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Aktas—an "Ephemeral" Upper Paleolithic Site in North Kazakhstan

This paper presents new findings from field studies at Aktas, an Upper Paleolithic site first excavated in 1982 and 1983. It is located in North Kazakhstan, where Paleolithic sites are quite rare. We describe the stratigraphy, paleontology, archaeology, and chronology of Aktas. Six lithological layers are distinguished, two of which (3 and 4) abound in faunal remains. Chronology was generated from a new series of OSL-ages. The accumulation of layer 2 took place between ca 20–12 ka ago, whereas layers 3 and 4 were formed ca 50–30 ka ago. A side-scraper, made of imported flint, was found. The bulk of the faunal complex relates to large ungulates such as Pleistocene horse (Equus ferus), woolly rhinoceros (Coelodonta antiquitatis), and mountain sheep (Ovis ammon). Some bones bear traces of deliberate fragmentation and dismemberment using stone tools. These facts, along with the taphocenotic indicators (species composition, absence of traces of predator activity, etc.), as well as the location and stratigraphy of the site, allow us to conclude that the faunal assemblages at this location are anthropogenic. Traces of human occupation are scarce, suggesting that Aktas is an "ephemeral" site, attesting to human presence in that territory during the Late Pleistocene, but revealing no cultural indicators. The findings picture Aktas as a kill-site—the place where the prey

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was butchered and consumed. This is the only such site known in the area to date. The number of lithics is too small for cultural attribution. However, the estimated age suggests that North Kazakhstan was peopled as early as the beginning of MIS3, corresponding to the early stages of the Upper Paleolithic.

Keywords: *North Kazakhstan, Upper Paleolithic, Upper Pleistocene, paleontology, traceology, OSL-dating.*

Introduction

The southern portion of the West Siberian Plain, including the northern part of Kazakhstan, for a long time remained *terra incognita* for Paleolithic studies. No more than ten Paleolithic sites were known there (Petrin, 1986; Derevianko et al., 2003a). Almost all of them yielded just scarce artifacts, which can be explained by a shortage of local lithic raw material. Most sites are attributable to the final stages of Upper Paleolithic. They are associated with natural accumulations of mammoth fauna remains (Volchya Griva, Shestakovo, Gari, Shikaevka II) (Petrin, 1986; Derevianko et al., 2003a). The presence of abundant paleofauna remains indicates that archaeological finds occur there in stratigraphic sequence.

In the northern part of Kazakhstan, several sites with stratified Upper Paleolithic industries are known: Batpak-7, Ekibastuz-15, and others. However, the stratigraphic situation at the sites suggests the mixed character of archaeological assemblages, which are scarce and are at the initial stage of study (Merts, 1990; Taimagambetov, Ozhereliev, 2009; Anoikin, 2017).

In the eastern portion of Kazakhstan, stratified Paleolithic sites are rare— Shulbinka, Ushbulak, and Bystrukha-2 (Derevianko et al., 2003b; Taimagambetov, Ozhereliev, 2009; Rybin, Nokhrina, Taimagambetov, 2014; Anoikin et al., 2019, 2020). At most sites (Zaisan-1–3, Bukhtarma-1–5, Kozybai-1–2, Espe-1–3, and others) artifacts were collected from the surface (Derevianko et al., 2003b; Taimagambetov, Ozhereliev, 2009; Rybin, Nokhrina, Taimagambetov, 2014; Anoikin, 2017). A greater occurrence of artifacts on the surface of sites can be explained by a severely continental and arid climate that hampered the accumulation of loose sediments. Under such circumstances, each new stratified Paleolithic locality in this region becomes a source of information that can significantly expand our understanding of the early peopling stages here. Since Paleolithic sites in the region are scarce, it is important to revise earlier findings at the current level of knowledge and analytical techniques, especially with regard to chronology and environmental reconstruction. The resumed study of Shulbinka assemblages from East Kazakhstan made it possible to attribute the industry to the late stages of Paleolithic rather than to the Middle-to-Upper Paleolithic transitional period, as was previously supposed (Anoikin et al., 2020).

This paper presents new findings from field studies at Aktas, an Upper Paleolithic site in North Kazakhstan, first excavated in 1982 and 1983 (Matvienko, Kozhamkulova, 1986; Kozhamkulova, Pak, 1988). As the studies in the previous century were tentative, and the Late Pleistocene attribution was only a speculation, new state-of-the-art research is needed to arrive at an accurate cultural and chronological assessment of Aktas.

Previous studies

Aktas is located in the Akmola Region, Republic of Kazakhstan, 3 km south-west of Zhamantuz village (Fig. 1, *1*). The territory belongs to the isolated northern part of the Kazakh Hummocks, within the Kokshetau Uplands. The site is situated on the flat top of a cone-shaped hillock (ca 420 m above sea level), which is crowned with an exposure of quartzite rocks 15–20 m high (Fig. 1, *2*).

The study of the site began in 1982, after a geological survey conducted by researchers from the Institute of Geology, Academy of Sciences of the Kazakh Soviet Socialist Republic, and headed by V.N. Matvienko. During the survey, a bone-bearing horizon was found near the northern part of the rock-remnant. The horizon contained Late Pleistocene faunal remains, including bones with supposedly anthropogenic impact marks (Matvienko, Kozhamkulova, 1986). In that part of the site, the rock exposure is a nearly vertical wall up to 20 m high. In some places, the angle of the wall's inclination exceeds 90°, thus a small natural rock overhang is formed. Loose sediments form a gentle slope directed east–west at an angle of approximately 3–5°. In 1983, Matvienko and researchers from the Institute of Zoology, Academy of Sciences of the Kazakh Soviet Socialist Republic, continued the studies of the site (Kozhamkulova, Pak, 1988).

Fig. 1. Aktas site.
1 – map showing the location of the site;
2 – north-eastern view.

In 1982 and 1983, three adjacent excavations measuring approximately 25 m^2 were made near the northern edge of the rock-remnant (Fig. 2). The combined stratigraphic section, up to 4 m thick, included six main units represented by a soil horizon, layers of dense loamy sand and loam, and by materials of weathering crust (Fig. 3, *1*). Faunal assemblage, comprising thousands of bones and bone fragments, was collected from the middle part of the section, at a depth of 1–3 m from the ground surface (Matvienko, Kozhamkulova, 1986; Kozhamkulova, Pak, 1988).

In the collection of identifiable bones (ca 500 spec.), B.S. Kozhamkulova and T.K. Pak (1988) identified 16 species of mammals: cave hyena, cave lion, wooly rhinoceros, aurochs, bison, red deer, koulan, argali, and others.

Pollen analysis of sediments, conducted by L.N. Chupina, allowed identification of four main types of palynospectra. The first (corresponding to layer 5 in test pit 1 of 2021) and the second (corresponding to layer 4 in test pit 1 of 2021) palynospectra are typical of forest-steppe vegetation associated with expansion of swamps under humid and severe climate conditions. The third palynospectrum (corresponding to layer 3 and to the base of layer 2 in test pit 1 of 2021) represents the steppe type characterized by development of xerophilous vegetation in an arid climate; so this part of the section can be attributed to the end of the Late Pleistocene. The fourth spectrum (corresponding to layers 2 and 1 in test pit 1 of 2021) suggests more mesophilic vegetation; it represents Early Holocene pine and birch forest-steppe (Ibid.).

Bone "artifacts" interpreted as polishers and awls/needles evidence the presence of humans at the site. Regrettably, no explicit description or illustrations are given in the publications. The only photograph available (Matvienko, Kozhamkulova, 1986: 68) does not permit its reliable identification as the artifact.

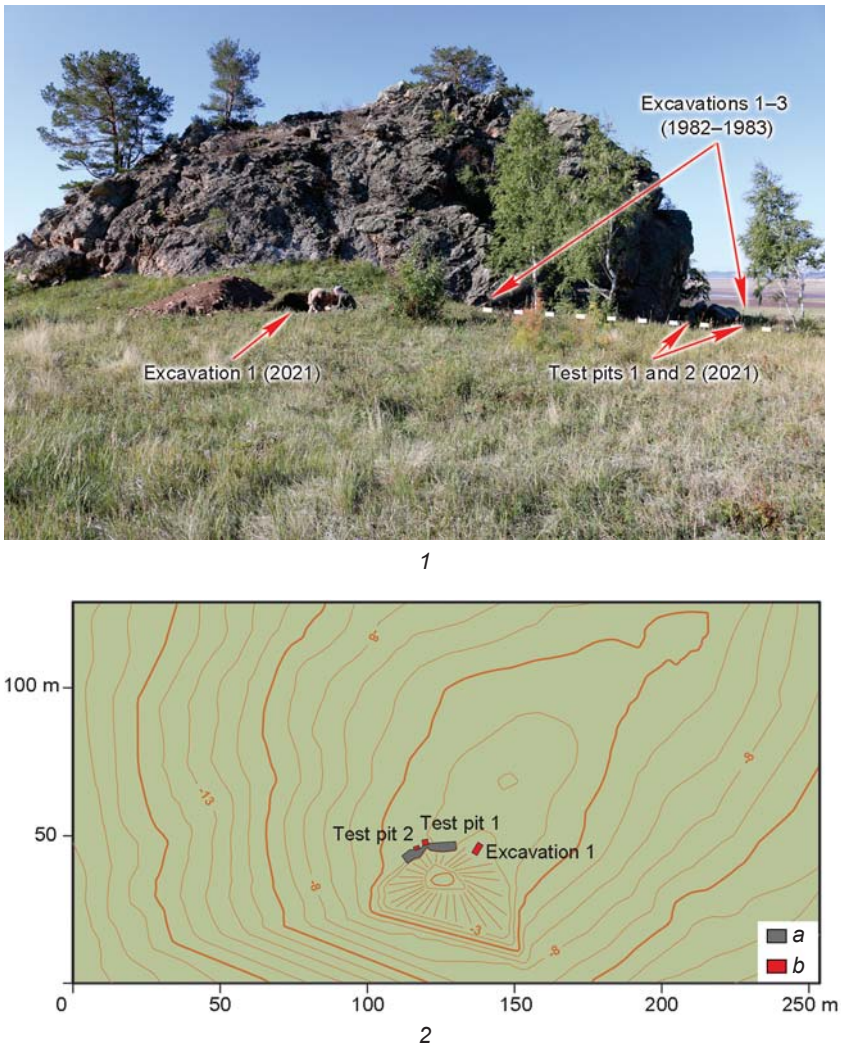

Fig. 2. Aktas site.
1 – location of the test pits and the excavations, northern view; *2* – topographic plan.
a – excavation 1 of 1982 and 1983; *b* – test pits and excavation of 2021.

Examination of the preserved part of the faunal assemblage collected in 1982 and 1983 and housed at the Institute of Zoology, Republic of Kazakhstan (Almaty), did not confirm the supposition that some bones bore evident marks of anthropogenic impact. The problem of lithic artifacts turned to be even more complicated, as they are mentioned only in one paper as "a few primitive stone tools and tool blanks made of quartzite: adzes, polishers, axe blanks, etc." (Ibid.: 67). No descriptions of the artifacts nor of their figures are given, and their storage location is unknown. Given that the authors are not archaeologists, and the rock ledge is composed of quartzite, the erosion of which results in artifact-like debris of various size, the claim that lithics were present in the assemblage must be looked at with a critical eye.

Results of 2021

Stratigraphy

Examination of Aktas was resumed in 2021, with the aim of assessing the chronology of the site and finding the evidence of human presence there. In the northeastern portion of the site, an area measuring 4 × 2 m and up to 3 m deep was excavated on a flat platform close to the edge of the rock-remnant. Near the northwestern part of the rock, two test pits were made. Test pit 1 (2 × 2 m) and test pit 2 (2 × 1 m) adjoined the northern wall of the best preserved excavation 3 of 1983 (see Fig. 2). The maximum depth of excavation there reached 2.8 m.

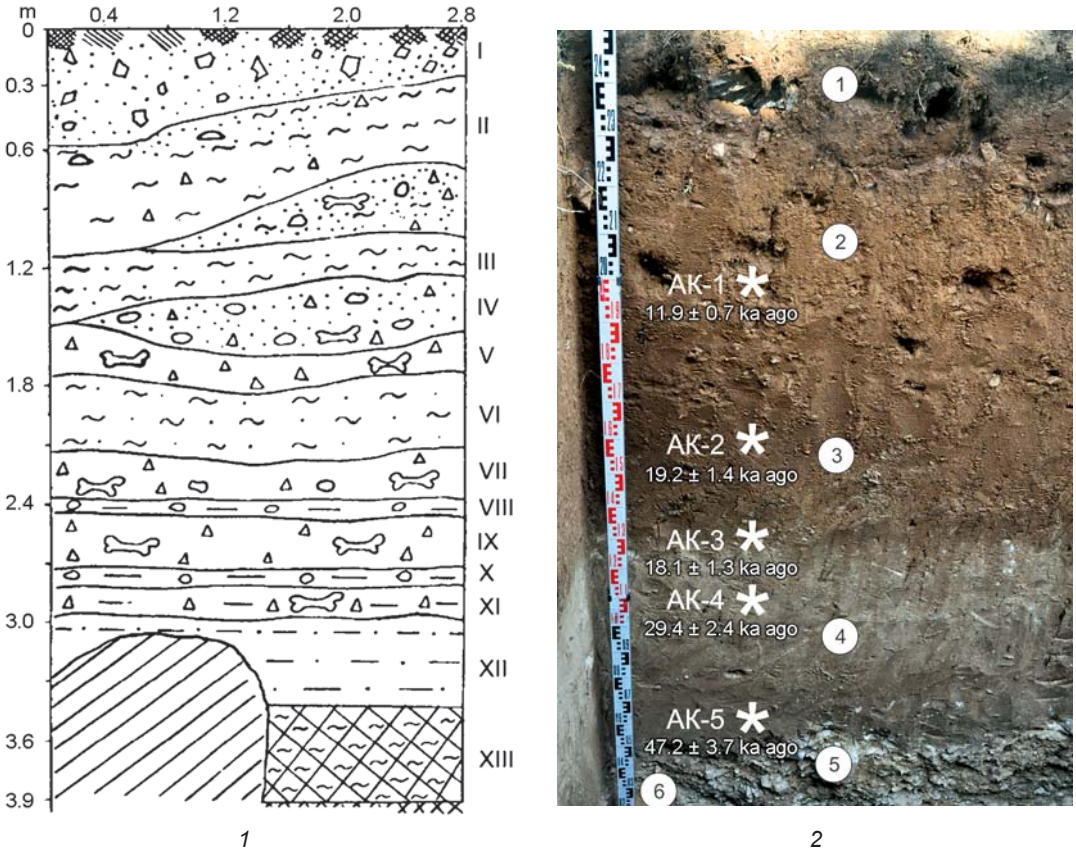

Fig. 3. Aktas site.
1 – stratigraphic profile of the western wall in excavation 2 (1982 and 1983) (Kozhamkulova, Pak, 1988: 124);
2 – northern wall of test pit 1 (2021), with indicated places where samples for OSL-dating were taken.

The most representative stratigraphic profile was revealed in test pit 1. It was correlated with the final section obtained during the excavations of 1982 and 1983 (Matvienko, Kozhamkulova, 1986). The following lithological units (from the top down) were recorded (see Fig. 3, *2*).

Layer 1. Modern soil horizon. Thickness 0.05–0.15 m (layer I in the section of 1982–1983).

Layer 2. Light, reddish-brown-gray loam including slightly weathered clasts varying in size. Thickness 1.0–1.2 m. Rare faunal remains were found in the zone of contact with underlying sediments (layer II).

Layer 3. Heavy, brownish-gray, dense sandy loam including small, slightly weathered clasts and calcareous concretions. Thickness 0.6–0.7 m. The layer contains well-preserved faunal remains (layers III–VI).

Layer 4. Detritus horizon filled with gray sandy loam. Clasts are slightly weathered, varying in size, some are large. Thickness 0.2–0.4 m. The layer contains poorly preserved faunal remains (layer VII).

Layer 5. Heavy, dense, gray and greenish-gray loam containing large number of small, slightly weathered clasts. Thickness up to 0.3 m. No faunal remains were found (layers VIII–XI).

Layer 6. Products of weathering crust of quartz-sericite and quartz-chlorite shale: heavy, loose, reddish-brown sandy loam. Visible thickness up to 0.1 m (layer XII).

The stratigraphic situation in the excavation differed from that recorded in the test pits. This can be explained by their differing locations. The excavation was located in the area with the thickest loose sediments. At the same time, main lithological units (including those containing paleontological materials) recorded in the test pits were also traced in the excavation (see Fig. 2). The differences were observed in the lower part of the section: between the bone-bearing sediments (the base of layer 4, analogous to layer 4 in the test pits) and the weathering crust (layer 8), the excavation, as compared to the test pits, comprised more lithological units, including a lens of heavily carbonized dark loams (layer 5), a broken paleosol horizon (layer 6), and a stratum of loose, rusty ocherous sandy loam (layer 7).

Paleontological material

Paleontological finds (241 spec.) were recorded in all excavated areas, though almost all of them came from the test pits (layers 3 and 4) (Table 1). In the excavation, only two large identifiable bone fragments were found, in the base of layer 4.

The bones are highly fragmented. Identifiable remains approximate 22 %. However, percentages differ significantly across the strata: ca 6 % in layer 4, and ca 26 % in layer 3. Layer 3 contained more bones than layer 4, and their preservation was better. In layer 4, most faunal remains were destroyed and "packed" into a bone-bearing breccia.

The bulk of the faunal complex relates to ungulates, whose species identification is impossible. Only the bones of Pleistocene horse (*Equus ferus*), woolly rhinoceros (*Coelodonta antiquitatis*), and mountain sheep (*Ovis ammon*) were reliably identified. Fragments of ribs, including those suitable for species identification, form a fairly high percentage. In taphocenoses associated with activity of carnivores, articular parts of ribs are normally absent.

Indicators of the anthropogenic origin of taphocenosis include the following (Klementiev, 2011; Pickering, 2002; Turner, Ovodov, Pavlova, 2013): small proportion of identifiable bones (1/4 of total number); absence of intense carnivore gnawing marks on bones (especially on epiphyses of ribs and tubular bones); and presence of a heavily abraded, "rolled" articular part of a horse's scapula, found *in situ*. In natural taphocenoses, a worn-off surface indicates significant transfer of the bone. No such condition is seen on the faunal remains of this site; hence, the articular part was either subjected to intentional anthropogenic effect or to trampling on the surface (Blasco et al., 2008). The almost complete absence of carnivore bones also serves as indirect evidence.

It is difficult to characterize statistically the state of bone surface preservation, since the number of finds is small and they came from the periphery of the site. Our experience and that of specialists in tapohonomy (Behrensmeyer, 1978) suggest that deposition was rapid: the surface of the cortical layer is well preserved, revealing no cracking or desquamation, in contrast to what is observed on bones that had been exposed for a long time. No statistical data on separate skeletal parts can be presented, owing to the scarcity of identifiable bones.

As to the chronological attribution of the paleofaunal assemblage in question, it should be noted that fossilization of the bones is typical of the period corresponding to MIS3, within the distribution zone of loess-like sediments in the moderate climatic belt of Eurasia. During the Late Pleistocene, in the north of Kazakhstan, wild horse, whose remains are most numerous at Aktas, was a wide-spread common species (Kozhamkulova, 1969; Gaiduchenko, 1998). The presence of *C. antiquitatis* and *O. ammon* remains is typical of the Late Pleistocene faunal complex in this region (Kozhamkulova, 1969).

Chronological assessment

During the field studies, five samples were taken for luminescence dating from the northern wall of test pit 1 (layers 2–4) (see Fig. 3, *2*). Preliminary treatment of the samples was conducted in OSL-dating laboratories of the Lomonosov Moscow State University and the Institute of Geography RAS, according to procedure elaborated at Aarhus University (Denmark)

Table 1. **Paleontological materials collected at Aktas in 2021, spec.**

Taxon / category	Test pit 1		Test pit 2	Excavation	Total
	Layer 3	Layer 4	Layer 3	Layer 5	
Coelodonta antiquitatis	2	3	28	1	34
Equus ferus	2	–	16	–	18
Equidae gen.	5	2	–	–	7
Ovis ammon	–	1	–	–	1
Large ungulate	16	15	96	1	128
Middle ungulate	2	2	–	–	4
Unidentifiable fragment	19	30	–	–	49
Total	46	53	140	2	241

(Kurbanov et al., 2019). OSL dating was performed at Risø Laboratory, Aarhus University.

Dating was carried out according to the modern methodology of parallel measurements on quartz and potassium feldspars, including the analysis of the distribution of doses and final ages (OSL, IR_{50} and $pIRIR_{290}$) (Murray et al., 2012). The results are given in Table 2. The most reliable results, based on the analysis of quartz samples, are printed in boldface. The data obtained show good correlation between estimations based on quartz and potassium-rich feldspar, which points to a high-precision for the obtained chronology. Thus, the series of OSL-dates has shown that the accumulation of layer 2 took place during the period corresponding to the second half of MIS2, between 20 and 12 ka ago; whereas bone-bearing layers 3 and 4 were formed during the period corresponding to MIS3, between 50 and 30 ka ago. These estimates do not contradict the composition of paleofauna, palynological spectra (Matvienko, Kozhamkulova, 1986), and the presence of paleosol underlying these sediments in excavation 1. This paleosol was probably formed during the initial stages of the Karga (Valdai) interstadial (early MIS3).

Archaeological materials

In the field season of 2021, no lithic artifacts were found *in situ*. However, when the spoil heaps from trenches of the 1980s were scanned, deposits similar in structure to layer 4 revealed an artifact made of spotted tawny-gray flint (Fig. 4). This was a longitudinal straight side-scraper fashioned on a core-like fragment of subrectangular shape and trapezoidal in cross-section. The dorsal face of one of the straight longitudinal edges shows large and medium, abrupt and vertical, stepped retouch forming a scraping element. On the opposite edge, a small area in the distal part was modified by irregular retouch on the dorsal face. The character of retouching and morphotypological features of this artifact correspond to the Upper Paleolithic.

Traceological analysis

Examination of the paleontological materials collected in 2021 revealed three items bearing marks of anthropogenic impact: the first phalanx of a horse,

Table 2. **Results of luminescence dating obtained for Aktas**

No.	Laboratory No.	Sample code	Sampling depth, cm	Water content, %	Equivalent dose (D_e)										Dose rate, Gray/thousand years		Age, thousand years			Age correlations	
					Fk, IR_{50}			Fk, $pIRIR_{290}$			Quartz				Fk	Quartz	IR_{50}	$pIRIR_{290}$	OSL	IR_{50}/OSL	$pIRIR_{290}$/OSL
					Gray	n_r	n_a	Gray	n_r	n_a	Gray	n_r	n_a								
1	218486	AK-1	72	10	32 ± 3	0	8	51 ± 4	0	8	41.8 ± 1.0	1	17	4.45 ± 0.19	3.51 ± 0.18	7.3 ± 0.6	11.4 ± 1.1	**11.9 ± 0.7**	0.61 ± 0.07	0.96 ± 0.11
2	218487	AK-2	107	10	42 ± 2	0	8	80 ± 6	0	8	54.5 ± 2.3	0	18	3.77 ± 0.16	2.84 ± 0.15	11.1 ± 0.8	21.3 ± 1.9	**19.2 ± 1.4**	0.58 ± 0.06	1.11 ± 0.12
3	218488	AK-3	138	10	65 ± 9	0	8	82 ± 7	1	7	62.6 ± 3.0	0	18	4.39 ± 0.19	3.45 ± 0.18	14.7 ± 2.2	18.6 ± 1.8	**18.1 ± 1.3**	0.81 ± 0.14	1.02 ± 0.12
4	218489	AK-4	164	10	107 ± 10	0	8	124 ± 14	0	8	92.6 ± 5.8	3	20	4.17 ± 0.18	3.23 ± 0.17	25.6 ± 2.6	29.7 ± 3.7	**29.4 ± 2.4**	0.89 ± 0.12	1.04 ± 0.15
5	218490	AK-5	193	10	120 ± 7	0	8	240 ± 13	0	8	148.3 ± 8.2	1	19	4.08 ± 0.18	3.14 ± 0.17	29.4 ± 2.1	58.9 ± 4.2	**47.2 ± 3.7**	0.62 ± 0.07	1.25 ± 0.13

Note: n_r – number of rejected aliquots; n_a – number of accepted aliquots; Fk – potassium rich feldspar.

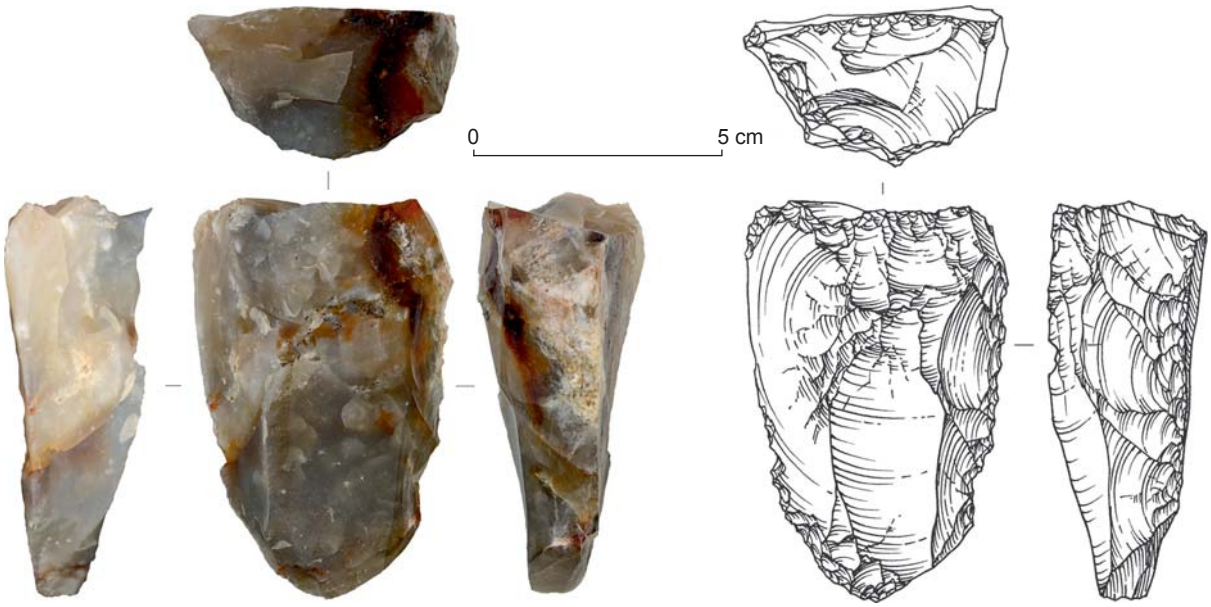

Fig. 4. Photograph and trace-drawing of the side-scraper from Aktas.

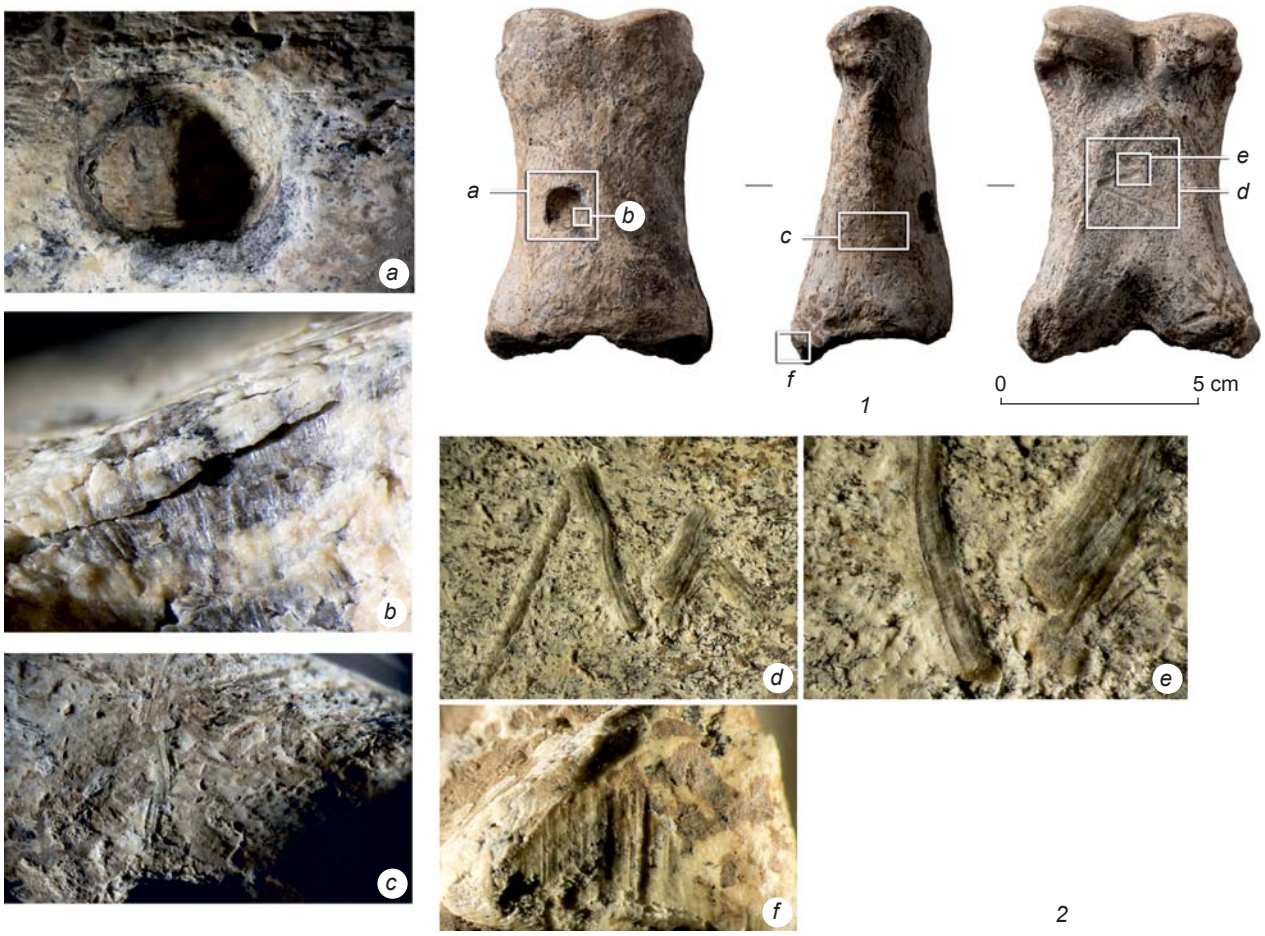

Fig. 5. Horse phalanx from Aktas in three projections (*1*), and traces of artificial modification on its surface (*2*).
a – lune in the medial part on the dorsal face (×12.5 magnification); *b* – linear marks located vertically on the lune's wall (×32 magnification); *c* – series of grooves with a typically ribbed bottom, located close to the lune on the dorsal face (×12.5 magnification); *d*, *e* – series of identical grooves on the plantar face (×8, 25 magnification); *f* – linear marks along the proximal edge (×25 magnification).

fragments of a rib, and fragments of a tubular bone of a large ungulate.

First phalanx of an ancient horse (Fig. 5). The bone is well preserved. Damages to the compact bone surface are rare; they are visible on protruding parts only. Traces of soil saprotoph activity (plant roots) are present.

The medial part of the dorsal face has a damaged area shaped as a heavy patinated deep lune (Fig. 5, *a*). Close to it, there are distinct wide grooves with a typically ribbed bottom (Fig. 5, *c*, *d*), indicating tool use (Fritz et al., 1993). On the plantar side, identical grooves are present (Fig. 5, *e*). These were likely caused by the removal of soft tissues with a stone tool. A series of similar linear marks (Fig. 5, *f*) serves as another evidence of artificial modification. Judging by the location, they probably appeared during detachment of the phalanx from the joint, or during abrasion of this area. Noteworthy is the lune on the dorsal surface of the phalanx (Fig. 5, *a*). In profile, it is V-shaped, with a small inclination. In plan view, its bottom is subround and edges are subsquare. Fragments of compact bone on the bottom of the lune suggest pressure rather than blow. Even at small magnification (ca ×30), parallel linear marks located vertically are clearly seen (Fig. 5, *b*). Judging by their shape, the object that brought about the damage was not too sharp, and penetrated into the surface at a small angle. The shape of the cavity and the absence of any marks on the opposite side of the phalanx exclude the possibility of the lune's appearing under the impact of the teeth of a large predator.

Similar artificial lunes, though larger and less distinct, were observed on large bones of mammoth and wooly rhinoceros found at the Paleolithic sites of Gari, Evalga, and Neftebaza in the Sverdlovsk Region (Russia) (Serikov, 2020) and at Mezhirichi (Ukraine) (Pidoplichko, 1976: 116–199). Cavities on the bone from Mezhirichi were interpreted as appliances for fastening elements of dwellings (guides, clamps for hides) (Ibid.).

It is hardly possible that the phalanx from Aktas served as a constructive element of a dwelling, taking into consideration the size of the bone and that of the cavity in it. However, it cannot be excluded that it was used as a rest or a handle in some utilitarian operations (handle of an awl or a punch, etc.).

Fragment of rib of a large ungulate (Fig. 6). The surface of the bone is exfoliated; small pieces of the

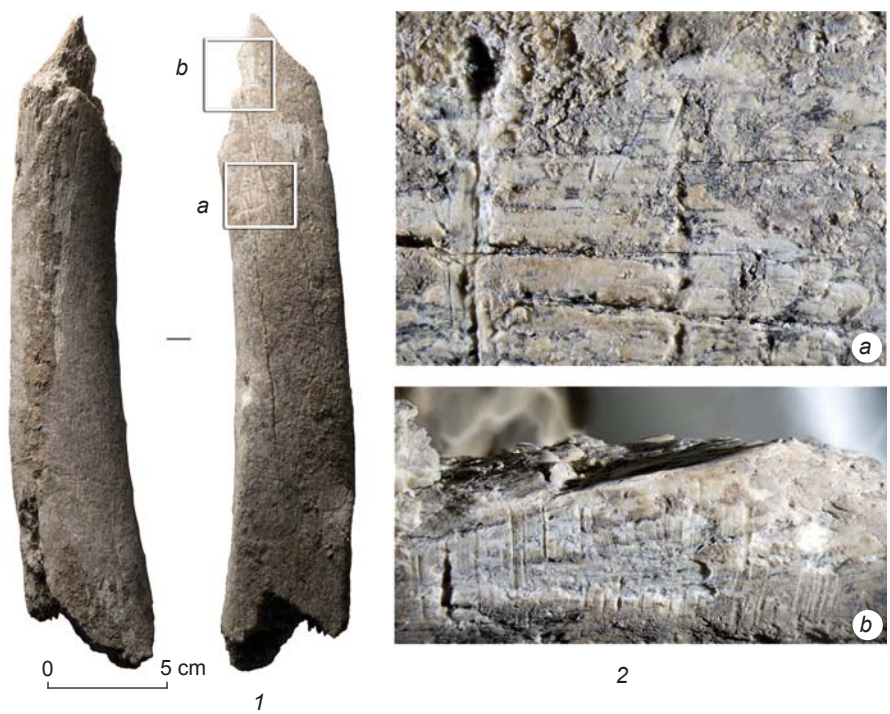

Fig. 6. Fragment of a rib of a large ungulate from Aktas in two projections (*1*), and traces of modification on its surface (*2*).
a – the first group of scratches located transversely to the bone (×10 magnification); *b* – the second group of linear marks of varying depth located transversely to the bone (×10 magnification).

upper covering continue crumbling. The outer layer of the compact bone is heavily damaged. Preliminary traceological analysis revealed two groups of linear traces on the outer side of the rib. The first group consists of several rather deep scratches located transversely, at different angles (Fig. 6, *a*). The second group is a series of unidirectional straight linear marks: some of them are deep, others are shallow. The first group likely attests to successive cutting operations, possibly the removal of soft tissues; while the second indicates simultaneous emergence of the entire group of marks, resulting from a contact of the rib surface with the working edge of a tool, possibly during scraping (Fig. 6, *b*).

The shape of the rib fragment at breached areas corresponds to green fracture. With regard to the poor state of preservation; it can only be supposed that the rib was split by a human.

Fragment of tubular bone of a large ungulate (Fig. 7). The bone is in a good state of preservation. Its surface reveals no signs of scaling or cracking, the trabecular bone is excellently preserved, and the edges of broken-off parts of the fragment are smooth and undeformed. Visible defects include traces of soil biota activity.

The morphology of the fragment points to the green fracture: edges are smooth and fracture surfaces have regular shape (Fig. 7, *a*, *b*).

It can be tentatively concluded that the fragment resulted from splitting the animal's tubular bone in fresh state. Since no similar artifacts are present, one cannot speak with certainty about intentional processing; the marks described above are only weakly suggestive of anthropogenic effect.

Discussion

Excavations conducted at Aktas in 1982, 1983, and 2021 revealed a large accumulation of Late Pleistocene faunal remains consisting of several thousand bones; approximately 700 of these can be identified as to species. Most faunal remains were concentrated near the foot of the northern edge of the rock remnant, which forms there a vertical wall with a negative angle of inclination at some places. Judging by the excavation data, the spot of bone concentration extended for 15–20 m lengthwise and for 4–5 m crosswise. Outside the spot, only solitary bones were found. Actually, all faunal materials were unearthed in 1982 and 1983.

Analysis of species composition shows that most bones belonged to ungulates, primarily to horse and to a lesser degree to wooly rhinoceros. Remains of koulan and bison also occur. Other species, chiefly predators, are represented by solitary finds.

The features of the site, as well as the composition and preservation of the faunal sample, indicate a high probability of an anthropogenic origin of that taphocenosis. The site is located on a rise, so it is unlikely that the bone-bearing horizon could have been formed as a result of natural geological

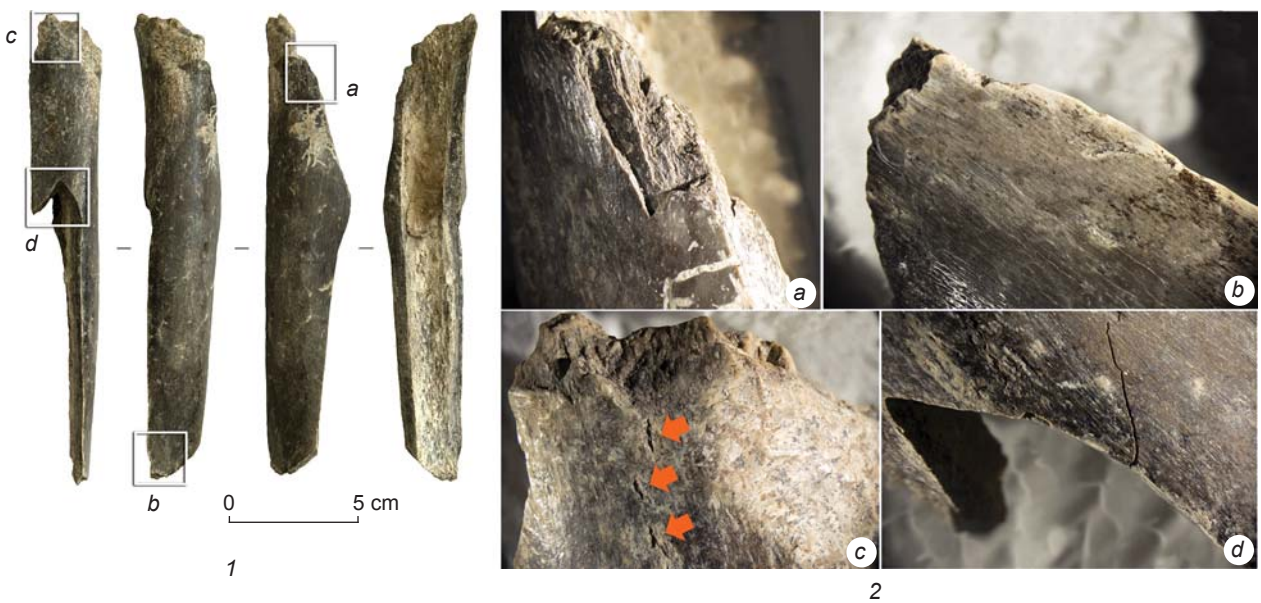

Fig. 7. Fragment of the bone from Aktas in two projections (*1*), and areas with green fractures (*2*).

processes, such as colluvial and deluvial transport, or as a result of accumulation in alluvium. Noteworthy is the predominance of bones of ungulate game-animals, mainly horses, among identifiable faunal remains. No bones in anatomical order were found. Almost all large bones are fractured, though articular parts of ribs are often preserved, which is atypical for activity of carnivores. Analysis of bone surfaces has not revealed a statistically meaningful number of marks left by predators or scavengers (gnaw marks, tooth marks, traces of gastric juice, etc.). At the same time, the collection contains solitary bones with clear marks of anthropogenic manipulations (splitting, scraping, cutting).

The convenient location of the site serves as another indirect evidence of human presence there. The site is located near a natural rock-shelter, at an elevated place from which humans could control an area of several square kilometers, with freshwater lakes.

The absence of lithic artifacts lying *in situ* can possibly be explained by the fact that no sources of raw material suitable for regular knapping were available in proximity to the site. Scarcity of lithics suggests parsimonious use, whereby debris from primary reduction was minimized, and/or a maximal amount of lithic artifacts was carried away from the site.

The only artifact found at the site was made of flint whose possible sources are located 30–40 km apart: alluvium of the Shagalaly (Chaglinka) River, washing out sediments of the Chalysh suite near the town of Kokshetau (Kokchetav). This suite contains diabases and porphyrites, as well as jasperoids, siliceous shells, and silicified sandstones (Geologiya SSSR…, 1972: 56–57). Elaborated modification of the artifact on a core-like piece also might indicate that it was transported as a raw material reserve and/or as an element of a portable toolkit.

The data obtained allow for the conclusion that Aktas is a specific archaeological object representing an "ephemeral" site. It contains evidence of human presence in the form of a single artifact, and traces of anthropogenic effect on several bones. The location of the site, the state of its preservation, and the composition of the faunal assemblage also attest to a presumably artificial origin for the bone-bearing horizon. Clearly, however, these data do not suffice to indicate prolonged residence at the site. Nor do they enable us to assess those people's subsistence strategy or their association with a certain industry. However, the presence of anthropogenic marks on bones from different layers suggests that occupation episodes were short but numerous.

It should be noted that Aktas is one of the rare sites in the region where taphocenoses was associated with human activity. Most sites in the southern part of Western Siberia attest that humans used large natural graveyards of the "mammoth" fauna (Derevianko et al., 2003). According to the OSL-dates, Aktas is one of the earliest Upper Paleolithic sites in the region. It is attributed to the second half of MIS3, while all sites at "mammoth graveyards" belong to a later period, within MIS2. Dwellers at the site most likely followed the subsistence and behavioral strategy that possibly corresponded to more favorable paleoenvironmental conditions. This enabled human populations to be independent of natural factors causing accumulations of bones (density of forest, abundance of prey, etc.). Traces of manipulations with fresh bones and absence of evidence of a long-term occupation suggest that Aktas might have been a kill-site, where animals were hunted and butchered. In this part of the continent, the only known locality of this type is the much younger Tomskaya site, situated approximately one thousand kilometers north-west of Aktas (Abramova, Matyushchenko, 1973; Tseitlin, 1983). Importantly, in distinction from Aktas, only one mammoth carcass was butchered at Tomskaya, while lithic artifacts are numerous there (ca 200 spec.). Since archaeological finds are very scarce at Aktas, likely because of a deficit of raw material for knapping and the remoteness of its sources, whereas faunal remains evidence butchery, the site itself must have been located elsewhere. At a short distance from the site, several long rock exposures forming convenient natural shelters are available. Regrettably, loose sediments are extremely thin there, providing no opportunities for successful archaeological investigation.

Conclusions

To date, Aktas is best regarded as a butchering camp with multiple short-term occupation episodes. The scarcity of archaeological finds does not allow reliable integration of the findings into the Paleolithic picture of the region. However, the estimated age suggests that the site can be attributed to the early stages of the Upper Paleolithic. Thus, Aktas is the only stratified Early Upper Paleolithic kill-site currently known

not only in North Kazakhstan, but in the southern part of the West Siberian Plain in general. Moreover, Aktas and Ushbulak are the only sites representing the early stages of Upper Paleolithic occupation of North Kazakhstan outside the Altai mountain system. Further studies of the site are hardly warranted, because the area of maximal concentration of faunal remains has been completely excavated, whereas the location of the site itself is very hard to determine. Possibly, it has not been preserved, since outside the examined sector the thickness of loose sediments is very low.

Aktas, then, evidences intense human presence in the southern West Siberian Plain as early as MIS3. This is supported not only by solitary sites in northeastern Kazakhstan, but also by largely contemporaneous remains of the "Ishim Man" (Fu et al., 2014).

Acknowledgements

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References

Abramova Z.A., Matyushchenko V.I. 1973
Novye dannye o Tomskoi paleoliticheskoi stoyanke. In *Iz istorii Sibiri*, iss. 5. Tomsk: Tomsk. Gos. Univ., pp. 16–23.

Anoikin A.A. 2017
Novye dannye o paleolite Severo-Vostochnogo Kazakhstana (po materialam rabot Severokazakhstanskogo paleoliticheskogo otryada IAET SO RAN). *Teoriya i praktika arkheologicheskikh issledovanii*, No. 4: 138–149.

Anoikin A.A., Pavlenok G.D., Kharevich V.M., Kulik N.A., Taimagambetov Z.K. 2020
Shulbinka Paleolithic site, Eastern Kazakhstan, Revisited. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 48 (4): 25–42.

