanks, there are 246 blades (36.8 %), 176 bladelets (26.3 %), including 32 microblades and small bladelets (Fig. 4, *1–4*, *6*, *7*, *9*, *10*); and 210 flakes. There are 33 core-trimming elements: 10 spec. are marginal, 15 spec. marginal laminar, 4 spec. are flakes resulted from trimming of flat cores' hinges, 2 spec. are semi-crested, one crested blade, and one flake from the striking platform of a core. The striking platforms are mostly plain; however,

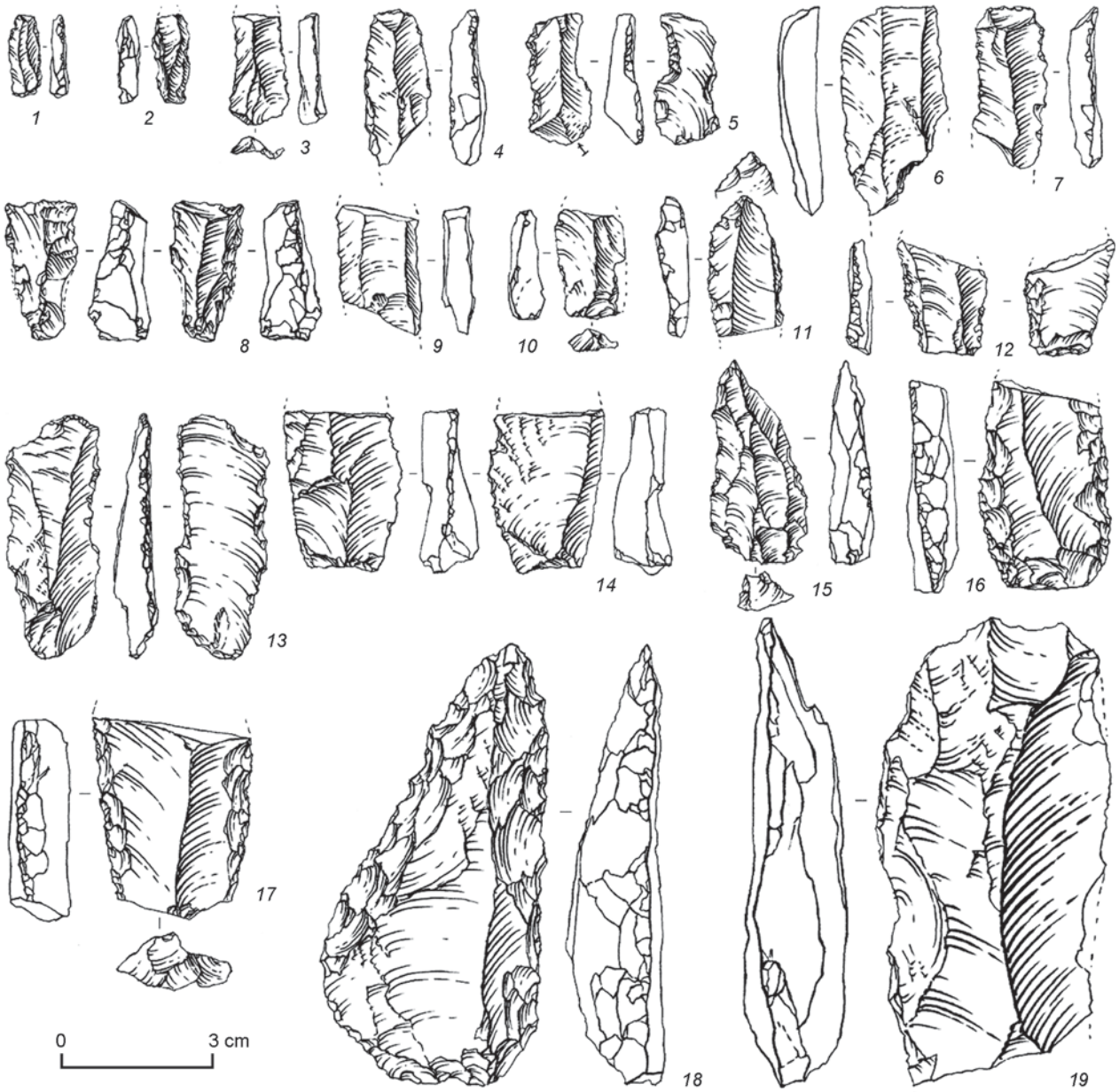

Fig. 4. Lithic artifacts from Kulbulak layer 23 (after (Krivoshapkin et al., 2010)).
1–4, *6*, *7*, *9*, *10* – blades and bladelets; *5*, *8*, *11–14*, *19* – retouched blades and bladelets; *15*, *18* – retouched points; *16*, *17* – side-scrapers.

puctiform, dihedral, and faceted platforms have also been noted.

Layer 23 revealed 46 tools. These are dominated by end-scrapers (*n*=14) of various shapes: with a convex working edge (*n*=4) (see Fig. 3, *6*), with a straight working edge (*n*=3), with an oblique working edge (*n*=2) (see Fig. 3, *4*), and flake scrapers (*n*=2). Several single tools were also found: a spurred side-scraper, a micro-end-scraper, a carinated end-scraper that is typologically close to carinated cores. There is a tool combining the features of an end-scraper and a side-scraper (see Fig. 3, *3*).

The second largest group contains side-scrapers (*n*=10): single longitudinal with straight working edge (*n*=2) and double longitudinal with straight working edge (*n*=5) (see Fig. 4, *16*, *17*). Blades bearing heavy one- and two-stepped retouch (*n*=2) (see Fig. 3, *9*) are morphologically and functionally close to the side-scrapers. Other tool types are retouched points (*n*=2) (see Fig. 4, *15*, *18*), a tool with trimming signs, spurred tools (*n*=2), a denticulate tool, a backed knife (see Fig. 3, *5*), retouched flakes (*n*=4), blades and bladelets (see Fig. 4, *1–4*, *6*, *7*, *9*, *10*), and retouched blades and bladelets (*n*=8) (see Fig. 4, *5*, *8*, *11–14*, *19*).

The researchers argued that according to the main technical and typological indicators, the lithic industry of layer 23 illustrated the development of the traditions noted in the industry of the underlying layer. These two industries are undoubtedly connected also chronologically: judging by the stratigraphic profile, they are separated by a relatively small time gap. The artifacts from layer 23 demonstrate the volumetric core technique and the trend to produce large-sized blade blanks, while the industry of layer 24 shows a dominance of narrow-face flaking and carinated tools; though, a significant number of blades and microblades were identified in the layer 23 collection.

Layers 17–13 yielded a small amount of representative materials (Pavlenok K.K., Pavlenok G.D. et al., 2018). Despite the small number of diagnostic artifacts in the overlying layers, the available finds illustrate the continuity in the development between the industries of these and underlying layers 23 and 24, the main feature being the use of blade reduction and the use of blades and bladelets as blanks.

The most numerous and informative material comes from the culture-bearing layer 12 about 5 m thick, which is subdivided into three horizons/sublayers (Derevianko, Pavlenok K.K., Shnaider et al., 2014; Kolobova, 2014; Derevianko, Pavlenok K.K., Pavlenok G.D. et al., 2016; Devyatova et al., 2016; and others).

Layer 12 was excavated over an area of 10 m^2 in 2014–2016. The layer's thickness varies from 4.65 m in the western part of the excavation to 4.0 m in the eastern part. Sublayer 12.3 yielded 2308 lithic artifacts. The share of the production waste (*n*=1727) is 74.8 %, including chunks/chips/shatters (*n*=1447) and unidentifiable spall fragments (*n*=280). The category of core-like tools includes 14 spec. (1 %); core-like fragments, 7 spec.

The category of cores comprises blade and bladelet cores (Fig. 5, *4*), blade and flake cores (Fig. 5, *7*), and discoidal cores with traces of radial flaking (Fig. 5, *5*). A convergent bladelet core shows a strongly convex striking platform with a broken edge. The share of exhausted cores is considerable.

The assemblage of spalls (*n*=567, 24.5 %) includes: flakes – 440 spec. (large and medium – 139 spec., small – 301 spec., blades – 57 spec.; bladelets – 34 spec.; and core-trimming elements – 36 spec.

The tool-kit contains 50 spec. It includes a uniface, a uniface blank, 2 single longitudinal convex side-scrapers, a single longitudinal straight side-scraper (Fig. 5, *1*), 3 double longitudinal side-scrapers with straight (*n*=2) (Fig. 5, *6*) and convex edges; a side-scraper, an end-scraper, a chisel-like tool, 2 truncated-faceted tools, 2 implements with signs of edge-rounding, 14 retouched flakes (Fig. 5, *8*), 8 retouched blades, and 12 fragments of tools of unclear typology.

The medium-sized uniface is sub-triangular in shape (Fig. 5, *10*). Its ventral surface is completely covered with negative scars of various-sized removals made from various parts of the edge and oriented toward the artifact's center. The end-scraper with a convex edge was fashioned on a small flake fragment (Fig. 5, *2*). In the distal part of the spall, a convex scraper edge was prepared through abrupt marginal laminar retouch on the dorsal face.

The chisel-like tool (Fig. 5, *3*) was made on the proximal fragment of a large spall. The facets of the fine abrupt, marginal, scaly retouch are located on both faces in the area of striking platform of the blank spall, overlapping the previous retouch scars. One truncated-faceted artifact shows the truncated element shaped in the area of the residual striking platform: truncation removals were made from the ventral surface; additional flattening removals, from the dorsal surface (Fig. 5, *9*).

In layer 12, stone tools were recorded mainly in the upper part, particularly in sublayers 12.1 and 12.1. The lithics were scattered over the deposits of a total thickness of 1.5 m. Artifacts (over 1500 spec.) were recorded all over the layer. Nevertheless, in terms

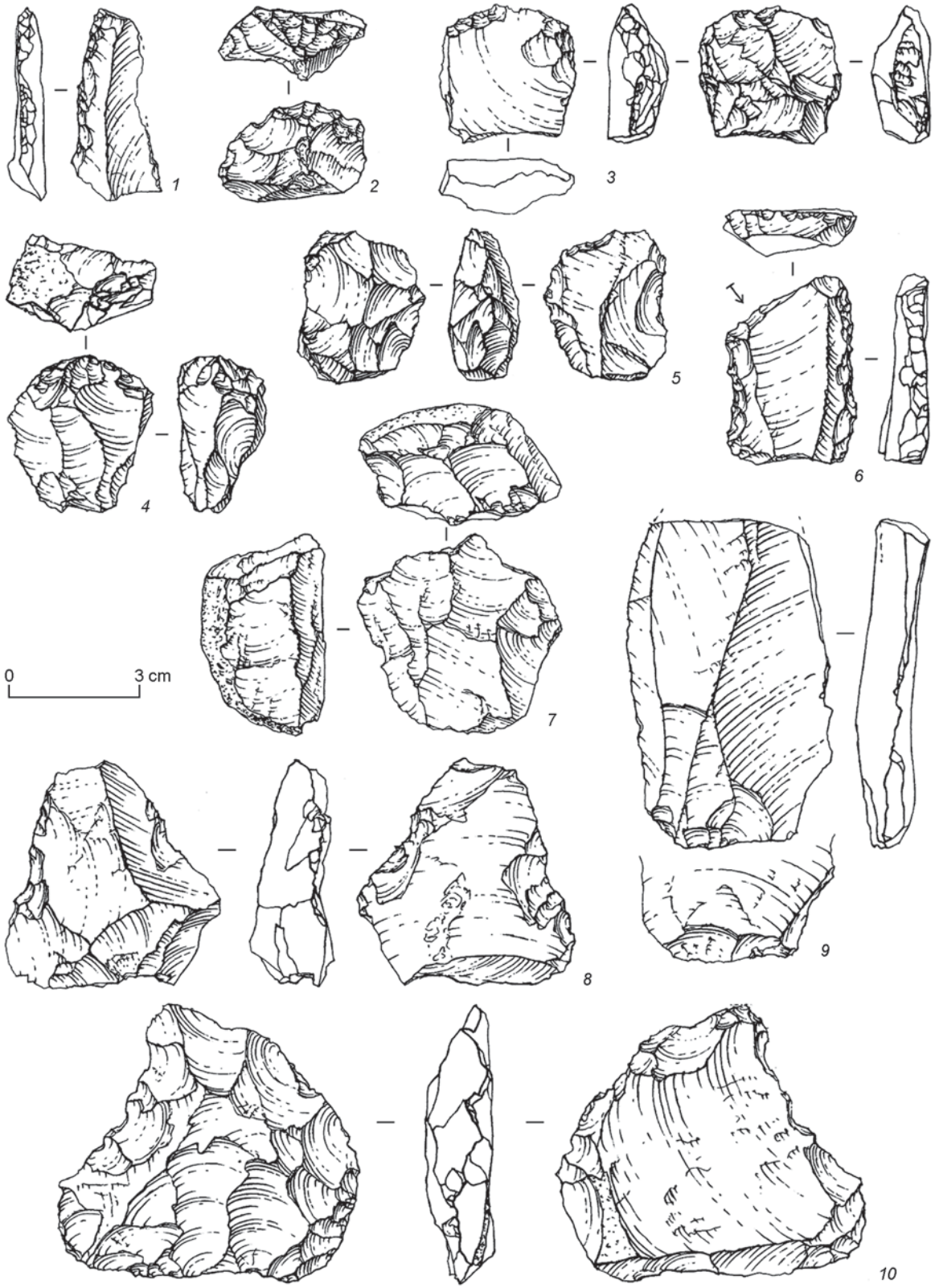

Fig. 5. Lithic artifacts from Kulbulak layer 12.3 (after (Derevianko, Pavlenok K.K., Pavlenok G.D. et al., 2016)).
1, *6* – side-scrapers; *2* – end-scraper; *3* – chisel-like tool; *4*, *5*, *7* – cores; *8* – retouched flake; *9* – truncated-faceted artifact; *10* – uniface.

of technology and typology, the lithic industry is homogeneous.

Layers 11 and 10 have been attributed to the terminal stage of the Middle Paleolithic; these yielded a small number of artifacts, which, however, illustrated the sustainable trend of preferably blade reduction. Notably, the date of 82 ± 9 ka BP is available for layer 10 (Vandenberghe et al., 2014).

The analysis of the Kulbulak lithic industry, from layer 24 correlated to MIS 7 through to layer 10, has shown the gradual development of the Middle Paleolithic industry over more than 100 thousand years. This industry is characterized by the Levallois and blade flaking technique aimed at the production of blanks in the form of variously sized blades and microblades. The cores contain carinated varieties used for the detachment of microblades. Cores of this type from the Kulbulak site are probably among the oldest in Asia (Kolobova, Krivoshapkin, Flas et al., 2011; Kolobova, Kharevich, Bocharova et al., 2022). These cores can be considered the evidence of emergence of one of the earliest small-blade industries in Asia.

The final Middle and the transition to the Upper Paleolithic

The further development of the Middle Paleolithic blade industry in Uzbekistan is well illustrated by the archaeological materials from the site of Obi-Rakhmat discovered in 1962 by A.R. Mukhamedzhanov. The first excavations were conducted by M.M. Gerasimov and H.K. Nasretdinov, and in 1964–1965 by R.K. Suleimanov, who summarized the findings in a well-published and very informative monograph (Suleimanov, 1972).

The Obi-Rakhmat Grotto is located in the southwestern part of the Koksuy Ridge, at an altitude of 1250 m above sea level, in the valley of the Paltau River, a right tributary of the Chatkal (Grot Obi-Rakhmat, 2004). The grotto is a large rounded rock-shelter facing south; its width in the entrance zone is 20 m, depth 9, maximum height of the vault is 11.8 m.

Suleimanov studied the Obi-Rakhmat industry using the statistical method of artifact analysis; he identified artifact complexes or tiers, each combining several culture-bearing layers. According to the main technical and typological features, he determined five industrial complexes: A – layers 21–15, B – 14–9, C – 8 and 7, D – 6–4, and E – layers 3–1.

The main type of blanks at Obi-Rakhmat Suleimanov described as prismatic blades. The blade index of the lithic collection was 60 % (Suleimanov, 1972). He analyzed the industries from the Obi-Rakhmat stratigraphic sequence and concluded that the Middle Paleolithic complex developed into the Upper Paleolithic within the framework of a single Obi-Rakhmat culture.

The statistical analysis allowed Suleimanov to substantiate the identification of the Obi-Rakhmat culture and to trace the successive evolutionary development of the Obi-Rakhmat industry with a gradual and constant emergence of Upper Paleolithic technical and typological features without any innovative abrupt changes or interruptions (Ibid.).

In 1998, the second stage of the Obi-Rakhmat Grotto studies began. It was carried out by the research team of the Institute of Archaeology and Ethnography SB RAS and the Institute of Archaeology of the Uzbekistan Academy of Sciences (scientific supervisors A.P. Derevianko and U.I. Islamov; the head of the team was first V.T. Petrin, and from 2001 to the present, the work has been led by A.I. Krivoshapkin). During the second stage of field work, the loose sediments inside the grotto were excavated almost completely, abundant archaeological materials were collected, a significant part of which was published. In the course of the excavations, the deposits of about 10 m thick were subdivided into 22 lithological layers, which contained 36 cultural horizons with varying degrees of saturation with archaeological materials: from several dozen in layer 16 to tens of thousands in layer 19 (Fig. 6).

In general, the grotto is filled with interbedded horizons of light-pale and gray sandy loam. The following pattern deserves attention: the pale layers are thicker – 50–60 cm; the gray layers are usually up to 15–25 cm thick, they are more saturated with artifacts, charcoal pieces, and bone remains. The detrital material contains mainly small, less often medium-sized, weakly rounded pieces of limestone. The Obi-Rakhmat stratigraphic column shows discrete culture-bearing layers lying horizontally, slightly sloping to the southwest, toward the entrance zone and the western wall of the grotto, which excluded intermixture of archaeological materials. Cases of possible artifact shifts associated with the activities of humans and burrowing animals were recorded during the excavations.

The lithic industry from the Obi-Rakhmat Grotto was described in many publications (Grot Obi-Rakhmat, 2004; Derevianko, Islamov, Petrin et al., 1998, 1999; Derevianko, Krivoshapkin, Anoikin et al., 2001; Krivoshapkin, Anoikin, Rybin, 2001; Krivoshapkin, 2012; Krivoshapkin et al., 2003;

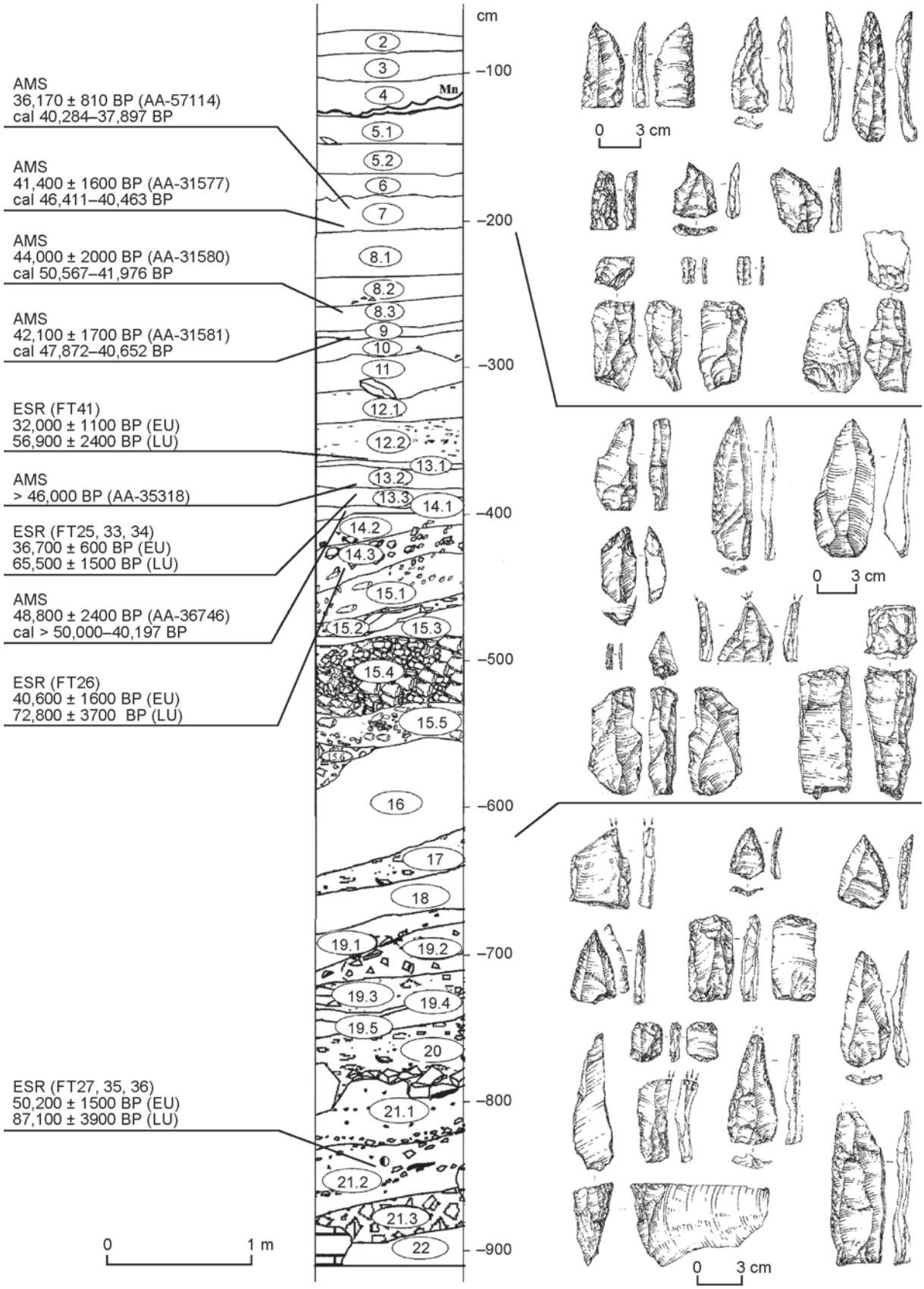

Fig. 6. Geochronology, stratigraphy, and lithic artifacts from Obi-Rakhmat Grotto (after (Derevianko, 2009)).

Derevianko, 2009, 2011; Kolobova, Shalagina, 2013; Krivoshapkin, Pavlenok K.K., 2015; and others).

To show the continuity in the evolution of the technical-typological complex at this site, below I will describe the findings of excavations of some culture-bearing horizons (21, 19.5, and 16) from 2001 field season (Derevianko, Islamov, Krivoshapkin et al., 2002).

The lowermost cultural horizon 21.2 has yielded artifacts which allowed the complete reconstruction of a core through refitting (Slavinsky, Milyutin, 2004). Notably, all flakes from the core concentrated over an area not exceeding 1 m^2. The refitted core can be described as having double platform, two striking surfaces and exhibiting traces of parallel flaking. At the final stage of utilization the microflaking was executed from its narrow face. This is the evidence for the employment of a narrow-face knapping technique for production of microblades during the earliest period of grotto occupation (Fig. 7, *7–11*).

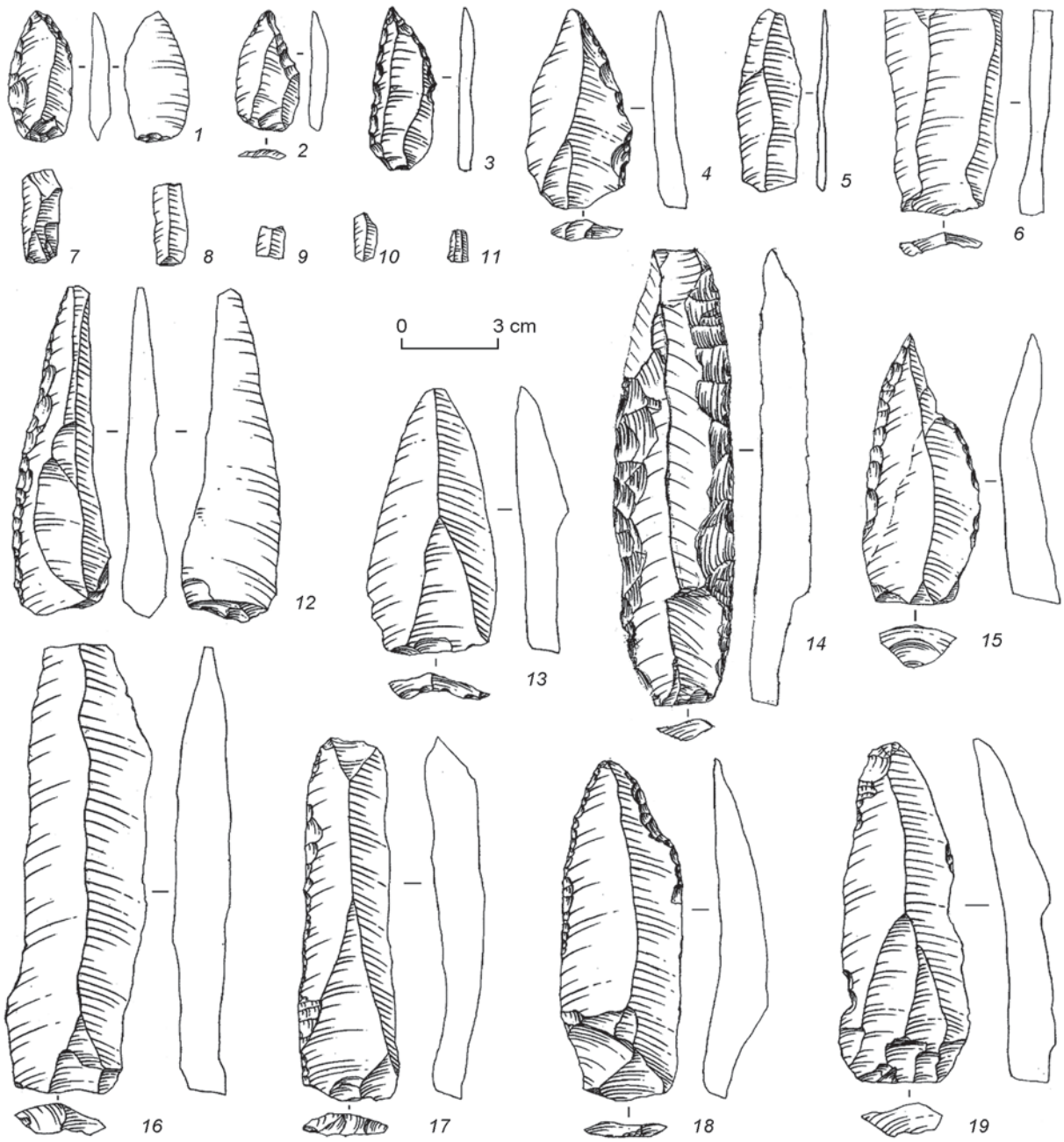

Fig. 7. Lithic artifacts from Obi-Rakhmat layer 21 (after (Derevianko, Krivoshapkin, Anoikin et al., 2004)).
1–3, *15* – scraper-borers; *4*, *12*, *14*, *17*, *18* – side-scrapers; *5*, *19* – blades with irregular retouch; *6*, *13*, *16* – blades; *7–11* – microblades.

Tools were fashioned mainly on elongated blades and blade flakes. The tool category includes unifacial and bifacial side-scrapers treated mostly by fine and medium-sized one-stepped retouch (Fig. 7, *4*, *12*, *14*, *17*, *18*); side-scrapers with well-prepared point at one end (scraper-borers?) (Fig. 7, *1–3*, *15*). Many blades bear irregular retouch (Fig. 7, *5*, *19*), and some blades show use-wear signs without retouching (Fig. 7, *6*, *13*, *16*). Notably, the Obi-Rakhmat lithic artifacts, despite the small number of finds in the lowermost layer, provide information concerning the development of the technical and typological complex of the Kulbulak site. The main difference is that the number of elongated, regular-shaped blades is greater in the Obi-Rakhmat industry. This is explained by the fact that at Obi-Rakhmat, cores were prepared on fine-grained rock bars, which were suitable for the detachment of large-sized blades; at the same time, the tradition of manufacturing microblades still persisted.

The most abundant (more than 40,000 lithic artifacts) and informative collection has been recovered from layer 19, where 5 distinct cultural horizons have been identified. I will focus on the description of the industry from horizon 19.5. The total number of lithic artifacts is 14,692. Primary reduction is represented by: core-like implements (*n*=48), flakes (*n*=817), blades (*n*=839), microblades (*n*=47), blade flakes (*n*=52), pointed blades (*n*=27), triangular spalls (*n*=46), points (*n*=44), fragments (*n*=98), chunks and chips (*n*=12,674). The category of cores includes three Levallois specimens: one Levallois blade core (Fig. 8, *1*) and two Levallois flake cores (Fig. 8, *4*); six radial cores, seven flat cores exhibiting a parallel flaking pattern, including six blade cores (Fig. 8, *5*) and one flake nucleus; three narrow-faced blade and microblade cores (Fig. 8, *3*), and seven cores on spalls. There are also 21 irregular cores and core-like fragments.

The tool-kit comprises 162 specimens. It includes Levallois points (*n*=7), one retouched Levallois point, elongated Levallois points (*n*=3), retouched elongated Levallois points (*n*=2), Levallois flakes (*n*=4), Levallois blades (*n*=23), unretouched points and their fragments (*n*=12), elongated points (*n*=10), retouched points and their fragments (*n*=5) (Fig. 8, *7*, *10*), retouched micropoints (*n*=2), side-scrapers (*n*=19) (Fig. 8, *15*), a denticulate-notched tool, denticulate tools (*n*=2), a notched tool (Fig. 8, *16*), spurred tools (*n*=2), end-scrapers (*n*=3) (Fig. 8, *12*), borers (*n*=2) (Fig. 8, *8*, *17*), backed knives (*n*=2) (Fig. 8, *6*), a blade with signs of trimming (Fig. 8, *11*), blades with irregular retouch (*n*=10) (Fig. 8, *14*), truncated spalls (*n*=4), combination tools—raclettes with points (*n*=3) (Fig. 8, *9*, *13*), retouched flakes (*n*=12), a tool fragment, retouched fragments (*n*=2) and chunks with retouch (*n*=3).

The technical and typological analysis of the lithic artifacts from layer 19 has revealed certain characteristic features of the Obi-Rakhmat industry. It was established that the leading primary reduction strategies were those aimed at the production of blades and blade blanks (including microblades) from narrow-faced and volumetric single-platform (more rarely, double-platform) cores of the Upper Paleolithic type. The tool-kit is dominated by retouched blades, burins, elongated points (including pointed blades), borers, end-scrapers, and backed knives. The category of points on blades includes a series of small, carefully prepared artifacts, usually with basal thinning, which most likely served as tips for projectiles. Such points are also typical of the overlying culture-bearing horizons, which makes it possible to consider them as the Obi-Rakhmat markers (Derevianko, Krivoshapkin, Anoikin et al., 2004). At the early stage of development of the Obi-Rakhmat culture, a rather large number of blade cores, including narrow-faced ones, and Upper Paleolithic tools have been identified.

The Obi-Rakhmat Grotto, starting from layer 14 (dated to 48,800 ± 2400 BP (AA-36746)) contains Upper Paleolithic artifacts. This does not mean that in future, when sufficiently representative material is found in layer 15, the lower boundary of the Upper Paleolithic industry will not be considered older. Thus, the Obi-Rakhmat Grotto is one of the unique Paleolithic sites in Eurasia, where 20 cultural layers and 36 horizons of human habitation were recorded within the clear boundaries of lithological layer 22.

The Obi-Rakhmat lithic industry, despite the large chronological range (90–30 ka BP) and the technical and typological homogeneity, clearly demonstrates its evolutionary character (without interruptions and innovative changes), which is illustrated by the increasing frequency of prismatic reduction in stone knapping, an increasing blade index and number of microblades up the profile (layers 21–15), by the decrease in the number of Levallois cores and, accordingly, the sizes of blanks, as well as by the continuity between the tools of the Middle and Upper Paleolithic types.

The archaeological materials from Obi-Rakhmat, same as those from Denisova Cave, provide a clear evidence of the Middle to the Upper Paleolithic transition, which lasted for a long time. Starting from lithological layer 17, the culture-bearing horizons demonstrate domination of the Upper Paleolithic

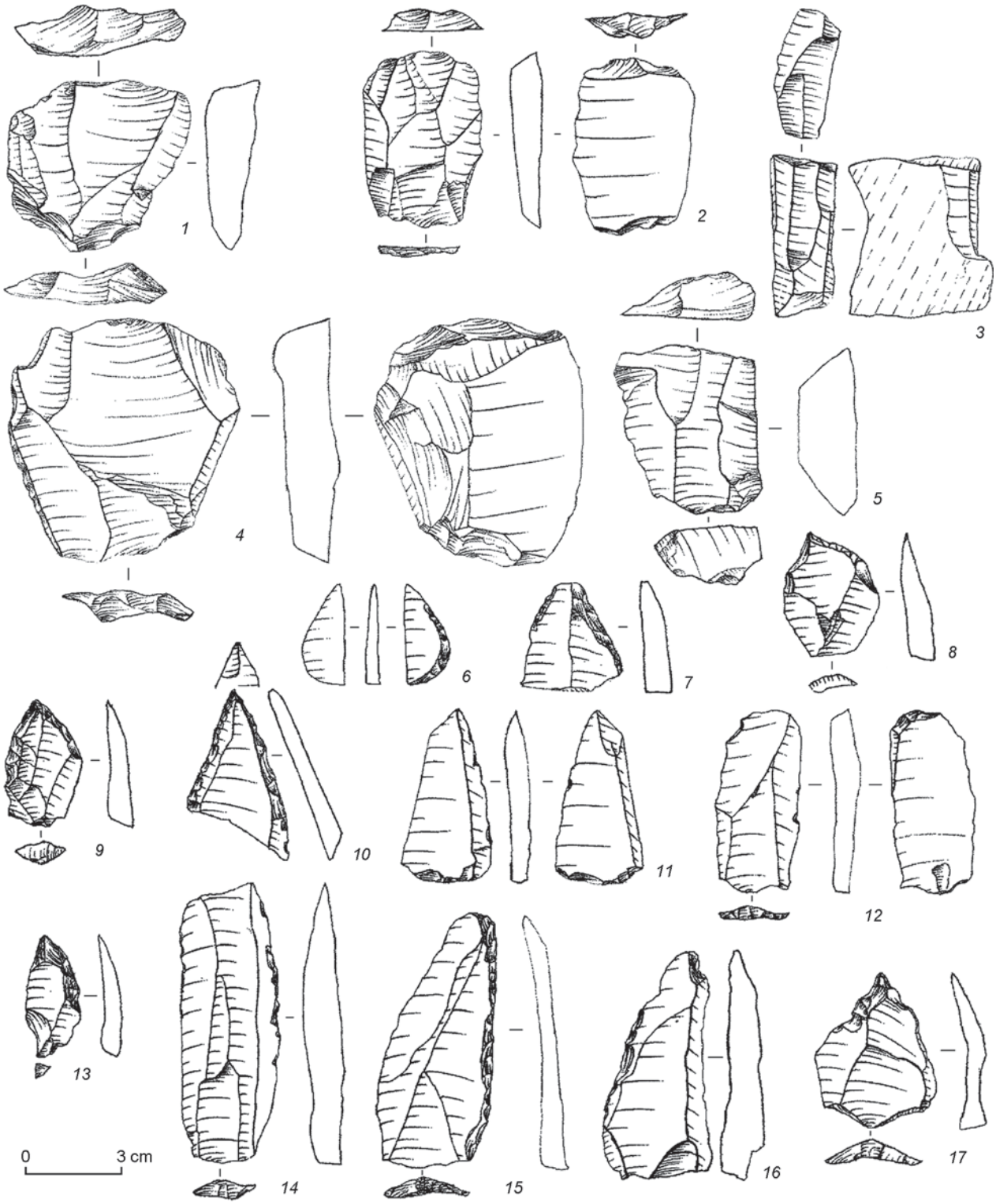

Fig. 8. Lithic artifacts from Obi-Rakhmat horizon 19.5 (after (Derevianko, Krivoshapkin, Anoikin et al., 2004)).

1, *4* – Levallois cores; *2* – frontal spall from a core showing bidirectional knapping; *3* – narrow-faced core for production of bladelets and microblades; *5* – flat core; *6* – backed knife; *7*, *10* – point fragments; *8*, *17* – borers; *9*, *13* – raclettes with retouched points; *11* – blade with trimming signs; *12* – end-scraper; *14* – irregularly retouched blade; *15* – side-scraper; *16* – notched tool.

industry over the Middle Paleolithic one. Available AMS radiocarbon dates make it possible to trace the decrease in the amount of the Middle Paleolithic artifacts and the relevant increase of the Upper Paleolithic artifacts up the profile. Dates for layer 7 are 36,170 ± 810 (AA-57114), calibrated* date 40,287–37,897 BP, and 44,000 ± 1600 (AA-31577); for horizon 8.3 – 44,000 ± 2000 (AA-31580), cal 50,567–41,976 BP; for layer 9 – 42,100 ± 1700 (AA-31581), cal 47,872–40,652 BP; for horizon 13.2 – >46,000 (AA-35318); for horizon 14.3 – 48,800 ± 2400 (AA-36746), cal >50,000 BP (see Fig. 6). The stratigraphic sequence of the Obi-Rakhmat Grotto has also been dated by the ESR method. The derived dates point to the initial Upper Paleolithic prior to 50 ka BP; the transitional stage has been dated to the range of 60–55 ka BP, like in Denisova Cave (Derevianko, 2022). The Obi-Rakhmat collection shows not only one of the earliest Upper Paleolithic industry in Eurasia, but also provides convincing evidence of its convergent development.

For a long time, the origins of the Obi-Rakhmat industry were unclear. The resumed excavations (since 2007) in Kulbulak, in the lowermost layers 24 and 23, have produced the Middle Paleolithic industry with components of the Levallois, blade and microblade reduction, dating back to the period corresponding to MIS 7; the origins of this lithic industry can be correlated with the Denisovan industry uncovered in pedocomplex 2 at Khonako-3 (Derevianko, 2024b). The archaeological materials of the cultural layers overlying layer 23 demonstrate further development and continuity in the evolution of the Middle Paleolithic industry at the site.

The artifacts from Kulbulak cultural layers 11 and 10 have been attributed to the terminal stage of the Middle Paleolithic blade industry. The date obtained for layer 10 is 82 ± 9 ka BP (Vandenberghe et al., 2014). The currently available material from Kulbulak does not make it possible to trace the transition from Middle to Upper Paleolithic, which is clearly identified in layer 2 with a date of 39,000 ± 4000 BP (GLL-080316) (Kolobova, 2014). Layers 3–9 produced a significantly small number of stone tools, which do not illustrate the development of the Middle Paleolithic industry at the site.

The terminal stage of the Kulbulak Middle Paleolithic industry is well represented by the Obi-Rakhmat lithic industry. The final Middle Paleolithic at Kulbulak layer 10 is dated to about 80 ka BP; hence, hominins with the Kulbulak terminal Middle Paleolithic industry occupied Obi-Rakhmat around 90–80 ka BP. Considering that Kulbulak was inhabited by Denisovans, they were the first settlers of the Obi-Rakhmat Grotto.

The results of excavations of layer 16, which yielded a small number of lithic artifacts and anthropological fossils (Derevianko, Krivoshapkin, Anoikin et al., 2001; Derevianko, Krivoshapkin, Slavinsky et al., 2003) are of great importance for understanding the development of the Obi-Rakhmat lithic industry and the taxonomic affiliation of the grotto inhabitants.

Layer 16 was rather thick (0.8 m); however, it yielded only 180 artifacts, vividly representing the blade-based lithic industry.

The core-like items (n=2) are represented by a bifacial double-platform core and a medium-sized core-like fragment. Plain, prepared by a single blow, opposing striking platforms of the core are strongly beveled. Adjacent frontal (narrow-end and flat) flaking surfaces were knapped in opposite directions and bear negative scars of small laminar removals (Fig. 9, *14*).

A total of 36 flakes were recovered. The blades (n=16) were subdivided by metric indicators into large (over 10 cm long) – 5 spec., medium-sized (7–10 cm) – 6 spec., and small (5–7 cm) – 5 spec. The residual striking platforms are usually plain (62 %); the remaining types of platforms included linear, punctiform, dihedral, and indeterminate varieties. Along with complete blades, ten blade fragments were found. Six pointed blanks (apart from blade blanks) were recorded in layer 16 (Fig. 9, *4*).

The finds comprise seven tools, including two Levallois points (Fig. 9, *3*, *7*). The double straight-convex side-scrapers were fashioned on blades. The straight working edge was prepared on the left longitudinal margin by dorsal continuous, abrupt, stepped, invasive, mid-faceted retouch spreading over the entire margin. The convex edge was prepared by dorsal continuous, vertical, scaly retouch at the medial part of the right longitudinal margin (Fig. 9, *1*, *9*).

Denticulate tools – 2 spec. One tool was prepared on a large blade (Fig. 9, *13*). Its left longitudinal margin was fashioned by large-scale, dorsal, abrupt, discontinuous, strongly modifying scaly flake scars localized in the medial-distal zone and forming a serrated working edge. The dorsal surface bears negative scars of several large removals in the medial and distal zones at the opposite edge. The other tool was made on a distal fragment of a flake; its right longitudinal margin was fashioned by dorsal abrupt,

*Calibration of the dates was made using OxCal program, v. 4.4.4, probability 95.4 %.

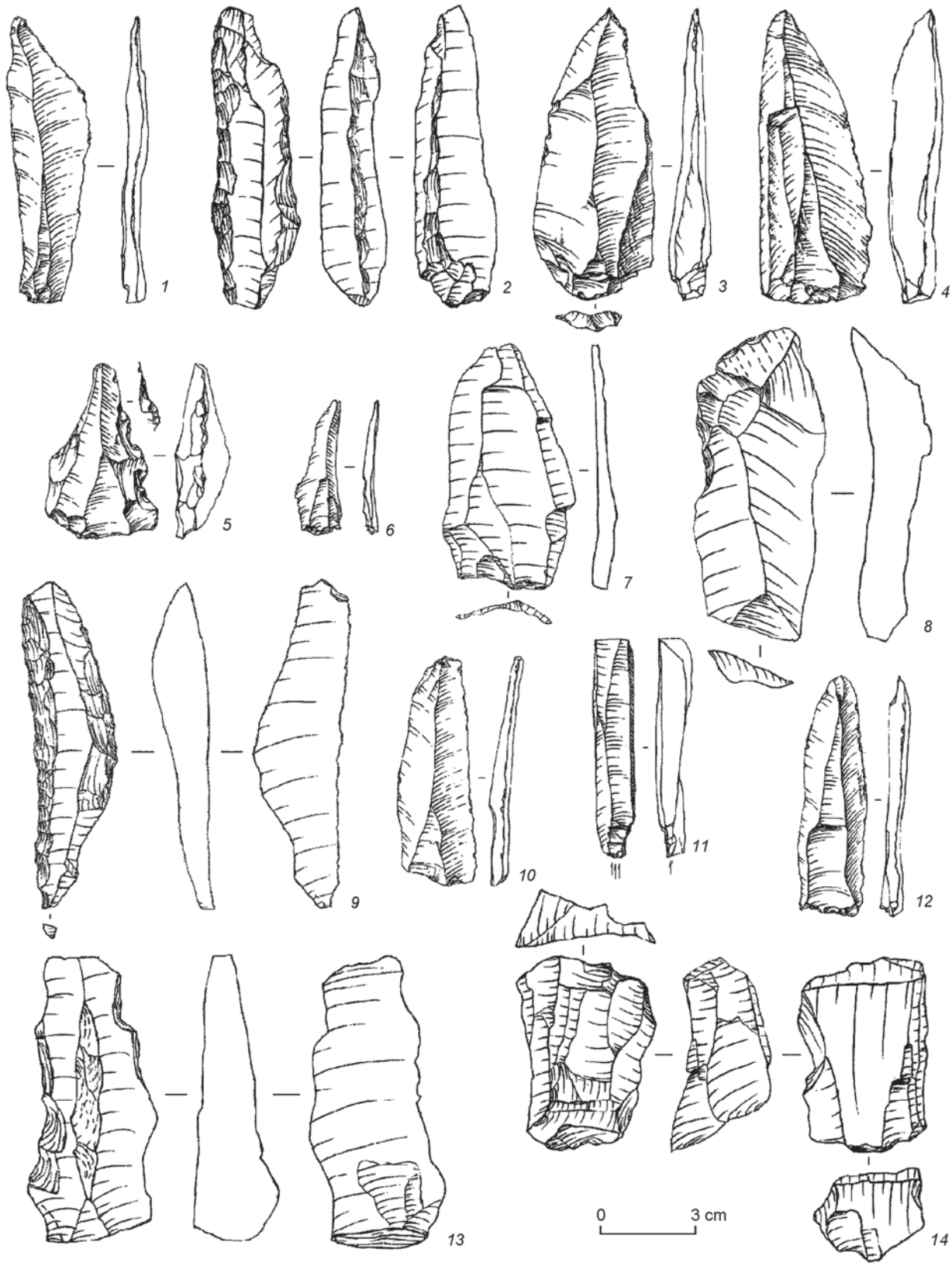

Fig. 9. Lithic artifacts from Obi-Rakhmat layer 16 (after (Derevianko, Krivoshapkin, Slavinsky et al., 2003)).
1, *9* – side-scrapers; *2* – combination tool; *3*, *7* – Levallois points; *4* – point; *5*, *13* – denticulate tools; *6*, *8*, *10*, *12* – blades with use-wear signs; *11* – burin; *14* – core.

discontinuous, scaly retouch forming a serrated working edge (Fig. 9, *5*).

The angular multifaceted burin (found in close proximity to anthropological remains) was prepared on a marginal spall (Fig. 9, *11*). Flaking was carried out from the plain residual striking platform of the spall onto the right-side longitudinal margin and the ventral face of the tool.

The combination tool shows the working edges of a straight double side-scraper and an end-scraper (Fig. 9, *2*). Several blades with use-wear signs have also been recovered from layer 16 (Fig. 9, *6*, *8*, *10*, *12*).

The artifacts from cultural layer 16 at Obi-Rakhmat, despite their small number, show the Upper Paleolithic trend in the development of the industry, as well as the vivid ties in the technical and typological features with the artifacts from both the underlying and overlying strata. Taking into account the age of layer 14 (see Fig. 6), layer 16 can be dated to approximately 60 ka BP, and the industry can be attributed to the Middle to Upper Paleolithic transition.

Paleoanthropological finds from Obi-Rakhmat layer 16 (OR-1) include six isolated well-preserved permanent teeth and about 150 small fragments of cranial bones. Initially, T.A. Chikisheva examined the recovered dental remains and pointed to the extremely archaic large sizes and shapes of the crowns (OR-1) on the one hand, and to certain morphological similarity with the teeth of modern humans on the other hand.

Later, the fossils from the Obi-Rakhmat Grotto (OR-1) were examined by other researchers (Glantz, Viola, Chikisheva, 2004; Viola, Seidler, Nadden, 2004; Glantz et al., 2008; Bailey et al., 2008). They determined the fossils as belonging to a single individual aged 9–12 years. As to the taxonomic affiliation of OR-1, anthropologists identified two diagnostic features of the fossils. The OR-1 dental system demonstrated large teeth and archaic traits that brought it closer to the East Asian *H. erectus*. Examination of skull fragments has shown that, unlike the teeth, their morphological structure was more consistent with modern humans. The parietal part is quite large; its dimensions exceed the range of variations in Neanderthals of a similar and older age. The skull fragments are quite thin. In OR-1, the parietal opening is located on the right side of the parietal bone. This position is noted in 37–80 % of modern humans. In fossil hominins, it is much less common. Anthropologists point out the mosaic morphology of the ear labyrinth, which is similar to that of Neanderthals. Despite the complexity of the taxonomic definition of OR-1, some researchers are inclined to correlate the individual with Neanderthals. This conclusion was made before the discovery of a new taxon of Denisovans. I have considered the issue of the taxonomic affiliation of OR-1 in a number of works (Derevianko, 2022, 2024a, b, etc.). I have put forward a well-supported hypothesis that this individual could not have been a Neanderthal, but was a representative of the Denisovan taxon.

Why OR-1 cannot be classified as Neanderthal. The hominins from Obi-Rakhmat and Teshik-Tash dispersed over the territory of Uzbekistan at the same time—about 50–60 ka BP. The dental system of OR-1 is completely different from that of European and Palestinian Neanderthals. The OR-1 individual belonged to the Denisovan taxon. The evolving Denisovans partially assimilated with the Central Asian *H. erectus* population, and inherited large teeth with a number of archaic traits from that taxon. The morphological similarity of the ear labyrinth of OR-1 and Neanderthals can be explained by the fact that Denisovans and Neanderthals had evolved from the same ancestral species—*H. heidelbergensis*. Around 400 ka BP, when this lineage was split, Denisovans settled in Central Asia, and Neanderthals in Europe; in the process of morphological and genetic evolution, these taxa acquired new derivative features and retained the archaic ones (Derevianko, 2024a). Moreover, the morphology of bony ear labyrinth of the Neanderthal type can also be traced in some Upper Paleolithic people of the anatomically modern type (Razhev et al., 2024).

Thus, the main anthropological characteristics of OR-1 do not provide grounds to attribute this individual to Neanderthal taxon. The lithic industries of the Obi-Rakhmat Grotto and Teshik-Tash Cave are completely different from each other. The Obi-Rakhmat Grotto demonstrates a local version of the Denisovan Middle Paleolithic industry, while Teshik-Tash Cave contains a Mousterian industry. Consequently, there is every reason to believe that the Obi-Rakhmat Grotto was inhabited by *H. s. denisovan*. Moreover, the Obi-Rakhmat and Teshik-Tash tribes populated the territory of Uzbekistan at the same time, which hampers the differentiate on of lithic industries from other sites dated to the first half of the Upper Pleistocene.

In the 20th century, a significant number of stratified sites and localities with surface occurrence of cultural remains were found and attributed to the terminal stage of the Uzbekistan Middle Paleolithic, including Kuturbulak, Zirabulak, Katasai, Khodjikent-1 and -2, Gurdara, Amankutan, and others. At that period, the hominin lithic industry in this area exhibited

the greatest variability of technical and typological complexes, which was the result of dispersal of two taxa—Denisovans and Neanderthals.

The sites of Kuturbulak and Zirabulak were discovered in the middle reaches of the Zarafshan River in 1971. They were located 1 km from each other, at the foot of the low Zirabulak mountain range, near the Kuturbulak and Zirabulak springs, which gave them their names (Tashkenbaev, Suleimanov, 1980). At Kuturbulak, excavation trench was established over an area of 165 m^2; five lithological layers were identified (excluding the uppermost heavily disturbed sod horizon). The Kuturbulak and Zirabulak stratigraphic sequences were strongly affected by the springs' activity, which resulted in the mixing of archaeological materials (Ranov, Nesmeyanov, 1973). In 1995, a joint Uzbek-Polish expedition led by K. Szymczak and T.Y. Grechkina worked at Kuturbulak. The researchers came to the conclusion that the Middle Paleolithic materials were redeposited (Szymczak, 2000).

The inhabitants of both sites used local raw materials from riverbed or coastal alluvium. At Kuturbulak, about 75 % of the artifacts were made of dark, fairly dense, fine-grained quartz sandstone of various colors—from almost black to ash-gray. This raw material is ductile and can be easily flaked. Other available raw materials were quartzite and, more rarely, flint. Let us briefly dwell on the characteristics of the lithic collection of this site. A more complete description was provided by N.K. Tashkenbaev and R.K. Suleimanov (1980), as well as B.K. Saifullaev (2001).

Analysis of the industry from Kuturbulak cultural layers has shown that the typology of the tools is generally similar to that of the Obi-Rakhmat. A distinctive feature of the Kuturbulak assemblages is a large number (70 %) of artifacts with signs of secondary working, and pebble tools (Tashkenbaev, Suleimanov, 1980: 57). In my opinion, in the Kuturbulak complex, the proportion of radial flaking is significantly higher and that of blade reduction is lower as compared to the Obi-Rakhmat industry. In the Kuturbulak collection, micro-flaking was found to be almost absent. The greater proportion of blades at Obi-Rakhmat can possibly be explained by the use of blanks in the form of bars; furthermore, the influence of regional specifics on these industrial complexes and their non-contemporaneity cannot be excluded. The lithic artifacts from Zirabulak are typologically quite similar to those from Kuturbulak. Excavators dug three test pits of 4 m^2 each at Zirabulak in 1972. A small number of stone tools similar to Kuturbulak artifacts were uncovered there.

No absolute dates were obtained for the both sites. The only datable find is the mandible of a Trogontherium elephant from Kuturbulak, which was recovered from the boundary between layers 2 and 3, and obviously wasn't located *in situ*. The age estimation based on this find should be considered preliminary.

Three sites of the final Middle Paleolithic have been discovered in the Zarafshan Valley, in the caves of Amankutan, Takaliksay, and Gurdara. The excavations produced a small number of Pleistocene animal bones and stone tools (Tashkenbaev, Suleimanov, 1980). The best-studied cave-site is Amankutan (1947–1957). The site yielded 220 artifacts made of flint, siliceous limestone, diorite, and quartz rocks. Primary reduction is represented by four discoidal cores. Eight blades, including one Levallois blade with a faceted striking platform, were found. Researchers identified 2 pointed tools, 2 side-scraper-like tools, and 12 denticulate-notched tools. Several Upper Paleolithic tools were found: six end-scrapers, two borers, and one atypical burin. No absolute dates were generated for the Amankutan site. V.A. Ranov and S.A. Nesmeyanov attributed it to the terminal Middle Pleistocene and the Mousterian culture (Ranov, 1971; Ranov, Nesmeyanov, 1973).

The lithic industry of the above-mentioned sites can be considered a regional variant of the final stage of the Denisovan Middle Paleolithic industry. A somewhat different technical and typological complex of stone tools was revealed at Khodjikent-1 and -2. The Khodjikent-1 Grotto was studied by A.P. Okladnikov in 1958–1959 (1958, 1961, 1963). During the excavations, a comparatively small number of lithic artifacts (n=374) was uncovered. Okladnikov attributed the grotto lithics to the late variant of the Levallois-Mousterian culture, and did not exclude the possibility of its "development" into the Upper Paleolithic. Ranov included the Khodjikent-1 industry in the same group as the Obi-Rakhmat (1971, 1972). The lithic collection similar to that of Khodjikent-1 was recovered from the nearby Khodjikent-2 Grotto. This explains the difficulty of attribution of the industries either to the Denisovan or Neanderthal taxa, since these were found at the sites without geochronological data and with approximate age estimation in the range of 90–50 ka BP.

Several open-air sites have been explored in recent years by the joint Russian-Uzbek archaeological expedition. In 2018–2023, in the valley of the Ertashsay River, a tributary of the Akhangaran River, twelve sites were discovered with surface occurrence

of cultural layer and a small number of lithic artifacts (Ertashsay-1–12), attributed to a wide chronological and techno-typological range (Middle Paleolithic to final Upper Paleolithic) (Pavlenok K.K., Kot, Pavlenok G.D. et al., 2019; Pavlenok G.D. et al., 2020; Pavlenok K.K. et al., 2021). Particularly noteworthy among them is the site of Kuksaray-2, located on the ridge between the Kuksaray and Dziblon gullies, on the right bank of the Akhangaran River.

Excavations at Kuksaray-2 were carried out in 2021–2023. Four test pits and two excavation trenches were established, showing certain variability in the stratigraphic sequence and the number of cultural layers. In total, about 400 lithic artifacts were recovered. An OSL-date of 68 ± 4.2 ka BP was obtained for layer 7 (Pavlenok K.K. et al., 2021, 2022a, b, 2023; Pavlenok et al., 2022).

The preliminary analysis of lithics from excavations 1 and 2 has led the researchers to the conclusion that the Kuksaray-2 lithic industry contains two separate cultural complexes—an older one, similar to the Sel-Ungur industry, which was not previously recorded in the Akhangaran River valley, and a younger blade-based one, which can be considered autochthonous. The researchers has put forward an assumption about the alternate habitation of the site by the carriers of two different stone-working traditions instead of the "evolutionary" model, which assumed a constant enrichment of the "Sel-Ungur" complexes with a blade component (Pavlenok K.K. et al., 2022a, b).

The conclusion as to the specifics of the Kuksaray-2 industry should be considered preliminary, because it was based on 400 lithic artifacts found in two excavations and several test pits, among which flakes, spalls, shatters, and chips, predominate, while stone implements of diagnostic types are few. Validity of the identification of the so-called markers (Tayacian point, Sel-Ungur-type side-scraper, Sel-Ungur retouch) raises serious doubts. It should be borne in mind that in the first half of the Upper Pleistocene, only Denisovans and Neanderthals could have settled in the territory of Uzbekistan and adjacent areas.

The Obi-Rakhmat industry shows continuous evolution based on blade reduction for at least 50 thousand years. This industry belonged to the Denisovans. The Teshik-Tash Grotto produced a Mousterian industry that differs from the Kuksaray-2 techno-typological complex. The lithic industry from Cave Sel-Ungur in Kyrgyzstan referred to one of the local trends of the Denisovan Middle Paleolithic industry (Derevianko, 2024b).

Conclusions

No Early Paleolithic sites with pebble-flake industry have yet been discovered in Uzbekistan, although the initial peopling of Central Asia by *H. erectus* tribes occurred 900–800 ka BP. The Kuldara site in Tajikistan belongs to this period (Ranov et al., 1987). The Karatau culture, identified by V.A. Ranov (1977), dates back to a later period, 600–350 ka BP. At the terminal stage of the Karatau culture, pedocomplex 4 at the sites of Khonako-3, Obi-Mazar-4, and Lakhuti-4 clearly demonstrates Middle Paleolithic elements in the Lower Paleolithic industry of hominins, which is explained by the migration of the morphologically and genetically developing Denisovan taxon to this territory after its split from the Neanderthals in the Levant ca 400 ka BP. Around 200 ka BP, or even earlier, the morphologically and genetically evolving Denisovan taxon left Tajikistan and started to disperse over the territory of Uzbekistan. Kulbulak is the earliest and most important site here, yielding abundant lithic collection. The collection suggests that around 200 ka BP or perhaps somewhat earlier, this territory was populated by *H. s. denisovan* with a Middle Paleolithic industry based on the use of mainly Levallois and blade techniques in primary reduction aimed at the production of blades and convergent blanks.

Noteworthy is the emergence in the industry of the narrow-faced and carinated cores for the detachment of blanks in the form of small blades and microblades. This is one of the earliest examples of microblade reduction in Eurasia. A peculiarity of the Kulbulak site is a gradual increase, up the stratigraphic profile, in the number of Upper Paleolithic tools made on blade blanks.

The Obi-Rakhmat technocomplex has shown the further development of the Kulbulak Middle Paleolithic industry. The Denisovans first inhabited the grotto ca 90–80 ka BP, and the entire stratigraphic sequence (21 cultural layers and 36 habitation horizons) of the site clearly demonstrates the development of the terminal Middle Paleolithic industry and the evolution on this basis of the Middle to initial Upper Paleolithic transition industry. The transitional period in Uzbekistan should be dated to no later than 50 ka BP or perhaps even earlier (Krivoshapkin, 2012).

The Kulbulak and Obi-Rakhmat lithic industry shows a continuous development over a period of about 150 thousand years. According to the main primary reduction features, technical and typological characteristics of the tool-kit, and the methods of its manufacture, this industry reveals parallels with the Middle Paleolithic industry of the Levant in the

west and especially with the Denisovan industry of Denisova Cave in the east. The similarity of the Middle Paleolithic industries of Kulbulak and Levant is explained by the fact that Denisovans, after leaving the Levant about 400–350 ka BP, despite all the changes in their industry associated with migration through the Iranian Plateau, dispersal over Central Asia, and adaptation to changing environmental conditions, retained some basic elements of the Levantine Middle Paleolithic.

The parallels in the Middle Paleolithic of Uzbekistan and Altai are the result of dispersal of Denisovans over these territories prior to the arrival of Neanderthals. The Denisovans populating the vast territories of Central Asia, part of East Asia, and Southern Siberia with different environmental settings, landscapes, flora and fauna, and availability of water and lithic resources, had to develop various adaptation strategies, which led to the emergence of regional variants of lithic industrial complexes. More than ten local variants have been identified in the Neanderthal culture in Europe alone. In the course of further studies in the regions where Denisovans could have settled (and they really did in the vast territories of Central, East, and Southeast Asia according to the available genetic data (Meyer et al., 2012; Prüfer et al., 2014)), researchers will identify local variants of the Denisovan lithic industry there, which originated as a result of living in various environmental conditions.