Anoikin A.A., Pavlenok G.D., Kharevich V.M., Taimagambetov Z.K., Shalagina A.V., Gladyshev S.A., Ulyanov V.A., Duvanbekov R.S., Shunkov M.V. 2019
Ushbulak—a new stratified Upper Paleolithic site in Northeastern Kazakhstan. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 47 (4): 16–29.

Behrensmeyer A. 1978
Taphonomic and ecologic information from bone weathering. *Paleobiology*, vol. 4: 150–162.

Blasco R., Rosell J., Peris J.F., Cáceres I., Vergés J.M. 2008
A new element of trampling: An experimental application on the Level XII faunal record of Bolomor Cave (Valencia, Spain). *Journal of Archaeological Science*, No. 35: 1605–1618.

Derevianko A.P., Molodin V.I., Zenin V.N., Leshchinskiy S.V., Mashchenko E.N. 2003a
Pozdnepaleoliticheskoye mestonakhozhdeniye Shestakovo. Novosibirsk: IAET SO RAN.

Derevianko A.P., Petrin V.T., Zenin A.N., Taimagambetov Z.K., Gladyshev S.A., Tsybankov A.A., Slavinskiy V.S. 2003b
Issledovaniya Rossiysko-Kazakhstanskoi arkheologicheskoi ekspeditsii v Kazakhstane (1998–2001). Novosibirsk: Izd. IAET SO RAN.

Fritz C., Menu M., Tosello G., Walter P. 1993
La gravure sur os au Magdalénien: Etude microscopique d'une côte de la grotte de la Vache commune d'Alliat, Ariège. *Bulletin de la Société Préhistorique Française*, iss. 90: 411–425.

Fu Q., Li H., Moorjani P., Jay F., Slepchenko S.M., Bondarev A.A., Johnson P.L.F., Aximu-Petri A., Prüfer K., de Filippo C., Meyer M., Zwyns N., Salazar-Garcia D.C., Kuzmin Y.V., Keates S.G., Kosintsev P.A., Razhev D.I., Richards M.P., Peristov N.V., Lachmann M., Douka K., Higham T.F.G., Slatkin M., Hublin J.-J., Reich D., Kelso J., Viola T.B., Pääbo S. 2014
Genome sequence of a 45,000-year-old modern human from western Siberia. *Nature*, vol. 514: 445–449.

Gaiduchenko L.L. 1998
Domashnyaya loshad i krupnyi rogatyi skot poseleniya Kozhai-1. In *Kalieva S.S. Poseleniye Kozhai-1*. Almaty: Inst. arkheologii RK, pp. 234–252.

Geologiya SSSR. Tsentralnyi Kazakhstan. Geologicheskoye opisaniye. 1972
Vol. XX, bk. 1. Moscow: Nedra.

Klementiev A.M. 2011
Landshafty basseina reki Udy (Zabaikalye) v pozdnem neopleistotsene (po faune krupnykh mlekopitayushchikh). Cand. Sc. (Geography) Dissertation. Irkutsk.

Kozhamkulova B.S. 1969
Antropogenovaya iskopaemaya teriofauna Kazakhstana. Alma-Ata: Nauka.

Kozhamkulova B.S., Pak T.K. 1988
Pozdnepleistotsenovaya teriofauna stoyanki Aktas (Kokchetavskaya oblast) i ee sopostavleniye s odnovozrastnoi faunoi Vostochnogo Kazakhstana. In *Mezhregionalnoye sopostavleniye mezozoi-kainozoiskikh faun i flor Kazakhstana*. Alma-Ata: Nauka, pp. 121–154. (Materialy po istorii fauny i flory Kazakhstana; vol. 10).

Kurbanov R.N., Yanina T.A., Murray E.S., Semikolennykh D.V., Svistunov M.I., Shtyrkova E.I. 2019
Vozrast karangatskoi transgressii Chernogo morya. *Vestnik Moskovskogo gosudarstvennogo universiteta*. Ser.: Geografiya, No. 6: 29–40.

Matvienko V.N., Kozhamkulova B.S. 1986
Aktas – stoyanka pozdnepaleoliticheskogo cheloveka v Severnom Kazahstane. *Vestnik AN KazSSR*, No. 1: 66–71.

Merts V.K. 1990
Paleoliticheskaya masterskaya Ekibastuz-18. In *Paleoekologiya Sibiri: Tezisy dokladov XXX RAESK*. Irkutsk, pp. 37–38.

Murray A.S., Thomsen K.J., Masuda N., Buylaert J.P., Jain M. 2012

Identifying well-bleached quartz using the different bleaching rates of quartz and feldspar luminescence signals. *Radiation Measurements*, vol. 47: 688–695.

Petrin V.T. 1986

Paleoliticheskiye pamyatniki Zapadno-Sibirskoi ravniny. Novosibirsk: Nauka.

Pickering T.R. 2002

Reconsideration of criteria for differentiating faunal assemblages accumulated by hyenas and hominids. *International Journal of Osteoarchaeology*, vol. 12: 127–141.

Pidoplichko I.G. 1976

Mezhirichskiye zhilishcha iz kostei mamonta. Kiev: Nauk. dumka.

Rybin E.P., Nokhrina T.I., Taimagambetov Z.K. 2014

Pervaya radiouglerodnaya data dlya paleolita Severo-Vostochnogo Kazakhstana: K voprosu o prodolzhitelnosti sushchestvovaniya levalluazskoi konvergentnoi tekhnologii na Altaye. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XX. Novosibirsk: Izd. IAET SO RAN, pp. 83–86.

Serikov Y.B. 2020

Ispolzovaniye kostei zhivotnykh paleoliticheskim naseleniyem rek Sosvy i Tavdy. *Arkheologiya Evraziyskikh stepei*, No. 3: 212–222.

Taimagambetov Z.K., Ozhereliev D.V. 2009

Pozdnepaleoliticheskiye pamyatniki Kazakhstana. Almaty: Kazak. Univ.

Tseitlin S.M. 1983

Tomskaya stoyanka (dannye novykh issledovaniy). *Bulleten Komissii po izucheniyu chetvertichnogo perioda*, No. 52: 181–182.

Turner C.G., Ovodov N.D., Pavlova O.V. 2013

Animal Teeth and Human Tools: A Taphonomic Odyssey in Ice Age Siberia. Cambridge: Cambridge Univ. Press.

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Neolithic Burials in the Zelinda River Mouth, Northern Angara: Burial Practices and Radiocarbon Chronology

We describe new findings relating to Neolithic burials at two cemeteries in the Northern Angara area, excavated in 2012 by the Boguchany archaeological expedition. The sites are located at the outlet of the Zelinda—the right tributary of the Angara. Two burials were revealed at Ust-Zelinda-1, and five at Ust-Zelinda-2. We describe preserved remains and the funerary rite, and analyze radiocarbon dates generated from the human bones. On the basis of archaeological parallels, we attribute certain burials to the Isakovo culture. Burial practices include the use of "ocher" and the supine position of the buried along the Angara, heads to the south, upstream of the site. Calibrated radiocarbon dates, details of the funerary rite, grave goods and their typological characteristics, as well as the placement of graves within the cemeteries, suggest that three chronological groups existed within the 7499–5583 cal BP (5550–3634 cal BC) interval. The ^{14}C date of the third group (5718–5583 cal BP, or 3769–3634 cal BC), details of the funerary rite, and grave goods are indicative of the Late Neolithic (Isakovo culture of the Southern Angara). Burials of the second group, which is the best represented (7157–6555 cal BP, or 5208–4606 cal BC), resemble those of the classic Isakovo tradition. The burial (without grave goods) attributed to the first chronological group dates to 7499–7317 cal BP, or 5550–5368 cal BC. It is hypothesized that "proto-Isakovo" traditions originated on the Northern Angara, having later spread to the Southern Angara.

Keywords: *Northern Angara, Neolithic, cemeteries, radiocarbon chronology, Zelinda River.*

Introduction

To date, a great number of sites and stratified complexes has been found in the Northern Angara area; the obvious goal of the current studies is to propose a cultural-chronological scale for the region and provide it with radiocarbon dates (see, e.g., (Berdnikov et al., 2020; Saveliev et al., 2020; Weber et al., 2021; and others)). The scale is based on pottery types and is associated mainly with the stratified sites of the Baikal region, the Southern Angara region, and the middle Yenisei. Therefore, intact complexes (including those containing ceramics) are especially valuable: they provide grounds not only for cultural attribution of archaeological materials, but also for direct radiocarbon analysis of the artifacts.

The artifacts recovered from graves are traditionally regarded as the bases for establishing the cultural-chronological horizons (complexes) of both large areas and archaeological microdistricts (see, e.g., (Okladnikov, 1950; Makarov, 2008)).

Large-scale excavations have shown that there are quite few cemeteries in the Northern Angara area; such

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large cemeteries as in the Baikal and Southern Angara areas are absent here (Okladnikov, 1950; Bazaliiskii, 2012). The Northern Angara cemeteries usually include from 1 to 10 graves (Boguchanskaya arkheologicheskaya ekspeditsiya…, 2015: 84–90, 127, 175, 255, 278, 293–395, 310, 328–329, 352–354, 390–391, 410–411, 420–421, 427–428, 441–444, 452, 453–454, 474–475, 492–493). Judging by the features of burial practice, grave goods, and radiocarbon dates, such small accumulations of burials do not form long-term cemeteries; they represent different chronological periods and cultural traditions. The graves do not contain ceramic vessels or any other grave goods, which fact often hinders cultural and chronological attribution of the site and comparison of habitation and funerary materials.

The purpose of this article is to introduce the archaeological information about burial practices and the results of the radiocarbon analysis of the Neolithic burials of the Ust-Zelinda-1 and -2 sites, belonging to one of the Northern Angara archaeological microdistricts.

Description of archaeological sites

The by now completely or partially flooded sites of Ust-Zelinda-1 and -2 were located on both banks of the outlet of the Zelinda River—the right tributary of the Angara (Ust-Ilimsky District, Irkutsk Region) (Fig. 1). The distance between the sites was 300–400 m (Fig. 2, *1*) (Boguchanskaya arkheologicheskaya ekspeditsiya…, 2015: 445). There are two rapids in this section of the river: the Upper and Lower Keul riffles. The cemeteries related to a number of archaeological features located 0.1–5.0 km from one another on the nearest islands (Kamenny, Vatakina, etc.) and at the outlets of the left tributaries of the Angara (Polovinnaya, Elovka, Zhevakan, Keul). Such a concentration of sites can be regarded as an archaeological microdistrict formed in the place where various natural features relevant for the Angara population in various periods were combined. Similar combinations of islands, estuarine sections of tributaries, and river rapids have also been noted in other parts of the Angara (Boguchanskaya arkheologicheskaya ekspeditsiya…, 2015: 445–477, Grishin et al., 2016: 4). We suggest giving this microdistrict the name of Keul-Zhevakan, since this name indicates the lower and upper boundaries of the microdistrict along the river, separated by 14.5 km. In general, it is reasonable to consider the archaeological features of such microdistricts as a whole. Unfortunately, this is not yet possible, because not all the findings from the long-term studies of the region by the Boguchany archaeological expedition have been published. This article provides information about the Neolithic cemeteries of the "Zelinda" part of the Keul-Zhevakan microdistrict. Notably, Ust-Zelinda-1 and -2 are the only cemeteries in the microdistrict that are located on the right (eastern) bank of the Angara.

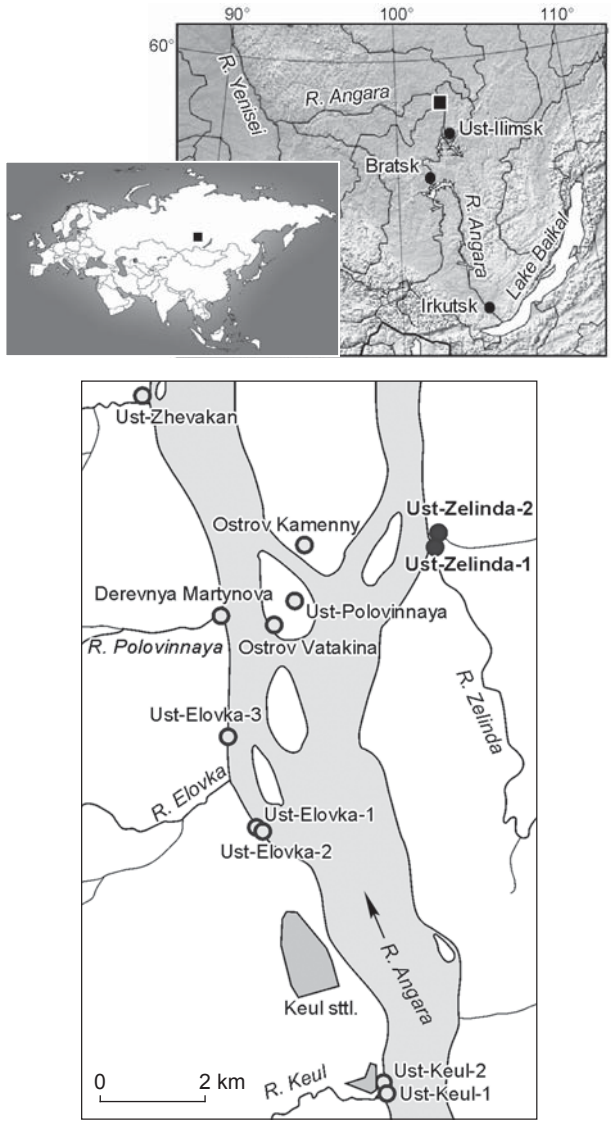

Fig. 1. Archaeological sites of the Keul-Zhevakan microdistrict in the Angara area.

These sites, together with the vast majority of other objects in the Keul-Zhevakan microdistrict, were discovered by E.O. Rogovskoi (2008, 2012) in 1997 and explored in 2007 and 2011. At Ust-Zelinda-1 and -2, Rogovsky revealed cultural layers of the Neolithic and medieval settlements, and identified traces of non-contemporaneous cemeteries. The present authors studied these sites in 2012 as part of the archaeological works of the Boguchany archaeological expedition (Garkusha et al., 2012; Marchenko, Garkusha, Grishin, 2012; and others).

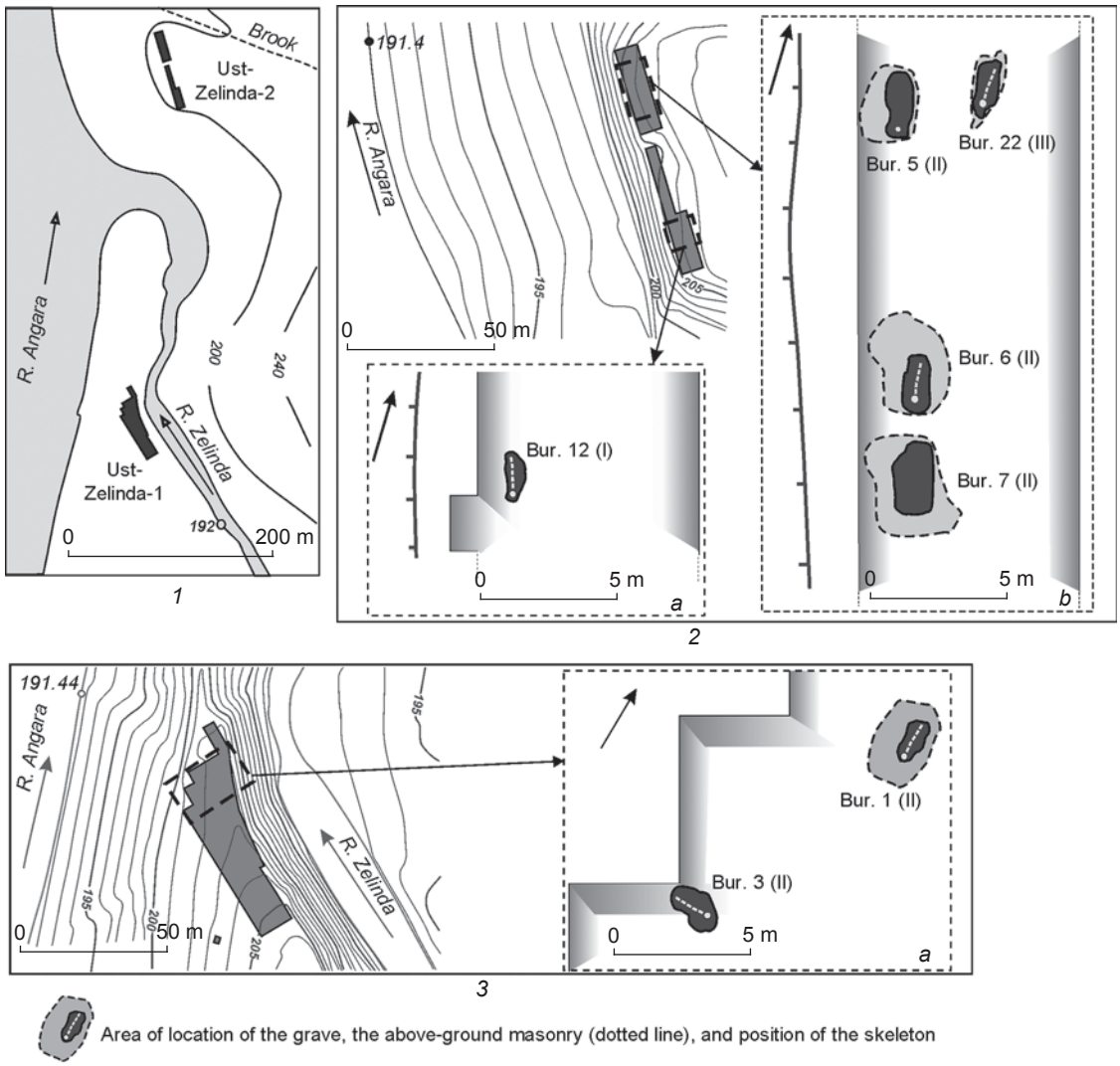

Fig. 2. Map showing location of the sites in the Zelinda River mouth (*1*), excavations of 2012 (*2*, *3*), and Neolithic cemeteries at Ust-Zelinda-2 (*2*, *a*, *b*) and Ust-Zelinda-1 (*3*, *a*). The numbers of chronological groups are given in parentheses.

Ust-Zelinda-1

At this cemetery, three burials were revealed; two of them (burials 1 and 3) were attributed to the Neolithic period. The burials were located 9 m from one another, on a slightly sloping area, and differed in the orientation of the buried and in the features of the funerary rite, including the above-ground burial structures (Fig. 2, *3*).

Burial 1. The burial was covered with a solid oval-shaped masonry (Fig. 3, *1*). The outer contour was formed by medium-sized boulders (crepidoma), the filling by smaller stones, under which there was burgundy-colored bedding. The grave was oriented along the N-S line. Its dimensions at the bottom were 1.65 × 0.7 m, the depth is 0.27 m from the level of the virgin land. The floor was horizontal and even. The pit was evenly filled with small stones to the depth of the skeleton bones. No signs of disturbing the grave were noted.

The remains of a 30–40-year-old man lay in a burgundy layer on the floor (Fig. 3, *2*). The southern part of the grave, where the skull was located, showed the greatest color-intensity. The skeleton was incomplete; the bones had been put in the anatomical order. Obviously, the body had been subjected to pre-inhumation actions that violated the integrity and, probably, the completeness of the skeleton. The bones showed a burgundy color, similar to the color of the filling. Under the bones of pelvis (4 spec.) and inside the skull, drop-shaped pendants made from the tubular bone of an animal were found (Fig. 3, *3*). The radiocarbon age is 6083 ± 44 BP (UBA-25017) (see *Table*, Fig. 4).

Burial 3 (see Fig. 2, *3*, *a*; 3, *4*). Small boulders outlined the borders of the grave. The pit was oriented

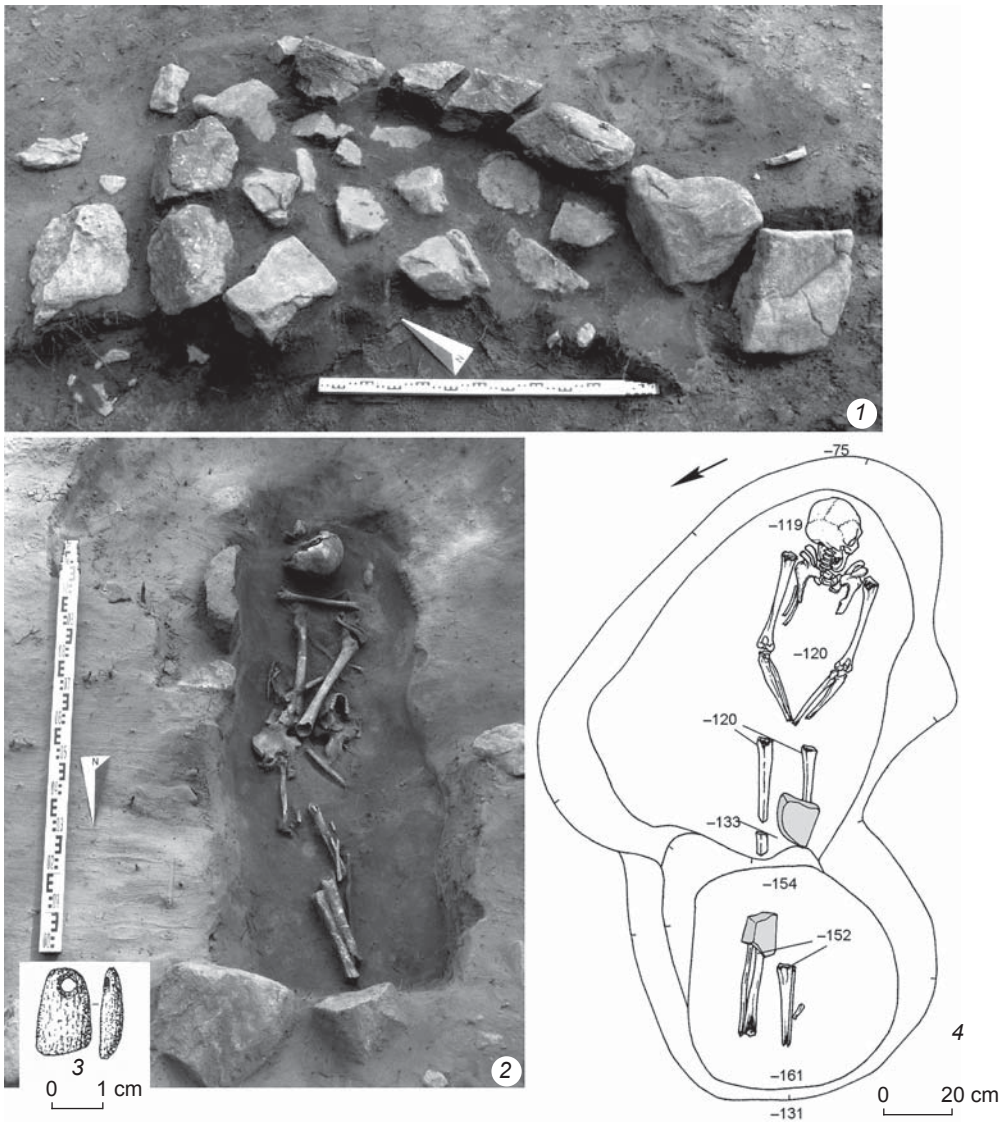

Fig. 3. Neolithic burials 1 (*1–3*) and 3 (*4*) at Ust-Zelinda-1.
1 – stone masonry; *2* – burial after excavation of the filling; *3* – pendant made of animal tooth; *4* – map of burial 3.

along the E-W line, the boundaries were conventional. The dimensions of the pit bottom were 1.1 × 0.6–0.8 m; the depth from the virgin land level was 0.42–0.55 m. The floor was flattened, slightly sloping to the NE. The grave was filled with small stones. Signs of disturbance of the original filling were noted.

At the bottom of the pit, *in situ*, the partially preserved bones of the skeleton of a 50–60-year-old man were located in anatomical order. The deceased was laid extended on his stomach, with his head towards east (perpendicular to the Angara), the hands were brought together in the pelvic area. The deliberate violation of the anatomical integrity in the pelvic bones is possible. A burgundy-colored layer, the brightest near the skull, was noted in the lowermost portion of the pit filling. A stone tablet and a small flattened boulder were placed to the right of the skull. The tibia bones were chopped off at the knees. Their distal parts were located at the bottom of an additional small pit 25 cm deep in the western part of the grave, at a distance from the rest of the skeleton, but in anatomical order and in accord with the skeleton position and orientation. The grave is relatively short in length, probably intended to contain a skeleton that has already undergone specific preparations.

Traces of pre-inhumation actions—the prone position, fixing the hands behind the back, cutting off the legs, atypical orientation of the deceased—correspond to a special ritual scenario, for example, the "neutralization" of the deceased. This emphasizes the extraordinary nature of the complex. The radiocarbon age is 5874 ± 35 BP (UBA-25019) (see *Table*, Fig. 4)

The results of radiocarbon dating of the human bone samples from the burials at Ust-Zelinda-1 and -2

Burial	Index	^{14}C-age, BP	^{14}C date, ± 2 σ		δ^{13}C, ‰	δ^{15}N, ‰	C:N $_{atom.}$
			Cal BP	Cal BC			
Ust-Zelinda-1							
1	UBA-25017	6083 ± 44	7157–6795	5208–4846	19.9	12.3	3.3
3	UBA-25019	5874 ± 35	6788–6559	4839–4620	19.8	12.8	3.6
Ust-Zelinda-2							
5	UBA-25020	5888 ± 57	6882–6555	4933–4606	–	–	–
6	UBA-25021	5077 ± 34	5910–5740	3961–3791	20.6	13.3	4.1
12	UBA-25022	6499 ± 40	7499–7317	5550–5368	20.3	12.4	3.3
22	UBA-25023	4898 ± 36	5718–5583	3769–3634	20.0	12.6	3.3

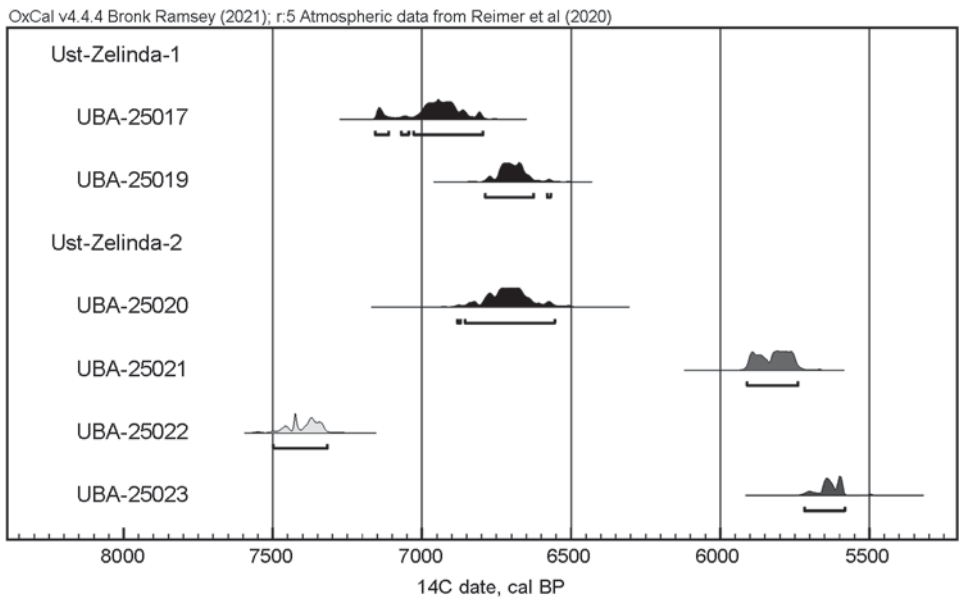

Fig. 4. Graph of calibrated radiocarbon age-values, years BP.

Ust-Zelinda-2

Five burials from the Neolithic period have been excavated at the site. All the burials were located at the edge of the terrace and oriented along the N-S line, along the Angara (see Fig. 2, *2*). In the northern part of the excavation area, along the edge of the terrace, burials 5–7 were located in a chain. The distance between burials 6 and 7 is 1 m; that between burials 5 and 6 is 8 m. Burial 22 was located 2 m from burial 5 and parallel to it; burial 12 was located in the southern part of the excavation area, 45 m south of burial 7.

Burial 5 (Fig. 5, *1*). At the level of the ancient surface, a single-layer loose masonry of small boulders and rubble, elongated along the N-S line, was recorded. Its size was 2.9 × 2.0 m. Over time, the stones had been shifted down the slope from the grave. Traces of calcined soil, sooty sandy loam, and small spots of red sandy loam ("ocher") were recorded among and under the stones. "Ocher" was also found under the stones and at the level of the bones; in the medial part of the pit filling, "ocher" was absent. At the eastern wall of the pit, in the lower portion of the stone masonry, vessel-wall fragments were found (Fig. 5, *10*). A large piece of the fragmented vessel and its context suggest that the item was placed in the grave for ritual purposes.

In the southern portion of the grave, the masonry is loose, which may be the result of penetration into the pit. Boulders and small fragments were found in the filling. Along the western edge of the pit and in the filling, a strip of orange calcined soil was traced. At the bottom of the pit, there was a layer of red sandy loam 5–12 cm thick, which contained scattered bones of the postcranial skeleton. Its color was most intense around the head. At the bottom, the pit acquired a rectangular shape; its dimensions were 1.55 × 0.7 m. The depth from

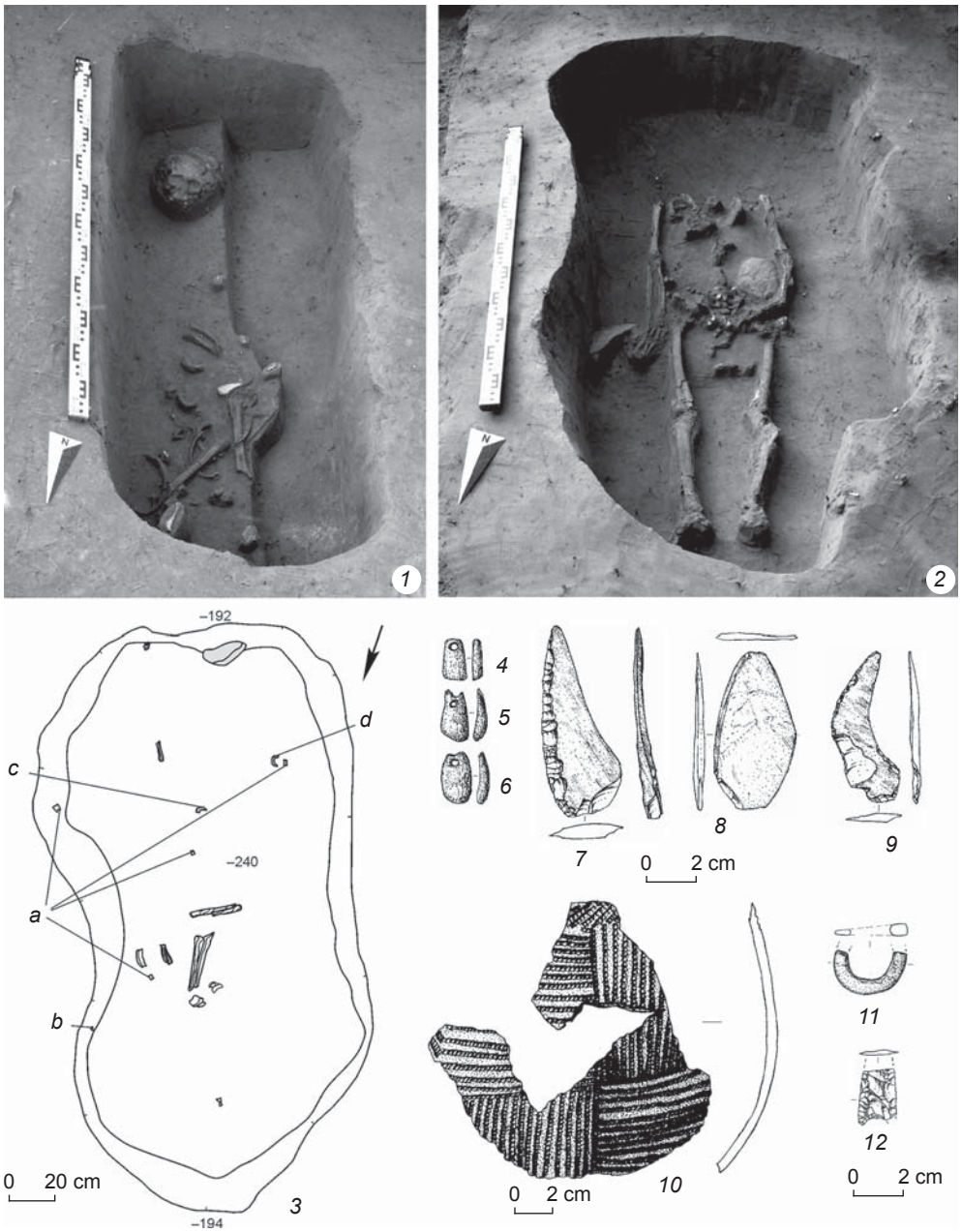

Fig. 5. Neolithic burials 5 (*1*, *4*, *5*, *7*, *10*), 6 (*2*, *6*, *8*), and 7 (*3*, *9*, *11*, *12*) at Ust-Zelinda-2.
1, *2* – burials after cleaning; *3* – burial layout; *4* – bone pendant; *5*, *6* – pendants from animal teeth; *7–9* – stone knives; *10* – vessel fragment; *11* – ring; *12* – arrowhead. *a* – stone arrowheads; *b* – pendants from animal teeth; *c* – stone knife; *d* – ring.

the virgin land level is 0.65–0.7 m. The floor is even and horizontal.

In the medial part of the lowermost filling-layer, scattered fragments of bones from a young woman 14–16 years old were found. The crushed skull was colored most intensely; the pigment was noted in the filling 10 cm above the skull and in the soil below the pit bottom up to 7 cm. The position of the skull indicates the initial orientation of the body with the head to the south; the bones of the postcranial skeleton lay in disorder. The sparse pattern of the masonry and the absence of large stones in the southern part of the above-ground burial structure suggest that the head (skull?) was buried separately and later.

Above the scattered human bones, in the medial part of the pit, the skull and lower jaws of a fox lay compactly. Nearby, there were three pendants made of red-deer bone and teeth with holes (Fig. 5, *4*, *5*). A stone knife (Fig. 5, *7*) and three more pendants made of teeth and bone were found on the floor in the central part of the pit. Two

similar pendants and a retouched flake were found in the filling. Radiocarbon age is 5888 ± 57 BP (UBA-25020) (see *Table*, Fig. 4).

Burial 6. It is covered with a masonry 3.0 × 3.8 m in size, made of boulders, elongated along the N-S line, which slightly shifted along the slope of the terrace. In the medial layer of the filling, medium-sized boulders and fragments were noted; in the lowermost filling layer, areas of red soil ("ocher") were traced. The dimensions of the grave along the bottom are 2.0 × 0.85–0.95 m; the outline is close in shape to oval (Fig. 5, *2*). The depth of the pit from the virgin land level is 0.2–0.3 m. The floor is subhorizontal and even.

The deceased adult (*adultus–maturus*) was laid in the supine position, with his feet to the north. The skull was missing. The postcranial skeleton was *in situ* in anatomical order. There were no obvious traces of post-burial disturbances of the grave. Most likely, the body was buried without the head. The most intense staining was noted around the bones. Apparently, "ocher" was used to decorate the body, rather than the bottom or the filling of the pit. The colored soil was recorded up to 5–7 cm below the floor.

Near the bones of the pelvis, the right and left forearms, and between the femurs, 46 holed pendants made from red-deer teeth were found (Fig. 5, *6*). Most of the pendants were located on the bones. The position of the pendants probably corresponded to the pattern on the clothing. Under the left wing of the pelvis, closer to the sacrum, there lay a polished stone knife, with its point towards the head (Fig. 5, *8*). Radiocarbon age is 5077 ± 34 BP (UBA-25021) (see *Table*, Fig. 4).

Burial 7. The above-ground burial structure, elongated along the N-S line, consisted of small and medium-sized boulders and shatters. Its dimensions were 3.8 × 2.6 m. The outline of the grave was irregular; the pit was oriented along the N-S line (see Fig. 5, *3*). The pit had been disturbed, its original size is undeterminable. The southern part of the filling contained medium boulders, probably marking a looting-pit. The dimensions of the grave at the bottom were 2.6 × 1.16–1.4 m; the depth from the virgin land level was 0.45–0.5 m. The floor was even and subhorizontal, possibly also disturbed. Separate spots of reddish pigment strewing were traced.

In the filling and on the grave floor, a few bones of the lower extremities and a mandible fragment of an adult individual (*adultus*, 20–30 years old) were located, disorderly.

In the central part of the pit, possibly *in situ*, a stone side-bladed knife was noted (see Fig. 5, *9*). In the southwestern part of the grave, almost on the floor, a half of a stone ring and a fragment of a stone arrowhead were found (see Fig. 5, *11*, *12*). The other noted items—fragments of stone arrowheads, a stone side-blade, and a fragment of a red-deer-tooth pendant—have obviously been displaced.

Burial 12. No masonry was found. The grave was identified by a patch of inhomogeneous light-gray sandy loam. The grave pit was oriented along the edge of the terrace, along the NNW-SSE line. The boundaries of the pit were indistinct (Fig. 6, *1*). The dimensions of the grave floor were 1.85 × 0.5–0.65 m, the depth 0.46 m. The floor was horizontal and even. Two medium-sized boulders were located in the filling above the feet, and two in the medial part of the grave.

The buried was a man 40–50 years old. The upper part of his body was probably displaced *in corpore* closer to the corner of the pit during inhumation or subsequent penetration. Initially, the dead was placed in a supine position, with his head almost to the south (upstream the Angara). At the bottom of the burial, blurry red-burgundy spots were traced. The radiocarbon age is 6499 ± 40 BP (UBA-25022) (see *Table*, Fig. 4).

Burial 22. The masonry had been partially destroyed by a 20th-century house. The dimensions of surviving masonry were 2.4 × 0.6 to 0.8 m. The grave was oriented along the edge of the terrace, along the N-S line. The dense filling was composed of boulders (up to 0.4 m in diameter) and medium and small rocks. A slab 0.3 × 0.2 m had been installed vertically in the southern part of the pit (at the head). In addition, three sandy loam layers were identified in the filling. There were no signs of disturbance. The grave pit had a regular oval shape (see Fig. 6, *2*). Its dimensions along the bottom were 1.53 × 0.65 m, the depth from the virgin land level 0.64–0.7 m. The bottom was even and subhorizontal.

The anatomical order of bones of the skeleton of an 8–9-year-old child was partially disturbed. The broken skull, with the occiput facing up, was located in the southern part of the grave. Only the pelvic and femoral bones were in a anatomically correct position. Judging by these bones, the deceased was laid in the supine position, with his head to the south. The rest of the bones lay disorderly. The body of the buried was probably subjected to pre-inhumation manipulations, which violated its integrity.

At the southern wall, close to the head, a compact crushed jar-shaped vessel was recorded (about 1/3 of its volume was missing) (see Fig. 6, *3*). Between the potsherds, there was an end-scraper (which had been probably placed in the vessel). Under the skull, an almost complete skeleton of a sable was found. To the west of the human skull, there was an accumulation of 11 stone arrowheads, two of which were located under the skull; the rest were scattered around (see Fig. 6, *14*, *15*). A large stone stemmed arrowhead was located separately (see Fig. 6, *12*).

At the bottom of the pit, among the bones of the buried person, several artifacts were found: an item made from an elk antler (see Fig. 6, *4*), a bone borer made from an elk

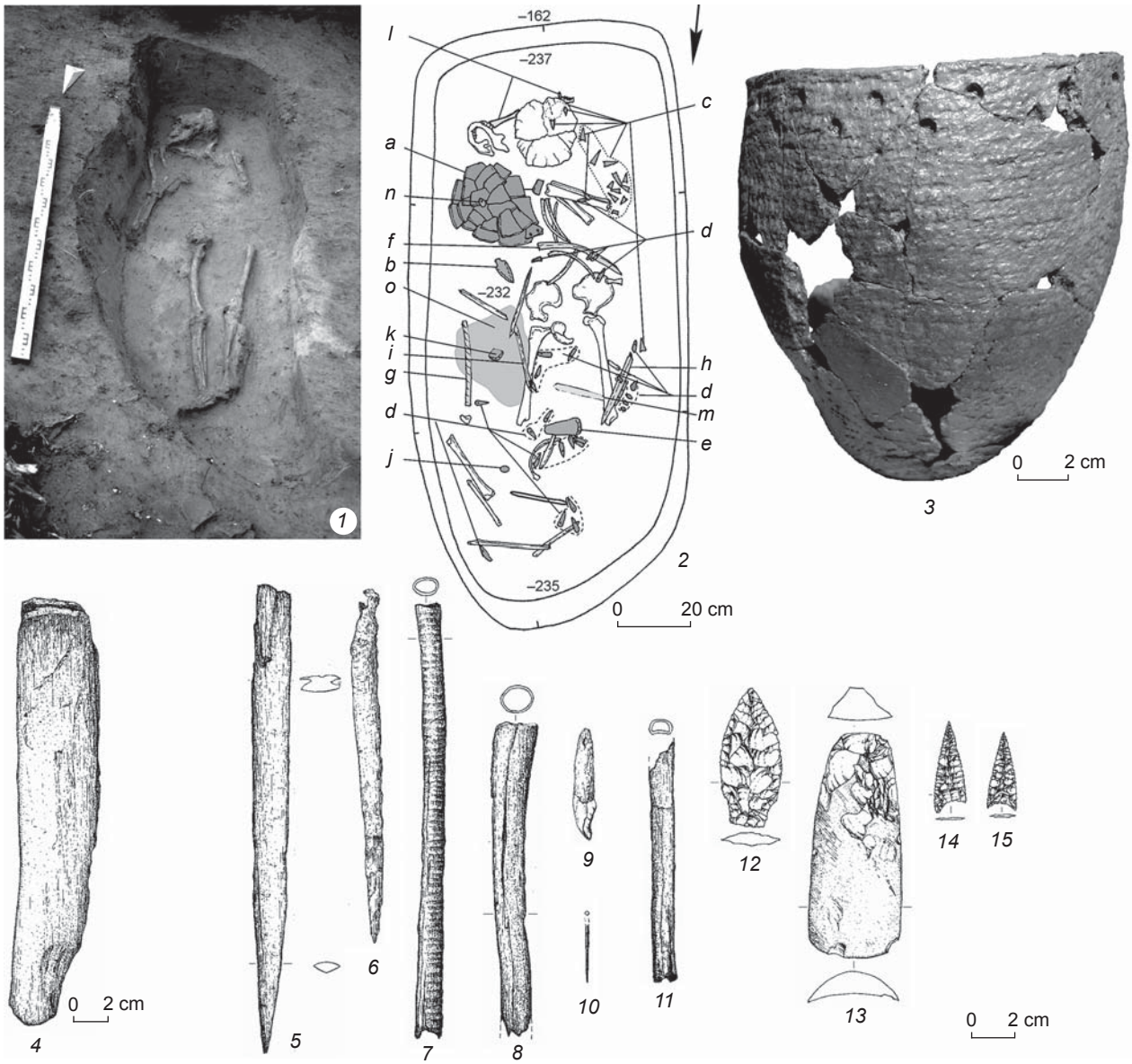

Fig. 6. Neolithic burials 12 (*1*) and 22 (*2–15*) at Ust-Zelinda-2.
1 – burial after cleaning; *2* – burial layout; *3* – ceramic vessel; *4* – antler artifact; *5* – bone haft of the side-bladed tool; *6* – bone borer; *7*, *8*, *11* – artifacts from tubular bones; *9* – pendant from animal tooth; *10* – bone needle; *12*, *14*, *15* – stone arrowheads; *13* – stone adze. *a* – ceramic vessel; *b* – stone arrowhead; *c* – stone arrowheads; *d* – pendants from animal teeth; *e* – stone adze; *f* – antler artifact; *g* – artifacts from tubular bones; *h* – bone side-bladed tool; *i* – bone borer; *j* – lithic blank; *k* – retouched flake; *l* – sable-bones; *m* – bone needle-case; *n* – stone end-scraper; *o* – patch of red pigment.

splint-bone (see Fig. 6, *6*), a hollow tube with transverse notches (see Fig. 6, *7*), and a needle-case made from the diaphysis of a bird-bone (see Fig. 6, *11*), in which a bone needle was found (see Fig. 6, *10*), the bone haft of a spear (dagger ?)* with two stone side-blades (see Fig. 6, *5*), a small polished adze (see Fig. 6, *13*), at least 23 pendants made of elk-teeth (see Fig. 6, *9*), a stone blank, and a retouched flake. A subrectangular spot of a red mineral, measuring 0.13 × 0.3 m, was recorded between the right femur and an ornamented bone tube. The radiocarbon age is 4898 ± 36 BP (UBA-25023) (see *Table*, Fig. 4).

*The lower part of the item is missing, so its interpretation as a spear-tang is of presumptive nature.

Results of radiocarbon dating

Anthropological remains from almost every Neolithic burial at both sites have provided radiocarbon

determinations (n=6) in the range from 6499 ± 40 BP (UBA-25022) to 4898 ± 36 BP (UBA-25023) (see *Table*, Fig. 4). The analysis was carried out in the laboratory of the ^{14}CHRONO Center for Climate, the Environment and Chronology at Queen's University Belfast. The measured collagen in almost all the samples meets the quality criteria (C:N ratio in the range of 2.9–3.6 (DeNiro, 1985)), which makes it possible to consider almost all dates reliable. The exception is the date of burial 6. In the sample from this grave, the C:N atomic ratio is above normal (4.1), which requires rechecking the age. The date of burial 5 is not quite reliable either, because the amount of material is insufficient for additional analysis (to measure the C:N ratio).

Comparison of ^{14}C-dates generated on the bones of humans, terrestrial and marine mammals from the Neolithic burials of Baikal and the Southern Angara revealed a freshwater reservoir effect (FRE) (Nomokonova et al., 2013). On the basis of regression analysis for specific sites in these regions, age adjustment models were developed, using δ^{13}C and δ^{15}N values (Schulting et al., 2014; Weber et al., 2016). Since all the radiocarbon data were derived exclusively from human bone samples, and there are no comparative data on terrestrial mammals yet, the issue of the FRE in the Northern Angara area and the possible correction of ^{14}C dates are not discussed in the article.

The results of measurement of stable isotopes δ^{13}C and δ^{15}N in the bones of all buried people at the cemeteries under consideration are close (see *Table*). This suggests a similar diet, which was obviously based on the meat of local herbivorous mammals and fish. Therefore, even if there is an age-estimation error due to the FRE associated with consumption of river resources (fish), it won't change the relative chronology of the burials within this sample. Consequently, when comparing the age of burials at Ust-Zelinda-1 and -2 with the radiocarbon chronologies of the cultures of Baikal and the Southern Angara area, we will primarily focus on similar data—chronologies built on data obtained for human bones, without correction for FRE (Weber et al., 2006; Bazaliiskii, 2012).

The ranges of all Neolithic calibrated dates from both sites falls within the range of 7499–5583 cal BP (or 5550–3634 cal BC)* (Reimer et al., 2020; Bronk Ramsey, 2009). The ^{14}C-date was established for burial 12 at Ust-Zelinda-2 (7499–7317 cal BP). Burials 1 and 3 at Ust-Zelinda-1 produced similar ages within the range of 7157–6559 cal BP. Burial 5 at Ust-Zelinda-2 (6882–6555 cal BP) is contemporaneous with the above. At Ust-Zelinda-2, burial 22 is the youngest (5718–5583 cal BP); burial 6 is close to it (5910–5740 cal BP).

Features of the funerary rite

Most of the sites described show the following features of the funerary rite: orientation of the buried with the head upstream the Angara, the "stretched supine" position, presence of stones in the grave filling, and traces of red pigment in the bottom part and/or on the bones of the skeleton. These features are generally characteristic of many Neolithic sites in the Baikal-Yenisei region (Bazaliiskii, 2012). All the complexes show traces of post-mortem manipulations with the bodies or post-burial penetration.

Noteworthy is the orientation of the skeleton perpendicular to the Angara in burial 3 at Ust-Zelinda-1. I.M. Berdnikov et al. (2021: 40) analyzed the burial complexes of the region and characterized this feature as a rare one. The interpretation of this feature should take into account the flow direction of the Angara tributaries, on the coast of which the graves in question are located. For example, the necropolis at Sosnovy Mys (Northern Angara) is located at the lower (downstream) part of Sosnovy Island, opposite the mouth of the Kata River (30 km north of the Zelinda mouth). This Angara area can also be considered as an archaeological microdistrict. A group of islands is located in an area of less than 4 km along the river. The large tributaries Yodarma (left) and Kata (right) flow into the Angara in this area (Boguchanskaya arkheologicheskaya ekspeditsiya…, 2015: 378–416, fig. 370). In total, 16 (!) archaeological sites have been discovered in this area. We believe that the human remains in burials 2, 4, 5, 7 and 8 at Sosnovy Mys are oriented with their heads upstream the Kata (i.e. to the east, perpendicular to the Angara). The bodies of deceased in burial 3 at Ust-Zelinda-1 are directed with their heads to the east, almost in the direction of the Zelinda stream in this area (Fig. 2, *3*).

Thus, at both sites, the practice of orienting the head of the buried upstream the tributary, rather than the

*The chronology of sites and cultures of the European and West Siberian Neolithic and Bronze Age is based on the calendar system of chronology (years BC). For East Siberian sites of the same periods, the non-calendar time-scale (years BP) is usually used. The same approach is retained when converting radiocarbon determinations to calibrated age values. These differences are associated with two traditions of estimating the age of the complexes: binding to the historical events of the Ancient World ("Western" tradition) or to dated geological deposits (the so-called geoarchaeology, "East Siberian" tradition). Since this article discusses the issues of the East Siberian Neolithic, the comparative analysis of chronologies will be executed in a non-calendar scale (years BP). For convenience of perception and for comparison with West Siberian materials, the calibrated values in the table will be duplicated in the calendar system. All calibrated values are given with ±2σ.

Angara, was recorded. For various reasons (place of birth, permanent residence, direction of roaming, etc.), the tributary turned out to be more significant than the Angara.

Chronology of burials

The results of radiocarbon dating indicate that the Neolithic graves at the mouth of the Zelinda are non-contemporaneous, and provide grounds for distinguishing at least three chronological groups (see *Table*, fig. 2, *2*, *3*; 4).

The first chronological group (7499–7317 cal BP (5550–5368 cal BC)) is burial 12 at Ust-Zelinda-2. Unlike other burials, it does not have any above-ground structure, nor grave goods; and it is isolated from other Neolithic graves (see Fig. 2, *2*, *a*). The ^{14}C-date of burial 12 coincides with the period of formation of the nearest dated Early Neolithic necropolis at Sosnovy Mys (group 1) – 7567–7275 cal BP (Saveliev et al., 2020: 27). The features of funerary rite recorded in burial 12 are similar to those noted in group 1 at the Sosnovy Mys cemetery. The orientation of the buried may seem to be a distinctive feature; however, we believe that the principle of orientation "head upstream the river" was the same, but the landmarks were different.

The second chronological group (7157–6555 cal BP (5208–4606 cal BC)) includes burial 1 and 3 at Ust-Zelinda-1, and burials 5–7 at Ust-Zelinda-2. The difference in age between burials 5 and 6 is 811 radiocarbon years; we explain this by the unreliability of the younger date of burial 6. The chronological closeness of the two burials is evidenced not only by spatial distribution, but also by the above-ground masonries, similarity in the sets of grave goods (pendants made of red-deer teeth and stone knives), and the use of the red mineral in the rite. All three burials (5–7) are located in the northern part of the necropolis and form a chain along the edge of the terrace (see Fig. 2, 2*b*).

The stone set of grave goods of burials 5–7 is distinct from those of other Neolithic burials at Ust-Zelinda-1 and -2. The set contains knives fashioned on elongated flakes. Two knives are double, convex-concave, showing variously shaped edges (burials 5 and 7). The concave edge is prepared by polishing; the convex edge is made through bifacial retouch. Similar double knives are known from burials of the Isakovo culture (Okladnikov, 1950: 175, fig. 26). The third knife, fashioned on a rounded tablet, shows an elongated oval shape (burial 6). It has a convex edge; the edge and back are polished.

Six other stone items—arrowheads, side-blades, and a fragment of a ring—were found exclusively in burial 7. Three arrowhead fragments bear signs of bifacial working. The two arrowheads probably had triangular blades with concave bases. The third arrowhead likely had a slightly convex tang. One side-blade was broken; it had been subjected to bifacial working. The second side-blade had a notch in the distal part, bearing signs of retouch on the dorsal face. The ring had been polished.

The appearance and composition of the grave goods, as well as the features of funerary rite, in burials 5–7 at Ust-Zelinda-2, in our view, generally correspond to the ritual practice of the Isakovo culture (Ibid.: 165–190; Bazaliiskii, 2012: 82, 84). The radiocarbon dates of the Isakovo cemeteries on the Southern Angara fall within a younger range, 6000/5800–5200 cal BP (Bazaliiskii, 2012: 81–83, tab. 5; Weber et al., 2016), as compared to the burials of the second chronological group of Ust-Zelinda-2; i.e. the Northern Angara materials are older than the "classic" Southern Angara Isakovo complexes.

A fragment of a large vessel-wall from the upper part of the filling of burial 5 at Ust-Zelinda-2 (see Fig. 5, *10*) is of considerable interest with respect to the chronology of ceramic vessels; in particular, in terms of its age in comparison with typologically close pottery from the Angara area. The context of location of this item cannot be considered unambiguous. However, its size and conditions of deposition (between and partially under the stones of the masonry) suggest that it was a ritual item. It belongs to a thin-walled vessel, densely decorated with comb-stamp impressions forming a "parquet" pattern. In terms of decorative and morphological characteristics, the vessel is close to one of the varieties of Ust-Belaya pottery from the Northern Angara area (for example, from the sites of Ust-Karabula, Tolsty Mys, Khedugin Ruchey) (Makarov, 2013: Fig. 23, *1*; Grevtsov, Lysenko, Galukhin, 2010: 512–514; Lysenko, Matveeva, Reis, 2011; Kogai, Berdnikov, 2013: Fig. 6). The radiocarbon dates available for Derevnya Pashino on the Northern Angara, to the west from Ust-Zelinda, attribute the Ust-Belaya complexes to the late 5th – first half of the 4th millennium BC (Grishin, Garkusha, Marchenko, 2011: 129). However, taking into account the results of dating the stratified deposits with the Ust-Belaya pottery in the Southern Angara area (the sites of Ust-Belaya and Gorely Les), these complexes can be compared by age (6716–6311 cal BP) (Berdnikov et al., 2021: 39, tab. 1)) with the second chronological group Ust-Zelinda burials where this Ust-Belaya ceramic fragment was found.

Now, let us turn to the Neolithic complexes of Ust-Zelinda-1 included in the second chronological group. These do not contain ceramic materials and expressive artifacts. Notably, burial 1 yielded bone imitations of red-deer teeth pendants, while the graves of Ust-Zelinda-2 contained pendants mainly made of red-deer teeth (burials 5 and 6). The above-ground masonry of burial 1 at Ust-Zelinda-1 shows a more sophisticated and peculiar structure; the pigment was used not only at the stage of decorating the lower part of the grave and human remains, but also during the construction of the masonry.

Despite the greatest chronological proximity of Ust-Zelinda-1 burials 1 and 3, the complex of burial 3 show signs of an "extraordinary" burial practices, which makes it essentially unsuitable for generalizations.

By the appearance of material culture and features of the funerary rite (above-ground burial structure, use of pigment, bone pendants imitating red-deer teeth) burials 1 and 3 from Ust-Zelinda-1 can be attributed to the Isakovo culture. However, there are still no sufficient grounds for correlating these burials with the Isakovo or with any other cultural group.

Burial 22 at Ust-Zelinda-2 belongs to the *third chronological group* and is distinguished by a "rich" set of grave goods. Noteworthy is an incomplete ceramic vessel (see Fig. 6, *3*). The restored container has a shape of somewhat closed jar, slightly curved walls, and tapers towards a rounded bottom. Its height is 15 cm, the rim diameter is 13.2 cm. The decoration consists of a row of shallow paired pitted pricks along the edge of the rim. The exterior and interior surfaces bear technological traces in the form of "textile" imprints. In terms of decorative and morphological features ("paraboloid" shape, tapering bottom, impressions of a large-mesh grid, rows of pit-impressions forming a zigzag line), the vessel corresponds to the Isakovo ceramic tradition (Okladnikov, 1950: 167, fig. 21–23; Saveliev, 1989; Berdnikov, 2013: 209; Bazaliiskii, Goryunova, 2017: 31–32, fig. 4, 5).

Parallels of most of the items made of bone (base of the side-bladed spear (dagger?), borer, ornamented tube, needle-case, pendants made of teeth) have a wide chronological range. Isolated items are found both in the Early Neolithic Kitoy and Late Neolithic Isakovo and Serovo complexes of the Baikal and Southern Angara areas, and in the graves of the "archaic group" on the upper Lena (Okladnikov, 1950: 180–182, 187, 272–277, 327, 365–366, 391; Bazaliiskii, 2012: 67, 87, 92–93).

The grave goods of burial 22 include triangular bifacial stone arrowheads with concave bases, with asymmetric (n=13) and symmetrical (n=2) form of blades, which are similar to the Late Neolithic artifacts of the Southern Angara area (Bazaliiskii, 2012: 87–90, 92). There is a large, leaf-shaped arrowhead with a distinct stem. Stemmed arrowheads are known in the Late Neolithic Isakovo and Serovo cultures (Okladnikov, 1950: 179, fig. 29, p. 230, fig. 68). A fluted adze (group 1 in the Okladnikov's classification), with traces of wear, is typical of the Isakovo material culture; this tool-type is also reported from the Serovo collections (Ibid.: 174–176, fig. 26, p. 202).

The features of the funerary rite recorded in burial 22 are characteristic of both the Isakovo and Serovo traditions (Ibid.: 165–190, 336–354; Bazaliiskii, 2012: 86–89, fig. 13, p. 92).

The radiocarbon date of the sample from burial 22 (5718–5583 cal BP) corresponds to the chronology of the Isakovo culture in the Southern Angara area (6000/5800–5200 cal BP (Bazaliiskii, 2012: 81–83, tab. 5; Weber et al., 2016)).

Despite the noted distinctions in the grave goods, the burials of the second and third chronological groups of Ust-Zelinda-2 show certain similar features. These are typologically similar subtriangular stone arrowheads and side-blades from burial 7 and 22, as well as personal ornaments made from animal teeth. Red mineral is used in the rite, but in varying degrees. In our opinion, the burials of the second and third groups at Ust-Zelinda-2 may reflect the changes and variants of the Isakovo traditions.

Conclusions

We have identified at least three main chronological groups of burials left by the population inhabiting the Zelinda estuarine area in the Neolithic (see Fig. 2, *2*, *3*; 4). By age, burial 12 at the Ust-Zelinda-2 cemetery is comparable with the Early Neolithic burial ground at Sosnovy Mys, and fits into the range of 7499–7317 cal BP (5550–5368 cal BC).

The burials of the second chronological group, the most numerous, belong to a fairly long period of 7157–6555 cal BP (5208–4606 cal BC). These are diverse in burial practices, and apparently reflect several episodes in the ritual development in the Zelinda mouth area. Cultural identification of the Ust-Zelinda-1 burials is complicated by the use of post-mortem manipulations with the body and/or the disturbance of all the complexes.

No burials contemporaneous to the graves of the second chronological group of Ust-Zelinda-1 and -2 have been identified among the Southern Angara burials. This group falls into the period of the so-called hiatus in the cultural development of the Baikal regions (Weber et al., 2006, 2016). However, according to a number of features, these burials most closely correspond to the Isakovo cultural tradition and, apparently, precede the appearance of classic complexes on the Southern Angara ("proto-Isakovo"). If this point of view is confirmed in the future, then it would be appropriate to return to Okladnikov's arguments for the periodization of the Baikal Neolithic, in which this researcher assigned the Isakovo complexes to the earlier period on the basis of a more archaic appearance of their material culture (blade-sided tools, massive side-scrapers) (Okladnikov, 1950: 176–183).

Burial 22 at Ust-Zelinda-2 has been classified into the third chronological group (5718–5583 cal BP (3769–3634 cal BC)); in terms of burial practice, specific grave goods, and radiocarbon age, it is closest to the classic Isakovo traditions of the Southern Angara area. The specificity of the vessel from this burial can

be considered a reliable cultural marker of this ceramic tradition in the region.

Until ^{14}C-dates on the bones of herbivorous animals are obtained, determination of the boundaries of radiocarbon chronology of the Neolithic graves at Ust-Zelinda-2 cannot be considered completed, although new data will hardly change the relative position of the complexes. Generation of new radiocarbon determinations will make it possible to establish the effect and magnitude of the FRE for the Neolithic in the Keul-Zhevakan archaeological microdistrict, and more reasonably distinguish groups on the basis of the chronology of complexes of the Middle Holocene and hiatus period in the cultural-chronological sequence of the Baikal-Yenisei region.

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References

Bazaliiskii V.I. 2012
Pogrebalniye kompleksy epokhi pozdnego mezolita – neolita Baikalskoy Sibiri: Traditsii pogrebeniy, absolyutniy vozrast. In *Izvestiya Laboratorii drevnikh tekhnologiy*, iss. 9. Irkutsk: Irkut. Gos. Tekh. Univ., pp. 43–101.

Bazaliiskii V.I., Goriunova O.I. 2017
Keramika iz isakovskikh pogrebeniy mogilnika Ust-Ida I v Pribaikalye. In *Problemy arkheologii, etnografii i antropologii Sibiri i sopredelnykh territoriy*, vol. XXIII. Novosibirsk: Izd. IAET SO RAN, pp. 30–33.

Berdnikov I.M. 2013
Klyucheviye aspekty istoriko-kulturnykh protsessov na yuge Sredney Sibiri v epokhu neolita (po materialam keramicheskikh kompleksov). *Izvestiya Irkutskogo gosudarstvennogo universiteta*. Ser.: Geoarkheologiya. Etnologiya. Antropologiya, No. 1: 203–229.

Berdnikov I.M., Krutikova K.A., Dudarek S.P., Berdnikova N.E., Sokolova N.B. 2020
K probleme khiatusa – pereryva v pogrebalnykh traditsiyakh neoliticheskogo naseleniya Pribaikalya. In *Aktualniye problemy nauki Pribaikalya*. Irkutsk: Irkut. Gos. Univ., pp. 15–20.

Berdnikov I.M., Krutikova K.A., Dudarek S.P., Berdnikova N.E., Sokolova N.B. 2021
K voprosu o srednem neolite Baikalo-Yeniseiskoy Sibiri. *Severniye arkhivy i ekspeditsii*, vol. 5 (1): 33–55.

Boguchanskaya arkheologicheskaya ekspeditsiya: Ocherk polevykh issledovaniy (2007–2012 gody). 2015
Novosibirsk: Izd. IAET SO RAN. (Tr. BAE; vol. 1).

Bronk Ramsey C. 2009
Bayesian analysis of radiocarbon dates. *Radiocarbon*, vol. 51 (1): 337–360.

DeNiro M.J. 1985
Postmortem preservation and alteration of in vivo bone collagen isotope ratios in relation to palaeodietary reconstruction. *Nature*, vol. 317: 806–809.

Garkusha Y.N., Grishin A.E., Marchenko Z.V., Kazakova E.A., Dudko A.A. 2012
Issledovaniye raznovremennoy stoyanki i neoliticheskogo mogilnika Ust-Zelinda-1 (Severnoye Priangarye). In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XVIII. Novosibirsk: Izd. IAET SO RAN, pp. 437–441.

Grevtsov Y.A., Lysenko D.N., Galukhin N.N. 2010
Spasatelniye raboty Beryambinskogo otryada Boguchanskoy arkheologicheskoy ekspeditsii IAET SO RAN v 2010 godu. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XVI. Novosibirsk: Izd. IAET SO RAN, pp. 509–514.

Grishin A.E., Garkusha Y.N., Marchenko Z.V. 2011
K probleme vydeleniya kultur epokhi neolita v Severnom Priangarye. In *Trudy III (XIX) Vseros. Arkheol. syezda v St. Russe*, vol. I. St. Petersburg: IIMK RAN, pp. 127–129.

Grishin A.E., Marchenko Z.V., Garkusha Y.N., Gurulev D.A., Shnaider S.V., Kulik N.A., Vasiliev S.K., Kerbs E.A. 2016
Stoyanka Pashina v Severnom Priangarye (issledovaniya 2008–2009 godov). Novosibirsk: Izd. IAET SO RAN. (Tr. BAE; vol. 2).

Kogai S.A., Berdnikov I.M. 2013
Neoliticheskiye materialy mestonakhozhdeniya Derevnya Martynova (Severnoye Priangarye). *Izvestiya Irkutskogo gosudarstvennogo universiteta*. Ser.: Geoarkheologiya. Etnologiya. Antropologiya, No. 2: 124–136.

Lysenko D.N., Matveeva V.E., Reis E.S. 2011
Predvaritelniye itogi polevykh issledovaniy poselencheskogo kompleksa Khedugin Ruchey v 2011 godu. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XVII. Novosibirsk: Izd. IAET SO RAN, pp. 427–431.

Makarov N.P. 2008
Karaulnenskiy arkheologicheskiy mikrorayon na Srednem Yeniseye: Problemy khronologii i kulturnoy interpretatsii. In *Vremya i kultura v arkheologo-etnograficheskikh issledovaniyakh drevnikh i sovremennykh obshchestv Zapadnoy Sibiri i sopredelnykh territoriy: Problemy interpretatsii i rekonstruktsii*. Tomsk: Agraf-Press, pp. 138–145.

Makarov N.P. 2013
Stoyanka Ust-Karabula i voprosy arkheologii Severnogo Priangarya. In *Arkheologicheskiye issledovaniya drevnostey Nizhney Angary i sopredelnykh territoriy*. Krasnoyarsk: Krasnoyar. kr. krayeved. muzey, pp. 130–175.

Marchenko Z.V., Garkusha Y.N., Grishin A.E. 2012
Issledovaniya na mogilnike Ust-Zelinda-2 v 2012 godu. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XVIII. Novosibirsk: Izd. IAET SO RAN, pp. 455–460.

Nomokonova T., Losey R.J., Goriunova O.I., Weber A.W. 2013
A freshwater old carbon offset in Lake Baikal, Siberia and problems with the radiocarbon dating of archaeological sediments: Evidence from the Sagan-Zaba II site. *Quaternary International*, vol. 290/291: 110–125.

Okladnikov A.P. 1950

Neolit i bronzoviy vek Pribaikalya, pt. 1, 2. Moscow, Leningrad: Izd. AN SSSR. (MIA; No. 18).

Reimer P., Austin W., Bard E., Bayliss A., Blackwell P., Bronk Ramsey C., Butzin M., Cheng H., Edwards R., Friedrich M., Grootes P., Guilderson T., Hajdas I., Heaton T., Hogg A., Hughen K., Kromer B., Manning S., Muscheler R., Palmer J., Pearson C., van der Plicht J., Reimer R., Richards D., Scott E., Southon J., Turney C., Wacker L., Adolphi F., Büntgen U., Capano M., Fahrni S., Fogtmann-Schulz A., Friedrich R., Köhler P., Kudsk S., Miyake F., Olsen J., Reinig F., Sakamoto M., Sookdeo A., Talamo S. 2020

The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal kBP). *Radiocarbon*, vol. 62: 725–757.

Rogovskoi E.O. 2008

Otchet ob arkheologicheskikh razvedochnykh issledovaniyakh v 2007 godu v doline Angary, na uchastke ot g. Ust-Ilimska do granits s Krasnoyarskim krayem, v zone zatopleniya Boguchanskim vodokhranilishchem (Irkutskaya chast), vol. 1. Irkutsk. *Arkhiv Tsentra po sokhraneniyu istoriko-kulturnogo naslediya Irkut. obl.* Inv. No. 853/I.

Rogovskoi E.O. 2012

Otchet ob arkheologicheskikh rekognostsirovochnykh rabotakh v zone zatopleniya vodokhranilishcha Boguchanskoy GES po r. Angare v Ust-Ilimskom rayone Irkutskoy oblasti v 2011 g.: In 5 vols. Novosibirsk. *Nauchniy arkhiv IAET SO RAN.* F. 1, Inv. 1, D. 773–777.

Saveliev N.A. 1989

Neolit yuga Sredney Sibiri: (Istoriya osnovnykh idey i sovremennoye sostoyaniye problemy): Cand. Sc. (History) Dissertation. Novosibirsk.

Saveliev N.A., Dudarek S.P., Timoshchenko A.A., Lokhov D.N. 2020

Mogilnik Sosnoviy Mys v Severnom Priangarye: Analiz pogrebalnogo obryada i rezultaty radiouglerodnogo datirovaniya. *Izvestia Irkutskogo gosudarstvennogo universiteta*. Ser.: Geoarkheologiya. Etnologiya. Antropologiya, vol. 34: 3–37.

Schulting R.J., Bronk Ramsey C., Goriunova O.I., Bazaliiskii V.I., Weber A. 2014

Freshwater reservoir offsets investigated through paired human-faunal ^{14}C dating and stable carbon and nitrogen isotope analysis at Lake Baikal, Siberia. *Radiocarbon*, vol. 56(3): 991–1008.

Weber A.W., Beukens R.P., Bazaliiskii V.I., Goriunova O.I., Saveliev N.A. 2006

Radiocarbon dates from Neolithic and Bronze Age hunter-gatherer cemeteries in the Cis-Baikal Region of Siberia. *Radiocarbon*, vol. 48 (1): 127–166.

Weber A.W., Bronk Ramsey C., Schulting R.J., Bazaliiskii V.I., Goriunova O.I. 2021

Middle Holocene hunter-gatherers of Cis-Baikal, Eastern Siberia: Chronology and dietary trends. *Archaeological Research in Asia*, vol. 25.

Weber A.W., Schulting R.J., Bronk Ramsey C., Bazaliiskii V.I., Goriunova O.I., Berdnikova N.E. 2016

Chronology of middle Holocene hunter-gatherers in the Cis-Baikal region of Siberia: Corrections based on examination of the freshwater reservoir effect. *Quaternary International*, vol. 419: 74–98.

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Classic Samarra Painted Pottery from Yarim Tepe I, the Neolithic of Northern Iraq

This study focuses on the Classic Samarra painted ware from the Standard Hassuna layer at Yarim Tepe I, in Northern Iraq. Two groups of imports are described. The first consists of Classic Samarra, apparently related to Central Mesopotamia; the second, of Samarra Ware imported from the west. It is hypothesized that the Samarra pottery was imported not only from the center to various parts of the periphery, but also from one part of the periphery to another. As a result of comparison of the ceramics, a hypothesis is proposed that Classic Samarra was formed based on a symbiosis of two earlier cultural groups: the Proto-Hassuna period in Northern Mesopotamia, and Neolithic traditions originating from Central Zagros.

Keywords: *Neolithic Mesopotamia, Samarra pottery, ceramic technology, turntable, Yarim Tepe I.*

Introduction

The formation in the last quarter of the 7th millennium BC in Central Mesopotamia of the Samarra culture, which is known for its high-quality painted pottery with rich geometric, anthropo- and zoomorphic ornamentation, is one of the mysteries of Mesopotamian archaeology of the Late Pottery Neolithic. The archaeological materials from the main sites of the Samarra culture are subdivided into two periods: Classic Samarra (coinciding with the period of existence of the Hassuna culture in the north of Mesopotamia) and Late Samarra or the CMT (Chogha Mami Transitional) period (coinciding with the time of the Early Halaf sites in the north, and Early Ubaid (Ubaid 0 period) in the south of Mesopotamia) (Oates, 2003).

Pottery from the Early Classic Samarra period is decorated with carvings and paintings (Ippolitoni, 1970–71). The latter are the most recognizable, but the origin of this tradition and its relationship to Hassuna is unclear. However, there are sites where Hassuna pottery is found together with Samarra pottery. It has been hypothesized that the Samarra tradition developed in parallel with the Hassuna one, during the period of the Proto-Hassuna in the Upper Mesopotamia (Oates, 2003), or that the Samarra Ware was a "chic" variety of Hassuna ceramics (Braidwood, 1945: 258; Perkins, 1949: 15). Another hypothesis holds that the Samarra ceramic style was formed on the basis of the Neolithic traditions of southern Iran (Fars Province) (McCown, 1942: 35); however, its relationships with the hinterland of the Central Zagros and the culture associated with Charmo (Jarmo) style ceramics has been denied (Mortensen, 1964: 36).

There are different points of view on whether the Samarra pottery of the Classic Samarra period, available at non-Samarra settlements, was imported (Lloyd, Safar, 1945: 282), or produced locally (Blackham, 1996), or whether only part of it was imported (Odaka, 2003).

The aim of this article is to describe the Classic Samarra pottery on the basis of the artifacts from the Yarim Tepe I settlement, get a better understanding of its origin, and identify various centers of its manufacture.

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Fig. 1. Map of the sites mentioned in the article.

History of studies of the Samarra culture

Overview of the main sites of the Samarra culture and the spread of the influence of its pottery style

Classic Samarra Neolithic pottery was first discovered in 1911, during excavations of the city of Samarra in Central Mesopotamia, one of the capitals of the Abbasid Caliphate (Herzfeld, 1930). Most materials of the Samarra culture of the Classic period were studied at the settlement of Tell es-Sawwan (es-Sawwan)* (Fig. 1). This settlement is located in the Tigris River valley, a few kilometers south of the settlement of Samarra, and yielded the earliest items of the Samarra culture (Breniquet, 1991, 1992). In the Euphrates River valley, not far from the border between Syria and Iraq, another Samarra site is located, Tell Baghouz (Baghouz) (Nieuwenhuyse, 1999; Nieuwenhuyse et al., 2001; Odaka, 2003: 25–27). The Samarra settlements of Chogha Mami, Serik, and Safar, with younger materials from the Samarra culture (CMT period), were located in the Diyala River basin (Oates, 1968, 1969, 1987).

Along with the original area of the Samarra culture (Central Mesopotamia), scholars usually identify a zone of distribution of the Samarra products and imitations that coincides in Upper Mesopotamia with the area of the Hassuna culture and is designated as Northern Samarra (Gut, 1995). The main sites of the Hassuna culture, which also contain Samarra pottery, are located on the territory of Northern Iraq. These are classic Hassuna settlements: Hassuna (Lloyd, Safar, 1945: 281) and Yarim Tepe I (Merpert, Munchaev, 1993: 87–88), the lower layers of the large stratified settlements of Nineveh (Gut, 1995; Perkins, 1949) and Arpachiyah (Mallowan, Rose, 1935: 10–29), as well as many unexcavated settlements located near the Sinjar Range and on the banks of the Tigris (Tomson, 1969: 71–74).

The settlements of Matarrah (Braidwood, Howe, 1960: 26, 35–37; Odaka, 2019), Shimshara (Mortensen, 1970: 62–63, 76), Said (Seid) Ahmadan (Tsuneki et al., 2015), and Nader (Kopanias et al., 2013), with Samarra pottery, were investigated in the Little Zab River basin, in the eastern part of Upper Mesopotamia.

To the west of this zone, Samarra pottery has been found at settlements in Syria: Chagar Bazar, Halula (Cruels, 2008: 674, 685), Boueid II (Suleiman, Nieuwenhuyse, 1999), and Sabi Abyad I (Le Mière, Nieuwenhuyse, 1996).

The northernmost sites with Hassuna and Samarra materials were found in southeastern Turkey, in the foothills of the Taurus: the settlement of Hakemi Use (Tekin, 2012: Fig. 44.8; 2021) and Takyan Höyük (Takyan) (Kozbe, 2013); beyond the Euphrates, settlement of Coba Höyük (Coba (Sakçagözü)), with fragments of Samarra ceramics (Taylor, Seton-Williams, Waechter, 1950: 56).

Subsequently, the Halaf culture, with its clear Samarra features in the ceramic traditions (Amirov, 2019: 425; Amirov, 2018; Oates, 2003: 415), was practiced in this area.

In the first half of the 6th millennium BC, the influence of the Late Samarra (CMT) culture extended far beyond its original territory into southern Mesopotamia. It is indicated by the materials of settlements on the alluvial plain of Lower Mesopotamia (Amirov, (s.a.)). The

*Hereinafter, in parentheses, an alternative name of the site indicated on the map is provided.

traditions of Samarra pottery manufacture had some effect on the production of the earliest pottery in the alluvial zone of southern Mesopotamia, which was observed in the materials of Tell el-'Oueili (Awayli) in the Larsa region (Lebeau, 1987; Larsa…, 1987; 'Oueili…, 1991). It is generally accepted that the decorative features of the ceramics of the Early Ubaid culture of the Ubaid 0 period were formed under the influence of the Samarra culture (Blackham, 1996: 1). Features of the Samarra culture are recorded in the foothills of the Southern Zagros, in modern Iran, in particular, at the Remremeh settlement in the Mehran Plain (Darabi et al., 2020: 50) and at the settlement of Chogha Sefid (Black-on-Buff pottery) in the Deh Luran Plain (Hole, 2011: 5).

Studies of the Samarra pottery

There are quite a number of descriptions of Samarra pottery, compiled by various researchers. They characterize items as covered with a layer of slip or light-colored, painted in colors ranging from red to black, but predominantly chocolate-brown (Campbell, 1992; Lloyd, Safar, 1945; Perkins, 1949). The surfaces of Samarra pottery from the foothills of the Taurus (in the very north of Upper Mesopotamia) are light-orange (buff) in color, most often not lightened (Tekin, 2012).

The most numerous Samarra pottery collection from Tell es-Sawwan was studied by F. Ippolitoni (1970–71). According to her observations, the lower construction horizons 1 and 2 of the settlements of Hassuna, Matarrah, and Shimshara yielded coarse unornamented pottery, "indistinguishable from Hassuna". Construction horizon 2 yielded the first few pieces of pottery with ornamentation made by incising and painting, which is typical of both the Hassuna and Samarra cultures. Construction horizon 3 (phases A and B) contained a lot of high-quality painted pottery, mostly with dense ornamentation, including anthropomorphic images, and a small amount of ceramics decorated with incises. These materials are designated as "Classic Samarra pottery".

Horizons 4 and 5 at Tell es-Sawwan contained, along with the Samarra ceramics, the Halaf ceramic imports (Ibid.). The paste of painted pottery usually contains a small amount of mineral inclusions, sometimes a fine plant admixture. The surface color varies from light-orange to greenish. The pottery has light coating, but slip is rare. The color of the painting varies from red-brown to dark-green, most often chocolate-brown, and depends on the firing (Ibid.: 123, 126).

The manufacturing technology of Samarra pottery has been most thoroughly studied on the basis of finds from Tell Baghouz (Nieuwenhuyse, 1999; Nieuwenhuyse et al., 2001). Samarra pottery contains a small amount of mineral admixture, and can be classified into several groups (Nieuwenhuyse et al., 2001: 153). It is assumed that during the construction of Samarra vessels, the basal part was most likely formed by pressing clay into the mold with the fingers; after that, it was built up with clay coils. The interior surface was smoothed with a flint or obsidian tool. The outer surfaces of the vessels are usually pale owing to re-oxidizing. Only a few fragments showed a greenish tint of the surface, which suggests firing at a temperature of over 1050 °C. The surfaces of most of the fragments are light-colored or simply well-smoothed, but not slipped. The researchers of the pottery from the site argued that the light color of the ceramic surface was due to the presence of salts in the clay composition, which rose to the surface in the process of liquid evaporation. The painting is monochrome, matte, and dense. The color of the painting is brown, black-violet, or purple. The brown color probably resulted from the use of magnetite during re-oxidizing or hematite during oxidizing firing. During the process of painting and at some stages of shaping of the Samarra ceramics, a turntable was probably used (Ibid.: 158). The most common are bowls. Scholars suggest that all Samarra pottery was made in the settlements (Nieuwenhuyse, 1999; Nieuwehuyse et al., 2001).

In the course of subsequent study, the Tell Baghouz ceramic collection was subdivided by the researcher into two technological groups: "import and imitation"—ceramics with a small amount of sand, fired at a high temperature, belongs to Classic Samarra; "localization"—ceramics with a large number of mineral inclusions, subjected to irregular firing, bearing a "unique" pattern (Odaka, 2003: 31–32).

Pottery of the Samarra appearance from Tell el-'Oueili in southern Mesopotamia was studied in order to identify raw materials and pigments that were used in painting*. The analysis showed that the Samarra pottery found at the settlement was not imported; it was local (Ubaid) production (Blackham, 1996: 2, 13).

Pottery from the settlement of Yarim Tepe I

The settlement of Yarim Tepe I is located near the Sinjar mountain range in Northern Iraq; it was excavated under the leadership of N.Y. Merpert and R.M. Munchaev. In the 6-meter thick cultural layer of the site, 12 construction horizons were identified, which show the sequence of the main Neolithic stages in the region: Proto-Hassuna, Archaic and Standard Hassuna (Munchaev, Merpert, 1981; Merpert, Munchaev, 1993; Petrova, 2016; Petrova, 2021).

*Relevant analyses were carried out by L.N. Courtiois and B. Velde (see: (Blackham, 1996)).

Research methodology

Analysis of all stages of the pottery technology included the following: composition of raw materials and pastes, techniques of vessel-shaping, surface treatment, firing (Bobrinsky, 1978), and decoration. The degree of ferruginization and sand-content in clay, and the sizes of natural mineral inclusions were determined in order to identify the differences in the traditions of raw material selection (Bobrinsky, 1999: 35–40; Lopatina, Kazdym, 2010). The degree of ferruginization was identified through re-firing small fragments in a muffle furnace at a standard temperature of 850 °C (Tsetlin, 2006). In the initial raw materials used for the pottery at the settlement, only very fine sand (0.1–0.3 mm) was found. If sand concentration does not exceed 10 %, it is assumed that the ceramic fragment was made of clay with a minor admixture of sand; the sand proportion of 20–30 % suggests a medium admixture of sand, the higher share indicates high sand-content.

The construction method was determined by the analysis of the direction of joints between individual clay elements in fresh horizontal and vertical cross-sections of ceramic samples. The presence of such joints indicates the use of the technology of hand application of slabs or coils (Bobrinsky, 1978: 139, 158, 174–184; Vasilieva, Salugina, 2010; Tsetlin, 2012; Roux, 2019: 164–166; Shepard, 1985: 184; Vandiver, 1987). With the use of slab technique, recorded on the studied ceramics, the joints were located at a small distance from one another and at a large angle to the walls of the vessel. However, the strong paddling inherent in the considered ceramics deformed (elongated) the joints.

The probability of applying the slip — an additional coating with clay of a different composition—was identified by the occurrence of cracks and losses on the layer's surface (Rue, 1981: 41; Shepard, 1985: 67). Special experiments were carried out to clarify the signs of slip coating.

The firing method was described by its type: oxidizing regime—with oxygen access, characterized by warm orange shades of surface and in a fracture; or red-oxidizing/semi-redox—without/with partial access of oxygen, characterized by cold gray shades of varying intensity. The terminal firing-temperatures were also determined: a heating temperature of 800 °C corresponds to uniform color of cross-section (Bobrinsky, 1999: 93–95; Volkova, Tsetlin, 2016; Rice, 1987: 343–344), temperatures above 1000 °C produce a green tint of the surface (Nieuwehuyse et al., 2001; Rice, 1987: 336).

Description of the material

The main (Hassuna) collection of pottery from the settlement of the Standard Hassuna period contains items of various shapes and purposes (tableware, containers for cooking and storing foodstuffs, etc.). This pottery has the following technological features: the predominant share is made of slightly ferruginous, medium-sandy clay; there are also items made of non-ferrous and ferruginous, slightly sandy clay; the composition of the clay in all finds shows an insignificant admixture of limestone. The paste of coarser products, like that of the pottery of the Proto-Hassuna and Archaic Hassuna periods, includes dung. The vessels were hand-made using the technique of double-layer slab application on base-mold, with subsequent paddling on it, which was typical of previous periods (Petrova, 2016, 2021). Many vessels are coated with a light slip, or are light-colored (this method had been used since the Archaic Hassuna period). The motifs are mostly painted with red paint, or incised. Firing was always carried out in an oxidizing environment, but its quality varied depending on the type of product and the firing device; at that time, two-tier furnaces were already widely used (Munchaev, Merpert, 1981), but not all products were fired in such furnaces.

At Yarim Tepe I, Samarra pottery appears at the boundary of horizons 6 and 5, in the layers of the Standard Hassuna period, and occurs up to the layers corresponding to the end of the settlement's existence (Merpert, Munchaev, 1971: 156–157; Merpert, Munchaev, 1973: 104). The greatest amount of pottery was recovered from horizons 5 and 4. The collection of Samarra ceramics deposited in the Institute of Archaeology of the Russian Academy of Sciences, consists of 55 fragments from 50 vessels*.

Among the Samarra ceramics from Yarim Tepe I, at least two groups of imported products, differing in the composition of the raw materials used, the firing mode, and, probably, their origin (Fig. 2–4), can be distinguished. The collection also includes vessels that can be interpreted as imitations of the Samarra pottery. Notably, authentic ceramics cannot always be distinguished from imitation, so for now I will not touch on this topic.

Classic Samarra pottery imports (see Fig. 2, 3) form the first group; most likely, they are associated with the main area of the Samarra culture—Central Mesopotamia. This category is the most numerous and shows a variety of elements and colors of the painted ornament, as well as technological features (differences in raw materials and surface coating methods). It is dominated by bowls (open vessels). Their diameters vary from 9 to 48 cm, but the diameters of the greater part of such vessels are in the range: 12–13, 16–18, and 21–24 cm. The potsherds thickness is in the range of 2–10 mm; however, within a single sherd, the thickness's variation does not exceed

*Two more Samarra vessels from Yarim Tepe I are kept in the collection of the Pushkin State Museum of Fine Arts (Moscow).

1–2 mm. The thickness of the fragments of four jugs (closed vessels with vertical necks) ranges from 4 to 13 mm, with diameters from 9 to 16 cm.

Classic Samarra pottery is made of four types of clays with an admixture of mineral inclusions: ferruginous–slightly ferruginous (predominant) (Fig. 5, *1*), strongly ferruginous slightly sandy (Fig. 5, *2*), non-ferruginous slightly sandy (Fig. 5, *3*), and ferruginous medium sandy (Fig. 5, *4*). The admixture of limestone in all types of clays is insignificant. Additional artificial impurities were not used.

Judging by the directions of joints between individual clay elements (see Fig. 2, *5*, *b*, *c*; 3, *5–8*) and the flow of the pottery paste inside the clay elements, vessels were constructed using the double-layer slab technique. The joints are strongly elongated, multi-layered, often poorly visible. Taking this into account, as well as the thin walls and flattened areas on the surface, it can be concluded that the vessel's surface was strongly paddled during shaping.

Traces of smoothing are almost invisible; it can be assumed that in some cases textile was used. In general, the entire surfaces of the vessels are light in color, which was achieved in various ways. Some items were made of non-ferrous clay (see Fig. 2, *1*, *a–c*). Several vessels were covered with slip, an additional layer of clay, probably mixed with a light-colored pigment (see Fig. 2, *2*, *b*). But in most cases, light coloring was performed, denser on the outer surface and less dense (but clearly visible, owing to uneven painting and paint-clots in surface irregularities) on the inner surface (see Fig. 2, *4*, *b*).

On a light surface, painting was made with brown (in most cases), red-brown, and orange paints. Painting is present on the outer surfaces of all the vessels, and on the very edge of the rim on the inner surface of half of the finds. It can be assumed that drawing horizontal lines on a number of items (in many cases, very close in several rows) was made on a turntable. On some products, joints between the beginning and the end of line are visible (see Fig. 2, *1*, *b*).

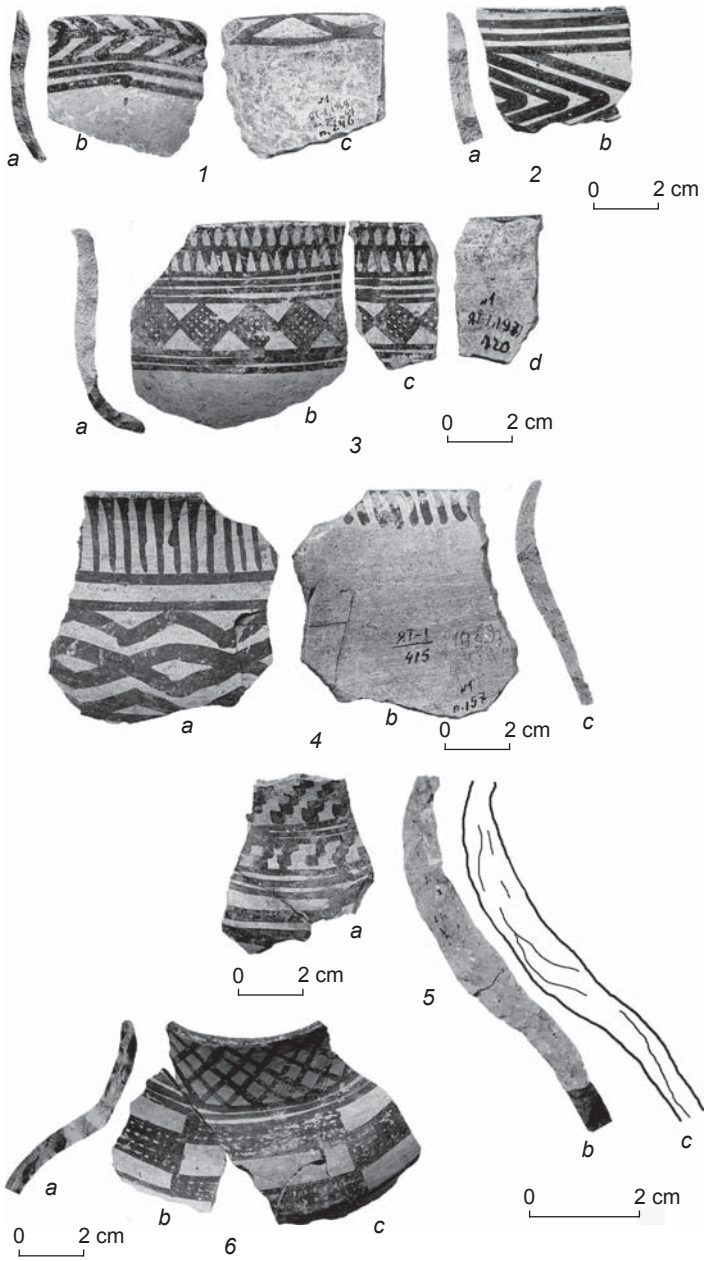

Fig. 2. Fragments of Classic Samarra imports. Yarim Tepe I.
1–4 – bowls: *2*, *4* – horizon 5, *3* – horizon 4, *1* – horizon 3; *5*, *6* – jugs: horizon 5.
Photo by A.A. Strokov.