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Microblade Production in the Sukhotino-4 Industry, Eastern Transbaikalia

We have analyzed microblade production at Sukhotino-4, a stratified site in the southern part of Chita, Eastern Transbaikalia, excavated in the 1970s and 1980s. Its lithic industry specialized in bifacial tools and, to a large extent, in microblades and tools made on them. The sample includes over 300 cores and their preforms intended for manufacturing microblades and found in eleven layers. On the basis of morphological and typological analyses, we reveal an absolute predominance of narrow-faced microcores, including wedge-shaped ones. Most microcores from all layers of Sukhotino-4 were made according to a standard scheme, which concerned all stages, from the choice of blanks to the use of the core. The analysis of metric parameters suggests that most microcores have a frontal height of 25–30 mm and a width of 9–11 mm. The predominance of a single standard in the preparation of blanks and in the utilization of cores allowed us to describe the Sukhotino type of narrow-faced microcores. Other types are represented by just a few specimens. Morphological and typological homogeneity of most microcores and bifacial tools from all layers, correlating with the Sartan glacial cooling, suggests that the Upper Paleolithic industry of Sukhotino-4 existed for a long time.

Keywords: **Upper Paleolithic, lithic industry, microblades, narrow-faced cores, Transbaikalia, Sartan cooling.**

Introduction

Sukhotino-4 is one of the largest Stone Age sites in Eastern Transbaikalia, located on the southern outskirts of Chita (Fig. 1); the site was discovered in 1972 (Kirillov, 1973, 1986; Okladnikov, Kirillov, 1980: 41). The excavations continued intermittently until 1989 (Cherenshchikov, 1998: 4). A total of 11 cultural layers were excavated over various areas (Fig. 2) (Kirillov, 2003: 3). Until 1979, the first three layers were considered as a single culture-bearing horizon (Kasparov, 1986); the preliminary description of the Sukhotino-4 lithic industry was based on the materials from this joint layer (Okladnikov, Kirillov, 1980: 41–51). During the excavations of 1979, two other cultural layers were established; the top horizon was subdivided into layers 1–3, and the new layers were designated layer 4 and 5. Layers 6–11 were discovered in 1984 and assigned to the lower level (complex); their large-scale excavations were carried out in 1988 and 1989 (Cherenshchikov, 1998: 39). Throughout the entire period of research at Sukhotino-4, excavations were supervised by I.I. Kirillov.

In their monograph, A.P. Okladnikov and I.I. Kirillov gave the percentage of blades and microblades (7.7 %) in the collection from the first

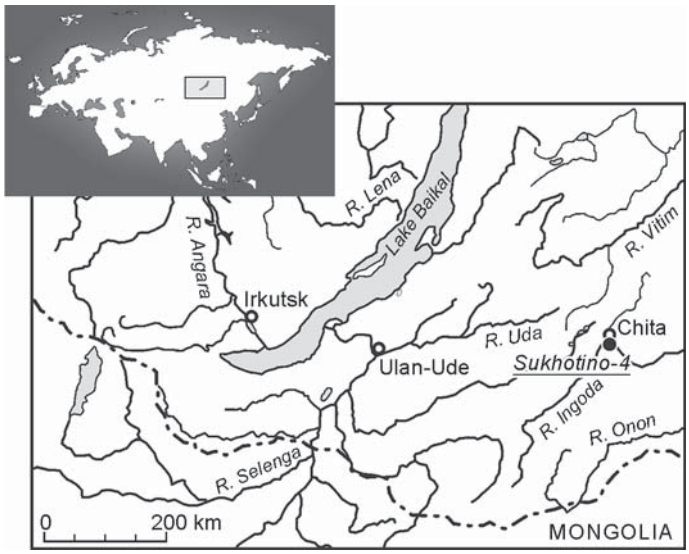

Fig. 1. Location of Sukhotino-4 in Eastern Transbaikalia.

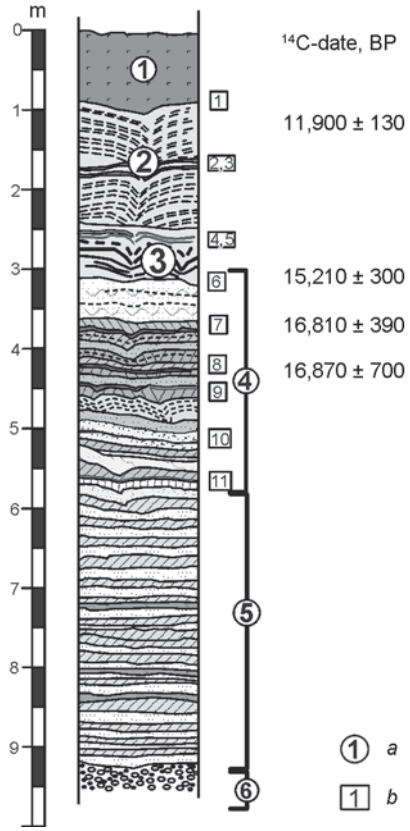

Fig. 2. Stratigraphic column of Sukhotino-4.
a – lithological strata; *b* – culture-bearing layers.

joint layer (*n*=15,300), and indicated the availability of cores for microblade production (1980: 45). These artifacts constitute a significant part of the Sukhotino-4 lithic industry, being the most typical feature of the collection.

The microblade cores from layers 6–11 were examined and classified by O.Y. Cherenshchikov in his dissertation; he proposed a detailed multi-level typological scheme (1998: 86–91), which revealed different stages of core reduction and modification. In our opinion, this classification is too complicated to be applied in case studies.

Microblade cores occur in all layers at Sukhotino-4, which is also typical of other sites in Transbaikalia and adjacent regions where developed microblade flaking was widely used. At the same time, there are some specific features in the morphology, typology, and preparation techniques of such cores in different areas and certain archaeological sites (Tashak, 2000; Tashak, Antonova, 2011; Ineshin, Tetenkin, 2010: 217, 218; Tetenkin, 2017). The differences may be due to both the chronology and the cultural specificity of each site. In this regard, a detailed analysis of microblade production in Sukhotino-4 industry is of undoubted interest.

Microblade cores

In describing the microblade flaking technique in Sukhotino-4 industry, several key factors should be mentioned. First, the vast majority of microblade cores were prepared and used according to a standard scheme, with minor deviations. Second, the materials from all the layers contain formally and typologically similar microcores. Third, the recovered artifacts demonstrate the use of a single raw material in microblade production. All this allows us to treat the entire set of microcores and their blanks recovered from various layers of Sukhotino-4 as a single whole.

Attributive analysis and determination of metric parameters involved 328 (more than 80 %) cores bearing negative scars from microblade removals, as well as several dozen blanks of microblade cores. The sample does not include uninformative, usually damaged, artifacts with single traces of microblade removals, cores modified into various tools, nor tools with negatives of microblade removals. Some of these are described separately. All the Sukhotino-4 layers are dominated by narrow-faced microcores (*n*=313), most of which are wedge-shaped (*n*=279). Other varieties are few in number: prismatic, conical, barrel-shaped cores and those with negatives of microblade removals on wide surfaces. Some of the heavily exhausted cores resemble cone-shaped nuclei, but they represent the terminal stage of narrow-

faced core reduction. The large number of artifacts showing all stages of microblade flaking provides the opportunity to determine the main trends in microblade production. Narrow-faced microcores at Sukhotino-4 were prepared on flat rounded pebbles (more than 60 %), large flakes, flaggy stone pieces, and in some cases fragments of large bifacial tools. The preferred dimensions of the Sukhotino microcores have been established on the basis of the metric parameters of the cores and core blanks. The main measurements were made along three axes of the items under study: height—from the lower point in the distal part to the upper point in the striking platform zone; width—from one lateral face to another (maximum distance); depth—from the flaking surface to the remote point on the back surface (Fig. 3). Notably, a core is not an end product, and its metric parameters change in the course of utilization. However, the vast majority of narrow-faced cores in the Sukhotino-4 industry were prepared and utilized within the framework of the specified standards, and more than 90 % of all the items studied are carinated products, i.e. their long axis is parallel to the flaking surface. A certain proportionality of a core's height and depth at the initial stage of reduction is less common. Cores with the long axis perpendicular to the flaking surface are few. Throughout the whole sequence of core utilization, starting from blanks till the exhausted cores, the least variable of the three measured parameters of the narrow-faced microcores is the flaking surface width. This value clearly represents the standard in core preparation. The largest number of cores are from 7 to 9 mm wide (*n*=197); the number of cores with smaller widths is significantly lower, and only 16 cores show the width in the range of 13–19 mm

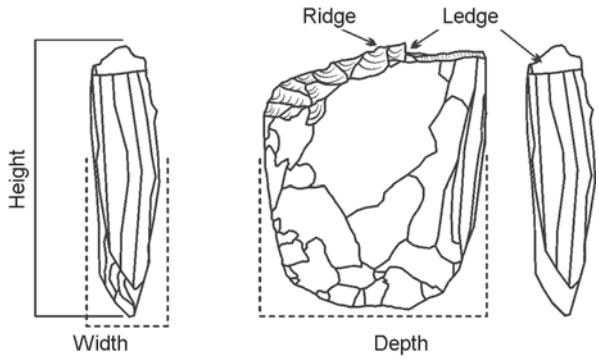

Fig. 3. Scheme of the typical Sukhotino-4 narrow-faced core at the initial stage of reduction.

(Fig. 4). The low variability of this parameter is due to the fact that the shape of the cores of the leading type was determined by special preparation, and the blanks before the reduction were bifaces and unifaces of oval, rounded, or angular shape (Fig. 5, *2*, *4–6*). Bifaces were prepared on various raw pieces, but mostly on flat rounded pebbles of jasper-like rock of various shades of yellow, orange, and cream-brown (Fig. 5, *1*, *3*). Various raw materials of a different color are less common. If the core blank was a primary flake, then its dorsal surface with a pebble cortex became the lateral edge of the core (Fig. 5, *7*), with minimal preparation of the ridge and rear. Occasionally, lateral faces of the cores retained pebble cortex (Fig. 6, *1*). Hence, the preforms of most cores, ready for reduction, were laterally flattened pieces whose width did not change during the utilization of the core. In most cases, a wedge was immediately formed. In some cores, the wedge was not prepared at the distal part (Fig. 6, *3*). Notably, the flaking process often did not reach the zone where the lateral faces converged and formed a ridge. Moreover, flaking of at least one third of the cores was stopped right in the middle of the process. This suggests that most measurements of the width of nuclei are correct.

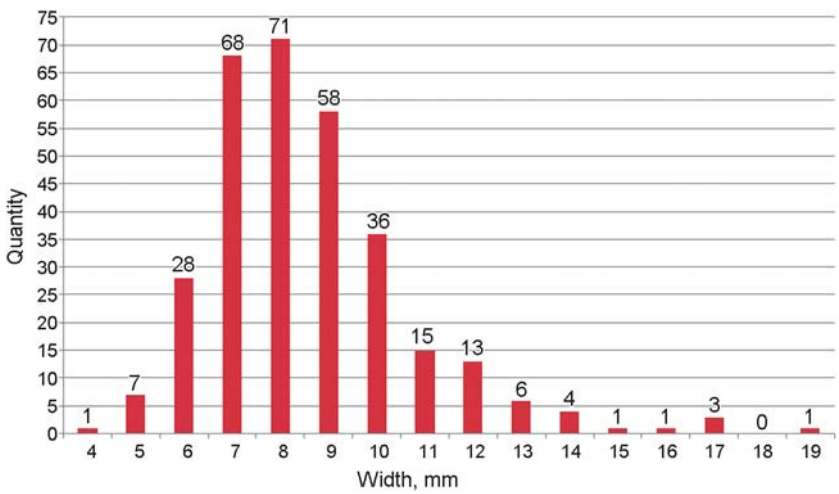

Fig. 4. Quantitative distribution of microblade cores by width.

The second metric parameter—the height of the core—was changeable; however, it is unclear whether these changes were significant. In this respect, the shaping and reduction of striking platforms are especially indicative. First, many core preforms were prepared on bifaces and unifaces with faceted and ridged edges. One of the long edges was used as

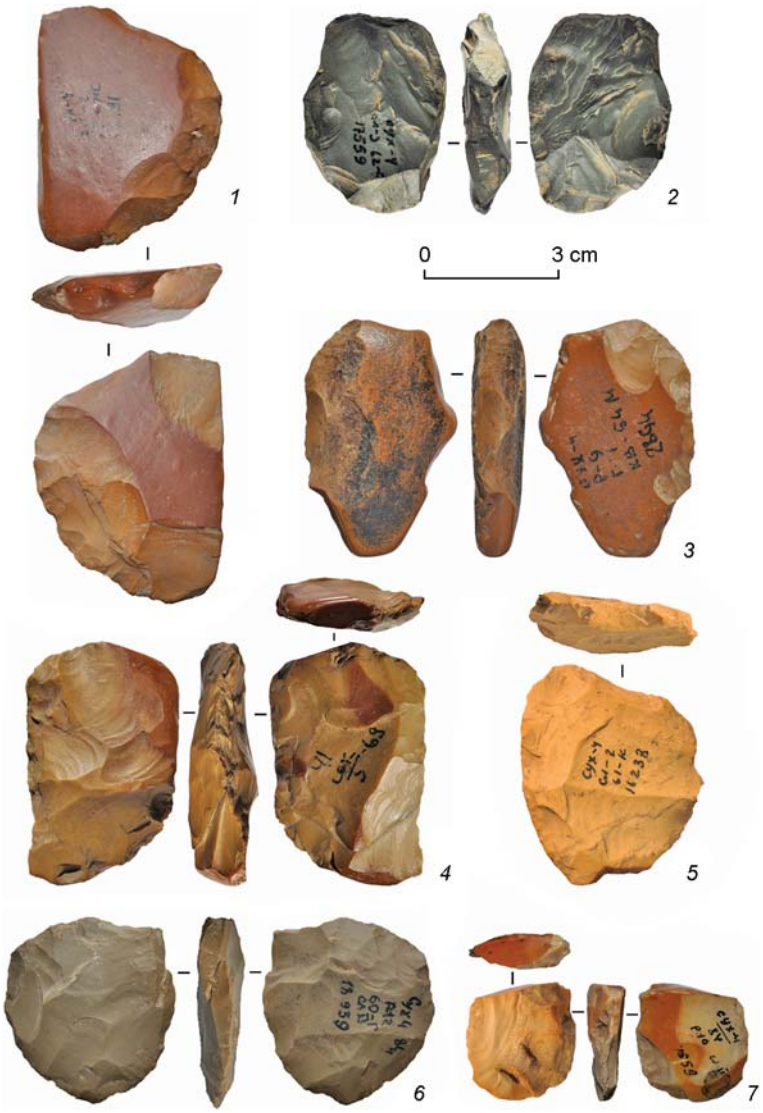

Fig. 5. Blanks of the narrow-faced microblade cores from the initial stage of preparation to test removals.

a flaking surface; the striking platform was fashioned on the short edge adjacent to the flaking surface at a right (or close to it) angle (Fig. 6, *2*). In rare cases, in the most typical Sukhotino-4 narrow-faced cores, the lengths of the flaking surface and striking platform are similar, which implies a slight excess of the core depth over its height (Fig. 6, *8*) at the initial stage of flaking. In a considerable number of cores, the margin area prepared to be the striking platform was bifacially retouched, resulting in the formation of a ridged edge along the central axis or with a deviation to one or another lateral face (Fig. 6, *4–6*, *8*). At the next stage of striking-platform preparation, longitudinal flakes were removed from the flaking surface. The removals were short (microflakes) and long (microblades) (Fig. 6, *2*, *5*). Unlike the flaking surface, from which full-fledged microblades were removed, the striking platform was fashioned through short (from 1/4 to 2/3 of the edge length) microblade removals; however, negative scars of full-fledged microblades are also noted. Usually, there are one or two negative scars on striking platforms; three and more scars are less common. Additional lateral fine flaking was also used, most often in the cores >8 mm wide. The absolute majority of narrow-faced cores (*n*=224) retained clear traces of the ridged edge that formed the area of the striking platform at an early stage of preparation; this feature is one of the distinctive elements of these cores (Fig. 6, *1*, *2*). The ledge formed between the upper edge of the ridge and the surface of the striking platform rises no more than 3 mm (see Fig. 3). This observation shows that the decrease in the height of microblade cores fashioned according to the described sequence is not critical, and can be controlled. The described scheme of fashioning narrow-faced cores and the relevant morphology are the most typical of the Sukhotino-4 lithic industry; hence, we propose to designate it as the Sukhotino type.

Another technique of preparation of striking platforms was used on flat pebbles fashioned into microblade cores. When the surface and edges of such a pebble had been worked, a massive unprepared part in the area of the planned striking platform (see Fig. 5, *3*) was reduced through a transverse blow. As a result, a depression was formed in the middle part of the striking platform (see Fig. 6, *7*). Such depressions occur on 20 % of narrow-faced cores. The striking platform—the area between the depression and the flaking surface—was prepared according to the described scheme. The area between the depression and the back surface could be worked into a ridged edge or remained intact. In the process of core reduction, the percussion area, marking the transverse fragmentation, became invisible. Transverse fragmentation of blanks in the form of incompletely prepared pebbles or prepared bifaces sometimes resulted in the creation of a surface (either flat or slightly beveled to one of the lateral

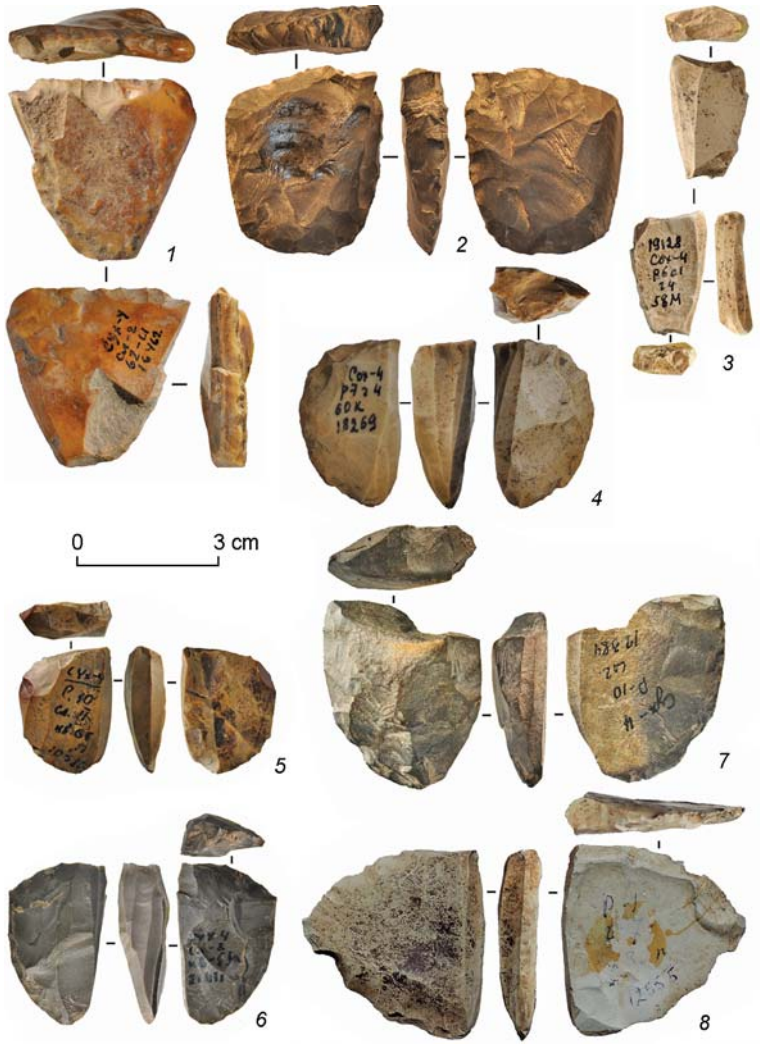

Fig. 6. Narrow-faced microblade cores.

faces), which was used as a striking platform; but the additional fine working from the flaking surface was executed in all cases. Cores with the described design of striking platforms also belong to the Sukhotino type of microblade cores.

The distribution of narrow-faced cores by height also shows certain patterns (Fig. 7). The largest number of cores (n=126) is in the range from 24 to 28 mm high. The ranges of 23–20 and 29–32 mm demonstrate a smooth decrease in the number of artifacts. The same analysis of microcore blanks (n=72) has shown similar results: in the range from 24 to 29 mm, there was one artifact in each grade. The availability of such artifacts indicates that cores not exceeding 24–29 mm high were produced intentionally, rather than emerging in the course of reduction of larger cores. Blanks from 45 to 55 mm do not have striking platforms nor ridged edges in place of future striking platforms, which implies a lower height of the utilized items.

The Sukhotino-4 collection of the narrow-faced wedge-shaped cores includes artifacts resembling the Yubetsu

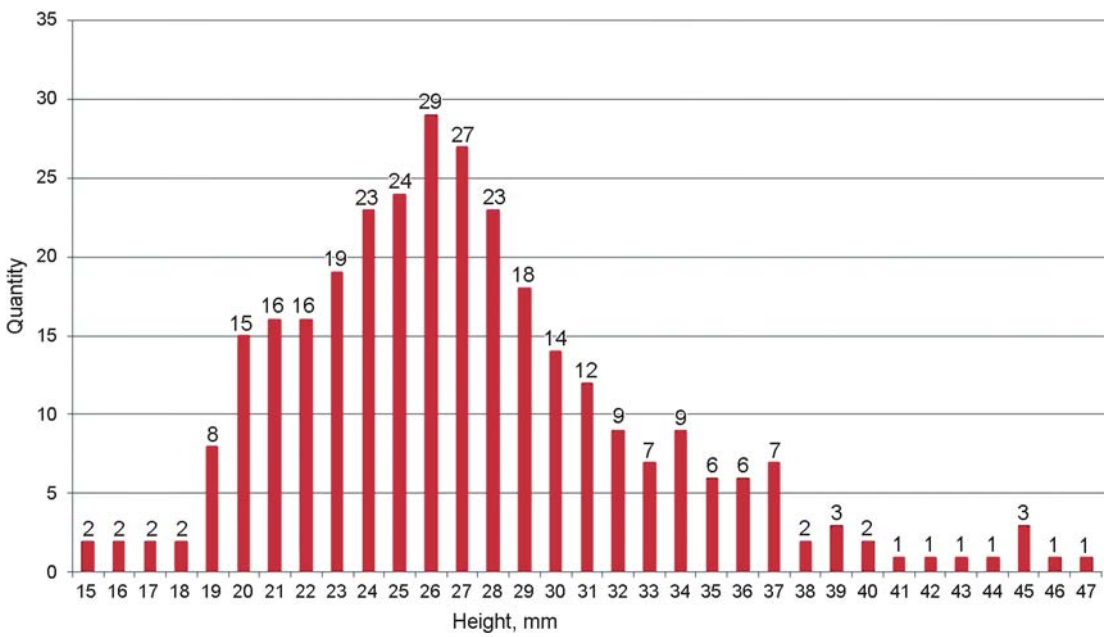

Fig. 7. Quantitative distribution of microblade cores by height.

cores (*n*=9), in which the longitudinal axis is perpendicular to the flaking surface (Fig. 8, *1*, *3*). These cores have planar striking platforms prepared and rejuvenated by longitudinal removals (possibly ski-shaped); sometimes, the frontal surface was additionally worked by fine flaking. Two cores are exceptions: one shows the elongated striking platform fashioned by a transverse breakage, rather than a longitudinal removal; the other has planar and short striking platform, and the sharp bevel to the back surface is carefully prepared similar to the ridge in the area of striking platform in the Sukhotino-type cores. Ten other artifacts with planar striking platforms have proportional height and depth (*n*=5) or the depth is less than the height of the flaking surface (*n*=5); half of these artifacts were fashioned on unifaces and pebbles, which excludes them from the Yubetsu list. Notably, the identification of Yubetsu cores in Sukhotino-4 is based only on the finished forms; it is hardly possible to trace the Yubetsu technique on the available materials at the site. A.P. Okladnikov and I.I. Kirillov described the "ski-shaped blades" that were removed from the planar platforms beveled towards back surfaces (1980: 45), but didn't provide any drawings. To date, no ski-shaped spalls have been recorded among the lithic artifacts from Sukhotino-4. In this regard, the mass production of cores with planar striking platforms prepared by the Yubetsu technique is questionable; moreover, there are quite few such cores in the Sukhotino-4 collection. Among these, only one is 9 mm wide, the others are from 10 to 14 mm and make up about 7.3 % of the narrow-faced cores included in the group of the specified range. Among all the cores with planar platforms, the share of cores 10–14 mm wide is over 50 %, i.e., most of them are considerably thicker than those of Sukhotino type. Notably, exactly the cores with flaking surfaces exceeding 10 mm in width show the traces of use-wear thinning. The Yubetsu-type cores have signs of fine flaking along the lateral edges from the side of the striking platform after its rejuvenation (Fig. 8, *1*). In the cores with massive cross-section, occupying an intermediate position between narrow-faced and prismatic cores, the thinning was carried out from the side of the striking platform, flaking surface, and back surface (Fig. 8, *2*). No thinning of the Sukhotino cores after the start of utilization was recorded. Planar platforms on the Sukhotino-type cores resulting from their poor preparation were identified on more than ten cores. Double-platform cores with two flaking surfaces of approximately the same height and depth represent a peculiar development of this trend. The striking platforms of such cores show negative scars of long removals similar to those on the flaking surface (Fig. 8, *4*). The width of such cores, being some deviation from the Sukhotino standard, is 10–13 mm, but there are specimens 8 mm wide. Narrow-faced cores also demonstrate planar striking platforms fully or partially retaining pebble cortex (*n*=14). Three such cores were prepared on large flakes with natural backs.

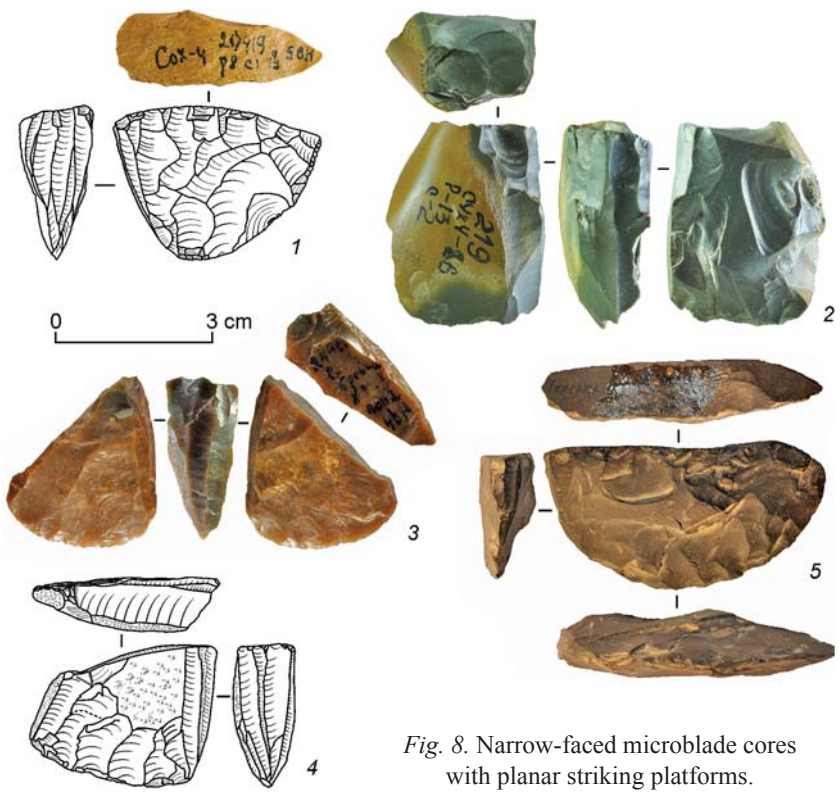

Fig. 8. Narrow-faced microblade cores with planar striking platforms.

The collection includes two items fashioned on oblong fragments of large bifaces, one of which can be conventionally classified as a core (since it bears only a few negatives of small removals), and another artifact was subjected to microblade reduction (Fig. 8, *5*). Similar bifaces in Sukhotino-4 were purposely prepared as tools—knives (Tashak, Kovychev, 2020). Both fragments were produced by transverse breakage of large

bifaces—a technique of fashioning bifacially worked backed knives (Ibid.). In the two above-mentioned cases, the backs were modified into striking platforms without any additional trimming. Apparently, only few microblades were removed from the core, because the height of the flaking surface slightly exceeds 1 cm, and the shape of the biface's fragment wasn't significantly changed. Such items are reminiscent of burin-cores rather than full-fledged nuclei.

The collection of narrow-faced cores comprises those with two opposing flaking surfaces. Such cores were prepared through additional operations. Before splitting, the cores could have been intentionally shaped: for example, by flaking the lateral faces and creating a longitudinal ridge. Some artifacts show minimal preparation. For example, microblades were removed from an oblong pebble of a sub-square cross-section after preparation of the striking platform through fine flaking. The collection under consideration contains 17 such microblade cores. Noteworthy are several cores with wide flaking surfaces, resembling the most common narrow-faced cores. The difference is that in this case microblades were removed not from the narrow face, but from the wide plane, which is designated as the lateral surface, in the terminology of narrow-faced cores. In our opinion, the emergence of such cores is not accidental. In almost half of the narrow-faced cores (n=99), the microblade flaking surface partially extends (the frontal surface facing the observer) to the right (n=65), or left (n=29) lateral face, or both (n=5). Most likely, the frequent formation of "twisted" microblades during the flaking process shifted microblade flaking to the lateral faces. The negatives of these blades show that, for example, a removal, starting from the striking platform in the center of the flaking surface, gradually reached one of the lateral faces in the distal part. Subsequent removals of microblades were carried out with respect to this shift.

Artifacts with microblade negative scars

The Sukhotino-4 collection, apart from microcores, contains various other items bearing scars of microblade removals. In particular, end-scrapers are noteworthy. The artifacts were shaped by microblade flaking along longitudinal edges. In an end-scraper of about 3 cm long, lateral flakes are well correlated with the removals from cores. In smaller end-scrapers, the main purpose of the lateral microblade flakes is clear—they reduced the width of the "stem".

The Sukhotino-4 lithic collection contains a large number of chisel-like tools, some of which were fashioned on microblade cores. For example, O.Y. Cherenshchikov identified 13 items of this kind in the materials from layers 7–10, and included these artifacts into groups of microcores (1998: 66, 75, 78, 80). Some of these tools bear bladelet negative scars on one of the wide surfaces, but no traces of microblade removals along the longitudinal edges, which would be diagnostic for the classification of these pieces as reshaped microblade cores. Nevertheless, microcores thinned through longitudinal removals were used as chisel-like tools. Also, some chisel-like implements show use-wear signs in the form of longitudinal microblade removals. The rear of one wedge-shaped core has a concave working edge of a planing tool.

In sum, in the Sukhotino-4 industry, microblade flaking was used not only for the production of microblades, but also for modeling during tool manufacture.

Discussion

The available series of radiocarbon dates of Barun-Alan-1 and Sukhotino-4—the two main sites of the Khengerekte-Sukhotino culture—suggests that this culture lasted throughout the Sartan glacial cooling. Judging by the date of level 7c at Barun-Alan-1, the origin of this culture can be assigned to the Late Karga interstadial (Tashak, 2020, 2023). The upper boundary of its existence is determined by the radiocarbon date of layer 1 at Sukhotino-4: 11,900 ± 130 BP (SOAN-841) (Okladnikov, Kirillov, 1980: 51), or 14,056–13,502 cal BP*. Sukhotino-4 layers 6–8 produced the following dates, respectively: 15,820 ± 300 (LE-3652), 16,810 ± 390 (LE-3647), and 16,870 ± 700 (LE-3653) BP (Lisitsyn, Svezhentsev, 1997). Their calibrated values are 19,895–18,338, 21,404–19,380, and 22,255–18,909 BP. Layers 10 and 11 of Sukhotino-4 can be correlated with the lower part of level 7b at Barun-Alan-1, dated to 22,920 ± 140 BP (TKa-17114), or 27,604–26,986 cal BP (Tashak, 2020: 126). For the underlying level 7c, three dates are available: 24,096 ± 889 BP (NSKA-s572) – 30,375–26,497 cal BP; 26,340 ± 1250 BP (LU-7836) – 34,051–28,322 cal BP; 26,911 ± 975 BP (NSKA-s571) – 33,713–29,265 cal BP (Tashak, 2019).

*All calibrated dates were obtained using the OxCal 4.4 software, with a range of 95.4 % (Bronk Ramsey, 2021; Reimer et al., 2020).

Microblade production played a significant role in the Sukhotino-4 lithic industry. This production was based on a set of standard technical approaches that ensured the production of serial standard blanks and ready-to-split cores. Notably, this industry, belonging to the Khengerekte-Sukhotino culture, is distinctly based on bifacial flaking (Tashak, 2020). A significant portion of its tools such as knives, points, and chisel-like implements are bifaces (Tashak, Kovychev, 2020). The standardization of the Sukhotino-type microcores is expressed in their shape (flat and vertically oriented), individual elements, and sizes. Other types account for less than 10 % of microblade cores. Distinct narrow-faced cores of the Yubetsu type are few. Despite the availability of various bifaces that could have been blanks for the production of such cores in layers 4–11, their stable occurrence is observed only in layers 1–3. The small number of the Yubetsu cores suggests that this technique was at the initial stage of its development and was not established in the Sukhotino-4 industry; also, this technique could have reflected an external influence that wasn't accepted. The Yubetsu as one of the leading techniques was recorded in various areas of Transbaikalia and Northern Cisbaikalia, for example, at the site of Bolshoy Yakor-1, 650 km northeast of Sukhotino-4 (Ineshin, Tetenkin, 2010: 218; Tetenkin, Henry, Klementiev, 2017: 51). The most ancient cultural horizons of this site are chronologically similar to Sukhotino-4 layers 1–3. This technique is well represented in the materials of the Arshan-Khunduy site, which is located 470 km southwest of Sukhotino-4. At the same time, at other sites of the Khengerekte-Sukhotino culture (Tashak, 2020, 2023), Yubetsu cores and elements of their manufacture were not recorded.

Conclusions

The Sukhotino-4 microindustry is dominated by Sukhotino type cores. In the classic version, they were prepared on flat bifaces and unifaces, are vertically oriented along the long axis, and have striking platforms fashioned by short microblade removals. Most striking platforms retain traces of bifacially processed ridged edge. Microcores 24–30 mm high predominate, few specimens exceed 40 mm. The length of most microblades is 20–30 mm. Cores of the Sukhotino type have been recorded in all layers of Sukhotino-4, which suggests the long-term use of this technique, at least since the beginning of the Sartan cooling.

The closest to the Sukhotino cores, in terms of the morphology and design of striking platforms based on bifaces, are the Kovrizhka-type cores from the Lower Vitim; these were identified by A.V. Tetenkin in the materials from culture-bearing horizons 6 and 2B at Kovrizhka IV (2017). According to the results of radiocarbon dating, these horizons were formed ca 16–15 ka BP (Ibid.: 112, 113), which is close in time to cultural layer 6 of Sukhotino-4 and the top of level 7b of Barun-Alan-1.

Microblade cores of the Sukhotino type have also been recorded at other sites of the Khengerekte-Sukhotino culture (in Western and Eastern Transbaikalia). One core was found at the Khenger-Tyn-3 sanctuary (located 2 km southeast of Barun-Alan-1) (Tashak, 2005). Microblade cores, including those of the Sukhotino type, were found in all levels of layer 7 of Barun-Alan-1. Typical Sukhotino cores were reported from the stratified site of Dvortsy, 20 km northwest of Sukhotino-4, in the valley of the Kadalinka River; the Dvortsy materials have not yet been published.

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Masks and Sculptured Human Heads in Early Neolithic Complexes of Northern Mesopotamia

This study focuses on sculptural representations of human heads and faces and related sources from Northern Mesopotamia, dating to the 10th to early 8th millennia BC. Consideration is given to archaeological context, placement relative to other ritually meaningful objects and complexes, and to material traces of actions performed with them. The distribution of masks and separate sculptural and relief images of the human head, in Northern Mesopotamia in the Pre-Pottery Neolithic (PPN), is determined in its western and central regions during the Late PPNA, Early and Middle PPNB periods. The tradition of manufacturing such objects, like the custom of burying or otherwise ritually manipulating separate human skulls, had been practiced in the Levant at least since the Upper Epi-Paleolithic. Many PPN masks and sculptured heads were found in contexts resembling those relating to human crania (and sometimes postcrania) in ritual complexes. Ritual actions with human skulls and sculptural representations of human heads were apparently based on similar religious beliefs broadly aimed at the wellbeing of the community, its security, stability, and reproduction.

Keywords: **Northern Mesopotamia, Pre-Pottery Neolithic, human head motif, mask, sculpture, funerary rite.**

Introduction

One of the important aspects in the early stages of the Neolithization process in the territory of West Asia was the so-called revolution of symbols (Cauvin, 1994). Numerous and expressive material evidence of this revolution was obtained during examination of sites in the Fertile Crescent and the adjacent areas in the second half of the 20th to 21st centuries (Kornienko, 2015c). With a great variety of shapes, sizes, materials, and technologies of symbol representations, a comprehensive study of sources makes it possible to identify stable motifs, plots, and themes that reflect some significant elements of the worldview of West Asian communities in their transition to the Neolithic way of life. This study focuses on the manifestations of the human head motif in the materials of the Early Neolithic sites of Northern Mesopotamia of the 10th to early 8th millennia BC* (Fig. 1). These materials demonstrate a certain regional unity when compared to contemporary data of neighboring regions of West Asia*. At the same time, the analysis of material sources of Northern Mesopotamia has revealed local areas of closer cultural interaction in this region.

Sculptural representations of human heads in the Natufian data

Sculptural representations of human heads have already been known from the Natufian sites (ca 13,500–11,700 BP). Three such items (two are made in a schematic manner, and one in a realistic manner) belong to the Early Natufian period, while the fourth item belongs to the Late Natufian (Grosman

*Hereinafter, the dates are calibrated.

*For more details on the chronology, terminology, and main directions in the study of neolithization process in Northern Mesopotamia and adjacent territories, see: (Kornienko, 2021).

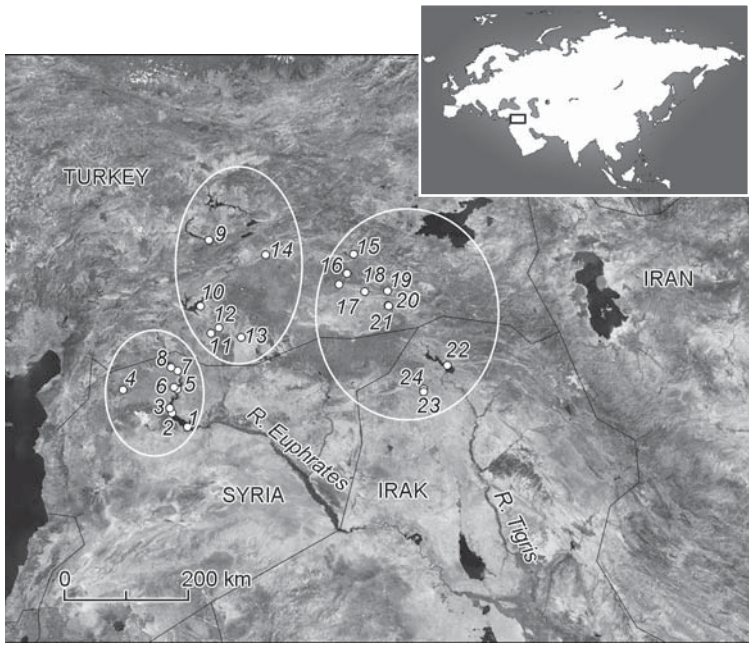

Fig. 1. Location of the sites of the Final Epi-Paleolithic (11th millennium BC) and Early Neolithic (10th–8th millennia BC) in Northern Mesopotamia.

1 – Abu Hureyra; *2* – Tell Mureybet; *3* – Sheikh Hassan; *4* – Tell Qaramel; *5* – Jerf el Ahmar; *6* – Tell Halula; *7* – Dja'de el-Mughara; *8* – Tell Abr-3; *9* – Cafer Höyük; *10* – Nevali Çori; *11* – Yeni Mahalle (Şanlıurfa); *12* – Göbekli Tepe; *13* – Karahan Tepe; *14* – Çayönü Tepesi; *15* – Hallan Çemi; 16 – Demirköy; *17* – Körtik Tepe; *18* – Hasankeyf Höyük; *19* – Gusir Höyük; *20* – Çemka Höyük; *21* – Boncuklu Tarla; *22* – Nemrik 9; *23* – Tell Maghzaliyah; *24* – Qermez Dere. The conventional boundaries of the western, central and eastern areas are shown.

Fig. 2. Sculptured human heads from the Levant and the western part of Northern Mesopotamia.

1 – from Nahal Ein Gev II (after (Grosman et al., 2017: Fig. 3); photo by Gabi Laron; *2* – from Tell Abr-3 (after (Yartah, 2013: Fig. 143)); *3*, *4* – from Jerf el Ahmar (after (Ibid.: Fig. 188, *10*, *11*)).

et al., 2017). The Late Natufian artifact, of about 12,000 years old, was found in Nahal Ein Gev II (Southern Levant, Israel). It is a polished limestone pebble measuring 9 × 6 cm with the carved relief of a human face (Fig. 2, *1*). Polished flake-scars on the reverse side of the pebble suggest that this is a mask (Ibid.: 1). The facial features are rendered schematically. There are only connected lines of the eyebrows and nose shown by T-shaped relief (mouth, ears, and hair are missing; eyes are not worked out). However, the human face is quite recognizable. Interestingly, in the subsequent periods of the Pre-Pottery Neolithic (PPN), this rather specific T-shaped design of facial features was reflected in the tradition of manufacture of various ritual objects—masks, images of human head in round sculpture and relief, as well as full-length human figures—in the territory of Southeastern Anatolia.

Human head motif in the symbolism of the Early Neolithic communities of Northern Mesopotamia: A review of sources

Materials from a number of sites in Northern Mesopotamia relating to the PPNA, Early and Middle PPNB, contain small masks, separate and broken off images of the human head in round sculpture, as well as large-scale analogs of the above-mentioned types of items. The vast majority of masks and sculptured human heads of various sizes are made of stone,

mostly limestone; those made of clay and bone are extremely rare. All these images can be divided into three types according to the degree of detail elaboration: 1) conventional (without any details); 2) schematic or stylized (most often T-shaped facial features are depicted); 3) realistic (with details). The meaning of the human head motif in the symbolic system of the Early Neolithic communities of Northern Mesopotamia can be better understood judging by the contexts of finds, their location with regard to other ritual objects, and the recorded evidence of the corresponding activities. It is also useful to see how the human head motif appears according to different sources, and compare the available data.

At the site of Tell Abr-3, in the filling of ritually decorated building M10b (PPNA), among other numerous symbolically meaningful items, a miniature sculpture of a human head (about 4.5 cm high) was found (Fig. 2, *2*). The sculpture was carved from chlorite in a realistic manner, with elaborate details of the face and ears (Yartah, 2013: 90–95). At the site of Jerf el Ahmar, two miniature sculptural masks (4.0 and 4.3 cm high) were discovered without a clear context, in the layers of the PPNA to PPNB transition period. The masks were made of stone in a realistic manner, with their human facial features represented in relief and engraving technique (one mask also shows teeth and hair) (Fig. 2, *3*, *4*). Both masks are individual in their execution. The masks contained the remains of fastenings in the upper parts of their backs. The assumptions were made that the masks were elements of composite figurines (Stordeur, Abbès, 2002: 586–587, fig. 17, *2*, *3*; Stordeur, 2015: Fig. 111, *1*, *2*), and were attached to something (Dietrich O., Notroff, Dietrich L., 2018: 4–5).

No human burials were found at the investigated areas of the sites of Tell Abr-3 and Jerf el Ahmar. On extremely rare occasions, parts of human skeletons at these sites were found to be buried during construction or burial of public structures. For example, at Tell Abr-3, only arm bones were found. These were situated in partially anatomical position in ritually decorated structure M1a on the "reliquary platform", which contained a complex of cult objects embedded into it (Yartah, 2013: 109, fig. 82). In the PPNA layers of Jerf el Ahmar, on the floor of a burnt public structure (EA 30), the skeleton of a decapitated young woman was found. In another similar structure (EA 7), at the bottom of a hole under one of the two main supporting pillars, two human skulls were discovered (Stordeur et al., 2001: 36–37). In general, during the Upper Epi-Paleolithic and Early Neolithic, human remains and remains of certain animal species were widely used in the ritual practices of the Levant and Northern Mesopotamia. Skulls or their fragments occur in ritual context associated with structures, including those with special purposes, more frequently than other parts of the skeleton (Kornienko, 2012, 2015b, 2022b; Zinchenko, 2022).

The layer of phase IVB of Tell Mureibet (Early Middle PPNB) yielded a finely worked pendant in the form of a man's head with a beard, made of dark-red polished stone (talc?), 24.6 mm high (Maréchal, Alarashi, 2008: 600, 617, fig. 19.7). In addition, also at the level of phase IVB, five human skulls were recorded close to each other, near red clay pedestals. One more skull ("skull 2") was found *in situ* on a similar pedestal nearby (Chamel, 2014: 336–352, fig. 159).

The Early PPNB levels at the Çayönü Tepesi site contained two miniature images of a human head, or a zooanthropomorph. One of these is made of clay and has some defects, its dimensions being 2.8 × 3.4 × × 2.8 cm. The other is made of bone in a stylized manner, with disproportionately large round eyes. Its dimensions (2.8 × 3.1 × 0.4 cm) suggest that it is probably a mask. The context of these finds is not specified (Vor 12 000 Jahren..., 2007: 295, 300). It is also known that the filling of a symbolically decorated public Terrazzo Floor Building (the Middle PPNB) yielded a limestone slab (with a preserved length of 70 cm); one of its narrow sides bore a schematic relief image of a human head "as large as a plate" (Schirmer, 1983: 467; Erim-Özdoğan, 2011: Fig. 51). The facial features were depicted by T-shaped relief. The slab was found in the redeposited state, in the northwestern corner of the room; it had been left there before the ritual of burial of the Terrazzo Floor Building. At the same time, in the ritual context of the Çayönü Tepesi complex, the human head motif is broadly manifested in the funerary rite: in particular, in the materials of the Skull Building (Özbek, 1992; Le Mort et al., 2000: 40; Kornienko, 2015b: 45).

Miniature sculptures of human heads (up to 6 cm high) made of stone both in a schematic and a realistic manner, were found during the excavations of the Nevali Çori settlement, pertaining to the Middle PPNB period (Vor 12 000 Jahren..., 2007: 291–292, No. 105–109). Several such artifacts were found in house 6, the so-called workshop of the stonecutter and sculptor, in two pits located in different rooms of the structure (Hauptmann, 1999: 72). They had been buried together with fragments of limestone and fragments of other stone figurines (image of the head of a grinning predator and an L-shaped

pillar). According to the researchers of the site, the miniature stone sculptures differ significantly, in the quality of details, from the clay sculptures found in the residential part of the settlement. As observed by H. Hauptmann, the limited motifs of the stone portable art representing animals, people (in many cases only their heads), and a pillar, correspond to the examples of large sculptures from Nevali Çori (Ibid.: 77). The miniature stone sculptural representations of human heads have parallels among the large-scale specimens from this site (Vor 12 000 Jahren..., 2007: 68, 70) and from other Early Neolithic sites in Northern Mesopotamia. The miniature stone mask discovered in Nevalı Çori in redeposited state (Ibid.: 292, No. 110; Schmidt, 2006: Abb. 18) is comparable to the large and miniature stone masks from Göbekli Tepe.

The burial complexes in the residential part of Nevali Çori suggest the spread of the custom of decapitation during the performance of secondary burials. For example, in house 2 (level 3), eight skulls (without mandibles) and other parts of skeletons of 12 individuals were discovered under the floor of northeastern room. A large number of human remains were also found under the floors of other dwellings, such as houses 21A and 21B (levels 1 and 2); one of the pits (house 21A) contained five skulls and some long skeletal bones. A single skull was found in the center of a rubble-filled pit in house 6 (level 3). Skeletons without skulls were also recorded in the Nevali Çori burials that had been made under the floors of dwelling buildings (Hauptmann, 1993: 57; 1999: 70–73).

The study of the Göbekli Tepe archaeological complex (PPNA and Middle PPNB) yielded a large number of round stone sculptures of human heads of various sizes, several stone masks, and one clay mask, which is rare for the sculptural images of that time. During surface cleaning prior to excavations, a massive limestone mask 42 cm high was found there (Dietrich O., Notroff, Dietrich L., 2018: Fig. 4). Its reverse side is slightly concave, with flake scars and pecked recesses. The mask may have been designed to be fixed to a wall or another support. The depiction of the face is schematic. The T-shaped relief shows the eyebrows and nose, the holes indicate the eyes, and the mouth is absent. The researchers of the site note that this manner of depicting a face is also typical of the Göbekli Tepe round sculptures representing anthropomorphs in full height. Thus, it can be argued that it is the human face that is depicted on the minimalist masks similar to that under discussion (Ibid.: 7). The second mask, made of limestone, is miniature, 5.7 cm high, with a clearly concave reverse side (Ibid.: Fig. 5). Facial features are rendered schematically. The eyebrows and nose are indicated by T-shaped relief, eyes by holes, and the mouth is absent. The mask was found in the upper layers of the filling in enclosure D, near eastern central pillar 18, at the level of the carved fox silhouette thereon. In the same area of this enclosure's filling, 10 cm below, a fragmentarily preserved small mask made of burnt clay (1.3 × 0.7 cm), with a realistic image of a human face, was found (Dietrich O., Dietrich L., Notroff, 2018: 8–9, fig. 2). The prominent nose is finely worked out, through holes show the wide-open eyes, and a small hollow shows the mouth. The back of the mask is concave. Whether the item was intentionally burned remains unclear.

Two masks were made from a flint cortex. One of them, 4.7 cm high (Dietrich O., Notroff, Dietrich L., 2018: Fig. 6), was found within enclosure H, next to pillar 51, one of the two central pillars. The representation of facial features is schematic, but in a slightly different style than in the previous cases. The eyebrows and nose are shown by a V-shaped relief, the eyes are indicated by holes, and the mouth is absent. Six parallel curved chevrons engraved above the eyebrows may represent hair, headgear, tattoos, or scarification (Ibid.: 8, 10). Another mask, 4.5 cm high, was discovered near the eastern central pillar of enclosure C, at floor level. The facial features are shown by T-shaped relief (Ibid.: Fig. 7). According to the researchers of Göbekli Tepe, this frequently recorded technique of stylized representation of facial features on stone gives the impression of "statics and super-individuality" (Ibid.: 8–10). At the same time, each of these items is clearly different from the others in terms of size, representation features, color, and rock type.

Notably, all the masks found in Göbekli Tepe (except for one—a large-sized mask found in the redeposited state) come from the filling of large public structures of worship of level III, PPNA. The researchers of the site note that these finds should be dated with caution (Ibid.: 11), because the process of backfilling the rooms could have been continued also during the Early PPNB, in which case some older materials could have been used.

During the excavations at Göbekli Tepe, by 2018, in addition to the masks depicting human faces, a collection of 17 sculptural representations of human heads had been assembled*. These are mostly parts

*Since then, for various reasons, the volume of field research at the site has been noticeably reduced.

of full-figure sculptures of anthropomorphs. This is the largest group of finds described to date among the anthropomorphic images from the Pre-Pottery Neolithic sites. The items are made of limestone and have different sizes: from 4.0–4.6 to 22–46 cm (Şanliurfa müzesi..., 2017: 105, 137–141; Dietrich O., Notroff, Dietrich L., 2018: 11). Most of them depict human heads, conventionally or schematically, including the images with facial features shown by T-shaped relief. Only rare images are realistic. Several sculptured human heads were found in the redeposited state on the surface. Those found *in situ* come from the filling of public structures of worship of level III (PPNA), namely, enclosures C, D, and H. For example, two images of human heads in round sculpture (23 and 26 cm high) were found in enclosure D at floor level, near the western central pillar (Dietrich O., Notroff, Dietrich L., 2018: 12–13, fig. 9). Places of discovery of the round full-figure sculptures in Göbekli Tepe, both zoomorphic and anthropomorphic, suggest that the items found *in situ* had not been distributed randomly in the cultural layer (Becker et al., 2012: Fig. 21). Like the masks and sculptured heads from enclosures C, D, and H, the round full-figure sculptures were also thoughtfully placed, often near the pillars of structures and most often near the central pillars.

In enclosure D, on the redeposited slab found near central pillars and on pillar 47 included in the perimeter of walls, some relief compositions have preserved. Among their motifs, one is probably a human head depicted by a circle, separately from the body. The facial features in the circle engraved on the slab are rendered by standard T-shaped pattern of eyebrows and nose (Dietrich O., Notroff, Dietrich L., 2018: Fig. 9). In general, the materials of fillings of public structures of worship at Göbekli Tepe give reason to believe that the certain symbolic objects were specifically placed therein during the ritual of leaving those buildings before these were buried (Dietrich, 2016: 6; Dietrich O., Notroff, Dietrich L., 2018: 12).

O. Dietrich reports that most of the anthropomorphic sculptures at Göbekli Tepe have survived only in fragments. Of the 43 specimens, only nine have been determined to be complete (excluding minor damage). Heads are most abundant among the fragmented anthropomorphic sculptures. The large number of identified broken off sculptured heads and their spatial distribution speak in favor of the intentional separation of these parts from the figures for their subsequent placement in certain parts of the backfilled structures (Dietrich, 2016: 5). The presented data closely echo the results of studies of the Göbekli Tepe materials by palaeoanthropologists. For a long time, no human burials were found at Göbekli Tepe. Nevertheless, by 2017, in addition to tools, sculptural images, a large number of fragmented animal bones and other objects, 691 fragments of human bones had also been identified in the filling of the structures of level III and Level II. Most of the fragments (n=408) have belonged to skulls. There are three fragments of parietal bones with traces of scarification, including that with traces of perforation. Forty skull fragments show incisions due to separation of flesh from the bone. The signs of decapitation are represented by the cuts on two (out of seven detected) cervical vertebrae (Gresky, Haelm, Clare, 2017).

At Karahan Tepe, where the field research has been actively conducted since 2019, it has been confirmed that a complex of public structures of worship had functioned during the period from the Late PPNA to the Middle PPNB (Karul, 2021). At least 20 sculptural and relief images of human heads of all three types (conventional, schematic, and realistic) and of various sizes have been found so far. Some of these bear flake scars in the neck area. The full-figure anthropo- and zoomorphic sculptures have also been discovered, including those with broken off heads. A significant part of these finds is already on display at the Sanlıurfa Archaeology Museum. Let us dwell in more detail on one of the published specimens, which was recorded *in situ* along with other ritual objects.

The large-sized realistic sculptured human head in the form of high relief was carved from the limestone bedrock on the ridge of the western wall of structure AB during its construction. Eleven pillars were found *in situ*, in front of this sculptural object. Ten of them were carved from the limestone bedrock, like the whole structure itself (Fig. 3), and were shaped like a phallus (Ibid.: 24). The eleventh pillar was L-shaped, made of a limestone slab, and embedded in the floor. It seems to depict a bird.

The stone pestles/"scepters" of phallic shape and of Γ-shape, sometimes with sculptured tops in the form of bird-, animal- or human head, stem from the earlier or contemporaneous to Karahan Tepe sites located mainly in the central and eastern parts of Northern Mesopotamia (Kornienko, 2022a: Fig. 2, 3). The combination of motifs of phallus and human/animal/bird head is known from the sculptural design of pillars in the central and western parts of the region (Kornienko, 2018). The sculptures of

Fig. 3. Structure AB at Karahan Tepe. View from the west (after (Karul, 2021: Fig. 6)).

that time from the central part of Northern Mesopotamia present compositions with a bird or animal motif combined with the depiction of a human head (Schmidt, 2006: Fig. 16; Vor 12,000 Jahren..., 2007: 70; Dietrich O., Notroff, Dietrich L., 2018: Fig. 10).

It is quite likely that the complex of expressive large-scale sculptural objects of structure AB at Karahan Tepe demonstrates the combination of images of the head, phallus, and bird/animal that was common for that time and region. The special role of the high-relief anthropomorphic head as a ritual object is emphasized by its extraordinary size (exceeding the usual size of a human head), elevated location, and uniqueness. The facial features in this remarkable sculptured human head are carefully worked out (Fig. 4). The nose and narrow slanting eyes were rendered partially by the T-shaped pattern. The cheekbones, mouth, and wide lower jaw with the elaborated chin are clearly shown. On the

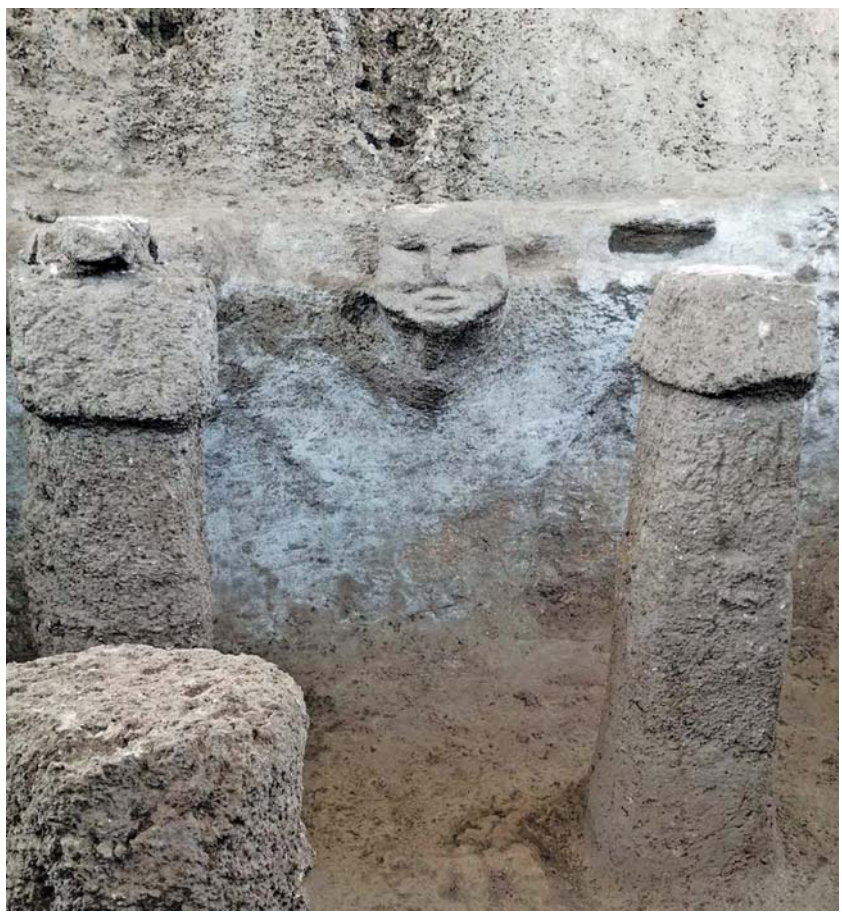

Fig. 4. The phallus-shaped pillars and the sculptured human head carved in bedrock. Karahan Tepe. Structure AB (after (Karul, 2021: Fig. 7)).

neck going into the wall, the Adam's apple attracts attention. There can hardly be any doubt that this is the representation of a male head.

Concerning the spatial distribution of the Early Neolithic masks and images of the human head in round sculpture and relief discovered on the territory of Northern Mesopotamia, it can be noted that the sites of the eastern part of the region contained separate sculptures of the human head much more rarely than those in the central and western parts. One such rare image in the east of the Northern Mesopotamian region is the sculptured top of a polished stone rod from Nemrik-9, with realistically engraved human facial features (Kozłowski, 1997: Fig. 2). This top was not broken off.

A conventional sculptural representation of a human head was found at Hasankeyf Höyük, where the skeleton of one of the individuals buried in the extended position differed from the others by the absence of the skull. Instead, there was a sphere-shaped clay item. This PPNA site, containing about 100 burials, showed no other cases of a skeleton missing the skull or a separate burial/exposure of skulls (Miyake, 2016: 34–36).