Vessels were subjected to oxidizing firing regime: walls are calcined through in almost all of them; the firing temperature reached ca 800 °C, and in some cases ca 1000 °C. The use of a forge cannot be excluded.

Imports associated with Northwestern Mesopotamia form the second group (see Fig. 4). Among the finds from Yarim Tepe I, six fragments comparable with the ceramics from Tell Baghouz were noted. The ceramics of this group differ from the rest of the ceramics of the site by the grayish color (of varying degrees of intensity) of the surface and cross-section. Probably, these are fragments of bowls. Unlike the vessels of Classic Samarra, related to Central Mesopotamia, the walls of these items are thicker—from 6 to 11 mm.

All items are made of slightly ferruginous, highly sandy clay (see Fig. 4, *1*, *d*, *g*, *2*, *c*; 5, *5*), with the exception of one vessel made of slightly sandy clay. Artificial admixtures were not used. The construction method was the same as that used for manufacturing the vessels of Classic Samarra (double-layer slab

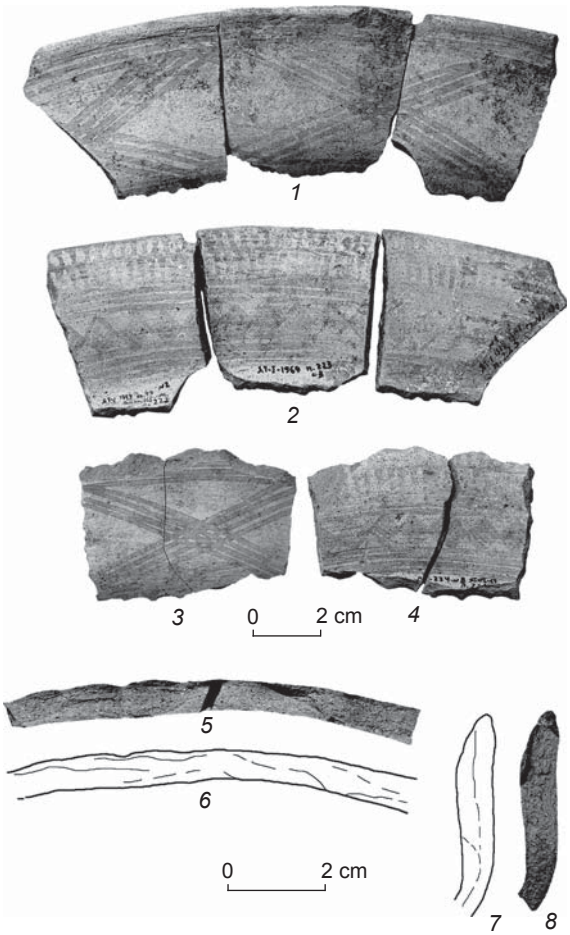

Fig. 3. Fragments of Classic Samarra imports – bowls. Yarim Tepe I. Horizon 4. *Photo by A.A. Strokov.*

technique, paddling). Traces of smoothing (with a cloth or a rough scratching-tool) were recorded only on the inner surfaces. Two fragments showed no surface coating. The surfaces of three vessels were painted with light paint. This is shown by the uneven layer of paint and its concentration in relief depressions, especially on the inner sides of the fragments (see Fig. 4, *1*, *b*, *2*, *b*). The items made of slightly sandy clay have a considerably thick slip coating (see Fig. 4, *3*). All products are ornamented with brown (almost black) paint. The grayish-greenish tint of varying degrees of intensity of the surface and cross-section indicates that firing was carried out in a red-oxidizing or semi-redox environment, at a temperature of ca 1000 °C.

Discussion

At the settlement of Yarim Tepe I, as early as the Archaic Hassuna period, Hassuna vessels were made using similar types of raw materials and the same methods of surface coating (light coloring, slip) as those used in the manufacture of Classic Samarra pottery. The double-layer slab technique for construction the Samarra ceramics was also used at the settlement earlier, during the Proto-Hassuna and Archaic Hassuna periods, and contemporaneously, during the Standard Hassuna period, in combination with the use of base-molds (Petrova, 2021). Samarra pottery revealed no traces of spacers or molds; however, it is difficult to imagine that a thin-walled vessel with two layers of slabs, with strong paddling, could have been manufactured without a mold.

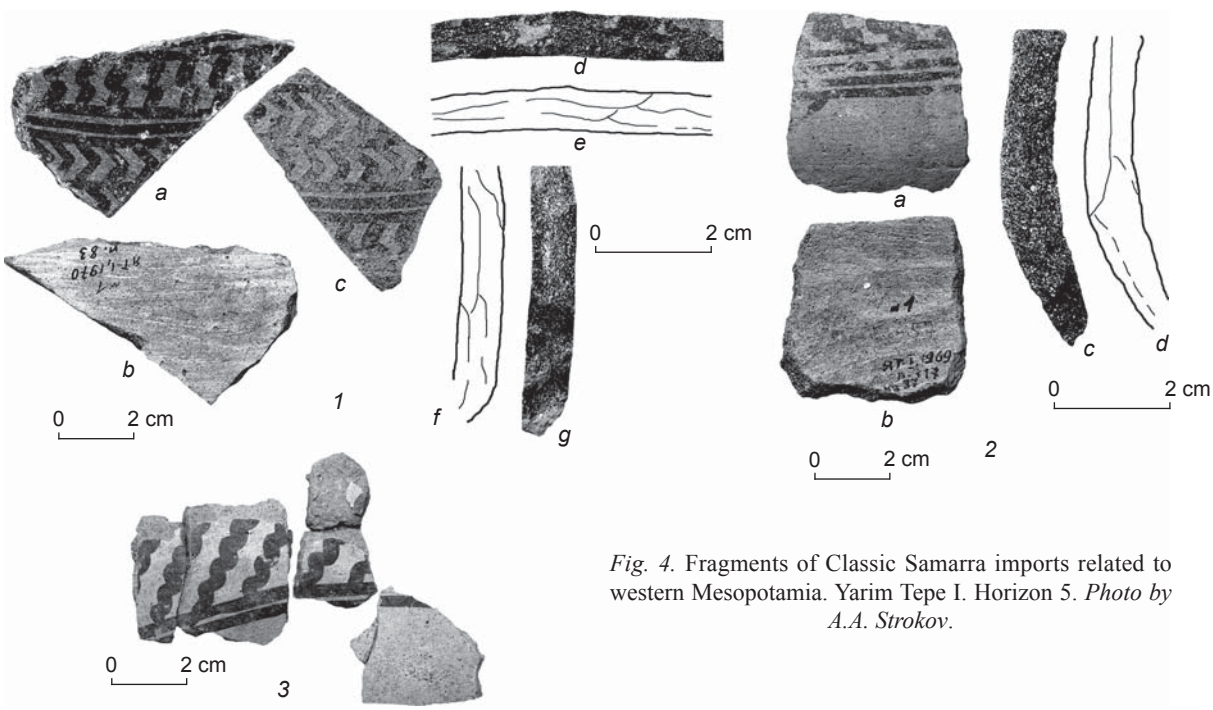

Fig. 4. Fragments of Classic Samarra imports related to western Mesopotamia. Yarim Tepe I. Horizon 5. *Photo by A.A. Strokov.*

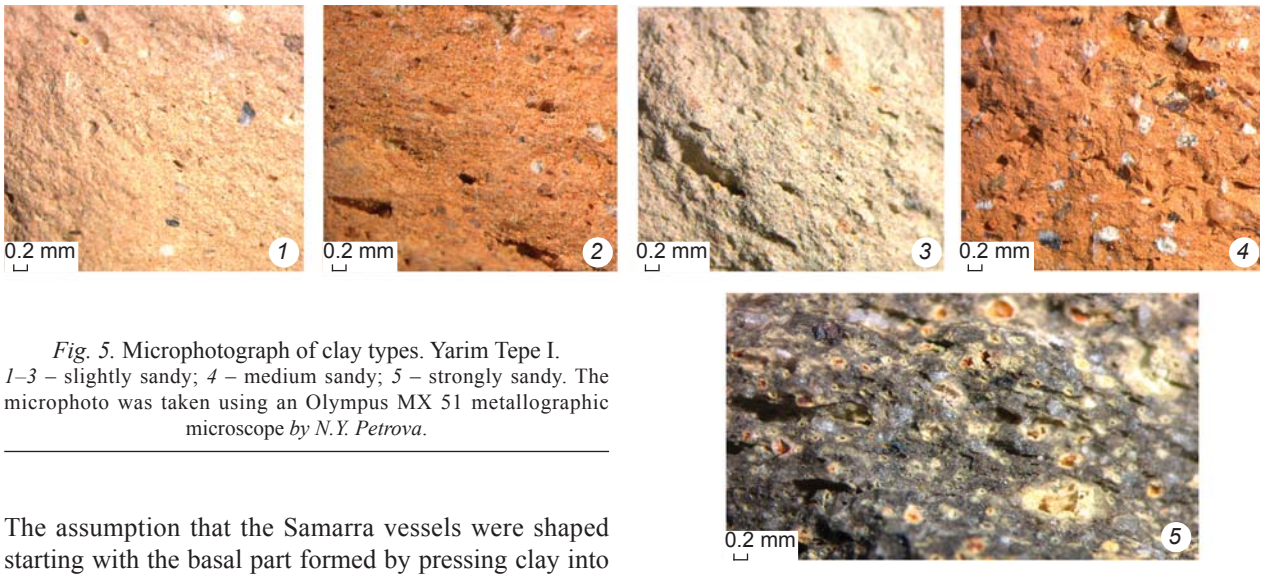

Fig. 5. Microphotograph of clay types. Yarim Tepe I.
1–3 – slightly sandy; *4* – medium sandy; *5* – strongly sandy. The microphoto was taken using an Olympus MX 51 metallographic microscope *by N.Y. Petrova*.

The assumption that the Samarra vessels were shaped starting with the basal part formed by pressing clay into the mold with the fingers, and then built up with clay coils (Nieuwenhuyse et al., 2001: 153), has not been confirmed by the Yarim Tepe I materials.

Possibly, the Samarra vessels, which were less elaborate and were imitations, were made at the site; but this issue requires further consideration.

In contrast to the Standard Hassuna ceramics, which, as noted above, partially continued the tradition of an earlier time (Petrova, 2016, 2021), the Samarra pottery was made without artificial impurities. The degree of paddling of the vessels and the uniform thickness of the walls of Samarra ceramics testify to a more developed method of manufacture than that of the Hassuna Ware. In addition, it is possible that a slow turntable appeared in the Classic Samarra period, used in drawing even parallel lines on surfaces. Some fragments show the joints between the end of the painted horizontal line and the point of its beginning (see Fig. 2, *1*, *b*). The distinctions are also observed in the color of painting. The Hassuna ceramics are mainly red, while the Samarra ware are brown, close to black, sometimes orange.

Given the differences in raw materials and ornamentation, it can be assumed that the imported Classic Samarra ceramics were manufactured in various places. The future studies of Yarim Tepe I ceramics by scientific methods will probably provide new data to prove this assumption, and to answer the question about the local or non-local origin of some of the products, including those that can be considered imitations.

There is no doubt about the non-local origin of the Samarra tradition, which involves red-oxidizing or semi-redox firing of pottery. Neither signs of the use of this type of firing, nor the raw materials for the manufacture of such ceramics were available at the settlement at the time under study or earlier. However, the pottery's features indicate Western origin; the sites in the western part of Upper Mesopotamia provide the evidence of this type of firing, which is represented by the ceramics known as DFBW (Dark Faced Burnished Ware). This firing-technology was used both at an earlier time and the time corresponding to the existence of the Samarra and Hassuna cultures (Balossi Restelli, 2006). Samarra vessels, similar to those recorded at Yarim Tepe I, are likely present at the Tell Baghouz site (Nieuwenhuyse et al., 2001; Odaka, 2003: 31–32). Several fragments of ceramics with large amounts of mineral admixture, subjected to redox firing regime, were also reported from the settlement of Tell es-Sawwan (Ippolitoni, 1970–71: 123, 126). However, this group of ceramics from the settlement of Yarim Tepe I includes one unusual artifact that was fired in a semi-redox environment, but was made from slightly sandy clay and slipped using the technique combining Eastern and Western traditions.

J. Oates's suggestion that the Samarra tradition originated from the Proto-Hassuna culture (2003: 409) is probably reasonable, given the common features in the pottery technology of Samarra products and the Proto-Hassuna and Archaic Hassuna ceramics (Petrova, 2016, 2021). In this regard, it is important to note that the carvings on early ceramics from Tell es-Sawwan (Ippolitoni, 1970–71) appearing in horizon 2 can also be traced on separate products of the Archaic Hassuna, and even from the preceding Proto-Hassuna time (for example, Tell Sotto).

The Samarra community of the period of Classic Samarra was likely formed by representatives of various cultural traditions. For example, the decorative style of ceramics from the settlement of Tell es-Sawwan (see, e.g., (Ibid.: Fig. I. 6, 8; X. 4)), located on the eastern bank of the Tigris River, to the west of the mountain pass to the Central Zagros valleys, was probably formed (as shown by the study's results) under the influence of the Guran ceramic style, developed on the basis of the

Charmo (Jarmo) style. The latter was widespread both in the inner part of Zagros (for example, the Guran Tepe in the Hulailan Valley (Mortensen, 2014: 60, fig. 66)), and in the area of exit from the mountain corridor into Central Mesopotamia (the settlement of Kah Sareh in the Sarpol-e-Zahab valley) (cf. (Alibaigi, Salimiyan, 2020: Fig. 6.*2*, *3*)). It was the place where the road from Ecbatana to Babylon passed through the valleys in Kermanshah Province, between the mountain ranges; in the Neolithic time, this road would have connected the valleys of the Central Zagros and the territory of Mesopotamia. The relationship with Zagros is also evidenced by the double-layer slab technique of vessel construction, which was identified in the ceramics of the first half of the 7th millennium BC at the settlements of Ali Kosh and Guran (Petrova, Darabi, 2022).

Conclusions

The issues discussed in this article are far from being fully resolved. However, it is clear that the culture of the Classic Samarra period was formed with participation of various cultural groups. Today it can only be assumed that these were the bearers of the traditions of the eastern part of Upper Mesopotamia during the Proto-Hassuna and Archaic Hassuna periods, as well as the representatives of the cultural traditions of the central part of the Zagros. It is interesting that ceramics with Classic Samarra ornaments (table vessels, e.g. bowls) were imported not only from the center to various parts of the periphery, but also from one part of the periphery, for example, from the western zone of Upper Mesopotamia, to another. All the noted phenomena and the relevant reasons require additional research, including field studies.

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References

Alibaigi S., Salimiyan A. 2020
Archaeological landscape of the Neolithic period in western foothills of Zagros mountains: New evidence from Sar Pol-e Zahab region, Iran-Iraq borderland. *Iraq*, vol. 7: 1–25.

Amirov S. 2018
The morphology of Halafian painted pottery from Yarim Tepe II, and the process of Ubaidian acculturation. In *II Workshop on Late Neolithic ceramics in Ancient Mesopotamia: Pottery in context*. Barcelona: Museu d'Arqueologia de Catalunya, pp. 15–24.

Amirov S.N. 2019
Syria. Kratkiy arkheologo-istoricheskiy ocherk ot paleolita do nachala epokhi ellinizma. In *Kavkazskiye gory i Mesopotamskaya step na zare bronzovogo veka: Sbornik v chest 90-letiya R.M. Munchaeva*. Moscow: IA RAN, pp. 423–445.

Amirov S.N. (s.a.)
Samarrskaya kultura. Ms.

Balossi Restelli F. 2006
The Development of "Cultural Regions" in the Neolithic of the Near East. The "Dark Faced Burnished Ware Horizon". Oxford: Archaeopress. (BAR Intern. Ser.; vol. 1482).

Blackham M. 1996
Further investigations as to the relationship of Samarran and Ubaid ceramic assemblages. *Iraq*, [vol.] LVIII: 1–15.

Bobrinsky A.A. 1978
Goncharstvo Vostochnoy Yevropy. Istochniki i metody izucheniya. Moscow: Nauka.

Bobrinsky A.A. 1999
Goncharnaya tekhnologiya kak obyekt istoriko-kulturnogo izucheniya. In *Aktualniye problemy izucheniya drevnego goncharstva*. Samara: Samara. Gos. Ped. Univ., pp. 5–109.

Braidwood R.J. 1945
Prefatory remarks. In *Lloyd S., Safar F. Tell Hassuna: Excavations by the Iraq Government Directorate of Antiquities in 1943-44.* Chicago: The Univ. of Chicago Press, pp. 255–259. (Journal of Near Eastern Studies; vol. 4 (4)).

Braidwood R.J., Howe B. 1960
Prehistoric investigations in Iraqi Kurdistan. Chicago: The Oriental Inst. of the Univ. of Chicago.

Breniquet C. 1991
Tell Es-Sawwan. *Réalités et problèmes, Iraq*, [vol.] LIII: 75–90.

Breniquet C. 1992
Rapport sur deux campagnes de fouilles à Tell Es-Sawwan, 1988-1989. *Mesopotamia*, [vol.] 27: 5–30.

Campbell S. 1992
Culture, chronology and change in the Later Neolithic of North Mesopotamia: PhD Thes. Edinburgh: Univ. of Edinburg.

Cruels W. 2008
The Proto-Halaf: Origins, definition, regional framework and chronology. In *Proceedings of the 5th Intern. Congress on the Archaeology of the Ancient Near East*. Madrid: pp. 671–689.

Darabi H., Mostafapour S., Yari A., Mohammadi F., Zeinali S., Shahverdi M., Fadaeian I. 2020
Investigating the Late Neolithic in the lowlands of Southwestern Iran: Sounding at the site of Remremeh, Mehran plain. In *Neo-Lithics 2020*. Berlin: Ex oriente, pp. 47–52.

Gut R.V. 1995
Das prähistorische Ninive. Zur relative Chronologie der frühen Perioden Normesopotamiens, Bd. 19. 355. Mainz am Rhein: Baghdader Forschungen.

Herzfeld E. 1930
Die vorgeschichtlichen Töpfereien von Samarra. Berlin: Dietrich Reimer (Ernst Vohsen).

Hole F. 2011
Interactions between Western Iran and Mesopotamia. From the 9th–4th Millennia B.C. *Iranian Journal of Archaeological Studies*, No. 1: 1–14.

Ippolitoni F. 1970–71
The pottery of Tell es-Sawwan – first season. *Mesopotamia*, [vol.] V/VI: 105–179.

Kopanias K., Beuger C., Carter T., Fox Sh., Hadjikoumis A., Kourtessi-Philippakis G., Livarda A., Magginnis J. 2013

The Tell Nader and Tell Baqrta Project in the Kurdistan Region of Iraq. Preliminary Report of the 2011 Season. *SUBARTU*, vol. 6–7: 23–57.

Kozbe G. 2013

The Later Neolithic in the Şirnak Area (Southeast Turkey). In *Interpreting the Late Neolithic of Upper Mesopotamia*. Turnhout: Brepols, pp. 479–492. (Papers on Archaeology from the Leiden Museum of Antiquities; [vol.] 9).

Larsa et 'Oueili (1983). 1987

Rapp. Prélim., J.L. Huot (ed.). Paris: Ed. Recherche sur les Civilisations.

Lebeau M. 1987

Aperçu de la céramique de la phase 'Oueili (Obeid 0). In *Larsa (10-e campagne, 1983) et 'Oueili (4-e campagne, 1983): Rapport préliminaire*. Paris: Ed. Recherche sur les Civilisations, pp. 95–120.

Le Mière M., Nieuwenhuyse O. 1996

The prehistoric pottery. In *Tell Sabi Abyad. The Late Neolithic settlement*. Istanbul: Nederlands historisch-archaeologisch instituut, pp. 119–284.

Lloyd S., Safar F. 1945

Tell Hassuna: Excavations by the Iraq Government Directorate of Antiquities in 1943-44. In *Journal of Near Eastern Studies*, vol. 4 (4). Chicago: The Univ. of Chicago press, pp. 255–331.

Lopatina O.A., Kazdym A.A. 2010

O yestestvennoy primesi peska v drevney keramike (k obsuzhdeniyu problemy). In *Drevneye goncharstvo: Itogi i perspektivy izucheniya*. Moscow: IA RAN, pp. 46–57.

Mallowan M.E.L., Rose J.C. 1935

Excavations at Tell Arpachiyah. *Iraq*, vol. III: 1–178.

McCown D.E. 1942

The comparative stratigraphy of Early Iran. Chicago: The Univ. of Chicago press. (Studies in Ancient Oriental Civilization; No. 23).

Merpert N.Y., Munchaev R.M. 1971

Rannezemledelcheskiye poseleniya Severnoy Mesopotamii (po materialam raskopok Sovetskoy ekspeditsii). *Rossiyskaya arkheologiya*, No. 3: 141–169.

Merpert N.Y., Munchaev R.M. 1973

Early agricultural settlements in the Sinjar plain, Northern Iraq. *Iraq*, vol. 35. Autumn: 93–113.

Merpert N., Munchaev R. 1993

Yarim Tepe I. In *Early Stages in the Evolution of Mesopotamian Civilization. Soviet Excavations in Northern Iraq*. Arizona: The Univ. of Arizona Press, pp. 73–114.

Mortensen P. 1964

Additional remarks on the chronology of early village-farming communities in the Zagros Area. *Sumer*, vol. 20: 28–36.

Mortensen P. 1970

Tell Shimshara. The Hassuna Period, vol. 5.2. Copenhagen: Munksgaard.

Mortensen P. 2014

Excavations at Tepe Guran. The Neolithic Period. Leuven, Paris, Walpole, Ma: Peeters.

Munchaev R.M., Merpert N.Y. 1981

Rannezemledelcheskiye poseleniya Severnoy Mesopotamii. Moscow: Nauka.

Nieuwenhuyse O. 1999

Tell Baghouz reconsidered: A collection of "Classic" Samarran sherds from the Louvre. *Syria*, [vol.] 76: 1–18.

Nieuwenhuyse O., Jacobs L., Van As B., Broekmans T., Adriaens A.M. 2001

Making Samarra fine ware – technological observations on ceramics from Tell Baghouz (Syria). *Paleorient*, vol. 27: 147–165.

Oates J. 1968

Prehistoric investigations near Mandali, Iraq. *Iraq*, vol. 30, 1 (Spring): 1–20.

Oates J. 1969

Choga Mami 1967-68: A preliminary report. *Iraq*, vol. XXXI, Autumn: 115–152.

Oates J. 1987

The Choga Mami transitional. In *Colloques internationaux CNRS*. Paris: Prehistore de la Mesopotamie, pp. 163–179.

Oates J. 2003

Samarran issues. In *Interpreting the Late Neolithic of Upper Mesopotamia*. Brepols: Brepols publ., pp. 407–416.

Odaka T. 2003

Samarra pottery in the National Museum of Aleppo, Syria. *Al-Rafidan*, vol. XXIV: 25–35.

Odaka T. 2019

Neolithic potsherds from Matarrah, Northern Iraq: The collection of the University Museum, the University of Tokyo. In *Decades in Deserts: Essays on Near Eastern Archaeology in Honor of Sumio Fujii*. Tokyo: Rokuichi Syobou, pp. 251–260.

'Oueili. 1991

Travaux de 1985, J.L. Huot (ed.). Paris: Ed. Recherche sur les Civilisations.

Perkins A.L. 1949

The comparative archaeology of Early Mesopotamia. Chicago: Univ. of Chicago Press.

Petrova N.Y. 2016

Tekhnologicheskoye izucheniye keramiki poseleniya Yarim-tepe I (periody Protokhassuny i Arkhaicheskoy Khassuny). *KSIA*, No. 242: 48–59.

Petrova N. 2021

Neolithic pottery technology of Sinjar Valley, Northern Iraq (Proto-Hassuna and Archaic Hassuna periods). In *Neolithic Pottery from the Near East. Production, Distribution and Use*. Analia-Istanbul: Koç University Press, pp. 213–228.

Petrova N., Darabi H. 2022

Analysis of Neolithic pottery technology along the Iranian Zagros foothills. *Documenta Praehistorica*, vol. XLIX: 2–27.

Rice P.M. 1987

Pottery Analysis. A Sourcebook. Chicago, London: Univ. of Chicago Press.

Roux V. in Collaboration with Courty M.A. 2019

Ceramics and Society. A Technological Approach to Archaeological Assemblages. Cham: Springer.

Rue O.S. 1981

Pottery Technology. Principles and Reconstruction. Washington: Taraxacum, Australian National Univ.

Shepard A.O. 1985

Ceramics for the Archaeologist. Washington: Carnegie Institution of Wash.

Suleiman A., **Nieuwenhuyse O. 1999**
A note on the Hassuna/Samarra site of tell Boueid II. *Neo-Lithics*. *A Newsletter of Southwest Asian Lithics Research*, vol. 1: 1–2.

Taylor J.D.P., Seton-Williams M.V., Waechter J. 1950
The excavation at Sakce Gözü. *Iraq*, vol. XII (2): 53–138.

Tekin H. 2012
The contribution of Hakemi Use to the prehistory of Upper Mesopotamia. In *Interpreting the Late Neolithic of Upper Mesopotamia*. Turnhout: Brepols Publ. n.v., pp. 493–502.

Tekin H. 2021
An overview of the Late Neolithic period of Southeastern Anatolia. *Journal of the Turkish Institute of Archaeology and Culture Heritage*, vol. 1: 49–78.

Tomson B.E. 1969
The archaeology of Northern Mesopotamia. A thesis submitted to the Faculty of the Department of Anthropology. Arisona: The Univ. of Arisona.

Tsetlin Y.B. 2006
Ob opredelenii stepeni ozheleznennosti iskhodnogo syrya dlya proizvodstva glinyanoy posudy. In *Voprosy arkheologii Povolzhya*, iss. 4. Samara: Nauch.-tekhnich. tsentr, pp. 421–425.

Tsetlin Y.B. 2012
Drevnyaya keramika. Teoriya i metody istoriko-kulturnogo podkhoda. Moscow: IA RAN.

Tsuneki A., Rasheed K., Saber S.A., Nishiyama Sh., Anma R., Ismail B.B., Hasegawa A., Tatsumi Y., Miyauchi Y., Makino M., Kudo Y. 2015
Excavations at Qalat Said Ahmadan, Suleimani, Iraq-Kurdistan: First interim report (2014 season). *Al-Rafidan*, vol. XXXVI: 1–63.

Vandiver P. 1987
Sequential slab construction: A conservative Southwest Asiatic ceramic tradition, ca. 7000-3000 B.C. *Paleorient*, No. 13 (2): 9–35.

Vasilieva I.N., Salugina N.P. 2010
Loskutniy nalep. In *Drevneye goncharstvo. Itogi i perspektivy izucheniya.* Moscow: IA RAN, pp. 72–87.

Volkova E.V., Tsetlin Y.B. 2016
K metodike izucheniya rezhimov obzhiga drevney keramiki. In *Traditsii i innovatsii v izuchenii drevneishei keramiki*. St. Petersburg: IIMK RAN.

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The Megalithic Tradition of East and Southeast Asia

We review the scholarship relating to the megalithic tradition of East and Southeast Asia and the results of its archaeological study. The major center of this tradition in East Asia is Korea, where it reveals considerable heterogeneity. In the Bronze Age, it is represented by dolmens and menhirs, and in the later periods by stone tombs, chambers, and pyramidal mounds. The latest megaliths are anthropomorphic statues of the Dolhareubang type, on Jeju Island off the southern tip of the Korean peninsula. Southeast Asian megaliths, which are described in detail, originate from similar structures in East and South Asia while being less known and less accurately dated, and revealing specific features of construction. Owing to the ethnographic sources on local peoples, Southeast Asian megaliths provide valuable data on their layout, function, and associated mythology. We demonstrate common features in megalithic traditions of East and Southeast Asia and their specificity in each region. Principal sources are described, and major trends in the study of megaliths in those territories are outlined. In sum, megaliths of East and Southeast Asia are an independent archaeological phenomenon requiring future studies.

Keywords: *East Asia, Southeast Asia, Korean Peninsula, megaliths, megalithic culture, chronology, burial practice.*

Introduction

Megaliths and megalithic complexes are one of the most spectacular categories of archaeological sites that accompanied ancient cultures from the Neolithic to the Middle Ages, and some traditional cultures documented by ethnographic evidence. The duration and scale of the works involved in creating these structures, as well as the importance of the social functions assigned to them, make it possible to use such terms as the "megalithic tradition" or "megalithic culture".

The classic typology of megaliths (menhirs, dolmens, cromlechs, etc.) was developed on the basis of sites in Western Europe, and was used by Europeans during their first acquaintance with megalithic complexes in East and Southeast Asia in the 18th and early 20th centuries.

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Further research revealed a much greater typological and functional diversity of structures with megalithic features, and proved the need for detailed study of this phenomenon.

In the Russian archaeology, there is some experience in analyzing megalithic complexes of the Bronze Age on the Korean Peninsula, the Jomon period in Japan, and sites of various periods in Indonesia on the Islands of Java and Bali (Nesterkina et al., 2017; Tabarev, Gavrilina, 2020; Tabarev et al., 2017). This experience fosters the study of the megalithic traditions in individual cultures, periods, and regions of East and Southeast Asia for clarifying their common and local features.

This article provides an overview of the sources, main results, and promising areas of research on megaliths in East and Southeast Asia. To study the whole variety of manifestations of the megalithic culture in East Asia, we need to consider the structures in Korea as the largest center of megalithic culture in that region.

The megalithic tradition of Southeast Asia (Vietnam, Laos, Cambodia, Indonesia, Philippines, and Malaysia) shows constructive-typological and functional diversity of structures. Therefore, to achieve its goal, this article will discuss the most important structures and complexes, and show that the Korean megalithic culture, which has been considered relatively homogeneous until now, has significant chronological and morphological variability, and finds some parallels in Southeast Asia.

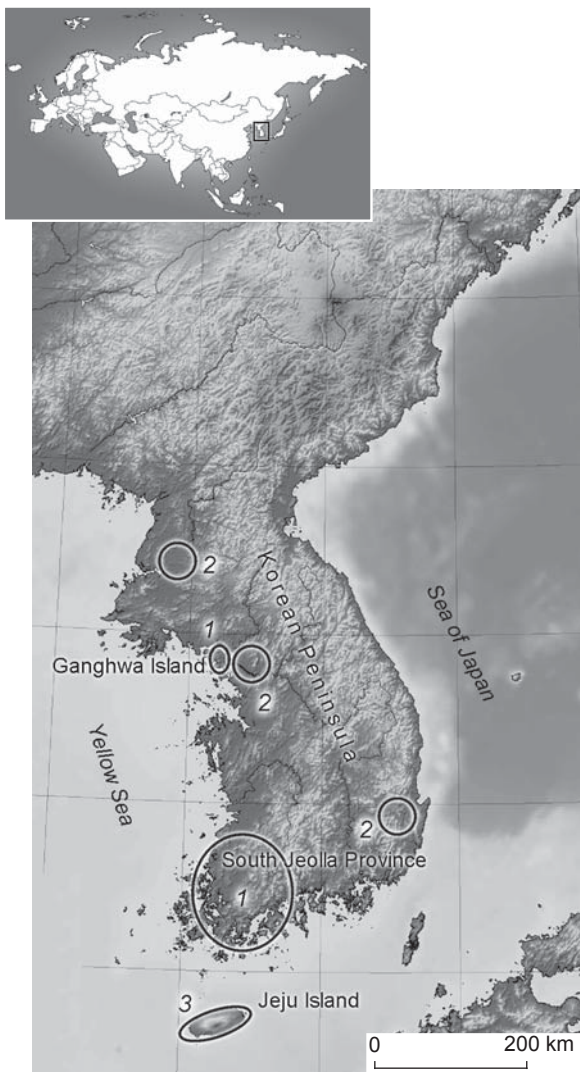

Fig. 1. Megalithic complexes on the Korean Peninsula. *1* – early megaliths (the dolmen culture); *2* – mound and under-mound complexes with megalithic features; *3* – anthropomorphic *Dolhareubang* statues.

Description of megalithic structures

Korean Peninsula

The megalithic tradition in East Asia flourished in the Bronze Age (10th–3rd centuries BC), when the Korean Peninsula became its main area (Li Yonmun, 2002: 258–260). According to preliminary data, over thirty thousand megalithic structures are concentrated there on a rather compact territory. The centers of the megalithic culture in Korea are Ganghwa Island in the west, and South Jeolla Province in the southwest (Fig. 1), although megaliths occur almost everywhere. The megaliths of the Korean Peninsula include dolmens and menhirs (Hanguk jiseokmyo …, 1999: 1203).

Although Korean dolmens are heterogeneous, differences in their structures do not imply chronological significance, since structures of several types often appear at the same site (Hado-ri on Ganghwa Island, Juklim-ri and Sanggap-ri in Geochang County, etc.). Along with classic dolmens (Fig. 2), the peninsula also has "non-classic" structures in the form of stone slabs and boulders, sometimes resting on low supporting stones (Fig. 3). Beneath some of the slabs, stone boxes or earthen pits have been discovered, which in rare cases contained the remains of the deceased. Korean scholars consider all dolmens on the peninsula to be burial sites (Hanguk jiseokmyo yeongu …, 2000: 9, 256, 261).

Anthropological evidence related to dolmens is scarce, so the question of the purpose of Korean megaliths is still open. It can be assumed that not all dolmens were burial structures. Some might have had a ritual and commemorative function, serving as centers for collective rituals of community, as is indicated by numerous pottery fragments associated with dolmens. The usual scarce burial goods of Korean megaliths provide little information about time of their creation, so the objects were dated to a wide chronological period in the Bronze Age.

The dating of the dolmens on Jeju Island deserves special attention. Since the island is located off the southeastern coast of the Korean Peninsula, far from the

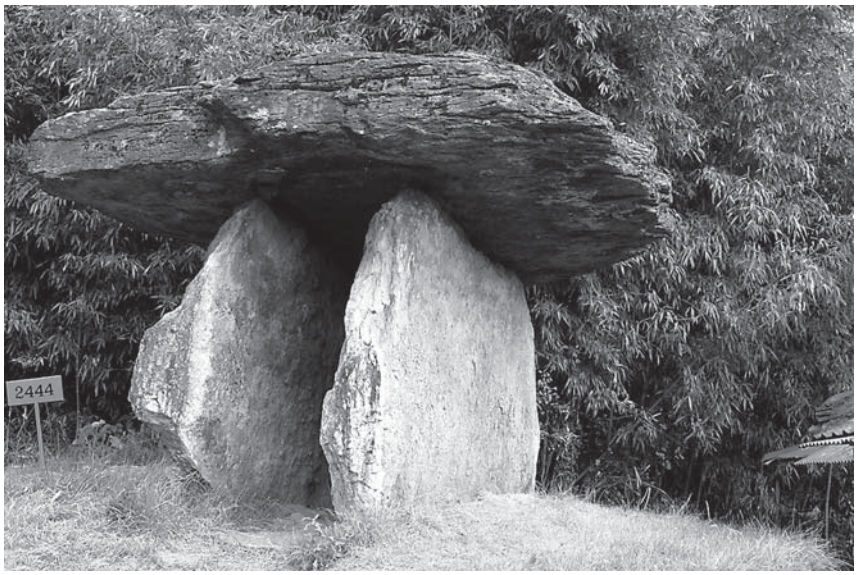

Fig. 2. Dolmen Dosan-ri in Geochang, North Jeolla Province, Republic of Korea. 2006. *Photo by A.L. Nesterkina*.

Fig. 3. Dolmens Hyosan-ri and Daesin-ri in Hwasun County, South Jeolla Province, Republic of Korea (Hwasun Hyosan-ri-wa…, 2015: Fig. 8).

main cultural and historical centers on the mainland, it is generally believed that many elements of traditional Korean culture were preserved on the island for a relatively long time, and dolmens functioned there until the Early Iron Age, longer than those on the peninsula (Ibid.: 139–140).

In the subsequent periods of the Iron Age and Middle Ages, megalithism manifested itself in the construction of mounds and under-mound structures, such as tombs, chambers, and pyramidal mounds (Seong Jeongyong, Seo Hyeonju, 2007: 261–270) (see Fig. 1). Notably, the anthropomorphic *Dolhareubang* sculptures have been discovered only on Jeju Island. These objects are full-size (1.3–1.8 m high) human-like statues (see Fig. 1, 4). There are forty-five such sculptures on Jeju Island. It is difficult to establish the exact time of their creation; historical sources mention their existence on the island in the 18th century. Thus, it can be concluded that individual elements of the megalithic tradition that originated in Korea during the Bronze Age have survived in some of its regions until the ethnographically modern period (Hwang Si-Kwon, 2019: 45–48).

Fig. 4. *Dolhareubang* statue (Hwang Si-Kwon, 2019: Fig. 8).

Continental and insular parts of Southeast Asia

The earliest manifestations of the megalithic culture in *Laos* include menhirs and chambers (3rd–1st millennium BC) in the northeast of the country, in Huaphan, Luang Namtha, Luang Prabang, Xienghuang, Sankongfan, and Keohintang provinces (Fig. 5). An important site is the complex, dating to the turn of the eras, called the "Plain of Jars" in Xienghuang Province. Over a thousand locations with three thousand megalithic urns have been discovered in its territory.

The "jars" of Laos were first mentioned by J. McCarthy (1888). In the 1930s, M. Colani conducted extensive archaeological research in the area. She cataloged and described nearly ten thousand megaliths, and proved the connection between stone urns and funerary rites (Colani, 1930). In the 21st century, archaeological excavations were continued at the site; its boundaries, as well as the number and degree of preservation of the objects, were clarified (Bergh, van den, 2008; Baldock, Bergh, van den, 2009).

A serious problem in the study of the stone urns is establishing their age. The most reliable date seems to be 500 BC–800 AD, which corresponds to the *Sa Huỳnh* archaeological culture, which area extended from the Mekong delta to the south of the Tonkin region (Colani, 1930).

In the north of Laos, the Hintang archaeological park is located, with 1500 vertically set flat menhir stones

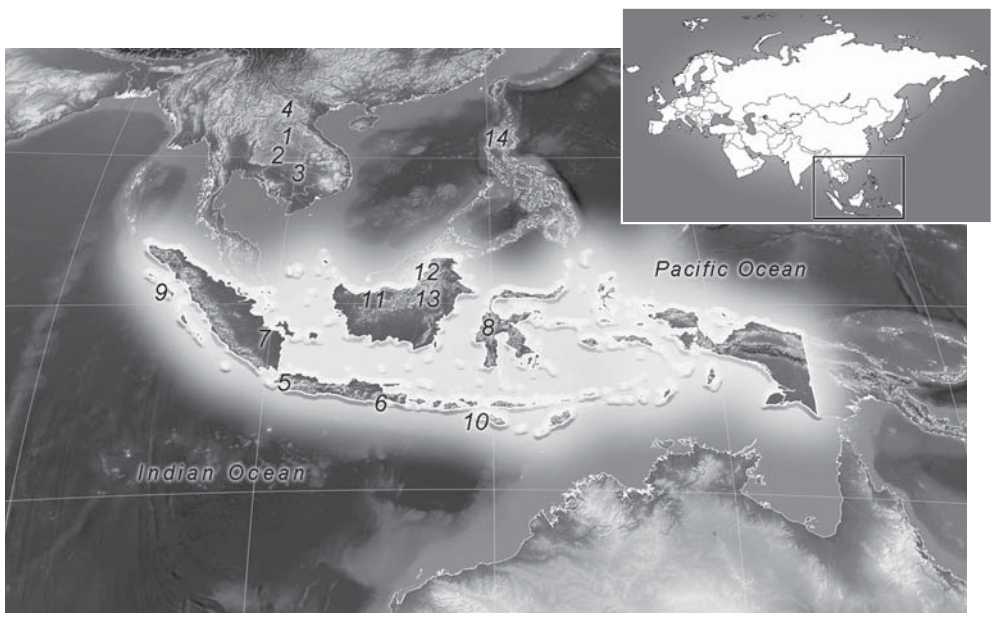

Fig. 5. Areas of megalithic complexes mentioned in this article in the continental and insular parts of Southeast Asia.

1 – Hintang, Laos; *2* – "Plain of Jars", Laos; *3* – Prasat Thom, Cambodia; *4* – Sa Pa, Vietnam; *5* – West Java, Indonesia; *6* – East Java, Indonesia; *7* – Pasemah, Indonesia; *8* – Bada Valley, Indonesia: *9* – Nias Island, Indonesia; *10* – Sumba Island, Indonesia; *11* – Sarawak Province, Malaysia; *12* – Sabah Province, Malaysia; *13* – North Kalimantan Province, Indonesia; *14* – North Luzon, Philippines.

reaching 3 m high, with large stone slabs covering grave-pits between the menhirs. The *Hintang* megalithic culture, like the Plain of Jars, was dated to the Bronze Age (3rd–2nd millennium BC) (Higham, 1989). On the basis of the evidence from excavations in Hintang Park, Colani suggested that the menhirs were associated with burial ceremonies, since ceramic burial urns were found in the pits (1930).

In Vietnam and Cambodia, only few classic megaliths are known. Notable archaeological sites in *Cambodia* include pyramidal temples made of brick and laterite: Baksei Chamkrong, Prasat Thom, etc.

The first studies of megaliths in *Vietnam* were carried out in 1927 (Bouchot, 1927). Various complexes have been discovered at Hang Gon (Fig. 6), Dong Pho, Chu Pa, Lam Kha, Vu Xa, Kim Boi, Tam Dao, Thien Ke, Nam Dan, Ban Thanh, Mau Son, Ta Van Giay, and Soc Son. M. Colani and L.M. Cadière studied the general attitude of the peoples of Vietnam towards stones. Describing medieval terracotta statues in the Thu Bon valley, Colani observed many cults of spiritual stones called "But" (the predecessors of the later "Kut")—decorated stones "coming out of the earth" (Cadière, 1911).

Noteworthy is the Sa Pa complex, discovered in 1925 in Northern Vietnam. It consists of stones with petroglyphs (Goloubew, 1929) and includes about two hundred stones, the largest of which is 15 m long and 6 m high. The subjects of the petroglyphs are diverse and include people, stilt-houses, and ritual symbols.

Megalithic structures in *Indonesia* have been known since 1842, when first descriptions of terraced rice-fields with the vertically set menhir stones in Salakdatar in West Java Province appeared (Soejono, 1969). Later, dolmens and stone sarcophagi were discovered in Eastern Java, stone sculptures in Sumatra (Pasemah Plateau), and urns and anthropomorphic sculptures in the Bada Valley on Sulawesi (Raven, 1926; Kruyt, 1932; Sarasin P., Sarasin F., 1905). There is information on megaliths on the small islands of the Indonesian Archipelago, such as Bali, Flores, Nias, Sumba, etc. (Fig. 7).

Some hypotheses have been proposed concerning the origin and time when these stone structures were created. R. Heine-Geldern suggested that megaliths appeared in Indonesia as a result of two waves of migration. Representatives of the first, Neolithic, wave 4500–3500 BP left mainly menhirs, dolmens, and stone terraces, while the second wave, corresponding to the Bronze and Early Iron Ages ca 2500 BP left stone sarcophagi, funerary urns, and tombs (Heine-Geldern, 1928). However, most of the accompanying archaeological evidence (iron and gold items, glass beads, Chinese porcelain), as well as radiocarbon dates, point to a later period from the 7th to the 16th century AD, which gave some scholars grounds to associate the construction of these objects with Indo-Buddhist influence. Indonesian archaeologists attribute the appearance of megaliths to the Final Neolithic ca 2500 BP (Steimer-Herbet, Besse, 2017).

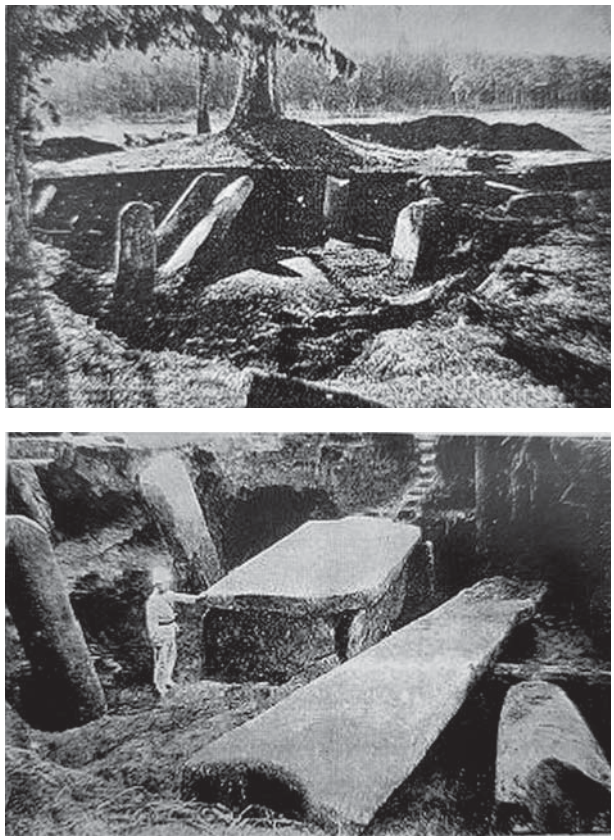

Fig. 6. Megalithic complex in Hàng Gòn, Vietnam (Bouchot, 1927: Ill. 10).