The eastern region of Northern Mesopotamia, as compared to central and western ones, did not reveal the widespread custom of decapitation in the Pre-Pottery Neolithic communities (Karul, 2011: 2–6, fig. 6, 7; Rosenberg, 2011: 82–83; Erdal, 2015; Sołtysiak, Wiercińska, Kozłowski, 2015; Miyake, 2016: 34–36; Özdoğan, 2024: 53; and others). There are rare such cases, in particular those recorded from the sources of Qermez Dere (Watkins, 1992: 68) and Boncuklu Tarla (Kodaş et al., 2022: 82–83).

Conclusions

Having studied the data on the discovery of masks and images of the human head in round sculpture and relief in the Early Neolithic complexes of Northern Mesopotamia, we can note that their distribution has been mainly recorded in the western and central parts of the region, at the levels of the Late PPNA and the Early and Middle PPNB. The available materials suggest that the origins of the tradition of making such objects, as well as of the custom of separate burial of human skull/s or ritual use of skulls, were developed in the Upper Epi-Paleolithic in the Levant. Later, these traditions spread to the neighboring areas.

A miniature stone mask with the eyebrows and nose depicted by T-shaped relief comes from the Late Natufian strata of the southern Levantine settlement of Nahal Ein Gev II. In the Early Neolithic, this specific manner of representing facial features in round sculpture and relief images of human heads became widespread in the central part of Northern Mesopotamia.

There is still no information about the occurrence of any separate sculptured human heads in the eastern part of the Northern Mesopotamia*. Furthermore, the materials from the eastern part of Northern Mesopotamia do not show a widespread tradition of secondary burials with separation of skull from the skeleton, with separate burial, or with exhibition of skulls. They also do not show the existence of anthropomorphic images without heads nor the custom of breaking off the heads of anthropomorphic sculptures. In the western and central areas of the region, the evidence of such activities has been recorded at a number of the PPNA–Middle PPNB sites. The depiction of the human head by objects of different categories in various ritual practices was typical of the given areas in the specified period. The distribution of ritual objects associated with this motif has also been recorded in the sources from the Southern and Central Levant of the Pre-Pottery Neolithic period (Cauvin, 1994: 154–155; Kornienko, 2012; Ben Zion, 2014; Dietrich O., Notroff, Dietrich L., 2018: 17). However, specific features of the design of such objects and the contexts of their location are somewhat different from those of the Northern Mesopotamia region, in some respects quite dramatically.

The available data from the western and central regions of Northern Mesopotamia do not allow us to trace any correlation between the place of discovery and the type of sculptural representation of the human head (mask, relief, or round sculpture; schematic or realistic). The noted variations of images sometimes occur in similar contexts: in construction sacrifices, in the filling and decoration of symbolically marked public buildings. The conventional representations of the human head were obviously created in the unplanned cases, or when there was not enough time for more careful manufacture of the object, like in the burial materials with a missing skull at Hasankeyf Höyük. In many instances, the circumstances of the discovery of masks, reliefs, and round sculptures of human heads are comparable to those of human skulls

*Although in the last three decades the excavations in the territory of Southeastern Anatolia, in the upper reaches of the Tigris River, have noticeably intensified (Karul, 2020).

(and sometimes other bones) in ritual complexes. Ritual actions with these objects seem to have had a common ideological basis broadly aimed at the wellbeing, stability, security, and reproduction of the community (Kornienko, 2012, 2015b).

The dominance of male symbols and images is a characteristic feature of the iconography of Northern Mesopotamia in the Pre-Pottery Neolithic (Hauptmann, 1999; Schmidt, 2006: 80, 97, 99, 113, 160, 185; Kornienko, 2015a; and others). When there are grounds for determining the sex of the depicted individual (as, for example, in the case of a pendant in the form of a man's head with a beard from Mureybet), sculptural images represent men. Quite expressive is the interior decoration of structure AB at Karahan Tepe, with ten phallic and one Γ-shaped pillars carved from limestone. These are located in front of the large high relief of a man's head placed on the upper ridge of the western wall of the room. The composition made by relief and engraving on the front side of the bench of the large structure AA at Sayburç (Early PPNB, Southeastern Anatolia) is equally impressive. The mural about 70–90 cm high and 370 cm long contains five human and animal figures participating in the ritual/mythical scenes. Four of these are shown with erect phalluses (Özdoğan, 2024: 46, fig. 11). The most significant character of the composition seems to be a man holding his penis in his right hand (with his left hand placed on the abdomen). The full-face high-relief image distinguishes him from the others engraved in profile (Ibid.: 52, fig. 11, 12, 16). Noteworthy is the disproportionately large head of the character*. Given our knowledge of ritual objects of this region in the Early Neolithic, we can assume that this head is depicted as a large mask worn on the face.

The combination of the motifs of a phallus and a human or animal head is a very common and stable technique in the iconography of Northern Mesopotamia in the Pre-Pottery Neolithic. It has been repeatedly recorded in the design of monumental stelae and small pestles/"scepters" with the tops in the form of zoo- or anthropomorphic heads. Such objects of ritual practices, along with other sources, reflect the totemic views, male dominance in social life, and implementation of rites aimed at the reproduction, protection and prosperity of the community.

The idea of interdependence, inseparability of life and death is most minimalistically and concisely represented in many cultures precisely in the motif of a separated head—the upper and most semantically significant part of a body. This meaning (perhaps not the only one) is likely conveyed by the masks and sculptural representations of the human head found at the sites of Northern Mesopotamia of the Pre-Pottery Neolithic.

*Interestingly, the head of the second man, whose image is engraved, conforms to the usual proportions.

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Shell of *Tritia nitida* Sea Snail from a Neolithic Burial at the Ust-Aleyka-5 Flat Burial Ground, Barnaul Stretch of the Ob

We present the findings of a multidisciplinary study of burial 2 at Ust-Aleyka-5 on the Upper Ob. In 1982, an upright burial of a child with abundant funerary offerings (lithic artifacts, ornaments made of bones and teeth of mammals, shells of *Unio* bivalves) was unearthed. We focus on a find unique in the region—the shell of a sea snail *Tritia nitida*, a gastropod, which, at present, lives in the Mediterranean, Black, and Azov seas. The Raman spectroscopy analysis of a mineral pigment detected on the shell allowed us to identify it as red ocher. Similar traces were found on drop-shaped pendants made of bone, antler or deer teeth, and on fossil shells of *Unio* aff. *tumidus*. On the basis of AMS analysis, burial 2 dates to the mid- or late 4th millennium BC. The *T. nitida* shell indicates ties (likely indirect ones) of the Barnaul stretch of the Ob to the Black Sea region.

Keywords: **Neolithic, child burial, marine mollusk, *Tritia nitida* shell, Barnaul stretch of the Ob, Raman spectroscopy.**

Introduction

The Ust-Aleyka-5 site is located in the village of Ust-Aleyka in the Kalmansky District of the Altai Territory (Fig. 1), on a promontory formed by the left side of the Aley River valley in its estuary zone. In 1982, Neolithic burial 2, a single upright burial of a young child with numerous accompanying goods (lithic artifacts and ornaments made of mollusk shells, antler or bone, and teeth of mammals), was discovered and studied at the site (Borodaev et al., 2022). The distinctive funerary rite and the unusual set of burial goods might have been associated with the physical characteristics of the deceased, who had macrocephaly syndrome,

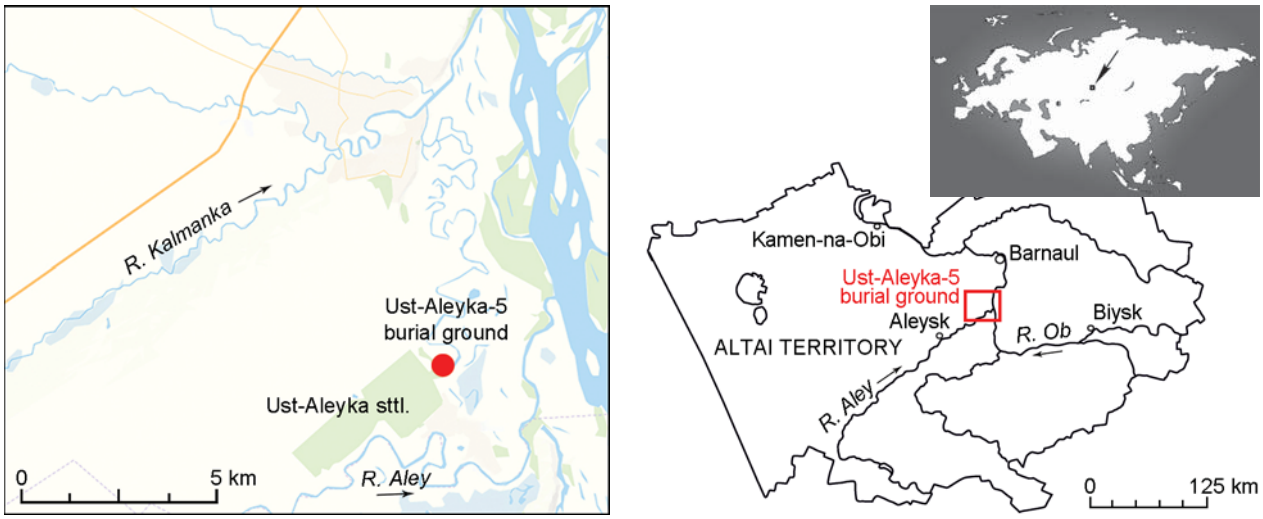

Fig. 1. Location of the Ust-Aleyka-5 site.

probably caused by hydrocephalus (Ibid.). The burial requires thorough investigation and full publication of its evidence.

This article discusses the items of funerary offerings (sea-mollusk shell, stone tools including a burin, a primary medium flake, and a small flake) that were not reflected in the previous publication of the evidence from the site (Ibid.). The destiny of these items is associated with the circumstances of discovery of the Neolithic burial. When clearing down to the level of the sterile soil, the grave spot did not stand out in color, and differed from the surrounding loam only by its softer texture. The grave was discovered during the control excavation of virgin soil. Stone tools (burin, primary medium flake, and small ordinary flake), sea-mollusk shell, crown of sable tooth, and red-deer tooth a the hole for hanging were found in humified loam above the level of virgin soil. At this stage of study, there is no doubt that all these artifacts belonged to the upper part of the grave-pit filling. There was no such confidence during the field studies. The pendant made of a red-deer tooth clearly belonged to the burial goods (there were many similar finds in the burial), while the attribution of the shell to the goods from burial 2 required additional arguments because of the peculiarity of the find. To provide these, a study was conducted using advanced methods of research.

When packing the evidence from Ust-Aleyka-5 burial 2, finds from the upper part of the grave-pit filling accidentally got into a bag with the child's bones, and for a long time they were out of the main collection of artifacts transferred to the Altai Archaeology Museum at the Altai State University (Ibid.). These items were discovered quite recently, during sorting out the anthropological evidence for the analysis of postcranial skeleton (Solodovnikov et al., 2024).

This article is aimed at introducing a unique find from the Stone Age of Siberia, i.e. the shell of a *Tritia nitida* sea snail, in the context of burial goods from an unusual Neolithic child's burial in the Ust-Aleyka-5 burial ground.

Study methods

Macro- and microtraces of wear, as well as residues of pigment and organic matter on the surfaces of the artifacts were examined at low magnification using MBS-10 and Carl Zeiss stereoscopic microscopes (×8–56). More detailed microlevel (×100–500) study of the items was carried out using an Olympus BNM metallographic microscope. Macrophotographs were taken with a Canon EOS 5D Mark IV camera with Canon EF 100mm f/2.8L Macro IS USM lens using a tripod equipped with microscope head providing smooth manual focusing, and a Lumen-3 light source. The Helicon Focus software enhanced obtaining images of wear traces with focusing over the entire area of one frame.

Taxonomic affiliation of the mollusk shell was based on its morphological features (size, shape, aperture structure, surface texture). The group and species of the shell under study were identified using guides and handbooks on marine mollusks (Alekseev D.O., 2003; Kantor, Sysoev, 2006; Anistratenko V.V., Khaliman, Anistratenko O.Y., 2011).

To identify the substance inside the shell, determine the coloring pigment on its surface, and confirm the hypothesis that the shell belonged to sea mollusks, the molecular composition of substances (organic, coloring, and shell) was analyzed using Raman spectroscopy with the M532/785 microscope ("Spectr-M") in the Laboratory of Digital Archaeology at the Institute of Archaeology and Ethnography SB RAS. The spectral range of the unit was 100–4000 cm^{-1}; the entrance slit was 20 μm. A laser with a wavelength of 532 nm was used for analyzing the shell's surface and pigment (power 50 mW), and a laser with a wavelength of 785 nm was used for studying the dark substance in the shell's aperture (power 250 mW).

Findings

The most distinctive and informative find among the evidence discovered in the upper part of the grave-pit filling is the shell of a sea mollusk of ovoid-conical shape, measuring 16.1 × 7.7 mm (Fig. 2, *1*). Its walls are relatively thick; outer relief consists of radial rows of tubercles and depressions between them, which give the surface a cellular appearance. The aperture, with noticeably thickened edges and groove at the bottom, had a shape typical of buccinoid mollusks. It was established that the shell belonged to the marine gastropod *Tritia nitida* (Jeffreys, 1867).

The shell under study has largely lost its natural coating and typical color and partially lost its surface relief, most likely as a result of natural processes in the sea or during human use. This could not have happened during archaeological processing, since in that case neither traces of pigment on the surface (Fig. 2, *2*) nor fragments of organic matter inside (Fig. 2, *3*) would have been preserved.

Examination of the item using Raman spectroscopy (seven points analyzed) revealed a substance typical of marine mollusks on the surface of the shell (Fig. 3, *1*). The shell is based on calcium carbonate (recorded in the spectrum by peaks at 149, 205, 275, 701, and 1082 cm^{-1}). The presence of carotenoids is also observed (marked in the spectrum by peaks at 1132 and 1516 cm^{-1}) (Withnall et al., 2003; Borodina, Nekhoroshev, Soldatov, 2008).

Spots of ocher pigment of reddish color are recorded on individual areas of the shell surface. They contrast with the natural color of the mollusk; the pigment is integrated into the surface and is evenly distributed in the depressions of the relief. Spots of bright brick-red pigment are located mainly on a small area of the outer surface of the shell (see Fig. 2, *1*, *2*). At a magnification of ×40–200, these look like clusters of particles, which protrude above the surface of the shell at the point of maximum concentration. Particles of paint occur not only in the depressions of the relief, but also on radial tubercles; in fresh shells of this species they are white or beige. Individual small spots of dark red pigment are also present inside the shell in the immediate vicinity of the organic matter remains (see Fig. 2, *1*, *3*).

The results of Raman spectroscopy indicate that the pigment (eight points analyzed) is based on hematite (Fig. 3, *2*). The spectra show peaks that mark this natural mineral pigment (240, 410, 490, 600,

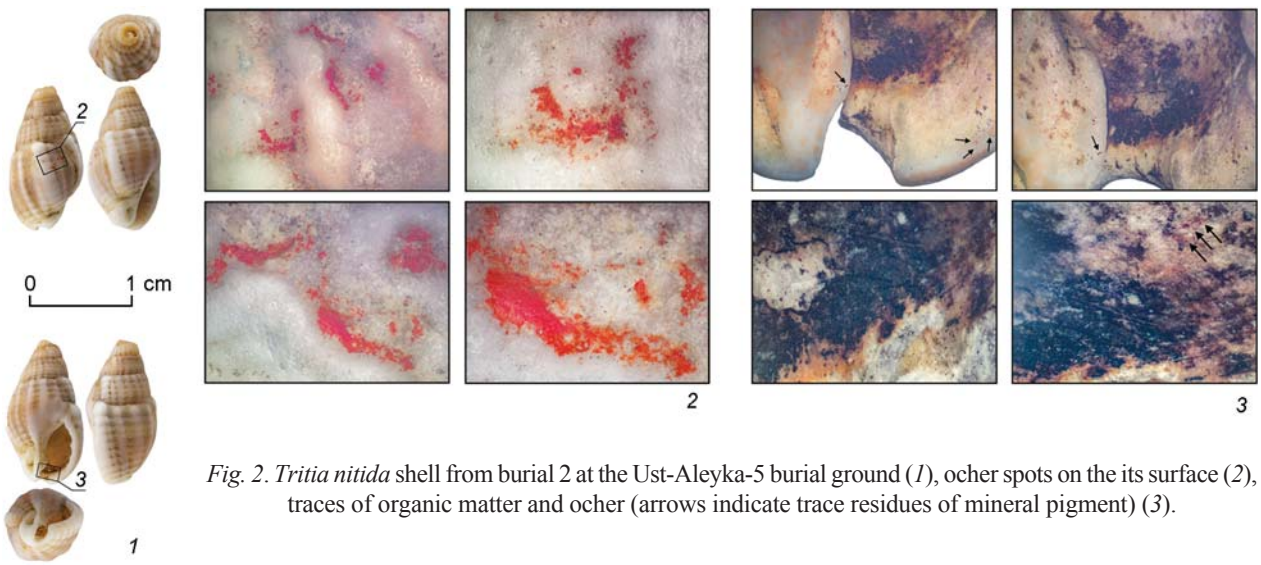

Fig. 2. Tritia nitida shell from burial 2 at the Ust-Aleyka-5 burial ground (*1*), ocher spots on the its surface (*2*), traces of organic matter and ocher (arrows indicate trace residues of mineral pigment) (*3*).

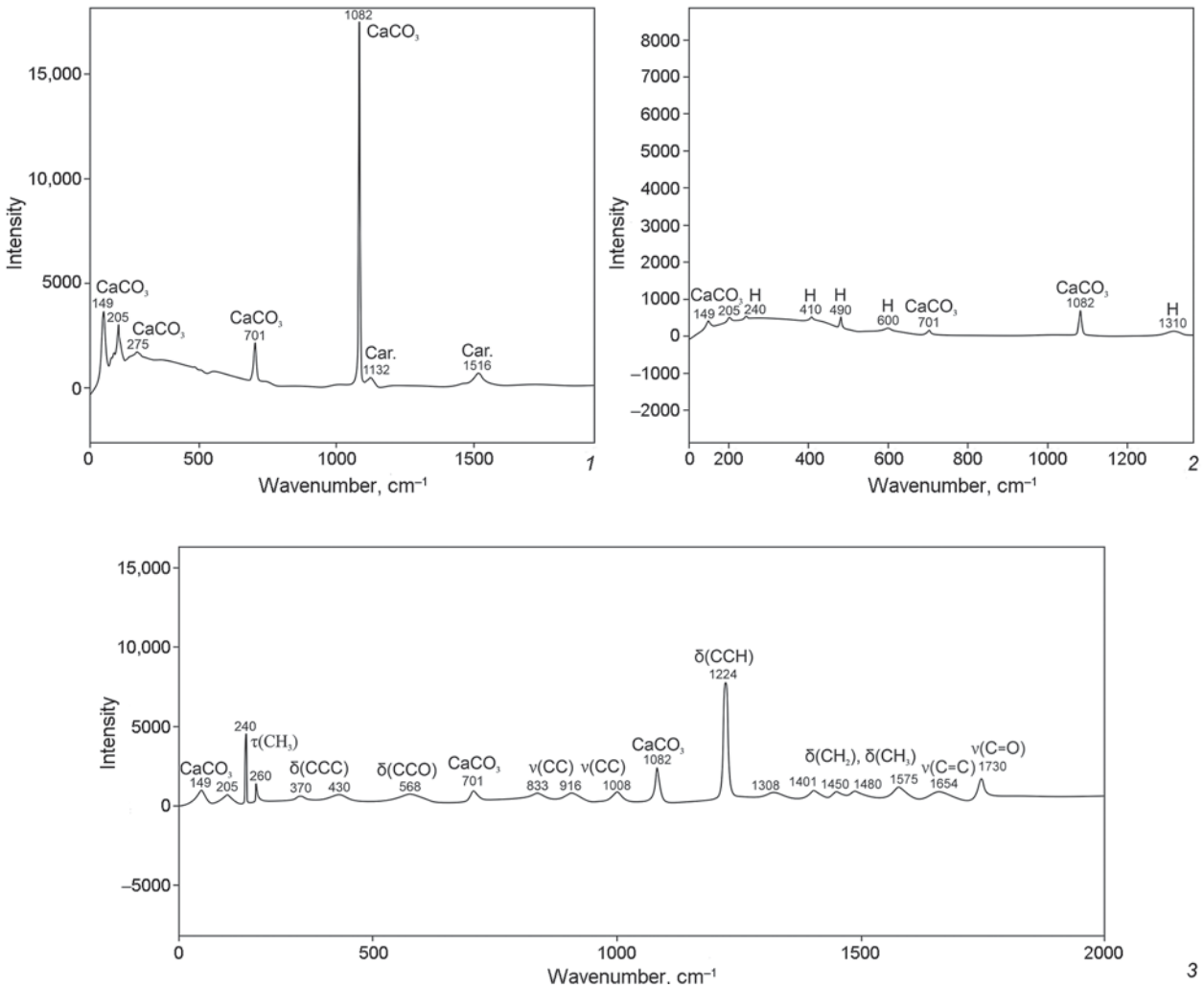

Fig. 3. Raman spectra of samples from the surface of the mollusk shell: shell (*1*), red pigment (*2*), dark substance on the inner surface (*3*). $CaCO_3$ is biogenic calcium carbonate in the crystalline form of aragonite; Car. – carotenoids; H – hematite; $\tau(CH_3)$, δ(CCC), δ(CCO), ν(CC), δ(CCH), $\delta(CH_2)$, $\delta(CH_3)$, ν(C=C), ν(C=O) – compounds of organic adhesive substance.

and 1310 cm^{-1}) (Wojcieszak, Wadley, 2019). Strong luminescence indicates the use of red ocher rather than pure hematite (Marucci et al., 2018: Fig. 2). In Neolithic and Chalcolithic burials of Northern Eurasia, ocher almost always served as such pigment. Although no traces of its use were found during the excavation of the burial, fragments of ocher were discovered on teardrop-shaped pendants made of antler or bone (Fig. 4, *1*) during microscopic examination of the collection of goods from burial 2.

Pendants of irregular ellipsoid shape made from the fossil shell of the pearl mussel *Unio* aff. *tumidus* have already been the subject of a separate study (Borodaev et al., 2022). Subsequent microscopic examination revealed traces of ocher thereon (Fig. 4, *2*). During the manufacture of the pendants, the inner surface of the shell became the face surface. Traces of ocher are usually clearly visible in the holes of the items or on their inner surfaces, which were processed using a fairly coarse abrasive, and its traces were not removed by subsequent smoothing or polishing. Ocher is best seen in microrelief of holes and traces of abrasive, but sometimes also appears on the outer surfaces of pendants.

Microscopic examination revealed traces of ocher on pendants made of red-deer teeth (Fig. 4, *3*, *4*). Pigment, which also appeared in the form of a cluster of particles, is present on natural fractures of the tooth root, which were not modified during the grinding process (Fig. 4, *3*). The pigment is less distinct inside the drilled holes and, over a significant

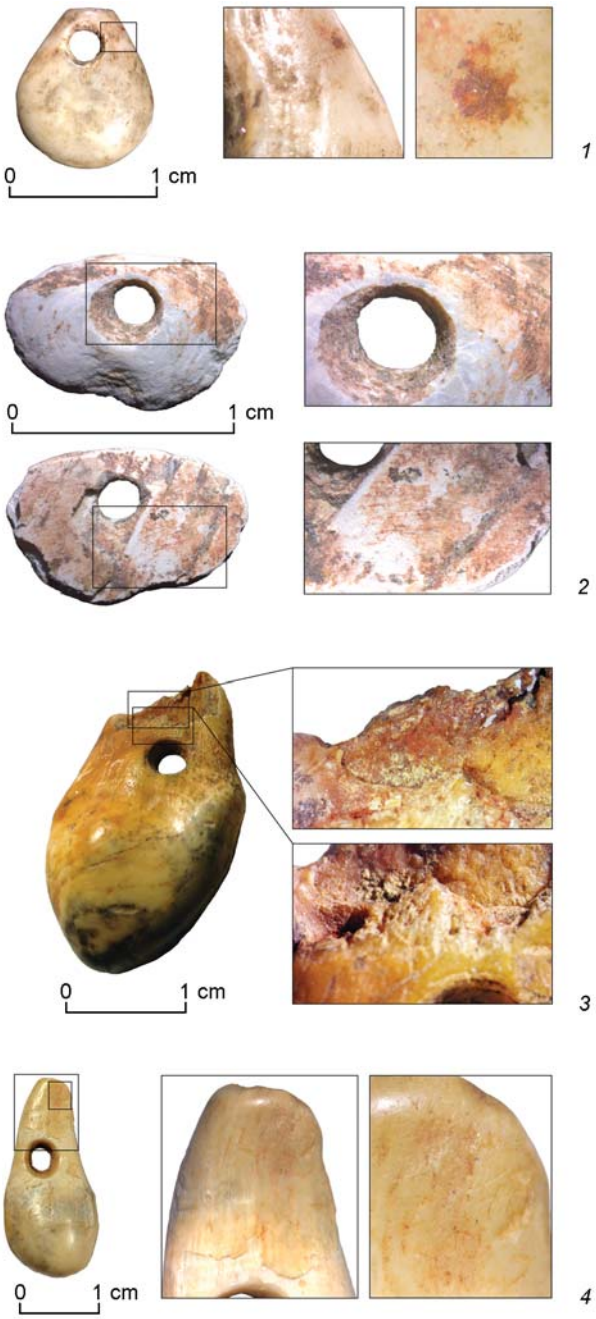

Fig. 4. Finds from burial 2 at Ust-Aleyka-5.

1 – teardrop-shaped pendant made of antler or bone with traces of ocher (general view and fragment); *2* – mother-of-pearl pendant from a fossil shell of pearl mussel *Unio* aff. *tumidus* with traces of ocher (general view, interior side of the shell (outer side of the item) and exterior side of the shell (inner side of the item)); *3*, *4* – pendants made of red-deer teeth with traces of ocher (general view and fragments).

area, in the scratches that appeared during grinding of the tooth root (Fig. 4, *4*). Unfortunately, the strongly polished surfaces of the teeth and their laboratory processing did not contribute to the good preservation of ocher traces.

A small piece of mineral pigment of irregular trapezoidal shape (Fig. 5, *1*) was also found in burial 2. Scraping or grinding such stone produces powdery red ocher. All sides of the artifact were ground. Its concave surface was covered with numerous chaotically located scratches of varying depths of penetration, which were patinated. In some places, where the surface layer is damaged, it is clearly visible that the specimen under study is bright red inside (Fig. 5, *2*). Pigment particles appearing on the shell of the *Tritia nitida* sea snail (see Fig. 2), teardrop-shaped pendants made of antler/bone (see Fig. 4, *1*), mother-of-pearl pendants made of fossilized pearl mussel shells (see Fig. 4, 2), and pendants made of red-deer teeth (see Fig. 4, *3*, *4*) from Ust-Aleyka-5 burial 2 are visually indistinguishable in color and structure.

In the upper part of the grave-pit filling, a small greenish stone tablet of sub-triangular shape was also found (Fig. 6, *1*). On one of its sharp corners, trace analysis has revealed marks of medium wear typical of a burin on hard material. The shape, size, and wear of the working edge, as well as traces of pigment on the working area detected by microscopic examination (Fig. 6, 2), suggest that the tool was

Fig. 5. Fragment of a trapezoidal item made of hematite (?) from burial 2 at Ust-Aleyka-5.

1 – general view; *2* – area with traces of multidirectional scratches.

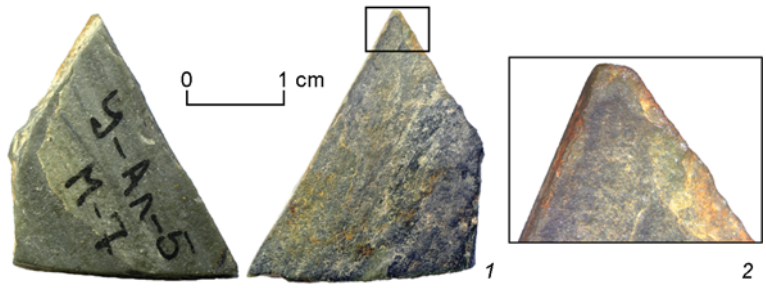

Fig. 6. Burin from burial 2 at Ust-Aleyka-5.
1 – general view; *2* – fragment with traces of wear and ocher.

used for scraping off pigment from the hematite (?) fragment described above (see Fig. 5).

We can conclude that the shell of the *Tritia nitida* sea snail (see Fig. 2) and the burin (see Fig. 6) from the upper part of the grave-pit filling are undoubtedly a part of the funerary offerings in the Neolithic child burial 2 at the Ust-Aleyka-5 cemetery.

Discussion

The *Tritia nitida* sea snail and other closely related species of this genus are currently widespread on the Atlantic coast of Europe, and in the Mediterranean, Black and Azov seas. This taxon belongs to the family Nassariidae, order Buccinifomes, class gastropoda. Mollusks of this species have an ovate-conical shell with seven to eight slightly convex whorls separated by a fairly deep suture. The last whorl occupies slightly over a half of its entire height. On the surface of the shell, there are rows of radial and spiral folds, at the intersection of which protruding tubercles are located. The aperture is rounded-oval; its inner surface at the edge is usually slightly serrated. The height of the shell is up to 20–23 mm; the width is up to 10–15 mm (Fig. 7). The mollusks live on the bottom in the coastal zone. In the Black Sea basin, they occur along the entire coast (Anistratenko V.V., Khaliman, Anistratenko O.Y., 2011).

In Southern Europe, ornaments made of *Tritia nitida* shells have been found dating back to the Early Upper Paleolithic (Borić, Cristiani, 2019). It is difficult to provide a comprehensive overview of the Northern Mediterranean archaeological sites that contained tritium shells, and *Tritia nitida* in particular, since in the archaeological literature species definitions of shells used as ornaments are usually given without taking into account taxonomic and nomenclatural changes made in the mollusk systematics in the second half of the 20th–early 21st centuries (Kiyashko, Khlopachev, 2022: 108). For example, in the Western European literature, *Tritia nitida* is given as *Nassarius reticulatus* or *N. reticulatus* var. *nitidus* (Dupont, 2003: 50), while *Cyclope neritea* mollusks, which have a completely different shell shape, are considered tritiums (Borić, Cristiani, 2019: 223).

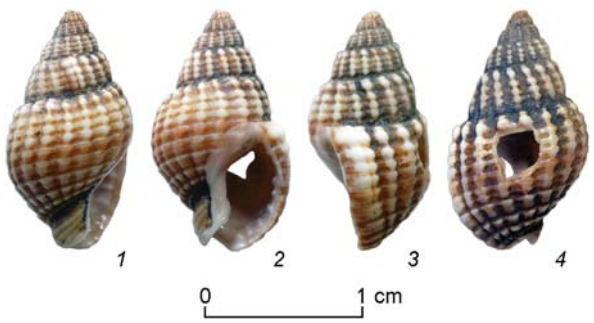

Fig. 7. Modern shell of *Tritia nitida*. Black Sea, Sevastopol (from the collection of D.V. Kuzmenkin).

The published data suggest that the most common means of attaching the shells was holes in their walls (for the example, see Fig. 7, *2*, *4*), which were formed naturally after the death of the mollusk or as a result of a deliberate blow (Ibid.: Fig. 2, 5, 6). Some of such holes show signs of "abrasion" from the thread (Mărgărit, Boroneanț, Bonsall, 2021). A fundamental question is how the shell of *Tritia nitida* could have been used. No holes nor grooves that could be interpreted as traces of attachment to clothing, headwear, or use as body ornaments can be visually identified on the shell in question. However, the remains of some substance are visible on the inner surface of the shell in the area of the columellar groove, even with the naked eye (see Fig. 2, *1*, *3*). In modern empty shells of *Tritia nitida*, which can be collected on the seashore, traces of mollusk's body are usually absent (see Fig. 7, *2*).

Using Raman spectroscopy, we have established that the dark substance on the inner surface of the shell (14 points were examined) is of organic origin (see Fig. 3, *3*). The obtained spectra demonstrate specific peak-markers of carbon compounds: $\tau(CH_3)$ – 240, 260 cm^{-1}; δ(CCC) – 370, 430; δ(CCO) – 568; ν(CC) – 833, 916, 1008; δ(CCH) – 1224; $\delta(CH_2)$, $\delta(CH_3)$ – 1308, 1401, 1450, 1480, 1575; ν(C=C) – 1654; ν(C=O) – 1730, which are part of the structures of organic adhesives (wax, wood resins) (Edwards, Falk, 1997; Brody, Edwards, Pollard, 2002). For the

shell under discussion, these can be the remains of an adhesive used for attaching a cord or strap that was threaded through the columellar groove, and attached to the inside of the shell using a knot and glue. Simple actions with a knot tied at the end of a thread have shown that the shell could have been attached to the end of a strap or string (Fig. 8) and used as a pendant. The presence of the *Tritia nitida* shell above the child's head suggests that it could have been a part of a headwear decoration.

In the fossil state, *Tritia nitida* and the morphologically close species are known from the Late Cenozoic (starting from the Miocene) deposits of Europe and Northwest Africa; they are numerous in the Pleistocene deposits of the Black Sea region (Ilyina, 1966: 138–140). Fossil representatives of this genus have not yet been known in Siberia or Central Asia. Taking into account the distribution (modern and geological) of mollusks of the *Tritia* genus, it can be assumed that the nearest region from which the shell of this mollusk could have reached the Upper Ob region is the Azov region or, more broadly, the Northern Black Sea region.

Individual shells of the *Tritia* genus have been found at archaeological sites far beyond their habitation area; for example, at the Upper Paleolithic (ca 15 ka BP) site of Yudinovo in the Bryansk Region. Numerous ornaments made from shells of sea mollusks of the *Nucula*, *Cerastoderma*, *Steromphala*, *Cerithium,* and *Melarhaphe* genera, which were most likely delivered from the Northwestern Black Sea region, were also found at that site (Kiyashko, Khlopachev, 2022). The distance from Yudinovo to the supposed shell collection sites is approximately 700 km in a straight line, and from the Black Sea region to the Upper Ob region it is more than four times greater.

The *Tritia nitida* shell is a single find unique for archaeological sites of the Altai and the entirety of Siberia. Shells of sea mollusks (including fossils) belong to a rare category of burial goods of the Neolithic and Chalcolithic cemeteries of the Altai (Kungurova, 2005; Kiryushin Y.F. et al., 2011; Kiryushin K.Y. et al., 2021).

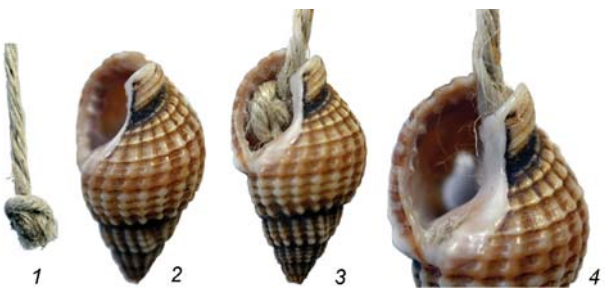

Fig. 8. Reconstruction of the method of attachment through the columellar groove using a modern shell of *Tritia nitida*.

Two AMS dates were obtained for teardrop-shaped pendants made of bone or antler: 5550 ± 25 BP (IGAN-5829) and 5219 ± 86 BP (NSKA-01941). The calendar-age intervals determined after calibration show a small spread for the first date (4445–4415, 4400–4380, 4375–4350 BC according to 1σ, and 4450–4340 BC according to 2σ) and significant spread for the second date (4230–4190, 4170–4090, 4080–3950 BC according to 1σ, and 4350–3800 BC according to 2σ).

The closest parallels to the teardrop-shaped pendants made of bone or antler, ornaments made of red-deer incisors, and lithic artifacts from burial 2 at Ust-Aleyka-5, appear among the evidence of the Solontsy-5 flat burial ground (northern foothills of the Altai) (Borodaev et al., 2022). Valves from *Glycymeris sp*. shells (marine bivalves) were found in burials at this cemetery (Kungurova, 2005: 33, 111, fig. 31, *4*). Radiocarbon dates of 5485 ± 85 BP (SOAN-4627) and 5325 ± 45 BP (SOAN-4628) were obtained for burials 1 and 7 at Solontsy-5 (Ibid.: 57). The regions closest to the Altai with locations of fossil Glycymerides are the southern part of the Turgay Depression and the Aral Sea region (Kiryushin K.Y. et al., 2021).

The evidence from the Tuzovskiye Bugry-1 flat burial ground (Barnaul stretch of the Ob) includes ornaments made of fossil shells of *Dentalium* sea mollusks (Kiryushin Y.F. et al., 2011). They look like slightly curved tubes, tapering towards the front end, with porcelain-like surface. There are no known locations of these mollusks in the Altai Territory; moreover, there are not even the types of deposits in this region where they could occur. The closest locations of fossil Dentaliids to the Altai are in the Aral Sea region (Alekseev A.K., 1963).

Two AMS dates of 4649 ± 54 BP (GV-03584) and 4937 ± 56 BP (GV-03585) were established in the Center for Accelerator Mass Spectrometry of the Novosibirsk State University and the Novosibirsk Science Center (AMS Golden Valley) for the Tuzovskiye Bugry-1 burial ground using human bones from burial 33, where *Dentalium* mollusk shells were found. Using human bones from burial 35, where *Cardiidae* sp. mollusk shells were found, an AMS date of 4398 ± 57 BP (GV-03586) was obtained in the same Center.

Various shell ornaments appear among the evidence from the Sopka-2 burial ground (Baraba

forest-steppe). Two pendants made of shell valves of *Idionoma* sp. and *Anodonta* sp. were found in the Early Metal Age burial complex (burial 643) (Molodin, 2001: 37, figs. 14, 35, 36). As V.I. Molodin noted, pendants made of shell valves of *Idionoma* sp. and *Anodonta* sp. clearly indicate "the direction of contacts and the origin of carriers of the culture associated with the Irtysh basin" (Ibid.). The evidence from the Early Metal Age burial complex (Ust-Tartas culture) includes over forty items made of mollusk shells of *Corbicula tibetensis Prash.*, Anodonta sp., *Idionoma* sp., *Glycymeris* sp., *Scaphopoda*, of the *Dentaliidae* family (Ibid.: 102). According to Molodin, these finds testify to indirect connections between the inhabitants of Siberia and Central Asian territories; most likely, they were maintained thanks to the Ust-Narym and Botai communities, who lived in the modern Eastern and Northern Kazakhstan (Ibid.: 116).

Burial 2 at Ust-Aleyka-5 is the earliest among the Neolithic–Early Bronze Age burials in the southwestern Siberia, where shells of marine and fossil mollusks, as well as items made from these, were found. The shell of *Tritia nitida* clearly indicates connections between the population of the southwestern Siberia and those of the Azov region and Northern Black Sea region. At this stage of research, we cannot identify the carriers of the archaeological cultures who contributed to the movement of shells from the Northern Black Sea region to the south of Western Siberia.

Microscopic examination and analysis of substances using Raman spectroscopy has revealed traces of ocher on the shell of the *Tritia nitida* sea snail, ornaments made of *Unio* shells, teardrop-shaped pendants made of bone or antler, and pendants made of red-deer incisors. Ocher was so widely used in the burial practices of the Northern Eurasian population during the Mesolithic–Chalcolithic that there is no point in giving examples. As for the Final Mesolithic–Chalcolithic complexes in the Barnaul stretch of the Ob, ocher was found there only in burial 18 at the Firsovo XI flat burial ground, which has an AMS date of 9106 ± ± 80 BP (GV-02889) (Kiryushin K.Y. et al., 2021: 27). It suggests that the presence of ocher in Ust-Aleyka-5 burial 2 is another feature distinguishing it among the Neolithic–Chalcolithic burials of the Barnaul stretch of the Ob. However, traces of ocher were discovered only in the process of microscopic study of archaeological collections from the site. Possibly, a similar study of evidence from other burials of that period in the region may also reveal traces of ocher.

Notably, the microscopic study of archaeological collections from the Neolithic-Chalcolithic burials of the Altai, including use-wear analysis of artifacts, is an extremely promising area of research, which may provide rich information for historical reconstructions.

Conclusions

Our research unambiguously indicates that the shell of the *Tritia nitida* sea snail and the stone burin from the Ust-Aleyka-5 burial ground are part of the funerary offerings from burial 2.

The area closest to the Upper Ob region, whence the *Tritia nitida* shell could have been delivered, is the Azov region or (more broadly) the Northern Black Sea region.

The *Tritia nitida* shell testifies to ethnic and cultural contacts in the steppe belt of Northern Eurasia (from the Black Sea region to the Upper Ob region).

Microscopic examination has revealed traces of ocher use on the shell of *Tritia nitida* sea snail, ornaments made of *Unio* shell, teardrop-shaped bone or antler pendants, red-deer tooth pendants, and a burin. The use of ocher in the funerary rite of the population inhabiting the Barnaul stretch of the Ob has so far been recorded only in burial 18 at the Firsovo XI flat burial ground.

Acknowledgments

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A Neolithic Burial in the Northern Upper Ob Basin

The study describes new materials from Neolithic burial 33 at Krokhalevka-5 in the Kudryashovsky archaeological micro-region (Novosibirsk Region). The burial was single and had been disturbed. Details of funerary rite and descriptions of lithics are provided. The outlines of the lower part of the pit and the infill with remains of wood suggest that part of a wooden boat had been placed in the grave, possibly as a symbol of passage in space. Similar religious beliefs are evidenced by practices of the Neolithic Lower Ob people, who made tiny boats of clay. The custom of using boats or their copies in the funerary rite has survived until recently among the West Siberian natives, primarily those of the Ob basin. Results of radiocarbon analysis corrected for freshwater reservoir effect suggest that the burial dates to the mid-5th millennium BC (late 6th millennium BC without correction). Closest parallels to the lithics found there are those relating to the Zavyalovo stage of the Upper Ob culture and to certain Neolithic burials of the Barnaul-Biysk area and the Altai Mountains. Broader parallels include those from the Neolithic cultures of the Baraba forest-steppe and the Lower Ob. Craniometrically, the individual from Krokhalevka-5 burial 33 reveals eastern features. The graphic reconstruction of his appearance demonstrates that he differed from people of the Baraba forest-steppe.

Keywords: **Neolithic, boat burial, Upper Ob basin, radiocarbon chronology, lithic artifacts, funerary rite, facial reconstruction.**

Introduction

Our knowledge of the history of Early and mid-Neolithic Siberia is rather poor. Archaeological finds dating to that period are few, making their classification difficult and the historical reconstructions unreliable. Specifically, the early and middle stages are documented by camps and settlements rather than burials. Comparison of materials from burials and settlements is hampered by the absence of ceramic ware—the most reliable cultural indicator—in graves. Owing to the geographical position, the Upper Ob region was always a convenient natural transport corridor and one of the areas where populations from various landscape zones along the north–south and west–east lines intensely contacted. At the moment, the contacts are most vividly reflected in Final Neolithic materials, specifically, those of the Kuznetsk-Altai culture, having parallels in the Late Neolithic Serovo culture in the Baikal and Angara regions (Anikovich, 1969; Molodin, 1977: 29–30; Kiryushin Y.F., Kungurova, Kadikov, 2000: 51–54; Kungurova, 2005: 51–56). Archaeological evidence of the earlier stages of settling the Upper Ob region

is much scarcer and rather deficient in terms of completeness and preservation, burial practices, and grave goods.

A qualitatively more complete archaeological and skeletal material from Krokhalevka-5 burial 33, as well as results of radiocarbon dating, extend our previously scarce knowledge of the complex pattern of cultural and biological history of the Upper Ob population.

Materials

The site of Krokhalevka-5 is located in the Kudryashovsky archaeological micro-region, in the left-bank area of the Ob River, 21 km north-west of Novosibirsk (Fig. 1). Burial 33 is situated on the edge of an elevated promontory-shaped platform of the first fluvial terrace 9 m high, on the shores of oxbow lakes of the Chik-Chaus river system (distributary channel of the Ob). This part of the site reveals a high concentration of ritual objects dating to various stages. Evidence of a Neolithic burial was recorded after studying Early Bronze Age and medieval graves. At the level of the subsoil, the burial was represented by an oval spot (1.6 × 0.8 m) of light gray sandy loam with large yellow inclusions. The spot was extended along the NNW–SSE line and had indistinct boundaries. Excavations demonstrated its intrusive nature. Initial boundaries of the grave itself at the subsoil level have not been traced.

The grave was 1.5 m deep* (Fig. 2). The pit was primarily filled with mixed medium-dense sandy loam of yellowish-gray color. In the course of excavations, it became apparent that the yellow sandy loam of the encompassing layer is almost identical to the sediment filling the upper horizons of the grave. This caused indistinctness of its boundaries. The transect demonstrated traces of movement of parental soft sediments (layers of sand and aleurite) and the middle portion of the ground filling the pit, in the direction of the terrace slope. Owing to this shift, the western wall of the pit got a negative inclination (Fig. 3, *A*). The middle part of the sediment filling the southern half of the grave contained small coaly spots and fragments of burnt wood.

The contour of the top of the grave pit was nearly oval and measured 1.95 × 0.9 m. At a depth of 1.2–1.3 m, the pit sharply tapered in its center for 0.2 m, and got narrow, subrectangular, irregular outlines. Near the bottom, the northern (head) edge of the pit formed an acute angle (Fig. 3, *B*). Importantly, the coloration of the sediments changed in this part of the grave: the southern part was filled with nonhomogeneous dark gray sandy loam, while the northern part containws brown

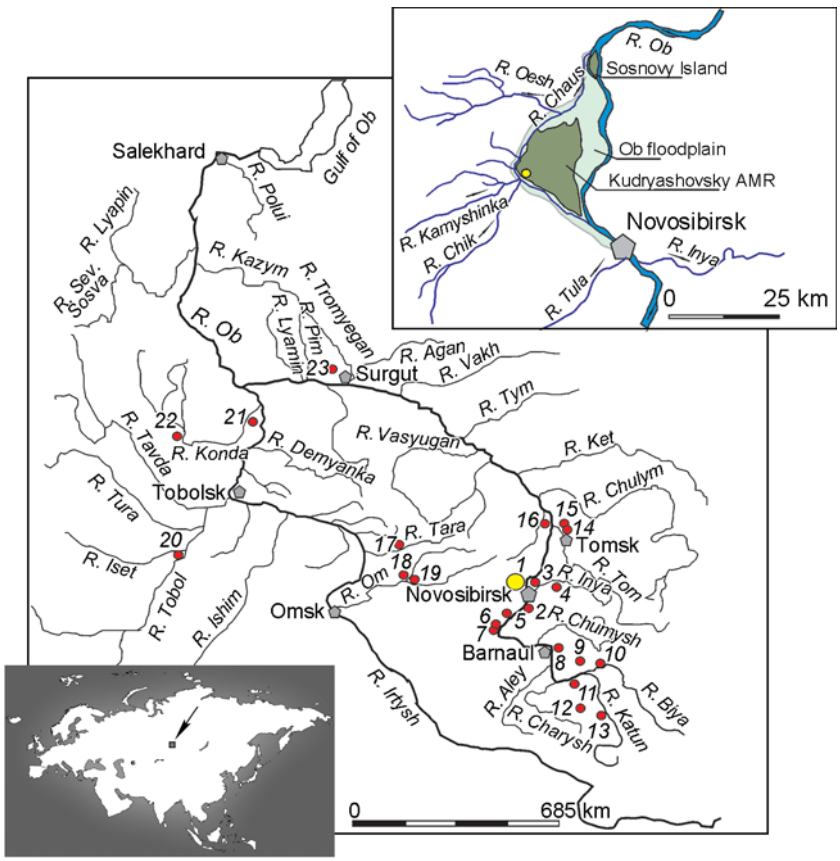

Fig. 1. Location of the sites mentioned in the text, and the scheme of the Kudryashovsky archaeological micro-region.

1 – Krokhalevka-5; *2* – Zavyalovo-2 and -8; *3* – Sedova Zaimka-2; *4* – Zarechnoye-1; *5* – Ordynskoye-1e; *6* – Ust-Aleus-4; *7* – Krutikha-5; *8* – Firsovo XI; *9* – Bolshoi Mys; *10* – Malougrenevo; *11* – Tsygankova Sopka IV; *12* – Kaminnaya Cave; *13* – Nizhnetytkeskenskaya Cave; *14* – Tomsk burial ground on Bolshoi Mys and Staroye Musulmanskoye Kladbishche; *15* – Samus burial ground; *16* – Ishtan burial ground; *17* – Protoka; *18* – Vengerovo-2A; *19* – Sopka-2/1; *20* – Buzan-3; *21* – Chilimka V; *22* – Leushi XIV; *23* – Bystry Kulyegan-66.

*Hereinafter, depths are given from the level of the spot.

Fig. 2. Burial 33 at the level of horizons 6 (*A*) and 7 (*B*).

ground with tiny fragments of unburnt wood, lithic artifacts, and human bones. The bottom part of the pit measured 0.35–0.50 m wide and 2.1 m long, given the negative inclination of the wall in the foot area. The bottom was horizontal and uneven.

The only bones found on the bottom of the pit *in situ* in anatomical order were foot bones of a male aged 25–30 (skeleton No. 1). The position of the skull (without mandible) in the northern part of the pit was evidently close to original, suggesting that

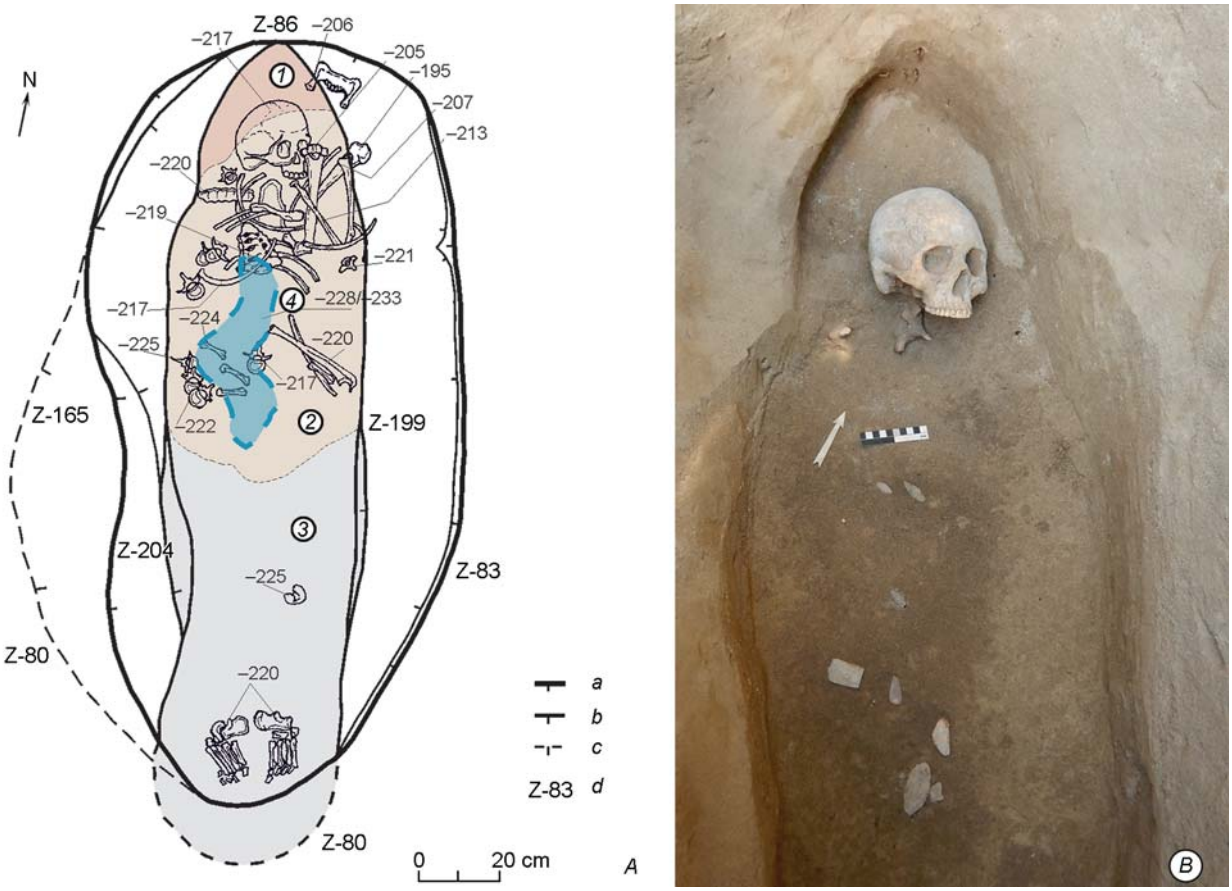

Fig. 3. Plan of burial 33 at the level of horizons 7, 8 (*A*) and the bottom part of the pit at the level of horizon 8 (*B*).

1 – dense, nonhomogeneous, spotted, grayish-brown sandy loam; *2* – homogenous light-brown sand; *3* – nonhomogeneous dark-gray sandy loam; *4* – distribution area of the lithic artifacts.

a – upper contour of the pit; *b* – lower contour; *c* – contour of the pit with negative inclination; *d* – bench mark.

the body had been placed in the supine extended position, head oriented toward NNW. The principal accumulation of disordered bones was discovered in the northern part. In the upper part, pelvic bones and mandible were found. Most long bones were in the upright position, indicating intrusion that had disrupted the anatomical position of skeletal parts, which had already been devoid of soft tissues. Judging by the fact that the bones lay close to one another, these had been simultaneously thrown to the bottom of the looters' hole. A few small bones of skeleton No. 1 (those of hands, vertebrae, and ribs) were found at various levels of the infill. The skeleton was virtually complete, except for both missing femora and the left ulna. In the upper (and to some extent middle) part of the infill, disordered bones of another adult were found (skeleton No. 2), namely left clavicle, fragments of right tibia, a lumbar vertebra, and a fragment of another one (thoracic?). Absence of bones of that skeleton on the bottom of the pit suggests that these had gotten to the infill during or after the looting. The preservation of bones of both skeletons is good.

First grave goods—two stone arrowheads—were discovered 0.3 and 0.1 m above the pit bottom. The rest of them were scattered on the bottom and in the sediment filling the central part of the grave near the bottom, where the concentration of disintegrated bones of skeleton No. 1 was lower. Ten more arrowheads, an adze, and a knife were found there. The artifacts were oriented differently, lay horizontally and disorderly.

Radiocarbon chronology

Two radiocarbon dates, close to each other, were obtained on bones of both individuals. The dates point to contemporaneity of the skeletons within the range of 5209–5047 cal BP (see *Table*). The date for scattered skeleton No. 2 is somewhat older than that for skeleton No. 1; however, this difference in not essential.

Values of $\delta^{15}N$ in collagen of both individuals are high (see *Table*), which is typical of populations oriented primarily toward fishing and hunting mammals. The isotope signal pointing to utilization of river biological resources within the Krokhalevka part of the Upper Ob region determines the influence of the freshwater reservoir effect (FRE) on anthropological materials (Svyatko, 2016). According to results of cross-dating of the organic remains of terrestrial and freshwater origin from the Early Iron Age site of Krokhalevka-11, the difference between the two radiocarbon estimates can amount to 600 years (Z.V. Marchenko, unpublished). Estimating the age of burial 33, we should take this into account and assume that the skeletons may be 600 years younger than the ^{14}C-age suggests (see *Table*). Therefore, the actual ^{14}C-date of burial 33 (based on skeleton No. 1) falls within the first half of the 5th millennium BC (see *Table*). Notably, human bones from Neolithic burials of the Upper Ob, Tomsk, and Altai can likewise be affected by FRE, and the difference between real and estimated radiocarbon age has yet to be assessed. The absence of other organic remains in burial 33 revents us from conducting a direct cross-dating to make sure if FRE is present and, if so, estimating its magnitude.

Grave goods

The grave goods comprise mainly stone tools used for domestic and hunting purposes (biface, arrowheads, adze, and knife).

The biface is leaf-shaped, measuring 70 × 33 mm. It is shaped by irregular marginal retouch (Fig. 4, *1*). The arrowheads are leaf-shaped, with a straight or slightly beveled base, of medium (53–67 mm long,

Radiocarbon dates for Krokhalevka-5 burial 33

Skeleton	Lab code	^{14}C-age, years BP	^{14}C-date (±2 σ), years BC	$\delta^{13}C$, ‰	$\delta^{15}N$, ‰	C : N atom.	^{14}C-age after correction (–600 years) for FRE, years BP	^{14}C-date after correction for FRE (±2 σ), years BC
No. 1	UBA-39724	6 122 ± 42	5209–4945	–23.6	13.4	3.1	5 522 ± 42	4451–4266
No. 2	UBA-39725	6 224 ± 45	5307–5047	–22.9	12.9	3.1	5 624 ± 45	4542–4357

Note: Dates were calibrated using OxCal 4.4 (Bronk Ramsey, 2009) and the IntCal20 calibration curve (Reimer et al., 2020); FRE stands for freshwater reservoir effect.

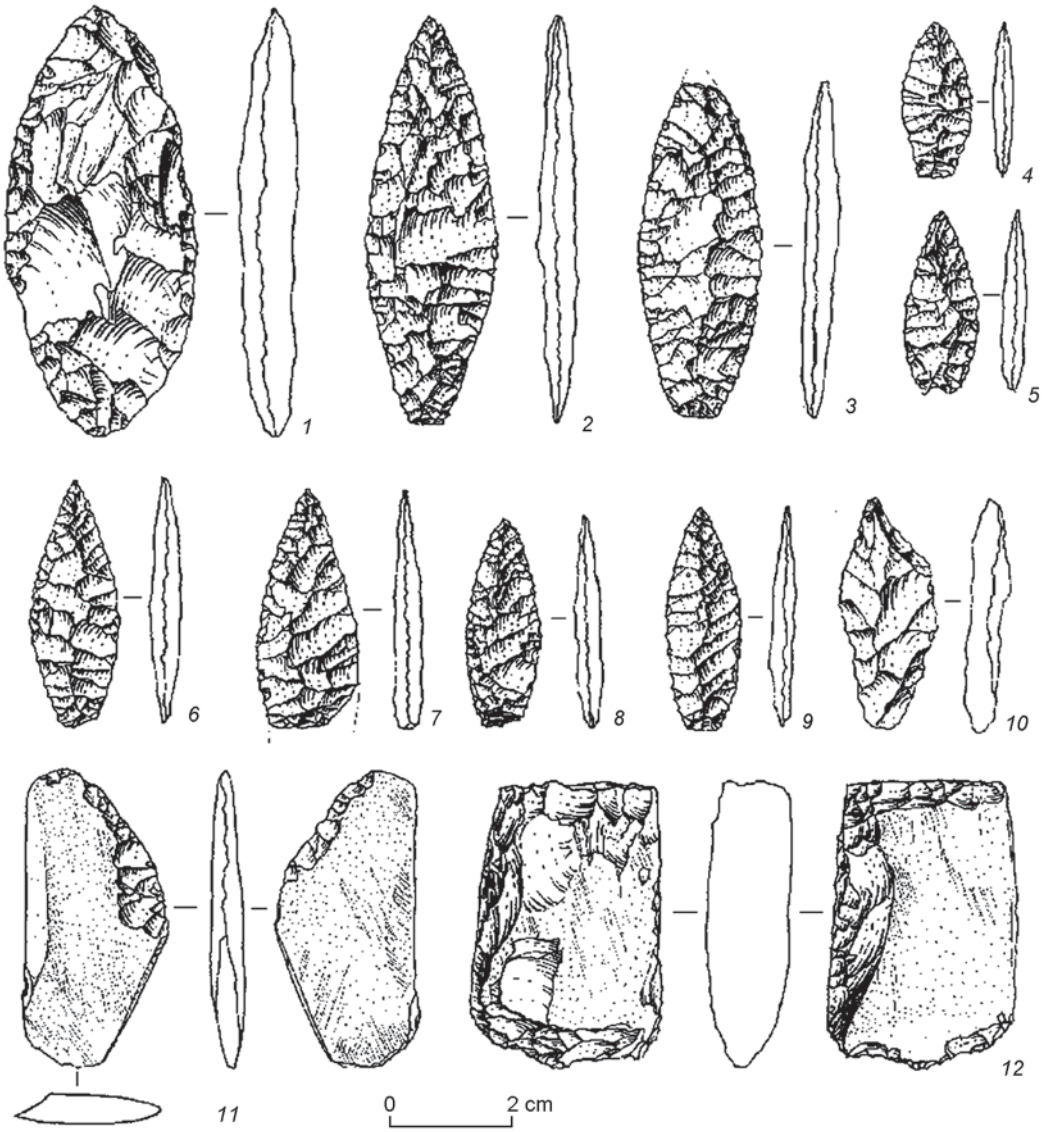

Fig. 4. Lithic artifacts from burial 33.
1 – biface; *2–9* – arrowheads; *10* – borer; *11* – knife; *12* – adze.

22 mm wide, *n*=2) and small (14–42 mm long, 11–17 mm wide, *n*=10) sizes (Fig. 4, *2–9*). Three specimens bear a small notch on the base. It is impossible to determine the character of primary reduction owing to continuous covering retouch.

In the Upper Ob region, the closest parallels to the small and medium-sized arrowheads, as well as to large bifaces, were found at the Late Neolithic sites of Zavyalovo-2 and -8 (Molodin, 1977: Tab. 5; pl. VI, *3*, *8*) and at the Firsovo XI burial ground (Kiryushin Y.F., 2002: Fig. 51). A similar large biface came from Ust-Tartas burial 422 at Tartas-1 in the Baraba forest-steppe (Molodin et al., 2011: Fig. 14, *2*). In the Middle Ob region, leaf-shaped arrowheads of various sizes form a stable component of burial goods at cemeteries such as Tomsk and Samus and from a burial near Ishtan village (Komarova, 1952: Fig. 14, *1–10*; Matyushchenko, 1973: Fig. 11; 1985: Fig. 1, *2*, *6*; 5, *3*; Kosarev, 1974: Fig. 6, *24*, *25*, *28*, *38*; 21, *7*, *9*).

Parallels to the small leaf-shaped arrowheads with a notched base (large ones are less numerous) were found to the south, in Neolithic assemblages of the Barnaul stretch of the Ob (Firsovo XI burial ground), as well as in the Altai Mountains (burial in Nizhnetytkeskenskaya Cave) and their northern foothills (Ust-Isha and Bolshoi Mys burial grounds) (Kiryushin Y.F., Kungurov, Stepanova, 1995: 137, fig. 20; Kiryushin Y.F., Kungurova, Kadikov,

2000: Fig. 24, *3*; 25, *1–6*, *11–13*, *16–18*; 46, *1–5*, *7*; Kiryushin K.Y. et al., 2021: 26–27). Similar types of artifacts, along with large spear-like projectile points and minute subtriangular arrowheads with a notched base, are often found in Kuznetsk-Altai burial complexes (Kungurova, 2005: Fig. 25, *4*; 39, *17*, *18*). Miniature leaf-shaped points can be encountered in the Chalcolithic Bolshoi Mys culture in the forest-steppe Altai (Novenkoye-20, Tsygankova Sopka-4, Malougrenevo) (Kiryushin Y.F., 2002: Fig. 21, *3*; 22, *10*, *11*, *12*, *14*, *15*; 25, *4*, *6*).

The axe-adze is miniature (47 × 31 × 12 mm), polished, and subrectangular (Fig. 4, *12*). Its working edge is heavily worn out and faceted, so it is impossible to determine its shape. The back is straight, wedge-shaped in its cross-section, and shaped by blunting retouch. The closest parallels in terms of technique, morphology, and size can be found among artifacts from the Ob-Irtysh burial grounds of Protoka in the sub-taiga zone (Polosmak, Chikisheva, Balueva, 1989: Fig. 10, *1–3*) and Sopka-2/1, Vengerovo-2A in the forest-steppe zone (Molodin, 2001: Fig. 6, *4*; Molodin, Mylnikova, Nesterova, 2016: Fig. 14, *6*, *10*). Axes and axe-adzes from the Zavyalovo sites, like some similar tools from other Neolithic sites in the Upper and Tomsk regions of the Ob, are somewhat different: these are larger, trapezoid in plan view, and oval in cross-section (Matushchenko, 1973: Fig. 2, 3; Molodin, 1977: Pl. VIII, *1*, *2*). In the Tomsk stretch of the Ob, a series of polished, slightly retouched small and minute adzes of trapezoid and subrectangular shape deserves mentioning (Matyushchenko, 1973: Fig. 4, *5*, *6*; 5, 6; Kosarev, 1974: Fig. 5, *10*). Small polished axe-adzes are also typical of the Middle Neolithic in northwestern Siberia (Poseleniye..., 2006: Fig. 44, 45, *1–6*; Dubovtseva, Klementieva, 2022: Fig. 2, *5*, *6*; 3, *5*, *6*, *13*).

The knife (48 × 23 mm) is double and has the form of a symmetrical subtriangle (Fig. 4, *11*). One edge is straight polished; it forms an inclined surface with the cutting margin. Another edge is fashioned on a slightly convex opposite end with bifacial retouch. The back is straight and polished.

Stone knives in the Neolithic collections of the Upper and Tomsk regions of the Ob are represented both by large retouched specimens and small polished implements with a slightly concave working edge made on blades (Matyushchenko, 1973: Fig. 12; Kosarev, 1974: Fig. 6, *17–20*, *23*; 21, *8*). The latter were found in the Middle Ob region (Samus burial ground and Nagorny Ishtan) (Matuyschenko, 1973: Fig. 12, *8–12*). Miniature polished knives (on shale, aleuralite, aleurosandstone), with a straight blade without retouch on the back, are known from Middle Neolithic collections of northwestern Siberia: burial and dwelling at Chilimka V (Dubovtseva, Klementieva, 2022: Fig. 2, *3*; 3, *3*), Bystry Kulyegan-66 (Poseleniye..., 2006: Fig. 45, *12*, *13*; 46, *5*). A subtriangular implement with a straight though unpolished, but retouched blade was found at the Chalcolithic site of Malougrenevo on the Biya River (Kiryushin Y.F., 2002: Fig. 29, *19*).

A borer made on a fragment of an elongate stone (Fig. 4, *10*) was found 20 cm from the bottom. Its working element in the form of a tang was shaped by several removals on both sides, while the opposite part is modified on one side to make a "stem". A morphologically similar implement, though of a more complex type (end-scraper–borer), was encountered in the collection from Zavyalovo-2 (Molodin, 1977: Pl. VII, *10*).

A miniature drop-shaped pebble (17 × 13 mm) was also found near the bottom of the grave pit. Similar adornments with a hole for hanging are widely represented in Neolithic and Chalcolithic collections from various regions of Western Siberia (see, e.g., (Polosmak, Chikisheva, Balueva, 1989: Fig. 11; Matveev, Zakh, Volkov, 1997; Zakh et al., 2014: Fig. 14, 21, 36; Molodin, Mylnikova, Nesterova, 2016: 39)).

Funerary practice

The fact that the burial was disrupted prevents us from assessing the burial rite in more detail. One can note its individual specificity: supine extended, oriented down the course of the Ob anabranch (in this case, north-north-west), absence of ocher or ceramics, scarcity of lithics, represented by hunting and domestic tools. The grave pit was rather deep (1.5 m), narrowing towards the bottom, with a wall formed by an acute angle in the head zone. The sediment filling the grave contained redeposited fragments of wood: charred in the middle part of the section (possibly the remains of bonfire strewn into the grave) and uncharred in the undisturbed bottom part. Since the bones of both skeletons are well preserved, it can be stated with certainty that the burial contained neither bone or horn tools nor small ornaments typical of significant number of Neolithic burials in the Upper Ob region and contiguous eastern areas (see, e.g., (Marochkin, 2014)).

Single and, less often, double burials in the supine extended position are rather common in Neolithic funerary traditions of southwestern Siberia,

including the Upper Ob region (Molodin, 1977: 25–29; Kiryushin Y.F., Kungurova, Kadikov, 2000: 9–14; Zakh, 2003: 67–70; Kungurova, 2005: 14–17; Marochkin, 2014; Fribus, Grushin, 2017). Quite often, the graves are oriented parallel to the course of the river. Significant depth of grave pits is typical of Neolithic burials of Firsovo XI (from 0.4 to 1.3 m) and Bolshoi Mys (from 1.0 to 1.45 m) (Kiryushin Y.F., 2002: 26). Against that background, the Baraba cemeteries such as Protoka, Avtodrom-1, and Vengerovo-2A are unusual. These were arranged as long-term collective graves: complete bodies or their parts were successively placed into the shallow pit of the main burial tier by tier (Polosmak, Chikisheva, Balueva, 1989: 12–16, 25–30; Bobrov, Marochkin, Yurakova, 2015; Molodin, Mylnikova, Nesterova, 2016)

Noteworthy is a special attitude to human long bones. It is possible that long bones of skeleton No. 1 were taken out intentionally. In Baraba, such practice is evidenced by Tartas-1 Chalcolithic burial 380, where leg bones of at least two adults were placed in a row, and a child skeleton was found on top of them (Molodin et al., 2011: 41).

In our view, morphological traits of the lower part of the grave pit, specifically, of its northern edge, as well as brown soil and small fragments of unburnt wood can be interpreted as remains of a funerary construction resembling a dugout. Judging by specifics of the infill, not the whole boat but only a part of it could have been placed in the northern half of the pit. Its presumable length was 1.12 m, including 0.5 m of the narrower, subtriangular fore part. The maximum width of the "boat" was 0.5 m and 0.35 m in its fore part. Another interpretation of the funerary construction is a treetrunk coffin with a pointed end. In our view, however, in such a case, fragments of wood and brown sandy loam would spread over the entire bottom of the grave, not only in its northern part.

Burials in a pit possibly referring to a boat, or in an actual boat, are quite rare. The chronologically closest parallels are two burials: that at the Leushi XIV site in the area adjoining the right bank of the Konda, and that at the Buzan-3 burial ground in the Ingalskaya Dolina (Ingala Valley) nearby the confluence of the Tobol and Iset rivers. The shape and size of the lower part of the grave at Leushi XIV correspond most closely to the Krokhalevka burial: the pit narrows to 190 × 48 cm towards the bottom and takes the form of a boat with a pointed end and a narrow stern; the infill contains charcoals; and ocher, found *in situ* and resembling the outlines of the human body, like the scarce human remains (teeth), suggest that the position of the deceased was supine extended (Besprozvanny, Starostina, 1986: 35). Distinctive features of the funerary rite included use of ocher, absence of grave goods, and the orientation of the grave perpendicular to the river (though, similar to Krokhalevka burial 33, it was oriented to the north-west). By analogies with the funerary rite documented in burial grounds of the Urals and Western Siberia, the authors dated this burial within the broad interval of the Neolithic to Early Bronze Age.

At the Chalcolithic burial ground of Buzan-3*, remains of a dugout were preserved in a large (6 × 4 m) and deep (2.3 m) pit, in the form of decayed wooden sides with traces of soot, ocher, and resin impregnation of the floor (Matveev, Zakh, Volkov, 1997: 156). The total length of the boat was 5.1 m. The front of the boat narrowed sharply below and formed something like a short keel with a ledge, which, according to the authors, might bear a sculpture (Ibid.). Judging by the photograph (Ibid.: 157, figure), the pit narrowed sharply not only in one end, but also in the center, as in the burials at Krokhalevka-5 and Leushi XIV. No anthropological remains have been preserved. Grave goods included 170 polished round stone pendants from an outfit and several stone arrowheads. According to the authors, the nearby grave also had a distinct boat-like shape and was 4 m long; traces of ocher were found on its bottom.

Notably, in the Middle Neolithic, the boat mythologem was embodied in the Lower Ob ritual clay vessels shaped as boats (Chestyiag and Barsova Gora ceramics) (Neolit..., 1996: 262; Dubovtseva, 2021: 9–10), and petroglyphs showing people in boats were common in the Neolithic rock art of the Tom basin (Okladnikov, Martynov, 1972: 186–187).

During the Early Iron Age, utilization of a boat in funerary practice in the Lower Ob region was documented by Y.P. Chemyakin based on the materials from a Kulaika burial at Barsova Gora (2022). Judging by morphological traits of the burial, Chemyakin concluded that a boat with cut off stern was placed in a shallow grave pit. According to him,

*In the publication, the 14C calendar date of the burial (based on charcoal from the adjacent grave) is estimated at "3190 ± 60 BC" (Matveev, Zakh, Volkov, 1997: 158). The respective absolute date, after adding 1950 years, is 5140 ± 60 BP. The calibrated 14C-date falls within the 4213–3776 BC interval (±2 σ, OxCal 4.4 (Bronk Ramsey, 2009), calibrating curve IntCal20 (Reimer et al., 2020)), so the burial is somewhat younger than Krokhalevka even if FRE is taken into account.

this tradition preserved during the Middle Ages, at the Kintus and Saigatina stages of the Lower Ob culture.

In the 2nd millennium AD, the ritual practice of space passage, connected with a boat, was reflected in funerary rites of people inhabiting different areas of the Ob region. For example, in the first half of the millennium, the Upper Ob people used boat-shaped birch-bark covers for burials, while in the middle Ob region, dugout boats with a cut off stern or frontal part were utilized (Ocherki..., 1994: 230, 283). In the 19th century, Khanty of the Lower Ob still practiced above-ground burials in a boat with a deliberately cut off front and stern (Murashko, Krenke, 2001: 20–21). Cases of an inverted vessel being placed over a grave have also been noted there. The Nenets of the Lower Ob buried the deceased in a boat placed in a shallow pit or on the ground surface, in boat halves set one over another (Ocherki..., 1994: 380). This tradition (burying in boat halves, on the ground surface, or in shallow pits) persisted for a long time among Ugrians and Samoyeds in the Urals and Siberia (Khanty, Mansi, and Nenets) (Semeinaya obryadnost..., 1980: 131, 145). The Selkups buried the deceased in birch-bark or dugout boats placed in shallow pits (up to 0.5 m deep). In East Siberian funerary rites, as far as we know from ethnographic sources, boats were not used.

Discussion

Features of material culture and funerary rite were shared by several Trans-Uralian and West Siberian cultures of the Middle Neolithic. This mostly concerns stone tools (biface, arrowheads, and borer) from burial 33, linking it with nearby sites such as Zavyalovo-2 and -8 on the right-bank Ob near Novosibirsk (Molodin, 1977: Pl. V, *6–9*, *12–18*, *22*, *24*, *26*, *28*; VI, *3*). However, the Krokhalevka collection lacks large polished adzes, end-scrapers on flakes, and blade implements (retouched blades, inserts, and end-scrapers) typical of the Zavyalovo toolkits of the Neolithic Upper Ob culture (Ibid.: Pl. VII–VIII, X). There are more similarities between the polished stone tools from Krokhalevka (small adzes and knives) and materials from the Baraba forest-steppe and the Lower Ob (Polosmak, Chikisheva, Balueva, 1989: Fig. 10, *1–3*; Molodin, 2001: Fig. 6, *4*; Poseleniye..., 2006: Fig. 44, *2–6*; 45, *1–8*; 46, *4*, *5*). No doubt, certain parallels in various lithic industries of different southern regions of Western Siberia indicate close ties and similar subsistence strategies, including those relating to stone raw material procurement.

Similarity between the Krokhalevka burial and that of the Kiprino period near Ordynskoye village is noted in the use of remains of combustion products: thick pile of coals at Ordynskoye and traces of coal in the middle of southern part of the destroyed infill at Krokhalevka. However, there are also significant differences: different shapes of burial pits, absence of ceramics in the Krokhalevka burial, and somewhat different composition of the grave goods from Ordynskoye (pendants of bear teeth, knife-shaped blades, and flakes). Covering of the deceased with coals was recorded in the Neolithic burial at Kaminnaya Cave (Markin, 2000: 55). The use of fire in rituals, including secondary cremation, was documented for Neolithic sites in the Tom region of the Ob and for Chalcolithic and Neolithic sites on the Konda River (Komarova, 1952: 12; Klementieva, Pogodin, 2020: 132, 136).

The use of boats or their parts in the funerary rite is exceptional in the Trans-Uralian and West Siberian Neolithic, but this may be partly due to the scarcity of excavated Neolithic burials and the poor preservation of organic materials. However, the existence of such practice among the Ugrians and Samoyeds attests to its archaism and its wide distribution in the past, primarily among the Ob peoples.

The comparative typological analysis of lithics reveals similarities with sites situated primarily along the Ob, from its upper stretch in the Altai Mountains (Nizhnetytkeskenskaya Cave) to the Lower Ob, as well as along the rivers of the Ob-Irtysh basin. The fact that Krokhalevka burial 33 correlates with the Middle Neolithic (Zavyalovo stage of the Upper Ob culture, see above) does not contradict the results of radiocarbon analysis: if FRE (600 years) is taken into account, this complex can date to the mid-5th millennium BC. Within the same chronological framework, there existed traditions of the Middle Neolithic of the Lower Ob (second half of the 6th to first half of the 5th millennia BC) (Dubovtseva, 2021), whose ceramic and lithic artifacts (Bystrinka culture and Chestyiag settlements) are partially comparable with those in the Novosibirsk Ob region.

Thus, the grave goods and funerary rite of Krokhalevka burial 33 reflect to a greater extent the regional Upper Ob specifics associated with the Trans-Uralian and West Siberian populations.

At the same time, cranial features of the Krokhalevka man suggest affinities with East Siberians rather than with inhabitants of the Baraba

forest-steppe (Chikisheva et al., 2024). This is evidenced by facial reconstructions of the Neolithic people of southwestern Siberia (Fig. 5) (Chikisheva, Pozdnyakov, 2021: Fig. 8–11). Individuals cranially closest to Krokhalevka are those from the Salair region (Zarechnoye-1, mound 4, burial 6) and from the southern Upper Ob (Firsovo XI, burial 9). However, these three Neolithic burials differ in terms of archaeology. For example, Zarechnoye-1 burial contained a round-based vessel and a bone point; the pit was subrectangular and shallow (0.57 m) (Zakh, 2003: 69–70). An artifact common to both Zarechnoye-1 and Krokhalevka is a small polished axe-adze. Regrettably, burial 9 of the Firsovo XI burial ground has not been described in detail (Kiryushin Y.F., 2002: 26–28; Kiryushin K.Y. et al., 2021: 21, fig. 1). We can only presume that its similarity with the Krokhalevka burial was in the considerable depth of the grave pit and in the absence of ceramics. All three burials are single, and the position of buried persons is supine extended.

At first sight, archaeological observations disagree with skeletal ones. But the rates of cultural and biological evolution differ, the former being more rapid. A closer look at physical features of the Krokhalevka man and its comparison with other known individuals suggests that all the three males (Krokhalevka, Zarechnoye-1, and Firsovo XI) may have common ancestors, specifically displaying an evolutionarily conservative physique and some eastern admixture (Chikisheva et al., 2024). At the same time, one cannot rule out that Neolithic populations of Western Siberia, especially those of the Upper Ob, were much more variable than it appears at present. Their origin, too, might differ, which would account for the observed biological and cultural heterogeneity.

If we presume that part of the Upper Ob population had rather recently (in the late 6th to mid-5th millennium BC) migrated from East Siberia, then we should deal with the fact that its culture had undergone a considerable transformation. Notably, at the later stage of the Neolithic (Serovo), in the 4th millennium BC, cultural ties between Western Siberia and the Angara-Cis-Baikal area become more evident in the Kuznetsk-Altai culture.

Conclusions

The "boat" burial at Krokhalevka-5 extends our knowledge of cultural and biological diversity of the Neolithic Upper Ob population. Cranial features of the buried man indicate eastern origin of certain populations of that region. Cultural elements, however, reveal local ties. Possible reasons are adaptation to local raw material resources and contacts with neighbor western and southern Siberians. The cultural parallels document the primary direction of ties—with neighboring populations of the Barnaul-Biysk stretch of the Ob and the Altai Mountains, to a lesser extent with those of the Baraba forest-steppe and northwestern Siberia. Scarcity of archaeological and skeletal data on Western and Southern Siberia and of radiocarbon dates prevents us from making a detailed assessment of the chronology and intensity of these processes.

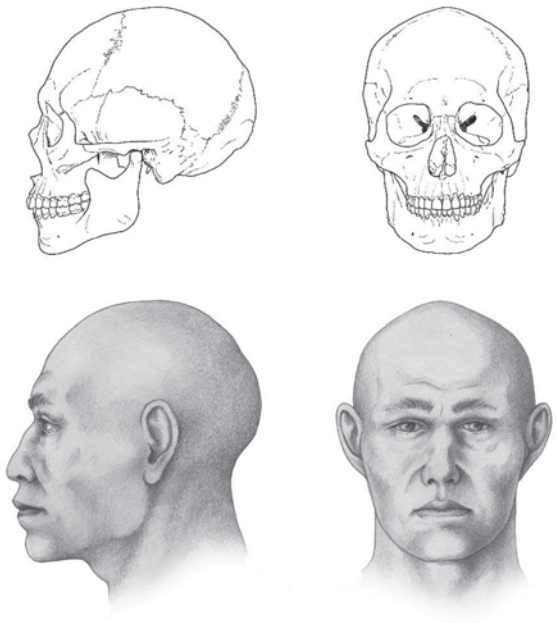

Fig. 5. Graphic facial reconstruction of the man 25–30 years old from Krokhalevka-5 burial 33. Reconstruction by D.V. Pozdnyakov.

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A Study of Seima-Turbino Bronze Artifacts Discovered in China

We describe Seima-Turbino artifacts from museum collections and sites in China—two spearheads from the Gansu Provincial Museum and two daggers from the Tianshui Museum. The composition of metal was analyzed. Spearheads are made of copper with minor additions, and daggers are made of bronze. The shape of the latter is identical to that of the specimens from Sopka-2/4B. Their type and technology suggests that they were not made by people of the Qijia culture, but were imported by the Seima-Turbino people. Typology and chronology of daggers and spearheads from China are examined. Parallels with those from Western Siberia are listed. We conclude that ties between the cultures of Qijia and Seima-Turbino date to 2200–2000 BC, and the origin of metallurgy in China was intrinsically linked to that phenomenon.

Keywords: **Tianshui, spearheads, daggers, Qijia culture, Seima-Turbino phenomenon, chemical composition.**

Introduction

Seima-Turbino remains are widely distributed throughout the Eurasian steppes and are renowned for their advanced casting techniques and unique metal products. Celts, spearheads, daggers, and knives are frequently discovered in Seima-Turbino burial sites, all of which are highly recognizable. In recent years, researchers in China have continuously discovered, identified, and discussed celts and spearheads associated with the Seima-Turbino phenomenon (Saiyima-tuerbinnuo wenhua..., 2019; Shao Huiqiu, 2021). Through investigation, we have found that the Gansu Provincial Museum collects two spearheads of Seima-Turbino type, and the Tianshui Museum two daggers of this type. In this study, we employed a handheld XRF fluorescence analyzer to conduct a metal composition analysis of these four Seima-Turbino metal artifacts. By examining their properties and casting techniques, the research aims to explore the interaction and exchange of Seima-Turbino artifacts and casting technology in the eastern Eurasian continent.

Methods and samples

The alloy composition of two spearheads and daggers was analyzed using a handheld X-ray fluorescence (XRF) analyzer from Thermo Scientific, the Niton XL3 series. The detection mode was "Metal→ →Standard Element", and the testing time for each point was about 30 seconds. Valid data points were obtained from the midrib of each spearhead, various locations on the blade, the bottom of the socket, and

the edges of the barb and loop. The detection points of two daggers were distributed in the middle of the dagger body and on both sides of the handle.

Spearhead No. 47922, Gansu Provincial Museum. This spearhead was collected by Gansu Provincial Museum in the 1990s from a village near Lanzhou city. It has a total length of 38.9 cm, with the widest part of the spearhead measuring 13.5 cm and the diameter of the socket being 4.2 cm. The spearhead is characterized by a wide leaf-shaped blade with a rounded and blunt tip, a midrib, and a broad barb and a loop located on opposite sides of the socket. At the lower end of the socket, there are three parallel raised chords 0.1 cm wide, and a nearly square-shaped hole about 1.5 × 1.5 cm in size. The loop is flat on one side and convex on the other, with a small piercing ca 1 mm in diameter (Fig. 1). The spearhead is intact, and shows no signs of chopping or cutting. Additionally, a casting core is observed inside the socket, which is different in color (grayish-green) from ordinary clay. The texture of the core is hard, with evidence of burning.

Based on analysis, this spearhead is made of copper with small amounts of impurities such as arsenic, iron, and bismuth (Cu-As-Fe) (see *Table*).

Spearhead No. 12308, Gansu Provincial Museum. This spearhead was collected in 1957 by Gansu Provincial Museum from a market in Lanzhou city. It is in good condition and has a total length of 35.1 cm, with a maximum width of 11.7 cm and the diameter of the socket 4.0 cm. The spearhead has a narrow leaf-shaped blade with a midrib. Its barb is broken and still retains the marks of the break. The cross-section of the barb is diamond-shaped. The barb and the loop are located on opposite sides of the socket. There are three parallel raised chords at the lower end of the socket, which are 0.3 cm wide, and three parallel raised chords on the upper end, which are ca 0.1 cm wide. The blade has several notches and even some rolled edges, indicating that it was likely used for chopping or cutting (Fig. 2). Additionally, casting core is observed inside the socket, which is different in color (grayish-green) from ordinary clay. The texture of the core is hard, with evidence of burning.

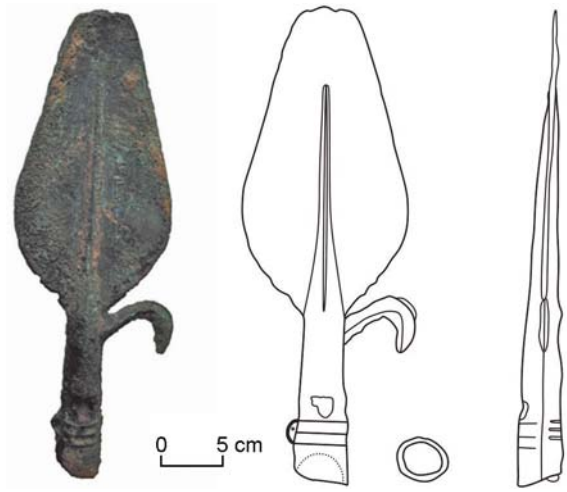

Fig. 1. Spearhead No. 47922, Gansu Provincial Museum.

Upon analysis, the spearhead was found to be composed of copper, with trace amounts of impurities such as lead, iron, and bismuth (Cu-As-Ag) (see *Table*).

Dagger No. 1, Tianshui Museum, Gansu. The dagger measures 24.7 cm in total length, with a blade length of 15.3 cm and a maximum width of 3.6 cm. The handle is 9.4 cm long and 2.4 cm wide, with a handle-blade connection width of 2.6 cm. The dagger body is narrow and elongated, with a rounded and blunt tip in the shape of a willow leaf. The handle of the dagger protrudes on both sides, with a concave center and an I-beam section. There are small holes at both ends of the handle: one of a circular shape and a diameter of 0.2 cm near the dagger body, and the other of an irregular shape with a length of 1.5 cm and a width of 0.5–0.8 cm at the other end (Fig. 3, *1*).

The analysis has shown that dagger No. 1 is composed of bronze (Cu-Sn) (see *Table*).

Dagger No. 2, Tianshui Museum, Gansu. The dagger measures 21.3 cm in total length, with a blade length of 10.9 cm and the maximum width of 3.4 cm. The handle is 10.4 cm long and 2.3 cm wide, with a handle-blade connection width of 2.6 cm. The dagger body is narrow and elongated, with a rounded and blunt tip in the shape of a willow leaf.

Elemental composition of the spearheads and daggers, wt%

Sample	Cu	As	Fe	Ag	Sn	Pb	Other
Spearhead 47922	97.05	0,73	1,59	–	–	–	0.63
Spearhead 12308	94.72	0.38	–	1.72	–	–	3.18
Dagger 1	85.87	0.147	–	–	12.712	0.098	1.173
Dagger 2	75.553	0.033	–	–	21.369	0.28	2.765

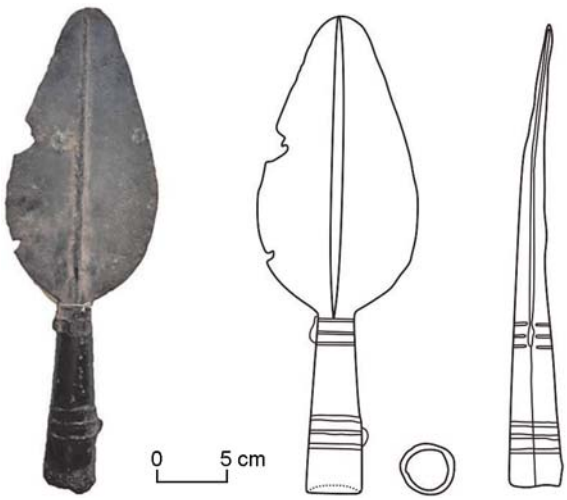

Fig. 2. Spearhead No. 12308, Gansu Provincial Museum.

Fig. 3. Daggers No. 1 and 2, Tianshui Museum, Gansu.

The handle of the dagger protrudes on both sides, with a concave center and an I-beam section. There are oval holes at both ends of the handle: one with a length of 0.8 cm and a width of 0.5 cm near the dagger body, and the other measuring 0.8 × 0.7 cm at the other end (Fig. 3, *2*).

The analysis has shown that dagger No. 2 is composed of bronze (Cu-Sn) (see *Table*).

Typology and chronology of spearheads

To date, a total of 16 Seima-Turbino type spearheads have been discovered in China, including one from Shenna site (Qinghai Province), one collected by Datong County Cultural Relics Management Office (Qinghai), two by Gansu Provincial Museum, one by Shaanxi History Museum, four from Xiawanggang site (Xichuan, Henan Province), one collected by Shanxi Museum, one by Shanxi Arts and Crafts Museum, one by Chaoyang Cultural Relics Management Office, one by National Museum, and three by Nanyang Museum. Additionally, a piece of barb with a diamond-shaped cross-section and a ridge in the middle was unearthed in the third phase of the Xiawanggang site in Xichuan (Xichuan Xiawanggang..., 1989: 298–299). This fragment was similar to the barbs from Shaanxi History Museum, Gansu Provincial Museum, and Nanyang Museum collections.

Typology. Based on the shape of the spearheads under study, they can be divided into two types.

Type A has a leaf with barb and ring on the same side. The tang of the spearhead is forked at the connection with the base of the spearhead leaf, forming a fork-shaped ridge. This type of spearhead is very similar to those found at the Turbino and Rostovka cemeteries and is believed to have been directly introduced by the Seima-Turbino people. This fact provides favorable evidence for the cultural ties between the Seima-Turbino and Chalcolithic archaeological cultures in China. Two spearheads of type A have been found: one is kept in Shanxi Arts and Crafts Museum and the other in Chaoyang Cultural Relics Management Office in Liaoning.

Type B has a wide leaf with a ridge running through the center of the leaf. The socket has a barb on one side and a ring on the other side. Three raised cords are at the lower end of the socket. There are currently 14 spearheads of type B found, mainly distributed in Gansu, Shaanxi, Shanxi, and Henan provinces. As compared to type A spearheads, those of type B have wider leaves, which change from narrow willow-shaped to wide leaf-shaped, and have a blunt and round tip, which lost its practical combat function. The fork-shaped ridge disappears and becomes a central ridge, and the barbs and rings of most type B spearheads are on different sides of the socket.

The analysis of metal composition has shown that the Seima-Turbino spearheads kept in the Gansu Provincial Museum are copper. Spearhead No. 12308 contains 1.72 % silver, which distinguishes it from other Seima-Turbino spearheads discovered

in China. A certain proportion of silver is found in some spearheads, daggers, and celts excavated from Turbino cemetery. This proportion demonstrates significant fluctuations, sometimes exceeding 50 %, while artifacts with lower silver content make up around 1 % (Chernykh, 1970: 127–171). The Cu-Ag alloy metal items were found only at Seima-Turbino sites. Therefore, there is a close connection between the spearhead No. 12308 and the metal artifacts from Turbino cemetery.

According to statistics, 9 copper spearheads (56.3 % of the total number of items from this category), 5 arsenic-copper spearheads (31.3 %), and 2 bronze spearheads (12.4 %) have been discovered within China. The spearhead from Liaoning is very similar to that from Rostovka cemetery, both in appearance and in metal composition. This suggests that type A spearheads were directly imported from Western Siberia. However, unlike the Rostovka specimen, the Liaoning spearhead did not undergo secondary processing and grinding.

Chronology. During excavations in China, 5 spearheads of the Seima-Turbino type were discovered: 1 from Shenna site in Qinghai Province, and 4 from Xiawanggang site in Xichuan in Henan Province. In addition, the latter site yielded the above-mentioned copper barb.

The Xiawanggang spearheads pertain to the settlement complex where pit XWGT2H181 was investigated in 2008, in the northeast of square T2. The pit was recorded in layer 4.B and breaks through layer 5. It is nearly circular in plan view, 0.5 m deep, with a mouth diameter of 1.15 m. The filling consists of two distinct layers: the lower one is soil light gray in color, while the upper one is composed of a large number of blocks of red-burnt clay, stones, and hard soil. Four spearheads were found at the bottom of the pit, stacked and adhered together. Three of them were oriented with their points to the west, and one to the east. The filling contained a small amount of pottery shards of Longshan and Yangshao cultures (Xichuan Xiawanggang, 2020: 195–196). The pit was intentionally dug out to bury the four spearheads and then reinforced and sealed with red-burnt clay and hard soil stones (Gao Jiangtao, 2009). Gao Jiangtao believes that the sediments enclosing the pit were formed over a very short period of time in a broad stratigraphic horizon. The cultural layer of Xiawanggang site contains artifacts from three stages: the Late Longshan culture, Erlitou culture, and Western Zhou period. Gao attributes the four spearheads to the Late Longshan culture (Gao Jiangtao, 2015).

According to the ^{14}C dating data and the stratigraphic sequence of sediments, the Longshan materials at Xiawanggang were attributed to the period of approximately 2200–1880 BC (Xichuan Xiawanggang..., 2020: 589–602).

A copper barb (T15② A:39) 3.8 cm long was unearthed from the layer of Erlitou culture at Xiawanggang (Xichuan Xiawanggang..., 1989: 298), underlain by Longshan cultural layer. During the excavation works, the barb could have been displaced. Regardless of the actual situation, the barb belongs to the period earlier than the third phase of the Erlitou, i.e., 1610–1555 BC (Zhongguo kaoguxue..., 2003: 80–81).

During the 1991–1993 works at the Shenna site (Wang Guodao, 1995), a Seima-Turbino spearhead was discovered. It was attributed to the Qijia culture.

The third phase of the Erlitou culture is dated to 1610–1555 BC, while the main period of the Qijia culture and the late period of the Longshan culture pertain to 2000 to 1600 BC (Zhongguo kaoguxue..., 2003: 535–557). In summary, the Seima-Turbino spearheads discovered in China date back to approximately 2000–1600 BC.

Typology and chronology of daggers

The number of daggers unearthed at Seima-Turbino sites is far less than that of spearheads. Based on the shape of the handle and blade, daggers can be classified into three types: A, B, and C (Fig. 4).

Type A. The handle is trapezoidal in shape, occupies about half of the entire length of the dagger, and is slightly shorter than the blade. It is decorated with simple lines or triangles. The blade is leaf-shaped and waisted. Dagger of this type have been discovered at the cemeteries of Seima, Reshnoye, Pesochnoye, and at the sites of Iset I, Irbitskoye Ozero, and Shaitanskoye Ozero II.

Type B. The handle is trapezoidal or rectangular in plan view, is significantly shorter than the blade, and occupies about one-third of the dagger's length. It is decorated with vertical grooves or perforated triangles, sometimes with animal images. Parallel lines are often used to adorn the junction between the handle and the blade. The blade has willow-leaf shape. The upper part of the blade has the same width as the handle. Such daggers have been discovered at the Seima cemetery, near Perm, and in the Galich hoard.

Type C. The handle is rectangular in shape, with two protruding sides and a concave middle section.

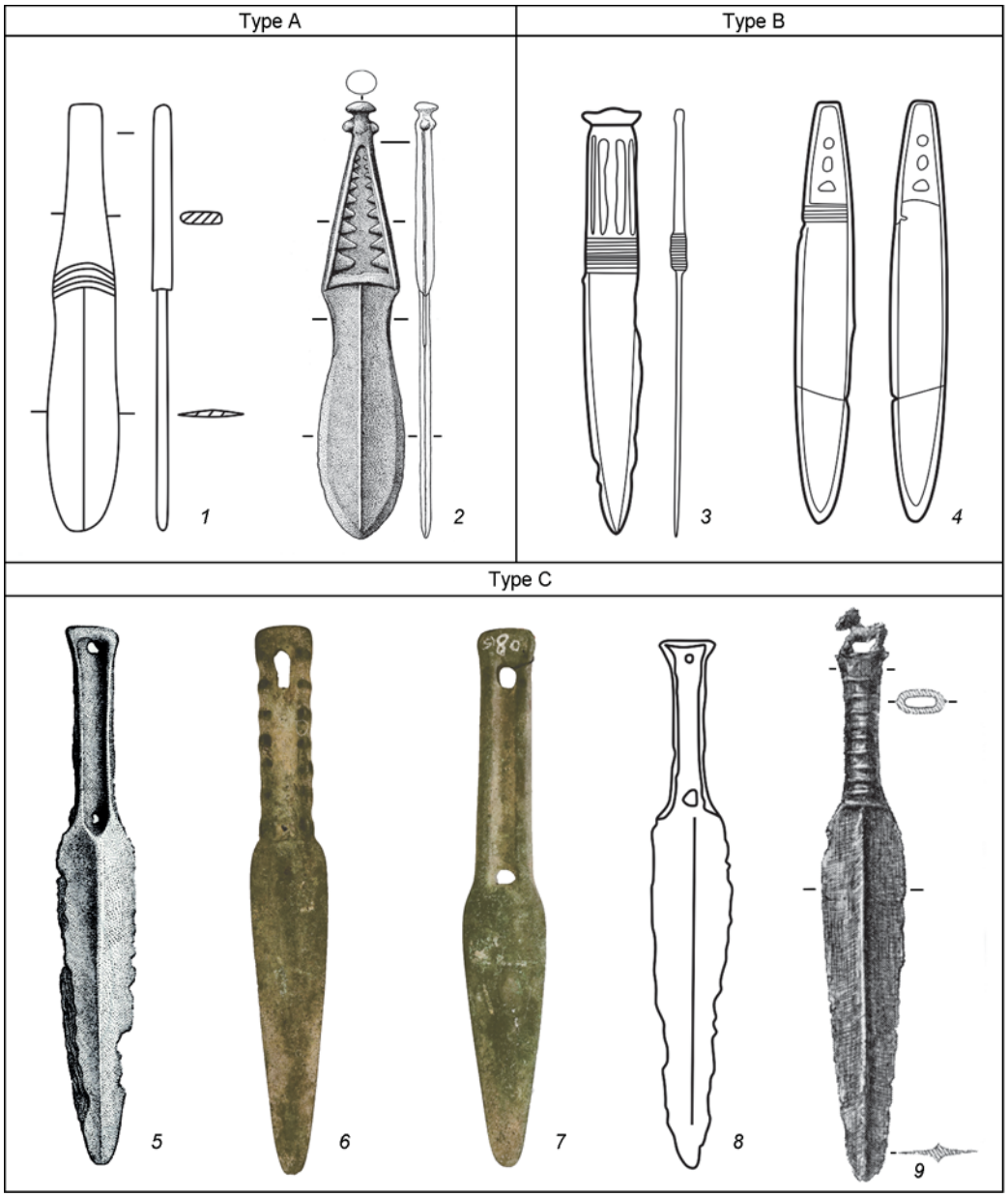

Fig. 4. Daggers of the Seima-Turbino type.
1 – Reshnoye cemetery; *2* – Shaitanskoye Ozero II; *3*, *4* – Seima cemetery; *5* – Sopka-2/4, burial 420; *6*, *7* – Tianshui Museum, Gansu; *8* – Ili valley, Xinjiang; *9* – Karakol hoard.

The cross-section resembles an I-beam. Perforations are often present at both ends of the handle, and the blade has an evident longitudinal ridge. The three most representative examples were unearthed in burials 420, 425, and 443 at the Sopka-2/4B cemetery (Molodin, 1993). Identical daggers have also been found at the Second Karakol hoard on the eastern shore of Issyk-Kul Lake (Vinnik, Kuzmina, 1981), in Charyshskoye of the Altai Territory (Kiryushin, Shulga, Grushin, 2006; Kovtun, 2013: Ph. 161–162), in the Yenisei Governorate in Russia (Chlenova, 1976: Pl. 8, *22*; Kovtun, 2013: Pl. 111, *7*), and in Tianshui, Gansu Province in China (listed above). In addition, in the Ili River valley, Xinjiang, a dagger with unclear cross-section was discovered (Li Suyuan, 2014), but judging from its shape it undoubtedly belongs to type C. Other daggers have been found in Kurshim and Semey (Semipalatinsk) in eastern Kazakhstan, and in Zmeinogorsk in Russia (Altai..., 2006). In their appearance, these daggers show parallels to those with I-beam section handles from Sopka-2/4B: narrow and elongated, with perforations or horizontal

parallel raised cords on both ends of the handle, and the dagger's head embellished with a standing animal. The distinguishing feature of this type of dagger is the elliptical cross-section of the handle (Fig. 4, *9*), and its distribution area is slightly more southern, indicating a regional variation (Molodin, 2015) (Fig. 5).

The daggers of type A have been discovered at the cemeteries of Seima, Reshnoye, at the sites of Iset I, Irbitskoye Ozero, and Shaitanskoye Ozero II. This points to their distribution primarily to the west of the Ural Mountains. This region is the western outskirts of the Seima-Turbino transcultural phenomenon. The blade of this type of dagger (slightly narrowing near the handle and widening downward, with a central ridge) is similar to daggers of the Abashevo culture. The only difference is that Abashevo daggers have no handle. Metal composition analysis has revealed that daggers of type A are mostly made of bronze with tin content up to 12.18 % and a small amount of copper. (Grushin et al., 2006; Lunkov, Orlovskaya, Kuzminykh, 2009; Lunkov, Kuzminykh, Orlovskaya, 2011, 2013; Chernykh, Kuzminykh, 1989: 218–238).

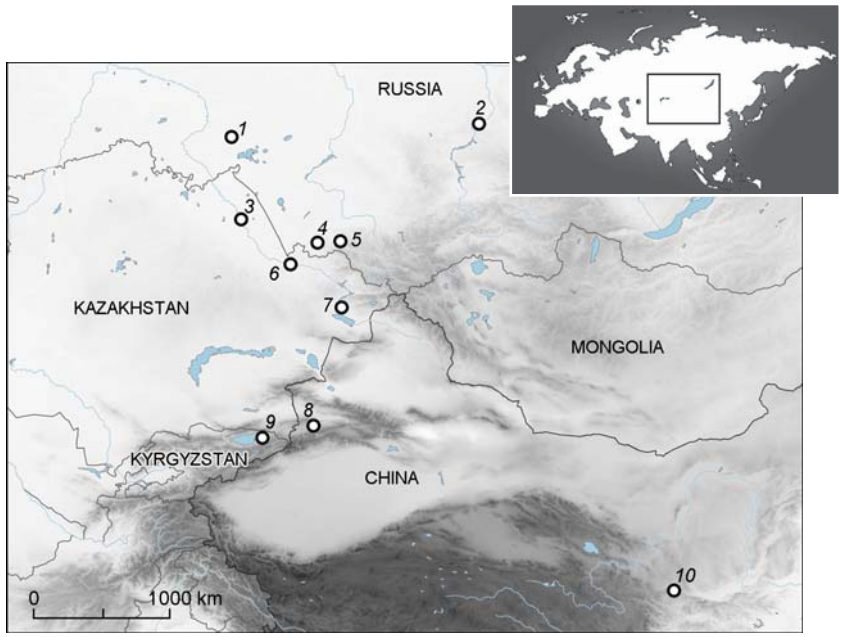

Fig. 5. Distribution of daggers of type C.
1 – Sopka-2 cemetery; *2* – Yenisei Governorate; *3* – Pavlodar; *4* – Zmeinogorsk; *5* – Charyshskoye; *6* – Semey (Semipalatinsk); *7* – Kurshim; *8* – Ili valley, Xinjiang; *9* – Karakol; *10* – Tianshui, Gansu.

Daggers of type B have been found in the Seima cemetery, near Perm, and in the Galich hoard. As compared to daggers of type A, the daggers of type B have shorter handles, their blades near the handles do not narrow and have no central ridges. Such artifacts are also discovered in the Abashevo materials. Fewer daggers of type B have been analysed, and they are mainly made of bronze (Cu-Sn) or arsenic-copper (Cu-As) alloys (Chernykh, Kuzminykh, 1989: 297–298).

Daggers of both types A and B are concentrated in the western region of the Seima-Turbino distribution area, and may be closely related to the Abashevo culture; those of type C are primarily found in the eastern region of this area.

Two daggers collected in the Tianshui Museum, as well as the daggers unearthed at Sopka-2/4B, belong to type C. Their handles have I-beam section with grooves and perforations. Daggers from Sopka-2/4B, in the longitudinal grooves of their handles, have revealed the remains of decayed wood; and the dagger unearthed from burial 425 had a piece of leather wrapped around its handle. This suggests that the grooves were used to place wooden planks therein, to give volume, and then the handle was wrapped with a strap. The strap was fastened using perforations, and if these were absent, the unevenness on both sides of the handle's first section was used to hold the leather through the grooves (Molodin, 2015) (Fig. 6, *1*). The two daggers from the Tianshui Museum have grooves or perforations on their handles, which likely have been used for the same purposes.

Li Suyuan once classified the dagger found in the Ili valley (Fig. 6, *2*) as a spearhead typical of the Andronovo culture (2014). However, in fact, such metal artifacts are Seima-Turbino daggers of type C, similar in shape to daggers found in Semipalatinsk and other places. The dagger excavated from the Zhukaigou site in Inner Mongolia has a perforation at the handle wrapped with hemp rope (Tian Guangjin, 1988). It has a similar shape to the daggers from Sopka-2/4B and possibly demonstrates the influence of the Seima-Turbino traditions. Its decoration in the form of grid imprint is a regional feature of the Ordos (Lin Yun, 2011) (Fig. 6, *3*).

The Seima-Turbino remains are dated to approximately 2200–1900 BC, with the finds from

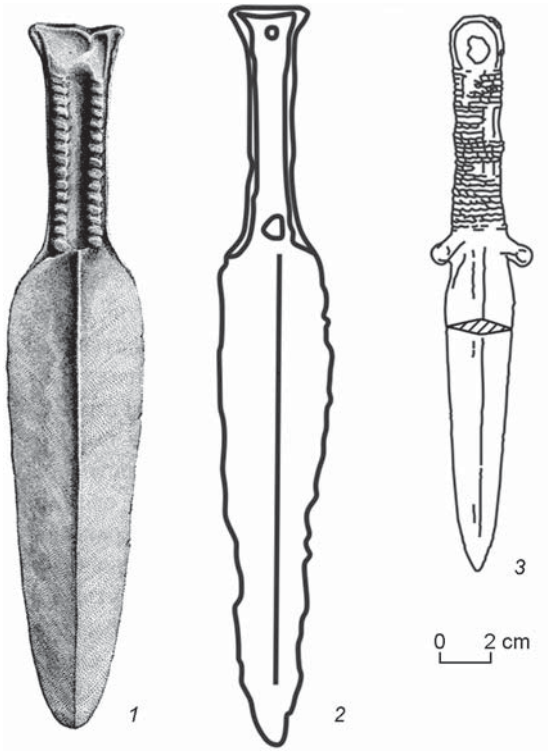

Fig. 6. Daggers from Sopka-2/4B, burial 425 (*1*), Ili valley in Xinjiang (*2*), and Zhukaigou site, burial 1040 in Inner Mongolia (*3*).

the Sopka-2/4 cemetery being the earliest among the known daggers of this type (Marchenko et al., 2017). Typological analysis suggests that the daggers with handles excavated from this cemetery may represent the most primitive form of Seima-Turbino daggers (Kovtun, 2016). Therefore, the daggers of type C are dated to around 2200 BC. For comparison, the Qijia culture in the Hexi Corridor is estimated to have existed between 2000–1600 BC (Yang et al., 2019), while the Longdong region, where Tianshui city is located, saw the formation of the Qijia culture around 2200 BC (Jia et al., 2013). Consequently, the two daggers of type C kept in the Tianshui Museum, similar to those from Sopka-2/4B, are believed to date to 2200 BC or later.

Interaction between the Qijia and the Seima-Turbino cultures

The Qijia culture materials show parallels to Seima-Turbino artifacts. According to L.G. Fitzgerald-Huber, the single-eared celt and the arched-back knife found at the Xinglin site in Min County, Gansu Province, as well as the bone-handled bronze knife and bronze awl unearthed at the Huzhuzongzhai site in Qinghai Province, and the strip-shaped metal artifact excavated at the Huangniangniangtai site in Wuwei, demonstrate similarities in typology with artifacts from Seima-Turbino sites. The triangular patterns on the middle of the strip-shaped metal artifact from Huangniangniangtai are identical to those on the handle of a dagger of the Seima-Turbino type. It cannot be ruled out that this artifacts can be a part of such a dagger (Fitzgerald-Huber, 1995). Additionally, C. Debaine-Francfort suggests that the celt from the Qijiaping site is similar to those celt from Seima-Turbino sites (1995: 269–299). V.I. Molodin compared the spearhead from the Shenna site in Qinghai with those from Seima-Turbino sites, and suggested that cultural exchange existed between the Qijia culture and the Seima-Turbino communities (Molodin, Komissarov, 2001). Mei Jianjun also argues that the bone-handled knife from the Weijiataizi site (Gansu) and the spearhead from the Shenna site are similar to the Seima-Turbino relics (Mei Jianjun, Gao Binxiu, 2003).

Three barbed spearheads (one from collection of the Cultural Relics Management Office in Datong County, Qinghai Province (Liu Xiang, 2015), and two from the Gansu Provincial Museum) and two daggers (from the Tianshui Museum) of the Seima-Turbino type are the evidence of the fact that the Qijia culture was deeply influenced by Seima-Turbino traditions. The prefecture-level city of Tianshui, located in the southeastern part of Gansu Province, in the western section of the Qinling Mountains, is part of the eastern distribution area of the Qijia culture. The Qijia remains found at the Shizhaocun site in Tianshui exhibit earlier features than those from archaeological sites in central and western Gansu (Zhao Xin, Ye Maolin, Tian Fuqiang, 1990). The academic circles generally agree that the Qijia culture originated in the Longdong region (Wang Hui, 2012). Therefore, it is possible that during the early formation stage of the Qijia culture and Seima-Turbino remains, there was communication between Western Siberia and the eastern Hexi Corridor.

Metal component analysis indicates that Qijia metal artifacts were made of pure copper, arsenic-copper, and bronze. Metallographic analysis shows that these were produced using both casting and forging methods (Xu Jianwei, 2010: 56–58). Notably, bronze artifacts found at the sites of Zongri, Gamatai, and Mogou are primarily small objects such as beads, earrings, and tube-shaped ornaments, produced by forging. Conversely, pure copper artifacts discovered at the

sites of Huangniangniangtai, Qijiaping, Zongri, Gamatai, and Xinglin were mainly cast and include knives and celts (Guo Deyong, 1960; Sun Shuyun, Han Rubin, 1981; Xu Jianwei, 2010: 56–58; Wang Lu et al., 2022; Yang Yimin, 1985; Liu Rui, Gao Jiangtao, Kong Deming, 2015) (Fig. 7). Thus, the traditional metal artifacts processing techniques of the Qijia culture involve forging small tin-copper decorative items and casting large practical copper items. Two bronze-cast daggers from the Tianshui Museum do not conform to this tradition.

A significant characteristic of Seima-Turbino metal artifacts is the use of Cu-Sn alloys (Chernykh, Kuzminykh, 1989: 178–192). Tin-copper and tin-arsenic-copper products absolutely dominate in the eastern region of this culture. The daggers of Seima-Turbino type cast in tin-copper show significant fluctuations in tin content, ranging from as low as 1.2 % to as high as 15 %. The content of arsenic and lead is relatively stable, with As less than 0.1 % and Pb around 0.1 % (Ibid.: 163–177). The two daggers from the Tianshui Museum are consistent with this characteristic. Thus, the type, use, and casting techniques of these artifacts suggest that they were not produced locally and are not the relics of the Qijia culture, but were directly imported by Seima-Turbino people.

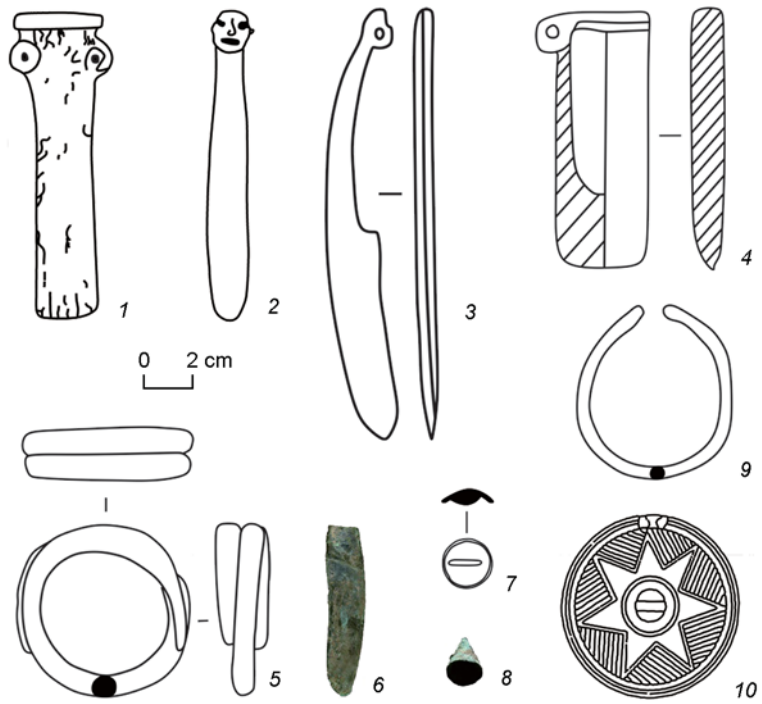

Fig. 7. Metal artifacts of the Qijia culture.
1, *2* – celt and daggers from the Qijiaping site; *3*, *4* – knife and celt from the Xinglin site; *5*, *10* – ring and mirror from the Gamatai site; *6–8* – respectively, knife, button, and cone-shaped cap from Mogou; *9* – bracelet from the Xinzhuangping site.

Conclusions

The discovery of Seima-Turbino spearheads in the Gansu Provincial Museum and Seima-Turbino daggers in the Tianshui Museum indicates that during the Early Bronze Age, represented by the Qijia culture, Seima-Turbino artifacts spread from Western Siberia to Northwestern China. Combined with the discovery of Seima-Turbino barbed spearheads in Qinghai, Shaanxi, Shanxi, Henan, Liaoning, and other regions, it can be concluded that there was a close cultural exchange between Seima-Turbino communities and populations of northwestern and central plains of China. Along with new types of products, there was the dissemination of metal production technologies. The discovery of cast Seima-Turbino spearhead in Fukang, Xinjiang, and stone celt-casting molds unearthed at the Erlitou site of Dongxiafeng further strengthens the evidence that early bronze casting technology in China was closely related to the Seima-Turbino phenomenon.

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Metal Production of Andronovo Communities and Farmers of Central Asia and Iran: Stages of Development and Search for Interactions

The article examines late 3rd and 2nd millennia BC mining and metallurgy across vast territory of Central Eurasia, inhabited by Andronovo pastoralists and Central Asia farmers. We provide chronological framework for the emergence and evolution of mining techniques (exploitation of various horizons of the oxidation zone of volcanic massive sulfides, copper porphyry, skarn and copper sandstone deposits, the use of specialized mines), appearance of arsenic bronze, tin bronze, and iron. Despite local peculiarities, mining and metallurgy passed through similar consecutive developmental stages in Central Eurasia. Archaeological data suggest that in the Late Bronze Age, Andronovo communities settled southwards from the steppes of Northern Eurasia to Kazakhstan and Central Asia. They played a major role in the spread of tin bronze and the exploitation of tin mines in Central Asia in the first half of the 2nd millennium BC. So far, there is only indirect evidence of contacts between Andronovo communities and people of the Iranian Highlands. The most promising sites that may yield such evidence are those of the Bactria-Margiana Archaeological Complex in northeastern Iran. Mineralogical and geochemical research methods help to assess the technological features of metallurgy and to discover ore sources; however, the interaction between Bronze Age communities can be explored only through archaeological and typological studies of sites and artifacts.

Keywords: **Ancient metallurgy, mining, ancient mines, Bronze Age, metal artifacts, Andronovo.**

Introduction

One of the most pressing issues relating to the Eurasian Late Bronze Age concerns the development of metallurgical practices of Indo-Iranian peoples across the wide area covered by their settlement. The advancement of ancient Indo-Iranian peoples from the East European Plain to the Southern Urals, as well as further south and east, is recorded by numerous archaeological, linguistic, and genetic data (Gimbutas, 1977; Kuzmina, 1994: 264–267; Narasimhan et al., 2019). During the Late Bronze Age (2nd millennium BC), the Andronovo people significantly expanded their area of settlement to the east as far as Altai and China, as well as south to Central and South Asia, including what is now Uzbekistan, Tajikistan, Turkmenistan, India, and Afghanistan (Kuzmina, 1994: 384–391; Chernykh, 2008) (Fig. 1).

There is evidence of trade and economic ties between the carriers of the northern steppe cultures (Sintashta, Andronovo), the Bactria-Margiana oasis civilizations, and the people of the northeastern territories of Iran (Bonora, 2021; Abdi, 2012). It is also advisable to search for the relationships in the

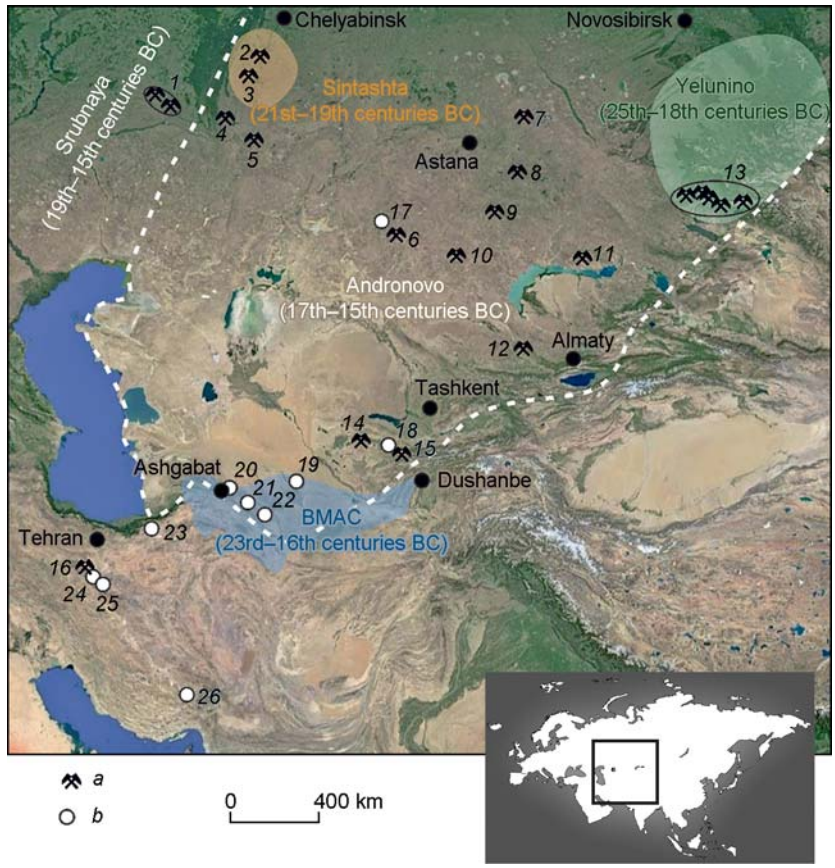

Fig. 1. The layout of the areas of cultures and some sites mentioned in the article.

a – ancient mines and deposits: *1* – Kargaly ore field, *2* – Novotemirsky, *3* – Vorovskaya Yama, *4* – Ishkininsky, *5* – Elenovsky, *6* – Zhezkazgan, *7* – Bozshakol, *8* – Altyntobe, *9* – Uspenskoye, *10* – Kenkazgan, *11* – Sayak, *12* – Shatyrkol, *13* – Kalba-Narym deposits (Sn), *14* – Karnab (Sn), *15* – Mushiston (Cu, Sn), *16* – Veshnave; *b* – settlements: *17* – Taldysai, *18* – Tugai, *19* – Gonur-Depe, *20* – Anau, *21* – Namazga-Depe, *22* – Altyn-Depe, *23* – Tepe Gissar, *24* – Tepe Sialk, *25* – Arisman, *26* – Tepe Yahya.

field of metal production: there is an opinion that the incentive for the dispersal of steppe pastoralists of the Late Bronze Age could have been the search for a new mineral resource base (Kuzmina, 2000). This review focuses on the features of mining and metallurgy of the Andronovo communities, their predecessors and neighbours in the adjacent territories, as well as tracking their transformation in the southern direction. Information on the development of copper deposits, ore types and alloys used is collected on the basis of published archaeological and analytical studies.