Fig. 7. Stone urn in the Bada Valley, Sulawesi, Indonesia (Heeckeren, van, 1958: Ill. 22).

Megaliths on Nias Island in the Gomo region were made not for burying the dead in them, but for indicating their social status. According to narrative tradition, all ancestral stories refer to the progenitor known as Hia

Walani Adu. He initiated the ceremony of erecting stone monuments (Duha, 2012; Pramaresti, 2018) associated with holding intergroup festivities, during which the representatives of the tribal elite distributed treats to all participants (Beatty, 1992; Feldman, 1988).

Megalithic heritage on Sulawesi Island is concentrated in the areas of Napu, Besokha, and Bada. Stone sculptures and huge cylindrical urns with massive lids are the most common type of object (Heeckeren, van, 1958). Analysis of the contents of the urns has shown the presence of only ashes and pottery fragments (Raven, 1926).

The anthropomorphic sculptures include both male and female figures with hypertrophied sexual characteristics. The face was rendered in a distinctive manner. Two handles on the sides of the head represent the ears; nose is straight; the bridge of the nose extends to the eyebrows; there is no mouth (except for one item found in the Bada Valley); the eyes are round, protruding, or slanting (Heeckeren, van, 1958).

Numerous megalithic tombs have been discovered on Sumba Island. The first information about them is contained in the works of R. Heine-Geldern (1936), G.P. Rouffaer (1937), H.G. Keith (1947), and A.N.J. van der Hoop (1932). Modern studies describe some regularities in the arrangement of tombs (see, e.g., (Steimer-Herbet, 2018)).

The monuments of megalithic culture appear widely on the Island of Java. Over two hundred sites with megaliths have been found in West Java Province alone. In 2019, West Java Province was visited by Russian scholars, who examined megalithic monuments of various types, including complexes with vertically set stones, pyramidal structures, and tiered monumental structures (Tabarev, Gavrilina, 2020) (Fig. 8).

Borneo/Kalimantan is the third largest (743,330 km^2) island in the world. It is currently divided between three countries—Brunei, Indonesia, and Malaysia. Targeted studies of megaliths have been carried out since the 1920s, predominantly in the Malaysian part in Sarawak and Sabah Provinces. Scholars have reported the presence of various megaliths, including menhirs (single and paired up to 1.0–1.2 m high), stone urns, bas-reliefs, as well as natural rocks and boulders of unusual shapes with ritual symbols among the *Kelabit* people (Banks, 1937; Mjöberg, 1925), and studied anthropomorphic sculptures and stones, set vertically inside and around settlements for protection against disease and epidemics (Evans, 1923).

Fig. 8. Megalithic complexes in West Java Province, Indonesia. *Photo by A.V. Tabarev*.

The British explorer T. Harrisson made the greatest contribution to the study of megaliths in the Malaysian part of the island. His works provide detailed information about the geographical areas of megalithic objects, as well as their number and diversity (Fig. 9). According to the observations of Harrisson, "megalithic activity" was an integral part of ritual practices and accompanied the most important events, such as feasts, weddings, and funerals. It was associated with the cultures of the Metal Age (first centuries of our era) and the cultures of historical time (starting from the 13th–14th centuries) (Harrisson, 1970, 1973; Harrisson, O'Connor, 1970).

Systematic study of megaliths in the vast Indonesian territory of Borneo has been carried out since the 1990s by French scholars in the Bahau River basin (North Kalimantan Province) (Arifin, Sellato,

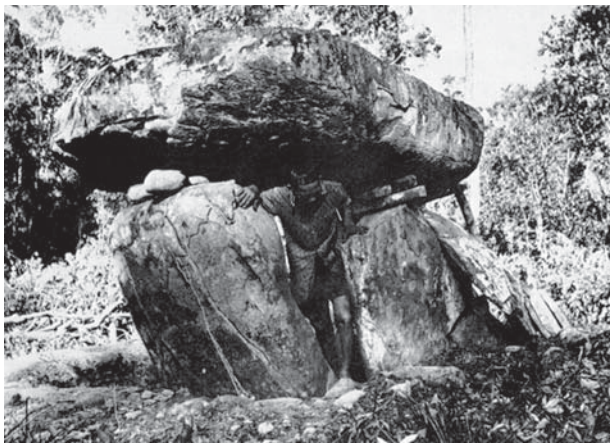

Fig. 9. Dolmen in Sarawak Province, Malaysia (Harrisson, 1973: Ill. 1).

Fig. 10. Dolmen with funeral urn, Kalimantan. *Photo by B. Sellato*.

Fig. 11. Dolmens with funeral urns, Kalimantan. *Photo by B. Sellato*.
1 – group of dolmens; *2* – single dolmen with a child burial.

2003). The researchers have discovered a large number of megalithic complexes created by the *Ngorek* group, which inhabited this territory in the first half of the 18th century.

Most of the megaliths are associated with funeral rituals and consist of the so-called dolmens with urns—structures of several vertically set stones 1.5–2.0 m high, covered with a horizontal slab (Fig. 10). Stone or ceramic urns up to 1 m high with the remains of the dead were placed inside these structures (Fig. 11, *1*). There are also miniature dolmens 0.2–0.4 m high, containing children's burials (Fig. 11, *2*). Sandstone used for manufacturing megaliths was processed exclusively with polished adze-like basalt tools (Sellato, 2016).

Other types of megaliths include rectangular funerary sarcophagi, steles with anthropomorphic and zoomorphic images in relief, and individually standing menhirs. A specific variant (the *aso* tradition) are huge (up to 30 m long) figures of real (crocodile) and mythological (dragon) animals made of earth and stones, which play the role of psychopomps (creatures accompanying the souls of the dead to the afterlife) and at the same time serve as symbols of fertility (Schneeberger, 1979).

In the *Philippines*, no classic menhirs, dolmens, or cromlechs have been found. The common opinion is that in the Philippines the megalithic culture is very poorly represented, if not absent entirely (Beyer, 1948). Nevertheless, in the traditional culture of the local population, among the representatives of the *Igorot* ethnic groups in the mountainous regions in the north of Luzon Island, a number of public buildings and elements of agricultural systems made of stone are known, which fully correspond to the concept of "megalithic culture". The first type is *dap-ay*—an open area lined with stone slabs, with a hearth in the middle; it was a variant of the "men's house", where various problems in the life of community were solved. Some *dap-ay* are outlined with vertically set stone slabs reaching 2 m high; large river-boulders were placed as benches along the inner perimeter (Heine-Geldern, Vanoverbergh, 1929; Jensen, 1960; Evangelista-Leones, 2004). There is information on several tombs with "stone domes" among the *Ifugao* groups (Lambrecht, 1938). The second type is associated with the practice of large-scale modification of mountainous terrain; these are the *Ifugao* rice-terraces (included in the UNESCO World Cultural Heritage List). The edges of the terraces were reinforced with walls made of large stones going into the ground to a depth of 2 m. The amount of material and labor-costs during the construction of the walls was comparable to the construction of the Egyptian pyramids; therefore, they are traditionally considered as megalithic and monumental complexes (Beyer, 1955). Initially, the terraces were attributed to the 3rd–2nd millennia BC; but later, on the basis of research including radiocarbon dating, it was discovered that creation of various structural elements began in the 15th–17th centuries (Acabado, 2009).

Conclusions

The megalithic culture of East and Southeast Asia is a unique yet morphologically and chronologically heterogeneous phenomenon.

Although Korean megaliths of the Bronze Age, represented by dolmens, have been sufficiently well studied, studies aimed at identifying the diversity of both early Korean megaliths (dolmens) and later manifestations of megalithism (elements of burial mounds and under-mound structures) seem promising. An important task, of not only archaeological but also historical and ethnographic research should be clarification of the time when the *Dolhareubang* anthropomorphic statues on the Island of Jeju appeared.

Considering the subject of megalithic traditions, research on the continental and insular parts of Southeast Asia is promising. The megalithic traditions of this region, related in their origin to those of the adjacent regions of East and South Asia, show a number of peculiarities, such as degree of study resulting from the difficulty of detecting and analyzing the complexes, specific structural aspects, and problems of dating. However, precisely the megaliths of Southeast Asia make it possible to trace the specific details of their construction, as well as the purpose and mythological accompaniment of the complexes thanks to the ethnographical data of the local peoples. Research based on archaeological and ethnographic approaches will be especially productive. In this regard, it is important to use the huge information capacity of publications on the initial period of studying the megaliths (18th–first half of the 20th century), which provide descriptions of the rituals and ceremonies associated with the megaliths, as well as photographs and sketches of objects that have been partially or completely destroyed by now. All this presupposes active international cooperation between archaeologists and ethnographers, aimed at studying Asian megaliths.

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References

Acabado S. 2009
A Bayesian approach to dating agricultural terraces: A case from the Philippines. *Antiquity*, vol. 83: 801–814.

Arifin K., Sellato B. 2003
Archaeological survey and research in four districts of Interior East Kalimantan. In *Social Science Research and Conservation Management in Interior Borneo: Unraveling Past and Present Interactions of People and Forests*. Jakarta: Center for Intern. Forestry Research, pp. 201–241.

Baldock J., Bergh J., van den. 2009
Geological mysteries of the plain of jars begin to unravel. *Geology Today*, vol. 25 (4): 145–150.

Banks E. 1937
Some megalithic remains from the Kelabit country in Sarawak with some notes on the Kelabits themselves. *Sarawak Museum Journal*, vol. 4: 411–438.

Beatty A. 1992
Society and Exchange in Nias. Oxford: Clarendon Press.

Bergh J., van den. 2008
Safeguarding the plain of jars, an overview. Recherches Nouvelles Sur Le Laos. In *New Research on Laos*. Vientiane, Paris: École française d'Extrême Orient, pp. 65–80.

Beyer H.O. 1948
Philippine and East Asian archaeology, and its relation to the origin of the Pacific islands population. *Bulletin of the National Research Council of the Philippines*, No. 29: 1–130.

Beyer H.O. 1955
The origin and history of the Philippine rice terraces. In *Proceedings of the Eighth Pacific Science Congress of the Pacific Science Association, 16–28 November 1953*, vol. 1. Quezon City: Univ. of the Philippines, pp. 387–397.

Bouchot J. 1927
Les Fouilles (des Xuan Loc). *Bulletin de la Société des études indochinoises*, No. 2: 155–156.

Cadière L.M. 1911
Le culte des pierres en Annam. *Missions Catholiques*, vol. 63 (2209–2218): 158–172.

Colani M. 1930
The megaliths of Upper Laos. Paris: École française d'Extrême-Orient.

Duha N.A. 2012
Omo Niha: Perahu Darat di Pulau Bergoyang. Gunungsitoli: Nias Heritage Foundation.

Evangelista-Leones S. 2004
The Bontok Igorot tribe: An internal scanning of its governance system. *Philippine Journal of Public Administration*, vol. XLVIII (1/2): 86–123.

Evans I.H.N. 1923
Studies in religion, folk-lore and custom in British North Borneo and the Malay Peninsula. Cambridge: Cambridge Univ. Press.

Feldman J. 1988
The seat of the ancestors in the homeland of the Nias People. In *Islands and Ancestors: Indigenous Styles of Southeast Asia*. New York: The Metropolitan Museum of Art, pp. 33–49.

Goloubew V. 1929
L'âge du Bronze au Tonkin et dans le Nord-Annam. *Bulletin l'École française d'Extrême-Orient*, vol. 29: 1–46.

Hanguk jiseonmyo (goindol) yujeok jonghap josa yeongu: Bunpo, hyeongsik, giwon, jeonpa mit sahoebogwon [Complex Study of Korean Dolmens: Distribution, Typology, Origins, Relations and Social Reconstruction]. 1999
Seoul, Munhwajaecheong [Cultural Heritage Administration of Republic of Korea], Seoul Daehakkyo banmulgwan [Seoul National University Museum]. (In Korean).

Hanguk jiseonmyo yeongu iron-gwa bangbeop: gyegeupsahoeui balsaeng [Theories and Methods of Dolmen Research in Korea: Emergence of Stratified Societies]. 2000
Seoul, Juryuseong: (In Korean).

Harrisson T. 1970
The prehistory of Borneo. *Asian Perspectives*, vol. XIII: 17–45.

Harrisson T. 1973
Megalithic evidences in East Malaysia: An introductory summary. *Journal of the Malaysian Branch of the Royal Asiatic Society*, vol. 46 (1): 123–139.

Harrisson T., O'Connor S.J. 1970
Gold and Megalithic Activity in Prehistoric and Recent West Borneo. Ithaca, New York: Cornell Univ. Southeast Asia Program.

Heeckeren H.R., van. 1958
The Bronze-Iron Age of Indonesia. S-Gravenhage: Martinus Nijhoff.

Heine-Geldern R. 1928
Die Megalithen Südostasiens und ihre Bedeutung für die Klärung der Megalithenfrage in Europa und Polynesien. *Anthropos*, vol. XXIII: 276–315.

Heine-Geldern R. 1936
Prehistoric research in Indonesia. *Annual Bibliography of Indian Archaeology*, No. 13: 26–38.

Heine-Geldern R., Vanoverbergh P.M. 1929
Der Megalithkomplex auf der Philippinen-Insel Luzon. *Anthropos*, vol. 24 (1/2): 317–321.

Higham Ch. 1989
The archaeology of Mainland Southeast Asia: From 10,000 B.C. to the fall of Angkor. Cambridge: Cambridge Univ. Press.

Hoop A.N.J., van der. 1932
Megalithic Remains in South Sumatra. Zutphen: W.J. Thieme'Cie.

Hwang Si-Kwon. 2019
Jeju dolhareubang-ui jejak sigi gochal [A Study on the Production Time of Dolhareubang (Totem pole) in Jeju Island]. *Tamra munhwa* [Tamra culture], No. 61: 45-94. (In Korean).

Hwasun Hyosan-ri-wa Daesin-ri jiseokmyo gun [Dolmens in Hyosan-ri and Daesin-ri, Hwasun]. 2015
URL: https://www.heritage.go.kr/heri/cul/culSelectDetail.do?VdkVgwKey=13,04100000,36&pageNo=1_1_1_0. (Accessed March 13, 2022). (In Korean).

Jensen A.E. 1960
Feld-Terrassen und Megalithen. Eine Skizze. *Paideuma*, vol. 7 (4–6): 258–373.

Keith H.G. 1947
Megalithic remains in North Borneo. *Journal of the Malayan Branch of the Royal Asiatic Society*, vol. 20 (1): 153–155.

Kruyt A. 1932
L'immigration préhistorique dans les pays des Toradjas occidentaux. *Hommage du Service Archéologique des Indes Néerlandaises au Premier congrès des préhistoriens d'Extrême-Orient*, vol. 2: 1–15.

Lambrecht F. 1938
The Mayawyaw ritual. *Publications of the Catholic Anthropological Conference*, No. 3: 327–493.

Lee Young Moon. 2000
Hanguk jiseonmyo sahoe yeongu [Korea Dolmen Society Research]. Seoul: Hagyeong Munhwasa. (In Korean).

McCarthy J.F. 1888
Siam. *Proceedings of the Royal Geographical Society and Monthly Record of Geography*. New Monthly Ser., No. 10/3: 117–134.

Mjöberg E. 1925
An expedition to the Kalabit country and Mt. Murud, Sarawak. *Geographical Review*, vol. 15 (3): 411–427.

Nesterkina A.L., Solovyeva E.A., Tabarev A.V., Ivanova D.A. 2017
The megaliths of Korea and Japan: An analysis of origins and functions. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 45 (3): 106–114.

Pramaresti E.W. 2018
Perkembangan Ragam Hias Pada Omo Sebua di Nias Selatan, Sumatera Utara. *Majalah Arkeologi*, vol. 27 (2): 80–88.

Raven H.C. 1926
The stone images and vats of Central-Celebes. *Natural History*, No. 26: 272–282.

Rouffaer G.P. 1937
Ethnographie van de kleine Soenda Eilanden in Beeld. S-Gravenhage: Nijhoff.

Sarasin P., Sarasin F. 1905
Reisen in Celebes. Wiesbaden: S.W. Kriedel's Verlag.

Schneeberger W.F. 1979
Contributions to the ethnology of Central Northeast Borneo (parts of Kalimantan, Sarawak and Sabah). *Studia Ethnologica Berniensia*, vol. 2.

Sellato B. 2016
The Ngorek of the central highlands and "megalithic" activity in Borneo. In *Mégalithismes Vivants et Passés, Approches Croisées. Living and Past Megalithisms: Interwoven Approaches*. Oxford: Archaeopress Archaeology, pp. 117–150.

Seong Jeongyong, Seo Hyeonju. 2007
Baekje [Baekje culture]. In *Hanguk gogohak gangue* [Lectures on Korean Archaeology]. Seoul: Sahoe Pyeongnon, pp. 255–300. (In Korean).

Soejono R.P. 1969
The history of prehistoric research in Indonesia to 1950. *Asian Perspectives*, No. 12: 69–92.

Steimer-Herbet T. 2018
Indonesian Megaliths: A Forgotten Cultural Heritage. Oxford: Archaeopress Archaeology.

Steimer-Herbet T., Besse M. 2017
Indonesian megaliths as the result of the interaction between indigenous peoples and Hindu-Buddhist kingdoms. In *Austronesian Diaspora. A New Perspective. Proceedings of the International Symposium on Austronesian Diaspora (18th–23rd July 2016, Nusa Dua, Bali, Indonésie)*. Gadjah Mada University Press: pp. 301–318.

Tabarev A.V., Gavrilina T.A. 2020
Megaliticheskiye kompleksy tropicheskoy chasti tikhookeanskogo basseyna: Indoneziya. *Teoriya i praktika arkheologicheskikh issledovaniy*, No. 1: 152–165.

Tabarev A.V., Ivanova D.A., Nesterkina A.L., Solovyeva E.A. 2017
The Jomon megalithic tradition in Japan: Origins, features, and distribution. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 45 (4): 45–55.

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The Beginning of Iron Metallurgy in East Asia

This study focuses on the beginning of the Early Iron Age in the Far East. A revision of the published data indicates a lack of synchrony in the appearance of bronze artifacts in cultures of the Amur region and Primorye in the late 2nd to early 1st millennia BC. Iron and cast iron were widely distributed in the Urilsky and Yankovsky cultures. However, no such artifacts are known in contemporaneous cultures such as the Evoron, Siniy Gai, and Lidovka, which are attributed to the Bronze Age, whereas the earliest iron and cast iron artifacts of the Urilsky culture come from the western parts of the Amur basin. All known bronze artifacts of that culture were widely distributed during the Shang and Western Zhou stages, in Karasuk-type cultures of Southern Siberia and Central Asia of the late 2nd to early 1st millennia BC. In China, the earliest iron artifacts appeared between the 8th and 6th centuries BC, while in the provinces of eastern Liaoning and southwestern Jilin they appeared between the 4th and 1st centuries BC. Cast iron celts of the Yankovsky culture in Primorye, which in 1960s were dated to 1000–800 BC, are now believed to be no earlier than 400–200 BC, coinciding with the appearance of iron in Manchuria. It is concluded that in East Asia, iron and cast iron first appeared in the western Amur basin in 1100–900 BC.

Keywords: *Western Amur region, East Asia, Bronze Age, iron, cast iron, Urilsky culture, Yankovsky culture.*

Introduction

The issue of the beginning of the use of metal by the population of the Amur region and Primorye is associated with the problem of the Bronze Age in these regions and the phenomenon of the early emergence of iron and cast iron items, which were discovered in the first half of the 1960s due to excavations at a settlement on the Peschany Peninsula in Primorye and at the Urilsky Ostrov settlement on the Amur River. A.P. Okladnikov attributed a late group of dwellings of the Yankovsky culture on the Peschany Peninsula, where ten iron items, including two cast iron celts, were discovered, "to the turn of the 2nd and 1st millennia BC, most likely to the 10th–9th centuries BC" (1963: 176). Iron items from the Urilsky Ostrov settlement were dated to the same period (Derevianko, 1973: 243). Finds from seasonal sites on the Bureya River in the Western Amur region, which were excavated in 1980–1990, also testify to local production of iron and cast iron already at the initial stage of the Urilsky culture (11th–2nd centuries BC) (Fig. 1) (Drevnosti Burei, 2000: 77–79; Shelomikhin, Nesterov, Alkin, 2017: 69–70).

According to O.V. Yanshina, the proximity of the time when bronze and iron items appeared among the population of the Far East does not always make it possible to establish a particular chronological period of archaeological sites and cultures; it is a specific feature of the beginning of the Early Iron Age in this region (2004: 4). Therefore, establishing the earliest time for the onset of iron ore smelting and manufacturing iron and cast iron items in East Asia is a priority for research. Solving this

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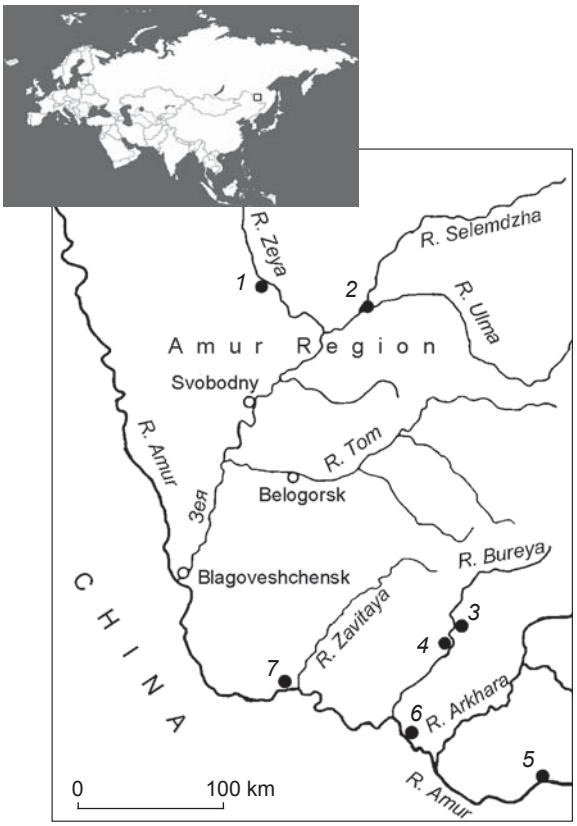

Fig. 1. Archaeological sites with metal artifacts of the Urilsky culture in the Western Amur region.
1 – Ango; *2* – Ust-Ulma I; *3* – Sukhiye Protoki-2; *4* – Bukinsky Klyuch-1; *5* – Urilsky Ostrov; *6* – Innokentievka; *7* – Poyarkovo-1.

problem using the currently available evidence will point to a chronological range for the beginning of the Early Iron Age in the Far East.

The "Bronze Age" in the Amur region and Primorye

Two centers of early bronze items stand out in the Amur region. At Lake Evoron, on the Lower Amur River (Eastern Amur region), the following bronze artifacts were found: a fishing hook, fragment of a knife, and two-bladed arrowhead with a tang. The Evoron complex pottery differs from items of both the Neolithic and Urilsky cultures of the Early Iron Age. Several settlements with similar pottery are known from the Evur River, which flows into Lake Evoron. At one of these sites, the Sargol settlement, round-bottomed pottery was found, along with a small bronze knife 14.5 cm long and 1.8 cm wide (Derevianko, 1969: 98; Medvedev, 2003: 167, fig. 1, *8*; p. 170, fig. 2, *1*). A Sargol-Urilsky bronze plaque 7.5 cm in diameter was found in a complex with a vessel, stone beads, and other items (Fig. 2, *1*) at the Gyrman site in the Khabarovsk Territory (Medvedev, 2012). The materials from these sites have been united into the Evoron culture of the Bronze Age (second half of the 2nd millennium BC). Scholars have observed the connection of its people with carriers of the Glazkov culture—the tribes living in the taiga regions of Eastern Siberia in the second third of the 3rd–mid 2nd millennium BC (Okladnikov, Derevianko, 1973: 200–203).

V.E. Medvedev suggested that there were two lines of development of cultures among the Bronze Age population living on the Lower Amur River—Evoron and Sargol (2003: 169–170). The emergence of the Sargol line could have been influenced by the culture of migrants from the basins of the Lena and Aldan rivers. Medvedev tentatively dated the beginning of the Bronze Age to the late 2nd millennium BC, and mentioned that until the results of absolute dating are obtained, "it is permissible to conventionally consider the Bronze Age" the period from the 13th–12th to the 9th–8th centuries BC (Ibid.: 170–171).

According to V.A. Deryugin, the pottery of the Evoron type appeared "at the settlement of Sargol and in dwellings of the Early Iron Age" and belonged to the first half of the 1st millennium BC (Deryugin, Losan, 2009: 53).

I.Y. Shevkomud attributed two population groups on the Lower Amur River to the period after the "Voznesenovskoye collapse" of the Late Neolithic. He associated one local population group with the evidence of the Koppi culture, and the second group with assemblages left by migrants having no roots in the traditional Lower Amur Neolithic. The period from the 17th to the 9th–8th centuries BC Shevkomud called "the Bronze Age", but with some specific historical aspects resulting from interruption in development. However, in his point of view, all paleoethnic and paleocultural processes in the early 1st millennium BC proceeded "with clear dominance of the incoming Urilsky culture" (Shevkomud, 2015: 143).

A different cultural world is represented by three bronze items kept in the Grodekov Khabarovsk Regional Museum. These include two narrow celts and a spearhead with a wide leaf-shaped blade and socketed base, similar in shape to the Shang-Yin spear in China (Fig. 2, *4*) (Konkova, 1989: 20, fig. 15, *5*).

In the Western Amur region, in a settlement at the mouth of the Ango River, at its confluence with the Zeya River, a bronze plaque in the form of two circles connected by a narrow neck (Fig. 2, *10*) was found, along with flint and chalcedony knife-like blades, retouched arrowheads, flakes, and a stone adze. A smelting hearth with remains of slag from a bronze foundry was found at a settlement near Berezovka on the Zeya River. These finds, considering the parallels with the items of the prehistoric Chifeng II culture (according to the present-day concepts, this is the culture of the upper layer of Xiajiadian), were dated to

Fig. 2. Bronze (*1*, *3–6*, *8–14*), silver (*7*), and combined (*2*) items.
1–12, *14* – Amur region; *13* – Museum of History, Huludao, Liaoning Province, China.
1 – Urilsky-Sargol type; *2*, *3*, *5–12*, *14* – Urilsky culture; *4*, *13* – Shang-Yin period. Different scale.
1 – (Medvedev, 2012: 188, fig. 11); *2*, *3*, *7–9* – Sapunov Museum of Archaeology at Blagoveshchensk State Pedagogical University; *4* – (Konkova, 1989: 20, fig. 15, *5*); *5*, *6*, *10–12*, *14* – Museum of History and Culture of the Peoples of Siberia and the Far East at the IAET SB RAS.

the Yin-Karasuk period, or ca 15th–10th century BC (Okladnikov, Derevianko, 1973: 203, 206). However, the collection from the Ango River consists of surface finds which, in our opinion, are of a mixed nature. The bronze item and the stone adze represent the Urilsky culture, as does a bronze knife from the first cultural layer of the Paleolithic site of Ust-Ulma I on the Selemdzha River (Fig. 2, *11*) (Derevianko, Zenin, 1995: 5–6). The knife has a moon-shape (conventionally called "elbow-shape") and a thick midrib on one side of the blade, which does not correspond to the small size of the item (8.2 cm long). In the Urilsky layer of the Sukhiye Protoki-2 site, a blade fragment of a bronze knife, decorated with a row of depressions, and a bronze tubular bead were found (Fig. 2, *5*, *6*) (Drevnosti Burei, 2000: 78, fig. 31, *5*, *6*). The elemental composition of the plaque from the Ango River, the knife from Ust-Ulma, and paw-shaped plaques from Urilsky Ostrov and Bukinsky Klyuch-1 (Fig. 2, *12*, *14*) corresponds to two bronze alloys: tin-lead and tin. The knife was cast of the former alloy, containing more lead and silver. A tin-lead bronze alloy, but with a larger amount of tin, was also used for manufacturing the paw-shaped plaque from the settlement of Urilsky Ostrov (Nesterov, 2017: 34). The alloy of the lobed plaque of tin bronze found on the Ango River shows high iron content. Significant admixture of iron is clearly visible on the surface of the item, in the form of rust (Nesterov, Kolmogorov, 2021: 89).

Stone replicas of bronze weapons with midribs* served as the basis for identifying the Bronze Age in Primorye (Lidovka I, Pad Kharinskaya, Bukhta Moryak-Rybolov, Rudnaya Pristan, etc.). These replicas were possibly associated with Seima-Turbino and Karasuk-Yin bronze artifacts (Yanshina, 2004: 14–16). These finds also included a ceramic copy of a convex bronze plaque, with notches inscribed along the edge, from the Krounovka site (Ussuriysk Urban District, Krounovka River) (Yanshina, 1998), as well as two stone elements of the composite handle of a bronze dagger found at the Rettikhovka-Geologicheskaya site (Chernigovsky District, Primorye Territory) (Krutykh et al., 2008).

The largest number of bronze items with Karasuk features was found at the settlement of Siniy Gai A, near Lake Khanka, which allowed D.L. Brodyansky to identify the Siniy Gai culture of the Bronze Age (1987: 129). The calibrated values (±2σ)* of two radiocarbon dates (2875 ± 45 BP (SOAN-1540) and 2820 ± 55 BP (SOAN-1541)) for the samples from Siniy Gai A

*Most of these replicas of bronze spears with midribs are random finds from Central and Eastern Primorye, which correspond to the areas of the Siniy Gai and Lidovka Bronze Age cultures (Konkova, 1989: 37–39).

*The calibrated interval was established with the use of the Calib611 software.

(Brodyansky, 2013: 36) of 1135–922 (88 %) and 1129–833 (99.9 %) BC, respectively (the synchronized interval of the two dates corresponds to the second half of the 12th–10th centuries BC), also indicate the Karasuk period. Taking into account the Karasuk features of bronze items, Brodyansky considered it more correct to date the settlement to the second half of the 10th–8th centuries BC (Ibid.). These sites should probably also include the sites of Medvezhya III in Primorye, Ingelin in the Mudanjiang River basin in China (Zhang Taixiang, Zhu Guozhen, Yang Hu, 1981; Alkin, 1985; Brodyansky, 1987: 158), the multilayered site of Dvoryanka-1 where bronze items were found (Klyuev et al., 2005), and the Sheklyaevo-21 workshop for the manufacture of personal adornments and other stone implements (beads, magatamas, rings, pendants, disks) in the valley of the Arsenyevka River. Items of everyday life and the copy of a bronze spearhead were also found in this workshop (Klyuev, 2012: 45–46, fig. 4).

In 1989, V.I. Dyakov attributed not only the Siniy Gai, but also the Lidovka culture to the Bronze Age. The radiocarbon data for the Lidovka culture available at that time made it possible to link these two cultures to the first half of the 1st millennium BC, despite the absence of absolute dates for Siniy Gai (Dyakov, 1989: 209–210). Four calibrated dates for Lidovka I correspond to the range of 759–538 BC, or the 8th–6th centuries BC (Table 1). Judging by the above calibrated dates for Siniy Gai A, the Siniy Gai and Lidovka cultures existed in Primorye not simultaneously, but successively.

The above brief analysis of problems of the Bronze Age in the Far East was provided in order to show the non-simultaneous emergence of bronze items in the cultures of the Amur region and Primorye in the late 2nd–first half of the 1st millennium BC. The question of why iron and cast iron became widespread in the Urilsky and Yankovsky cultures, but were absent from the contemporaneous Evoron, Siniy Gai, and Lidovka cultures, still remains open.

Iron and cast iron of the Urilsky culture

The earliest iron items in the Amur region are associated with the Urilsky culture. Since its identification in the 1960s, there have arisen some questions concerning the origins of this culture. Even then, scholars observed the difference between the Late Neolithic Osinovoye Ozero culture (late 4th–2nd millennium BC) of the Western Amur region and the contemporaneous Voznesenovskoye culture (3rd–mid 2nd millennium BC), which was spread east of the Lesser Khingan mountains (Okladnikov, Derevianko, 1973: 299).

The rugged mountains of the Lesser Khingan hampered constant communication between the inhabitants of the Western and Eastern Amur regions, including communication along the Amur River and through the Khingan canyon, and were an important factor leading to the ethnic and cultural differences among the population of the Amur region in the pre-Urilsky and post-Urilsky periods.

Table 1. **Radiocarbon dating of samples from the Lidovka I settlement***

Material	^{14}C-date, BP	Lab code	Calibrated date, BC	
			σ	2σ
Charcoal	2570 ± 60	SOAN-1388	808–748 (48%) 688–665 (14%) 644– 589 (27%) 579–556 (1%)	**838–508** (99.9%) 457–455 (0.001%) 438–420 (0.009%)
"	2450 ± 50	SOAN-1389	747–688 (28%) 665–644 (9%) 588–581 (3%) 554–478 (35%) 472–414 (25%)	**759**–683 (24%) 670–**407** (76%)
"	2610 ± 45	SOAN-1390	824–768 (100%)	895–868 (3%) 857–856 (0.001%) **850–748** (83%) 688–665 (6%) 643–589 (6%) 580–557 (2%)
Charred millet	2535 ± 40	SOAN-1424	792–748 (36%) 687–666 (19%) 643–590 (36%) 578–562 (2%)	**800**–698 (37%) 696–**538** (63%)

*Compiled after (Dyakov, 1989: 209).

The spread of a unified Urilsky culture in the Amur region already at the early stage of its emergence indicates the migratory nature of population change in this region in the late 2nd millennium BC. It has been established that the proto-Urilsky population arrived from the western and southwestern regions of Manchuria and eastern regions of Inner Mongolia. Cultural similarity typical of the inhabitants of the Amur region at the initial stage of the Urilsky culture makes it possible to conclude that the migrants included approximately equal shares of carriers of various cultures moving to the Amur River up the Nonni River and down the Sungari River (Nesterov, Girchenko, 2018).

In the Amur region, the proto-Urilsky settlers faced a lack of available ore components for bronze production. Traces of ore mining have not yet been found, but there is some evidence of smelting down and remodeling of bronze items. A polished stone adze is kept in the Sapunov Museum of Archaeology at Blagoveshchensk Pedagogical University. The upper part of this adze is wrapped in a thin bronze sheet (Fig. 2, *2*). A bronze knife discovered at the Selemdzha River was made from the fragment of a large knife, dagger, or pickaxe of the Shang or Western Zhou period (Varenov, 1989: 9–30). Possibly, it was cast already in the Amur region in a one-sided mold, with the imprint made by one side of one of the above items (Fig. 2, *13*). Therefore, the other side of the blade is smooth, without the midrib (Fig. 2, *11*) (Zenin, Nesterov, 2021: 447). The bronze adornments (sewn-on plaque and pendant) from the sites of Bukinsky Klyuch-1 and Urilsky Ostrov (Fig. 2, *12*, *14*) are replicas of two typologically similar plaques whose originals resulted from merging two varieties of items: three-partite paw-shaped pendants with an eyelet at the top from Mongolia, and two-partite adornments with a loop on the reverse side from North China (Volkov, Novgorodova, 1960). All items of the Urilsky culture made of bronze and silver (Fig. 2, *3–12*, *14*) were widespread in North China, the western part of Manchuria, Central Asia, and Southern Siberia during the Shang-Yin and Western Zhou periods, corresponding to the Karasuk period, in the late 2nd–early 1st millennium BC.

The earliest iron and cast iron items of the Urilsky culture come from the sites of Sukhiye Protoki-2, Bukinsky Klyuch-1, and Urilsky Ostrov in the Western Amur region. An elbow-shaped knife from the Sukhiye Protoki-2 site is morphologically similar to elbow-shaped bronze knives of the Karasuk culture. It has a flat handle 1.4 cm wide and a blade sharpened on one side, which is at an angle to the handle. The width of the blade is 1.8 cm; the total length of the fragment is 6 cm. At the transition area between the blade and the handle, there are two protrusions that distinguish this item from Southern Siberian bronze specimens with one "spike". The knife was made of iron plate 2 mm thick (Fig. 3, *1*). Three fragments of a celt-like base probably belonged to an elongated trapezoidal tool; the maximum width of the item is 2.5 cm. There are low ridges along the edges (Fig. 3, *2–4*). The knife was made of low-carbon steel with uneven distribution of carbon, while the celt was made of white cast iron similar in composition to low-melting iron with carbon content of 4.3 % (Kramintsev, 1996: 126).

Three radiocarbon dates were obtained from charcoal samples in layer 3 of the Sukhiye Protoki-2 site, where the iron knife and fragments of a cast-iron item were found. These dates correspond to the calibrated interval of 1032–914 BC or the 11th–10th centuries BC (Drevnosti Burei, 2000: 97), that is, the period close to the events of the Zhou expansion into Manchuria and the probable resettlement of the proto-Urilsky conglomerate to the Amur region.

Additional evidence of early iron smelting and the manufacturing of iron items is an iron rod from layer 5.1,

Fig. 3. Iron (*1*, *5*, *8*) and cast iron (*2–4*, *6*, *7*) items of the Urilsky culture.
1 – elbow-shaped knife; *2–4*, *6*, *7* – celts; *5* – knife; *8* – sword. *1–4* – Sukhiye Protoki-2; *5*, *6* – Urilsky Ostrov; *7* – Innokentievka; *8* – Nizhnetambovskoye cemetery. *1–6* – Museum of History and Culture of the Peoples of Siberia and the Far East at the IAET SB RAS; *7* – Sapunov Museum of Archaeology at Blagoveshchensk State Pedagogical University; *8* – (Shevkomud, (s.a.)).

where only evidence of the Urilsky culture was found, at Bukinsky Klyuch-1 on the Bureya River (Shelomikhin, Nesterov, Alkin, 2017: 35, fig. 14, *6*). In layer 3.3, which also contained artifacts of this culture, a piece of iron slag was discovered. This find testifies to the presence of iron-smelting production among the Urilsky population already in the early period of its existence. According to radiocarbon dating, layer 5.1 in the stratigraphic column of alluvial deposits on both banks of the Bureya River emerged 3100 ± 40 BP (LE-2260), which corresponds to the calendar interval of 1502–1266 BC (±2σ) (Drevnosti Burei, 2000: 188–189).

Iron artifacts that were discovered in the areas to the east of the Lesser Khingan belong to the middle and late stages of the Urilsky culture. These include two unidentifiable items (one of which is rather massive) from the settlement of Kochkovatka, and the fragment of a knife from the Maksim Gorky site (Derevianko, 1973: 293, pl. XX, *4*; p. 331, pl. LVIII, *17*). An iron sword was found in a burial at the Nizhnetambovskoye cemetery (Fig. 3, *8*) (Shevkomud et al., 2007).

It seems that the carriers of the Urilsky culture were forced to start smelting iron and to cast iron in the 11th–10th centuries BC for several reasons and due to various circumstances. First, after resettlement of migrants from Manchuria to the Amur region, who had belonged to a complex ethnic and cultural entity (the proto-Urilsky conglomerate) and had the skills of bronze casting, they lost a stable connection with their mother cultures whose carriers were able to replenish their supplies of bronze and components for its manufacturing. Second, in the Amur region, there were no easily accessible copper ores and components for bronze production (Konkova, 1989: 11). It is still unclear how the Urilsky people discovered iron smelting—by chance or by purposeful inquiry. In the Amur region the knowledge of artisans about high-temperature methods of bronze smelting and firing ceramic products could have been applied to iron production from swamp ores. Knowledge about iron quite possibly could have been brought from Manchuria. The bronze casters could have acquired it from smelting copper sulfide ore, when iron was also obtained on the side (Grigoriev, 2000: 74–76). The Urilsky metallurgists made iron elbow-shaped knives of the Karasuk type and celts from cast iron, which were similar to their bronze and stone prototypes.

The beginning of iron use in East Asia

It is commonly believed that the inhabitants of the northern and northeastern regions of Asia Minor (Anatolia) knew iron not only in the period of the Hittite state (18th–12th centuries BC), but also earlier, "during the period of the Hattians–proto-Hittites, the inventors of smelting from ore", since an iron dagger dated to ca 2100 BC was discovered on this territory in Alaca Höyük (Giorgadze, 1988: 238–239). It was in Anatolia that a variety of iron items began to be produced in the 14th–13th centuries BC, whereas the period of widespread use of iron began in the Ancient East in the 12th century BC (Ibid.: 254).

Three bronze tools with iron blades of the *yue* type (Fig. 4, *1*) and one copper *ge* pickaxe with a *yuan* iron blade of the Shang and Western Zhou periods (from the 14th to the 11th–9th centuries BC) have been found in China. Their chemical analysis has revealed a high content of nickel, which is typical for meteoric iron (Mogilnik epokhi Shan…, 1977: 3; Kuchera, 1977: 102). However, the mere fact that iron was processed and that an iron piece was connected to a bronze base is

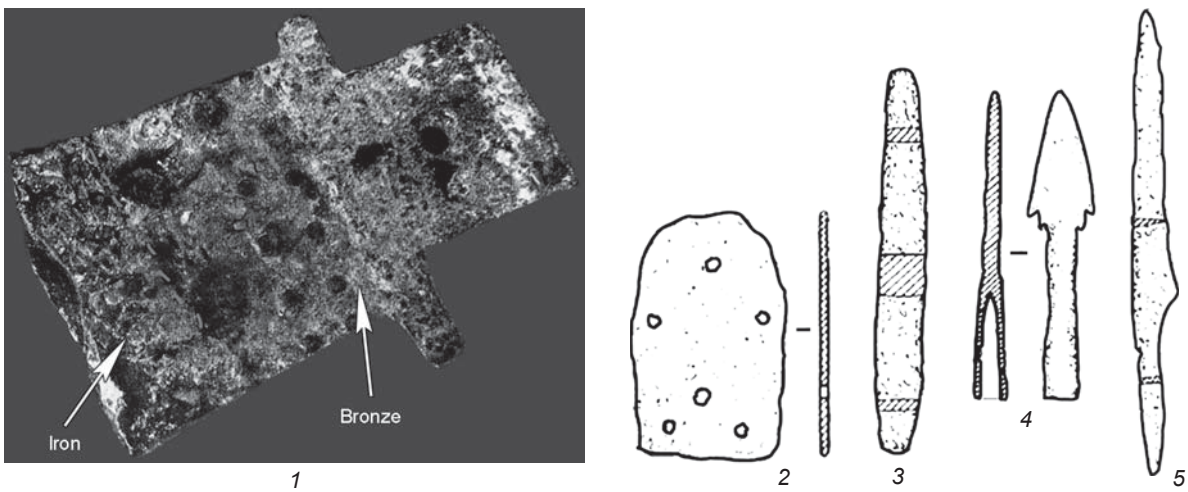

Fig. 4. Yue bimetal polearm from Taishi, Hebei Province (*1*) and ironware of the Guntulin culture (*2–5*), China. Different scale.
1 – (Kuchera, 1977: 101, fig. 44); *2–5* – (Sobolev, 2021: 37, fig. 3).

important. It suggests that the artisans of bronze casting had knowledge of a metal that was new to them. At present, there is no reliable evidence on the procurement of iron ore and on the mastery of iron smelting from it, as with the use of the hot forging technique, and even more so, on casting from ferrous metal in China in the 16th–9th centuries BC.

Chinese scholars have identified two independent centers for producing items made of iron on the territory of present-day China: the northwestern center in Xinjiang and the central center. The manufacture of items made of iron began in the 10th century BC or somewhat earlier in Xinjiang and in the 8th century BC in Central China. Chinese archaeologists associate the first period of ore mining and development of iron smelting technology with the 8th–5th centuries BC or the Chunqiu period (770–476 BC). At that time, processes of smelting and cementation of iron were elaborated in Central China, and cast iron was obtained. Swords, daggers, knives, spades, shovels, hoes, and adzes were made of iron and cast iron (Xian Qin…, 2005: 45). In South China, iron items of the 8th–5th centuries BC have not yet been discovered. As for Inner Mongolia in North China and the Ningxia Hui Autonomous Region in Central China, items made of iron have been found there only in three out of thirteen cultures of the Late Bronze Age and transitional period to the Early Iron Age: the Maoqingou culture of the 7th–4th centuries BC (to the east of Ordos, on the border of Inner Mongolia, Shaanxi and Hebei Provinces), the Taohongbala culture of the 7th–3rd centuries BC (Ordos), and Yanlan culture of the 8th–3rd centuries BC (Ningxia Hui Autonomous Region) (Ibid.). The earliest iron items made by hot forging belonged to the period from the 8th to the 6th centuries BC. Sixty percent of these date back to the 6th–5th centuries BC. All finds of the early period (the 8th century BC) are exclusively double-edged swords (Ibid.: 22ff).

The earliest iron artifacts in Northeast China were found at the Guntuling site on the Sanjiang Plain (Fig. 4, *2–5*). The Guntuling culture was contemporaneous with the Poltse culture, according to the Russian classification. Chinese scholars date the Guntuling culture to the period from the 2nd century BC to the 2nd century AD. According to the radiocarbon analysis of charcoal samples, it still existed in the first half of the 4th century AD (Sobolev, 2021: 39).

The earliest iron items in the eastern part of Liaoning Province and the southwestern part of Jilin Province were dated to the period from the 4th–3rd to the 2nd–1st centuries BC. The vast majority include tools, such as hoes of various types, axes, sickles, knives, chisels, drills, punches, and fishhooks (Zhang Wei, 1997).

Scholars correlate the beginning of the Early Iron Age on the Korean Peninsula, in its northeastern and central parts, with the initial period of the Chundo culture, which evolved on the basis of the newly arrived Krounovka culture and local culture of the Bronze Age in the 4th–3rd centuries BC. The iron items of the Yan Kingdom of Northwestern Korea belonged to approximately the same time (Subbotina, 2008: 16; Hong Hyuong Woo, 2008: 26–27).