Features of Bronze Age mining and metallurgy in the Southern Urals

From the 4th to the 2nd millennium BC, the Southern Urals was a major mining and metallurgical region of Northern Eurasia (Chernykh, 1970: 37–49; 2008). The widespread use of metal products in the 4th millennium BC here was associated with Yamnaya (Pit Grave) communities (Degtyareva, Ryndina, 2019). The main ore base of the earliest ancient metallurgists in the region was the rich copper sandstone stratiform deposits of the Cis-Urals (Kargaly, 2002: 19–24). The primary minerals of the ore bodies of these near-surface deposits probably consisted of the copper-rich secondary sulfides of chalcocite and covellite. The deposits were developed in the form of small quarries and mines (Ibid.: 25–33). The metal smelted by the Yamnaya communities is mainly represented by pure copper, less often by arsenic bronzes (Degtyareva, Ryndina, 2019).

There is evidence that at around the turn of the 3rd to 2nd millennia BC, the ores derived from these deposits were used by the Abashevo people, who manufactured predominantly arsenic bronze tools (Gorbunov, 2008; Degtyareva, 2009). Copper sandstones were developed most extensively during the Srubnaya (Timber Grave) period, in the 18th–15th centuries BC; in terms of the metal products composition, copper and tin bronze smelting dominated (Kargaly, 2004: 106–133).

The earliest metal items in the Southern Trans-Urals, recorded at the settlements of the Kysykul-Surtandy culture, date back to the 3rd millennium BC (Krizhevskaya, 1977: 96–99). However, the absence of metallurgical slag fragments dating to this period is explained by the use of native copper (Grigoriev, 2015: 65–94). Large-scale metal production in the Southern Trans-Urals began during the Sintashta period, i.e., around 2100–1900 BC. Oxidized copper ores of volcanic massive sulphide (VMS) and skarn deposits mined here were confined to ultramafic and volcanic rocks (Zaykov et al., 2005; Ankushev et al., 2021). Here, the development was presumably carried out by an open pit, i.e., the upper horizons of the oxidation zone were revealed by small open

pits (Zaykov et al., 2005). The most common type of metal used in the Sintashta culture was arsenic copper and bronze, pure copper was less common (Degtyareva, 2009). At the turn of the 3rd to 2nd millennium BC, in the Southern Urals, single imported tin bronze items appeared, associated with the Seima-Turbino transcultural phenomenon (Marchenko et al., 2017).

Chronologically, the Sintashta communities are followed by the Petrovka population, whose relics are considered an early stage of the Alakul culture (Vinogradov, 2017). Analysis of primary ingots and metal products of the Petrovka culture of the Southern Trans-Urals indicates the dominance of pure copper, as well as the beginning of the widespread replacement of arsenic-based bronzes by tin bronze (Vinogradov, Degtyareva, Kuzminykh, 2013). In the Southern Urals, tin dopants were imported because of the complete lack of accessible tin deposits (Grigoriev, 2015: 475–476).

Later, during the 18th–16th centuries BC, the Southern Trans-Urals became a zone of interaction between the Srubnaya and Andronovo (Alakul) communities, which continued to exploit the same deposits as the Sintashta metallurgists, albeit working them by means of shaft mining (Ankusheva et al., 2022). Analysis of metallurgical slags and metal products shows the use of sulfide covellite-chalcocite ores (Avanesova, 1991: 73–83; Artemyev, Ankushev, 2019; Ankushev et al., 2021). The almost complete absence of traces of metal smelting from ores in unfortified Alakul settlements suggests the transfer of this type of activity to specialized settlements or mine workings (Grigoriev, 2015: 502–503; Ankusheva et al., 2022). The composition of metal of the Srubnaya-Alakul communities in the Southern Trans-Urals demonstrates the dominance of copper and tin bronze, often together with lead impurities (Tigeeva, Novikov, Shilov, 2016; Kulevchi VI..., 2020: 486–496).

In the Final Bronze Age (ca 15th–10th centuries BC), the Southern Trans-Urals was inhabited by Cherkaskul, Mezhovka, and Sargary-Alekseyevka communities, who left no evidence of metallurgical redistribution of ores in the settlements. While it is possible that they continued the exploitation of the same deposits, data supporting this hypothesis are sparse (Ankusheva et al., 2022). Metal composition of this period remains poorly investigated; copper and tin bronzes are predominant (Degtyareva, Vinogradov, Kuzminykh et al., 2019).

Bronze Age mining and metallurgy in the territory of Kazakhstan

In Eastern Kazakhstan, the Early-Middle Bronze Age is represented by Yelunino and Alkabek sites, where no evidence of metal smelting has been recorded, but items made of tin and arsenic bronze have been discovered (Merts, 2017: 211–217). At the turn of the 3rd–2nd millennia BC, the presence of the Sintashta and Petrovka population is noted on the territory of Northern Kazakhstan. The metal artifacts are similar to those found at the sites of the Southern Trans-Urals (Shevnina, Logvin, 2015: 131–139, 186–188).

The establishment of mining and metallurgy in Central Kazakhstan is associated with the southward dispersal of the Petrovka (Early Alakul) and Early Srubnaya populations during the first centuries of the 2nd millennium BC (Vinogradov, 2017; Taldysai..., 2020: 206–211). They began to actively develop oxidized (oxide-carbonate) and sulfide (chalcocite-covellite) copper sandstones ores of the Zhezkazgan ore field. Mine workings comprise quarries of various sizes and depths (Margulan, 1966: 266–268). Although the primary smelted metal was copper, arsenic bronze was also widely used. Tin bronze was less common (Taldysai..., 2020: 90). Conversely, in the metal of the Petrovka (Early Alakul) burial sites of Sary-Arka, tin bronze is more widespread than arsenic bronze (Degtyareva et al., 2020).

Later, the Andronovo community, which dispersed widely in Kazakhstan during the mid-2nd millennium BC, can be seen to have exploited various types of copper ores: VMS and copper porphyry deposits in Mugodzhary (Yuminov et al., 2013), copper sandstones of the Zhezkazgan-Ulytau (Margulan, 1979: 233–256), stratiform deposits in terrigenous strata (Altyntobe, Uspensky, Efimovskoye, Kenkazgan), copper porphyry deposits of Central (Bozshakol) and Southern Kazakhstan (Shatyrkol), skarn deposits (Sayak), and many others (Zhauymbaev, 1987; Berdenov, 2008; Agapov, Degtyareva, Kuzminykh, 2012). Of great importance was the development of tin deposits in the pegmatites of the Kalba and Narym ridges, which were the main source of tin for Northern Eurasia (Chernikov, 1960: 118–121). In the settlements of that period, metal artifacts made of copper and tin bronze predominated (Kuznetsova, Teplovodskaya, 1994: 73–84; Kalieva, Kolbina, Logvin, 2016).

In the Final Bronze Age, the development of the same deposits was continued by the Sargary-

Alekseyevka communities, who extracted copper and tin bronze (Agapov, Degtyareva, Kuzminykh, 2012; Degtyareva, Vinogradov, Kuzminykh et al., 2019). It was also at this time that iron metallurgy was born, as evidenced by the slags found at the Kent settlement in Central Kazakhstan, dating back to the 15th century BC (Ankushev et al., 2023).

Bronze Age mining and metallurgy in Central Asia

In Central Asia, metal production associated with the Anau culture appeared in the territory of Southern Turkmenistan in the late 5th–4th millennia BC (in the literature, this period is also referred to as Namazga I–III). At that time, there was only a metal processing centre here, which used imported ore, while all technologies were borrowed from West Asia (Ruzanov, 2013: 284). The next stage in the development of ancient metallurgy falls on the middle-late 3rd millennium BC (coinciding with the Namazga IV and V periods in Southern Turkmenistan). At this time, in Central Asia, independent local metallurgical centers were created, associated with the development of mines, and arsenic bronze appeared (Kuzmina, 1966: 88–90). Rare tin bronze items, which occurred in this region since the 23rd century BC, are associated with Iranian or Afghan sources (Ruzanov, 2013: 88–90).

In the 23rd–16th centuries BC, the vast territory of modern Turkmenistan, Southern Uzbekistan, Afghanistan, and northeastern Iran was occupied by the Oxus civilization (or the Bactria-Margiana Archaeological Complex, BMAC). The best-studied metal items are those from the administrative and religious center of Gonur-Depe; these are primarily made of copper-arsenic alloys, with fewer examples of pure copper and tin bronze (Kraus, 2021). The sources of local copper ore have not yet been definitively identified (Garner, 2021). Presumably, BMAC tin bronzes in the 3rd millennium BC originated from Iranian sources (Berger et al., 2023).

During the second quarter of the 2nd millennium BC, local sedentary farmers interacted with Andronovo communities, which led to the formation of polycultural sites (Avanesova, 2012). The earliest is the specialized metallurgists' settlement of Tugai. Although the authors of the excavation studies attribute this settlement to the 23rd–20th centuries BC, its material complex has parallels in the Ural-Kazakhstan materials of the Petrovka (Early Alakul) culture of the early 2nd millennium BC (Avanesova, 2015).

Local ore deposits of various types were widely developed: copper sandstones (Varzyk, Naukat), skarn (Tymsk mines), polymetallic (Vozrozhdennoye, Aktashkan) (Avanesova, 2012; Ruzanov, 2016). Ancient mines were developed by means of open pits and adits during different time periods; their exact dates are not available (Buryakov, Kasymov, Rostovtsev, 1973: 76–84). Mass bronze casting production appeared, and arsenic bronzes were replaced by tin bronzes (Kuzmina, 1966: 90–91). The most important stage of mining in Central Asia was the extraction of tin by Andronovo miners in the Zeravshan ridge deposits (Karnab, Lapas, Changalli, Mushiston), where ancient mines are recorded (Avanesova, 2012; Ruzanov, 2016, Berger et al., 2023).

Andronovo communities also adopted the Central Asian traditions of metalworking (tools and ornaments) (Kuzmina, 1966: 90–98). In the Aral Sea region, during the Late Bronze Age, the Tazabagyab culture was widespread, which was formed as a result of mixing of the local population with the incoming Andronovo communities. Copper and tin bronze artifacts found here were presumably made from local ores (Itina, 1977: 136–137).

Bronze Age mining and metallurgy in the Iranian Highlands

With the start of the Chalcolithic period in ancient Iran around 5500 BC, large-scale production of native copper tools began to spread; the first evidence of copper production from malachite and cuprite dates back to that time (Thornton, 2009; Thornton, Rehren, Pigott, 2009). One of the first dopants used in copper alloys was arsenic (Pigott, 2004). The use of sulfide copper ores and sulfoarsenides began ca 4th millenium BC (Emami, 2014). At the end of that millennium, metal-oriented centers emerged in Sialk, Hissar, and Arisman (Thornton, 2009). The beginning of the use of tin bronzes dates back to the turn of the 4th and 3rd millennia BC in Mesopotamia and Western Iran (regions of Khuzestan and Luristan). The appearance of copper-tin alloys in Luristan at around 3200–2800 BC is a surprising fact, since at many other sites in Iran the complete absence of tin is observed up until the end of the 3rd millennium BC (Ibid.). In the 3rd millennium BC, in Iran, arsenical bronze was widely used, probably obtained as a result

of mixing copper and "speiss" $FeAs_3$ (Thornton, Rehren, Pigott, 2009). Intense use of tin and tin bronze in Mesopotamia began in the mid-3rd millennium BC, and in Iran at the end of the 3rd millennium BC (Thornton, 2009). Afghan deposits (Drangiana) are considered the most likely source of tin (Pigott, 1999). During the Bronze Age, VMS, copper-porphyry, and skarn copper deposits were developed in the Iranian Highlands (Momenzadeh, 2004). A striking example of the development of VMS deposits is the ancient mine of Veshnaveh, revealing the evidence of extraction from various eras (Stöllner, Mireskandari, Roustaei, 2011).

The above overview is given in the infographic (Fig. 2). Taking into account the complexity of multicultural interactions of the Bronze Age communities, all geographic and chronological boundaries drawn are approximate. The different extents to which the materials have been studied also introduce a large error in the characterization. The review is based on both AMS and LSC dating, and in the absence of these, on the typological characteristics of culturally identifiable artifacts.

Evidence of interaction of the Andronovo communities with the population of the Iranian Highlands in terms of metallurgy

The Bronze Age technologies of mining and metallurgy in the territory of the Southern Urals, Kazakhstan, Central Asia, and the Iranian Highlands passed through the developmental stages typical of the entire Central Eurasian region. The most archaic forms of copper mining were limited to the search for native metal. Later, the upper horizons of the oxidation zone of copper deposits began to be mined in open pit workings. Finally, rich sulfide ores of the secondary enrichment zone started to be exploited using the shaft method. So far, there is no evidence of the massive use of chalcopyrite ores here. The order of changing various metals is similar: copper – arsenic bronze – tin bronze – iron. However, the onset and duration of these periods vary in different communities. One of the earliest attempts in obtaining arsenic bronze, which dates back to the second half of the 5th millennium BC, was recorded by the discovery of an awl in Tepe Yahya (Southern Iran) (Thornton, 2010). Despite this, the use of native copper did not give way to arsenic bronze for several more centuries. Tin bronzes, first appearing in Luristan only in the late 4th millennium, did not become widespread for another thousand years, too (Oudbashi, Emami, Davami, 2012). This long period of time was dominated by copper and arsenic bronzes.

There is evidence of relationships between the Andronovo communities with the Oxus civilization and the agricultural societies of Central Asia on the territory of modern Turkmenistan, Uzbekistan, Kyrgyzstan, and Tajikistan (Avanesova, 2012; Ruzanov, 2013: 89, 269, 273, 278; Bonora, 2021). Based on the typology and compositional features of the products, E.E. Kuzmina suggests the penetration of Andronovo metal into Central Asia, explaining the replacement of arsenic bronze by tin bronze by the expansion of Indo-Iranian peoples (1994: 141, 155). Other researchers believe that tin bronze appeared on the territory of Central Asia before the first contacts between farmers and pastoralists, at the end of the 3rd millennium BC, and was associated with Iranian imports and active trade and production ties (Ruzanov, 2013: 88–90; Biscione, Vahdati, 2021). However, the widespread mining of tin ores in Eastern Kazakhstan and Central Asia was associated exactly with the dispersal of Andronovo communities (Chernikov, 1960: 118–121; Berger et al., 2023).

Evidence of the direct influence of Central Asian and northeastern Iranian farmer cultures on the metal production of steppe cattle breeders remains rather scanty. For example, some Andronovo ornaments show similarities with more ancient items of the Southeastern Caspian region (Kuzmina, 1966: 84–85). During the excavations of the Deh Dumen cemetery (second half of the 3rd millennium BC) in Southwestern Iran, wide-necked bronze vessels of a type previously found in Luristan and Susa were discovered (Oudbashi, Naseri, Malekzadeh, 2016). Although the shape of these vessels is not similar to the local pottery, it resembles the Early Alakul vessels from Kazakhstan (Degtyareva, Kuzminykh, Loman et al., 2019).

Conclusions

Modern archaeological research proves pronounced contacts between steppe pastoral and agricultural communities of Central Asia. There were definitely trade connections between the Central Asian population and the inhabitants of the Iranian plateau in the Bronze Age. So far, no direct material evidence has been found of the mass dispersal of steppe products and technologies to the southwest beyond

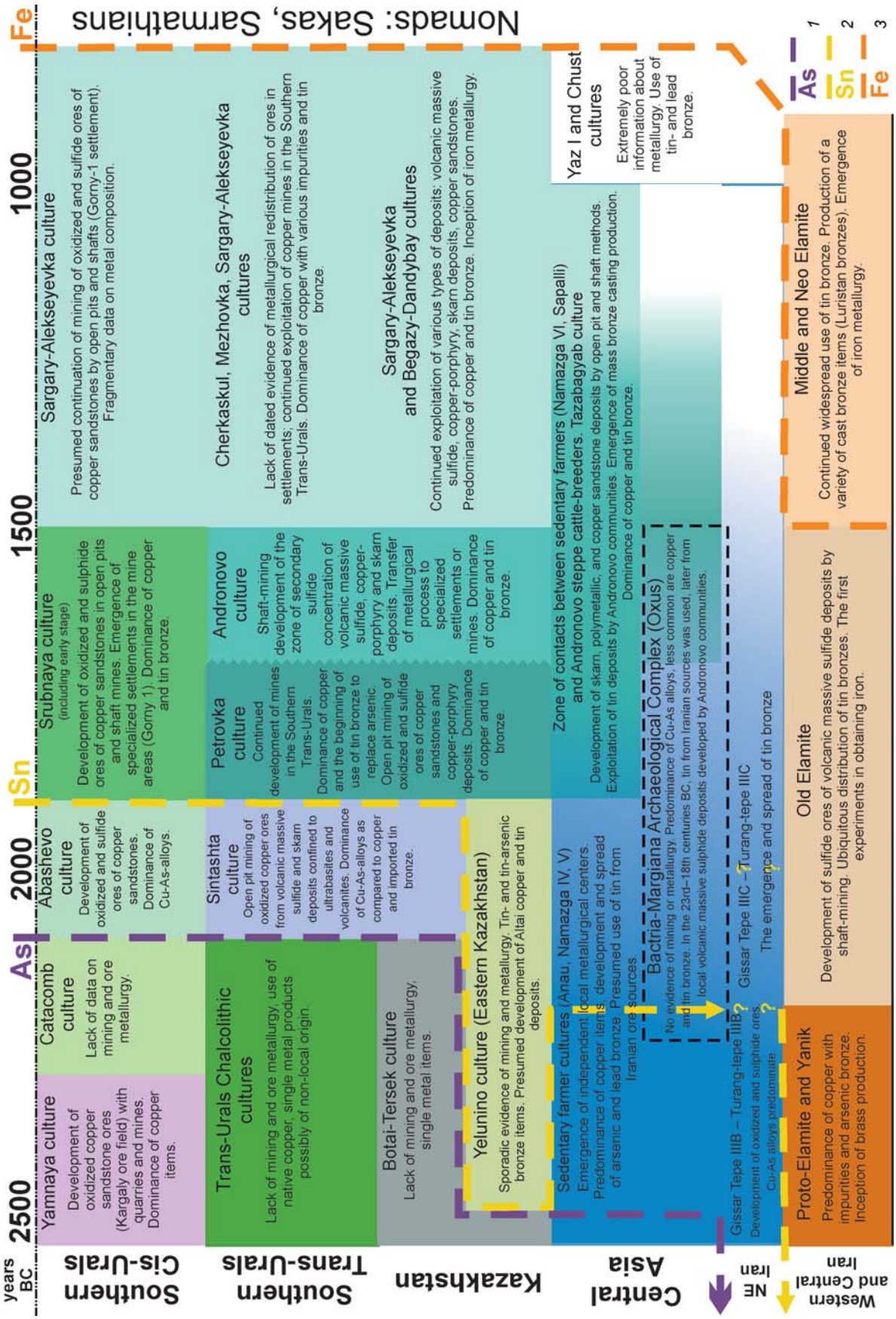

Fig. 2. Features of mining and metallurgy of Central Eurasia in the second half of the 3rd–2nd millennia BC.
1, 2 – distribution of arsenic bronze and tin bronze, respectively; *3* – distribution of iron.

the Kopetdag. The most promising sites to search for such evidence are the BMAC sites in northeastern Iran (Biscione, Vahdati, 2021). At archaeological sites of the second half of the 2nd millennium BC on the Jajrom plain in North Khorasan, molded ceramics with carved geometric ornamentation are found, which show parallels to decoration of vessels of steppe communities (Vahdati, 2020).

Analytical methods are likely to be of little help in studying the interaction of metallurgical technologies of northern cattle-breeding and southern agricultural Bronze Age societies. Only mass typological studies of the collections of metal products found in the territory of the Iranian Highlands, along with artifacts of other types, in particular ceramics, can help in solving this issue.

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Antimony Ornaments, Votive and Ritual Items of the Koban Culture in the Caucasus as a Historical Source

Archaeological excavations carried out in the Republic of North Ossetia – Alania over the past 15 years have yielded numerous artifacts associated with the Proto-Koban (15th/14th to early 12th century BC) and "classic" Koban culture (9th–8th centuries BC). Here, we analyze antimony artifacts from the cemeteries of Adaidon, dating to the Proto-Koban stage, and Elkhotovo, representing "classic" Koban. The analysis of composition of the metal revealed the recipes used by ancient craftsmen for manufacturing weapons, ornaments, and votive items. Antimony ornaments from Elkhotovo suggest that this substance was used not only in the Middle and the beginning of the Late Bronze Age in the Caucasian highlands, but also much later in the piedmont zone of the region. The study of certain bronze artifacts from Adaidon suggests that to make ornaments and votive items more attractive, antimony in the amount of 4.5–5.0 % was added. As a result, they acquired a light-golden color and luster.

Keywords: **Bronze and Early Iron Ages, Caucasus, Koban culture, antimony ornaments and insignia, metal composition of artifacts, antimony deposits in the Caucasus, Adaidon and Elkhotovo cemeteries.**

Introduction

Scientific analysis methods are crucially important in studies of the material culture of ancient populations, including research on the ancient metal ware. In a number of recent scientific publications (Skakov, 2001, 2003; Gak, Mimokhod, Kalmykov, 2014: 89), it is rightly noted that antimony artifacts have not previously been considered first-priority objects in studying ancient history. Meanwhile, analysis of archaeological finds for the presence or absence of antimony and the antimony percentage content in the metal composition, as well as the cartography and chronology of these products, provide important information concerning metallurgical production techniques, the nature and vectors of social contacts, and, possibly, economic ties between the Caucasus and adjacent regions. Antimony artifacts, primarily personal ornaments, were used by the bearers of the Kayakent-Khorochoy culture, which was widespread in the Northeastern Caucasus in the third quarter of the 2nd millennium BC (Kruglov, 1958: 82; Krupnov, 1951; Markovin, 1960: 97), and the Koban culture in the Proto-Koban stage (Koban 1, A, B, according to the periodization by V.I. Kozenkova) (Krupnov, 1951; Kozenkova, 1996: 114–115; 2013: Fig. 16, *21–22*; Moshinsky, 2003; Moshinsky, Skakov, 2000; Skakov, 2001, 2003; Gak, Mimokhod, Kalmykov,

Fig. 1. Location of Adaidon (*1*) and Elkhotovo (*3*) cemeteries and the place of discovery of the accidental find (*2*).

The present paper reveals the metal composition of 31 artifacts from the Adaidon and Elkhotovo cemeteries, and one artifact accidentally found near the village of Koban in North Ossetia. The sample includes personal ornaments, weapons, and outfit accessories. These artifacts of the Caucasian Koban culture have been found in three landscape-altitude zones in the Republic of North Ossetia (RSO) – Alania, and can be attributed to two chronological periods (Fig. 1). The Adaidon cemetery (15th/14th–5th centuries BC) is located in the alpine meadow zone, at an altitude of 1673–1700 m asl (Chshiev, 2012). The accidental find—a pendant shaped like a ram's head (9th–7th centuries BC)—comes from the mountain-forest landscape belt at an altitude of 1328 m asl. Elkhotovo cemetery (9th to early 7th century BC) is located in the foothill-plain zone at an altitude of 315 m asl.

In addition to antimony items, the sample under study comprises artifacts made of copper- and silver-based alloys originating from the same closed complexes as the antimony pieces; the chemical analyses provided a great amount of information and revealed the whole variety of paleometal recipes used (see *Table*, No. 2–5, 7, 9, 18–20, 22, 32). Analysis of large, massive weapons bearing use-wear traces and made of copper alloyed with arsenic has shown that this alloying element,

2014). A.Y. Skakov carried out a comparative analysis of Proto-Koban beads and similar items from Transcaucasian sites, and inferred certain connections between the Proto-Koban antiquities and materials from Transcaucasia and the steppe regions of Eastern Europe (2003: 20).

Metal composition of the artifacts under study, %

Sample No.	Artifact	Cu	As	Sn	Pb	Sb	Ag	Ni	Fe	Other
1	2	3	4	5	6	7	8	9	10	11
1	Bronze twisted cylinder-shaped bead	83–85	Trace	14–16	–	Trace	Trace	Trace	< 0.5	–
2	Bronze pin with five protrusions	70–75	2–4	22–26	–	–	–	–	< 0.2	–
3	Bronze straight axe with tubular butt	94–95	4–5	–	Trace	–	Trace	–	< 0.3	–
4	Bronze subtriangular dagger's blade	89–90	8–9	–	–	–	Trace	–	–	Bi < 0.4, Au < 0.6
5	Silver oval-shaped pendant	2–4	–	–	< 0.4	–	> 95	–	–	–
6	Bronze laminar bracelet	93–95	1–1.5	13–15	< 0.6	Trace	Trace	–	–	–
7	Bronze pin with five protrusions	88–91	Trace	8–10	< 0.7	–	Trace	< 1	–	–
8	Bronze head of votive mace	95–97	1–2	–	–	1–2	Trace	1.0–1.5	–	–
9	Bronze pin with twisted top	95–96	3–4	–	–	–	–	< 1	Trace	–
10	Bronze pole-axe with arched blade	91–92	7–8	–	< 0.6	–	Trace	–	–	–

Table (end)

1	2	3	4	5	6	7	8	9	10	11
11	Bronze straight axe with tubular butt	94–95	4–5	–	–	–	Trace	< 1	–	–
12	Antimony cone-shaped bead	~1	1–2	–	–	> 97	–	–	< 0.5	–
13	Antimony disc-shaped button-bead	Trace	4–5	–	–	> 95	–	–	–	Mn
14	Bronze bullet-shaped pendant	69–71	29–31	–	–	Trace	?	–	–	–
15	Antimony ovoid pendant with transversal flutes	–	1–2	–	–	> 98	–	–	–	–
16	Antimony globular bead	–	1–2	–	–	> 98	–	–	–	–
17	Antimony amphora-shaped bead	–	2–3	–	–	> 97	–	–	< 0.3	–
18	Bronze straight axe	66.816	0.522	0.418	–	0.219		–	–	–
19	Bronze bracelet sub-triangular in cross-section	90–91	9–10	–	Trace	–	–	–	–	–
20	Bronze double-curved axe	93.312	0.210	0.160	–	–	–	0.179		–
21	Antimony mace head with geometric ornaments	< 0.7	1–2	–	–	> 97	–	–	–	–
22	Bronze leaf-shaped spearhead	88–91	8–10	–	–	Trace	< 0.7	1–1.5	Trace	–
23	Antimony disc-shaped button-bead	Trace	7–8	–	–	> 91	–	–	< 0.8	Zn
24	Antimony ring-shaped pendant	–	2–3	–	–	> 97	–	–	–	–
25	Antimony amphora-shaped bead	–	2–3	–	–	> 97	–	–	–	–
26	Antimony ovoid pendant	Trace	1–2	–	–	> 98	–	–	–	–
27	Bronze arch-shaped pole-axe with a socket decorated with two sculptured ram heads	90.438	1.168	14.319	–	4.522	–	0.358	–	–
28	Antimony sub-rectangular fluted clasp	Trace	1–2	–	–	> 98	–	–	–	–
29	Bronze arch-shaped axe with a socket decorated with two sculptured ram heads	77.243	11.23	0.232		5.267		0.246	0.077	Zn 0.428
30	Bronze pendant “winged ram”	80–82	13–15	–	–	4–5	< 1	Trace	–	–
31	Bronze pendant in the shape of ram’s head	97–98	< 0.5	< 0.8	< 0.5	Trace	Trace	~1	–	–
32	Bronze arch-shaped axe	83–85	14–16	–	–	~1	< 0.6	–	–	–

*Corresponds to the number of the artifact in Fig. 2.

in contrast to antimony, was used by ancient craftsmen in production of everyday utensils rather than votive artifacts.

Materials and methods

The study focused on the artifacts found in the course of archaeological excavations of the Elkhotovo and Adaidon cemeteries of the Koban culture (excavations by V.T. Chshiev), and the accidental find from the village of Koban—a pendant in the form of a sculpted ram’s head. As was noted above, metal samples of 32 artifacts were analyzed.

Samples (up to 1 g) were collected mechanically. Samples No. 1–17, 19, 21–26, 28, and 30–32 were subjected to X-ray fluorescence (XRF) analysis using an ArtTAX spectrometer (Brüker) in the Scientific and Technical Examination Department of the State Hermitage Museum in April 2023. The metal compositions of samples No. 18, 20, 27, and 29 were analyzed using the techniques of X-ray photoelectron spectroscopy (XPS), inductively coupled plasma atomic emission spectroscopy, and Fourier transform infrared spectroscopy. The samples were placed into the metal ultra-high vacuum measuring chamber of a Thermo Fisher Scientific Escalab 250 Xi spectrometer. A high degree of vacuum (residual gas pressure 2×10^{-10} mm Hg) was achieved by means of pumping-out technique in the following sequence: forevacuum – zeolite – turbomolecular – magnetic discharge – titanium sublimation pump. The physical basis of the XPS method is the X-ray photoeffect: the photons cause emission of electrons from the sample, with a kinetic energy depending on their atomic energy level. These studies were carried out in the laboratories for the physics of adsorption phenomena and the physics of surface and catalysis

of the Khetagurov North Ossetian State University under the supervision of Prof. T.T. Magkoev in July 2022.

Interpretation of the findings

The analysis has revealed that the archaeological items under study were made of antimony, arsenic, tin, or a multi-component alloy with a combination of copper, tin, arsenic, lead, and antimony.

Of the total of 32 artifacts, ten items are weapons found in the tombs of the Adaidon cemetery. Analysis of the materials has shown that these were made of copper alloyed with tin and arsenic. Eight weapons (Fig. 2, *3*, *4*, *10*, *11*, *22*, *27*, *29*, *32*) belong to the Proto-Koban period, two other items to the period of the "classic" Koban culture (after periodization by V.I. Kozenkova (1996)). Notably, seven items from the Proto-Koban stage—a dagger-blade, a spearhead, a poleaxe, and axes—are made of arsenic bronze with a copper content of 77–94 % and the arsenic share varying from 4–5 to 14–16 %. This is typical of the Caucasian metal ware of the Middle and Early Late Bronze Age. Interestingly, the Proto-Koban poleaxe (Fig. 2, *27*) is cast of tin bronze with a high Sn content (see *Table*, No. 27). This content is higher than that in the double-curved axe belonging to the "classic" Koban stage (see *Table*, No. 20), which is characterized by the widespread use of such metal. For comparison: the tin content in bronze items from the Tli cemetery of the same period is 11–15 % and more (Tekhov, 1977: 200–202).

The analyzed ornaments and accessories of the Proto-Koban outfit from the Adaidon cemetery (16 items) include a cylindrical twisted bead; two rod-shaped pins with five protrusions and one with a twisted head; an oval temple pendant of one and a half turns; a bracelet with a subtriangular cross-section, and one made from a thin plate of bronze, decorated with linear punched design; a bullet-shaped pendant; a fluted ovoid pendant; one globular and two amphora-shaped beads; a disc-shaped button-bead with a hidden loop; a ring-shaped pendant and an ovoid one; and a sub-rectangular fluted clasp (Fig. 2, *1*, *2*, *5–7*, *9*, *14–17*, *19*, *23–26*, *28*). Quite unexpectedly, the metal of the twisted bead, two pins with five protrusions and the laminar bracelet showed a high tin content (see *Table*, No. 1, 2, 6, 7), while the copper alloy of the bracelet with subtriangular cross-section showed only arsenic admixture (see *Table*, No. 19). Only a small admixture of copper and lead was revealed in the silver alloy of the oval temple pendant of one and a half turns, covered with a loose violet patina (see *Table*, No. 5). Metal samples from the other ornaments and the clasp (these items bear a thin layer of beige and light brown patina) predictably showed a high content of antimony (see *Table*, No. 15–17, 23–26, 28).

The votive mace heads made of bronze (Fig. 2, *8*) and antimony (Fig. 2, *21*) and a massive bronze pendant plaque in the form of a flattened figure with hatchet-shaped "wings" crowned with a sculpted head of a curve-horned ram (Fig. 2, *30*) were analyzed in addition to the above-described Proto-Koban items from the Adaidon cemetery. The former two artifacts may have served as insignias, while the third item, with an oval loop at the top of the reverse side, was probably used as a standard or was related to sacred symbolism. The bronze head is a hollow ball with four rounded protrusions and a thin tubular socket. The shape of the head is similar to that of the bronze mace heads of the Proto-Koban stage, but the latter are larger and not hollow, but full cast. Such items are typical of high-mountain burial grounds of that period (Tekhov, 2000: 162; 2006: 179, fig. 26, *2*). The antimony mace head with a linear and concentric ornament over the entire surface is cast of a brittle alloy and, accordingly, is less durable than bronze-cast products. Therefore, both items under study we classify as votive. An artifact identical to the above-described antimony head in shape, metal composition, and ornamentation pattern was discovered in the Proto-Koban Faskau cemetery in the vicinity of the village of Galiat in the Uallagkom Gorge in the RSO – Alania (Gak, Mimokhod, Kalmykov, 2014: 104, fig. 3, *49*). Another antimony head of a similar shape and with close, but not identical, ornamentation is kept in the collection of A. Kossnierska in the German Historical Museum (Motzenbäcker, 1996: Abb. 6). It was found "in Faskau or Kumbulta" (Ibid.: 68). This mace head is small and has a thin, non-through socket, which again convinces us that the above items had votive, symbolic meaning. E.I. Gak, R.A. Mimokhod, and A.A. Kalmykov rightly emphasize that during the smelting process, the antimony raw material "was transformed into metal, the further use of which, owing to its physical and chemical properties, was limited to the casting of decorative and ritual-cultic products..." (2014: 119).

Comparing the metal composition of the antimony ornaments from the Adaidon necropolis with that of those from the cemeteries of Faskau, Upper Rutkha (Kumbulta), and Kayakent provides noteworthy

Fig. 2. Artifacts under study.

1–11, *14–30*, *32* – Adaidon cemetery; *12*, *13* – Elkhotovo cemetery; *31* – accidental find, village of Koban. *1–4*, *6–11*, *14*, *18–20*, *22*, *27*, *29–32* – bronze; *5* – silver; *12–13*, *15–17*, *21*, *23–26*, *28* – antimony.

results. The analysis of the X-ray fluorescence data derived for the items from the latter three sites (Ibid.: 93–95, Tab. 1) as compared to our findings (see *Table*) has shown that the antimony content in these ornaments is practically the same – 97–98 %. Notably, the metal of the items from Faskau, Upper Rutkha (Kumbulta), and Adaidon contains almost no impurities, except for a small amount of copper and arsenic (from 0.21 to 2–3 %) (Ibid.). Citing data on the antimony content, Gak, Mimokhod, and Kalmykov rightly note: "Such high antimony values leave no doubt that we are dealing with a fairly pure metal that was smelted directly from the antimony mineral. The noticeable admixture of copper in the bead and paw pendant from Faskau (3.54 % and 4.62 %), as well as silver (4.5 %) and iron (up to 4.43 %)

in some Lolin beads is considered normal in this case. The total share of natural ore impurities in the extracted metallic antimony can reach several tens of percent" (Ibid.: 94). The above-mentioned similarity in the metal composition suggests that the population of the sites under discussion, including Adaidon, used raw materials from the same ore deposit to make antimony ornaments and insignias.

The main element in the metal of the "winged ram" pendant is copper. Noteworthy is the high concentration of arsenic in combination with the antimony content that is quite high in impurities (see *Table*, No. 30). In our opinion, this indicates intentional alloying, as a result of which the metal of the pendant became quite solid (tested during sample selection) and at the same time got an attractive bronze shine.

Conclusions

The executed analyses have shown that the artifacts selected as supposedly containing antimony from the burials of the Adaidon and Elkhotovo cemeteries were actually made of antimony, the content of which in the samples ranges from 91 to 98 %. Tin and antimony were added to the main metal (copper) for manufacturing personal ornaments and votive-ceremonial products of the Proto-Kaban period from the Adaidon necropolis; some items were cast from pure antimony (beads, pendants, votive mace heads).

An important finding of the study is the frequent occurrence (in the same complex of burial goods at the Adaidon cemetery) of the artifacts made of bronze alloyed not only with arsenic, as expected for such an early time (15th/14th to 13th centuries BC), but also with tin, including in high concentrations, which is not typical of Late Bronze Age materials from the northern slope of the Main Caucasian Range.

Another significant result of the study is that the antimony ornaments occurred not only in early (Proto-Koban) burials, but also in graves of the Early Scythian period. The analysis of the bead and the button-bead from Elkhotovo (Chshiev, 2021: 63–68; 2022: 162, fig. 23, *38*; p. 180, fig. 41, *40*) has shown for the first time that antimony items were used by the population of the Caucasus not only in the Middle and Early Late Bronze Age, but also much later—in the 9th–8th centuries BC. The metal composition and the shapes of the above artifacts and the similar items from the Proto-Koban complexes of the Adaidon and Kari Tsagat cemeteries (Digor Gorge, RSO – Alania) were strikingly similar (Skakov, 2003: 21, fig. 1, *1–13*, *29–31*), despite the gap of 400–500 years between burial dates and the location of the sites in different landscape zones and altitude belts. In our opinion, this can be explained by the stable metallurgical tradition of manufacturing antimony products, which was practiced in the entire distribution area of the Koban culture and survived, at least in the area of the culture's main variant, until the 9th–8th centuries BC.

The comparison of the metal composition of the analyzed Proto-Koban artifacts from Adaidon with their functional attribution and appearance has shown that ancient craftsmen used various, often complex, multi-component alloys, depending on the purpose of the manufactured product. In particular, daggers, axes, spears, and poleaxes bearing use-wear signs and used as real weapons were made of arsenic bronze; while ornaments, votive items, ritual, and symbolic items, including ceremonial and ritual poleaxes and mace heads, were cast of antimony or bronze with an admixture of tin and antimony. These additives were apparently introduced into the metal to give a more attractive appearance (golden color with a shimmer, luster) to bronze products. In our opinion, a fairly high content of tin and antimony in the bronze of the socketed poleaxe decorated with two sculpted ram's heads is explained by the fact that it was not a combat weapon, but a ceremonial poleaxe; therefore, the requirements as to its appearance prevailed. The analysis of the ceremonial and combat bronze belt with rich engraved ornaments from burial 350 of the Tli cemetery (excavations by B.V. Tekhov), carried out in the laboratory of the University of Debrecen (Chshiev et al., 2020), has shown a similar tin concentration (11–12 %).

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Burial of a Warrior in the Pazyryk Mound at Khankharinsky Dol, Altai

This article presents the findings of excavations of mound 46 at the Khankharinsky Dol cemetery on the left bank of the Inya River, 1–1.5 km southeast of the Chineta village in the Krasnoshchekovsky District of the Altai Territory (northwestern Altai). Inside the mound, there was a burial of a male, placed in a crouched position on his right side, with his head oriented toward the east. Along the northern wall of the grave, the burial of a horse was found, oriented in the same direction. The most interesting funerary items were an iron dagger, an iron pickaxe, and decorated belt plaques made of horn. Parts of a horse harness included iron ring bits, a horn girth buckle, and a block. Analysis of the funerary rite and artifacts allows us to attribute the mound to the Pazyryk culture, and tentatively date it to the late 5th to 4th centuries BC. The fact that the dagger and the pickaxe were real weapons rather than replicas, and that the horse was buried, suggests that the man was a professional warrior, possibly a high-ranking one. Another sign of this are the decorated horn belt plaques, known to be endowed with important socio-cultural meaning among the Central Asian nomads.

Keywords: **Altai, Pazyryk culture, funerary rite, nomads, burial goods, weapons.**

Introduction

The Khankharinsky Dol mound cemetery has been studied for over twenty years by the Krasnoshchekovo Archaeological Expedition from the Altai State University. This site is a part of the Chineta archaeological microdistrict located near the village of Chineta in the Krasnoshchekovsky District of the Altai Territory (northwestern Altai). The cemetery is in the eastern part of the second floodplain terrace on the left bank of the Inya River (left tributary of the Charysh River), 1–1.5 km southeast of the village of Chineta (Fig. 1). Over forty burial mounds of the Scythian-Saka period have been excavated at the site. This article describes some preliminary results of studying mound 46 at the Khankharinsky Dol cemetery, which belonged to the Pazyryk culture of the Altai.

Description of the funerary rite

Mound 46 was discovered in the central part of the cemetery, in the second chain of burial mounds located to the west of the first chain. The diameter of the stone mound, composed mainly of one or two layers of small and medium-sized stones, was 8.75 m along the N-S and 8.5 m along the W-E line. The height of the stone structure was 0.35 m. Together with the soil layer the height reached 0.5 m (Fig. 2). There were almost no stones in the central part of the mound owing to soil subsidence into the grave. Along the circumference of the burial mound, a stone circle-crepidoma was identified, which had significant gaps in some areas. A sub-rectangular grave measuring (at the level of the ancient horizon) 2.30 × 1.90 × × 2.28 m (depth is given from the zero benchmark) was under the mound. It contained the remains of a male

buried on his right side with his legs bent at the knees and his head oriented toward the east (Fig. 3). Two rectangular belt plaques made of horn and decorated with fish scale ornamentation were found in the waist area, near the pelvic bone. An iron battle pickaxe with the remains of a wooden handle was slightly lower. Under the right femur of the buried person, a combat iron dagger with the remains of wood decay was discovered. A two-link ringed iron bit lay 0.05 m to the east of the human skull; ram bones (ritual food) and an iron knife were 0.15 m to the north.

Fig. 1. Location of the Khankharinsky Dol cemetery.

Fig. 2. Burial mound 46 after removal of the mound.

Fig. 3. The grave in mound 46.

An accompanying burial of a horse was along the northern wall of the grave on a clay shelf. The animal was placed on its stomach with its legs bent, and was oriented with its head toward the east. A horn girth buckle and block were found in the area of the horse's ribs.

Chronology and attribution of the burial goods

The burial goods comprise different types of items. Two rectangular horn belt plaques (Fig. 4) are of particular interest. The front sides of both plaques are decorated with fish scale ornamentation. The first plaque is 8.2 cm long, 4.4 cm wide at one end, and 5.3 cm wide at the other end, and near the wide end has a 1 × 1 cm subsquare hole with one rounded side. In addition, four of five holes at the edges and one hole in the center of the plaque for attaching the item have survived. The second plaque is 8.5 cm long, 4.6 cm wide at one end, about 6 cm wide at the other end, and also has three holes near the narrow end and two holes near the wide end for attachment.

Plate buckles made of horn (bone) are quite rare in the burial mounds of the

Fig. 4. Horn belt plaques.

Scythian period in the Altai Mountains. For example, they were found in mound 1 at the Ala-Gail-3 cemetery (Kubarev, Shulga, 2007: 110, fig. 25, *6*, *7*) and mound 17 at the Yustyd XII cemetery (Kubarev, 1991: 86, fig. 21, *1*, *2*). In addition, items of this type were discovered in mound 30 at the Chineta II cemetery located in the same valley as Khankharinsky Dol (Dashkovskiy, Shershneva, 2020: 51, fig. 8, 9). According to experts in this area, at the final stage of the Pazyryk culture in the Altai, metal belt fittings were replaced mostly by wooden and leather items, and in rare cases, by horn items (Kubarev, Shulga, 2007: 102). Scholars have also mentioned that horn plate buckles were more typical of the belt sets of ancient nomads of Tuva and Mongolia. Such plaques were covered with high-quality artistic carving (Semenov, 2003: Pl. 110; Kubarev, 1991: 86; Grach, 1980: 35, fig. 35, *10*, *11*; Volkov, 1978: 105, fig. 3, *8*; Tseveendorj, 1978: 111, fig. 3, *24*; Mandelshtam, 1983: 27, fig. 2, *9*).

Importantly, mound 17 at Yustyd XII, mound 1 at Ala-Gail-3, and mound 30 at Chineta II were dated to the 4th–3rd centuries BC. Noteworthy is also the fact that in mound 30 at Chineta II, a male 40–50 years of age was buried in an extended supine position with his head oriented toward the west and without any burial goods, except for plate buckles (Dashkovskiy, Shershneva, 2020). Although such items have been discovered at Scythian sites in the Altai Mountains, they were not typical of the Pazyryk culture, but rather reflect the interaction of nomads of various ethnic groups in the region.

Some scholars suggested an alternative interpretation of the function of horn (bone) plaques, considering them to be part of plate armor (Novgorodova, 1975: 225; Saveliev, Hudiakov, 1984: 71; Troitskaya, 1983: 34). According to E.A. Novgorodova, the small number of such finds may be explained by the rarity of such armor in Central Asia in the mid-1st millennium BC (1975: 225). However, further research and discovery of paired horn plaques in the belt area of those buried in Khankharinsky Dol and Chineta II indicate that these were items associated with belts.

Items of weaponry include an iron dagger and a pickaxe. The dagger has a diamond-shaped blade in cross-section, heart-shaped crossguard, and handle pointed at the top (Fig. 5). The total length of the item is 27.5 cm; the blade is almost 17 cm long and 3.6 cm wide; the handle is 8.5 cm long. There are five subsquare holes on the handle for attaching wooden overlays with pins. Two overlays could possibly have had a bar-shaped pommel at the top, as shown in the reconstruction (Fig. 5, *3*, *4*). The dagger probably was stored originally in a wooden sheath, since remains of wood decay were found on and under it.

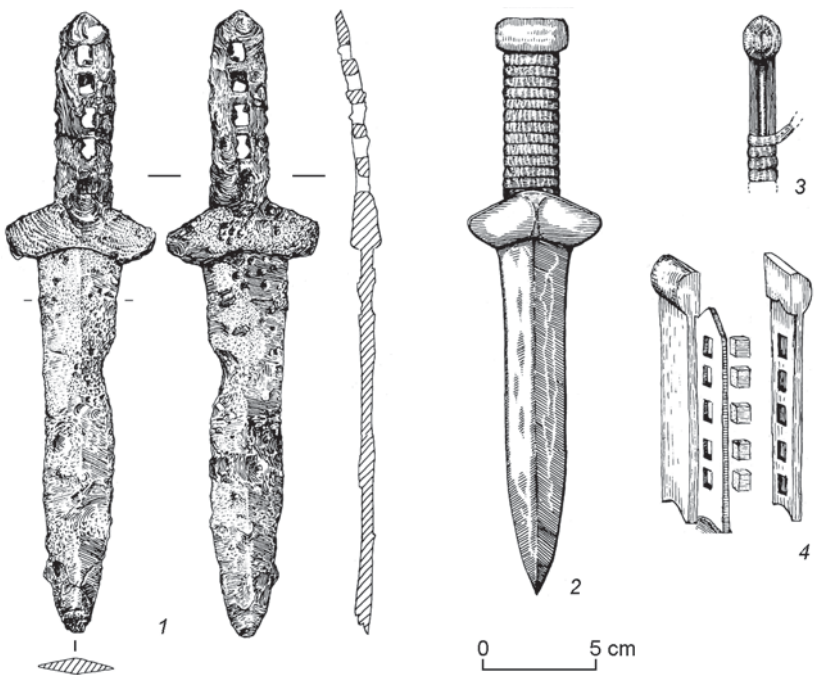

Fig. 5. Iron dagger (*1*), reconstruction of the dagger (*2*), and fastening of its handle in the sheath (*3*, *4*).

Iron combat daggers are relatively rare at Pazyryk sites. They are usually 27–40 cm long (Kubarev, 1987: 54–59; Kubarev, Shulga, 2007: 74–78; Surazakov, 1989: 40). At a certain stage of studying the nomadic weaponry, it was suggested that all iron daggers from the Pazyryk burials were combat daggers (Kubarev, 1987: 56). However, accumulation of new evidence has made it possible to correct this point of view. Replicas of daggers and pickaxes made of iron have occurred in burials even at the late stage of development of this culture (Kubarev, 1992: 57; Surazakov, 1989: 49). Out of over sixty Scythian mounds that the current author studied at Khankharinsky Dol and Chineta II, only two (in addition to the one under discussion) contained combat daggers: mound 25 at Khankharinsky Dol yielded a bimetallic dagger, and mound 29 at Chineta II had an iron dagger (Dashkovskiy, 2021: 126–127). Iron combat daggers have been well studied using the evidence of the Kamenka and Bystryanka cultures of the Altai (Likhacheva, 2020: 118–133; Mogilnikov, 1997: 36–47; Shulga, Umansky, Mogilnikov, 2009: 148, fig. 108; Shulga, 2003: 54; and others).

To the best of our knowledge, in the Scythian cultures of the Altai, there are no complete parallels to the dagger from mound 46 at Khankharinsky Dol. However, daggers similar to the one under consideration in some morphological features are known from the materials of the Pazyryk, Kamenka, Staroaleyka, and Bystryanka cultures. For example, a slotted handle appeared both on real combat bimetallic and iron daggers, and on bronze replicas (Surazakov, 1989: 39–51; Kubarev, 1987: 54–65; 1991: 73–77; Likhacheva, 2020: 232–237; and others). Noteworthy are also five sub-quadrangular holes on the handle. Similar morphological features appeared on the dagger from mound 8 at Maltalu IV (Kubarev, 1992: 56, fig. 18, *3*). According to V.D. Kubarev, this was a replica similar in size to a real dagger. Notably, the length of this item was 27 cm, that is, it was slightly smaller than the dagger under consideration. The dagger from mound 46 at Khankharinsky Dol can be tentatively dated to the 4th century BC.

The second weapon is a battle iron pickaxe with remains of a wooden shaft (Fig. 6). Its length is 18.3 cm; the internal diameter of the socket is 3.1 cm. The pickaxe has a striking part rounded in cross-section with a flattened, expanding butt in the form of an axe. The diameter of the striking part is 1.3 cm; the width of the rounded end of the butt is 3.6 cm. According to some scholars, the carriers of the Pazyryk culture made real battle pickaxes mostly

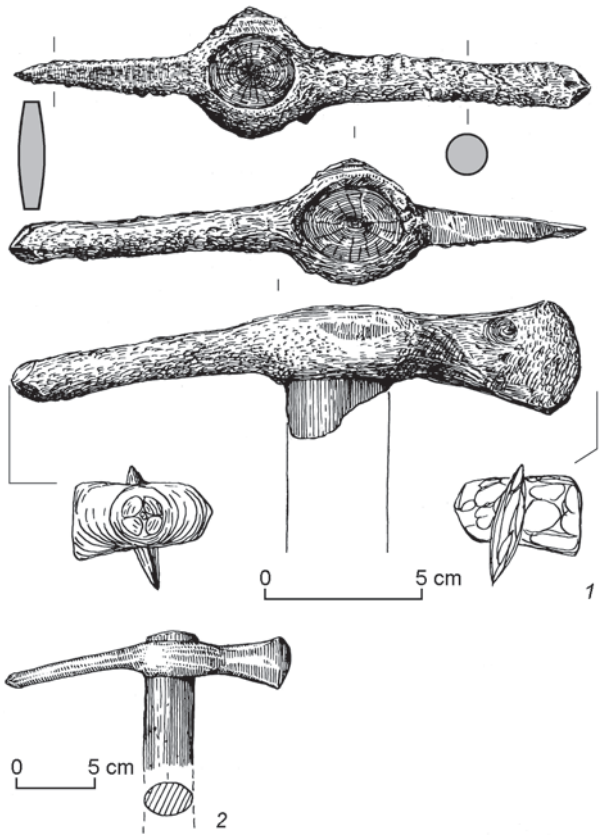

Fig. 6. Iron pickaxe (*1*) and its reconstruction (*2*).

of iron (Kubarev, 1991: 79). In order to identify the item as a replica or as a real battle pickaxe, not only is its size important (Surazakov, 1989: 51; Kubarev, 1992: 65), but also its weight (Kiryushin, Stepanova, 2004: 58). The discovery of heavy bronze pickaxes has made it possible to identify some of these as real weapons. In total, there have been slightly over ten iron and bronze battle pickaxes found in the burial mounds of the Pazyryk culture (Ibid.: 60). The iron pickaxe from mound 22 at the Barburgazy I cemetery is relatively similar to that of mound 46 at Khankharinsky Dol. It also has a hatchet-shaped butt, but it is slightly longer and more inclined (Kubarev, 1992: 64–65, fig. 21, *1*). The item from mound 9 at the Kosh-Tal cemetery (Surazakov, 1993: 42, fig. 31, *1*) is also similar to the one under consideration. Poorly preserved iron hatchet-shaped war hammers were also found in mounds 8 and 23 at Maltalu IV (Kubarev, 1992: 65, pl. XLVIII, *4*, LXVII, *5*). Such finds also occurred at the sites of the Scythian period in Tuva (Grach, 1980: 198, fig. 60, *1*; Kyzlasov, 1979: 73, fig. 59, *3*; Semenov, 2003: Pl. 32, *25*, *26*; and others). For example, a pickaxe similar to the one under consideration was discovered in mound 28 at Suglug-

Khem I (Semenov, 2003: Fig. 32, *25*). V.A. Semenov dates such artifacts from Suglug-Khem I and II to the 2nd century BC. He holds to the viewpoint that the sites of the Pazyryk culture, including those excavated in the Pazyryk locality and on the Ukok plateau, need to be dated to a much "younger" period, that is to the 2nd century BC (Ibid.: 76–81, pl. 107). Semenov cites a series of radiocarbon dates for the cemeteries of Suglug-Khem I and II, which correlated with the archaeological evidence fairly well, and indicates the period of the 5th–3rd centuries BC. However, he believes that these dates, like those previously obtained for the cemeteries of the Pazyryk culture of the Altai, cannot be used to establish the chronology of the sites (Ibid.: 79–80).

War hammers with a hatchet-shaped butt, but with a faceted striker, are known from the Saka burials in the Pamir, in particular mound 1 at Alichur II. B.A. Litvinsky designated hatchet-shaped war hammers as "pickaxe-hatchets", and emphasized their wide occurrence in the Scythian period in the Black Sea region, the North Caucasus, the Kama region, Central Asia, Northern China, and Southern Siberia (1972: 120–125, pl. 43, *5*). Bronze and iron pickaxes, similar in type to the item from Alichur II, were found at the Karas cemetery near Pyatigorsk and in a Sind grave on the Taman Peninsula near the Tsukur estuary (Krupnov, 1960: 205; Melyukova, 1964: 68). Wedge-shaped war hammers, including those with hatchet-shaped butts, are quite widespread in the materials of the Ananyino culture, but these are made mainly of bronze (Zbrueva, 1952: 104–106). The item from burial 18 at the Ananyino cemetery (Ibid.: Pl. XXII, *11*) is of particular interest. Litvinsky considered it to be one of the closest parallels to the war hammer from Alichur II, although he mistakenly believed that it was made of iron, whereas in fact the item was made of bronze.

An war hammer with a wedge-like striking part and a hatchet-shaped butt from mound 1 at Alichur II was dated to the late 5th–4th century BC (Litvinsky, 1972: 123). Iron pickaxes with hatchet-shaped butts from the burial complexes of the nomads in the Altai Mountains were usually dated to not earlier than the 4th century BC (Kubarev, 1992: 66) or, taking into account bronze replicas of items of this type, to the 5th–3rd centuries BC (Surazakov, 1989: 53–54). The item from mound 46 at Khankharinsky Dol may also be classified as a war hammer and dated to the late 5th–4th century BC.

The horse equipment consisted of an iron bit, horn girth buckle and block (Fig. 7). The bit consisted of a set of two-piece links each ending in a single ring (Fig. 7, *1*). The length of one link was 11.1 cm; the length of the other link was 10.2 cm; the diameter of the ring ends was 2.9 and 3.4 cm, respectively. Such bits have been found in large quantities at the Pazyryk sites in different areas of the Altai, including its northwestern part (Dashkovskiy, 2023: 28–32; Kubarev, 1991: 42–44; Kubarev, Shulga, 2007: 270, fig. 4, *11–18*; Shulga, 2015: 93–97; Kiryushin, Stepanova, 2004: 45–46; and others). They appeared here in the 6th century BC, and were used throughout the entire period of the Pazyryk culture (Surazakov, 1989: 25; Kubarev, 1992: 32; Shulga, 2015: 96).

The sub-rectangular, plate-shaped girth buckle, without a hole for the free end of the girth strap, with a hook-shaped pin perpendicular to the frame, was made of horn (Fig. 7, *3*). The length of the item was 7 cm; the width at the top with the pin was 3.7 cm; the width at the bottom was 3 cm. A suboval hole 1.7 cm long and 0.7 cm wide was in the lower part. According to the classification proposed by P.I. Shulga, the buckle belonged to type 1, variant 1. Shulga mentioned that 28 well-preserved buckles out of 105 items of

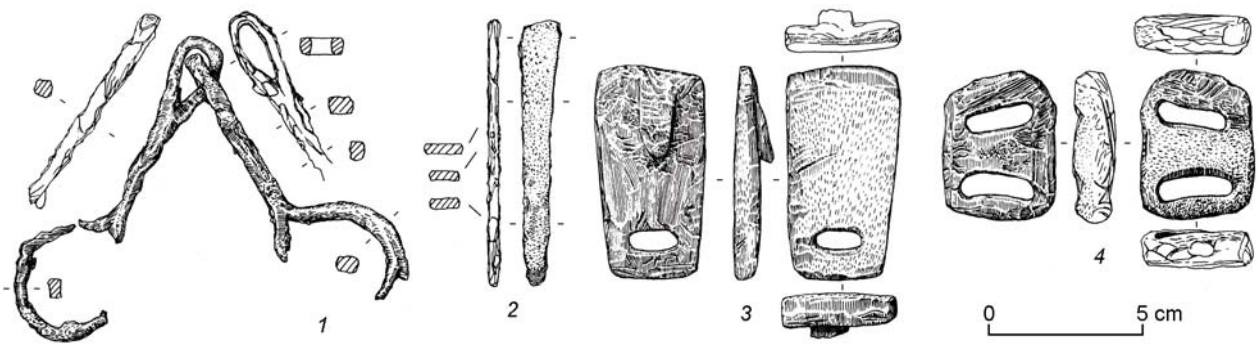

Fig. 7. Iron bit (*1*) and knife (*2*), horn girth buckle (3) and block (*4*).

this type have survived from burial mounds of the Pazyryk culture (2015: 124–125). After excavations of burial mounds of the Scythian period in the Chineta archaeological microdistrict, there have already been found over 30 such artifacts. Buckles from mound 32 at the Kastakhta cemetery (Stepanova, 1987), elite mounds of Tuekta I, Bashadar II, and Katanda (Rudenko, 1960: 354–355, pl. XXII, *6*, XLI, *6*, LXV, *6*; etc.), and other locations are relatively similar to the items from Khankharinsky Dol.

The sub-rectangular girth block with rounded corners made of horn has two sub-parallel oval holes (Fig. 7, 4). The length of the item is 4.9 cm; the width is 3.7 cm. Such blocks, combined with horn girth buckles with a hook-shaped pin, were relatively common at the early stage of the Pazyryk culture (Shulga, 2015: 116–128) and probably continued to be used in the later period of its development (Ibid.: 311, fig. 80, 81). The block from mound 32 at Kastakhta, where a similar girth buckle was also found (Stepanova, 1987), is the most similar to the block under consideration. Such items have appeared among the material evidence from the Ulandryk I (mound 15) (Kubarev, 1987: 235, pl. XXXIV, *4*), Uzuntal I (mound 2) (Savinov, 1993: 6, fig. 6, 7), and Borotal I (mound 99) cemeteries (Kubarev, Shulga, 2007: 234, fig. 39). In most cases, horn girth buckles and blocks of this type have been found in burial mounds dated to the 5th (second half of the 5th) to 4th centuries BC.

The iron knife can be classified as a straight laminar knife without a distinct handle or pommel. Its length was 8.6 cm, and its maximum width was 1.4 cm. Such knives were widespread throughout the entire period of the Pazyryk culture (Surazakov, 1989: 16–23; Kiryushin, Stepanova, 2004: 72–76; Kubarev, 1987: 52–54; 1991: 69–70; 1992: 53–54; and others).

Social attribution

Previous study of the weaponry set from the burial mounds of the Pazyryk culture has showed that their nomadic society was highly militarized (Kocheev, 1990, 1998; Dashkovskiy, 2005; and others). This is confirmed by a high percentage (up to 70 %) of weapons of various types in the male burials, with this figure reaching 73 % for the most socially active age group (20–35 years of age). Various injuries caused by weapons were observed on the bones of some of the buried males. A large share of cenotaphs (7–8 %) also suggests high military activity. Considering the presence of weaponry, 5–6 % of them can be associated with structures built in honor of fallen warriors whose bodies were not able to be buried. In addition, a significant amount of cenotaphs date back to the periods of important historical events (the campaigns of Alexander the Great, etc.), which had serious military and political ramifications. The analysis of the funerary rite and burial goods, as well as socio-typological modeling, have made it possible to identify a specific group of professional warriors—members of the retinue—in the military hierarchy of the Pazyryk society (Dashkovskiy, 2003: 57–59; 2005). Most likely, they were mounted warriors, which is evidenced by accompanying burials of horses in addition to weaponry.

Military retinues existed in different historical periods among many peoples of Southern Siberia and Central Asia, including the Sagly people, Sakas, Tagarians, Xiongnu, Turkic people, Uighurs, Kyrgyz, Mongols, etc. (Grach, 1980: 46–48; Kulemzin, 1980: 166; Hudiakov, 1986: 166; Vladimirtsov, 1934: 87–96; Kradin, 1996: 81–82; and others). They were usually based on personal ties between warriors and leaders, rather than on traditional clan-tribal relations. The military retinue could include representatives of both the elite and lower social groups who had proven themselves in the art of war (Dashkovskiy, 2003: 59).

Considering that combat daggers, pickaxes (war hammers), and shields are extremely rare in the Pazyryk burials, the discovery of two real, not imitated, weapons—an iron dagger and pickaxe—in mound 46 at the Khankharinsky Dol cemetery clearly indicates the special social status of the buried male. Most likely, he was a professional warrior and member of the retinue during his lifetime. Ancient nomads had a tradition of supplying particularly distinguished deceased warriors with combat weaponry (Kubarev, 1981: 32–33). Moreover, the two decorated belt plaques made of horn, which are a fairly rare find for the Pazyryk burials, also emphasize the status of the deceased. It is no coincidence that belts had a special semantic load, reflecting the social status and ideological views of the nomads of Central Asia (Dobzhanskiy, 1990: 60–72). The following observation may indirectly confirm its significance in the Scythian period. A certain pattern was noticed when studying burial grounds of that time in the northwestern Altai. Burials of males over 45 years of age, made according to the canons of the funerary rite, usually contained no socially marking items. The reason may be that people of that age were already excluded from the active social life of the

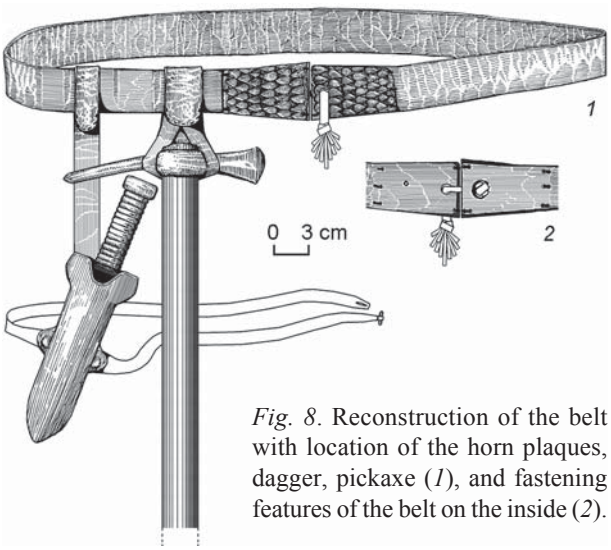

Fig. 8. Reconstruction of the belt with location of the horn plaques, dagger, pickaxe (*1*), and fastening features of the belt on the inside (*2*).

group. Nevertheless, a nomad would probably retain the right to be buried with his belt, which reflected his place in the social organization of nomads. Be that as it may, in mound 31 at Chineta II, only two horn belt plaques were present as the accompanying goods in the burial of an elderly male (40–50 years of age). The study of mound 46 at Khankharinsky Dol has made it possible to reconstruct the belt of a nomad and identify the location of the horn plaques, iron dagger, and pickaxe on it (Fig. 8). Such a belt undoubtedly demonstrated the special status of the buried male warrior.

Finally, it is worth noting once again that the accompanying burial of a horse also reflected the position of the deceased in the social system of the nomads. Although archaeologists consider horse burials an important marker of the funerary rite in the Pazyryk culture, this component was observed in only about 37 % of the burials, which is precisely associated with the social and property status of the deceased and his family (Tishkin, Dashkovskiy, 2003: 144–150). In the burial mounds of the Pazyryk culture, which were studied at the Khankharinsky Dol cemetery, accompanying horse burials appeared much more often than in other areas of where this rite was used. Moreover, the share of such burials there was significantly higher than at other Pazyryk sites in the northwestern Altai. Along with the presence of prestigious and socially important things, including imported items, this circumstance has allowed the current authors to propose the identification of the so-called regional elite of the nomads in one of the areas of the Pazyryk culture, which includes the northwestern group of sites in the Charysh River basin, with the elite burial complex in the valley of the Sentelek River (the cemetery of the Urochishche Balchikovo-3) and necropolises of Khankharinsky Dol and Chineta II (Dashkovskiy, Meikshan, 2015; Dashkovskiy, 2022).

Conclusions

Research has revealed that mound 46 at Khankharinsky Dol belonged to the Pazyryk culture of the Altai, and could be preliminarily dated to the late 5th–4th century BC. The presence of real combat weaponry (an iron dagger and battle pickaxe), which is extremely rare for the sites of this culture, suggests that the buried male was most likely a professional warrior and had special military merits. In addition, decorated horn belt plaques confirm the non-ordinary social status of the deceased. The accompanying burial of a horse with elements of riding equipment (the girth buckle and block made of horn, and the iron bit) testifies not only to the cultural affiliation of the burial mound, but also to the social and property status of the buried nomad.

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A Tes Stage Mound-Vault at Skalnaya-5, Khakassia

This article introduces the findings relating to the construction of a mound-vault Skalnaya-5 in Khakassia—the only virtually completely preserved Tes funerary structure. On the basis of these data and using the Blender 4 software, we carried out a visual reconstruction of the vault. This collective tomb was a cabin, whose walls were built of nine layers of logs and covered with a multi-layered timber ceiling. Functionally, such a construction ensured a maximal influx of air. The entrance, which had two steps at the inner end, was arranged as a special opening in the wall and was used for a considerable time. Inside the vault, there was a two-level construction with upper shelves made of three log-spacers opposite the entrance and the lower ones made of wide planks, placed along two walls. The bodies and/or their effigies with clay-plaster masks were laid on the shelves and on the log floor. The analysis revealed the secondary use of wooden details of dwellings or household buildings, which had been trimmed in situ before being joined. We were able to record construction techniques used during the Tes and earlier stages. These could be related to winter huts or utility buildings dug into the ground, or wooden structures strengthening the walls of mining shafts. The closest constructive parallels are found in the Pazyryk culture, possibly evidencing the conservatism of house-building in the Altai-Sayan highland during the Early Iron Age.

Keywords: **Khakassia, Tes stage, mound-vault, funerary shelves, reconstruction, house-building.**

Introduction

Insight-giving remains of burial structures of the Tagar culture have always provoked great interest among scholars, making it possible to build up consistent cultural and chronological series based on the appearance, specific features, and purposes of individual structural elements*, and to identify foreign cultural influences. These structures should be viewed not only in the context of entry into the other world (afterlife), but also as embodiments of the appearance of earthly dwellings and one of the important symbols of Scythian cultures (see, e.g., (Vadetskaya, 2007: 70; Prishcheva, 2018: 158; Mylnikov, 2022: 84–86; Polosmak, 2023: 100)). Several key points should be made for the purpose of this publication, to elucidate how stable house-building traditions were reflected in the funerary rites of the Tagar population. First, it is necessary to rely on the set of sources on the burial structures that could be used for making interpretations. On the basis of the principle of reliability, we should distinguish complete, partial, or fragmentary reconstructions of log buildings, depending on their degree of preservation. Second,

*Almost all periodizations by S.A. Teploukhov, M.P. Gryaznov, M.N. Pshenitsyna, S.V. Kiselev, L.R. Kyzlasov, N.L. Chlenova, E.B. Vadetskaya, A.V. Subbotin, and N.Y. Kuzmin are based primarily on the changes in the types of burial structures (see, e.g., (Gryaznov, 1968: 188–190; Subbotin, 1983: 64; Stepnaya polosa..., 1992: 206–209; Kuzmin, 2011: 18–26, 71–77)).

in reconstructions of visual images, one should rely not on artistic sketches made by descriptions, but on factual and objective field documentation, including archaeological drawings, photography, and video filming. Third, wooden burial structures should be visualized in stages, using both traditional (modeling, graphic reproduction) and recent software tools elaborated for architectural engineering and design. We have taken all these key points into account while reconstructing the burial structure of the Tes mound-vault Skalnaya-5. This complex was studied in 2021 in the Askizsky District of the Republic of Khakassia during rescue works, and brief preliminary results were published (Bogdanov, Timoshchenko, Ivanova, 2021: 883–885).

Description of architectural features of the complex

The Skalnaya-5 burial mound is located northwest of the town of Uytag, in the left-bank valley of the Abakan River, with gentle hills. It is a part of a vast cemetery of the Tagar culture. The size of the steep-sided stone and soil embankment stretching along the N-S line was 33 × 24 m, with a height of 3 m. Construction methods and the organization of the internal and external space, as well as structural elements and stratigraphic sections, were analyzed to identify two construction stages. The first stage corresponds to the Sargash period, as evidenced by the enclosure made of large dug-in slabs of Devonian sandstone, rising 1.3–1.5 m above the ancient surface (Fig. 1, *1**). The walls were selectively reinforced with buttresses and had both corner and pier (two per side) stele stones with beveled tops (Fig. 1, *2*, *5*). The so-called twelve-stone burial mound of the "Salbyk type" (after (Akulov, Pauls, 2008: 8)) had a passage from the east, formed by a corridor of vertically installed slabs with end corner steles. After the burial rite, the passage was closed by a wall of flagstones laid horizontally in seven layers (Fig. 1, *3*). The entire space inside the enclosure was covered with layers of large bands of sod and loam right up to the upper edge of the wall stones. It is impossible to determine more about the original structure, since it was rebuilt during the Tes period, and the central burial was destroyed. The enclosure walls of the preceding stage were covered with sandstone slabs, laid flat on top of each other in three to ten layers (Fig. 1, *1*, *6*). The height of these new walls reached at least 1.2 m. In addition, the Tes people set up massive steles vertically at each wall of the enclosure and at the corners, wedging them with large boulders (Fig. 1, *4*, *5*). The height of the steles could reach 3.2 m. Seven such later stones were found in the southeastern wall of the enclosure, five in the southwestern wall, and three in the northwestern wall. The earthen "platform" of clay and sod blocks (Fig. 2, *1*) was also increased in height by five to six layers across the entire internal area. Originally, the structure could have had a pyramidal shape; in order to prevent it from spreading, layered walls of flagstone were made (see Fig. 1, *6*). During that construction stage, a flat-bottomed, weakly curved, hand-molded vessel covered with a lid made of a small sandstone slab could have been placed near the eastern corner of the enclosure on the outside. The earthen "body" of the burial mound covered a monumental wooden burial crypt, which was inserted into a larger Sargash burial pit (see Fig. 2, *3*). Only fragments of posts from the so-called palisade along the walls and flattened wood slabs of the cover on the edge of the original pit remained from the early burial (Fig. 4). Despite two large-scale break-ins by robbers, and arson on the chamber from the inside, all the main structural parts of the Tes burial vault have survived.

The logwork of nine layers (internal size 7.2 × × 6.3 m, height 3.2 m) was built using saddle notch joints (Bolshaya kniga..., 2017: 162), with the saddle facing down (Fig. 5; 6, *2*, *3*). Woodwork was carried out during the process of assembling the logs into a single structure. Notably, saddle notches on the logs of the structure had a flattened trapezoidal profile, and sometimes a larger size than was required for joining. This feature and the absence of traces of careful marking indicate a possible secondary use of some of the logs for construction of the vault. This is also confirmed by the presence of towing points and the scorching of some trunks on the outside, where the funeral fire did not reach.

The ceiling of the vault is made of the longitudinal cover of 12 massive logs, additionally pressed by two transverse logs at the edges (see Fig. 2, *2–4*). Thinner logs were laid on top in a lattice pattern in four layers (see Fig. 2, *3*). There were no traces of birch-bark coverings. A cavity from two supporting logs that secured the ceiling cover, along with the upper latticed ceiling, had some ventilation and "springy" qualities.

*Photographs and drawings were made by E.S. Bogdanov, with participation of A.S. Nemkova and A.S. Ivanova.

Fig. 1. Mound-vault Skalnaya-5.

1 – north view of stone enclosure at the level of the grave spot; *2* – northwest view of stone enclosure at the level of the native soil surface; *3* – east view of the entrance to the enclosure of the Sargash mound closed by a stone partition; *4* – southeastern corner of the enclosure (arrows indicate the steles installed by the Tes people); *5* – southwestern corner of the enclosure (method of installing the slabs with buttresses is visible); *6* – west view of the multilayered wall made of flagstone on top of the enclosure.

An opening for entering (a void in four logs) was made in the western wall of the logwork (see Fig. 2, *6*). Since only one log remained above it, two more logs were set up vertically along the edges of the opening on the inside to increase the rigidity of the log structure (see Fig. 3, *3*) and ensure greater stability of its components. This opening was made before the log structure was placed into the burial pit. A corridor 1.5 m long and at least 1 m wide led to the opening through the earthen "body" of the burial mound at a slight slope, ending in two steps made of stone tiles, leading downwards (see Fig. 2, *6*; 4). This structure can be visually reconstructed very conventionally owing to its poor state of preservation. Most likely, its base consisted of two external vertical posts installed parallel to each other, and a horizontal cover made of thin slabs and panels between the entrance and logwork (see Fig. 2, *5*).

Fig. 2. Structural features of mound-vault Skalnaya-5.

1 – west view of the earthen above-ground structure (bands of sod and loam are visible); *2* – north view of remains of the wooden structure destroyed by robbers; *3* – surviving fragment of multilayered wooden cover; *4* – logs of the ceiling-cover; *5* – stratigraphic section of the passage to the vault (remains of a post, slabs, and stones of the cover are visible); *6* – opening in the wall of the logwork (steps faced with stone tiles and supporting posts inside the vault are visible).

The interior of the vault consisted of a two-level structure. Three log-spacers were at the level of the fourth layer of logs (from below) along the wall opposite the entrance, parallel to each other (at a distance of 0.4–0.5 m) (see Fig. 3, *1*, *2*; 4). Their trimmed ends were inserted into specially cut sub-rectangular grooves in the walls of the logwork (see Fig. 3, *2a*). The presence of six supports placed under the logs in the central part suggests the bearing of some load. Functionally, this structure provided maximum air access. The shelves made of planks (45–60 cm wide, 3–5 cm thick) were located along the northern and southern walls and one layer of logs below the structure described above (see Fig. 3, *4–6*; 4). They rested on the cracks between the logs of the logwork, and had no supports. Holes for fastening, which do not coincide with each other, have survived on two planks. The common outline of these additional fastening elements has the shape of a bow tie (see Fig. 3, *5a*). Such fasteners were typically used only for connecting thick boards, which had been preliminarily adjusted by the edges (Ibid.: 166). However, the general mismatch of the two parts of insets clearly indicates that boards from some other

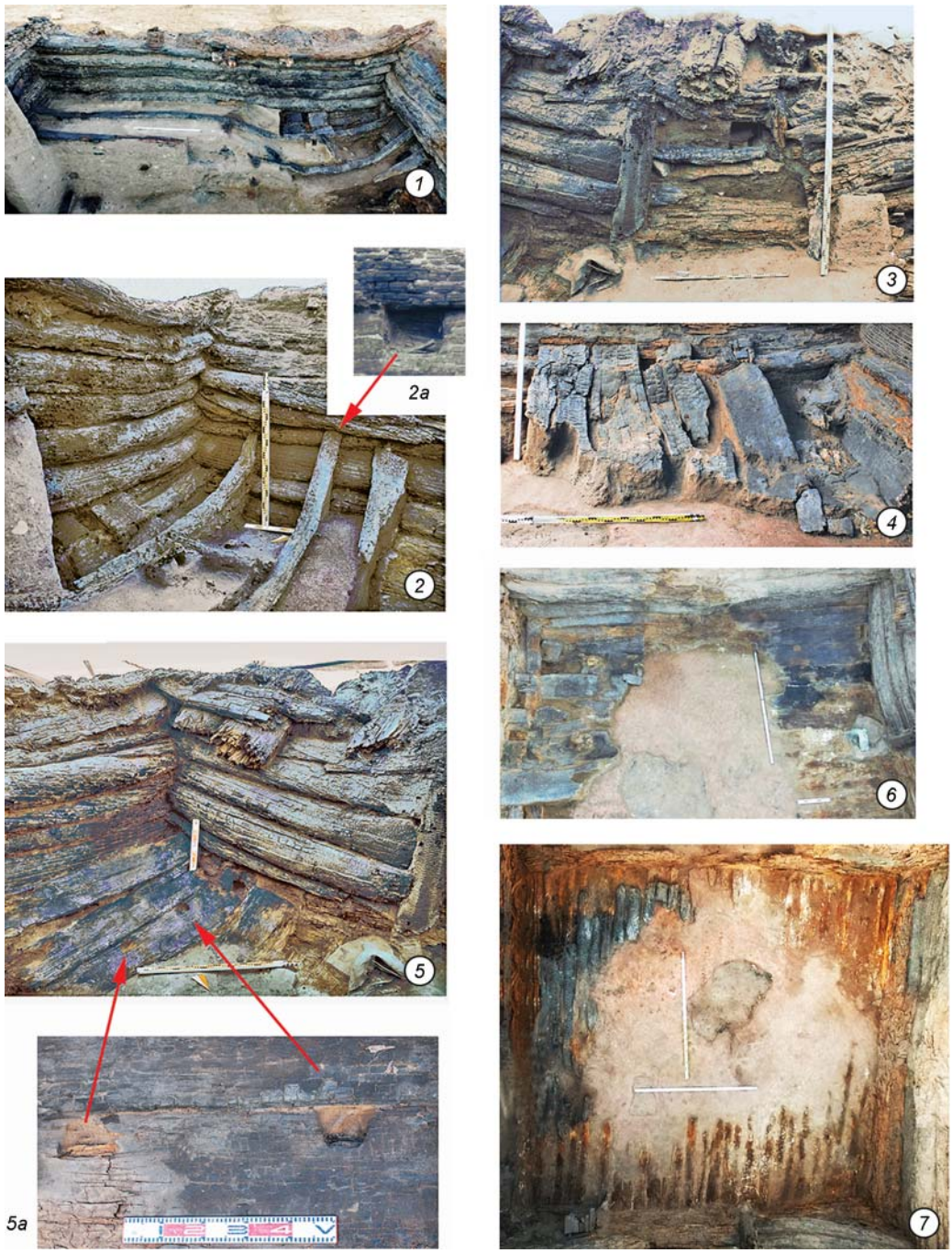

Fig. 3. Internal structure of the vault.

1 – shelves made of log-spacers at the eastern wall of the logwork; *2* – place of fastening of shelves made of log-spacers in the southeastern corner of the logwork (*2a* – groove in the wall); *3* – east view of the blocked-up opening-entrance to the vault; *4–6* – shelves made of planks (*5a* – fasteners on bank boards); *7* – view of remains of the cleaned floor made of logs (with remains of robber's pit in the center).

disassembled wooden structures were used. Generally, the vault furnishings were quite well optimized with the maximum filling of the entire internal space with structural elements for the most convenient performance of funeral and ritual ceremonies.

The floor in the vault consisted of unhewn logs tightly laid in a W-E direction (see Fig. 3, *7*). Since their ends were under the walls of the logwork, most likely, laying the floor was the initial construction stage of the wooden structure in the pit.

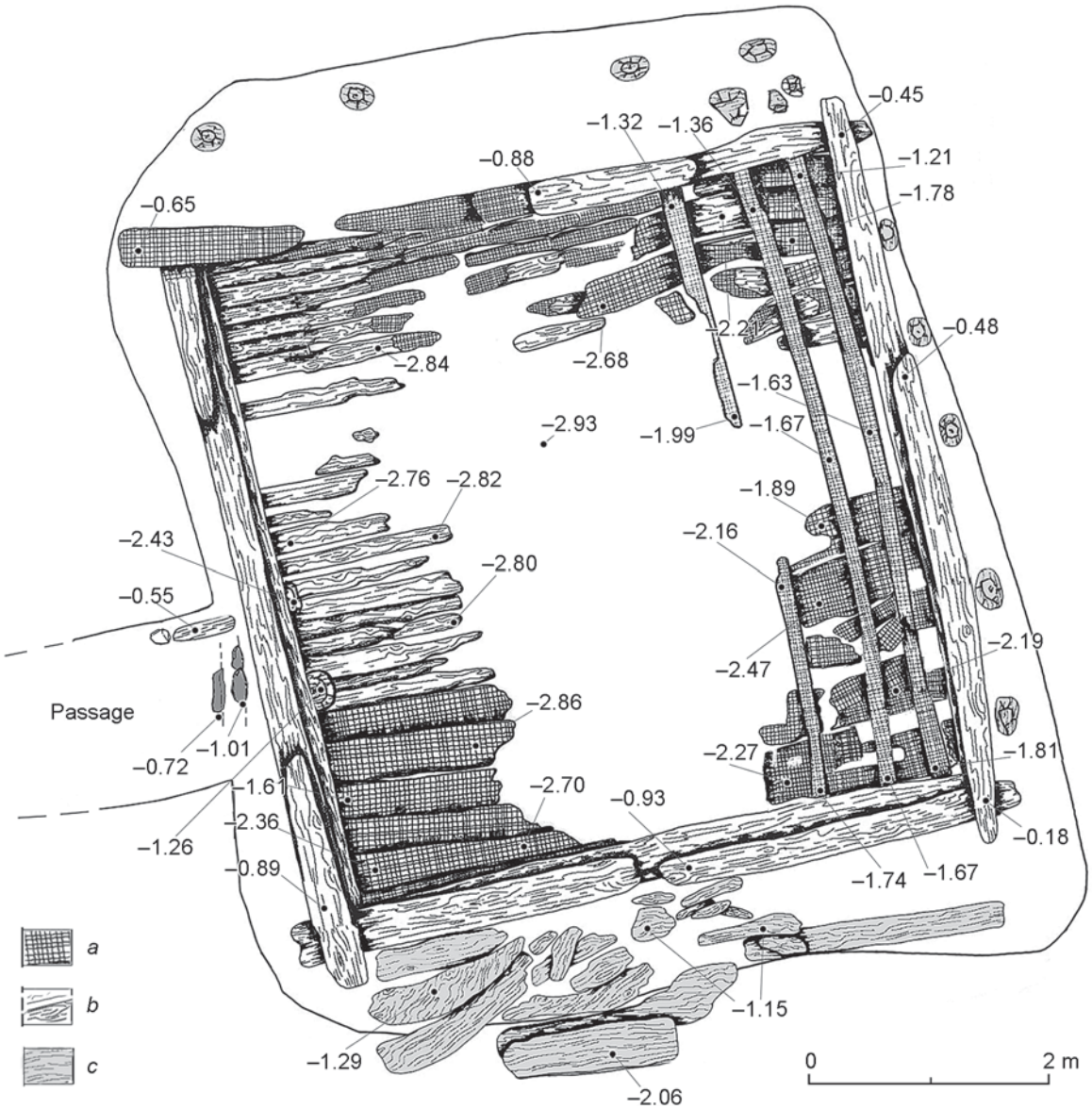

Fig. 4. Plan of the wooden structure at the level of the shelves.
a – charred wood; *b* – logs; *c* – remains of the Sargash log cover.

Visual reconstruction methods

Visual reconstruction of the wooden vault was carried out in several stages. First, traditional large-scale modeling provided an idea of the general parameters and fastening features of the log structure. Then, based on the model, a number of drawing reconstructions were manually made for selecting the most representative angles and sections. The final stage was 3D modeling of both the object and its main parts using Blender 4—one of the best 3D graphics and animation packages to date (Serova, 2021; Krauder, 2023). Therein, the main emphasis is made on polygonal modeling, which ensures high accuracy of control over the facets and points of the reproduced object according to the given dimensions. This software offers a wide range of textures for object parts and angles of its lighting. Rendering makes it possible to "bake" the results of the virtual reconstruction into static images (see Fig. 5–7*).

*The basis for the 3D model of the vault was developed by A.D. Kutyrev, finishing and visualization of the computer reconstruction were carried out by A.Y. Chulyuskin (employees of the multimedia historical park "Russia—My History" in Novosibirsk) on the basis of the model and drawings made by A.P. Borodovsky.

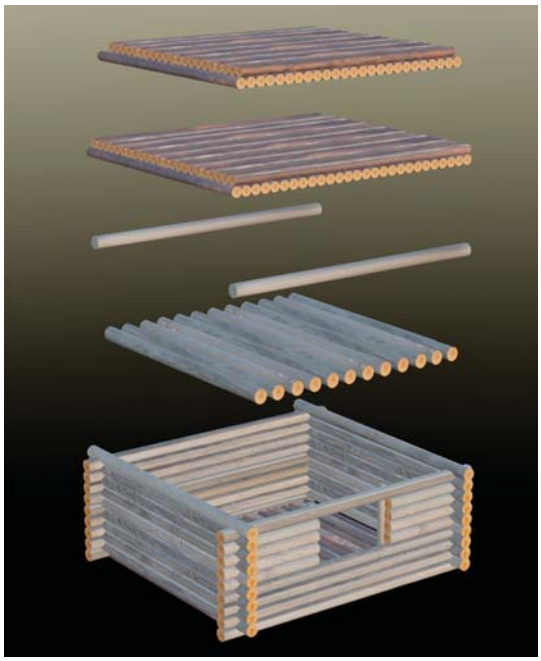

Fig. 5. Visual reconstruction of elements in the logwork.

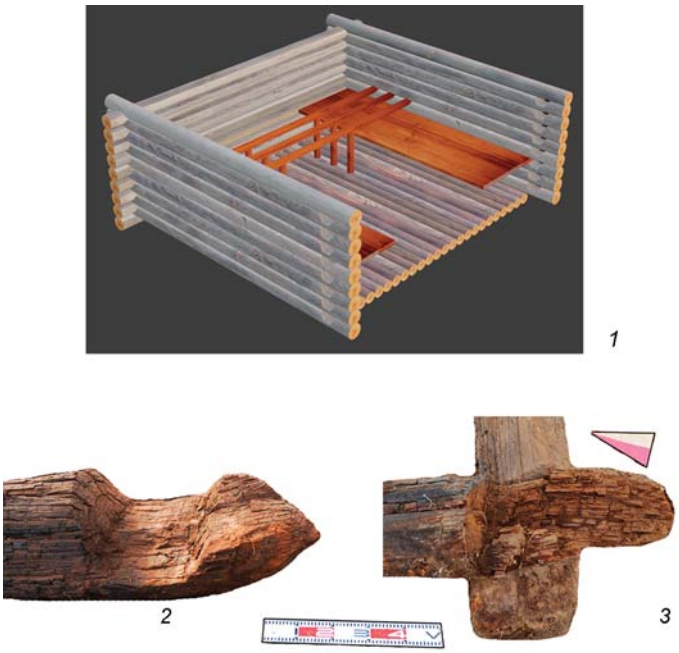

Fig. 6. Visual reconstruction of details of the internal layout (*1*), design of the end of the log with the saddle notch (*2*), and saddle-notch joint (*3*).

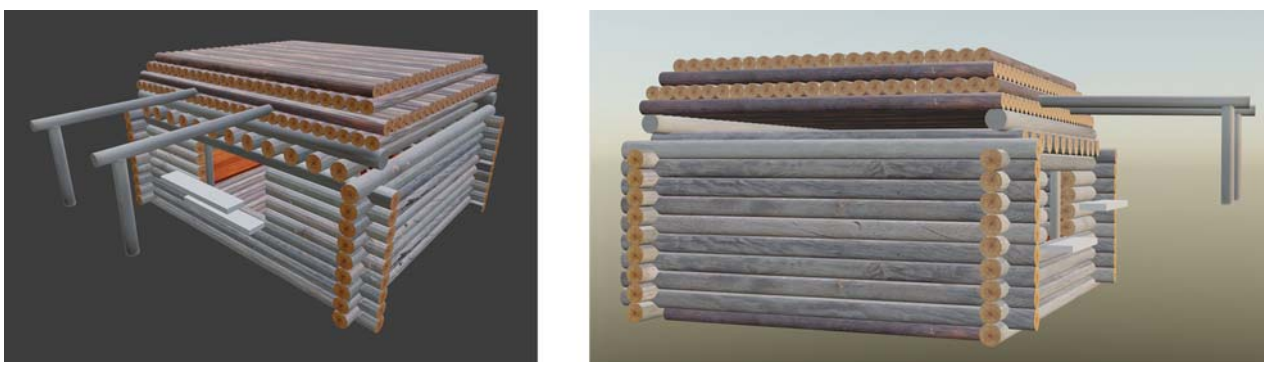

Fig. 7. Visual reconstruction of the vault with the entrance.

Discussion of the results and controversial points

Our visual reconstruction was based on the archaeological source, and objective field documentation. The Tes people obviously used the vault for quite a long time. At first, the deceased persons (and/or effigies)* were laid directly on the floor along the transverse walls quite close to each other, with a free passage in the center. After some time, wide plank shelves were built on both sides of the vault for the newly buried. The final act of the rite was setting fire to the tomb on the inside and closing the entrance. Owing to the lack of oxygen, the wooden vault and its contents did not completely burn out. Unfortunately, some aspects of the funerary rite cannot be established because of the fire and subsequent large-scale robberies. The cover of the logwork collapsed after the first robbery, breaking the interior furnishing of the vault.

Notably, a complete and objective reconstruction of the entire mound-vault Skalnaya-5 is complicated by a small number of the studied Tes collective tombs and large-scale looting (destruction) of these complexes in ancient times. The available drawing reconstructions (Subbotin, 1983: Fig. 1; Vadetskaya, 1986: Pl. 7, *24*, *25*; 2009, fig. 64, 88, 155; Stepnaya polosa..., 1992: Pl. 92;

*For specific aspects of the Tes funerary rite, see (Vadetskaya, 2006; Kuzmin, 2011: 176–179; Bogdanov, 2024).

Kuzmin, 2008: Fig. 2; 2011: fig. 11, 17–20, 25), after reviewing the photographs and drawings from field reports and publications, raise many questions and reveal a number of inconsistencies. As a result, we find parallels with our evidence only in relation to individual structural elements, which might have been caused by one of the key trends of the Tes period—the maximum diversity of burial structures due to active mutual influence of the Tagar and Tashtyk traditions (Savinov, 2009: 54; Vodyasov, Zaitseva, 2023: 297). For example, specific features of the above-ground burial structure at Skalnaya-5 can best be seen in mounds near the village of Tes, mounds Kyzyl-Kul, Tepsey XVI, Barsuchikha I, and Lisiy near the village of Sabinka, Novye Mochagi, Tas-Khyl, Togr-Tag, and especially in the Barsuchy Log mound (Pshenitsyna, 1979: 83; Vadetskaya, 1986: 82–83; 1999: 308; Pavlov, 1987; Kuzmin, 2011: 52; Parzinger, Nagler, Gotlib, 2010: 171–177).

Similar plank shelves—P.G. Pavlov called the planking "separating the upper deceased from the lower ones"—were discovered in the Lisiy burial mound near the village of Sabinka (1987: 110), while simplified versions of shelves made of logs laid next to each other had already appeared in the Sargash vaults (Vadetskaya, 1999: Pl. 100, 101). These facts allow us to consider the structure of three log-spacers in the Skalnaya-5 vault also a bunk on which the deceased could have been laid in preparation for the next stages of burial rituals (see Fig. 6). Air permeability (the entrance to the vault remained open for a long time) could have contributed to the natural transformation of the corpse into a skeleton, especially if we take into consideration the design of the ceiling deck with the cavity and gaps (see Fig. 7). It is not known at what point (or after what time) the earthen embankment was built in the central part of the enclosure, and the wooden vault could have stood open for a long time for performing the necessary ritual actions. That being said, the purpose of the structure made of log-spacers might also have been different.

Taking into account reused wooden elements for constructing the burial logwork, many observations of the repeating algorithms lead us to broader parallels and associations than a simple search for parallels among the Tes evidence. For example, the structure of the interior chamber of the vault is similar in its parameters to the so-called log cribwork with sides corresponding to the length of logs within 6–10 m. According to ethnographic data, such cribworks had up to nine layers of logs (Ashchepkov, 1950: 31).

The process aspects of the entrance to the Skalnaya-5 mound-vault were typical for the arrangement of window and door openings in subbasements (Zabello, Ivanov, Maksimov, 1942: 15; Ashchepkov, 1950: 84, 87). It is interesting that the Tagar petroglyphs (Bolshaya Boyarskaya and Malaya Boyarskaya rock art sites) show similar openings in depictions of residential log buildings (Gryaznov, 1933: 44, 45; Devlet, 1976: 8). These houses are shown to have eight or nine layers of logs and a different location of the opening as compared to the Tes vault. In the petroglyphs, the opening begins at the level of the floor of the structure; in the vault, at the fourth log from the bottom. Nevertheless, the similarity of a number of structural elements on the petroglyphs and in real late Tagar log vaults makes it possible to expand argumentation significantly in the discussion of the diversity of types of residential buildings in this period (Prishcheva, 2018: 153, 158). Moreover, according to a number of features, the Boyarskaya petroglyphs belong to the final period of the Tagar culture (Devlet, 1976: 30).

The closest structural parallels among the surviving log burial structures of the Early Iron Age appear in the evidence of the Pazyryk culture. N.Y. Kuzmin, albeit without much evidence, believed that vaults with vertical supporting posts and two-story under/above-ground structures were closely related to the Han traditions (2008: 194). However, precisely the 5th Pazyryk burial mound also had an opening in one of the side walls of the outer burial log structure (Mylnikov, 2022: 84), although it started from the second log from the bottom and was not four, as in our case, but three logs high. The opening in the wall, as in the Tes vault, was made in advance, before the log structure was installed in the burial pit. According to observations by S.I. Rudenko, this is confirmed by the direction of cutting (from the inside and outside on different walls) and the complete absence of chips from such impact inside the burial pit (1953: 55–56). Another similarity with the Pazyryk evidence can be found in the longitudinal layer of logs and two transverse logs pressed against it at the edges (Ibid.: 55). The basis for establishing the structural similarity between the Pazyryk and Tes wooden structures is the extremely slow evolution of traditional dwellings of the indigenous Siberian population, revealed by the ethnographic data (Ashchepkov, 1950: 11).

Conclusions

Compliance with the principles of correlating an informative archaeological source with modern

visualizing capacities has made it possible to create a sufficiently high-quality level of reconstructions, comparable with various historical parallels.

1. When comparing our data with the ideas of scholars about the appearance of the Tes collective tombs, we may observe the maximum variety of forms with several main features:

– stone enclosure with an abundance of steles and horizontal slab-based laying of the walls;

– powerful multi-layered wooden cover over the logwork;

– opening-entrance in the wall of the logwork;

– layered shelves for placing the dead or their effigies.

2. The part of mound-vault Skalnaya-5, which we reconstructed herein, belongs to the second construction period at the site, and fully reflects all pragmatic tasks that the Tes builders of the burial structure set for themselves. The structure of the logwork, opening (entrance), wooden cover, and interior furnishing were predesigned; special grooves for fastenings were prepared in advance. Additionally, various parts from residential or utility buildings could have been reused, with their on-site adjustment during the assembly.

3. We managed to identify construction techniques typical of a number of structures of the Tes and earlier periods, among which there could well have been winter huts or utility buildings deepened into the ground, and wooden structures for strengthening the walls of mining shafts during their laying. The vault at Skalnaya-5 has several details in common with such structures. One of these is the multi-layered cover made with the obvious function of "springing" the entire structure of the cover when laying logs in a lattice pattern. Another important detail was the presence of a ventilation cavity between the floor and ceiling of the burial chamber. At the same time, the ceiling, made of thicker logs, was not laid tightly, but with gaps, which provided additional air flow into the chamber. This structural element might have had a certain importance for the speed and quality of mummification processes of the remains placed in the vault. Such good ventilation was also extremely important for the function of mining shafts, in order to avoid the accumulation of flammable methane gas during extraction of copper-bearing rock.

4. The structural similarity of the Pazyryk and Tes wooden structures used in burial practices is quite enough to assume conservatism in the development of house building in the Early Iron Age in the Altai-Sayan.

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"Angular" and "Trestle" Forts in 17th to Early 18th Century Russia

Written sources of the 17th century mention "kosoi" (angular or slanted) forts. F.F. Laskovsky of the Engineer Corps interpreted this term as referring to forts with walls made from inclined logs (palisades). This idea was generally accepted by the scholarly community. The architect S.N. Balandin, without offering any proof, claimed that the "kozelchaty" forts (from "kozly", trestle supports) were a subtype of "kosoi" (angular) forts. The purpose of the present study is to test the conclusions of Laskovsky and Balandin using new evidence. As it turns out, neither the written nor archaeological sources support these versions. In fact, there is enough information to disprove both. The meaning of the word "kosoi" in the 17th–19th century Russian language suggests four hypotheses regarding the structure of walls of "angular" forts. Comparison of them reveals that the term "angular" referred to fortifications with non-straight walls, those joining not at a right angle, as well as those that were triangular in plan view. The specific layout of "kozelchaty" forts cannot be determined due to the lack of evidence. Probably their walls actually rested on trestle supports—two supports made of two or three logs each, on which a horizontal log was placed. Such forts were common mostly in northeast Asia, where forests were scarce, and the ground was frozen or rocky, preventing people from digging ditches for log palisade walls.

Keywords: **Russian Empire, Siberia, Far East, angular forts, trestle forts, palisade walls, trestle supports.**

Introduction

The descriptions of wooden defensive structures from the written sources of the 17th century sometimes mention a *kosoi* ('angular', 'slanted') fort* as a type of palisade wall. At the current time, there has been formed a consensus in historiography that an angular palisade should be understood as a palisade wall that is inclined towards the enclosed space and rests on a platform, trestle supports, or an earth embankment, and palisade walls could be either set into the ground or not. It seems, however, that such a construction of the walls does not provide any advantages over an ordinary palisade, neither for construction nor for defense. Vertically installed logs do not have to be deepened into the ground either. Therefore, we should turn to the historiography of the problem and trace the path by which scholars arrived at their current ideas about the structure of angular forts.

Historiographical overview

The issue of the structure of such walls was first addressed by F.F. Laskovsky in the mid-19th century: "Since the 17th century, fort fences, in terms of construction method, were subdivided into standing, logwork, and angular fences. <...> ...an angular fort probably consisted of logs that were inclined towards

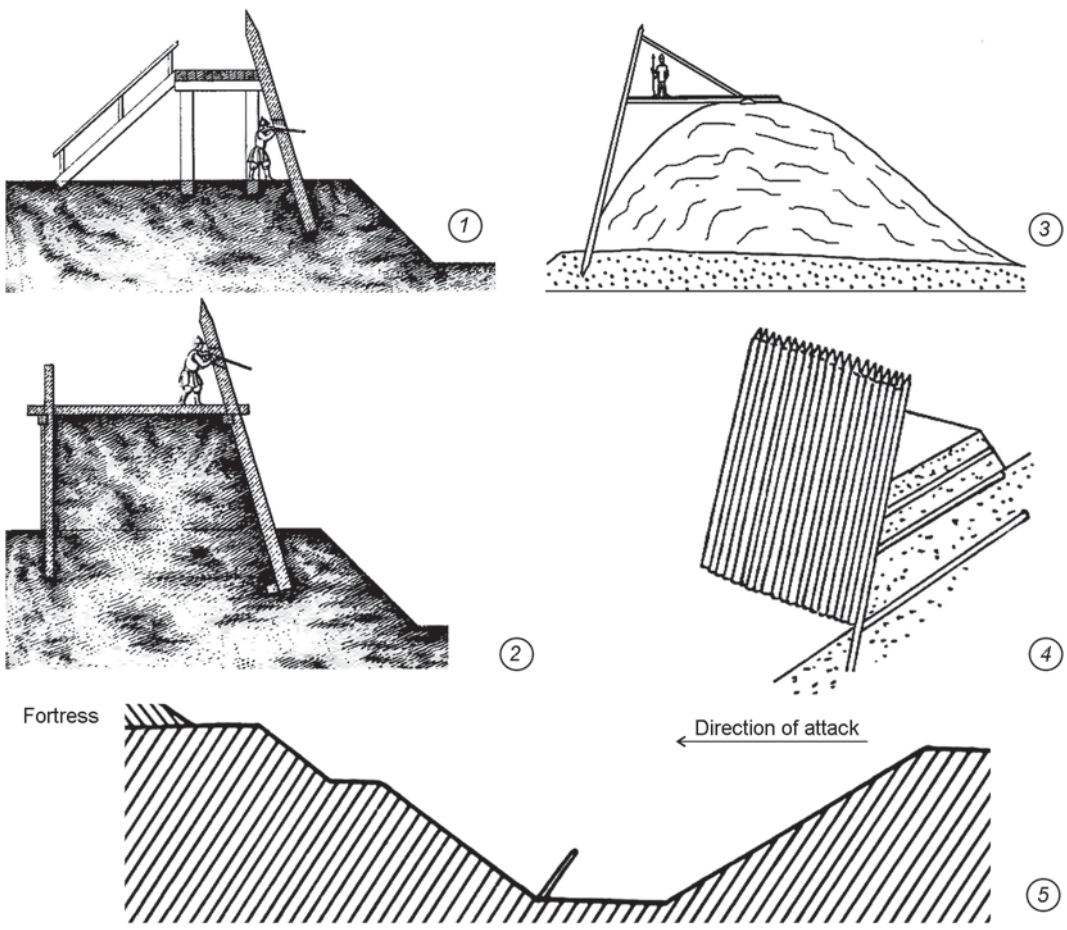
*Hereafter, the terms "angular fort", "angular palisade wall", and "angular palisade" will be used as synonyms.

the interior; and in such a case, they were supported on that side by a rack that served as a platform for the shooters or a small embankment adapted for the same purpose" (see *Figure*, *1*, *2*) (1858b: 101; 1858a: Fig. 84, 85). Laskovsky's conclusion is based on information contained in the order to the Astrakhan governors from 1625: "...and whether the fort was built straight standing, or of logwork, or angular" (Akty..., 1841: 217). Laskovsky was aware of the uncertainty of a reconstruction based on a single example from which the meaning of the term "angular" did not follow directly, and thus formulated his conclusion as a hypothesis.

In 1916, M.V. Krasovsky briefly mentioned angular forts, merely indicating that the wall was inclined towards the enclosed space and could have been supported by a platform. However, the illustration also showed an inclined wall resting on a soil backfill of space between two parallel palisade walls with the outer one inclined and raised above the level of the platform (see *Figure*, *1*, *2*) (Krasovsky, 2002: 100, fig. 100, *a*, *b*).

In 1950, E.A. Ashchepkov thus wrote about angular forts: "The difference between a 'standing fort' and 'angular fort' was only that in the former case, the palisade fence stood vertically, while in the latter case, it was inclined towards the enclosed space" (1950: 49). The author probably adopted this point of view from Laskovsky or Krasovsky, whom he did not refer to due to the popular nature of his publication, yet he removed Laskovsky's doubts regarding the design of "angular forts" from his formulation.

P.A. Rappoport proposed a curious reconstruction of the structure of the "angular" palisade wall: it was inclined, set up at the bottom of the outer slope of the rampart or inner slope of the ditch. The slope of the wall could either be in the direction of the field or the fortress. He came to this conclusion



Reconstructions of angular fort walls.

1, *2* – structure of an angular palisade (after (Laskovsky, 1858a: Fig. 84, 85)); *3* – reconstruction of a defense system at the Ratskoye fortified settlement, 6th construction period (after (Enukov, 2005: 77, fig. 17, *1*)); *4* – angular fort of the Late Middle Ages (after (Enukov, 2005: 77, fig. 17, *2*; Nosov, 2002: 62)); *5* – angular palisade wall in a ditch (after (Rappoport, 1967: Fig. 111, *2*)).

by analyzing evidence from a number of sites: 1) at the fortress in Galich, at the base of the inner slope of the ditch, obviously a paling that sloped towards the field was set up* (see *Figure*, *5*); 2) in Suteisk, a palisade wall inclined towards the fortress might have been in the middle part of the inner slope of the ditch**; 3) at the Belyovskoye fortified settlement, "on the front slope of the field rampart... the remains of two posts dug into the embankment were uncovered. <...> They were inclined forward at an angle of 65° to the horizon. There was a distance of about 60 cm between the posts, that is, the paling in this case was not continuous. Apparently, the space between the posts was closed with something, most likely with horizontally laid logs. This structure should no longer be described as paling, but as a simple type of wooden frame wall"*** (Rappoport, 1967: 164, 165). Rappoport also pointed out that the palisade wall on the front slope of the rampart in Pereyaslavl in the 16th or 17th century was inclined. It was built by driving thick pine logs into the ground (1956: 86; 1967: 135). It seems impossible to build an inclined palisade wall by driving thick piles into the ground at an angle, since this is a technically non-trivial task requiring a sophisticated pile-driving mechanism. There is no evidence as to its existence during that period. In addition, the remains of the wall survived as individual palisade logs, which is not evidence of an extended wall of this design. Thus, the examples and arguments provided by Rappoport do not allow for the conclusion that there was a practice of building inclined palisade walls in the western Russian lands in the 10th–17th centuries.

Several years later, S.N. Balandin addressed the issue of angular forts: "Angular forts with walls slanting inward were a variety of palisade fortification. An angular fort had a platform on the inside of the walls, on which the palisade fence rested" (1974: 15; fig. 3, *b*). This thesis reiterated the conclusions made by Laskovsky, although the author did not refer to him and ignored his doubts regarding the correctness of such an interpretation of "angular forts". Balandin did not limit himself to this and went further in reconstructing the structure of angular palisade walls. He stated: "The bottom of the palisade logs could have been dug into the ground, but apparently, this type of wall construction was more common with palisade logs not dug into the ground. <...> Angular forts were often built in the northeast of Siberia, which is probably also associated with permafrost, which made earthworks difficult" (Ibid.: 15–16). To confirm his statement, Balandin cited a description of an attack: "...Kataev's Cossacks attacked the Yukaghir fortification 'going behind the shields'. Apparently, these were the shields of a 'walking town'—a movable field fortification, widely used in the Russian military" (Ibid.). From this, Balandin moved on to another assumption: "Such portable shields could have protected the Cossack fort instead of palisade logs" (Ibid.: 16). The Cossacks built the fort "in one day... 40 sazhens away, and the next day a new fortification 20 sazhens away from the Yukaghir fortress, and 'began to fire guns at the fortress from above, from their fort...' (source: (Dopolneniya..., 1848: 283))" (Ibid.: 15). Then, the author made yet another unsubstantiated assumption: "Perhaps the fortification of Kataev's Cossacks was an angular fort with walls resting on trestle supports with a platform from which the 'upper battle' was conducted" (Ibid.: 16). After that, Balandin, as it seemed to him, found a confirmation of his suggestion: "Documents indicate the occurrence of such a wall design. In 1704, Vasily Kolesov built a 'trestle fort with a circumference of seventy sazhens and height of two and a half state sazhens' near the Upper winter quarters and the state granary in Kamchatka, 'and built a trestle fort with a height of two and a half state sazhens near the Lower winter quarters, which is in Kamchatka, on the springs...' (source: (Strelov, 1916: 23))" (Ibid.). Thus, the author first invented the word "trestle", and

*The current author is of the opinion that the structure was not an inclined palisade wall, but rather a low (probably about 1 m high) inclined paling, which was intended to prevent attackers from moving towards the fortress walls. This point of view is based on two considerations: 1) if it were a full-fledged palisade wall, why was the slope made facing the field? First, it would reduce the height of the wall and second, it would make such structure less durable, since without support it would be more likely to collapse as compared to a vertical wall; 2) presence of a palisade wall in this place with a height of at least 2 m, straight or inclined towards the field, would give attackers the opportunity to take cover behind it during an assault, and move under its cover along the entire perimeter of the defensive structures without being noticed by the defenders, which would make it possible to prepare devices for overcoming the palisade wall and accumulate people in the most favorable place for assault.

**Angular palisade walls, which were inclined towards the fortress parallel to the slope of the rampart, will be discussed below. Here, we will only express our bewilderment as to how a palisade ditch intended for setting a wall inclined towards the fortress could have been constructed in the middle part of the inner slope of the ditch.

***The current author is of the opinion that it is impossible to assess the structure of a wall based on the remains of two posts.

then discovered that there existed trestle forts*, which by their name confirmed his conjecture. Consequently, angular and trestle forts are the same thing in terms of typology of their wall structure.

Balandin's argumentation was based on assumptions that had no evidence at all. In his research, he must have proceeded from his idea of an angular fort, interpreting the facts in such a way that they would confirm this concept. As will be shown below, the Balandin's initial guess was erroneous, which entailed argumentation aimed at "proving" a concept that had no relation to historical reality and therefore could not be derived from it on the basis of the available historical facts. This example shows the methodological inadequacy of the research procedure moving from guesswork to its proof. More feasible seems to be the approach moving from factual evidence through its analysis to a targeted generalization, in order to identify common features and patterns, and formulate a conclusion on their basis.

Twelve years later, N.P. Kradin published an article on the walls of wooden defensive structures in Siberia. The article says the following about the structure of angular forts: "...the fort logs had an inclined position. Such a wall was supported by a small embankment of the fortress, 'special trestles', or a platform attached to the wall" (Kradin, 1986: 243). Kradin did not refer to the works of his predecessors either, although the above fragment clearly borrowed some points from the work of Laskovsky and the article by Balandin discussed above, from which Kradin took the idea that the wall of the angular fort could have rested on trestle supports. In 2002 Balandin's concept was repeated by K.S. Nosov (2002: 62).

The assumptions of Balandin that trestle forts were a type of angular fort and that the latter's palisade logs were not dug into the ground were accepted by the scholarly community (see, e.g., (Berezikov, 2016: 14; Vershinin, 2018: 139, 141; Vilkov, 1987: 13, 14; Nikitin, 1987: 60; Opolovnikova, 1989: 65; Istoricheskaya entsiklopediya..., 2009: 564)). Thus, it can be stated that Balandin was the author of the current, generally accepted concept of angular forts.

In the early 21st century, the topic of angular forts became discussed in the context of the East European Plain of the 10th–11th centuries. V.V. Enukov suggested that fortified settlements of the Romny culture in Posemye had sloping palisade walls, and pointed out their genetic connection with angular forts of the 17th century on the fringes of the Russian State, including Siberia and the Far East (see *Figure*, *3*, *4*) (Enukov, 2005: 81–83). Enukov's concept was refuted by Y.Y. Morgunov who believed that palisade-like structures discovered during archaeological excavations should be interpreted as inclined facing of the escarpment wall. However, Morgunov did not challenge the existence of forts with sloping walls in the 17th century (2008: 42).

Laskovsky, and later Balandin, might have relied on purely linguistic considerations: structural features of a slanted palisade wall were derived from the meaning of the word *kosoi* ('angular', 'slanted'). If we turn to the dictionary of V.I. Dahl*, it is written in the beginning of the relatively extensive article "Kosoi": "A slanted wall or post, not vertical, inclined". Further on, some meanings may also be applied to the structural features of a palisade wall: "non-straight" (a wall that does not form a straight line), "curved line, bend, arc" (a wall that goes crookedly or along an arc), "a slanted angle, inclined, more or less than a right angle, acute or obtuse" (a junction of the walls of a fort at an acute or obtuse angle), "triangular" (the fort is triangular in plan view; at a certain stage, the Angular (Okhotsk) Fort was like this) (Dahl, 2006: 176, 177; Rezun, Vasilievsky, 1989: 224). Dahl's dictionary was available to Balandin, but he did not take these additional meanings into consideration.

In 1980, the seventh edition of the Dictionary of the Russian language of the 11th–17th centuries was published. In the article "Kosoi", the first meaning was indicated as "*having slanted, not vertical lines or edges*". This meaning was illustrated, among other things, by some descriptions of fort walls: "An angular fence, wall, angular fort—*a fence, wall made of slanted poles or logs*. And from that tower down the Busolga River, there is an angular fort wall made of logs, and at the end of that wall there is an angular fence made of logs, low, without a bridge. <...> And on the women's passage from the Opoka River, a standing angular fort was built measuring 263 sazhens. <...> And from the Polnaya River, [there is] an angular fort and palisade of 100 sazhens" (Slovar..., 1980: 365). From these descriptions, it is not possible to deduce that the walls of the forts were inclined. The author of the dictionary entry could have been familiar with the concept of

*Or vice versa: first he learned about the existence of trestle forts, and then came to the conclusion that a siege fort had a wall resting on trestle supports. In this case, Balandin did not prove the fact of the existence of such trestles in trestle forts as he imagined them to be (see (Balandin, 1974: 16, fig. 3, b)).

*It was published after the work of Laskovsky.

angular forts, which had already taken shape by that time, since he ignored other meanings of the word "angular" applicable to the structure of palisade walls in angular forts: having a curvature, bend, crookedness (Ibid.: 365–366) (curved palisade wall). In addition, the author was not perplexed by a number of contradictions in the examples he had given, if angular forts were understood as palisade walls with an inclination towards the enclosed space. For example, it is unclear what an "angular fort wall made of logs" and "angular fence" were. Following the concept of inclined walls, one has to conclude that not only were the palisade walls inclined, but also the log walls, that is, the walls consisting of logwork of some design; and the "angular fence" had a wall inclined towards the interior space. Cribworks are known to have horizontally laid logs. The slope of such a wall would allow a foot soldier to climb it, especially since such a fence was low. No less dramatic contradiction is present in the phrase "standing angular fort". According to the current generally accepted concept of angular palisade walls, this is impossible, since a standing fort had a vertical palisade wall, while an angular fort had an inclined wall. A palisade wall could not be both vertical and inclined at the same time. Therefore, the classification of palisade walls into angular and standing does not reflect the historical reality, and angular forts should mean not an inclined palisade wall, but a wall whose design would not contradict the concept of a "standing fort".

Hypotheses as to the structure of "angular" forts

It seems to be the case that the definition of "angular" as applied to the palisade wall describes its design. Our predecessors were right that the solution to the specifics of angular palisade walls should be sought starting with the meaning of the word "angular" in the 17th century. However, they limited themselves to an unmotivated choice of just one meaning of this word. This article, however, will consider all possible aspects in the design of angular palisade walls as alternative hypotheses, following from the appropriate meanings of the word "angular":

1) a palisade wall having an inclination towards the enclosed space (the traditional and generally accepted concept);

2) a vertical non-linear palisade wall (arc-shaped, wavy, or having sharp bends);

3) adjacent vertical palisade walls joining not at a right angle;

4) an angular fort triangular in plan view (a variation of hypothesis 3, since in this shape of the fort, the adjacent vertical palisade walls join at an acute angle).

It would be important to discuss each hypothesis by identifying the facts that confirm or refute it in the sources. No information has been found confirming the validity of the first hypothesis. On the contrary, there are arguments in favor of its inconsistency. For example, the description of Fort Okhotsk, which was originally called "Angular", says: "Okhotsk log town" (cited after (Rezun, Vasilievsky, 1989: 223)). In the description of the Stroganovs' patrimonial estate of 1629–1639, "an angular log wall of the fort" is mentioned (Dopolneniya..., 1846: 119). The absurdity of building inclined log walls has been discussed above, and therefore the existence of such has been rejected.

According to the description of Odoev* from 1678, its walls were "a standing angular fort" (Dopolneniya..., 1875: 234). A similar example would be: "*And on the women's passage from the Opoka River, a standing angular fort was built...*" (Slovar..., 1980: 365). Judging by these descriptions, a fort could have been both standing and angular.

The description of a section of the Ryazan Vozhskaya Abatis from 1659 mentions that "many links fell out" of an angular fort "and it rotted completely" (Storozhev, 1890: 4). According to the generally accepted idea of an inclined palisade wall, it should rest on a platform, trestles, or a rampart. In this case, it is unclear in what way many links could fall out of the palisade. This was only possible if the wall stood vertically or was inclined without support.

Another section of the Ryazan Vozhskaya abatis in 1659 was described as follows: "...a ditch was made behind those log obstacles, and an earthen rampart was on the other side of the ditch, and an angular fort was behind the rampart" (Ibid.: 13). If we assume that in this case, the angular fort had an inclined wall resting on the rampart, it should have had been inclined towards the field. However, such a wall design lacks an advantage over a vertical fence, because its defenders could not hit the enemy from behind such a wall, since there was no place for them to stand there. Finally, numerous descriptions of angular forts

*At present, the urban-type settlement of Odoev in the Tula Region.

have no information about connection of the wall with any supporting structures (platform, trestles, or rampart).

Archaeological studies provide only one case of studying a site that might have had an angular fort wall: the excavations at Fort Alazeya. However, a six-meter section of the palisade made of vertically set logs was discovered there (Alekseev, 1996: 24).

The second hypothesis (a non-straight palisade wall) has a number of indirect confirmations. For instance, the descriptions of the Ryazan Vozhskaya abatises, as well as abatis fortifications near the town of Dobryi and on the Opoka River, and the Stroganovs' patrimonial estate, mention angular forts that were comprised of extended open walls (up to 337 sazhens), partitioning off the space from one natural or artificial obstacle (ravines, rivers, swamps, log obstacles, etc.) to another. These were obviously not rectilinear, but ran in a curve, adapting to the terrain. The hypothetical straightness of such walls is meaningless, since it was not assumed that the space along them would be shot at from towers, which were usually absent* (Storozhev, 1890: 1, 3, 4, 12, 13; Dopolneniya..., 1846: 119; 1875: 301; Slovar..., 1980: 365).

The second hypothesis is also confirmed by the presence of angular palisade walls near the Tyumen and Pelym posads (Leontieva, 1988: 56; Russkaya istoricheskaya biblioteka..., 1875: 138). Unlike the town walls, which ran straight from corner to corner, the posad walls were much longer and followed the terrain (for example, adjusting to the contours of the hill slope**). It was impractical to enclose the space of the spontaneously formed posads with straight walls from the point of view of both consumption of building materials and tactics of defense, which did not involve shooting along the walls from towers.

A request for describing forts near Astrakhan can be cited as a confirmation of this hypothesis: "...was the standing fort built straight, or made of logs or angular..." (Akty..., 1841: 217). This phrase shows that a standing fort (with a vertical palisade wall) could be built straight or not straight. The latter feature could not refer to the inclination of the wall, since it was reported to be vertical ("a standing fort"). Therefore, what is discussed here is the straightness or curvature of the wall in plan view. It seems that the cited phrase should be understood as follows: was a standing fort set in a straight manner? Was a fort made of logs set in a straight manner? Or were they set at an angle? We have not examined the original request, but believe that this passage was not divided into semantic parts by commas. The punctuation marks must have been added during editing of the document for publication, which led to a change in the meaning. We have not found any information in the sources, which refutes this hypothesis.

The third hypothesis (the joining of adjacent palisade walls not at a right angle) is also confirmed by the sources. The description of ("Angular") Fort Okhotsk reports: "...the town made of logs, and made at an inclined angle" (Rezun, Vasilievsky, 1989: 223). That is, the angle was not a right angle; it was more or less than 90°. The image of Fort Nizhnyaya Kamchatka from 1755 clearly shows that several angles (possibly all) were acute or obtuse (Krasheninnikov, 1755: Pl. between pp. 240 and 241). The description of the Stroganovs' patrimonial estate reports: "...at the end of that wall, there is an angular fence of logs" (Dopolneniya..., 1846: 119). It seems pointless to build a fence with an inclined wall, as mentioned above. Therefore, the "angular fence" should be understood as cribwork with angles larger or smaller than right angles. In the sources of the 17th century, one can also find references to angular barns that obviously meant those made of logs with corners that were not 90° (Russkaya istoricheskaya biblioteka..., 1904: 907, 909). One of the towers of Fort Krasnoyarsk, according to the description of 1761, was diamond-shaped in plan view (Kochedamov, 2021: 64). We have not found any information that would refute this hypothesis.