Dynamics of iron production in the Far East in the Early Iron Age (in place of conclusions)

Migration of the proto-Urilsky conglomerate, mixed in terms of culture, from the western and southwestern regions of Manchuria and adjacent areas of Inner Mongolia to the Amur region, presumably in the second half of the 11th century BC, caused by political and possibly natural changes, led to the emergence of the Urilsky culture in that region. Its carriers quickly found a way to smelt iron and cast iron probably using swamp iron ore. Items made of iron and cast iron have been rarely found in the Amur region, yet they appear in the evidence from the sites of the Urilsky culture throughout its entire history. The above radiocarbon dates of the Urilsky seasonal sites of Sukhiye Protoki-2 and Bukinsky Klyuch-1 on the Bureya River, and data on the later emergence of iron and cast iron production in different regions of China as compared to the Amur region, run counter to the opinion of V.A. Kramintsev that "the Urilsky and Yankovsky cast iron products should be recognized as imported", which was confirmed by "their scarcity, technical and typological seriality, and lack of local variants" (1996: 128); at least this is typical of collections of the Urilsky cast iron items.

According to the results of metallographic analysis, the iron-cast celt No. 2 from the settlement of the Yankovsky culture on the Peschany Peninsula is similar to a celt fragment from Southern Manchuria (Bitszyvo, 1st century AD) in terms of chemical composition of cast iron, but, more importantly, also according to manufacturing techniques, which is confirmed by the microstructure of the studied items (Bogdanova-Berezovskaya, Gintsburg, Naumov, 1963: 354). However, Okladnikov divided the evidence from the settlement into two groups of different periods and proposed to date the second group, which included iron items such as celts of white cast iron, to the 10th–9th centuries BC (1963: 176). Scholars have repeatedly noted that attribution of cast-iron celts from the settlement on the Peschany Peninsula to the early 1st millennium BC has not been confirmed by the results of metallographic analysis and available parallels from the late 1st millennium BC to the early 1st millennium AD (Dyakov, 1989: 13; Sidorenko, 2007: 136–140).

In 2007, at the settlement of Barabash-3 in Khasansky District in Primorye, a blacksmith workshop of the

Table 2. **Radiocarbon dating of blacksmith workshop at the Barabash-3 settlement***

^{14}C-date, BP	Lab code	Calibrated date, BC	
		σ	2σ
2180 ± 60	SNU-07-R080	**359**–275 (51%) 260–**172** (49%)	**386–91** (99%) 70–60 (1%)
2220 ± 60	SNU-07-R081	**375**–345 (19%) 322–**205** (81%)	**398–157** (98%) 135–115 (2%)
2415 ± 45	SOAN-7267	720–695 (13%) 540–405 (87%)	**752–698** (18%) 668–634 (7%) 624–612 (1%) **596–397** (74%)
2435 ± 90	SOAN-7268	749–698 (24%) 666–642 (7%) 591–578 (5%) 566–406 (63%)	**791**–**389** (100%)

*Compiled after (Klyuev et al., 2009: 176).

Yankovsky culture was studied. Similar cast-iron celts were found there (Klyuev et al., 2009). Radiocarbon analysis of four samples (Table 2) has revealed data of various times: the calibrated dates (±2σ) to which the SOAN index corresponded, turned out to be earlier (8th–4th centuries BC) than dates with the SNU index (4th–1st centuries BC). Nevertheless, their synchronization within the early 4th century BC (398–389) makes it possible to date the workshop and cast-iron celts to the late stage of the Yankovsky culture, as suggested by the authors of the publication (Ibid.: 176). Thus, the emergence of celts of this type in Primorye and beginning of the spread of iron in Manchuria were close in time, not earlier than the 4th–3rd centuries BC.

In the Poltse culture of the Eastern Amur region (late 1st millennium BC–first half of the 1st millennium AD), the use of iron and cast iron items both in everyday life and in warfare (Fig. 5) increased as compared to the Urilsky culture. Around the 2nd–1st centuries BC, the Poltse artisans learned how to make high quality celts. M.A. Mogilevsky identified a celt made not of cast iron, but of steel showing a structure of fine-grained

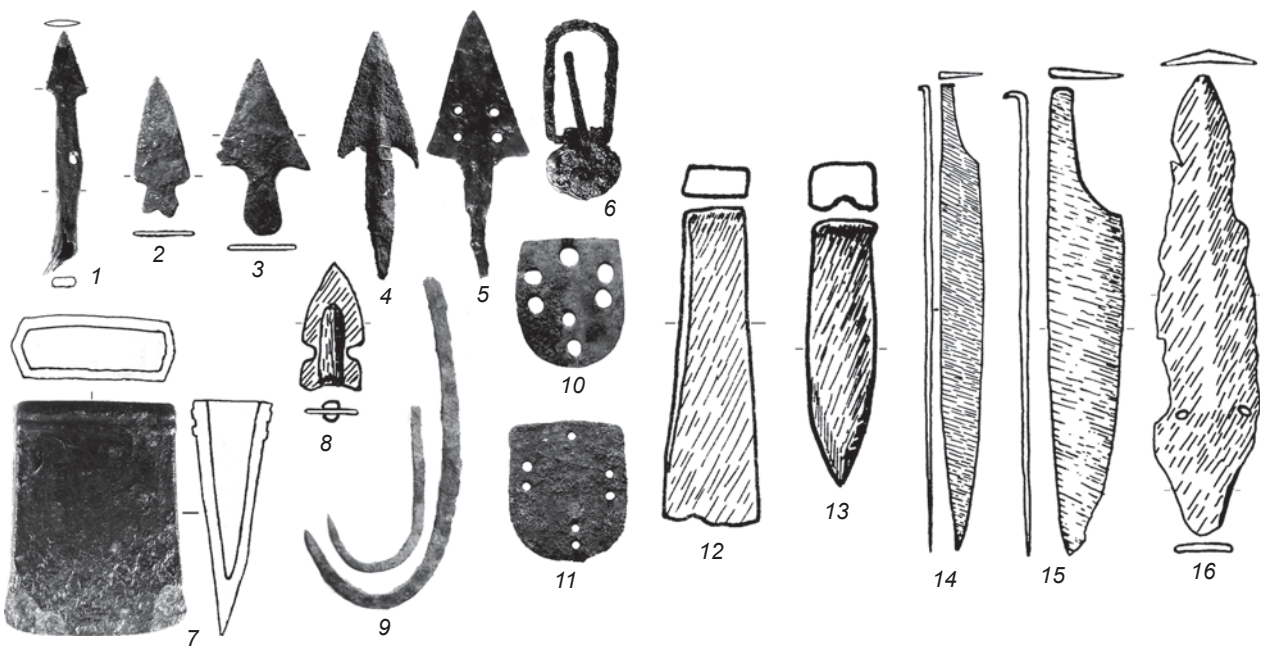

Fig. 5. Iron items of the Poltse culture from the Eastern Amur region.
1–7, *9–11* – Museum of History and Culture of the Peoples of Siberia and the Far East at the IAET SB RAS; *8*, *12–16* – (Derevianko, 1976: 284, pl. VI, *5*, *8*; p. 295, pl. XVII; p. 303, pl. XXV, *8*; p. 307, pl. XXIX, *2*, *4*).

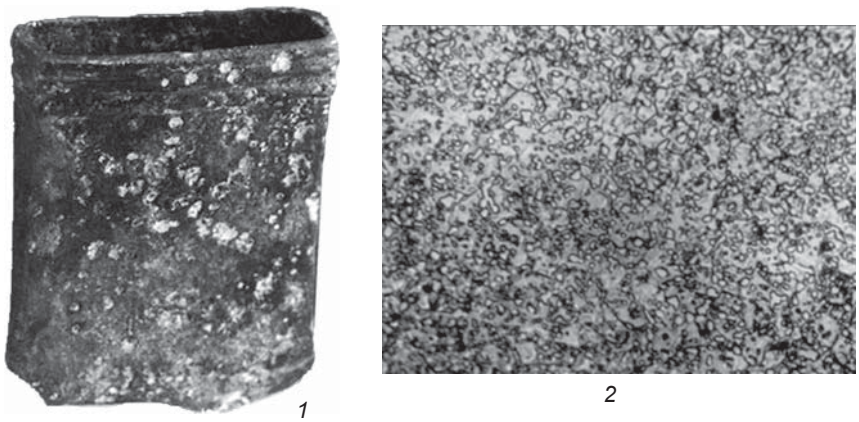

Fig. 6. Cast steel celt from dwelling 4 at the Poltse I settlement (*1*) and micrograph of its fine-grained structure (*2*).
1 – Museum of History and Culture of the Peoples of Siberia and the Far East at the IAET SB RAS; *2* – (Mogilevsky, 2005: 12, fig. 1).

cementite, with carbon content of 1.5–1.8 %, which is typical of Damascus steel (Fig. 6) (Kramintsev, 1996: 125). The Poltse metallurgists smelted high-carbon steel from bloomery iron and charcoal in comparatively small crucibles; with technical limitations of the time, they could ensure only the minimum necessary heating of the molten material. This might have been associated with incomplete filling of the mold during manufacturing of thin-walled products, which can be seen in some celts from the collection. A simple solution to this problem was preheating of the mold, which probably was placed into a fire next to the furnace where the crucible with the molten material was located. In the cast experimental samples, Mogilevsky obtained structures from pearlite to coarse-grained ferrite with cementite plates along grain boundaries. Moreover, the optimum temperature for formation of fine-grained cementite was approximately 650–700 °C, and a fire could provide it (Mogilevsky, 2005).

This technology did not receive further development in the Amur region. One of the reasons could have been death of foundry workers during the capture of the settlement of Poltse I by enemies (Derevianko, 1976: 47). The foundry blacksmiths most likely did not realize which kind of alloy they managed to obtain; such casting of celts into heated molds could have occurred by accident. According to Kramintsev, the Poltse celts are typologically consistent and show traces of decarburization, which indicates a high level of technology for their production and "their imported origin" (1996: 128). This hypothesis seems justified, since according to Chinese archaeologists, the origin of the Poltse culture was associated with resettlement of the proto-Poltse population to the Amur region and to the Sanjiang Plain from the Liaodong Peninsula and regions in the lower reaches of the Liao River (Zhongguo Dongbei…, 2009: 271).

Thus, the Western Amur region can currently be considered as a place where for the first time in East Asia, judging by radiocarbon dates and types of artifacts similar to the items of the Karasuk culture, iron and cast iron appeared among the carriers of the Urilsky culture, in the 11th–10th centuries BC.

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References

Alkin S.V. 1985
Neoliticheskiye pamyatniki vostochnoy chasti Dunbeya. In *Problemy arkheologii Sibiri i Dalnego Vostoka*. Irkutsk: Izd. Irkut. Gos. Univ., pp. 31–33.

Bogdanova-Berezovskaya I.V., Gintsburg B.B., Naumov D.V. 1963
Zhelezniye kelty iz poseleniya na poluostrove Peschanom. In *Okladnikov A.P. Drevneye poseleniye na poluostrove Peschanom u Vladivostoka. Materialy k drevney istorii Dalnego Vostoka.* Moscow, Leningrad: Izd. AN SSSR, pp. 353–354. (MIA; No. 112).

Brodyansky D.L. 1987
Vvedeniye v dalnevostochnuyu arkheologiyu. Vladivostok: Izd. Dalnevost. Gos. Univ.

Brodyansky D.L. 2013
Siniy Gai. Poseleniya neolita i bronzovogo veka v Primorye. Vladivostok: Izdat. dom Dalnevost. Federal. Gos. Univ.

Derevianko A.P. 1969
Problema bronzovogo veka na Dalnem Vostoke. *Izvestiya Sibirskogo otdeleniya AN SSSR*. No. 6: Ser. obshchestv. nauk, iss. 2: 94–99.

Derevianko A.P. 1973
Ranniy zhelezniy vek Priamurya. Novosibirsk: Nauka.

Derevianko A.P. 1976
Priamurie (I tysyacheletiye do nashey ery). Novosibirsk: Nauka.

Derevianko A.P., Zenin V.N. 1995
Paleolit Selemdzhi (po materialam stoyanok Ust-Ulma I–III). Novosibirsk: Izd. IAET SO RAN.

Deryugin V.A., Losan E.M. 2009
Problemy klassifikatsii, periodizatsii keramiki epokhi paleometalla Severo-Vostochnogo Priamurya. In *Kulturnaya khronologiya i drugiye problemy v issledovaniyakh drevnostey vostoka Azii*. Khabarovsk: Khabar. kr. muzey im. N.I. Grodekova, pp. 47–73.

Drevnosti Burei. 2000
S.P. Nesterov, A.V. Grebenshchikov, S.V. Alkin, D.P. Bolotin, P.V. Volkov, N.A. Kononenko, Y.V. Kuzmin, L.N. Mylnikova, A.V. Tabarev, A.V. Chernyuk; E.I. Derevianko (ed.). Novosibirsk: Izd. IAET SO RAN.

Dyakov V.I. 1989
Primorye v epokhu bronzy. Vladivostok: Izd. Dalnevost. Gos. Univ.

Giorgadze G.G. 1988
Proizvodstvo i primeneniye zheleza v Tsentralnoy Anatolii po dannym khettskikh klinopisnykh tekstov. In *Drevniy Vostok: Etnokulturniye svyazi*. Moscow: Nauka, pp. 238–262.

Grigoriev S.A. 2000
Drevneye zhelezo Peredney Azii i nekotoriye problemy arkheologii Volgo-Uralya. *Izvestiya Chelyabinskogo nauchnogo tsentra UrO RAN*, iss. 1: 73–78.

Hong Hyuong Woo. 2008
Keramika poltsevskoy kultury na vostoke Azii (V. do n.e. – IV v. n.e.): Cand. Sc. (History) Dissertation. Novosibirsk.

Klyuev N.A. 2012
Epokha paleometalla Primorya: Otkrytiya 2000-kh godov. In *Dalnevostochno-sibirskiye drevnosti*. Novosibirsk: Izd. IAET SO RAN, pp. 41–50.

Klyuev N.A., Garkovik A.V., Sleptsov I.Y., Gladchenkov A.A. 2005
Epokha kamnya i paleometalla Zapadnogo Primorya: Otkrytiya i nakhodki 2004 goda. In *Severnaya Patsifika – kulturniye adaptatsii v kontse pleistotsena i golotsena*. Magadan: Izd. Sev. Mezhdunar. Univ., pp. 81–84.

Klyuev N.A., Kan In Uk, Sleptsov I.Y., Gladchenkov A.A. 2009
Kuznechnaya masterskaya rannego zheleznogo veka v Primorye. In *Kulturnaya khronologiya i drugiye problemy v issledovaniyakh drevnostey vostoka Azii*. Khabarovsk: Khabar. kr. muzei im. N.I. Grodekova, pp. 175–178.

Konkova L.B. 1989
Bronzoliteinoye proizvodstvo na yuge Dalnego Vostoka SSSR (rubezh II–I tys. do n.e. – XIII v. n.e.). Leningrad: Nauka.

Kramintsev V.A. 1996
Litaya stal poltsevskogo poseleniya. In *Noveishiye arkheologicheskiye i etnograficheskiye otkrytiya v Sibiri*. Novosibirsk: Izd. IAET SO RAN, pp. 125–128.

Krutykh E.B., Kolomiets S.A., Moreva O.L., Dorofeeva N.A. 2008
Kompleks finalnogo neolita poseleniya Rettikhovka-Geologicheskaya (po rezultatam issledovaniya 2004 g.). In *Stoletiye velikogo APE*. Vladivostok: Izd. Dalnevost. Gos. Univ., pp. 115–138. (Tikhookeanskaya arkheologiya; iss. 16).

Kuchera S. 1977
Kitaiskaya arkheologiya. Moscow: Nauka.

Medvedev V.E. 2003
Akademik A.P. Okladnikov i neolit Nizhnego Priamurya: Razvitiye idey. In *Problemy arkheologii i paleoekologii Severnoy, Vostochnoy i Tsentralnoy Azii*. Novosibirsk: Izd. IAET SO RAN, pp. 164–171.

Medvedev V.E. 2012
Nakhodki u sela Gyrman (k voprosu o bronzovom veke v Priamurye). In *Yubiley lidera*. Vladivostok: Izd. dom Dalnevost. Federal. Gos. Univ., pp. 185–193.

Mogilevsky M.A. 2005
Cast ultrahigh carbon steels with Damascus type microstructure. *Materials Technology*, vol. 20 (1): 12–14.

Mogilnik epokhi Shan, obnaruzhenniy v uyezde Pingu, Pekin. 1977
Wenwu, No. 11: 1–8. (In Chinese).

Nesterov S.P. 2017
Bronzoviye lapchatiye blyashki urilskoy kultury iz Zapadnogo Priamurya. *Gumanitarniye nauki v Sibiri*, vol. 24 (2): 33–36.

Nesterov S.P., Girchenko E.A. 2018
Kontseptsii proiskhozhdeniya urilskoy kultury v Priamurye. In *Vostok Azii: Problemy izucheniya i sokhraneniya istoriko-kulturnogo naslediya regiona*. St. Petersburg: Rostok, pp. 201–209.

Nesterov S.P., Kolmogorov Y.P. 2021
The study of non-ferrous metal artifacts of the Early Iron Age and medieval cultures in the Western Amur basin. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 49 (2): 84–93.

Okladnikov A.P. 1963
Drevneye poseleniye na poluostrove Peschanom u Vladivostoka. Materialy k drevney istorii Dalnego Vostoka. Moscow, Leningrad: Izd. AN SSSR. (MIA; No. 112).

Okladnikov A.P., Derevianko A.P. 1973
Dalekoye proshloye Primorya i Priamurya. Vladivostok: Dalnevost. kn. izd.

Shelomikhin O.A., Nesterov S.P., Alkin S.V. 2017
Dolina Burei v epokhu paleometalla: Materialy i issledovaniya pamyatnikov Bukinskiy Klyuch-1 i Bezumka. Blagoveshchensk: Izd. Blagoveshch. Gos. Ped. Univ.

Shevkomud I.Y. 2015
Neolit – paleometall v Nizhnem Priamurye – kontseptsiya paleokulturnogo razvitiya. In *Pervobytnaya arkheologiya Dalnego Vostoka Rossii i smezhnykh territoriy Vostochnoy Azii: Sovremennoye sostoyaniye i perspektivy razvitiya*. Vladivostok: Izd. Inst. istorii, arkheol. i etnogr. DVO RAN, pp. 140–176.

Shevkomud I. (s.a.)
Ocherk istorii drevnego mira Nizhnego Amura. URL: http://khabkrai-nasledie.ru/arheologija/istorii-drevnego-mira-nizhnego-amura. (Accessed May 27, 2022).

Shevkomud I.Y., Bochkareva E.A., Kositsyna S.F., Matsumoto T., Uchida K. 2007
Issledovaniya Nizhnetambovskogo mogilnika (o pogrebenii voina s mechom). In *Severnaya Yevraziya v antropogene: Chelovek, paleotekhnologii, geoekologiya, etnologiya i antropologiya*, vol. 2. Irkutsk: Ottisk, pp. 301–306.

Sidorenko E.V. 2007
Severo-Vostochnoye Primorye v epokhu paleometalla. Vladivostok: Dalnauka.

Sobolev A.E. 2021
Kultura guntulin na severo-vostoke Kitaya. *Gumanitarniye nauki v Sibiri*, vol. 28 (1): 33–40.

Subbotina A.L. 2008
Pamyatniki rannego zheleznogo veka tipa chundo na Koreiskom poluostrove: Cand. Sc. (History) Dissertation. Novosibirsk.

Varenov A.V. 1989
Drevnekitaiskiy kompleks vooruzheniya epokhi razvitoy bronzy. Novosibirsk: Novosib. Gos. Univ.

Volkov V.V., Novgorodova E.A. 1960
Karasukskiye priveski iz Mongolii. *Sovetskaya arkheologiya*, No. 4: 155–160.

Xian Qin liang Han tieqi de kaoguxue yanjiu. 2005
[Archaeological Study of Iron Items of the Periods of Pre-Qin, Qin Dyiasty, and Two Han Dynasties]. Beijing: Kexue. (In Chinese).

Yanshina O.V. 1998
Keramicheskaya "blyakha" (?) iz Krounovki. In *Mir drevnikh obrazov na Dalnem Vostoke*. Vladivostok: Izd. Dalnevost. Gos. Univ., pp. 137–140. (Tikhookeanskaya arkheologiya; iss. 10).

Yanshina O.V. 2004
Problema vydeleniya bronzovogo veka v Primorye. St. Petersburg: MAE RAN.

Zenin V.N., Nesterov S.P. 2021
Artefakty epokhi paleometalla s pamyatnika Ust-Ulma III v Amurskoy oblasti. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XXVII. Novosibirsk: Izd. IAET SO RAN, pp. 441–447.

Zhang Taixiang, Zhu Guozhen, Yang Hu. 1981
Mestonakhozhdeniye Ingelin, uyezd Ninan, prov. Kheiluntszyan. *Kaogu*, No. 6: 481–491. (In Chinese).

Zhang Wei. 1997
Obnaruzheniye i issledovaniye izdeliy iz zheleza rannego perioda na ravnine Sunnen. *Beifang wenwu*, No. 1: 13–18. (In Chinese).

Zhongguo Dongbei diqu Xia zhi Zhanguo shiqi de kaogu wenhua yanjiu. 2009
[Research of Archaeological Cultures in Northeastern China from the Xia Dynasty to the Warring States Period]. Beijing: Kexue. (In Chinese).

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Tools Used in Tagar Rock Art: Findings of an Experimental Traceological Study

We describe the findings of traceological analysis and experiments with bronze and iron tools used by Tagar and Tes artists. The pecking traces these tools leave on the red Devonian sandstone were examined to assess which of them could have been used in rock art production. At the first stage, a preliminary analysis of Tagar petroglyphs was carried out, and metal tools and weapons from the Martyanov Museum of Local History in Minusinsk were examined. Morphologically suitable ones were selected, and experimental tools were made of stone, copper alloys, and low-carbon steel. Experiments were conducted and samples of pecking traces were produced. The final stage of the work consisted of comparing these samples with actual petroglyphs, and use-wear traces on the experimental tools with those on the actual tools. This approach made a direct comparison possible. Among the Tagar and Tes metal tools, those that had likely been used in rock art production were detected. The conclusion was made that no specialized tools designated for that purpose existed at that time in the Minusinsk Basin. Rather, multifunctional tools were used. These were made of tin bronze and low-carbon steel with thermal processing. Such tools first appeared in the region in the Early Iron Age.

Keywords: *Rock art, petroglyphs, Tagar culture, Minusinsk Basin, use-wear analysis, experiment, traceology.*

Introduction

Correlating petroglyphs with specific forms of tools used for their creation has always been crucial for the study of techniques applied to petroglyph making. This becomes particularly acute when petroglyphs do not have a clear cultural or chronological attribution (for example, the earliest rock art) (Molodin et al., 2019; Miklashevich, 2020; Zotkina et al., 2020; Zotkina et al., in press), but is also relevant for imagery that is reliably associated with a particular archaeological culture. The problem primarily results from the scarcity of finds, which may be linked to the process of creating rock art (Zotkina, Bocharova, 2017: 28). Even if artifacts that, according to their morphological features, might have served as tools for creating rock art were found directly under the panel with petroglyphs, the fact of their use in this capacity needs to be proven.

The experimental traceological approach is usually applied to the study of techniques in rock art (Beaune, de, Pinçon, 2001; d'Errico, Sacchi, Vanhaeren, 2002; Girya, Devlet E.G., 2010; Aubry, Sampaio, Luis, 2011; Miklashevich, 2012; Bradfield, Thackeray, Morris, 2014; Zotkina et al., 2014; Santos Da Rosa et al., 2014; Zotkina, 2019; Fedorova, 2019; Zotkina, Kovalev, 2019; Zotkina et al., 2020; Molodin et al., 2020). Several studies are known that have successfully correlated rock carvings with the archaeological tools used for their creation (Alvarez et al., 2001; Plisson, 2007; 2009: 442–443; Gueret, Benard, 2017: 105–111; Lopèz-Tascon et al., 2020).

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The tools for experimental reproduction of rock images are usually chosen using one of two approaches. The first approach is to examine the most diverse toolkit. This is optimal if there are no data on the period when the petroglyphs were created and there is a lack of tool finds potentially suitable for making these images. In this case, one needs to test all acceptable options, for which a fairly representative series of tools made of various lithic raw materials and metal alloys is assembled. It is advisable to select the tools with active parts of various shapes, different weights, etc. (see, e.g., (d'Errico, Sacchi, Vanhaeren, 2002)). The second approach implies a larger amount of initial data available. If cultural and chronological attribution of petroglyphs is reliably established, it is advisable to turn to the archaeological evidence and to make a selection of tools with morphological features suitable for making rock images (see, e.g., (Zotkina, 2016: 311, fig. 7)). Then, after the analysis of archaeological collections, a reference base is formed, which should be as close as possible to the technological conditions relevant for the archaeological culture under consideration. This approach was followed while studying the technological features of rock art of the Tagar and Tes period and of the toolkit available to ancient artists at this time.

Scholars associate the rock art of the Scythian period in the Minusinsk Basin with the Tagar culture (8th–3rd centuries BC) and with the Tes transitional stage (late 3rd century BC to early 1st century AD) (Savinov, 1994: 124; Kuzmin, 2008: 187). It is considered "a separate trend of the Scythian Siberian style" (Sovetova, 2005: 4). Notably, the style in rock art of that period evolved according to its own laws and did not always fully correspond to internal stages in the development of the Tagar culture and its Tes stage (Vadetskaya, 1986: 77–129; Kuzmin, 2008; Chlenova, 1992). Therefore, the rock art style development does not always correspond to periodization of the material culture (Sovetova, 2005: 15). Scholars often call the Tes rock art of the Minusinsk Basin "the transitional Tagar-Tashtyk" style (Ibid.; Devlet M.A., 1976; Baiberdina (Talyagina), 2019), taking into account the gradual emergence and consolidation of the figurative tradition in connection with the arrival of a new population and recognizable artifacts typical of the Tes stage.

The tools of the Tagar and Tes period are heterogeneous in composition and mechanical properties, since metalworking in the Minusinsk Basin at that period underwent significant changes. Scholars describe the period from the 8th to the 4th century BC as technologically unstable, with preservation of the remnants of the pre-Tagar period. By the 5th–3rd centuries BC, tin bronze became the main material, with a standardization of technology (Naumov, 1963: 189–190; Khavrin, 2000). At the later stages of the Tagar culture, in Southern Siberia there appeared iron items; however, scholars identify them as imported products (Zavyalov, Terekhova, 2014: 111). The increase in the number of iron items at the Tes stage, including artisan tools, can be associated with the emergence of local metallurgy, yet the first known centers for manufacturing ferrous metal items go back to the period corresponding to the Tashtyk culture (Sunchugashev, 1979: 28). These data determined the choice of archaeological evidence whose features became the basis for manufacturing bronze and iron experimental tools used in the technological study of rock art of the Tagar culture and Tes stage.

This study was intended to establish the technological capacities of the Tagar and Tes metal tools as implements for creating petroglyphs by pecking, and to identify the artifacts that could have been used for this purpose.

Material and methods

Following the classic experimental traceological approach (Semenov, 1957: 6–7, 9, 11), the study of archaeological artifacts involves:

analyzing the archaeological evidence;

proposing a working hypothesis based on the data obtained, preparing experimental tools, and conducting a series of experiments;

comparing the results of experiments with the initial data—traces on the experimental tools vs. original artifacts; making a conclusion that confirms or rejects the working hypothesis.

This study was carried out in order to reconstruct the technological process of making petroglyphs using the pecking technique in conditions as close as possible to those in which the artists of the Tagar-Tes period had to work. For doing this, experimental tools (replicas of archaeological metal artifacts) were made on the basis of archaeological data, morphological features of the Tagar and Tes tools, and published information on the chemical composition of Tagar bronze alloys. A panel of red-colored Devonian sandstone with a fairly intense desert varnish, found near the village of Poilovo in Kuraginsky District of the Krasnoyarsk Territory, was chosen as the experimental test site for producing the samples of pecking (Zotkina et al., 2020: 449). No rock images were found on the surface during preliminary inspection of the panel under different lighting conditions and by microscope. There were also no petroglyphs on the adjacent panels, which made this panel the most suitable as an experimental test site.

The experimental traceological study involved both reconstructing the technological process of pecking the Tagar petroglyphs and identifying specific use-wear traces that appeared on Tagar metal tools in the course of their use in making rock carvings. Thus, the research algorithm was as follows:

creating replicas of bronze tools (experimental tools) based on the analysis of collections of Tagar metal artifacts;

performing various types of pecking (direct and indirect, sparse and dense, with and without removal of the active part of the tool from the surface) on the panel of the experimental site, using the replicas of Tagar and Tes metal tools;

carrying out traceological analysis on experimental samples of the pecked surface;

studying use-wear traces on the active parts of the replicas of the Tagar and Tes metal tools;

comparing the traceological features of the pecking samples and use-wear traces on the experimental tools with their archaeological originals.

Thus, the study implied a comprehensive analysis of the *chaîne opératoire** of creating petroglyphs in the Tagar period.

Documenting the process and results of the experimental traceological study involved recording each stage of the experiment in accordance with the description protocol (taking into account the time of pecking, the number of impacts, various methods of pecking, position of the tool on the panel, features of tool use-wear, and characteristics of the resulting modification of the rock surface). The experiments were recorded using a GoPro Hero 5 Action Camera (video recording 120 fps). The 3D-models rendering the details of all the samples of pecking were made using the cloud photogrammetry technique (the frames were put together using the Agisoft Metashape Pro software). A Nikon D750 full-matrix camera with an AF-S MICRO Nikkor 60 mm macro lens and Nikon Speedlight Kit R1C1 Macro ring flash, which makes it possible to produce shots uniformly illuminated in all areas, was used for obtaining high-precision models (over one million points over the area of 3–5 cm^2) and further studying the traces in detail both in plan and in side view.

Specific features revealed by pecking in plan view were analyzed using a portable microscope with ×20 magnification (Nikon 11470 NS). For obtaining the data on the features of pecking in side view, 3D-models of experimental tools and traceologically significant areas of petroglyphs were analyzed. The MeshLab, Blender, and Geomagic Studio software was used for analyzing the metric parameters of indentations in plan and side view, as well as the morphological features of pecking marks (based on 3D-models).

Rock images at various scales (from a general view of the panel to details of petroglyphs with areas of 1 cm^2 or less) were photographed using a Nikon D750 camera with different lenses (AF-S Nikkor 14–24 mm, AF-S MICRO Nikkor 105 mm, AF-S MICRO Nikkor 60 mm). Macrophotography captured use-wear traces on archaeological artifacts and experimental tools using the stacking technique with a Nikon D 3200 camera which had an AF-S MICRO Nikkor 60 mm lens. The Helicon Focus software was applied for obtaining sharp photographs based on the frames with focus on different areas. Documentation of use-wear traces on the active part of the experimental tools was made after each series of pecking, before rejuvenation, or after the tool became unusable.

*The sequence of specific operations that constitute an entire technological process (see (Leroi-Gourhan, 1964)).

Results

Experiments on the production of metal tools

Experimental replicas of tools and weapons of the Tagar culture, which could have been used for creating petroglyphs, were made for identifying potential bronze tools. Various artifacts of the Tagar culture of the 5th–3rd centuries BC from the collection of the Martyanov Museum of Local History in Minusinsk were examined. Individual iron items of the Tes period were also studied. Pointed and chisel-shaped tools, chisels, spear-shaped chisels, and battle axes were chosen as samples for experimental tools made of copper and bronze. Iron experimental tools included pointed tools.

Replicas made of non-ferrous metals were cast in clay two-partite casting molds using wooden experimental tools. The metal was smelted in ceramic crucibles in a coal hearth, using manual air injection with two-chamber bellows. Since mechanical properties of copper-based alloys significantly differ depending on the tin content, which, among other things, affects the nature of use-wear traces, the published results of analyzing the elemental composition of the Tagar metal items were used. Seventy six samples were taken into account (counter-weights, chisels, celts, spearheads, sickles, battle axes, axes, and items of unknown purpose). It has been established that most of the items were made of copper and bronze with a tin content reaching 12 % (Savelieva, 2015, 2016; Khavrin, 2000: Pl. 1; 2007: Pl. 1). Considering these data, copper and 5 % and 10 % tin bronze were chosen as materials for casting experimental tools. After smelting, the experimental tools were studied by scanning electron microscopy and energy-dispersive X-ray spectroscopy (SEM-EDX) using a Hitachi TM3000 desktop microscope and Bruker Quantax 70 elemental analyzer at the Center for Collective Use, "The Geochronology of the Cenozoic", at the Institute of Archeology and Ethnography SB RAS. It was established that the content of tin in the resulting bronzes was 4–5 and 7–8 %.

Subsequently, the castings were subjected to forging and metalworking using stone and metal tools with

parallels from a wide geographical and chronological range, which included hammers made of pebbles, copper, and bronze, anvils made of large pebbles, and abrasives of sandstone (Golubeva, 2016; Gorashchuk, Semin, 2018; Knyazeva, 2011; Fregni, 2014). Casting defects were removed. The functional elements of the tools were subjected to hard forging (cold hardening).

As a result, the reference collection of metal experimental tools (11 items in total) included (Fig. 1): copper chisels, 4–5 % and 7–8 % bronze; pointed tools made of copper, 4–5 % and 7–8 % bronze; a chisel-like tool made of 7–8 % bronze; spear-shaped chisel made of 4–5 % bronze; battle axes made of 7–8 % bronze, and hammers made of copper and 4–5 % bronze.

Iron experimental tools (pointed and chisel-shaped) were forged of low-carbon steel of two grades (CT1 with a carbon content of 0.06–0.12 % and CT3 with a carbon content of 0.14–0.22 %). Half of the experimental tools were hardened in cold water. As a result, eight experimental tools were obtained: pointed tools made of CT1 and CT3 steel, unhardened and hardened, and chisel-shaped tools made of CT1 and CT3 steel, unhardened and hardened.

Pecking experiments

After the set of reference metal tools was prepared, experiments were carried out to perform pecking on the rock surface (Fig. 2). Each tool was used until the final stage of wear—the state of the active part when the tool becomes unsuitable for pecking. In most cases, the experimental tools, despite intensive wear, were rejuvenated after each use. Typically, each experimental tool served to perform three or four pecking samples.

In the course of the experiments, attention was paid to the effectiveness of the tools and correspondence of the resulting indentations to traces of pecking among the petroglyphs of the Tagar and Tes period or other chronological periods. If after applying a

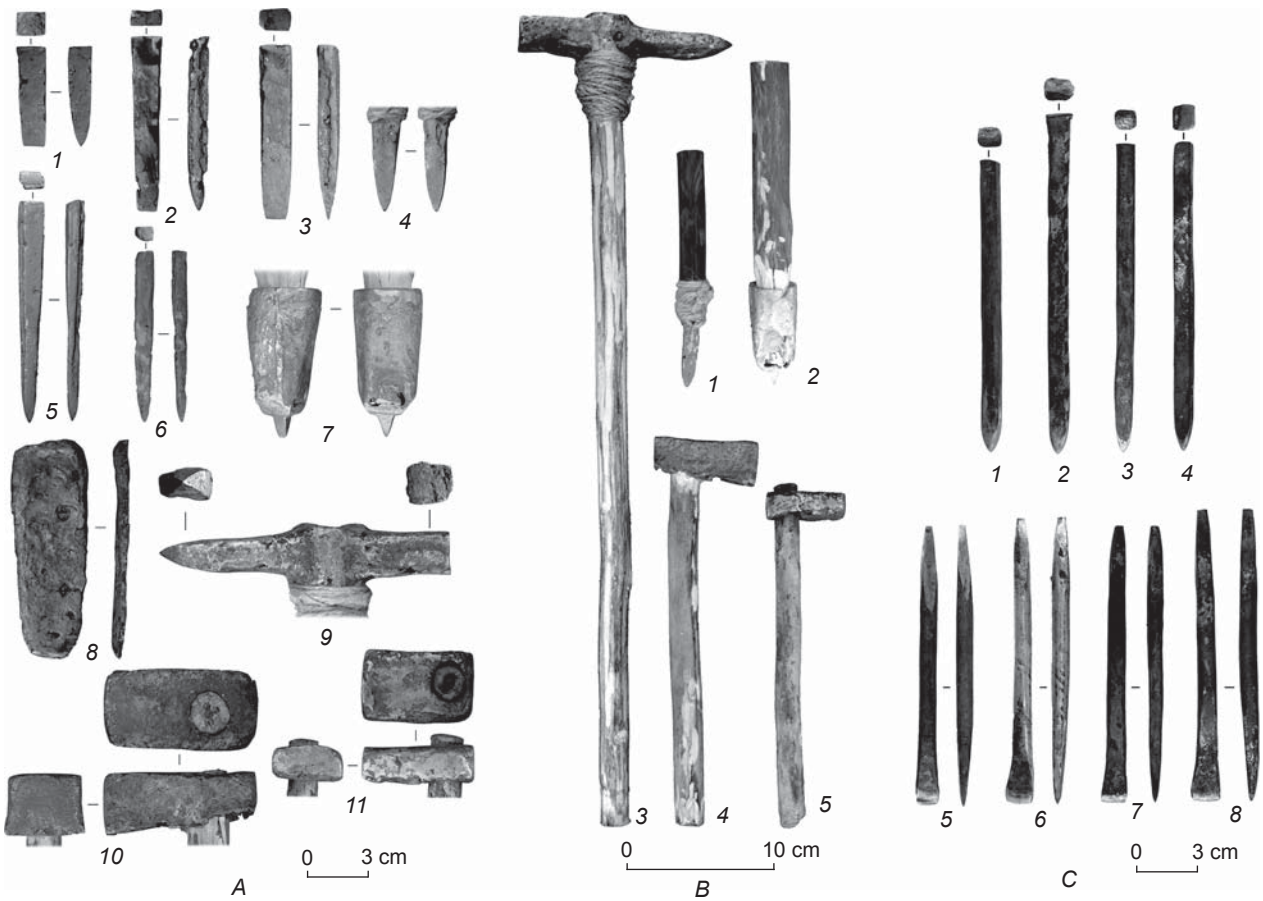

Fig. 1. Experimental metal tools.
A – copper (*1*, *4*, *10*) and bronze (*2*, *3*, *5–9, 11*) tools: *1–3* – chisels; *4–6* – pointed tools; *7* – spear-shaped chisel; *8* – chisel-like tool; *9* – battle axe; *10*, *11* – hammers. *B* – tools with wooden handles: *1* – pointed tool; *2* – spear-shaped chisel; *3* – battle axe; *4*, *5* – hammers. *C* – iron tools (*1*, *3*, *5*, *7* – CT1 steel; *2*, *4*, *6*, *8* – CT3 steel; *1*, *2*, *5*, *6* – non-hardened; *3*, *4*, *7*, *8* – hardened in cold water): *1–4* – pointed rod-shaped; *5–8* – chisel-shaped.

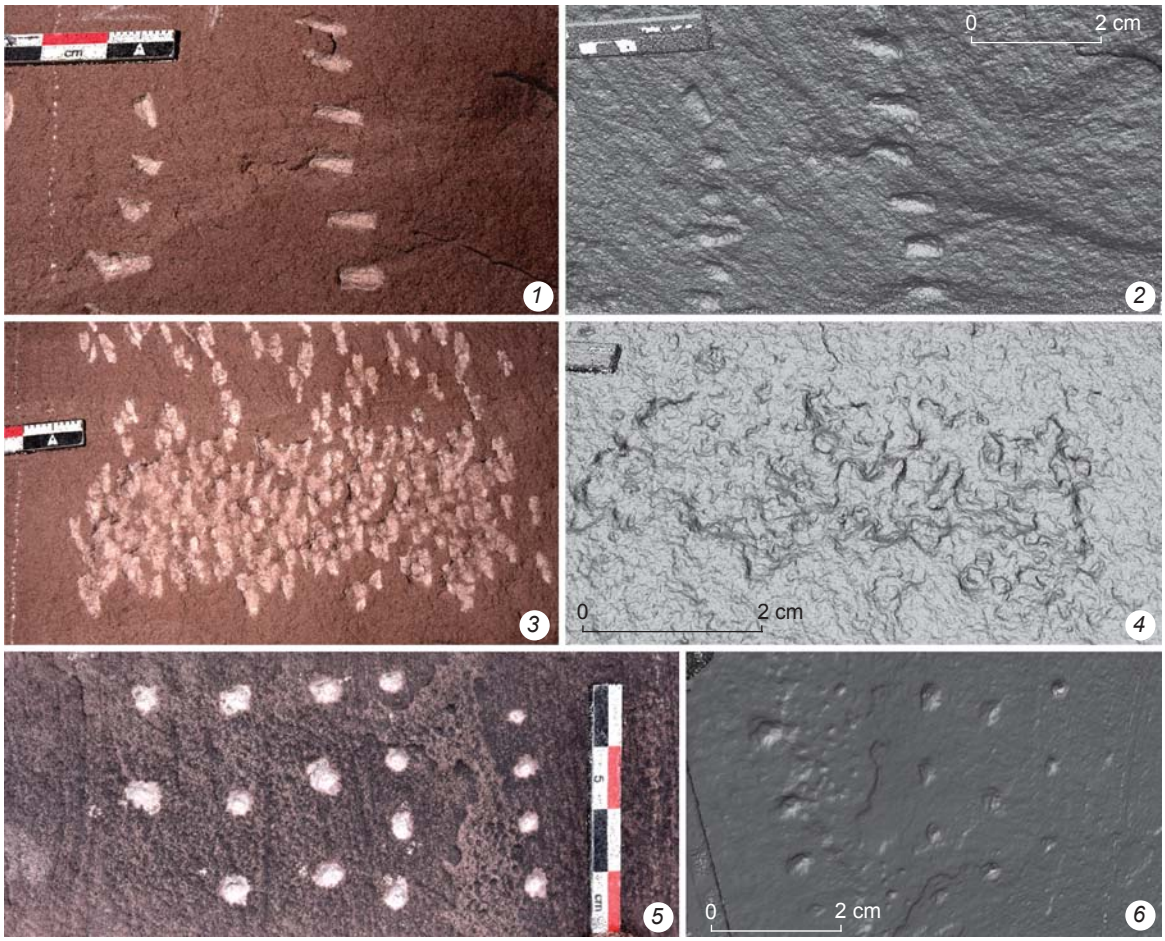

Fig. 2. Pecking made by experimental tools, using the direct dense pecking technique and indirect technique with separation (3D-models).
1, *2* – traces of sparse indirect pecking with chisel made of 5 % tin bronze; *3*, *4* – traces of dense direct pecking with chisel made of 5 % tin bronze; *5*, *6* – traces of sparse indirect pecking with rod made of hardened steel.

minimum number (about five) of impacts, the active part became unusable, and the resulting traces did not have a pronounced relief, were superficial, and did not correspond to the characteristics of the pecked indentations typical of the rock art of the region, such a tool was recognized as inapplicable for creating rock carvings in the pecking technique. The following conclusions were made based on the observations of pecking with metal tools.

Copper tools wore out very quickly; the active edge became deformed from only several impacts. The resulting indentations were few and superficial; the relief of the rock changed only slightly. The first rejuvenations with the help of an abrasive made it possible to quickly restore the effectiveness of the tools, since copper is a relatively soft metal. However, retouching of the working edge was required every 2–3 minutes; therefore, copper tools can hardly be considered suitable for creating petroglyphs in the pecking technique on red Devonian sandstone.

Bronze tools with a tin content of 4–5 % and 7–8 % respectively demonstrated similar capacities for creating rock carvings. On average, without rejuvenation, the effective pecking with rods made of such alloys lasted from 5 to 7 minutes. In the technique of direct pecking, about seven hundred impacts could be made during that time, which usually corresponds to the same number of marks (Fig. 2, *3*, *4*). As a result of impacts in the indirect technique with detachment of the tool from the processed surface, about sixty indentations were made (Fig. 2, *1*, *2*). Thus, using tools made of 4–5 % and 7–8 % tin bronze, without any or with only slight rejuvenations, one small image covering an area of 10 to 15 cm^2 (depending on the pecking density and chosen approach) could have been created in this technique. Traces obtained during experiments have a fairly pronounced relief; dependence of shape in the pecked indentations on the morphological features of the active part of the tool can be clearly observed. The most expressive traces remained after impacts with various chisel-shaped and rod-shaped tools

(Fig. 2). The experimentally obtained indentations were similar to those of the petroglyphs of the Minusinsk Basin (Fig. 3). It was suggested above that weapons might have been used as tools for creating petroglyphs (Zotkina et al., 2014: 57). However, during experiments, the inefficiency of the bronze battle axe as a tool for pecking was established. Since the wooden handle dampened and buffered the momentum of impacts, the marks were superficial and inexpressive.

Tools of hardened and unhardened low-carbon steel were also used during the experiments. Tools made of unhardened CT1 steel, just like copper rods, were found unsuitable for pecking. Experimental tools made of hardened steel CT1 and non-hardened steel CT3 were approximately comparable to the bronze tools mentioned above in terms of wear resistance and efficiency. However, owing to the greater hardness of the metal, the process of their rejuvenation required more effort and time. Traces of pecking left by steel and bronze tools also show similarities. Specific traces were left only by a pointed rod made of hardened steel CT3. The active part of the tool underwent minimal damage from pecking. Capable of leaving relatively expressive deep marks, it could be used for quite a long time without rejuvenation (see Fig. 2, *5*, *6*). The resulting indentations showed similarities to those appearing on the petroglyphs of the Minusinsk Basin (see Fig. 3, *3*, *4*). Rejuvenation of hardened steel tools required the greatest energy and time.

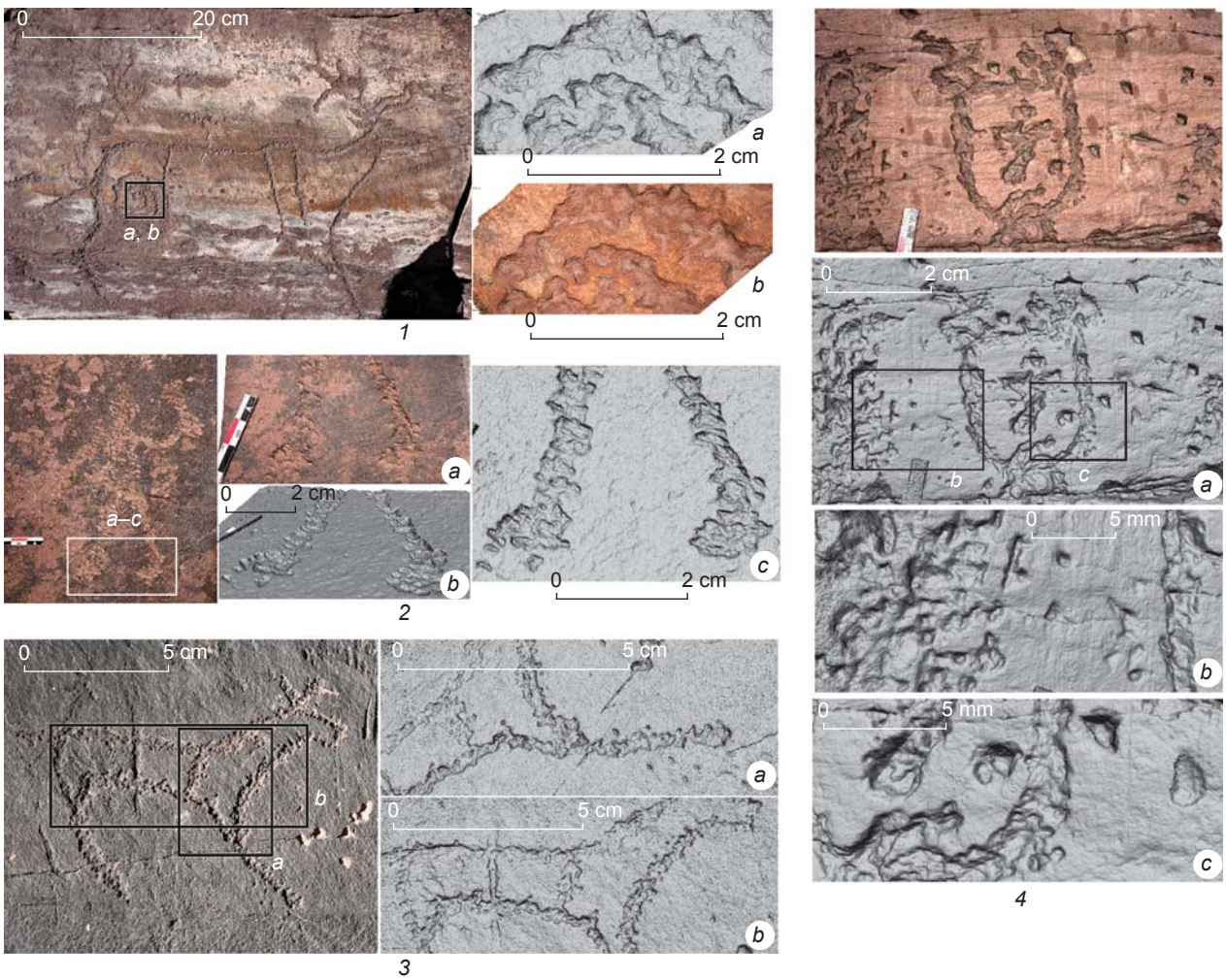

Fig. 3. Petroglyphs of the Tagar and Tes period and fragments of the rock surface with distinctive traces of pecking with metal tools.

1 – image of a deer in the Scythian-Siberian style (*a*, *b* – traceologically significant fragments (3D-models)), Sorok Zubiev, Oglakhty, Republic of Khakassia; *2* – image of a Tagar warrior with a battle axe in his hand (*a–c* – traceologically significant fragments (3D-models)), Shalabolinskaya Pisanitsa, Krasnoyarsk Territory; *3* – zoomorphic figure showing the posture of a sudden stop (*a*, *b* – traceologically significant fragments (3D-models)), Shalabolinskaya Pisanitsa, Krasnoyarsk Territory; *4* – image of a cauldron of the Tes period (3D-models with and without texture) (*b–c* with the traceologically significant fragments), Malaya Boyarskaya Pisanitsa, Republic of Khakassia.

Results of the comparative analysis between pecking experimental samples and the Tagar and Tes petroglyphs

The most typical signs of using metal tools are even contours of indentations and the stably repeating shape of traces. It is often close to being round, which indicates the use of a non-sharp point as an active part. Less often, this shape can be oblong or subtriangular, possibly resulting from the use of the main and sharp lateral parts of a chisel (Ibid.: 57, fig. 2). In the course of experiments, the tools that showed the greatest efficiency made it possible to produce indentations with features resulting from the use of metal tools (see Fig. 2). Moreover, samples of indentations created by these tools showed great similarity to indentations on late petroglyphs, including those attributed to the Tagar and Tes period (see Fig. 3). A comparative analysis makes it possible to apply the data obtained experimentally to the evidence of rock art and to draw the preliminary conclusion that the Tagar and Tes metal tools chosen as prototypes for the experimental tools could have been used for creating the petroglyphs of that period.

Results of analyzing use-wear traces on the experimental tools

The experimental tools were used for producing 76 pecking patterns. Examination of the copper and bronze tools

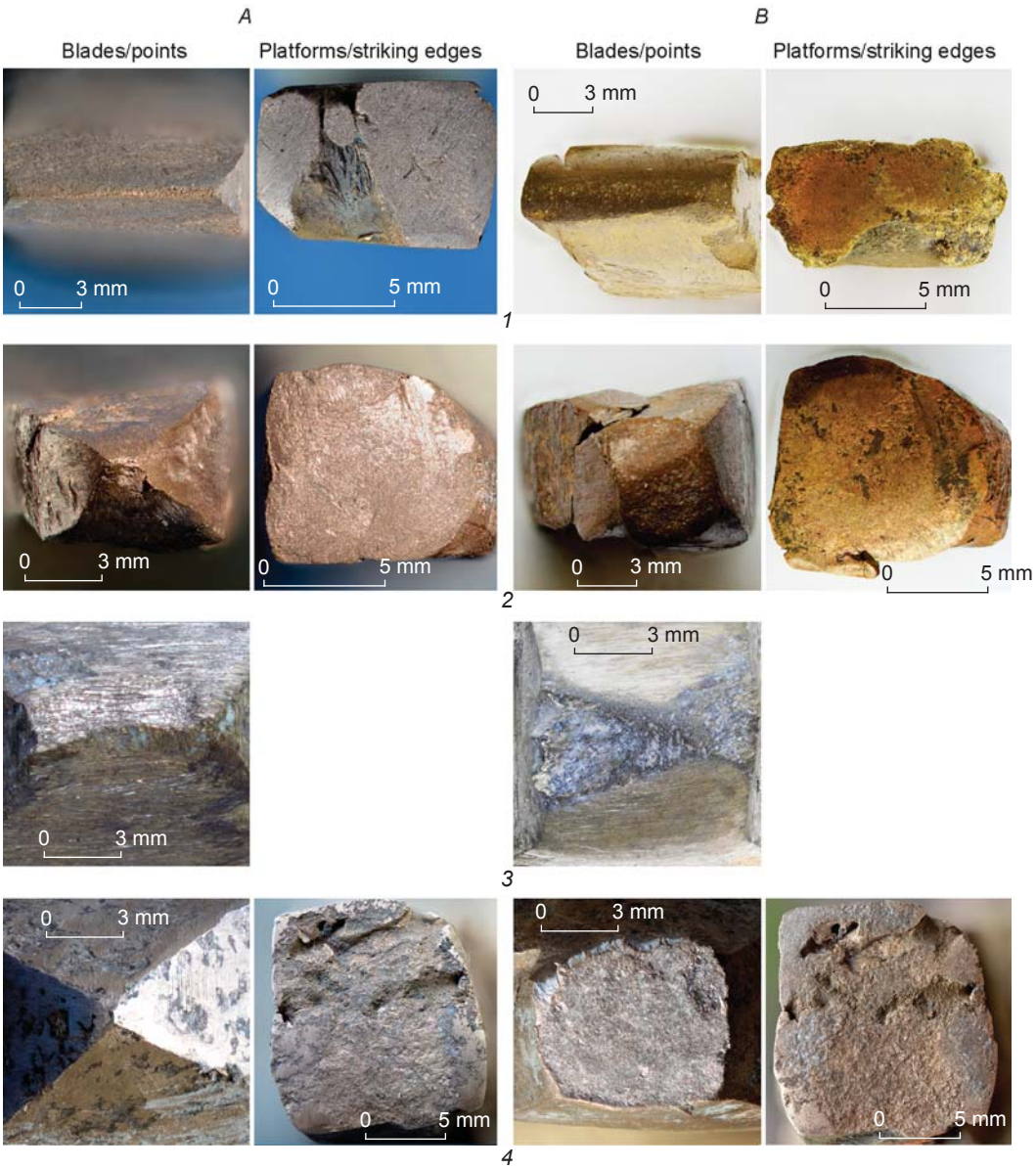

Fig. 4. Active parts of experimental bronze tools after manufacture (*A*) and after use (*B*).
1, *3*, *4* – 7–8 % tin bronze; *2* – 4–5 % tin bronze. *1* – chisel; *2* – pointed tool; *3* – spear-shaped chisel; *4* – battle axe.

revealed specific use-wear traces resulting from making petroglyphs in the pecking technique (see Fig. 1, 2).

The blades of chisels were distinctively flattened, and the microrelief of the rock surface was imprinted on the entire surface (Fig. 4). Metal protrusions directed to the side and individual groups of parallel scratches from tangential impacts were observed (Fig. 4, *1*). In the side view, thin items became deformed from strong impact.

The points had rounded flattenings with rock surface microrelief and metal protrusions, which were bent sideways and backwards (Fig. 4, *2–4*). Parallel scratches resulting from tangential impacts were visible along the edges (Fig. 4, *3*).

The striking edges and platforms were flattened and became rounded in the process of indirect pecking (Fig. 4, *1*, *2*, *4*). Their relief leveled out; delaminations appeared from strain hardening. There were imprints of a stone percussion tool with uneven microrelief in the location of impacts (Fig. 4, *1*; 5, *1*). Separate scratches along the edges are associated with tangential impacts (see Fig. 4, *1*).

Thin bronze items were often bent. The deformation degree of platforms in copper tools was much greater than that of bronze tools (2–7 and 1–2 mm, respectively).

The same traces are observed on the steel experimental tools. The points are flattened; they are imprinted with microrelief of the rock surface. The blades are crushed; distinctive depressions and protrusions of sandstone are observed on them. The striking platforms have metal cornices along the edges, linear tangential traces of impacts, and imprints of stone percussion tools (see Fig. 5, *2*, *3*).

Discussion

Four items with use-wear traces similar to those identified during the experiments have been found in the collection of the Martyanov Museum of Local History in Minusinsk. Bronze items include a rod-shaped tool rectangular in cross-section (MM A9335), a spear-shaped chisel (MM A499), and a chisel-shaped tool (MM A9734); the fourth item is a pointed tool made of iron (VF681-44) (Fig. 6).

The rod-shaped tool (MM A9335) has a striking part with plastic deformation from impacts and flattening showing stone tool microrelief (Fig. 6, *1*). Scratches from tangential impacts are visible along the edges. The tip

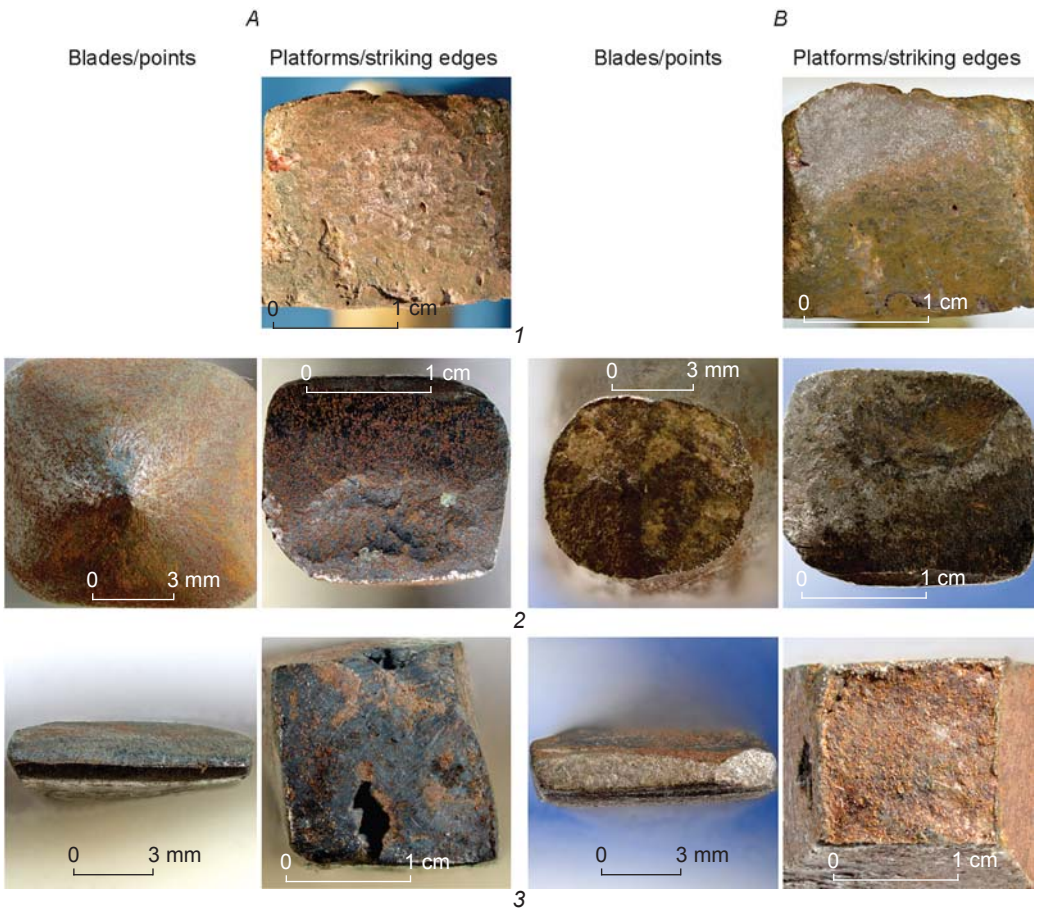

Fig. 5. Active parts of experimental copper and steel tools after manufacture (*A*) and after use (*B*).
1 – copper; *2* – non-hardened steel; *3* – hardened steel. *1* – hammer; *2* – pointed tool; *3* – chisel.

is rounded from impacts at different angles. Distinctive flattening with clear microrelief of the rock surface is visible. The tool became bent from multiple impacts.

The spear-shaped chisel (MM A499) (Fig. 6, *2*) is a socketed tool; its blade is evenly flattened and clearly shows the microrelief of the rock surface over its entire area.

The chisel-like item (MM A9734) has a flattened striking platform with traces of a stone tool and scratches from tangential impacts (Fig. 6, *3*). Its blade, bearing the imprints of relief of rock surface, is crushed.

Thus, bronze tools for drawing petroglyphs of the Tagar culture were identified among the universal tools of various forms.

The pointed iron tool (VF681-44) of the Tes stage is distinguished by a flattened striking platform with metal protrusions along the edges and linear marks from tangential impacts (Fig. 6, *4*). Although its tip is flattened, imprints of the microrelief of the rock surface, which do not expand to the sides, are preserved. Regular linear traces indicating rejuvenation of the tool appear on the sides.

The iron item is of very simple shape. The manufacturing and use of such tools made of metal with low carbon content occurred at the initial phase of the development of local metallurgy at the transitional Tes stage. The steel of the experimental samples was similar in carbon content to raw steel, which was obtained without special carbonization (Zavyalov, Rozanova, Terekhova, 2012: 31). Hardening in cold water was the simplest heat treatment technique used in Southern Siberia in the Xiongnu-Sarmatian period, as evidenced, for example, by locally produced iron files (Soenov, Konstantinova, 2015: Fig. 8). The tool from

Fig. 6. Tools with traces of working on a rock surface from the collection of the Martyanov Museum of Local History in Minusinsk.

1 – rod-shaped tool (MM A9335); *2* – spear-shaped chisel (MM A499); *3* – chisel-like tool (MM A9734); *4* – pointed tool (VF681-44).

the Martyanov Museum of Local History is interesting in the presence of a socket that was not used for its intended purpose. This is indicated by deformation of the striking platform and too small size of the hole. This socketed tool can be considered to be an example of copying bronze socketed varieties at an early stage of technological adaptation to new raw materials.

Unfortunately, there is no information on the context of discovering the metal items under discussion. These artifacts were surface finds; they entered the museum in the late 19th century. Nevertheless, the wear on these items provides very important information on the categories of tools that could have been used for creating rock images in the Scythian period.

Earlier experiments, aimed at reproducing pecking with stone tools made of pebble raw materials that were local to the Minusinsk Basin, showed very high efficiency and wear resistance of such tools. The possibility of using knapped pebbles as tools for making petroglyphs in the Tagar period cannot be ruled out, since they were more efficient than metal tools, and labor costs for their manufacturing in that period were much lower than those needed for manufacturing metal tools.

Conclusions

The experiments on reconstructing the technological process of creating petroglyphs by pecking has shown that rod-shaped and chisel-shaped tools made of 4–5 % and 7–8 % tin bronze typical of the 5th–3rd centuries BC, associated with the advanced stages of the Tagar non-ferrous metallurgy, as well as rod-shaped tools made of hardened low-carbon steel, could have been used to create the Tagar petroglyphs. Furthermore, a comparative study of traces on archaeological originals and experimental samples makes it possible to establish which petroglyphs were made with tools having the features discussed above (see Figs. 4, 5), and which metal tools were used to create the rock images (see Fig. 6). Thus, a comparative analysis of pecking traces on rock surfaces and use-wear traces on metal tools makes it possible to apply the experimental data to the archaeological evidence under study.

As a result of comprehensive technological study of the process and experiments on creating pecking with metal tools, a preliminary conclusion as to the absence of specialized tools for these tasks in the Tagar and Tes period can be drawn. The data obtained on the morphological features of the tools and on the nature of alloys of which the most effective tools for creating rock images in the pecking technique were made will be useful for subsequent research on the technological aspects of rock art in the Minusinsk Basin and Southern Siberia.

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References

Alvarez M., Fiore D., Favrey E., Guerra R.C. 2001
The use of lithic artifacts for making rock art engravings: Observation and analysis of use-wear traces in experimental tools through optical microscopy and SEM. *Journal of Archaeological Science*, No. 28: 457–464.

Aubry T., Sampaio J., Luís L. 2011
Approche expérimentale appliquée à l'étude des vestiges du Paléolithique supérieur de la Vallée du Côa (Portugal). In *La Investigación Experimental Aplicada a la Arqueologia*. Vol. 1: Tecnologia y Traceologia Litica Prehistorica y su Experimentacion. Granada: Universidad de Granada, pp. 87–96.

Baiberdina (Talyagina) M.A. 2019
Izobrazheniya tesinskogo vremeni v Minusinskoy kotlovine v kontekste arkheologicheskogo materiala. *Teoriya i praktika arkheologicheskikh issledovaniy*, No. 3 (27): 20–34.

Beaune S.A., de, Pinçon G. 2001
Approche expérimentale des techniques magdaléniennes de sculpture pariétale: Le cas d'Angles-sur-Anglin (Vienne). In *Préhistoire et approche expérimentale*. Montignac: Edition Monique Mergoil, pp. 67–75.

Bradfield J., Thackeray J.F., Morris D. 2014
An experimental investigation into the origin of incised lines on a 4000-year-old engraving from Wonderwerk Cave, Northern Cape Province. *South African Archaeological Bulletin*, No. 69 (199): 72–79.

Chlenova N.L. 1992
Tagarskaya kultura. In *Stepnaya polosa Aziatskoy chasti SSSR v skifo-sarmatskoye vremya*. Moscow: Nauka, pp. 206–223.

D'Errico F., Sacchi D., Vanhaeren M. 2002
L'analyse technique de l'art gravé de Fornols-Haut, Campôme, France. Implications dans la datation des représentations de style paléolithique à l'air libre. In *L'art paléolithique à l'air libre: Le paysage modifié par l'image, Tautavel-Campôme, 7–9 octobre 1999*. Carcassonne: Gaep, Géopré, pp. 75–86.

Devlet M.A. 1976
Bolshaya Boyarskaya pisanitsa. Moscow: Nauka.

Fedorova D.N. 2019
Primeneniye sovremennykh tekhnologiy dlya izucheniya petroglifov Russkogo Severa. *Zapiski IIMK RAN*, No. 20: 104–111.

Fregni E.G. 2014
The Compleat Metalsmith: Craft and Technology in the British Bronze Age. Sheffield: Univ. of Sheffield, Dep. of Archaeology.

Girya E.Y., Devlet E.G. 2010
Nekotoriye rezultaty razrabotki metodiki izucheniya tekhniki vypolneniya petroglifov piketazhem. *Uralskiy istoricheskiy vestnik*, No. 1 (26): 107–118.

Golubeva E.V. 2016
Teoriya i praktika eksperimentalno-trasologicheskikh issledovaniy nemetallicheskogo instrumentariya rannego zheleznogo veka – Srednevekovya (na materialakh yuzhno-tayozhnoy zony Sredney Sibiri). Krasnoyarsk: Sib. Federal. Univ.

Gorashchuk I.V., Semin D.V. 2018
Metallurgicheskiy i metalloobrabatyvayushchiy kompleks kamennykh orudiy truda s poseleniya Mikhailovo-Ovsyanka v Samarskoy oblasti. *Vestnik Udmurtskogo gosudarstvennogo universiteta*. Ser.: Istoriya i filologiya, No. 4 (28): 599–606.

Gueret C., Benard A. 2017
"Fontainebleau rock art" (Ile-de-France, France), an exceptional rock art group dated to the Mesolithic? Critical return on the lithic material discovered in three decorated rock shelters. *Journal of Archaeological Science*: *Reports*, No. 1: 99–120.

Khavrin S.V. 2000
Tagarskiye bronzy. In *Mirovozzreniye. Arkheologiya. Ritual. Kultura: Sbornik statey k 60-letiyu M.L. Podolskogo*. St. Petersburg: Mir knigi, pp. 183–193.

Khavrin S.V. 2007
Tagarskiye bronzy Shirinskogo rayona Khakasii. In *Sbornik nauchnykh trudov v chest 60-letiya A.V. Vinogradova*. St. Petersburg: Kult-Inform-Press, pp. 115–122.

Knyazeva E.V. 2011
Tekhnologiya metallurgii i metalloobrabotki na territorii Nizhnego Priangarya v sredniye veka: Opyt eksperimentalno-trasologicheskikh issledovaniy. *Vestnik Novosibirskogo gosudarstvennogo universiteta*. Ser.: Istoriya, filologiya. No. 5: Arkheologiya i etnografiya: 108–116.

Kuzmin N.Y. 2008
Etapy slozheniya i razvitiya tesinskoy kultury (po pogrebalnym pamyatnikam stepey Minusinskoy kotloviny). In *Nomady kazakhskikh stepey: Etnosotsiokulturniye protsessy i kontakty v Yevrazii skifo-sakskoy epokhi*. Astana: Prezidentskiy tsentr kultury Respubliki Kazakhstan, pp. 187–204.

Leroi-Gourhan A. 1964
Le Geste et La Parole. Vol. 1: Technique et langage. Paris: Albin Michel.

Lopèz-Tascon C., Pedergnana A., Ollé A., de la Rasilla M., Mazo C. 2020
Characterization of the use-wear and residues resulting from limestone working. Experimental approach to the parietal art of La Viña rock shelter (La Manzaneda, Asturias, Spain). *Quaternary International*, vol. 569–570: 212–227.

Miklashevich E.A. 2012
Tekhnika gravirovki v naskalnom iskusstve skifskogo vremeni. In *Izobrazitelniye i tekhnologicheskiye traditsii v iskusstve Severnoy i Tsentralnoy Azii*. Kemerovo: Kuzbassvuzizdat, pp. 157–202. (Trudy Sibirskoy assotsiatsii issledovateley pervobytnogo iskusstva).

Miklashevich E.A. 2020
O skhodstve drevneishikh naskalnykh izobrazheniy Yuzhnoy Sibiri i Tsentralnoy Azii i probleme ikh atributsii. *KSIA*, No. 261: 82–98.

Molodin V.I., Geneste Z.-M., Zotkina L.V., Cheremisin D.V., Cretin C. 2019
The "Kalgutinsky" style in the rock art of Central Asia. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 47 (3): 12–26.

Molodin V.I., Zotkina L.V., Cretin C., Cheremisin D.V., Batbold N., Tseveendorj D. 2020
Palimpsest s mestonakhozhdeniya Tsagaan-Salaa IV (Mongolskiy Altai): Otnositelnaya khronologiya izobrazheniy. *KSIA*, No. 260: 134–150.

Naumov D.V. 1963
Proizvodstvo i obrabotka drevnikh mednykh i bronzovykh izdeliy Minusinskoy kotloviny. In *Noviye metody v arkheologicheskikh issledovaniyakh*. Moscow, Leningrad: AN SSSR, pp. 159–190.

Plisson H. 2007
La fonction des outils de silex dans les grottes ornées paléolithiques. In *Congrès du Centenaire: Un siècle de construction du discours scientifique en Préhistoire*. Paris: Société Préhististorique française, pp. 125–132.

Plisson H. 2009
Analyse tracéologique de 4 pics d'Olga Grande: des outils pour les gravures de plein air? In *200 séculos da história do vale do Côa: na vida quotidiana dos caçadores-artistos do paleolithico*. Lisboa: IGESPAR, pp. 436–443.

Santos Da Rosa N., Cura S., Gersés S., Cura P. 2014
Between tools and engravings: Technology and experimental archaeology to the study of Cachao do Algarve rock art. In *UISPP 2014: Technology and Experimentation in Archaeology*. Oxford: pp. 87–96. (BAR Intern. Ser.; vol. 10, No. 2657).

Savelieva A.S. 2015
Tsvetnoy metall tagarskoy kultury: Istoriya issledovaniy sostava splavov na mednoy osnove s 1860-kh po 1950-ye gg. *Vestnik Tomskogo gosudarstvennogo universiteta.* Istoriya, No. 4 (36): 85–95.

Savelieva A.S. 2016
Tsvetnoy metall tagarskoy kultury: Istoriya issledovaniy sostava splavov na mednoy osnove s 1960-kh po 2000-ye gg. *Vestnik Tomskogo gosudarstvennogo universiteta*, No. 408: 125–133.

Savelieva A.S., German P.V. 2015
Bronzy iz kurgannogo mogilnika tagarskoy kultury Nekrasovo II (po materialam raskopok 1970 g.) *Vestnik Tomskogo gosudarstvennogo universiteta.* Istoriya, No. 6 (38): 108–118.

Savinov D.G. 1994
Razvitiye stilya izobrazheniy na plitakh kurganov tagarskoy kultury. In *Problemy arkheologii*, iss. 3. St. Petersburg: SPb. Gos. Univ., pp. 123–136.

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

Soenov V.I., Konstantinova E.A. 2015
Remeslenniye proizvodstva naseleniya Altaya (II v. do n.e. – V v. n.e.). Gorno-Altaysk: Izd. Gorno-Alt. Gos. Univ.

Sovetova O.S. 2005
Petroglify tagarskoy epokhi na Yeniseye (syuzhety i obrazy). Novosibirsk: Izd. IAET SO RAN.

Sunchugashev Y.I. 1979
Drevnyaya metallurgiya Khakasii: Epokha zheleza. Novosibirsk: Nauka.

Vadetskaya E.B. 1986
Arkheologicheskiye pamyatniki v stepyakh Srednego Yeniseya. Leningrad: Nauka.

Zavyalov V.I., Rozanova L.S., Terekhova N.N. 2012
Traditsii i innovatsii v proizvodstvennoy kulture Severnoy Rusi. Moscow: Ankil.

Zavyalov V.I., Terekhova N.N. 2014
K voprosu o proiskhozhdenii zheleznykh izdeliy u plemen tagarskoy kultury. *KSIA*, iss. 236: 109–112.

Zotkina L.V. 2016
Le bison de La Grèze (Marquay, Dordogne, France) sous le microscope. *Paléo. Revue d'Archéologie Préhistorique*, No. 27: 307–320.

Zotkina L.V. 2019
On the methodology of studying palimpsests in rock art: The case of the Shalabolino rock art site, Krasnoyarsk Territory. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 47 (2): 93–102.

Zotkina L.V., Bocharova E.N. 2017
Rezultaty tekhnologo-trasologicheskogo issledovaniya kamennykh orudiy dlya vypolneniya petroglifov v tekhnike piketazha. *Sibirskiye istoricheskiye issledovaniya*, No. 4: 27–45.

Zotkina L.V., Cretin C., Plisson H., Geneste J.-M., Molodin V.I. 2020
Technological parameters of rock art at the Kalgutinsky Rudnik site on the Ukok Plateau, Russian Altai region. *Quaternary International*, vol. 559: 188–197.

Zotkina L.V., Kolobova K.A., Sutugin S.V. (s.a.)
Technological or stylistic features: What defines the Minusinsk style in the earliest rock art from the Minusinsk Basin (Southern Siberia). In press.

Zotkina L.V., Kovalev V.S. 2019
Lithic or metal tools: Techno-traceological and 3D analysis of rock art. *Digital Applications in Archaeology and Cultural Heritage*, vol. 13.

Zotkina L.V., Solodeinikov A.K., Davydov R.V., Kurbanov R.N., Postnikov N.V., Sutugin S.V., Shevchenko T.A., Konokhov V.A., Fedorenko P.Y. 2020
Rezultaty polevykh issledovaniy pamyatnikov naskalnogo iskusstva drevneishego plasta na territorii Minusinskoy kotloviny v 2020 godu. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XXVI. Novosibirsk: Izd. IAET SO RAN, pp. 445–452.

Zotkina L.V., Tekhterekov A.S., Kharevich V.M., Plisson H. 2014
An experimental study of percussion technologies in the Minusinsk Basin: Percussion and tool types. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 1: 55–65.

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Grave Goods of an Elite Saka Burial at Kyrykoba in the Context of Cultural Ties Between the Nomads of Kazakhstan and Siberia

This article describes the findings of excavations of an Early Saka kurgan at Kyrykoba, Eastern Kazakhstan. The kurgan had been looted; human remains, according to physical anthropologists, belonged to a mature woman. Her cranium exhibited trepanation. Some 200 artifacts were found, mostly gold and stone ornaments (belt clips, gold seed beads, and simple beads). The most interesting find is a bimetallic pin made of iron. Its rod is missing; the tiny head, less the 1 cm in diameter, is covered with gold foil. On its surface, there is a figure of an ungulate with a curved antler, its body twisted 180°. This stylistic device in the depiction of ungulates and predators is typical of the Scythian-Siberian art of Kazakhstan and Western Siberia in 700–300 BC. Other rare finds include ornaments made from a cretaceous layer of oyster shells, such as pendants shaped as oval plates imitating tusks, or figurines of predatory animals—20 pieces, ranging in size from 0.4 × 0.4 to 2.5 × 2.5 cm. Oyster shells with thick cretaceous layers had been procured from the coasts of the Indian Ocean and the Persian Gulf. The beads and the animal figurine made from cretaceous layers of oyster shells are paralleled by those from an Early Scythian era burial at Gilevo-10, Altai. These artifacts indicate regional and intracontinental trade and cultural ties in Eastern Kazakhstan and Western Siberia, evidenced by similar technological traditions, images, compositions, and decorative motifs.

Keywords: *Early Iron Age, Kazakhstan, Altai-Sayan, Scythian animal style, trepanation, ornaments from cretaceous layer of oyster shells.*

Introduction

One of the long-term objectives for studying steppe areas of Kazakhstan and Siberia is a search for relationships between the intensity of intercultural contacts and the development of societies in the Early Iron Age. The clearest manifestations of interregional ties in Western Siberia have been found among the carriers of the Sargatka culture. According to N.P. Matveeva, by the second half of the 1st millennium BC, these people had formed diversified trade relations with the population of Central Asia (Bactria, Fergana, Semirechye, the interfluve of the Syr Darya and Amu Darya), Iran, India, and the Black Sea region. A massive influx of imported goods into the Sargatka area occurred from the 4th century BC; from

the 3rd century BC, it became a factor determining the outlook of their material culture. Imported items constituted 80–90 % of the grave goods of burials belonging to the representatives of the hereditary aristocratic stratum, which was at the top of the military hierarchy (Matveeva, 2000: 68, 286–298).

In the territory of Kazakhstan, the trade relations of the local population with sedentary agricultural centers fostered the emergence of nobility. The upper class consisted of tribal chiefs, tribal aristocracy, and heads of families and clans. Just as in the entire space of the Scythian-Siberian world, burials of tribal and clan aristocracy in Kazakhstan differed from burials of the middle and lower strata by specific features of the funeral rite, as well as the structure and size of the mound. An important social marker is the presence, in the grave goods, of a large number of distinctive highly artistic items made of rare raw materials (Grach, 1975).

During the excavations at the Kyrykoba cemetery in East Kazakhstan, a disturbed adult burial was discovered. The structure and size of the stone mound, the burial practices, which included craniotomy, and grave goods with peculiar pieces of art make it possible to consider Kyrykoba as an elite necropolis of the highest nobility of the Saka society. The high social status of the buried person is also indicated by adornments found in the grave, which were made of rare and therefore prestigious organic material procured on the coasts of southern seas and distributed along the intracontinental trade routes to the north, to Kazakhstan, and further, to the steppe regions of Western Siberia.

General information about the site

The cemetery of Kyrykoba is located near the village of Akshatau, Ayaguzsky District, East Kazakhstan Region (Fig. 1). It was discovered in 2012 by the employees of the Chair of Archaeology and Ethnology at the Department of History of the Gumilyov Eurasian National University. In the summer of 2018, in the area of the necropolis, kurgan 7 was explored by the archaeological team from that university.

The burial site was a flattened stone-and-soil mound rounded in plan view, with a diameter of about 28 m and height of 1.7 m. One of the structural features of the mound was a crepidoma along the perimeter of the kurgan, made of vertically set stone slabs (maximum size of 0.3 × 0.5 × 0.10 m). According to stratigraphic observations, the central part of the mound consisted of large blocks, while the peripheral part included smaller stones laid in several layers (Fig. 2, *1*). The stratigraphic cross-section clearly reveals the robbers' entrance, which led from the top of the mound to the burial.

Fig. 1. Location of the Kyrykoba cemetery.

The grave-pit was round in shape and slightly exceeded 3 m in diameter. A structure of a rectangular stone box measuring 3.0 × 1.3 × 0.5 m, oriented with its long sides along west–east, was found at a depth of 2 m. The ceiling, which was made of long flat slabs and laid across the box, has survived only partially (Fig. 2, *2*, *3*). The anatomical integrity of the skeleton had been violated. Anthropological analysis of the remains has shown that the skeleton belonged to a mature woman. A hole remaining from craniotomy was located in the right lower part of the occipital bone (Fig. 2, *4*).

The samples of bones were analyzed in the laboratory of the Center for Climate, the Environment, and Chronology (^{14}CHRONO Centre) at Queen's University Belfast. On the basis of AMS dating, the radiocarbon age of the site was established as 2579 ± 41 years. The calibrated indicators cover the calendar time interval of 273 years (821–548 BC).

Description of the grave goods and discussion

The collection of finds includes about two hundred artifacts, mainly personal ornaments (simple beads, gold seed beads, belt clips, plaques, and cone-shaped caps) (Fig. 3, 4; 5, *1*, *3–7*). The scope of this article does not allow for a detailed description of the entire collection; only a miniature bimetallic hairpin and adornments made of seashells are described. In our opinion, these artifacts expand our ideas about the socially prestigious artistic ornaments of the cattle-breeders from Kazakhstan, and serve as evidence of their contacts with the population of the remote coasts of the Indian Ocean and the Persian Gulf.

The Bimetallic hairpin is made of iron; its ellipsoidal head is covered with gold foil. The total length of the item is 2.4 cm. A small part of the hairpin's needle has


4

1


2


3

Fig. 2. Kurgan 7 at the Kyrykoba cemetery.
1 – mound; *2* – filling of the grave-pit; *3* – stone box with traces of robbery; *4* – cranium with traces of craniotomy.

survived. The fracture area was flattened and corroded, thus making it impossible to establish the reason for the damage (the needle might have been pressed down by stones during the collapse of the ceiling). The diameter of the head is 0.8 cm vertically and 0.5 cm horizontally (Fig. 5, *2*).

Iron pins decorated with gold have often been discovered in female burials at Scythian sites in Tuva (Savinov, 2002: 123–124). The head of the pin from kurgan 7 was decorated with embossed low-relief in ornamental style, typical of stamped relief representations and for gold appliqués on flat surfaces. A full image of an animal with a twisted body was placed in a small area. Notably, this artistically sophisticated representation was made on the spherical surface. The figure, with quite carefully elaborated details, occupied the entire space, thanks to which the composition looks complete and resembles well-known bronze plaques in the form of curled up predators. The distinctiveness of the Kyrykoba find is in a frontal, but not horizontal, view of the head in the figure on the pin. According to S.I. Rudenko, such an artistic technique was not a

"decisive point", since ancient artisans "knew how to fit animal figures into any geometric shape" (1953: 315).

Judging by individual elements of the animal's body, this was an ungulate animal (elk, deer, ram?), with an unusually curved antler having a leaf-shaped end. However, its tail, rendered as three separate strands, is more consistent with a horse. The combination of features belonging to different animals into a single image makes it possible to consider this image as an example of zoomorphic transformation. According to A.R. Kantorovich, such a stylistic technique was most often used for depicting ungulates in the 7th–4th centuries BC (2002: 118). However, according to K.A. Akishev, realistic images of deer, goat, and argali (ancient tribal Saka totems-ancestors) had already become a relic of the past in the 5th–4th centuries BC. In the Issyk time, their symbol—deer-antlers and goat-horns, or horses' heads with imitation of goat-horns—were more commonly represented (Akishev, 1978: 56–57, pl. 9). Masked horses, such as those found at the Berel cemetery, are also well known (Samashev, 2011: 57, 61, 65, 170, fig. 38–40, 109, 405). D.V. Cheremisin observed that masking sacrificial horses with horns was accompanied by reproducing the plot of their torment, which corresponded to the context of the funeral rite among the Indo-Iranian peoples (2005: 138).

Expressive depictions of animals with bodies twisted 180° were common in the Scythian-Siberian art of the eastern part of the steppe belt. The main

Fig. 3. Golden beads from the burial of kurgan 7.

Fig. 4. Necklace and beads from the burial of kurgan 7.

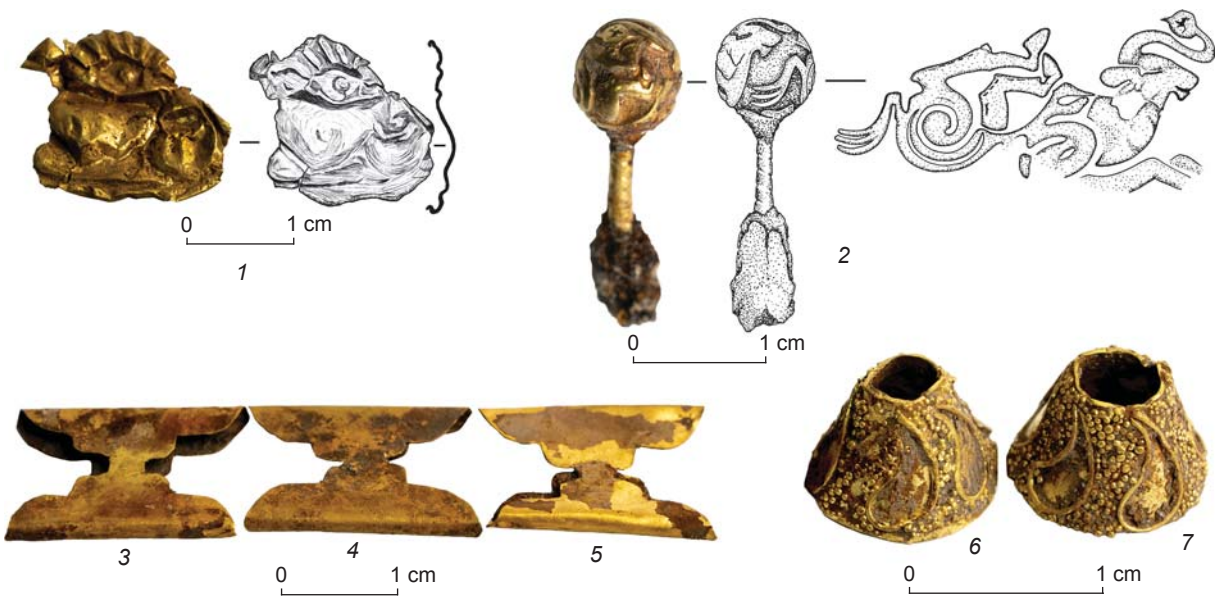

Fig. 5. Grave goods from the burial of kurgan 7.
1 – fragment of gold foil with embossing; *2* – bimetallic pin with image of an animal; *3–5* – onlays on a waist belt; *6*, *7* – conical caps.

characters were hoofed and predatory animals. Individual figures and compositions representing the scenes of torment appear on the pieces of dermatoglyphics, weaponry, carpet products, horn and metal adornments of horse-harness, and in rock art. In Kazakhstan, similar figures and compositions have been found on the items of grave goods at the Issyk and Berel necropolises, and in rock representations of the goat tormented by wolves, with a modified rear part of the goat's body (Akishev, 1978: Pl. 25; Samashev, 2011: Fig. 30, 36, 403; Maryashev, 1984: 46). This artistic device was also common in the Altai foothills and mountains, Minusinsk Depression, Tuva and Xinjiang, and was typical of the Scythian culture (Mogilnikov, 1997: Fig. 41, *5*; Borodovsky, Telegin, 2007: Fig. 2, 34, 10, 11; Korolkova, 2006: Pl. 16, *13*, *20*; 18, *1*; Bogdanov, 2006: Pl. XXXIX, 1, *9*; Moor, 2014: Fig. 6, 6a; Devlet E.G., Devlet M.A., 2005: Fig. 100, *1*; Sovetova, 2005: Pl. 9, *7–9*; Rusakova, 2003: 96, fig. 1, *1*, *3*; Grach, 1980: 178, fig. 40; Mandelshtam, 1992: Pl. 78, *16*; Rudenko, 1953: Fig. 157–161, 181–184, pl. CXI; Barkova, Pankova, 2005: Fig. 2, *1*, *2*, 5, 6, 12; Molodin, 2000: 117–118; Polosmak, 2001: Fig. 151; Barkova, 1984: Fig. 1, 6, b; Kubarev, 1998; 1999: Pl. IV, *13*; Cheremisin, 1990: 164).

In Scythian art, a kind of artistic "template", which was a part of the theme of "good torment", was created using the stylistic device of turning the back of the body in relation to the front. This device has been discussed in scholarly literature many times. Rudenko interpreted the graphic style of the Pazyryk tattoos, representing an animal with hind limbs thrown behind its back, as a device for depicting a sacrifice and regarded it as "a very ancient Sumerian style" (1953: 315). In a detailed interpretation, this technique illustrates ancient sacrifice. In ethnographic descriptions, such posture (with the broken spine) was typical of animals at the time of death (Devlet E.G., Devlet M.A., 2005: 108; Rusakova, 2003: 98; Sovetova, 2005: 43, 45). In the context of "good torment", the fight between an ungulate and predator was considered as a version of presenting the basic mythologeme, which reflected the cosmological ideas of the Iranian-speaking population of Eurasia (Kuzmina, 1976; Cheremisin, 2008b).

Another group of interpretations of the "pictorial text", which we can call "ethological", is based on a pragmatic approach to explaining the artistic features of the Scythian animal style. According to the warfare-and-hunting hypothesis proposed by V.A. Korenyako, the emergence of "expressive deformations", including "torsion" and "twisting" of animal's body, was associated with observations of its habits (2002: 146, 169–175). Following the hypothesis of Korenyako, Z.S. Samashev (2011: 167) clarified that the motive of "twisting" the body reflected the experience of watching the state of a wounded animal. He also suggested that expressive deformations made it possible to show moments of animal's natural behavior in its native habitat (Borodovsky, Telegin, 2007: 55). In this case, the deformity rendered the volume of the animal's body and helped the artisan to represent it from different angles (Umansky, Shamshin, Shulga, 2005: 65).