The fourth hypothesis (an angular fort that is triangular in plan view) is a variation of the third hypothesis, since the triangular shape of a fort suggests that the adjacent walls were joined at an acute angle (at least two angles had to be acute). An example is Fort Okhotsk: "...it was built... in the form of a triangle" (Rezun, Vasilievsky, 1989: 224). Fort Alazeya could have been the same, as suggested by the excavation plan and topography of the area (southern half of the excavation) (Alekseev, 1996: 20, fig. 4), as well as satellite images (N68.128300 E152.205630). Although the latter may demonstrate not the actual spatial distribution of fortifications, but the nature of vegetation that emerged after completion of excavations. We have not found any information that would refute this hypothesis.

*Angular forts could have had a sparse palisade, since there were no upper battlement platform or towers. For more information on sparse forts, see (Gorokhov, 2024).

**Otherwise, some areas would emerge between the slope and wall, from which the besiegers could operate.

Discussion

Examination of the hypotheses has shown that the generally accepted ideas about angular palisade walls as being inclined (usually towards the enclosed space) do not align with the historical reality. In the 17th century, "angular forts" implied two spatial distribution types of wall structure, which could have been combined with each other: 1) the wall was not straight, but curved; 2) adjacent walls were not joined at a right angle. In light of these conclusions, it has become possible to interpret some features in the depiction of palisade walls of Siberian towns by S.U. Remezov (Tobolsk, Berezov, Kuznetsk) as an indication of angular fort walls.

The widespread use of angular palisade walls in fortifying winter camps in Northeastern Asia in the 17th century was due to the initial lack of fences in the layout of winter camp buildings. These were arranged in accordance with local conditions, defense requirements, and economic activities. When the need arose, they were surrounded by a fence in such a way that many buildings would end up being a part of the palisade walls. Since buildings were initially located "chaotically", the fence would turn out to be uneven (with breaks or a wavy shape, if it repeated the outline of the slope of the hill where the winter camp was located), and the adjacent walls were not joined at a right angle.

Balandin unreasonably claimed that trestle forts were a variety of angular forts (with an inclined palisade wall supported by trestles) (1974: 16). Scholars (Vershinin, 2018: 141; Vilkov, 1987: 14; Korchagin, Ugryumova, 1997: 61; Kurilov, Mainicheva, 2005: 40) have accepted this point of view. After proving that angular forts had vertical walls, it is necessary to investigate what kind of walls trestle forts had. Such forts were mentioned in the sources only three times* and only in the far parts of northeastern Eurasia: Fort Kozelchaty (in this case, it is a proper name) on the Kolyma River and two forts in Kamchatka (Strelov, 1916: 24; Dopolneniya..., 1862: 29). Their descriptions do not make it possible to determine the structural features of the walls. In this case, it also seems appropriate to turn to the meaning of the word "kozelchaty" in the 17th–19th centuries.

In the Dictionary of the Russian language of the 11th–17th centuries, the fourth meaning in the article "Kozel" is "rafters" (Slovar..., 1980: 223). This is illustrated by a fragment of text from 1700, describing the structure of a wall which was supported on the outside by logs cut into the wall (Materialy..., 1884: Col. 1200). The dictionary by V.I. Dahl has the following meanings of the word "kozly": "three poles placed like a tripod; two such tripods with a crossbar; a small log on legs for a platform, for sawing logs or firewood", "a lying log on posts, for a bridge or for woodcutters" (2006: 134).

Thus, we can offer two hypotheses about the walls of trestle (*kozelchaty*) forts: 1) a palisade wall had supports in the form of logs cut into the wall at one end and resting on the ground at the other end; 2) the outer fence consisted of a row of forks (trestles). We do not have a sufficient amount of sources to give a substantiated preference to one of the two. Therefore, we will only express our thoughts on each hypothesis. The first hypothesis seems less likely, since supports for a wall are only required when it collapses due to decay or soil shifts, whereas the forts in Kamchatka were originally built as trestle forts.

The second hypothesis seems more likely, since the practice of surrounding forts with forked obstacles was widespread in Siberia and the Far East. Using a fence of forked obstacles (*cheval de frise*) without a wall could have been caused by the impossibility of building a palisade ditch in the winter, in permafrost, or in rocky soil. A shortage of timber in tundra zones cannot be ruled out as well. Such fences could be quite effective even against attackers with firearms. This is confirmed by the use of stationary forked obstacles filled with stones for fencing fortresses and movable forked obstacles for protecting temporary camps of hunters of the Russian-American Company on the Aleutian Islands in the 19th century (Zorin, 2002: 116), as well as by the image of the fence in the seasonal Yamyshevo fortress on the Upper Irtysh (Remezov, 2011: 97). Although a rampart of stones could also be made without forked obstacles, such a rampart would make it difficult to fight against the attacking enemy, which usually had numerical superiority. Forked obstacles could have served as a retaining wall, onto which stones and other available materials (logs, driftwood, rocks, loose soil, etc.) were piled from the outside. Overcoming such a wall was rather difficult for attackers. The defenders had the opportunity to take cover behind it, move safely and quickly under its cover, and shoot with both firearms and bows. If the enemy appeared on such a wall, it was possible to use a piercing weapon on a long shaft.

*We believe that this rarity was caused not by the small number of such forts, but because these were rarely called this name.

Conclusions

Using the definitions of *kosoi* ("angular") and *kozelchaty* ("trestle") as examples, this study has shown that some concepts related to the architecture of wooden defensive structures of the Russian State in the 16th to early 18th centuries, borrowed from written sources and used as terms in the process of scholarly comprehension of historical realities, do not have a strictly proven historical content. Therefore, when operating with the same terms, each scholar endows them with his own content, which he correlates with the historical reality in an unsubstantiated manner. Thus, clarifying the meanings of terms relating to the architecture of wooden defensive structures is an urgent task for Russian archaeology at this stage.

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Ritual Structures in the Volga and Ural Regions, Based on Findings of the Peter Simon Pallas Expedition

In the 18th century, the ancient and traditional cultures of ethnic groups inhabiting the Russian Empire came to the attention of prominent scholars. This was in accordance with the ruling empress' new attitude toward heterodox citizens of her state. This study describes findings of the Peter Simon Pallas 1768–1769 expedition to the Volga region and the Urals, published in 1773 in the second volume of his fundamental work "Travel to Different Provinces of the Russian Empire". Special attention is paid to scarce but important evidence about ritual structures associated with various confessions, and places where various pagan rites were performed by local dwellers of the respective areas. A number of sites have since been subjected to anthropogenic factors, destroyed, or rebuilt, sometimes radically changing their function. To various degrees Pallas's descriptions supplement the available information and can be used by experts as a source of knowledge about the traditional beliefs and history of certain monuments of religious architecture.

Keywords: **Volga region, Ural region, 18th century scholarly expeditions, Peter Simon Pallas, ritual structures, traditional beliefs.**

Introduction

Studying the culture of the Empire's population was one of the most important objectives of the early Russian science in the 18th century. A number of comprehensive expeditions were organized, the scale of which was unlikely to have been surpassed later. The scope of research topics may be called unprecedented, which precipitated the emergence and development of a wide range of sciences in Russia. A large amount of material was collected in the field of the humanities. In addition to historical, archaeological, linguistic, demographic, and other data, this material included information on the beliefs, mythological concepts, and rituals of the peoples inhabiting the Russian Empire. The emergence of folklore studies and ethnography fostered the development of Russian religious studies, which were ultimately formed in the first half of the 19th century.

Already during the first scholarly journey to Siberia under the patronage of the Russian State, acting through the Apothecary (Medical) Chancery, D.G. Messerschmidt collected quite extensive evidence on the spiritual culture, habits, and customs of the indigenous population. G.F. Miller and his fellow expedition members described the religious rituals of the Siberian peoples that they witnessed or that they learned about from their informants. This evidence was assembled in a separate section: "Information about Shamans, or Siberian Sorcerers". Research expeditions undertaken by the Academy of Sciences throughout the 18th century expanded knowledge about the ritual activities, sacred places, and religious worldview of the indigenous peoples of the Volga region, the Urals, Western and Eastern Siberia, the Far East, and Alaska, creating a corpus of sources for studying the traditional culture of the population of the eastern

outskirts of the Russian Empire. However, they also showed that the advance of the Russian administration into outlying regions, accompanied by the expansion of missionary activities and acculturation of the local population through the construction of schools and churches with parish educational institutions, was displacing traditional beliefs. Academic expeditions revealed and confirmed the ability of Siberian native populations to adopt components of another culture, specifically the Russian culture, when they came into contact with Russian settlers, received education, and became acquainted with the sciences (Shipilov, 2023: 220), yet simultaneously this changed their attitude towards the ancient cults.

The activities of Peter Simon Pallas constituted a certain milestone in the development of ideas concerning the spread of traditional beliefs and proselytizing religions. His journey throughout the Volga region in 1768–1769 was a subject of numerous scholarly articles, monographs, and handbooks, which described general issues concerning P.S. Pallas's participation in the study of the Lower and Middle Volga regions, as well as the route of the expedition, formation of collections (for example, Buddhist ritual portable art), and the traditional culture of the peoples inhabiting the region. The results of the expedition appeared in three parts in the work "Travel to Different Provinces of the Russian Empire in 1768–1774", published in St. Petersburg in 1771–1776 in German, in 1773–1778 in Russian, and in 1788–1793 in French. In 2007, the version in Russian was republished in a facsimile edition (Pallas, 2007). The first part of the edition of 1773–1778 in Russian (Pallas, 1773) was used for this study.

This article will focus on the information collected by P.S. Pallas about religious monuments and sacred places in the Volga and Ural regions, which has not been previously used as the main subject of research. The main goal of this study is to identify and describe the types of ritual structures mentioned by this scholar. This will emphasize the importance of his research work and its results as a source for scholars of our time in the field of ethnic history and historical development of religious beliefs in the Volga and Ural regions.

Research by P.S. Pallas

When Empress Catherine the Great decided to organize an expedition for studying natural history in the Russian Empire and turned to the Leipzig professor H.G. Ludwig for a recommendation, he named P.S. Pallas. On December 22, 1766, the Academy of Sciences elected P.S. Pallas to be a member of the Academy as a professor of natural history. After confirmation of his election in the summer of 1767, P.S. Pallas moved to St. Petersburg. He was actively involved in preparation of the expedition, discussed scholarly and organizational issues at meetings of the Academy, studied the works of predecessors, and compiled a research program (Borisenko, Hudiakov, 2005: 126). This work took almost a year; only in June 1768 did he leave for the journey.

As the head of the Orenburg Expedition, Pallas focused on the Volga region. When the new young member of the Academy set out on his journey, studying the distant past and traditions of the indigenous population on the outskirts of the Russian empire was not his main task, although the instructions he compiled prescribed "not travelling through any place uselessly so nothing important would be overlooked" and contained points on recording "all remnants of antiquity", spiritual traditions, and describing customs and habits (Fleiman, Bobyr, 2001: 5). Yet soon after the start of the expedition, "glimmers of ethnographic interest" appeared in his field journal along with descriptions of "natural phenomena" (Golovnev, Kisser, 2015: 64).

During his expedition through the Volga region, Pallas recorded Christian churches, Muslim mosques, and other ritual structures in varying degrees of preservation.

Despite the inclusion of territories with non-Orthodox populations—Crimea, the Kazan and Astrakhan Khanates, and Siberia—the overwhelming majority of subjects of the Russian Empire, including the central regions, Novorossiya, and Left-Bank Ukraine, were Christian. Not only were Russians, Ukrainians, and Belarusians Christians, but also representatives of the indigenous ethnic groups who converted to Orthodoxy earlier, in the 15th–16th centuries—the Karelians, Lapps, and Komi-Zyryans. In some areas, almost the entire non-Russian population was converted to Orthodoxy. Overall, according to official sources, Orthodox worshippers constituted over 84 % of the population of the Empire (Kabuzan, 2008: 16). Church statistics and general imperial censuses, although not entirely accurate, provide some idea about the confessions of the subjects of the Russian Empire as early as the 1730s (Ibid.: 9–10). However, in the southern and eastern regions of the country, the situation was not as clear-cut as in the western regions. On average, in the Volga region Orthodox made up slightly over 60 %

of the population; in the Kazan province they formed less than half of the population; in the Lower Volga region and Southern Urals, Orthodox made up 13 % and 15 %, respectively. In Siberia, the indigenous population was almost entirely pagan. Forced Christianization often led to the opposite of the desired outcome (Ibid.: 17–18, 23). For example, in the 1740–1750s, the share of the population in the Kazan province professing Islam increased in percentage points.

The first monument associated with religious beliefs and rituals was mentioned by P.S. Pallas in Kasimov. He wrote about the ruins of an old mosque. Only a high round tower, which had previously served as a minaret, remained of it. Pallas's remark that the mosque was being built again "with Supreme permission" is interesting (1773: 43). The publication of the "Spiritual Regulations" in 1721 changed the position of the Church and attitude of the highest state officials towards the Church. The policies of the Synodal Commission were distinguished by some rigidity, but already with accession of Elizabeth of Russia to the throne, interaction with "superstitions" began to be increasingly less repressive (Lavrov, 2000: 5). During the reign of Catherine the Great, changes in the attitudes towards the subjects of other religions, and Muslims in particular, became even more explicit. Her predecessors were not particularly tolerant: it was forbidden to build new mosques and active anti-Islamic propaganda caused discontent among the Muslim clergy. The Empress's trip to the Volga region in 1767 could have been a factor that changed her understanding of how to implement religious policies. Earlier, sometimes due to "self-interest", monuments of Islamic architecture were destroyed "in the most barbaric way" (Nauchnoye naslediye..., 1993: 32), but in 1768 Catherine the Great issued "the most gracious Imperial permission", according to which wealthy residents of Kasimov were given the opportunity to restore the destroyed mosque, building a new two-story building on the old foundation (Knyazeva, Akimova, Evtyukhina, 2018: 74). The white stone foundation and brick walls have survived until today. Initially, the mosque, like other buildings of the architectural ensemble, including those of non-sacred function, was made of wild stone mined in a quarry 12 km from Kasimov. In 1452, the town was granted to Prince Kasim Khan and acquired the status of an appanage Tatar khanate center (Ibid.). Archaeological research in 2014 in the area of the old mosque revealed the absence of the cultural layer of the 15th century, which suggests that the minaret and mosque were built later; judging by the survey pits, in the mid 16th century (Bocharov, Sitdikov, 2018: 135). Thus, Pallas's information about construction of a new mosque on the site of the old one fits the general historical context. He also described the external and internal structure of the remaining parts of the building, its size, and construction material in some detail.

In the immediate vicinity of the mosque, P.S. Pallas described the buildings located in the old Tatar cemetery. According to D.V. Makarov, in the mid-16th century it might have served as an honorary necropolis where service (military) class Chingisids and Tatars from the central provinces of the Russian Empire sought to be buried (Makarov, 2012: 26; Belyakov, 2010: 238). At that time, the town of Kasimov was perceived as the resting place of Tatar princes, as a dynastic necropolis. It is no coincidence that Pallas considered the khan's tomb to be "the most noteworthy" Tatar monument, which he did not fail to write about in a report to the Academy of Sciences (Nauchnoye naslediye..., 1993: 32). The town was a traditional place for the estates of the service class Chingisids. This could have been associated with the loss of the independence of Kazan and Astrakhan, and attempts of the Kasimov ruler Shah-Ali to create their equivalent in his town (Belyakov, 2010: 237). During his reign, a mosque with a minaret, palace, and *tekye* were built. Traces of the former necropolis were discernible even in the mid-19th century. The walls of several mausoleums have survived. The most famous of them today is the *tekye* of Afghan-Mukhammed, built by Ryazan artisans. The façade is decorated with brick patterns; small platbands "in the form of columns with bands, topped with triangular cornices" are above the arched windows; the belt under the eaves consists "of three rows of brickwork"; the jamb posts of the entrance portal are topped with "short cube-shaped semi-columns of white stone" (Knyazeva, Akimova, Evtyukhina, 2018: 74). Despite its status as a historical and architectural monument, the *tekye* is currently in a dilapidated state.

P.S. Pallas described the Shah-Ali Khan mausoleum in Kasimov, noting good preservation of the building. It was a brick quadrangular structure measuring 14.0 × × 7.8 × 4.9 m, with thick walls and wide eaves, oriented with its long axis along the east-west line, and divided into two rooms. The smaller room was intended for prayer; it had an entrance on the western side, a small window on the northern wall, and the floor was made of crude stone. The entrance to the larger room ("the vault or cellar") was on the southern side. No traces of door hinges or other fastenings were

found. A stone tablet with an inscription in Arabic was above the entrance (about 1.5 m wide). This room contained burials with surviving gravestones. The roof of the building was covered with earth, and guelder rose grew on it (Pallas, 1773: 44–45).

The tomb measured 6.5 × 5.8 × 3.5 m. There were two windows in the wall on the northern side and one on the eastern side. The windows had grates, but they had been broken by vandals. Pallas mentioned eight burials. Five of them were located by the eastern wall; one by the entrance; and two in the very center, one of which, according to Pallas, could have been a double burial. The central graves had stepped stone facing. Pallas reported that in addition to the burials, there were nine skulls in the room. Each grave had columnar tombstones, about 180 cm high, on pedestals on the eastern side. Only two of them were in an upright position; the rest were broken. The reddish tombstones had Arabic inscriptions, and their western side was decorated with carved "flowers or stars like a lattice" (Ibid.: 46). Pallas also mentioned an underground space under the tomb, which could be accessed through a narrow passage. The passage was covered with stone and filled with earth, and was marked with slabs on the outside. Bones, skulls, human hair, and remains of yellow, green, and striped taffeta-type fabric, which was well preserved and had hardly even lost its colors, lay in disarray on wooden platforms ("ambos") inside this basement. Pallas believed that "people with curiosity of the modern times who are worthy of condemnation destroyed their peaceful resting place" (Ibid.: 46–47). There is a legend that one can reach the minaret from this underground space (Knyazeva, Akimova, Evtyukhina, 2018: 74).

The Islamic architecture of Kasimov is an example of the medieval sacred architecture of the Golden Horde, which had Russian influences as evidenced by the lost "Gothic" gates of the palace of Prince Sayed-Borhan, and Russian motifs in the decoration of the Afghan-Muhammad *tekye*. In his reports to the Academy of Sciences, Pallas wrote that the remaining buildings in Kasimov, including those of religious purposes, should be given to the Tatar community, so it could take care of them and "at least preserve these ruins" (Nauchnoye naslediye..., 1993: 32). Since the buildings mostly did not survive the test of time, their descriptions in the travel diaries of P.S. Pallas are of interest as a source for studying these monuments.

Pallas also described a complex of Islamic sacred structures in the village of Bolgar, built on the "ruins of an ancient city" (1773: 185), which had been known of long before his journey. The census books, written sources on the abatis lines, and other documents of the 17th century contain some references to the Bulgar fortified settlement (Rudenko, 2014: 32). In the early 18th century, a dependent monastery was organized in its place; some buildings were adapted to the needs of the monks; some were dismantled for stone, etc. This might have prevented plundering of the monument by local residents for some time, which was observed later after the monastery ceased to exist (Ibid.: 34–35). In the early 18th century, Bolgar was visited by D.G. Messerschmidt and by Peter the Great during the Azov campaign. The tsar noted the less than satisfactory condition of the foundations of the ancient buildings, pointing out the need to fix them, and ordered to make copies of the inscriptions in Arabic (Pallas, 1773: 192). At the time of Pallas's stay, a minaret which was about 25 m high, with a repaired staircase of 72 steps, each more than 30 cm high, and a wooden roof with an Arabic inscription, was present at the site. The tower had small through holes, which served as skylights. The monument has survived to this day in its reconstructed form. Next to the minaret, there was a ruined quadrangular building made of tightly laid bricks and crude stones, which, according to Pallas, could have been a mosque (Ibid.: 188). Further research has confirmed his assumption. This structure was the Bolgar Cathedral Mosque, which could have been previously wooden (Khlebnikova, 1987: 60). Wooden constructions were typical of the town in the pre-Mongol period, but the buildings mentioned by Pallas should be dated to the time after 1236, when the Mongol troops of Khan Batu burned Bolgar.

Pallas also described a "vaulted mosque", built of stones of different sizes, with a quadrangular foundation and octagonal top, which, "after being repaired, was dedicated as a church in the name of St. Nicholas the Wonderworker" (1773: 187). Multifaceted and particularly octagonal mausoleums were widespread in the Islamic world. E.D. Zilivinskaya identified them as a separate type and found a number of parallels among mausoleums in regions of the Golden Horde (2009: 128–129). Another lower "tower" with thicker walls and two quadrangular buildings ("mosques") surrounding it have survived in the southwestern part of the dependent monastery. These buildings were located at one of the two cemeteries in Bolgar. One cemetery was used for burying ordinary residents, while the other was intended for the noble deceased, for whom richly decorated tombstones

and mausoleums, as well as the minaret, were built. Several buildings were described by Pallas as civil structures: the "monastic cellar", "judge's house", bathhouse, and dwellings (1773: 187, 189). However, some of them were assigned this purpose at the time of their description, which was significantly later than the time of their creation.

P.S. Pallas mentioned ancient tombstones of various sizes "with Arabic, and several with Armenian inscriptions" (Ibid.: 192). Upon the order of Peter the Great, some of them had been copied and 49 had been translated. According to the translations, 22 inscriptions dated back to 1223, which led Pallas to the assumption that there had been an epidemic in the town that year. According to D.G. Mukhametshin and F.S. Khakimzyanov, the earliest epigraphic monuments of Bolgar can be dated to 1271 (1987: 13).

On the road between Kasimov and Bolgar, Pallas briefly described the language, appearance, clothing, and ritual activities of the Moksha people who lived along the banks of the Volga, Cheremshan, and other places. Although they were baptized, "few remember their ancient rituals and customs", and did not have "any idols"; however, in secluded forest places, the Moksha people had special sanctuaries where they sacrificed horses, bulls, and smaller livestock to the invisible Almighty (1773: 178). Such rituals were also performed at the graves of deceased relatives. This situation was quite common. Christianity was perceived as extraneous, which was reflected even in folklore; and attempts to Christianize people of different faiths could end at the very least with the expulsion of preachers, and in the worst case with their murder. Notably, if in the 17th century we may speak of some religious tolerance, which implied voluntary expression of the desire to be baptized and receiving an altered social and tax status, in the early 18th century mass Christianization was initiated, aiming among other things at social mobilization and religious consolidation without changing the tax status, (Konev, 2006: 22–23).

Similar remote places that were called "keremets", for performing ritual actions, were described by Pallas among the Chuvash people. This sacral object was a quadrangular area surrounded by a fairly high fence, which had three entrances: from the eastern, northern, and western sides. The northern entrance had to face a source of water. A sacrificial animal was brought into the *keremet* from the eastern side, tied to poles during prayer, while people entered the interior from the western side. A canopy was made near the western entrance, under which the meat was prepared and a table with sacrificial bread was placed. The animal was slaughtered and skinned on the northern side; stakes were set up in the northern corner, and the animal's skin was hung on them. In September, the Chuvashes celebrated the end of the harvest. In honor of this event, they gathered at large *keremets* for joint ceremonial sacrifice. There were also small family *keremets*, which were used throughout the year on the occasion of illness, births, commemoration of the dead, etc.

Pallas described one such ritual monument in the village of Teidakovka. Unbaptized Chuvashes continued to live there at the time when the scholar visited the village. The *keremet* was located "in a pleasant place overgrown with birches" on the bank of a river far from the village (Pallas, 1773: 275). The cult of Keremet played an important role among the ritual activities of the pagan Chuvashes and was based on the veneration of ancestors (Matveev, 2005: 112). Other peoples of the Volga and Ural regions regarded him as a stern but fair spirit whom it was better not to anger. The symbol of Keremet among the Chuvashes was the tree and especially the birch tree. A source of clean water was also required for performing the rituals. A special person was responsible for maintaining order at the site, guarding it, and keeping it in proper condition—changing the fence three days before the ceremony, sweeping the site, burning garbage (and everything "unclean" along with it) (Pallas, 1773: 275). The information of Pallas was confirmed by later scholarly research.

The description of the sacred mountain of the "Kirghiz" in the vicinity of the Iletsk fortress is relatively detailed. This place consisted of a white hill located in an open space, without vegetation, which was swampy at the top. It was convenient to keep watch from it, and thus the hill was called "the guard mountain" by the local residents. Even in the late 1760s, pagans, passing by it, threw "all sorts of furs and other trinkets into this swamp" as a sacrifice (Ibid.: 357). The hill was also a place for festivities, during which people walked around it and prayed on their knees after washing their faces in the swamp.

There are indeed chalk cliffs near the former Iletsk fortress, which look unusual in the landscape. Considering that beliefs associated with stones, mountains, and stone structures were quite common in the Southern Urals (Tuzbekov, 2015: 151), Pallas's information is quite plausible. Similar rituals have been observed, for example, among the Bashkirs in relation to Mount Bolyn-gus. It was given special

reverence—before ascending it, ablutions and prayers were performed, and the ascent was made on the knees. Prayers were offered at the top, while at the end of the ritual, a meal was prepared at the foot of the mountain. Christians and Muslims who were believers also took part in the meal (Russian State Archive of Literature and Art. F. 1571, Inv. 1, D. 2913, fols. 1–55).

Experts distinguish various categories of stone objects and complexes used by the Turkic-speaking population of the region to carry out ritual actions: menhirs, burial mounds, placements of stones, cliffs, individual rocks, and mountains. As one may see, these include both natural and man-made objects. The worship of mountains can be associated with reverence for the mountain spirit-masters, which probably has roots in Tengrianism. A mountain with anthropomorphic outlines or with another unusual appearance could have been considered sacred. The white color of the hill that was described by Pallas could have become the reason for sacralization of this object by the local population.

During his travels in the Volga and Ural regions, Pallas noted the presence of several ancient burial mounds, but their descriptions were often fragmentary. Sometimes, the scholar limited himself to only reporting the fact of their existence, and sometimes to the violation of their integrity. For example, in the vicinity of the villages of Sevryukovo and Ermachikha (probably modern Sevryukaevo and Ermakovo in the Samara Region), he mentioned three burial mounds on the river bank, one of which had traces of plundering in the center.

However, there were also more detailed descriptions. Near the Buzuluk and Sorochinsk fortresses, Pallas recorded burial mounds with different structural features—with embankments and which were "low, lined with large terracotta tiles on the inside" (1773: 333–334). According to information from the tomb raiders, he wrote down information about the presence of human bones, copper arrowheads, weapons, and other copper, as well as gold objects, in the burials. The number of burial mounds increased as they approached Novosergievsk. In its vicinity, Pallas described a plundered burial mound around which he found human and marmot bones, as well as the polished fragment of a shell. A ceiling slab was discovered at the bottom of the robbers' pit about 2 m deep. A split anthropomorphic sculpture made of dark soft sandstone lay on the surface, a poorly made "facial" sculpture about 60 cm high, facing east, was to the east of it. The burial mounds varied in size. The height of a mound could reach 2 m or more; the circumference of the mound was "more than 50 steps" (> 30 m). Remains of burnt wood could be found in earthen mounds, which Pallas believed to be a sign of the funeral feast (Ibid.: 334). Human bones with the accompanying goods (iron objects, arrowheads, flint, tongs, and in some cases horse heads) were at the bottom of the burial pits in wooden coffins. According to Pallas, more interesting items could be found in smaller graves, because these would contain buried women, who were usually provided with ornaments as burial goods. He suggested that burials with iron items belonged to the Nogai Tatars or "Kirghiz", while those with stone slabs belonged to "another ancient people who lived in this land" (Ibid.: 335). On the whole, Pallas correctly identified the nomadic nature of the population that left the burial mounds he described. In fact, these were the first archaeological excavations for scholarly purposes in the Southern Urals (Salnikov, 2009: 161).

It is not possible to establish the exact cultural affiliation of the burial mounds described by Pallas. However, on the territory of the present-day Orenburg Region, shell ornaments have been found among the evidence from the sites of the Khvalynsk-Berezhnovka type, dating back to the second half of the 5th to the early 4th millennium BC (Bogdanov, (s.a.)). Judging by the presence of anthropomorphic stone sculptures, burial mounds in the Novosergievsk area must have belonged to Turkic-speaking nomads, who were known there in the 9th–12th centuries. Some scholars attribute them to the Golden Horde period (Garustovich, Ivanov, 2014: 17).

Conclusions

In terms of the emergence and development of historical sciences in the Russian Empire, the 18th century can be compared to a volcanic eruption. The lands with their indigenous inhabitants and their traditions and customs were studied for several centuries. After creation of the Academy of Sciences and organization of scholarly expeditions under its auspices, it became possible to collect an incredible amount of evidence, which is a rich source on the history and culture of the peoples of Russia. Even until today not all of this evidence has been studied and published. The name of Peter Simon Pallas is associated with the emergence of a clearly expressed ethnographic perspective on research

of the indigenous population of Russia (Borisenko, 2023: 21). P.S. Pallas's studies gave the impetus to compilation of an ethnographic description of the peoples of the Russian Empire (Golovnev, Kisser, 2015: 65), and he occupies a worthy place among other "ethnologists" of his time, who studied the peoples whom they wrote about in the field (Golovnev, 2018: 8).

During his travels through the Volga and Ural regions, Pallas noted a number of religious and ritual sites, such as Muslim stone complexes in the towns of Kasimov and Bolgar, which included mosques, minarets, and khans' tombs; *keremets*—sanctuaries of the Volga Chuvashes, where commemorative and festive rituals were performed; sacred mountains; and burial mounds. Much of the information he provided has been confirmed by modern scholarship, which indicates its reliability and relevance even today. The descriptions of ritual sites made by P.S. Pallas during his travels through the Volga and Ural regions can be used by specialists in the field of ancient and traditional cultures of these regions as an additional source.

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A Relative in Bearskin: The Bear in Lower Amur Folk Beliefs

The study examines certain aspects of the bear cult practiced by the Lower Amur peoples. Using myths and rituals of Nivkhs, Ulchi, and Nanai people, a human-animal interface is reconstructed in the context of the Amur hunter-gatherer worldview. Reference is made to the concept of personification and situational identity, offering an approach to the beast image in ritual from the standpoint of perceiving it as a human capable of shapeshifting. With this approach we were able to explore the anthropomorphic aspect of the bear image in traditional beliefs. The comparative analysis of the bear cults of Eurasia and North America suggests that the mythical carnivore is not the same as that hunted by humans. Rather, oblique terms used with reference to the bear show that it was perceived as a personified ancestor, relative, member of a different world, one from which the welfare of each human being depends. Such a status agrees with the Amur natives' belief that the bear personifies the "taiga/mountain man" visiting his "earthly kin" to help them solve their problems and fulfill their wishes. Ceremonial butchering symbolized the beast's transformation: the animal was supposed to cast off its fur to put it on again after returning to its kin. The Amur bear feast, as the analysis shows, carried yet another, social message. Ceremonies of the bear cult were performed to conclude marital, clan, and trade treaties. In the 20th century, changes in the life of the Lower Amur peoples, relating to literacy, consumers' ethics, and a more rational worldview, caused the decline of the bear's ritual and social role.

Keywords: **Lower Amur, peoples, bear, folk beliefs, ritual, myth, kin.**

Introduction

Bear as patron of the elements, guardian spirit of people and animals, personified retribution or punishing power, etc. is one of the most important images in the worldview of most peoples of the Northern Hemisphere. It functions not only as a spiritual entity acting in the earthly realm, but also as a deity associated with the cycle of death, rebirth, and revival of the human race and nature (Eliade, 1958). Bear remains discovered in Eurasia, especially at human burial grounds, can be considered the evidence of its perception as inhabitant of other world. These finds date back to different periods from the Neolithic (ca 8 ka BP) to the first half of the 20th century. This indicates that organization of bear burial grounds and cemeteries is a stable phenomenon emerging in ancient times and surviving until today (Gasilin, Gorbunov, 2018; Efremova, 2020; Kosintsev, 2000; Okladnikov, 1950; Timokhin, 1969; Kirillova et al., 2022; Losey et al., 2013).

Eurasian and North American ethnographic evidence shows that various sacred practices that were formed around the bear contain a common conceptual

layer: the animal comes to human society as inhabitant of other world; people kill it, skin it, and butcher the carcass; after some time, the taiga predator becomes reborn in its original form and comes to people again (Vasilevich, 1971; Zolotarev, 1939: 121–133; Frazer, 1998: 528–540, 546–547; Hallowell, 1926: 84; Kwon, 1999).

The traditional experience of the hunting peoples may help us to uncover the nature of influence of animals on human existence in the worldview of ancient people. Currently, after reviewing the accumulated ethnographic evidence, a number of anthropologists have drawn attention to the fact that the world order of hunters and fishermen, as opposed to cattle breeders and farmers, is based on the belief in superiority of animals, and not humans, over the natural environment, since animals build their relationships with the world and act as active independent principle. Free agency of animal nature becomes manifest in the bear cult. People communicate with the animal not simply as with animate object, but as with rational being, a kind of duplicate of the human person ("other than human being", "non-human") (Bird-David, 1999; Hill, 2010; Lien, Pálsson, 2019). It is assumed that the bear acts and experiences emotions similar to humans, and has social relationships with its relatives.

According to the leading anthropologists and ethnologists such as T. Ingold (1994), E. Hill (2010), M. Lien and G. Pálsson (2019), R. Willerslev (2007), anthropomorphization of the animal world is based on the daily perceptual experience of gatherers, hunters, and fishermen, who include the animals with whom they are forced to contact into their close circle. The emergence of such relationships can be regarded as a mechanism of natural selection, which involves interspecific competition and struggle for existence. Adapting to ecological niches and striving to gain access to vital resources, humans and animals build relationships according to the predator-prey pattern or assume the position of rivals (MacArthur, Wilson, 2001). Along with that, burials of animals that were buried like people and discovered by archaeologists and ethnographers, as well as the use of allegorical expressions and words of gratitude addressed to such animals, reflect a respectful and reverent attitude of humans towards them. This may also serve as evidence of deep integration of bears into social environment of people. Immersing itself into human existence, it undergoes a bodily metamorphosis taking off his "fur clothing", which in the ritual practices of the hunting peoples was formalized in the act of skinning a killed animal. In these communities, interaction with the outside world is based precisely on the idea of shapeshifting, where both man and animal can change their physical shells.

Anthropologist David Anderson, who has been studying the peoples of the Arctic and Subarctic regions for many years, defined the phenomenon when a person does not see a clear boundary between himself and objects of the surrounding world as "relational identity" (2000). It is expressed in fluid and situational self-identification of a person, when an individual moves from one identity to another during his lifetime or simultaneously adheres to several identities. The same positioning mechanism applies to the animal environment, when the person sees "other persons" or "people" in it (Willerslev, 2007: 6). The "human" capacities of the bear disclose in the conditions of outwordly being, when it not only meets with its relatives, but also acts as executor of the will of "earthly people" and messenger from their society in the status of ancestor or relative.

The idea of transformation of the taiga predator into a human and back has deep ontological meaning and social implications among the indigenous population of the Lower Amur region—the Nivkhs, Ulchi, and Nanai people. The ritual models that have evolved in this region—from raising a bear among the people to killing it in a den during a hunt—suggest cultural mutual influences reflecting elements of animal worship, typical of Siberia and South Asia. The data collected by researchers of bear ceremonies among the Nivkhs, Ulchi, and Nanai people require reinterpretation and revision in ontological context, using new conceptual and representational complexes, which show the world model of the inhabitants of taiga and river space in more detail. This study intends to identify the role of the bear in the perception and cognition of the environment by fishing and hunting communities from the Amur River valley, using accumulated ethnographic evidence and new conceptual tools.

"Other Man": Status of the bear in the Holarctic region peoples worldview

The area of ritual practices associated with bears lies within the boundaries of coniferous, broad-leaved, boreal, mountain, and evergreen forests of Eurasia

and North America. Ecological niches occupied by different subspecies of the brown bear (*Ursus Arctos*), which became the key figure in the natural environment of man, emerged in these regions. Using the findings of comparative analysis of bear rituals and ceremonial complexes by G.M. Vasilevich, B.A. Vasiliev, and A.I. Hallowell, two main levels of people's interaction with bears can be distinguished: hunting rituals, its killing in a den (early Eurasian-American), and keeping the animal in captivity (late, conventionally Ainu, Amur region) (Vasilevich, 1971; Vasiliev, 1948; Hallowell, 1926). Ritual actions and vocabulary used point to the well-established images of the bear that were not associated with hunting trophies or domesticated wild animals. In the mythical narratives of the taiga peoples, the main inhabitant of the forest is endowed with human qualities: "Little – Nice – Mosne", Mansi; "Kheladan", Evenki; "When grizzlies walked upright", Modoc people (Mify..., 2005: 71–77; Sbornik materialov..., 1936: 38–40; American Indian Myths..., 1984: 85–87). Despite the regional specificity of bear anthropomorphization, all of its likenesses fit into a single model of worldview.

The substitutive names of bear among different peoples reflect their ideas about the human nature of the predator, and can be divided into groups. The metaphorical expressions recorded among the Algonquins, Yakuts, Finno-Ugric peoples, and Tuvans, such as "son of the chieftain" (Algonquin), "lord", "worthy old man" (Yakut), "pride of the forest country" (Finno-Ugric), "king of the rocks" (Tuvan), not only distinguish the bear from other forest creatures, but also emphasize its high social status. A separate group of epithets recorded among the Algonquins, Yakuts, and Tunguses indicate the kinship of bears with humans: "elder brother", "cousin", "grandfather", "grandmother", "good father", etc. (Hallowell, 1926: 47–50; Vasiliev, 1948: 80–81). According to a number of anthropologists and ethnographers, such designations should be viewed in the context of hunting magic when a hunter (or fisherman) uses substitutive names of an animal in order to facilitate its capture. Animals are given "false" names to deceive and confuse their patron spirits and to divert anger from a man. Notably, after the death of the bear, the sentiment of addressing it changes from respectful to evaluative and stereotypical. The Algonquins call the dead beast "black food", "short tail", "angry", or "cat or lynx-like creature" (Vasiliev, 1948: 81; Frazer, 1998: 25–31; Hallowell, 1926: 43–46).

The examples of respectful, kinship-related, and derogatory emphatic constructions reflect specific aspects of the worldview. These lexemes are a kind of signs of people's presence in the world on which their welfare depends. The otherness of its inhabitants is emphasized by the metaphors such as "four-legged human", "old man with the fur garment", "mountain man", "forest woman", etc. (Vasiliev, 1948: 81; Hallowell, 1926: 46, 51).

The bear in the status of "other man" most clearly appears in the Tungus folklore. G.M. Vasilevich thoroughly studied oral lore of the Evenki and identified several layers of "bear" myths, which demonstrate the original component in the system of images and beliefs among the hunting and reindeer herding peoples of Siberia. In her opinion, the designations of the bear in fairytales are based on the territorial names of tribal groups, which were in close contact with the ancient Tunguses. For example, the word *ngamendri* from the narratives is associated with the Yenisei-Angara region, *mangi* with the Angara-Lena-Northern Baikal region, and *torganei* ~ *torgandri* ~ *torgani* with the Middle Amur region and the Sea of Okhotsk coast (Vasilevich, 1971: 153–157). The inclusion of these words in the Evenki fairy-tale prose shows how the bear cult reached the Tungus-speaking population, and reflects the specific aspects of interethnic and interclan communications in their society, clearly expressed in the Tungus version of the bear ritual. Notably, groups being in mutual marital relations participated in the ritual, which involved killing the animal in its den, butchering, eating, and burying its bones. The leading role was played by the relatives by marriage, those of the wife and mother. The traditional division of the entire circle of bear ceremony participants into the strata of "sons-in-law" and "fathers-in-law" manifests the idea of matchmaking, which was originally embedded in the bear cult. This is confirmed by the use of words with the root *da* (*da(n)*, *dakha*, *davun* mean 'to convey a request, someone else's words during matchmaking', 'matchmaker', 'petitioner', 'relative by marriage') during the ceremony (Anisimov, 1958: 120–122; Vasilevich, 1971: 164–168). A similar nature of relationship between the performers of a sacred ritual is also recorded in the tradition of *nimat* (*nimak* 'stranger'), which implies handling a killed bear. According to this tradition, a hunter is obliged to give his catch to a member of another clan from which his clan takes wives. Relatives on the mother's side are

engaged in skinning and butchering of the beast (this is called "covering the wound on the bear's body"), and they invite the hunter and their "fathers-in-law" to eat the cooked meat (Anisimov, 1958: 108–110). In ritual actions, the bear may become an actor and act as both the outsider and the relative of a person. This can be seen in the act when the participants in the ceremony are likened to crows, that is, strangers, speaking the language incomprehensible to the bear (Ibid.: 106–110; Vasilevich, 1971: 168). Essentially, the Evenki bear ritual conventionally demonstrates the relationships between strangers and relatives. These symbolic actions may be based on historical events associated with incorporation of "other people"—natives of the mountain taiga and tundra zone—into the Proto-Tungus tribes and clans.

In the Evenki narratives, noteworthy is also another episode with a purely ontological meaning. In the myth of Kheladan, the heroine butchers the *ngamondri* bear: she places the heart next to herself, intestines opposite the entrance behind the hearth (*malu*), pours the wool into a hole, and hangs small intestines on a branch of a leaning tree. In the morning, she discovers that an old man and old woman are sleeping opposite her; deer are wandering next to the chum, and horse's halters are hanging on the leaning tree (Sbornik materialov..., 1936: 40). In the myth of Gurivul, the bear, who gives people various dyes and tools for processing leather, sacrifices itself (Ibid.: 47). These mythical scenes contain the idea that the beast ensures the cyclical nature of human life. In the worldview of the Evenki, the sacrificial bear acts as a donor of reindeer and domestic craftmanship. As a "non-human", it regulates marital contacts and social ties, and takes upon itself the authority to materialize the ideal world of people.

"Taiga relative" in the folklore and ritual practices of the Amur Valley peoples

Since ancient times, the Lower Amur region was a place of mutual influence of cultural traditions from Siberia, the Pacific coast, and Southeast Asia, which was reflected in ritualistic and ceremonial activities of the local population, including the bear cult. Fishing and hunting groups in the floodplain and taiga areas of the Amur River basin adhered to two ritual forms of bear veneration. The first form developed in line with the Siberian (Tungus) traditions, and included killing a bear in a den, with subsequent hanging of its bones on tree branches (Samar Y.A., 1978; Timokhin, 1969). The second form, recorded in the Amur (Ainu) communities, involved purchasing or capturing a bear cub in the forest, keeping it in captivity for several years, and ritual killing. In this ritual complex, some scholars see traces of cultural borrowing from East/Southeast Asia where the practice of keeping animals—leopards, monkeys, snakes, or lizards—as spiritual patrons and protectors of settlements originated (Vasiliev, 1948: 94–96; Shternberg, 1933: 580). After entering the Amur region, this custom was transformed according to the needs of the hunting community.

For the inhabitants of the Lower Amur taiga, the bear was associated with their natural environment, which provided for their wellbeing. It is no coincidence that in the vocabulary of the Nanai and Ulchi peoples, the bear received the meaning of "old man, grandfather" (*mapa*/*mafa*) and was perceived as an ancestor. This was reflected in the Tungus form of the ceremony: an important detail was rendering honors to the eldest man in the group of bear hunters or to the *penter* hunter, who discovered the animal's den. An inevitable part of this ritual was hanging of bear bones on the branches of a tree (this followed the stages of skinning, butchering, and boiling the meat in a large cauldron) (Lopatin, 1922: 203–206; Onenko, 1980: 258; Smolyak, 1976: 145; Sunik, 1987: 21). Such aerial burial was recorded at the bear cemetery (*Vaiyo*/*Vayo*) not far from the Nanai village of Kondon (Samar Y.A., 1978; Smolyak, 1976: 148; Timokhin, 1969). Such "ossuaries" with skeletal bones arranged in anatomical order can be considered the embodiment of people's care for the afterlife of the main taiga predators. It was probably believed that exactly in the other world the bear's special qualities were activated, which made it the benefactor, donor, and patron for people.

The study of the Nivkh, Ulchi, and Nanai mythological and ritual layers associated with bears shows that in the reality, from which the taiga beast influences the world of people, it has the role of a "mountain, forest man-spirit" (*Palnivkh* – Nivkh), "bear-man" (*tkhyvan nig"vdy* – Nivkh), "mountain man" (*tkhyf-pal nig"vn"* – Nivkh), or "taiga man" (*duenteni* – Ulchi; *duenteni edeni* – Nanai) (Zolotarev, 1939: 112; Kreinovich, 1973: 173, 175; Savelieva, Taksami, 1970: 250; Smolyak, 1976: 145). His

"taiga world", which is a mirror image of earthly life, is accessible through the bear's den. This "world" is a separate space, with a settlement consisting of large houses where "bear-people" live in related groups. Each of their clans is related by blood to a certain clan of regular people. From their earthly relatives, the "bear-people" receive gifts and treats, some of which they distribute to their neighbors (Kreinovich, 1973: 170–175; Taksami, 1976: 215–216).

The "bear" legends that have survived until today are united by one plot, manifesting the relationship between the "forest" and regular people. It describes the den-dwelling owners watching how regular people are approaching their shelter. The woman of the house decides to go out to meet them. One version says that she puts on the skin, turns into a bear, and comes out of the den. The hunters kill her, butcher, put the pieces of meat in knapsacks, and go down the mountain. After some time, the she-bear with a large knapsack on her shoulders goes up the mountain (to the den) accompanied by four dogs. She first distributes the food she brought to other bear clans, and the rest of the food is kept by her household members. Another version of the legend says that the woman falls backwards, turns into a bear, comes out of the den, and the hunters kill her (Zolotarev, 1939: 123; Kreinovich, 1973: 174). The key point in these stories was the transformation of the "bear-man", the acquisition of bear or human form by putting on or shedding the skin. It was the culmination of the bear ritual. Its meaning was to create the body of the "taiga man"; in the ritual act, this corresponded to skinning the bear, similar to the process of removing clothes from a person*. For example, in this case, the Nivkhs called skinning of the beast *laz'nd*, while skinning of an ordinary animal was called *iznd*. During the removal of bearskin, people left uncut areas (three for males and four for females), which were then torn apart with fingers. These areas symbolized the *u"gr* buttons. In addition to these, another strip was left on the bearskin, which was called *vals*—belt (according to the Nivkhs, the bear uses this belt to carry a small *mly* bag with tinder, red flint, and iron steel for striking fire) (Kreinovich, 1973: 210–211).

The meaning-making component in the creation of the "taiga" man's body was the "road". According to the Ulchi, the bear, after crossing 40 ridges and cleaning itself of dirt on the way, returned to its taiga relatives by the "old man's road" or the "taiga road" (*mafa poktoni/duente poktoni*) (Zolotarev, 1939: 112, 123–124). Among the Nivkhs, the "mountain bear man" descended from the mountain to its "lowland" relatives and then returned home by overcoming the ascent (Kreinovich, 1973: 174).

The peoples of the Amur-Sakhalin region regarded the bear as a messenger of the "other" people with whom earthly people were connected by strong ties and obligations; therefore, the bear ritual was sometimes closely intertwined with funerary rite. Among the Nivkhs and Ulchi, it was customary for the relatives of the deceased to take a bear cub for keeping it in his/her memory. Treating the bear cub as a dear and welcome guest, people thereby expressed a request to the "bear-people", with whom their deceased relative ended up, to provide him/her with assistance and the same warm welcome that the "taiga" man received from regular people (Zolotarev, 1939: 114, 122; Kreinovich, 1973: 160, 176). E.A. Kreinovich observed all stages of the Nivkh ritual of sending a bear to its taiga brethren, and recorded an important point: the participants in the process first lowered the bear's skin through the smoke hole of the dugout, and then a small boy (1973: 218–219). This ceremony was dedicated to the death of the son of its organizer, and possibly implied the motif of the child's soul rebirth under the patronage of the "mountain (taiga)" people.

Another way to ensure support from the representatives of the "mountain (taiga)" world was to pronounce the substitutive name assigned to the bear by its owner or deceased person belonging to the third generation back, and after some time, to name the newborn son of the organizer of the ceremony by this name (Kreinovich, 1973: 220).

Patronage of the "bear-people" could also be gained by establishing family ties with them. According to the Nivkhs, this could be achieved by the clan of a hunter who was scratched, touched, or killed by a bear. Notably, among the Nanai people, a person who suffered from the beast was not awarded such honors. He and his relatives would become *galku nai*, that is, carriers of a special dangerous *gala* force; so their communication with other people was limited (Smolyak, 1976: 152–153; Taksami, 1976: 213).

*The Amur Nivkhs and Ulchi used the phraseological expressions "make a bear" (*kotr nyd'* – Nivkh), "work with a bear" (*kotrkir tynzd'* – Nivkh), "act as a bear" (*buyumba khupi* – Ulchi) in relation to this sacred ritual (Zolotarev, 1939: 121–122; Osipova, Temina, 2008: 57).

The most common way for regular people to get closer to "taiga people" was cohabitation with a representative of the latter, or conceiving from him, which was reflected in a number of the Lower Amur narratives (Zolotarev, 1939: 125; Kreinovich, 1973: 174–175; Nanaiskiy folklor..., 1996: 235–243). According to the Nivkhs and Ulchi, woman's close relations with the "mountain (taiga)" spirit resulted in a twin birth. The fact that the mother and these twins belonged to the world of the "mountain people" determined a special path for their posthumous existence. Unlike ordinary villagers, they were buried in a bear cage, without being burned (when describing their death, instead of *mud* the word *pnyud* was used, which referred to a bear kept in a cage) (Zolotarev, 1939: 140–142; Kreinovich, 1973: 390–395, 426–440).

The culmination of the bear ritual among the Lower Amur peoples was enactment of the plot of departure—the farewell of the main protagonist. According to the mythical story, a she-bear leaves the people who nursed and raised her, and returns to her fellow bears. In his monograph on the Nivkhs, Kreinovich provided an interesting detail: when a bear cub is brought to a village, on the second day it is given special food *n'azl avgu mos* 'jelly for gluing heels'. Such jelly is given to a girl before sending her to another clan, which makes it possible to compare the bear cub with marriageable girl (Kreinovich, 1973: 178). The comparison of a bear with bride can also be observed in the rituals of the Gorin Nanai people. In addition to the ritual killing of a bear in its den, they had a custom of raising a bear cub brought from the forest in order to give it then to the Ulchi people for their bear ritual. It was usually a three-year-old bear, which, regardless of sex, had moved from the *khoyor* age category to the *puer* category*. The *puer* name was also related to the farewell ceremony, which basically reiterated the wedding ritual of the Lower Amur peoples. The "bride" in the bear guise was seated in a wedding boat, mourned, and was taken away from home to the Ulchi or Nivkhs (Samar E.D., 2003: 37–38; Smolyak, 1982: 232). The same subtext, which identifies a woman as a departing and arriving component of the clan, is embedded in the ceremony of sending a bear to its taiga relatives. Wives, sisters, and daughters usually did not participate in the ritual acts of raising, killing, and butchering the bear. Certain fragments of the butchered carcass, which were considered taboo female parts, were set aside for them. For example, among the Nivkhs, female parts (*shan"k"inf*) included three long and three short ribs, vertebrae, shoulder blades, and pelvic bones; meat of the lumbar part was given to sisters, who were considered belonging to different clans or tribes (Kreinovich, 1973: 215–216).

Researchers of bear ceremonial complexes classified the Lower Amur as a region where the bear cult was organically integrated into the social and clan differentiation (Shrenk, 1903: 64–103; Hallowell, 1926: 106–120). The relationships between foreigners (relatives by marriage from other clans) and blood relatives were determined by the same principles as those between fathers-in-law and sons-in-law. When performing ritual actions, this was regulated by specific rules. Among the Nivkhs, a person who raised a bear cub could not kill it nor eat its meat, since such bear was considered his relative. These ritual actions had to be performed by the son-in-law—the foreigner; ritual killing of the animal was carried out on the *n"anyu* site, which belonged to the father-in-law's clan (Kreinovich, 1973: 180–181, 193, 256). Among the Ulchi, if a bear was bought, it had to be shot by one of the mother's brothers or *gusi*/*gamasun* sons-in-law (Zolotarev, 1939: 112).

Social and regulatory role of the bear is also associated with the *dokha* institution, which emerged in the Lower Amur as a form of unification of clans. Using the Nivkhs as example, L.Y. Shternberg showed that an important part of the consolidation process was the organization of a common bear festival. Each *kkhal* (clan) was obliged to buy from one to four bears, which were killed after one or two years, and the meat was always distributed among the members of the adopted clans (Shternberg, 1933: 297–299). The function of the bear as an exponent of the clan principle is recorded in the traditions of the Ulchi. One of the carriers and keepers of these traditions, M.S. Duvan, mentioned in his family history that settlers, having come to new places, adopted bears, whose number indicated the wellbeing of their families (FMA, the village of Bulava, 1991, 1992).

The tradition of raising a bear cub with people, which evolved among the Lower Amur peoples, also had a social and economic aspect. Preparing a bear for the ceremony of killing required much effort

*The word *puer*, which denotes a three- to four-year-old bear cub, was used in the rituals to denote "bride" (Onenko, 1980: 340).

and material costs from its owner. According to field researchers, owner of the bear, in order to feed his "fosterling", had to prepare much yukola, fish, berries (these ingredients were used for making *mos* jelly for the bear), and buy rice with the money earned from selling furs. It was only during the ritual that relatives on the wife's or daughter's side might compensate the beast's owner for all his expenses (Kreinovich, 1973: 179, 181–182). When making the *dokha* alliance, the relations between the host clans and adopted clans took the form of symbolic exchange. After performing the bear ritual, the host side offered new relatives a flint in exchange for their dogs; this act sealed the agreement on mutual assistance (Shternberg, 1933: 297–298). The bear ritual, after becoming a part of internal exchange between the communities living in different parts of the Amur River basin, was modified over time. For example, the Gorin Nanai people supplied the Ulchi with bear cubs in exchange for large boats which could be used to go out into the Sea of Okhotsk and sail to China. All the above suggests that for the Lower Amur peoples the bear was the embodiment of the patron of forest wealth, equivalent of exchange, expression of social status, and marker of social differentiation.

Transformation of the bear role in the worldview of the Lower Amur peoples: from sacred person to representative of the fauna

The bear cult in the Lower Amur region contains an archaic layer associated with hunting cultures; however, its social connotation was constantly redefined. With the development of trade relations in the Lower Amur, communication between neighbors evolved beyond kinship and family ties, and took the form of economic and business contacts. This new model of relationships included symbolic actions built over many generations and based on new ontological motives. For example, in the traditions of the Gorin Nanai, the bear that was sent to the Ulchi no longer played the role of an intermediary between "taiga otherness" and human existence. In this representational model, the land of "other people" was located in a physically tangible earthly plane. In the social institution of *dokha*, the bear acted as a symbol of the unity of communities from different earthly territories with their own landscape features—taiga and river zones, downstream and upstream river areas, river shore and sea coast (Tugolukov, 1972: 110).

In the late 19th to early 20th centuries, with the arrival of European population with agrarian traditions to the south of the Far East, the local community faced the phenomenon of depersonalization of the taiga space. The new neighbors viewed their natural environment through the lens of economic activities; in their perception of the world, forest predators personified a hindrance, a threat to human life, or resource objects. When settling in new territories, the migrants primarily cleared them of forests to construct houses and utility buildings, and to create arable fields and pastures. In the eyes of the indigenous population, the very act of cutting down trees could be regarded as destruction of the "taiga people's" home and the core of their universe associated with hunting. The report of the Organization of Local Governments, which provided medical and food assistance to new settlers in the Far East, stated that owing to intensive logging and burning of forests, the indigenous people migrated after animals who had gone deep into the taiga. The differences in the approaches to land management were manifested in the division of space between the indigenous community of the Amur region and the new settlers. "Russian hunters almost never enter the indigenous people reign, while the natives never intrude into the sphere of influence of the Russians" (Priamurye..., 1909: 268). The 1907 statistical reports on the Goldy (Nanai) population of Khabarovsk Uyezd cited the data testifying to the prevailing attitude towards bears as hunting trophies, and not as exponent of sacred essence (the indigenous hunters killed twenty bears, and the Russians only three). However, data confirm the surviving ritual importance of bears among the Gilyaks (Nivkhs) at that time: out of 74 bears procured by them, 64 were alive and were used to hold the bear festival (Ibid.: 268, 290).

Changes in the life of the Lower Amur communities in the 1920–1930s during the Soviet reforms transformed their worldview. Dominance of river fishing among the occupations of these peoples and transformation of the settlement structure due to construction of collective farms led to the decline of hunting and to the fading of the importance of bear as a key figure in the structure of human life. In the 1930s, introduction of the norms of literary language into everyday communication fostered the changes in the perception of taiga environment by the indigenous population. The transition from

acoustic to graphic forms of language became a turning point in the meaning-making and word formation for them. In oral languages, phonetics plays a large role. As noted by scholars who designed the first alphabets of the Nivkh and Nanai languages*, the identification of all phonemes and the assignment of graphic signs to them were the hardest tasks, since some phonemes were difficult to discern by ear and transcribe, which led to a reduced understanding of what was said. In addition, pronouncing the same word in different tones could change its semantics. Each concept reflected nuances of movements and actions, landscape features, or age and sex differences in different animal species in specific situations, while in the Russian-language version it was associated with the entire phrase. Transformation of the social order influenced the language structure, which determined new boundaries of understanding the world. The need to create new concepts and expressions arose, in order to designate the objects and phenomena brought into the indigenous environment. Their semantic content was conveyed with the equivalents that were essentially the lexical constructions. For example, in the Nivkh language, the concept of "worker" was interpreted as the "person living on his own" (p'səŋgir hum-nivx), "hospital" as the "house that fixes itself" (p'fəɦvəɦ-dəi) (Kreinovich, 1934: 187–188). The same semantic distortions emerged from attempts to transfer the vocabulary of fishermen or hunters into the graphic signs. The words have lost their connection to the life experience, and became generalized concepts and categories (Avrorin, 1959; Alkor (Koshkin), 1931; Arefiev, 2014: 34–43; Kreinovich, 1934). In the school education system, acquisition of knowledge and learning the grammar rules were based on materialistic concept of the structure of reality, in which animals were a part of physical nature.

The extent to which the innovations were consistent with the norms of life, developing over many generations, can be seen in the example of "bear" terminology, where many terms are related to ritual activities and social sphere. It comprises a lot of words denoting the details of the bear anatomy, as well as attributes and human actions associated with it. Notably, another way of transmitting information about the bear was the pictographic script discovered among the Nivkhs in 1929. It consisted of contour and relief images of bear, which were used to decorate wooden ritual utensils. Together, all these figurines revealed the circumstances of capturing or purchasing a bear cub, and its maturation up to the moment of killing (Kreinovich, 1934: 184–186). In the new language format, the sacred "bear" vocabulary was mentioned in the context of reviewing the past, and was no longer relevant. During the period of dominant atheistic ideology, the substitutive names of the bear, designations of bear ritual paraphernalia, ceremonial performers and actions, and "taiga" cosmography have lost their practical basis.

Field studies in the post-Soviet period in the areas of the Ulchi and Nanai residence revealed the loss of the bear's status as the "taiga man" in their social life. However, the surviving family histories and fragments of bear ritual complexes (musical logs) demonstrated the scale of the bear cult in the lower reaches of the Amur River in the past. Its existence as a social phenomenon was observed in the area from the Amur River estuary to the regions bordering China, where the competitor to the bear was the tiger. The most vivid memories of the respondents were of sex distribution of roles during the bear festival, taboos for women, following the soul of a killed bear along the "road of the dead" (Ulchi *bulyanchu*), and unity of relatives during the ritual (FMA: E.M. Digor, the village of Belgo, 1990; M.S. Duvan, the village of Bulava, 1991; I. Valdyu, the village of Savinskoye, 1996; V.M. Samar, the village of Kondon, 1998).

In the wake of rising interest in traditional heritage, in 1992, residents of the village of Bulava in the Ulchsky District decided to celebrate the bear festival after a long break. For this purpose, they specially bred a bear cub for two years. The preparation of the ceremonial site, ritual killing, butchering, organization of a feast with elements of competition between two groups of participants ("people of taiga" and "people of water"), burial of the bear's bones with smoking of its skull—everything was strictly regulated and carried out in compliance with the canons. However, these actions received mixed response from the public. The main question of how much this ritual is in demand today was addressed to the organizers and performers. Nowadays, re-establishment and preservation of cultural complexes from the pre-literate stages of history remain a controversial topic. The indigenous

*Since 1932, Latin-based writing systems were created for all small peoples of the North; since 1937, these were translated into Cyrillic (Arefiev, 2014: 39–42).

people from the Ulchsky, Nanaisky, and Solnechny districts of the Khabarovsk Territory face the problem of how to "revive" the forgotten bear cult. They realize that revering the "taiga man" has ceased to be the unifying idea for the village community in the changed social environment. Earlier, the image of the bear was associated with patronage of taiga elements, gift exchange, creation of interclan unions, hunting ethics, and norms of social order, while at present the beast is perceived as a representative of the animal world, dangerous to humans.

Conclusions

The Lower Amur peoples (Nivkhs, Ulchi, Nanai) have a tradition of revering the bear, which has both universal and specific aspects. The concept of the bear as the "other man", an individual with its own character and conscious behavior, is common for the traditions of all indigenous communities in the Holarctic zone. In the Lower Amur, the established attitude to the bear as a representative of "taiga/mountain humanity" was complemented by its perception as a relative of man. This was reflected in the worldview where human society and the "taiga people" were inextricably linked. "Bear-people" in their world lived in related groups, which had relatives among people. Close relationships between human and bear clans were embodied in ritual practices. In the Amur form of bear worship, known as the bear festival, the animal raised among people was killed, skinned, and butchered; after the feast, the bones and smoked skull were buried in a special cribwork. In this way, the "bear-man" was believed to leave its human relatives and return to its abode, acquiring true body on the way.

Among the Nivkhs, Ulchi, and Nanai people, the relations between the "bear-men" (who personified the "others") and representatives of human groups (who acted as relatives) in fact reflected a sophisticated social relationship in mythical and ritualistic form. The basis of this interaction was the mechanism of strengthening family ties through the institutions of marriage and *dokha* (unification of clans), as well as the practice of business contacts. Communication, represented both in the mythic-ritualistic realm and in the physical world, ensured the acquisition of material benefits (hunting and fishing catch, food, household and utility items, means of transportation), conclusion of a social contract on mutual assistance, and maintaining parity in all areas of activities. Additional semantic essence of the bear manifested itself as a standard of exchange and expression of social status in this sophisticated configuration of social relations; the attitude towards the beast determined the development of hunting rules and norms of social life.

Since the early 20th century, the image of the bear as the "taiga/mountain man" among the Lower Amur indigenous peoples began to fade owing to social and economic changes in the Far East caused by the influx of the European population with agricultural traditions and weakening of the importance of hunting in the economies of local households. With transition to written languages, which acted as filters in world perception, and introduction of materialistic concept of the structure of reality through the network of educational institutions, the bear began to be recognized as a symbol associated with traditions of the past, and a representative of the animal world.

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Reminiscences of Traditional Prayer Rituals in Modern Udmurt Culture

Based on my fieldwork in 2018–2019, 2022–2023, late 19th to early 21st century studies by other experts, and internet resources, I explore the functioning of traditional prayer rituals in modern Udmurt culture. Current religious rites fall into three groups: continuing, renewed at ancient sanctuaries, and initiated elsewhere. Prayer rituals are continuing in several Southern Udmurt villages and meant to secure the communities' wellbeing. They are a peculiar manifestation of Udmurt ethnic identity. Their deep meaning, however, is not always preserved, many elements are lost, and religious life in general is declining. Since the early 1990s, prayer rituals have been initiated at new places during festivals and holidays. They are thought to stimulate interest in Udmurt beliefs and rites and to propagate ethno-cultural codes outside Udmurtia. Under globalization and unification, the practicing of traditional rites preserves ethnic identity despite historical changes. Ceremonies with prayings contribute to the understanding and preserving ethno-cultural legacy.

Keywords: **Udmurts, traditional prayer rituals, sanctuaries, modern culture, tourism, identity.**

Introduction

Traditional beliefs of the Udmurts involve a system of cultic places and prayers, calendar and family rituals, as well as beliefs about deities and spirits. The main deities in the Udmurt pantheon were Inmar—god of the sky; Kyldysin—creator, patron of the earth and fertility; and Kuaz—deity of the atmosphere and weather phenomena. People appealed to them during ritual ceremonies with requests and thanksgiving prayers.

Three main categories of cultic places are associated with paying reverence to the patrons of tribes and family clans, masters of nature, and deceased ancestors. These are family, patronymic/clan, tribal/territorial sanctuaries; sacred places for praying to the masters of forests, meadows, fields, springs, rivers, lakes, etc., as well as cemeteries and special areas for commemorative and propitiatory rituals. The specific aspect of the pre-Christian Udmurt sanctuaries was their connection with the natural environment.

The calendar rituals included up to two dozen agrarian prayer rituals aimed at obtaining good harvest and livestock increase, and ensuring happiness and well-being for the members of village communities. The main rituals were dedicated to the beginning of agricultural works in the spring (*Gyron poton*, *Akashka*, "Easter" in the later version), end of sowing in the summer (*Gyron bydton*/*Gerber*), and thanksgiving prayers for completion of agricultural works in the fall (Ostrovsky, 1873: 22–24, 31–41; Pervukhin, 1888: Essay II, 1–138; Vladykin, 1994: 144–252; Shutova, 2001: 22–146; and others).

By the early 20th century, the Udmurt population was officially Orthodox. Pre-Christian views and

rituals retained their importance among unbaptized groups in the south of the present-day Udmurtia and adjacent regions, and in some places among the Christianized Northern and Central Udmurts. Nowadays, the majority of the Udmurt population is Orthodox, while the rest of the Udmurts do not associate themselves with any confession. Therefore, traditional religious beliefs and ritual actions have largely perished and lost their meaning of existence. However, in the late 20th–early 21st century, a number of elements of archaic beliefs have been systematically recreated in public and private life, museum practices, and in education and tourism. In this regard, we can speak about reminiscence of pre-Christian prayer rituals, when individual aspects of the integral complex of religious and mythological beliefs and cultic practices become reproduced for a shorter or longer periods.

This study presents new data on functioning of traditional Udmurt prayer rituals, establishes their preservation degree and role in the contemporary culture of Udmurtia using field ethnographic evidence (hereafter, FMA, field materials of the author), collected in 2018–2019 and in 2022–2023 from observing rituals, examining locations of old sanctuaries, and interviewing priests and participants in religious ceremonies. A comparative historical method was used, making it possible to determine the general trend in the development of traditional prayer rituals in the contemporary Udmurt culture.

Traditional prayer rituals in the contemporary Udmurt culture

Religious rituals performed nowadays can be divided into three groups: those continuing at old sanctuaries, those renewed at ancient cultic sites, and those initiated at new sites. These groups will be described using specific examples.

Continuing prayer rituals. Some Southern Udmurt villages have preserved traditional prayer rituals for ensuring well-being of the village community until today. For example, three old sanctuaries functioned since old times in the village of Kuzebaevo (Alnashsky District of the Udmurt Republic) in accordance with three social and cultic groups living there (*Lud-vyzhy*, *Bulda-vyzhy*, and *Budzyn-kua-vyzhy*): the sacred grove of Lud where people worshiped the master of nature Lud; sanctuary of Bulda/Buldavös dedicated to the territorial deity Bulda, and sacred building Great (*Budzyn*) Kuala where people prayed to clan deities. There were also other, less important cultic places. During prayers, people addressed their requests to the deities Inmar, Kuaz, and Kyldysin, as well as family and clan patrons—the keeper of happiness in the family and clan Vorshud and the deity of sacred center of the clan territory Mudor (for more details, see (Vladykin, 1994: 149–151, 271–273; Shutova, 2001: 46–58; Siikala, Ulyashev, 2011: 293–299; Lintrop, 2022: 88–96, 225–228, 310–317)).

At present, many ritual elements in the village of Kuzebaevo are being reduced, partly because the number of residents is decreasing: old people are passing away, and youth people are leaving the village. Prayer rituals in the sacred grove Lud (male) are now held once a year (previously twice) at night during the St. Peter's Day; a sheep is sacrificed (in 1994, four rams were slaughtered, while previously even more animals were sacrificed); only about ten participants gather for the ceremony. The large public sanctuary Bulda was abandoned seven or eight years ago, since there was no one to perform the prayer ritual. However, the sanctuary is visited privately in case of some special need. In the previous years, sheep, foals, and ducks were sacrificed there once every three years. Prayer rituals in the sanctuary of the Great (*Budzyn*) Kuala show the greatest stability. Members of 24 households participate in the ceremonies. They pray three times a year: on the Easter, during the St. Peter's Day, and on the feast of Protection of the Mother of God (Pokrov). Usually, they sacrifice one or two ducks, and during the St. Peter's Day up to five or six (in the 1990s up to thirty) ducks. Before collectivization, a heifer, bull, and foal were sacrificed in addition to ducks (FMA 2023; informant A.K. Karpov, born in 1962, the village of Kuzebaevo).

Until the mid-20th century, large public prayer rituals Buldavös were held in the village of Nizhniye Yurashi (Grakhovsky District of the Udmurt Republic) on the St. Peter's Day. People sacrificed white lamb, ducks, and geese, and every 12 years a calf and foal. The ceremonies lasted for five days, first in the courtyard of the honorary chairman of the prayer Bulda-*töro*, then in a clearing surrounded by oak trees. The *töro* sat in the center; three *vösyas* priests walked around him. Residents of dozens of surrounding villages gathered for religious celebrations (for more details, see (Shutova, 2001: 82–87)).

Buldavös is a male sanctuary; therefore, in the past, mainly men prepared and performed the ritual. Nowadays, women also do some duties there, helping to cook porridge with meat. According to folklorist I.V. Pchelovodova, in 2015, the order of prayer ritual there remained the same, but many elements

of the ritual were shortened, and musical instruments were not played. Crucial points of the ritual remained unchanged: people cooked ritual porridge with meat in cauldrons, addressed prayers to traditional deities, blessed food, had a meal, sacrificed coins in a small hole near a pine tree (previously under a linden or maple), and hung the brought gifts (white towels) on the tree branches (Pchelovodova, 2015: 109–111). In the late 20th to early 21st centuries, prayer rituals at this sanctuary were performed only sporadically owing to the lack of knowledgeable priests. "Knowledge of the course of the prayer ritual is a necessary component, since according to residents, ignorance provokes violation of tradition, which in turn leads to illness or death of people performing this prayer ritual..." (Ibid.: 110).

Fig. 1. Udmurt and Mari priests at the stump of the sacred oak tree at the Bulda/Ilma-Chara sanctuary, 2023. *Photo by N.I. Shutova*.

Notably, thanks to enthusiasm of the priests—adherents of ancestral customs and rituals—traditional prayer rituals are also performed in some other Udmurt villages (the village of Bagrash-Bigra in the Malopurginsky District, the village of Kuzyumovo in the Alnashsky District). However, there is a general trend towards gradual fading of religious activities owing to changes in the demographic situation in rural areas. Elderly carriers of traditions pass away, and young people do not adopt their practice of prayer rituals; they leave for the cities owing to the lack of jobs in villages.

Renewed prayers at the sites of old sanctuaries. The village sanctuary of the Great (*Bydzym*) Kuala existed near the village of Porvai (Igrinsky District of the Udmurt Republic) until 1942. It was abandoned after the death of the *vösyas* priest P.V. Emelyanov. In 1994, his grandson G.Y. Emelyanov resumed prayer rituals at the site of the sacred building. At first, the ritual was performed under a tree, and then a building was made. Religious ceremonies were performed three times a year. On the Easter (*Bydzym nunal*) and Pentecost (*Troycha*), Orthodox prayers and icons were used. On the Protection of the Mother of God, sacrifices were intended for the master of the forest Nyulesmurt. The rituals were supported by the village community, which believed that they helped in life. The prayer rituals stopped in 2014 after the death of G.Y. Emelyanov, since there was no one to perform the functions of the priest. Some of the older men who helped Emelyanov during the prayer rituals tried to continue this tradition, but failed (for more details, see (Shutova, 2018: 193–196, 208–212)), and the sanctuary became abandoned again.

In 2023, prayers were resumed at the public Udmurt-Mari sanctuary of Bulda/Ilma-chara near the villages of Varali, Udmurtskoye, and Mariyskoye Gondyrevo (Alnashsky District of the Udmurt Republic). In the clearing, a stump of a huge sacred oak tree has survived, where public religious ceremonies of receiving a new fire were performed in previous years (Fig. 1). At present, despite the fact that prayer rituals have long ceased, people remember this sanctuary. Someone from the residents of the adjacent villages tied six towels on the trees surrounding the stump of the sacred oak. In 2023, prayer rituals were performed in a clearing located next to the stump. The initiators of the ceremony were the Mari people of Udmurtia. They did not have their own priests left, so they invited *kart* priests from among the baptized Mari of the Mari El Republic and the Kirov Region, and unbaptized Mari of Tatarstan. The ceremony was initiated near a linden chosen as a sacred tree; a sheep was slaughtered, skinned, and porridge with meat was cooked in the village of Mariyskoye Gondyrevo. During the prayers, people appealed to main Mari deities. The ceremony was a mixture of elements from religious rituals of

different local Mari groups. In the same clearing, the Udmurt priests performed a more modest prayer ritual near a lit fire. Holding wooden bowls with the brought food in their hands, they walked around the hearth three times in the direction of the sun while throwing small pieces of food into the fire and splashing a little of drinks. They appealed to the deities Inmar and Kyldysin. However, both the Udmurt and Mari priests forgot to mention the master of the sacred place Bulda (FMA 2023).

Surges of religious activity in reduced and transformed form happen in a number of villages depending on spiritual needs of the village community. They quickly fade away owing to the lack of sufficient social base and organizers who have the necessary skills. In connection with the development of tourism, reminiscences of such phenomena can be observed in the villages of Staraya Salya and Karamas-Pelga (Kiyasovsky District of the Udmurt Republic). Such rituals continue in the museum environment; they show the demand among tourists and undoubtedly are welcomed by the local village community.

Organization of prayers at new locations. Since the early 1990s, there have been cases of reproducing traditional prayer rituals in new places both for demonstration and promotion of the Udmurt ethnic religion and attracting tourists. Since 1993, the republican (now interregional) and city summer Gerber festivals dedicated to the completion of sowing and honoring agricultural workers have been held annually.

In the late 19th to early 20th centuries, Gerber (Udm. ‘after the plow’, that is after completion of sowing) or Gyron bydton (‘completion of plowing’) was celebrated for several days, up to a week. It included a set of archaic and Orthodox Christian rituals: alternate prayers in a family, patronymic (clan), or village-wide Kuala, at a district or territorial sanctuary; visits to other people, games and festivities for the youth, and sports competitions. The culmination of the festivities was the prayerful appeal to the supreme deities Inmar, Kuaz, and Kyldysin, as well as family and clan patrons and deceased ancestors with gratitude for successful completion of sowing and request to ensure good harvest, prosperity, and health for all members of the group. Then followed blessing of ritual porridge and joint meal (for more details, see (Ostrovsky, 1873: 38–39; Pervukhin, 1888: Essay II, 8, 21–25, 68–69, 76–77; Luppov, 1927: 94–101)). The feast was based on religious motives. Gerber (or Gyron bydton) performed mediating (interacting between the world of people and world of deities and deceased ancestors), consolidating (visiting a related group at the level of patronymies and community), and communicative (facilitating exchange of information, development of common ideas, interests, moods, and attitudes) functions.

At present, the Gerber festival is predominantly secular. However, the sequence of actions and symbolism of the festival appropriate themes and imagery from the Udmurt mythology; prayer rituals are performed, and ritual porridge with meat is prepared and consecrated. Hereditary priests from the villages where this tradition has survived are invited to perform the prayer ritual. Initially, at the opening of the festival, an improvised appeal with prayers to old time deities was performed right on the stage. In recent years, religious ceremonies on the Gerber have become local. The priests are introduced at the official opening of the festival (Fig. 2). After that, they pray separately on a special area, cook porridge with meat, consecrate it (Fig. 3), and have a meal. Some of the consecrated porridge is added to the cauldrons intended for the other Gerber participants (FMA 2018, 2019; informants A.A. Razin, 1940–2019, the village of Kuzyumovo; N.T. Mikhailov, born in 1954, the village of Gord Namer). In 2023, the men chosen by the priests slaughtered a sheep (the priests themselves are not allowed to do this) early in the morning on a site near the forest and near the field designated for the festival, skinned it, and cut up the carcass. Then they cooked and consecrated the meat. Small portion of meat was left for the main cauldron with porridge for the priests. The rest of the meat was placed in twenty cauldrons intended for all Gerber participants. Other kinds of meat were added to these cauldrons with porridge in addition to the consecrated meat. After the prayer, the priests separately blessed the prepared porridge taken from one cauldron, and had a meal (FMA 2023; informant V.F. Botnikov, born in 1962, the village of Bagrash-Bigra). Notably, the location of Gerber festival changes every year. Hence, the site of the religious action is not reused and is not endowed with sacred properties.

Cultural and tourist park “Dondy Dor” (lit. ‘visiting Dondy’), dedicated to the legendary hero Dondy, was created in 2006 near the village of Adam (Glazovsky District of the Udmurt Republic). A series of seasonal events, recreating traditional festivals and rituals, are regularly organized there. These include the festival of winter spirits Vozhodyr (Christmastide, ritual period of time) and the ritual of Vozhopoton (the release of mythical harmful creatures *vozho* associated with deceased ancestors); spring competition Kuaka yumshan (“Crow Festival”); festival of summer

Fig. 2. Performance of Udmurt priests at the opening of the interregional Gerber festival, 2019. *Photo by N.I. Shutova*.

Fig. 3. Prayer ritual of priests at the interregional Gerber festival, 2019. *Photo by N.I. Shutova*.

spirits Kuarsur (festival of grass and leaves; in a later version it merged with the Orthodox Pentecost), timed to coincide with the summer solstice, ethnic and art festival Tylo tolez ("Fire Moon"); and autumn harvest festival Vyl zhuk ("New Porridge").

At the summer festival Kuarsur, spectators familiarize themselves with Udmurt mythology and spirits of the forest (Nyulesnyunya), water (Vukuzyo), and wind (Tolperi), who are in charge of natural phenomena and elements. In a ceremony, in a playful form, all participants, guided by the *töro* master of the ritual, ask for good harvest, favorable weather, and patronage in their undertakings (Tsentr kultury i turizma... (s.a.)). A certain mystical moment associated with these events is noteworthy. For example, organizers and participants of the ceremonies noticed that during the first events in the "Dondy Dor" Park, a white swan repeatedly circled above them and flew away. People took this as a sign of the blessing by the hero Dondy (FMA 2023; informant E.S. Nabokova, born in 1982, city of Glazov), since according to the legend, after his death he was turned by Inmar into white swan and assisted the Udmurts in their undertakings (Pervukhin, 1889: Essay IV, p. 10).

Interestingly, the foundation of the park began with the *Vyl intye potyku* ritual (lit., 'exit, foundation of a new place') performed in 2017. It included familiarization with the history of the village of Parzinsky Uchkhoz, near which Gubervös-2—large public sanctuary of the Northern Udmurts—used to function (abandoned in the mid-19th century). The main goal of the ceremony was praying at the sacred place near the revered pine tree. About 15–20 people in ethnic outfits gathered. Local historians compiled the text of the prayer based on the examples collected and published by N.G. Pervukhin in the late 19th century (1888: Essay III, pp. 7–37). Afterwards, some soil was taken from this area and brought to the cultural and tourist park that was being created. With prayers, the soil from the sanctuary was poured near three fir trees that had unusual qualities (double trunks) and were therefore chosen as sacred (FMA 2023; informants T.K. Pozdeeva, born in 1953, the village of Parzinsky Uchkhoz; A.V. Bazhenova, born in 1957, the village of Korshunovo; E.N. Bazhenov, born in 1983, city of Glazov). This ritual symbolized consecration and enculturation of new space, i.e. the area of the "Dondy Dor" Park.

Sometimes, traditional prayers are initiated at a place that has a special history or shows some distinctive features. For example, people began to revere old pine tree Batyr puzhym ("Mighty Pine") near the village of Chabishur (Uvinsky District of the Udmurt Republic). It is 375 years old and about 30 m high. Now this pine is listed as a site of natural heritage (*inkuazlen sinpeletez*) (Prirodniye pamyatniki... (s.a.)). This tree has a rich history. In 1918–1919, the famous Udmurt poet, educator, and public figure Kuzebay Gerd stopped his horse to rest under it and talked to local residents. Legends and history of the Tuklya clan are associated with this tree. Its representatives performed the Pokchi Mudor prayer rituals (*pokchi* 'small'; *mudor* is the center of ancestral territory) near that pine tree, and addressed words of gratitude and their requests to the deity Inmar. The *vösyas* priest Vasily Tratkanov (1959–2018) from the village of Pekshur had a special relationship to that tree, which connected him with his childhood years. He regularly came to it with his mother. Under that pine tree, his uncle introduced to him Udmurt customs and traditions. Vasily and his friends swung on a swing that was tied to that tree in the 1960s and 1970s. In many ways, precisely Vasily Tratkanov contributed to the decision to give that pine the status of a sacred tree (Ezhbaev, 2014: 74–75). Since 2012, the Guzhdor (a celebration of the first thaw) spring festival of the first thawed patch has been initiated annually under the Chabishur pine. Three *vösyas* priests gather for prayer. One priest addresses the words of his prayer to Inmar, the second one to Kyldysin, and the third one to Kuaz. In the fall of 2023, the thanksgiving prayer of Vyl zhuk (lit., 'new porridge', that is, new things) was initiated there for the first time (FMA 2023; informant G.E. Sidorov, born in 1964, the village of Uzey-Tuklya). In recent years, visit to the revered tree has been included in tourist routes.

Interestingly, in the Ludorvai Architectural and Ethnographic Museum-Reserve, a sacred building Great (*Bydzym*) Kuala was erected in full accordance with a similar structure from the village of Varkled-Bodya (Agryzsky District of the Republic of Tatarstan). Varkled-Bodya priests were invited to the opening of the Kuala and consecrated it. In the eyes of the public and museum workers, after prayers were performed, this site and the Kuala received the status of the sacred shrine.

On the surface, it seems that religious ceremonies are reproduced during public festivities and in museums only to attract tourists. However, such rituals, although in reduced and even theatrical form, are undoubtedly recreated at the call of the hearts of the event organizers, with the desire to broadcast Udmurt values to the outside world.

Discussion

Traditional prayer rituals nowadays include the most important aspects of the ritual: preparation (purification before the ceremony, special clean clothes), cooking ritual food on a ritual fire, prayerful appeals to the gods, sacrificial offerings, and public meal. At first glance, these prayers are associated with realities of a general typological nature (the place is a forest clearing or a site where an old sanctuary used to be located, set of simple ritual food and sacrificial gifts; main order of actions, improvised texts of prayers). Their reproduction in the Udmurt environment is of a relatively abstract kind—modest offerings, shortened prayer ceremony, rare slaughter of animals and birds, and brevity of prayer texts.

Prayers that are read during rituals are composed by priests based on their personal and public needs and ideas. They also include examples of texts published in academic and popular literature, and adopted from old priests, spiritual mentors and inspirers. Among the Udmurts, such people were Professor of the Udmurt State University, People's Artist of Udmurtia S.N. Vinogradov and Candidate of Philosophical Sciences and public figure A.A. Razin (FMA 2023; informants N.T. Mikhailov, born in 1954, the village of Gord Namer; V.F. Botnikov, born in 1962, the village of Bagrash-Bigra; A.P. Lekandrov, born in 1981, the village of Kuzyumovo; A.V. Bazhenova, born in 1957, the village of Korshunovo; E.N. Bazhenov, born in 1983, the city of Glazov).

In the late 20th century, religious ceremonies were performed in ordinary secular clothes (pants, shirts, jackets, caps or hats), with the exception of mandatory ethnic belts and sashes, as well as sacrificial towels. Nowadays, distinctive ethnic attributes of the contemporary Udmurt priests include picturesque outfits (robes, shirts, felt hats), which can be easily acquired thanks to active development of decorative and applied arts in Udmurtia since the beginning of the 21st century (Ligenko, Sidorova, 2022: 28–32).

Conclusions

This research (author's observations, interviewing of priests and participants of prayer rituals) has revealed that many elements of rituals have become transformed and reduced. Active religious life of the village community is fading, since there are no continuers of priests' work; old people pass away, and young people leave the village. The influence of the Orthodox Church has its impact, so the need for traditional prayers is disappearing. Nevertheless, there is a desire to turn to spiritual heritage of the ancestors in the life of the village community. People continue to reproduce ancient rituals that were performed by their fathers and grandfathers in memory of their departed relatives, which unites them with past generations, maintains spiritual connection with them, psychologically calms, and gives hope and confidence in the future.

All of the above indicates the preservation of a stable core of ancient beliefs about the world and about connection of man and society with nature and past generations in the contemporary Udmurt environment; these beliefs remain in demand even today. The need for rituals is caused by the conscious or unconscious belief that connection with the past will contribute to well-being and harmonization of life, and protect against misfortunes.

The vitality and reproduction of traditional prayer rituals, their revival in new places in the contemporary environment looks like manifestation of ethnic identity and desire to broadcast ethnic and cultural codes to the outside world. Organization of these rituals at festivals in the areas not associated with locations of old sanctuaries pursues multiple objectives. They include stimulating interest in the beliefs, rituals, and culture of the Udmurts, demonstrating the Udmurt identity, and attracting attention of representatives of other ethnic groups and tourists to it. The religious sacred content of the Gerber festivals and events initiated in the "Dondy Dor" Cultural and Tourist Park and other places currently plays only an accompanying role, developing in parallel with secular performances, games, and visitations of other people's homes. As a historical and cultural phenomenon, these ceremonies acquire a universal human spiritual meaning.

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Digital Forensic Analysis of Tooth Wear in Prehistoric and Modern Humans

In this study, we aimed to identify prehistoric and modern humans on the basis of the shape and texture of occlusal surfaces of their molars. Twelve specimens were tested (6 in each group). We used surface plot and plot profile analysis in the first experiment, and also three-dimensional (3D) surface plots, facet orientation, and roughness calculations in the second experiment, to test the deviation of the top gray or surface peak with fossa or surface valley and also bottom gray. Calculations from the three regions of interest indicate that the deviation results from prehistoric human teeth are smaller than those from modern human teeth. The calculated indices of molar surface roughness of prehistoric humans are generally lower than those of modern humans. The findings demonstrate that prehistoric human teeth were a bit more worn than modern human teeth.

Keywords: **Tooth wear, digital forensic, surface roughness, food ingredients, prehistoric human, modern human.**

Introduction

Teeth are a rather useful source of information in the identification of sex, age, and ethnic origin of humans (Kaifu et al., 2015; Krishan, Kanchan, Garg, 2015; Kurniawan et al., 2020). From an archaeological perspective, teeth are a valuable source owing to their durability, which often leads to them being found in good condition, because the enamel remains unchanged after the natural preservation of living organisms (Hillson, 2005: 1; Sperduti et al., 2018).

The shape of human teeth is strongly influenced by genetic factors (Berthaume, Lazzari, Guy, 2020). In addition, it can be influenced by a person's diet, including eating habits and food production techniques (Caglar et al., 2007). Humans who consume mainly fruits or other plant foods experience a decrease in the molar crowns; other factors are age and tooth wear (López-Torres et al., 2018). Eating habits of humans greatly affect the enamel hardness and the degree of tooth wear (Machado et al., 2022; Normando, de Almeida Santos, Abdo Quintão, 2016). For example, in Indonesia, particularly in its eastern regions, the culture of chewing betel leaves accelerates tooth wear (Murti, Koesbardiati, 2019; Permatasari, Artaria, 2015).

The type of food humans consume affects the structure or parts of their body, including the shape, size, and wear experienced by teeth (Scheid, Weis, 2012: 291), which play the key role in the digestion

process. The molars, as food crushers, adapt and change according to the type of food and diet consumed by humans (Ungar, Williamson, 2000). The amount and structure of abrasive substances in food, how the food is prepared, and sociocultural factors can, over time, contribute to the tooth wear, leading to changes in their shape (Machicek, Zubova, 2012; Molnar, 1971; Meng et al., 2011). Teeth, particularly the molars, have a wave-like pattern, which wears away; the highest degree of wear is experienced by the back molars of the mandible (Chikisheva, Polosmak, Volkov, 2009) as this area of the jaw moves more frequently when chewing, resulting in increased pressure and friction. In addition to food texture, tooth wear can be accelerated by certain substances in food. Research has shown that foods and drinks containing acid can erode teeth enamel (Al-Amri, Albounni, Binalrimal, 2021; Bartlett et al., 2011; Lussi et al., 2011; Lutovac et al., 2017; Zero, 1996), soft drinks adversely affect its hardness and can accelerate the tooth wear (Attin et al., 2005; Murti, Koesbardiati, 2019; Permatasari, Artaria, 2015).

There are several patterns of tooth wear experienced by humans. Nutrition is one of the main factors that influence its degree and patterns. Some previous studies stated that populations of hunter-gatherers had higher levels of dental wear than those with an agrarian economy or mixed foraging and cultivation subsistence (Molnar, 1971; Hinton, 1981; Smith, 1984; Kaifu, 1999; Larsen, 2002). The pattern of tooth wear in each human population is different, and can indicate the environmental lifestyle humans came from based on the types of food they consumed and how they chewed it. Teeth of prehistoric humans often exhibit flat molar surfaces with large cavities (Kurniawan et al., 2022), owing to consuming foods with crude fiber, such as hard-grain products (Eshed, Gopher, Hershkovitz, 2006). The diet of modern humans demonstrates the increasing number of soft and hard foods. The masticatory apparatus of modern humans has evolved and, though having the same common characteristics, is distinguished by moderate pterygoid bone, reduced alveolar process, and impacted third molars (Rose, Roblee, 2009). This is due to advanced food processing techniques (Das, Motghare, Singh, 2021; Masood, 2020).

In this study, the tooth surface analysis was carried out in order to find a new method in the scope of digital forensics. This analysis is often used to identify the level of hardness of a metal or other material. Hopefully, this method can be adapted for archaeological research.

Method

There are several stages in digital forensic analysis to determine the surface roughness of prehistoric and modern human teeth (Fig. 1). The mandibular specimen was digitalized using an X6812B smartphone with 50 MP f/1.6 (wide) and PDAF 2 MP (depth). Then, in the following stage, we used numerous plugins in Fiji (ImageJ) software to crop each molar image according to its size and start a 3D simulation. We utilized an HP Pavilion laptop with an Intel i7 processor, 8 GB RAM, and Windows 11 Pro to execute the program.

In the feature extraction stage, first, a 3D surface plot plugin was used to obtain a 3D image of the teeth by setting the grid size at 256, the smoothing scale at 25.0, the perspective at 0.0, and the lighting at 0.43. Second, a 32-bit grayscale filter was applied to the images. Third, we used surface plot and plot profile analysis to generate a histogram and visualize the level and contour of the tooth surface. Fourth, the facet orientation was conducted to increase the accuracy of the roughness calculation test, which was carried out to determine the level of surface roughness. In the last stage, the results were analyzed by observing the differences in the calculation of the deviations in the regions of interest (ROI) of each tooth (Fig. 2).

Feature extraction is a technique used to transform data into a more useful format to help identify differences in them. In this study, some features were used to identify differences in surface roughness between prehistoric and modern human molar teeth. First, a 3D surface plot was used. This method helps to create interactive plots of various types of images, where their luminance is interpreted as the height of the plot. The plot profile analysis was used to examine the surface contour of the object in a 3D model. On the basis of that image, a histogram was produced.

Second, the facet orientation plugin was used to view surface orientation results and statistics of topographic images obtained from profilometer results. The input image must be in a 32-bit format, and the user must provide the transverse distance between the pixels, expressed in the same units as the data range, which refers to the difference in height values or surface variations in the topographic image, encompassing the distance between the highest and lowest measured points on the surface. Third, the roughness calculation plugin was used, which displayed the statistical results of surface roughness

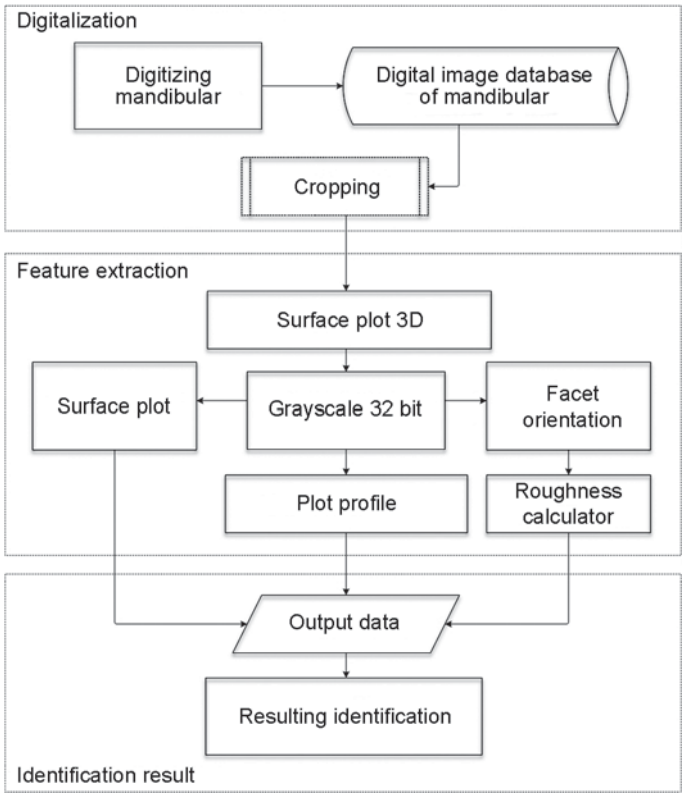

Fig. 1. Framework for surface roughness test.

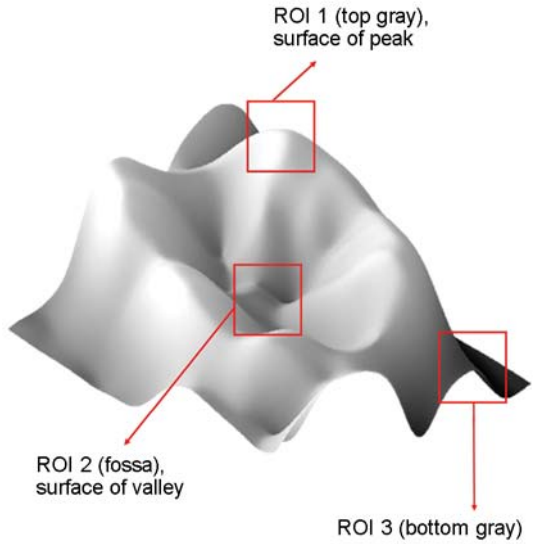

Fig. 2. Regions of the research.

levels based on topographic images. The roughness calculation values were as follows.

Arithmetic Average Roughness (R_a) is the arithmetic average of the absolute values of the surface profile's height deviations from the mean line, regardless of their direction. The formula is below (Whitehouse, 2012: 52):

$$R_a = \frac{1}{L}\int_0^L |\, y(x)\,|\, dx, \tag{1}$$

where L is the length of the surface profile, x is the position in the surface profile, and $y(x)$ is a function that describes the surface deviation from the baseline at position x in the surface profile.

Quadratic Roughness (R_q), also known as RMS (Root Mean Square) Roughness, is the average deviation of the surface profile from the mean line. The formula is below (Ibid.: 53):

$$R_q = \left[\frac{1}{L}\int_0^L [y(x)]^2\, dx\right]^{\frac{1}{2}}. \tag{2}$$

Kurtosis of the assessed profile (R_{ku}) measures the relative sharpness or flatness of the height distribution of the profile. The formula is below:

$$R_{ku} = \frac{1}{L}\int_0^L [y(x)]^4\, dx. \tag{3}$$

Skewness Roughness (R_{sk}) is a measure of the asymmetry of the surface profile. A positive skewness implies that the profile has more peaks than valleys, whereas a negative skewness suggests that the latter prevail. The formula is below:

$$R_{sk} = \frac{1}{L}\int_0^L [y(x)]^3\, dx. \tag{4}$$

Highest Peak Roughness (R_p) is the vertical distance between the highest peak and the lowest valley within the assessment length. The formula is below (Ibid.):

$$R_p = \mathrm{Max}_x[y(x)]. \tag{5}$$

Lowest Valley Roughness of a surface profile (R_v) is the distance from the lowest point of the profile to the mean line. The formula is below (Ibid.):

$$R_v = \mathrm{Min}_x[y(x)]. \tag{6}$$

Total Height Roughness (R_t) is the vertical distance between the maximum profile peak height and the maximum profile valley depth in a surface profile. The formula is below (Ibid.):

$$R_t = \mathrm{Max}_x[y(x)] - \mathrm{Min}_x[y(x)]. \tag{7}$$

Study materials

The dental data used in this study were provided by the Ethnography Museum at Airlangga University in Surabaya, Indonesia. Prehistoric specimens belong to 6 skeletons from Liang Bua-3 and -6 (LB-3, LB-6; Fig. 3, 4), Melolo-Urne-2 and -3 (Urne-2, Urne-3), and Sumba-2 and -F (SB-2, SB-F) in East Nusa Tenggara, Indonesia. The human remains from Liang Bua, discovered during excavations in 1965 (Murti, Suriyanto, Koesbardiati, 2013), are estimated to be 2600 years old (Oliveira et al., 2022). Archaeological finds from the above-mentioned sites include stone tools, flakes, bone fragments of bovids, pigs, porcupines, rats, fresh-water or sea mollusks, and also pottery, which suggests the lifestyle based on cultivation and foraging, characteristic of the period of transition to an agrarian economy (Atmosudiro, 1994: 126; Sukadana, 1981, 1984: 183).

Modern human teeth belong to the humans who lived in the territory of East Java during the industrial era (M-1–M-5; Fig. 5, 6) and the Majapahit era (M-6). Twelve specimens were analyzed (Table 1).

Experiment results

In the first experiment, prehistoric and modern human teeth were studied using the 3D plot of the molar crown, surface, and profile. The gray shades in the image show the value of the variable: the darker the color (gray value), the lower the variable value is. For each specimen, histograms were produced (Fig. 7, 8).

Fig. 3. Mandible of LB-3.

Fig. 4. Molar tooth of LB-3.

Fig. 5. Mandible of M-2.

Fig. 6. Molar tooth of M-2.

Table 1. **The sample of prehistoric and modern humans teeth under study**

Specimen	Age (year)	Sex	Dating	Size (pixel)
Prehistoric				
LB-6	17–25	Female	3390 ± 270 to 3830 ± 120 BP	129 × 127
LB-3	25–35	Male		129 × 127
SB-2	25–35	Female	2870 ± 60 BP	288 × 284
SB-F	25–35	Male	2870 ± 60 BP	288 × 284
Urne-2	24–35	Female	2870 ± 60 BP	230 × 232
Urne-3	25–35	Male	2870 ± 60 BP	336 × 340
Modern				
M-1	17–25	Male	2010–2015	88 × 87
M-2	27–35	"	2015	290 × 306
M-3	27–35	"	2015	298 × 326
M-4	27–35	"	2010–2015	294 × 292
M-5	25–35	Female	1980	344 × 352
M-6	20–30	Male	1529–1650	272 × 284

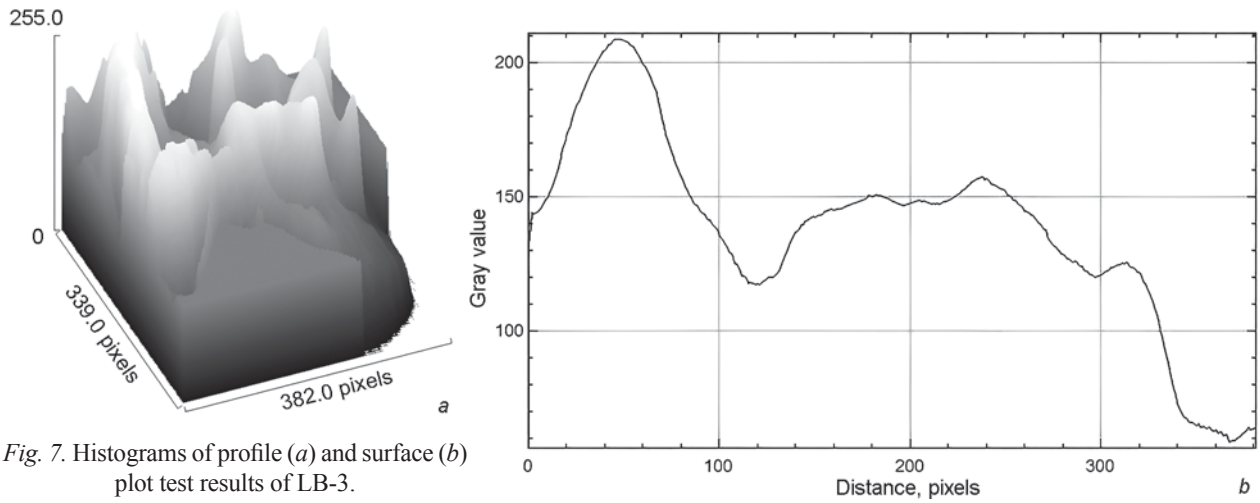

Fig. 7. Histograms of profile (*a*) and surface (*b*) plot test results of LB-3.

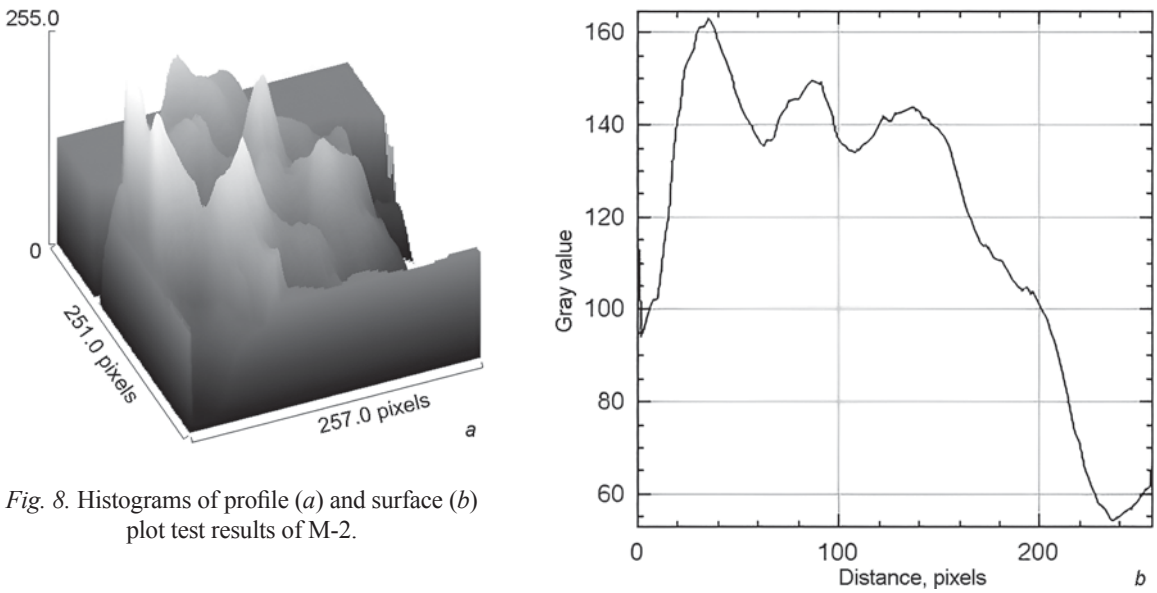

Fig. 8. Histograms of profile (*a*) and surface (*b*) plot test results of M-2.

The profile and surface plot test results provided the data characterizing the molars of modern and prehistoric humans (Tables 2, 3).

In the second experiment, the surface roughness of molars was analyzed. 3D surface plots from the first experiment were converted using the facet orientation plugin to the form of a polar plot (Fig. 9, 10). To determine the level of tooth roughness, the R_q, R_a, R_{sk}, R_{ku}, R_p, R_v, and R_t parameters were used (Tables 4, 5).

Table 2. **Results of profile and surface plot analysis of prehistoric human teeth**

Specimen	Top gray value (*Y*)	Bottom gray value (*Y*)	Fossa	Distance (*X*)	Difference between gray values	
					Top and bottom	For peaks and valleys
LB-6	158.90	29.10	58.70	316.00	129.80	100.20
LB-3	210.80	56.40	117.60	381.00	154.40	93.20
SB-2	217.30	27.60	165.30	366.00	189.70	52.00
SB-F	181.40	124.60	150.16	428.00	56.80	31.24
Urne-2	201.50	94.10	150.10	389.00	107.40	51.40
Urne-3	152.40	101.20	116.66	367.00	51.20	35.74
Total	1122.30	433.00	758.52	2247.00	545.70	363.78
Mean	**187.05**	**72.17**	**126.42**	**374.50**	**90.95**	**60.63**

Table 3. **Results of profile and surface plot analysis of modern human teeth**

Specimen	Top gray value (*Y*)	Bottom gray value (*Y*)	Fossa	Distance (*X*)	Difference between gray values	
					Top and bottom	For peaks and valleys
M-1	201.80	92.80	131.90	318.00	109.00	69.90
M-2	164.60	52.90	134.20	256.00	111.70	30.40
M-3	187.20	89.10	110.18	278.00	98.10	77.02
M-4	190.40	121.60	127.54	277.00	68.80	62.86
M-5	178.70	42.70	51.50	283.00	136.00	127.20
M-6	201.00	80.80	153.20	271.00	120.20	47.80
Total	1123.70	479.90	708.52	1683.00	643.80	415.18
Mean	**187.28**	**79.98**	**118.09**	**280.50**	**107.30**	**69.20**

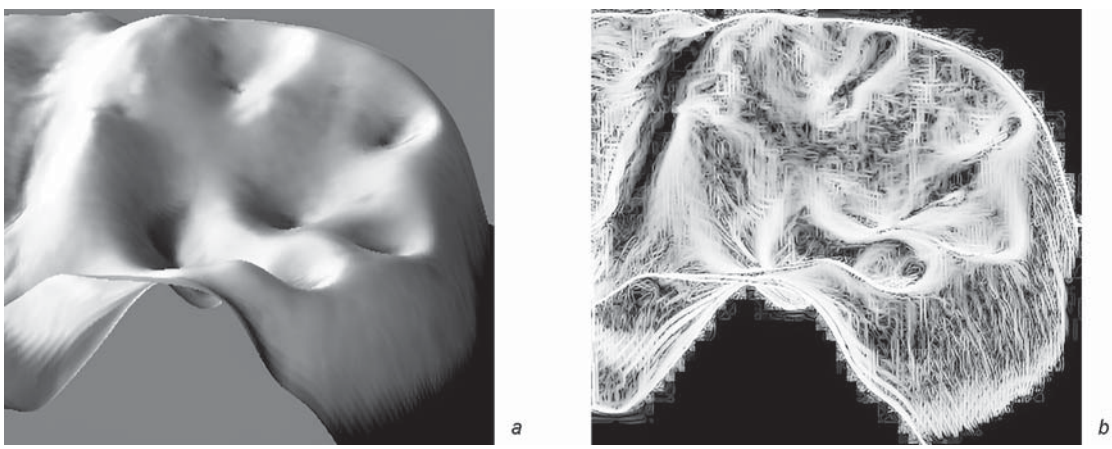

Fig. 9. Grayscale 32-bit 3D surface plot (*a*) and polar image facet orientation (*b*) of LB-3.

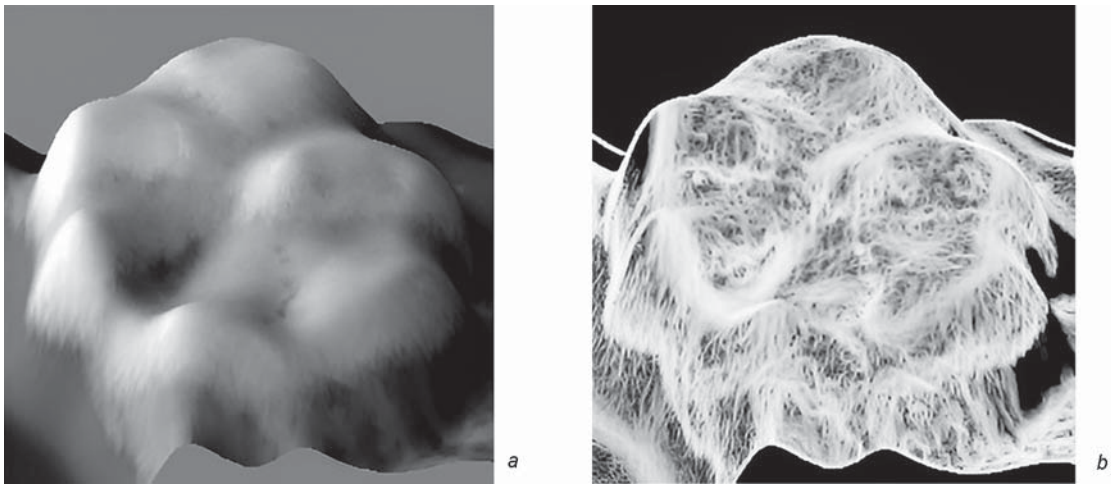

Fig. 10. Grayscale 32-bit 3D surface plot (*a*) and polar image facet orientation (*b*) of M-2.

Table 4. **Summary of results of roughness calculation test of prehistoric human teeth**

Specimen	R_q	R_a	R_{sk}	R_{ku}	R_p	R_v	R_t
LB-6	57.68	48.50	1.25	1.60	89.48	0.00	89.48
LB-3	59.08	50.30	1.24	1.58	89.48	0.00	89.48
SB-2	59.00	50.75	1.21	1.51	89.32	0.00	89.32
SB-F	56.03	44.60	1.30	1.72	89.57	0.00	89.57
Urne-2	60.13	53.44	1.17	1.41	89.33	0.00	89.33
Urne-3	75.53	70.76	1.09	1.20	89.22	0.00	89.22
Total	367.44	318.35	7.25	9.02	536.40	0.00	536.40
Mean	**61.24**	**53.06**	**1.21**	**1.50**	**89.40**	**0.00**	**89.40**

Table 5. **Summary of results of roughness calculation test of modern human teeth**

Specimen	R_q	R_a	R_{sk}	R_{ku}	R_p	R_v	R_t
M-1	48.98	31.86	1.59	2.57	89.58	0.00	89.58
M-2	61.48	52.20	1.21	1.50	89.59	0.00	89.59
M-3	69.27	62.50	1.13	1.29	89.54	0.00	89.54
M-4	60.46	50.60	1.23	1.55	89.32	0.00	89.32
M-5	65.98	58.25	1.17	1.39	89.56	0.00	89.56
M-6	64.61	56.66	1.17	1.40	89.51	0.00	89.51
Total	370.77	312.08	7.50	9.70	537.10	0.00	537.10
Mean	**61.80**	**52.01**	**1.25**	**1.62**	**89.52**	**0.00**	**89.52**

Discussion

The examination of 3D molar surface plots has identified substantial changes in modern and prehistoric human teeth. The latter appear flatter and tend to have less deviation between the deepest fossa and the top of the crown, with an average depth of 60.63, as compared to modern humans, where the average is 69.20. The profile plot test has shown that prehistoric specimens had a more even and stable histogram pattern than modern human teeth, indicating less wear of the latter.

Although prehistoric humans' average roughness (R_a) value is 1.05 m greater than that of modern humans, the quadratic roughness (R_q) value, which shows the same parameters as R_a, but is calculated by another method, is less (61.24 vs 61.80). Other calculations (R_{ku}, R_{sk}, R_p, and R_t) in prehistoric humans are lower than in modern humans.

Overall, the results show that prehistoric human molars experienced relatively higher wear. Tooth wear could be caused by various factors, including environmental and socio-cultural, as well as the type of food consumed. All prehistoric humans whose teeth were examined in this study lived in the period of transition to an agrarian economy and had mixed hunting, foraging, and cultivation (horticulture) subsistence (Winterhalder, Kennett, 2006). Their diet included game meat, fresh-water or sea mollusks (with or without prior cooking), and plant products, which could have been eaten raw (Sukadana, 1981, 1984: 185; Atmosudiro, 1994: 126). In prehistoric times, this food required strong jaws, large canine teeth, and strong chewing muscles. Excessive friction resulted in tooth erosion (Das, Motghare, Singh, 2021; Masood, 2020). Furthermore, the high tooth wear shown by prehistoric humans could have been caused by the influence of abrasive materials, such as sand that got into food owing to inadequate cleaning of products or owing to the use of pottery as cooking utensils (Murti, Koesbardiati, 2019).

In contrast, modern humans have a more varied diet, and can choose between soft or hard foods, resulting in less tooth wear. The development of food-processing equipment, which becomes increasingly sophisticated and diverse, also influences the texture of the food consumed. However, eating habits and cultural practices can also contribute to the tooth wear. For example, in Indonesia, there is a tradition of chewing betel leaves, which causes tooth decay (Ibid.).

Conclusions

The study of forensic digital analysis of tooth wear is a promising effort to understand the history of human subsistencies and its change. By using digital image processing technology through surface roughness tests on the molars of prehistoric and modern humans, this research can differentiate the level of tooth wear. Our experiments showed that prehistoric human teeth experienced more wear than modern human teeth. The findings of this study also support the earlier conclusions as to the decrease of the level of dental wear from prehistoric to modern populations, caused by the transition to an agrarian economy. The results of this research can provide an alternative method for reconstructing the diet of individuals or populations based on tooth wear, allowing for more precise measurements through digital image processing.

Acknowledgement

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PERSONALIA

The Double Anniversary of T.A. Chikisheva

The year 2024 marks a double anniversary for Tatyana Alekseevna Chikisheva—the anthropologist, Doctor of Historical Sciences, the Leading Researcher of the Department of Metal Ages Archaeology, the Head of the Division of Anthropology. First, it is her birthday, and, second, the round-number anniversary of her professional activity at our Institute.

In 1984, she joined the Institute of History, Philology and Philosophy of the Siberian Branch of the USSR Academy of Sciences, now the Institute of Archaeology and Ethnography of the Siberian Branch of the Russian Academy of Sciences (IAET SB RAS). By that point, Tatyana Alekseevna had already been an established scientist. She had graduated from the postgraduate studies at the Department of Anthropology of the Faculty of Biology of the Lomonosov Moscow State University (1979–1982). She had also defended her dissertation for the Candidate degree on the topic "Study of the Relationship Between the Anthropological Features of the Population and the Environmental Conditions of the Human Habitat (the Case of the Altai-Sayan Region)" under the scientific supervision of the future Academician RAS T.I. Alekseeva and B.V. Lavryashin. While working in Siberia, Tatyana Alekseevna has become a leading anthropologist not only at the Institute, but also in the Trans-Urals as a whole. First of all, she has systematized the numerous anthropological collections stored at the IAET SB RAS.

The scope of Tatyana Alekseevna's professional interests is diverse and has been expanding from year to year. It comprises various aspects of the Eurasian paleoanthropology: study and systematization of the anthropological composition of ancient populations; reconstruction of biological and cultural origins based on skeletal morphology, fluctuating asymmetry and pathological changes, traumata, surgical and ritual manipulations. The scientific works of Tatyana Chikisheva cover a wide chronological range—from the Paleolithic to the Modern Age.

Tatyana Alekseevna has studied the ancient population of Siberia on a particularly large scale.

As a result, a paleoanthropological database of the indigenous peoples of the region and the adjacent territories has been created. In 2010, she brilliantly defended her doctoral dissertation on the topic "Dynamics of Anthropological Differentiation of the Population of Southwestern Siberia in the Neolithic to Early Iron Age", which formed the basis of the monograph (2012) that was the fruit of many years of her labor. The monograph has provided a unique chronological range of materials. Analysis of numerous paleoanthropological remains has led to the important conclusion that the skeletal morphology of Eurasian populations in the Neolithic to Early Iron Age revealed evolutionary conservatism, evidenced by incomplete east-to-west differentiation. One of these lineages is represented in different anthropological variants in the northwestern taiga zone of Eurasia.

Developing V.V. Bunak's concept of human origins, Tatyana Chikisheva proved the old age of the Northern Eurasian anthropological formation and outlined its area: from the Onega region, the south of the White Sea, the northern forest zone of the East European Plain up to the Baraba forest-steppe.

Another unconsolidated cranial complex—the Southern Eurasian formation—was identified by T.A. Chikisheva on the basis of the Neolithic to Early Iron Age materials from the Altai-Sayan region. Being extremely fruitful, the idea made it possible to explain morphological features and anthropological similarity of carriers of the Okunev and Karasuk cultures, as well as the so-called Andronovo-type cultures of Western Siberia, the early nomads of the intermountain basins of the Altai-Sayan highlands, and the mountain systems of Dzungaria and Tien Shan. Judging by the unique Caucasoid-Mongoloid intermediacy of the ancient protomorphic anthropological communities of Eurasia, the similarity of spatially distant groups can be interpreted as a consequence of not only migrations, but also of the convergence of similar sets of traits.

The value of Tatyana Chikisheva's study lies in providing the comprehensive cranial and dental data, as well as the cultural and historical interpretation of the paleoanthropological findings. No wonder that this monograph has become a handbook for all those dealing with the issues of archaeology, ethnography, and history of this gigantic territory of Eurasia.

The scope of Tatyana Alekseevna's research makes her one of the leading anthropologists in our country. As a scientist, she hold the highest level of professionalism and the ability to see real people behind the anthropological evidence, which proves her talent and is very rare among the anthropologists. T.A. Chikisheva's works always act as an impetus for archaeological research. Many achievements of our Institute would not have been possible without her studies.

Tatyana Chikisheva is the author and co-author of more than 150 scientific works, including 13 monographs. Noteworthy is the multidisciplinary nature of her research.

The high academic ranking of T.A. Chikisheva is evidenced by the constant support of her projects by the leading scientific funds (Russian Foundation for the Humanities (RFH), Russian Foundation for Basic Research (RFBR), "Integration", and now—Russian Science Foundation (RSF)). The great authority of Tatyana Alekseevna among the colleagues is confirmed by her long-term work as an editorial board member of the journals of *Archaeology, Ethnology and Anthropology of Eurasia* and *Bulletin of Moscow University*. She is a member of the Dissertation Council and the Academic Council of the IAET SB RAS. For many years she was an expert of the RFBR.

Tatyana Alekseevna is in demand not only as a professional, but also as a real teacher. She has a deep understanding and insight of empirical and theoretical knowledge, which she generously shares with her students. She has supervised the preparation and defense of a great number of graduation papers, master's theses, and the dissertations for the Candidate degree. Indeed, through her efforts, the anthropological school in Siberia has been created.

We express our warmest and heartfelt congratulations to the anniversary celebrant, a person of deep spiritual wisdom and the highest professionalism. We wish Tatyana Alekseevna further creative success, good health, talented students, and new achievements in the science to which her whole life is devoted.

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T.I. Nokhrina, D.V. Pozdnyakov,
S.P. Nesterov, A.V. Tabarev,
A.I. Solovyev, and A.P. Borodovsky

AN RUz – Academy of Sciences of Uzbekistan

AN SSSR – USSR Academy of Sciences

BAR – British Archaeological Reports

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

CNRS – Centre national de la recherché scientifique

DVO RAN – Far Eastern Branch of the Russian Academy of Sciences

GANIIIYAL – Gorno-Altaisk Research Institute of History, Language and Literature (Gorno-Altaisk)

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)

IIFF SO AN SSSR – Institute of History, Philology and Philosophy, Siberian Branch, USSR Academy of Sciences (Novosibirsk)

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

IPOS SO RAN – Institute of Northern Development, Siberian Branch, Russian Academy of Sciences (Tyumen)

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

MARKhI – Moscow Architectural Institute (State Academy)

MIA – Materials and Investigations on Archaeology in the USSR

SAI – Collection of Archaeological Sources

UdmFIC UrO RAN – Udmurt Federal Research Center, Ural Branch, Russian Academy of Sciences (Izhevsk)

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

VCK NA – All-Union Committee for the New Alphabet

VNC RAN – Vladikavkaz Scientific Center of the Russian Academy of Sciences

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