The "hunting" hypothesis is also consistent with the suggestion of S.S. Sorokin, who observed that hunters carried the game—animal carcasses and skins—on the withers of a riding horse, and in this way they demonstrated good luck and personal prowess. Later, the substitute images of animals killed during the hunt were placed on the covers of saddles and served as a kind of insignia (Sorokin, 1973: 182). Developing the thesis about the proximity of the compositions with scenes of torment and the items on which they were represented, E.S. Bogdanov observed that saddle decorations were semantically more connected with the rider than with his horse. In accordance with principles of sympathetic magic, images of specific animals and fantastic creatures could have been believed to enhance the speed and fighting qualities of a horse (Bogdanov, 2006: 44–45).

It follows from the above that the relief miniature on the head of a pin from the Saka kurgan 7 at Kyrykoba enriches the set of images that are extremely indicative of Scythian art, and also expands the range of items on which they were applied.

Personal ornaments made of raw materials that were exotic for the steppe belt of Asia are outstanding finds from the burial mound under discussion. These include two pendants in the form of an oval plate with holes drilled at the ends (1.8 × 1.5 × 0.2–0.3 cm in size) (Fig. 6, *1*, *2*), six pendants in the form of a curved tusk of an animal with holes drilled at the ends and in the middle part (1.5–4.0 cm long and up to 1 cm wide) (Fig. 6, *3–8*), and twenty plaques in the form of similar but differently directed figurines of a predatory animal (minimum size of 0.4 × 0.4 cm; maximum size of 2.5 × 2.2 cm) (Fig. 7). According to the conclusion made by I.N. Kosenko from the Laboratory of Paleontology and Stratigraphy of the Mesozoic and Cenozoic at the Trofimuk Institute of Petroleum Geology and Geophysics SB RAS, all of these were made from cretaceous layers of subfossil (non-petrified) oyster shells.

The mollusks were small in size, so the signs that would make it possible to establish their species precisely were not available. The walls of bivalve shells, for example of the species *Ostrea edulis*, consist of several layers (Fig. 8, *1*). The outer layer (*periostracum*) is composed of organic horn-like substance; the next layer (cretaceous) is composed of calcite and is followed by a layer similar in microstructure to the previous one. The last (inner) layer (mother-of-pearl) is formed by lamellar crystals, with a distinctive luster or matte appearance.

The cretaceous layer has a typical porous structure, which can be seen on the surface of the finds (Fig. 8, *2*, *3*). One tusk-shaped pendant retained a part of the inner mother-of-pearl layer of the shell (Fig. 8, *4*). The microstructure of the cretaceous material is especially well seen on the inner side of the onlays of animal shapes (Fig. 8, *5*).

Mollusk shells and adornments made thereof have often been discovered at archaeological sites in the steppe belt of Eurasia. From the mid-4th millennium BC, ornaments made of shells of river mollusks *Colletopterum* were a part of grave goods at the Neolithic and Chalcolithic sites in the Ob and Angara basins (Molodin, 2001: 22, 37). According to some scholars, the tradition of making personal ornaments of mollusk shells was brought to Western Siberia by the migrants from Central Asia or East Kazakhstan. In Siberia, shells of mollusks from local rivers were probably used as raw material (Kiryushin et al., 2011: 37, 44–45).

Fig. 6. Pendants from cretaceous layers of oyster shells.
1, *2* – flat; *3–8* – in the form of animal tusk.

A variety of items, such as beads, pendants, plates with sophisticated outlines, and eye-shields, have been found in the Saka necropolises of the Eastern Pamir. According to B.A. Litvinsky, these items, which are not typical of Central Asia, might have been made of the Paleogene marine deposits. However, it is most likely that *Turbinella pyrum* shells were specially brought to this region from the sea coast of India: here, they have been discovered in megalithic structures (Litvinsky, 1972: 72, 141, 142, pl. 25, 26, 47). The system of trade relations did not change in the Xiongnu-Sarmatian Period. The *Turbinella pyrum* shells continued to arrive from India to Kazakhstan and steppe regions of Western Siberia (Mershchiev, 1970: Fig. 7, *1*, *2*; Egorov, 1993: Fig. 2, *2*).

The biomineral used for manufacturing the adornments mentioned above possesses such qualities as high density accompanied by low hardness. This made it possible to process the raw material using the simplest tools—a knife and small abrasives. Judging by the shape and size of pendants and onlays (Fig. 8, *4*, *5*), the cretaceous layer was quite thick, which is typical only of those mollusks from the southern seas. The properties of the material made it possible to produce very small onlays with careful treatment of all details

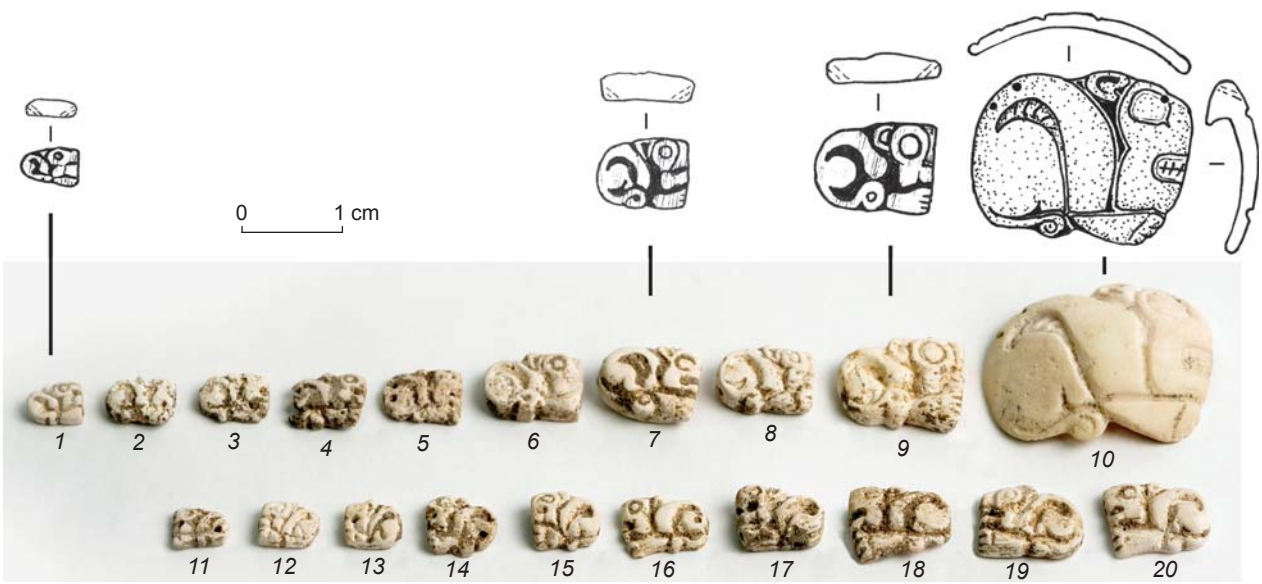

Fig. 7. Plaques in the form of animal figurines from cretaceous layer of oyster shells.

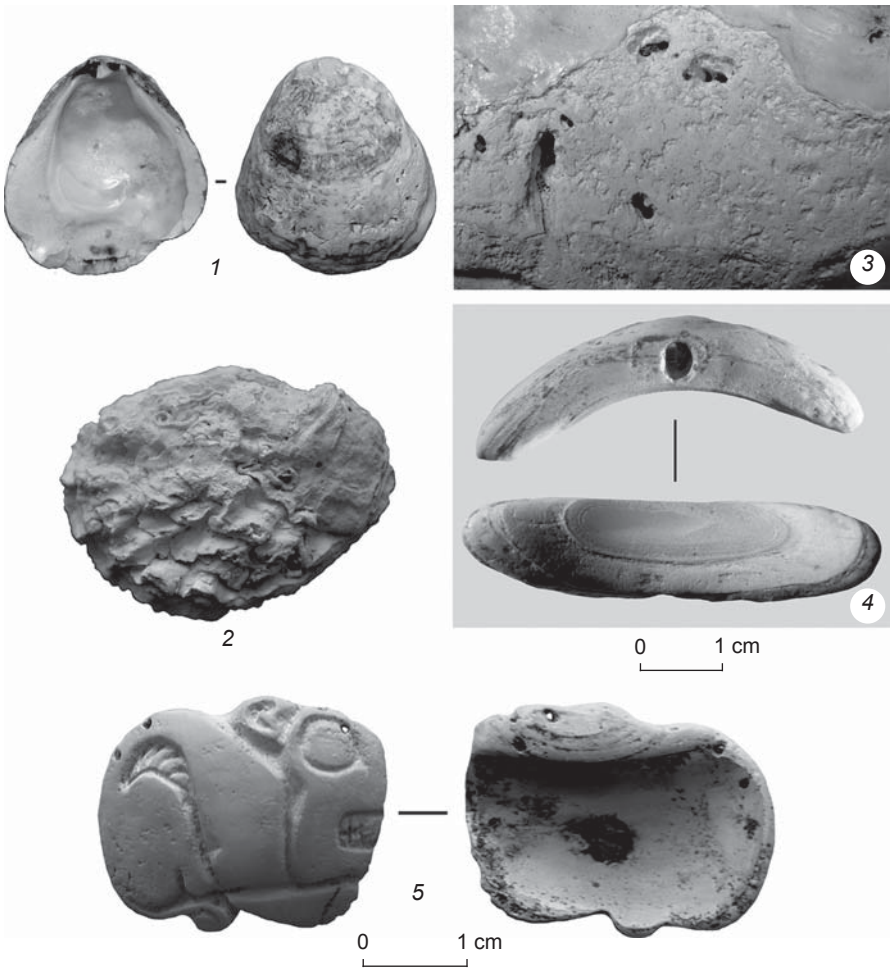

Fig. 8. Oyster shell (*Ostrea edulis*).
1 – oyster shell; *2*, *3* – cretaceous layer; *4* – pendant in the form of animal tusk; *5* – plaque in the form of animal figure.

while applying techniques used in carving bone, horn, and wood. A specific feature is the presence of traces of oblique drilling of holes on side faces, which was carried out in order to hide the system of fastening the onlays to the base (Fig. 8, *5*). Traces of using such a technique have been observed on flat rectangular ornaments of turquoise and on beads of chrysoprase at Scythian burial grounds (Ak-Dag, Sausken-3, and Dogee Baary-2 in Tuva) and on jade items from the burial sites of the Staroaleiskoye culture of the 5th–4th centuries BC (Obskiye Plesy-2 cemetery) (Volkov et al., 2019: Fig. 1–4).

The images of animals are stylized, so it is impossible to establish their species reliably. A rounded eye, oval ear, and open mouth with pointed teeth are emphasized. The position of the tail corresponds to the posture of the "resting animal". According to Y.B. Polidovich, noteworthy is the location of the tail below, as if protecting the lying animal. Bronze plaques from the Aral Sea region show a similar stylistic feature (Polidovich, 2002: 187, fig. 2, *4*). An independent semantic reading could have had a linear arrangement of plaques organized into two oppositely oriented groups, following the principle of proportional reduction of figures along with a pictorial posture of the "resting animal."

Plaques depicting animals from the Saka kurgan at Kyrykoba are unique, but they are not the only items made from cretaceous layers of subfossil shells. A "bead" in the form of a "cat predator" made "of white soft stone" was found in grave 6 at the Gilevo-10 cemetery of the Early Scythian period in the Altai, along with beads of various shapes (about 60 items) (Shulga, 2016: 29, fig. 10, *4 a–e*; 47, *5 a–e*).

The technique for making pendants in the form of animal tusks is not difficult, especially if their shape corresponds to geometric outlines of shells (see Fig. 6; 8, *4*). Wild boars' tusks were one of the most common ornaments in the Early Iron Age. Scythian kurgans contain large sets of natural boar tusks, some of which were framed with gold leaf ornamented in relief (Rudenko, 1960: 73–75, pl. XLIX, 5–8; Gryaznov, 1980). They were used as decoration for chest straps of stallions and as double clips. Such tusks performed an

aesthetic function and possibly served as amulets and indicators of a certain social status (Bokovenko, 2017: 23–24, fig. 13, *4*; 14, *10–11*). M.P. Zavitukhina noted that the tradition of decorating horse-harness with boar tusks became widespread in the Achaemenid period in Iran; it was also typical of the early nomads of the Altai. In this case, both natural boar tusks and their imitations made of wood, bronze, horn, or gold were used (Zavitukhina, 1961: 103). Imitations made of wood were especially numerous. According to Cheremisin, at individual sites, up to several hundred such imitations have been discovered. For example, at Tuekta I, over 370 wooden replicas of tusks in the sets of eight horses were found. In ordinary Pazyryk burials at Yustyd XII, there were up to 50 wooden imitations in a set per one riding-horse (Cheremisin, 2008a: 28).

Personal ornaments with natural boar tusks were typical of the initial stage of the early nomadic period. Later, their imitations made of various raw materials emerged. Wooden pendants were painted white or light yellow in accordance with the appearance of real prototypes (Borodovsky, Cheremisin, 1989: 129–130). Obviously, imported mollusk shells should be included into the range of raw materials of which the imitations were made. They could have been more affordable than real boar tusks.

Conclusions

The data from radiocarbon analysis and the assemblage of items suggest the attribution of kurgan 7 at Kyrykoba to the Early Saka period. In terms of creation time, it is close to such sites as Arzhan-2, Shilikty, Taldy II, and Zhalauly. The female buried in the kurgan belonged to the elite of Saka society. We believe that in her social status, she was similar to those buried in the northwestern foothills of the Altai (kurgan 1 at the Bugry cemetery, kurgan 9 at the Lokot-4a cemetery) (Chugunov, 2014; Shulga, 2003).

The adornments discussed above clearly reflect the connection between the assemblages from East Kazakhstan and Western Siberia. This is manifested primarily by the unity of the artistic traditions, revealed by the similarity of images, compositions, and decorative motifs. At the same time, a series of items made of raw materials atypical of the steppe belt raises the issue of intracontinental trade and cultural transmission carried out in the N-S direction. Subfossil oyster shells with fairly thick cretaceous layers could only be procured on the coast of the Indian Ocean and the Persian Gulf. From the shores of the southern seas, they found their way to the workshops of Northern India and Khwarazm, where personal ornaments of precious metals and ornamental minerals were mass-produced for the nomadic populations of the Asian steppes.

In the Kazakh steppe, long-distance trade emerged as early as the Late Bronze Age. In the Early Iron Age, it became an important factor that ensured consolidation of power among the chiefdom rulers. The distribution of rare and exotic goods within the society allowed them to increase their prestige and influence on the subjects (Kradin, 2001: 138).

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References

Akishev K.A. 1978
Kurgan Issyk. Iskusstvo sakov Kazakhstana. Moscow: Iskusstvo.

Barkova L.L. 1984
Rezniye izobrazheniya zhivotnykh na sarkofage iz 2-go Bashadarskogo kurgana. *ASGE*, iss. 25: 83–89.

Barkova L.L., Pankova S.V. 2005
Tattooed mummies from the large Pazyryk mounds: New findings. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 2: 48–59.

Bogdanov E.S. 2006
Obraz khishchnika v plasticheskom iskusstve kochevykh narodov TsentralnoyAzii (skifo-sibirskaya khudozhestvennaya traditsiya). Novosibirsk: Izd. IAET SO RAN.

Bokovenko N.A. 2017
Formirovaniye konskogo snaryazheniya rannikh kochevnikov Tsentralnoy Azii. *Ylken Altai əlemi*, No. 3 (4): 8–42.

Borodovsky A.P., Cheremisin D.V. 1989
K izucheniyu ukrasheniy iz kabanyikh klykov i ikh imitatsiy (sotsialno-tekhnologicheskiy aspekt). In *Skifo-sibirskiy mir. Problemy arkheologii skifo-sibirskogo mira (sotsialnaya struktura i obshchestvenniye otnosheniya)*, pt. II. Kemerovo: Kem. Gos. Univ., pp. 128–131.

Borodovsky A.P., Telegin A.N. 2007
Horn saddle ornaments dating to the Scythian period from the Ob plateau. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 2: 52–62.

Cheremisin D.V. 1990
Petroglify ustya r. Chui. In *Problemy izucheniya naskalnykh izobrazheniy v SSSR*. Moscow: Nauka, pp. 162–165.

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

Cheremisin D.V. 2008a
Iskusstvo zverinogo stilya v pogrebalnykh kompleksakh ryadovogo naseleniya pazyrykskoy kultury: Semantika zverinykh obrazov v kontekste pogrebalnogo obryada. Novosibirsk: Izd. IAET SO RAN.

Cheremisin D.V. 2008b
K semantike obraza klyuvogolovogo olenya v pazyrykskom iskusstve. In *Tropoyu tysyacheletiy: K yubileyu M.A. Devlet*. Kemerovo: Kuzbassvuzizdat, pp. 99–105.

Chugunov K.V. 2014
Zakhoroneniye "zolotykh lyudey" v traditsii nomadov Yevrazii (noviye materialy i nekotoriye aspekty issledovaniy). In *Dialog kultur Yevrazii v arkheologii Kazakhstana*. Astana: Syryarka, pp. 714–725.

Devlet E.G., Devlet M.A. 2005
Mify v kamne: Mir naskalnogo iskusstva Rossii. Moscow: Aletey.

Egorov Y.V. 1993
Novoye issledovaniye voina epokhi Velikogo pereseleniya narodov na Altaye. In *Kultura drevnikh narodov Yuzhnoy Sibiri*. Barnaul: Alt. Gos. Univ., pp. 77–80.

Grach A.D. 1975
Printsipy i metodika istoriko-arkheologicheskoy rekonstruktsii form sotsialnogo stroya po kurgannym materialam skifskogo vremeni Kazakhstana, Sibiri i Tsentralnoy Azii. In *Sotsialnaya istoriya narodov Azii*. Moscow: Nauka, pp. 158–182.

Grach A.D. 1980
Drevniye kochevniki v tsentre Azii. Moscow: Nauka.

Gryaznov M.P. 1980
Arzhan. Tsarskiy kurgan skifskogo vremeni. Leningrad: Nauka.

Kantorovich A.R. 2002
Klassifikatsiya i tipologiya elementov "zoomorfnykh prevrashcheniy" v zverinom stile stepnoy Skifii. In *Strukturno-semioticheskiye issledovaniya v arkheologii*, vol. 1. Donetsk: Don. Nats. Univ., pp. 77–130.

Kiryushin Y.F., Kiryushin K.Y., Shmidt A.V., Kuzmenkin D.V., Abdulganeev M.T. 2011
Mollusk shells from burials of Tuzovskiye Bugry-1 as indicators of ethno-cultural processes in Southern Siberia and Western Central Asia in the 3rd millennium BC. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 46 (2): 37–45.

Korenyako V.A. 2002
Proiskhozhdeniye skifo-sibirskogo zverinogo stilya (pragmaticheskiye aspekty semiotiki). In *Strukturno-semioticheskiye issledovaniya v arkheologii*, vol. 1. Donetsk: Don. Nats. Univ., pp. 131–188.

Korolkova E.F. 2006
Zveriniy stil Yevrazii: Iskusstvo plemen Nizhnego i Yuzhnogo Povolzhya v skifskuyu epokhu (VII–IV vv. do n.e.). St. Petersburg: Peterburg. vostokovedeniye.

Kradin N.N. 2001
Politicheskaya antropologiya. Moscow: Ladomir.

Kubarev V.D. 1998
Portativniy "altar" iz Chichkeshi. In *Drevnosti Altaya*. Gorno-Altaysk: Izd. Gorno-Alt. Gos. Univ., pp. 55–58. (Izv. laboratorii arkheologii; No. 3).

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

Kuzmina E.E. 1976
Skifskoye iskusstvo kak otrazheniye mirovozzreniya odnoy iz grupp indoirantsev. In *Skifo-sibirskiy zveriniy stil v iskusstve narodov Yevrazii*. Moscow: Nauka, pp. 52–65.

Litvinsky B.A. 1972
Drevniye kochevniki "Kryshi mira". Moscow: Nauka.

Mandelshtam A.M. 1992
Ranniye kochevniki skifskogo perioda na territorii Tuvy. In *Stepnaya polosa Aziatskoy chasti SSSR v skifo-sarmatskoye vremya*. Moscow: Nauka. (Arkheologiya SSSR; vol. 10).

Maryashev A.N. 1984
Pamyatniki epokhi bronzy i rannego zheleza v doline reki Koksu. In *Skifo-sibirskiy mir (iskusstvo i ideologiya): Tezisy dokl. 2-y Arkheol. konf*. Kemerovo, pp. 45–46.

Matveeva N.P. 2000
Sotsialno-ekonomicheskiye struktury naseleniya Zapadnoy Sibiri v rannem zheleznom veke (lesostepnaya i podtayezhnaya zony). Novosibirsk: Nauka.

Mershchiev M.S. 1970
Poseleniye Kzyl-Kainar-Tobe I–IV vv. i zakhoroneniye na nem voina IV–V vv. In *Po sledam drevnikh kultur Kazakhstana*. Alma-Ata: Nauka KazSSR, pp. 79–92.

Mogilnikov V.A. 1997
Naseleniye Verkhnego Priobya v seredine – vtoroy polovine I tysyacheletiya do. n.e. Moscow: Pushch. nauch. tsentr RAN.

Molodin V.I. 2000
Kulturno-istoricheskaya kharakteristika pogrebalnogo kompleksa kurgana No. 3 pamyatnika Verkh-Kalzhin II. In *Fenomen altaiskikh mumiy*. Novosibirsk: Izd. IAET SO RAN, pp. 86–119.

Molodin V.I. 2001
Pamyatnik Sopka-2 na reke Omi (kulturno-khronologicheskiy analiz pogrebalnykh kompleksov epokhi neolita i rannego metalla), vol. 1. Novosibirsk: Izd. IAET SO RAN.

Moor N.N. 2014
Kopytniye v nekharakternykh dlya zverinogo stilya tagarskoy kultury pozakh (po materialam tagarskoy melkoy plastiki). In *Arkhaicheskoye i traditsionnoye iskusstvo: Problemy nauchnoy i khudozhestvennoy interpretatsii: Materialy Vseros. (s mezhdunarodnym uchastiyem) nauch. konf.* Novosibirsk: pp. 51–53.

Polidovich Y.B. 2002
Prirodnoye i mifologicheskoye v skifskikh izobrazheniyakh (na primere pozitsii khvosta khishchnikov). In *Strukturno-semioticheskiye issledovaniya v arkheologii*, vol. 1. Donetsk: Don. Nats. Univ., pp. 181–198.

Polosmak N.V. 2001
Vsadniki Ukoka. Novosibirsk: INFOLIO-press.

Rudenko S.I. 1953
Kultura naseleniya Gornogo Altaya v skifskoye vremya. Moscow, Leningrad: Izd. AN SSSR.

Rudenko S.I. 1960
Kultura naseleniya Tsentralnogo Altaya v skifskoye vremya. Moscow, Leningrad: AN SSSR.

Rusakova I.D. 2003
K voprosu o mifologicheskikh predstavleniyakh rannikh kochevnikov. In *Arkheologiya Yuzhnoy Sibiri: Sbornik nauch.*

tr., posvyash. 70-letiyu so dnya rozhdeniya A.I. Martynova. Novosibirsk: Izd. IAET SO RAN, pp. 96–99.

Samashev Z.S. 2011

Berel. Almaty: Taims.

Savinov D.G. 2002

Ranniye kochevniki Verkhnego Yeniseya. Arkheologicheskiye kultury i kulturogenez. St. Petersburg: SPb. Gos. Univ.

Shulga P.I. 2003

Mogilnik skifskogo vremeni Lokot-4a. Barnaul: Izd. Alt. Gos. Univ.

Shulga P.I. 2016

Mogilnik ranneskifskogo vremeni Gilevo-10 v predgoryakh Altaya. Novosibirsk: Red.-izdat. tsentr Novosib. Gos. Univ.

Sorokin S.S. 1973

Bolshiye sedelniye podveski iz Pazyryka i Bashadara i ikh paralleli. *SGE*, iss. 36: 47–51.

Sovetova O.S. 2005

Petroglify tagarskoy epokhi na Yenisee (syuzhety i obrazy). Novosibirsk: Izd. IAET SO RAN.

Umansky A.P., Shamshin A.B., Shulga P.I. 2005

Mogilnik skifskogo vremeni Rogozikha-1 na levoberezhye Obi. Barnaul: Izd. Alt. Gos. Univ.

Volkov P.V., Mitko O.A., Gubar Y.S., Davydov R.V., Polovnikov I.S. 2019

Tekhnologicheskiy analiz ukrasheniy iz biryuzy (po materialam nakhodok iz mogilnika skifskogo vremeni Ak-Dag I v Tyve). *Vestnik Novosibirkogo gosudarstvennogo universiteta*. Ser.: Istoriya, filologiya, vol. 18. No. 7: Arkheologiya i etnografiya: 74–86.

Zavitukhina M.P. 1961

Mogilnik vremeni rannikh kochevnikov bliz g. Biyska. *ASGE*, iss. 3: 89–108.

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On Phoinix (Φοίνιξ) and Its Distinguishing Marks: A Karian "Type Site" or a Demos to Hellenistic Kamiros?

The oldest known inhabitants of Taşlıca (Bozburun Peninsula, in Southwestern Turkey), recorded as Phoinix in the inscriptions, were the Tloioi people. In the light of the ancient Greek corpus reported especially from the site of Fenaket (namely Rumevlek, forming the core of the dwelling zone) and the Classical wall ruins at the Acropolis, it is understood that the village has been systematically occupied since the 5th century BC. The settlement, which grew as a dominion of Kamiros as of the 3rd century BC, expanded its territory in the NE-SW axis over the centuries. Although Phoinix's chess-board system of insulae of the megara offers parallels with Kamiros, owing to its Hellenistic-style plan and layout, it contains clues to far more ancient codes. In this study, besides being greatly equated with the Hellenistic period, Phoinix's identity in the historical process, which gives indications of her Karianism, is discussed with the help of selective materials, basically authentic architecture tracked over the region. Apparently, the pyramidal monoliths were not unique to Phoinix; however, the Tloans, like the other neighboring komai on the mainland, seem to have managed to keep their traditions of communication with the "other world" through such features. Hence, these monoliths, which evoke the ziggurat morphology or the famous Mausoleum at Halicarnassus to connect to the afterworld, must have been the typical manifestations of the Karian mentality, sufficiently reflected by the aboriginal communities, however inevitably overshadowed by the grandest architectural projects of the Hekatomnid dynasty.

Keywords: *Karian Khersonesos, Bozburun, Rhodian Peraia, Tloioi, Gökçalça, pyramidal monolith.*

Introduction

The Karian communities of the Bozburun Peninsula in Southwestern Turkey (Fig. 1) entered into various organizations from the 5th century BC, and founded regional unions under the generic model of the Karian Federation. The basis of such associations went back to much more ancient times. The name of the union established in the Peninsula was the Karian Khersonesos (Strabo, *XIV*, II, 1; Cook, 1961: 56–57). It was equated with a large *polis* and minted its own coins.

The Khersonesos was annually paying an average of 3 talents (about 78 kg of silver, a paltry amount as compared to the tributes of the famous cities) to the superpower of the period, the Athenian State. All the villages/*demoi* of the Peninsula had a share in the payment of this tribute, while Phoinix was just one of them. Things changed with the rise of the Rhodian State onto the stage of history. The Peninsula became a semi-flexibly administered colony of Rhodes, recognized as the "Rhodian Peraia", from the end of the 3rd century BC till 166 BC, when the Romans banned Rhodes from its territory on the mainland.

A polyonomous village

Phoinix* is paired with the modern village of Taşlıca, meaning "rocky area", true to its name. The recorded expression of Phoinix (Φοίνιξ) (Searchable Greek Inscriptions, ASAA2: 167, 121)** or Phiniki, on the historical maps of Kiepert, may have been associated with the Phoenicians or palm tree (phonetic derivative of *phoenix dactylifera****). In the ecoregion of the *demos*, the *Phoenix theophrastii* palm is also known (Boydak, 1985; Kemeç, 2018). Other options sound extralogical. In later periods, from 1936 to the 1950s, when the region experienced outmigration, due to population exchange following victory in the Independence War of Turkey, the appellation of the core settled area turned into Fenaket in the dialect of the local people. As Fenaket's center of gravity shifted northward in the same interval, the village, where the Turkmens were settled, took its present name, Taşlıca.

In the region, the earliest known site (Oğuz-Kırca, 2014: 290–307), which was occupied before the Classical period, lies immediately south of Taşlıca, over the skirts of the two shallow hills Gökçalça and Somakkaya (Fig. 2). Following the Karian heyday, in the Hellenistic period, Phoinix became a subordinate of Kamiros (Meyer, 1925: 50, pl. I; Fraser, Bean, 1954: 80; Robert, 1983: 257; Oğuz-Kırca, 2014: 284), when the Rhodians officially had their feet on the mainland. The political, social, and economic impacts the insulars left in the *demos* have come to be known, with quite a good many inscriptions that were overwhelmingly reported from the upper and lower settlement by the early travelers, and with those surviving in several localities on the Island of Rhodes. The Hellenistic corpus also reveals that the ancient inhabitants of Phoinix were identified with the people

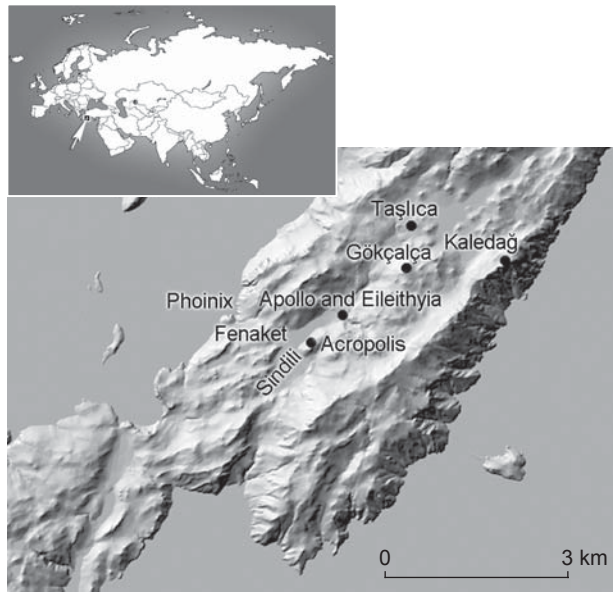

Fig. 1. Location of Phoinix.

of Tloioi (Gärtringen, 1902). A notable mention of the ethnicon was made on a 3rd century BC stele found in the northeast corner of the Acropolis. Accordingly, the task of Nikasimènés, as the *prytane* of the *demos* of the Tloans, ended (Chaviaras M., Chaviaras N., 1913; Bresson, 1991: No. 153, p. 150).

The given territory of Phoinix extended over an area of ca 2824 ha, near Thyssannos (modern Söğüt village) and Kasarae (Bozuk village). In the domain area also lay Elaeiussa Island (on the east) and Fenaket Island (on the west). In the direction of Serçe Harbour and passing through Kırkkuyular location, where dozens of wells and cisterns occur, in the heart of ancient Fenaket, there appears the living soil of Sindili Plain—a depression, traversed by the NE–SW orientation fault. This locality is one of the untouched tranquil landscapes of the Peninsula, with an uncontaminated environment, also describable with a rural economy and livestock tradition, dominated by goats and donkeys. In the dearth of forests but dominance of shrubland biome, territories below the radar were systematically renewed with the motion of herds over the centuries, which at the same time created suitable conditions for growing quality figs and almonds on stony arid land. The key to the region's rural treasury used to be viticulture, which suited the terraced lands of the Mediterranean, shiny almost all year round. Abandoned or presently cultivated, terrace relics highlight the sweaty labor of the farmers since archaic times. Water is the scantest agent drilled from underground reserves. The way in which Phoinix coped with hydrological problems made her a master in this field. The village's longing for fresh water is embodied in wells and cisterns.

*On Phoinix and the results of the survey that has produced the *demos* plan, fortified and settled areas in the center and *khora* over the redesigned territory, see (Oğuz-Kırca, 2014, etc.).

**On etymology, see (Umar, 1993: 266–267, 662). On this occasion, the author of this study has reservations about the suggestion made by Herda (2013: 463, fn. 235). The name of the settlement could hardly have had roots in the practice of purple-dye production in the Peninsula. No evidence or textual information has been adduced for this somewhat over-predictive opinion. Some influence from Phoenicia is possible in theory, since there are some known Karian cases, e.g. the city of Euromos that is claimed to have inherited the original name from a Phoenician princess called Europos (Ibid: 467, fn. 236).

***Ethnobotanical study has yielded sufficient information about the ancient flora of Knidos region, which is also typical of the Bozburun Peninsula. On the distribution of some critical fauna and flora species, including the Datça date palm (Anatolian *Phoenix theophrasti* groves), see Boydak, 1985: 130–134; Kemeç, 2018: 146).

Fig. 2. Gökçalça site, with rock-cut dwellings.

The Acropolis and bigwigs out from Gökçalça

The Acropolis (double-topped Hisartepe, inhabited since the 5th century BC) covers an area of ca 2.6 ha (Fig. 3, *a*) and rises over the Sindili Plain, neighboring Karayüksekdağ. The summit enjoys a spectacular view of the Aegean as far as Symi and the lower "city" Rumevlek. On its wings, the ramparts, which were mostly worked out in the Hellenistic period, are traced; whereas a ruined wall southward remained from the Classical era. To the east, there is the entrance to the fortress. Compatibly with the topography, the outer ramparts draw the contours of the hill (on Phoinix acropolis and reconstruction trial, see (Oğuz-Kırca, 2014)).

As a Classical and Hellenistic hub, the Acropolis was the civic administrative center. Another gigantic mass named Kaledağ (Ibid.), with a *phrourion* on top (Ibid.: 285), which must have acted as a shelter at times of risk, rises in the moderately distant *khora*, on the east of Taşlıca. Maintaining a very high visibility, this stronghold must have supported and guarded the Acropolis while watching the boundaries, i.e. in the case of a siege or attack from the "illegal" groups patrolling in the Mediterranean. This nearly trapezoidal-plan garrison (Ibid.: 294–295, 307–308; Oğuz-Kırca, 2015a: 132–136), with the boulder ramparts, must have burdened its military function over time and survived into many centuries. The ramparts, which were greatly worked with Lesbian masonry, fit well to the topography. Not that far off the Acropolis, but closer to modern Taşlıca, there is an earlier settlement (accessible through a narrow valley on its east-northeast). Its probable relation to the Archaic period is suggested by the masonry technique (in the dearth, so far, of datable evidence on topsoil). The settlement was speculated to match a dale, Gökçalça, which is within sight of Kaledağ. Maintaining quite an invisible position, this inland site hosts a minimum of 35 rock-cut dwellings, built using boulder blocks and often reposing on the bedrock on the one side (see Fig. 2) (Oğuz-Kırca, 2014: 290–291, 294–296, 302, 307).

The estimated perimeter of the *diateikhisma* (varying between 300–500 cm height, and 120 cm width) and outer walls (height between 150–500, with an approximate width of 100 cm) are 510 and 770 m, respectively. On the summit, there are six cisterns; some basic coordinates of relative importance match the eastern sector and the near environs of the Classical wall's ruin. A clear evidence of social engagement, providing insight also into the religious realm of the inhabitants, is contained in an in-situ rock-hewn 3rd century BC inscription (ca 150 cm high) listing the names of the donors (Rhodian citizens

Fig. 3. Acropolis (*a*), mega elements, remains of the columns (*b*, *d*), and traces of the Apollo sanctuary (*c*).

and possibly local elites as Tloans) for the construction of a sanctuary dedicated to Dionysus, found on the northeast (an estimated locus is given in (Oğuz-Kırca, 2014, 2015a: 473))*.

The vast majority of the epigraphic records were recovered on the reused stone walls of the historical houses in Rumevlek. The inscription on a 3rd century BC (255/236 BC) marble block (dated in connection with another name appearing on the above-mentioned donor list) contains a list of priests (Bresson, 1991: No. 148, p. 139–145). At the height of the Hellenistic period, particularly by the middle 3rd century BC, in the administrative system of the Island, there participated priests of Athena Polias and Zeus Polieus, Asclepius or Sarapis, etc. (and perhaps those incorporated to the system of *matroxenoi* (Foucart, 1889: 366–367) who were the offspring of intermarriages between the priestly or commercially important Tloans and Rhodians (often from a Rhodian citizen and a free Peraian mother) holding certain privileges, i.e. acting as the official *demesmen* to bring public recognition to their homeland). Notwithstanding this, there are quite a number of traces of political and social life with the participation of local rulers holding the position of *prytanis,* child athletes from Phoinix, family epitaphs, foreigners, etc. (Bresson, 1991: No. 137–172, p. 135–160).

*The greatest amount donated, 120 drachmae, was made by only one man, Rhodippos, son of Nikagoras (Bresson, 1991: No. 149, I.6, p. 144–148); the rest was paid as 20, 25, 30, 50, or 100 drachmae by about 70 men (Dürrbach, Radet, 1886: No. 2, p. 252–258).

Kamiros and Phoinix

Following the collapse of the Hittite Empire (1200 BC) and when the western coasts of Asia Minor began to be colonized by the Aeolians, Ionians, and Dorians (ca 1000 BC), the lack of organized power in Anatolia gave rise to new settlements. Around the same period, Dorians arrived at Rhodes, Cos, Halikarnassos, the adjacent islands, and near Karia up to the Meander (Bean, 1979: 2–6). Particularly coastal Karia, by then, entered in the domain of the Dorian Hexapolis, which was formed by Cos, Cnidus, Halicarnassus, Lindos, Ialysos, and Kamiros as separate autonomous *poleis*.

After her long strife for synoecism, the city of Rhodes was probably founded in the month of Καρνεῖος*,

*Which possibly matched August or September in the Spartan polities (Thucydides, V, 54).

Fig. 4. *Megara* of Phoinix and Kamiros.

i.e. in October/November of 408 BC (Badoud, 2014: 25). Having strived for synoecism, Rhodians began to institutionalize with the oligarchic administration of the Diagoras family, who took over authority by making Rhodes the capital. Diagoras originated from a titled family of Ialysos. He is known as a famous boxer who won the Olympics in 464 BC and won championships in many other semi-Olympics. He was one of the rare fathers to witness the victories of his sons and grandsons in the competitions. Diagoras had a share in bringing together three *phylae*: Ialysos in the north, Lindos in the east, and Kamiros in the west. The first is called an aristocrat, the second a merchant, and the third a farmer. Notably, Diagoras made effort to keep these three old *poleis* of the Dorian Island all together, considering the lineage relations as family rather than religious ties.

Lindos was a city of seamen and merchants, Kamiros was a treasure with an agricultural character, growing olives, vines, and figs. Kamiros was established on a hill, about three km west of Kalavarda village. The 6th–5th centuries BC marked its golden age; in 226 BC, the city was severely damaged by the earthquake that toppled the Colossus, and by the second tremor 84 years later. Despite all, this grid-planned Hellenistic *polis* (Fig. 4, *b*), where a sewer-design system can be clearly observed, is the best-preserved settlement on the island.

Phoinix, as affiliate of Kamiros, reveals a Hellenistic-style plan and layout, with unequal divisions of zones: (i) Acropolis, (ii) the lower settlement with *megaron* dwellings (Fig. 4, *a*), forming a chess-board system of insulae at Rumevlek (covering a broad span of time from the Classical to the Roman period), and (iii) *agora* and *temenos* of Apollo and Eileithyia. The tight and orderly arrangement of the *megara* surrounding Sindili (the great majority of which catch the eye by the modern road to Serçe Bay) looks similar to the Kamiran districts.

Temenos of Apollo and Eileithyia

Situated next to a dried-up stream-bed in Sindili, between Burgaz Tepe and Gökseriç, a small public structure (Chaviaras M., Chaviaras N., 1913; Bresson, 1991: No. 145, p. 138; Oğuz-Kırca, 2014: 287, 293–294, 303, 305) *naiskos* (which was later turned into a chapel with spolia) is hidden among fig trees. This structure is at fair a distance from the Acropolis, connected via an ancient trail. The stream-bed was first noted as Kislan Deresi/Creek Kızlar/Kışlar (?) by the Chaviaras brothers (Chaviaras M., Chaviaras N., 1913; Bresson, 1991: No. 145, p. 138). The area of *temenos* and *naiskos* is not designated on any ancient map, not even those of 5000 plots.

The chapel is oriented due east, with the entrance facing west (see Fig. 3, *c*). The plan is clear in the frontal part. The original structure was perhaps built in the Doric order (in this regard, noteworthy are the neighboring sanctuaries, *c.f.* the Doric temple of Apollo at Kamiros (Caliò, 2011: 348) and the shrine of Sinuri at Mylasa (Williamson, 2016: 87)). The *naos* behind the portico is small. A remnant of a small altar, a column base, and a socket where a statue could have been placed (re-used on the wall) can be seen toward the entrance. At the entrance, engraved inside the walls, below the gate lento, there was an inscription from the Hellenistic period (ca 250/101 BC), with the names of the god Apollo ("ΑΠΟΛΛΩΝΟΣΠΕ") and, slightly below it, the goddess Eileithyia ("ΕΛΕΙΘΥΑΣ*) (Dürrbach, Radet, 1886: 258–259, No. 4, 5; Bresson, 1991: No. 151, 152, p. 49). As attested, Apollo was one of the five principal deities of Phoinix. Thus, the original construction of the sacred area can be dated to the Early Hellenistic period. The clarity of the Apollo inscription indicates that he could have been a chief figure, despite many other deities enlisted with their associated priests, as noted earlier (Bresson, 1991: No. 148). There is another illegible inscription in Karian script seen on a façade (along with the one on the gate lento) (Oğuz-Kırca, 2022a: 1206, 1209). The reused ashlar and stepped blocks, particularly those with triglyphs (see Fig. 3, *d*) between the metopes, seemingly belonged to a distinguished building. Probably there was a cistern in the southwestern courtyard. In accordance with chronologization of many other inscriptions in Phoinix (see (Bresson, 1991: No. 135–160, p. 134–154)), the entire context points to the period between the 4th and 2nd centuries BC.

Phoinix was a purely agricultural land, with lots of herdsmen. The discovery of three large-size farmsteads, which were reported from three sectors of the *demos*, contributed to the corroboration of its agrarian character (Oğuz-Kırca, Demirciler, 2015: 54, 59, 71; Oğuz-Kırca, 2014: 284, 289–291, 294, 300–301)**. In fact, a dedicatory inscription in a temple of Dionysus (Bresson, 1991: No. 149, p. 145–149; Oğuz-Kırca, 2014: 284, 286, 304–305), the terrace relics in the close vicinity of the temple, and the rest of the *khora* relate to some other basic landmarks, such as farmsteads and associated agrarian installations, although no standing part of the structure is present***.

Presumably, cult practices survived into centuries, without breaking with the essence of the Karian religious patterns. At this point, the co-existence of Apollo and Eileithyia indicates that they can be regarded as the original cults worshipped in the region (Oğuz-Kırca, 2022b); and these cults almost manifest themselves at the very heart of the rebuilt chapel, where divinity-specific offerings (wine, incense, and honey) must also have been made in the late Antique period and thereafter. A possibility is that the original sanctuary was related to agriculture. In this respect, there is no reason why the temple of Dionysus should not be attributed to the sanctuary of Apollo, as long as this is validated through the introduction of convincing evidence in the near future, also in view of the cult of Apollo Erethimios found in Rhodes.

Going deeper, it is worth dwelling on the wording "Apollonos Pe" in the inscription. It may designate a Peraian (τό Πέραν) Apollo, or Apollo Petasitas (Bresson, 1991: No. 151, p. 149), who was linked with the rural landscapes and the soil itself. Notably, part of a workshop (now in the form of reused material) and its remnants lie on an adjacent field in the *temenos* area. The space may find expression in the agricultural context, as it might have had a relation to a *torcularium* (utility dwelling where juice- and oil-presses were kept). The name of Petasitas evokes the typical Thessalian round winged hat *petasos* (Bonfante, 2003: 73, 75)*, identified with Hermes, and worn by the farmers (as is depicted on Ainos tetradrachms) (May, 1950: 253b).

There can be another interpretation of adding "Pe" after the name of a deity. The winter month of Pedageitnyos, references to which occur in Kamiros in the 3rd century BC (Tit. Cam. 155, I.1)** or in the Doric calendar of Rhodes (Prittchett, 1946: 358; Birch, 1873: 137)***, can be related to Apollo Pedageitnios (Stoddart, 1850: 38, 40; Le Guen-Pollet, 1991: 111).

Once again acknowledged from Kamiros, one more interpretation may involve the Roman Apollo Petasitas or Petasites (Tit. Cam. 132, I.1). It is believed that the goddess Eileithyia eases the pains of women during their labor and delivery, or migraine attacks (Grossman, Schmidraml, 2001). Thus, Apollo's epithet might have corresponded to the antispasmodic attributes of the herb *Petasites hybridus* (butterbur)****. Whatever the answer is, Apollonos Pe still remains a unique name.

*For a critique of Eileithyia at Phoinix, see (Oğuz-Kırca, 2016: 240.

**A fourth one, as yet unpublished, lies in the western part of the *demos*.

***Hypothetically localized on the Acropolis, close to the stone containing the donation list, and can be related to the enclosure as if peeking out of the ground (Oğuz-Kırca, 2014: 284, 286, 304–305).

*Miscellaneous versions of the *petasos*, which was worn until the late Archaic and Classical periods, were used until the Etruscans (Bonfante, 2003: 73, 75).

**For a commentary by A. Bresson see (Bresson, 1991: No. 151, p. 149).

***In the light of incised eponyms on the amphorae, a prediction (Gyllenbok, 2018: 377) involves an interval between December and February.

****Its habitat is moist regions: for example near water banks, or the coast of the Black Sea (see, e.g., (Tys et al., 2015: 152; Kaya, Gümüş, 2018: 314)).

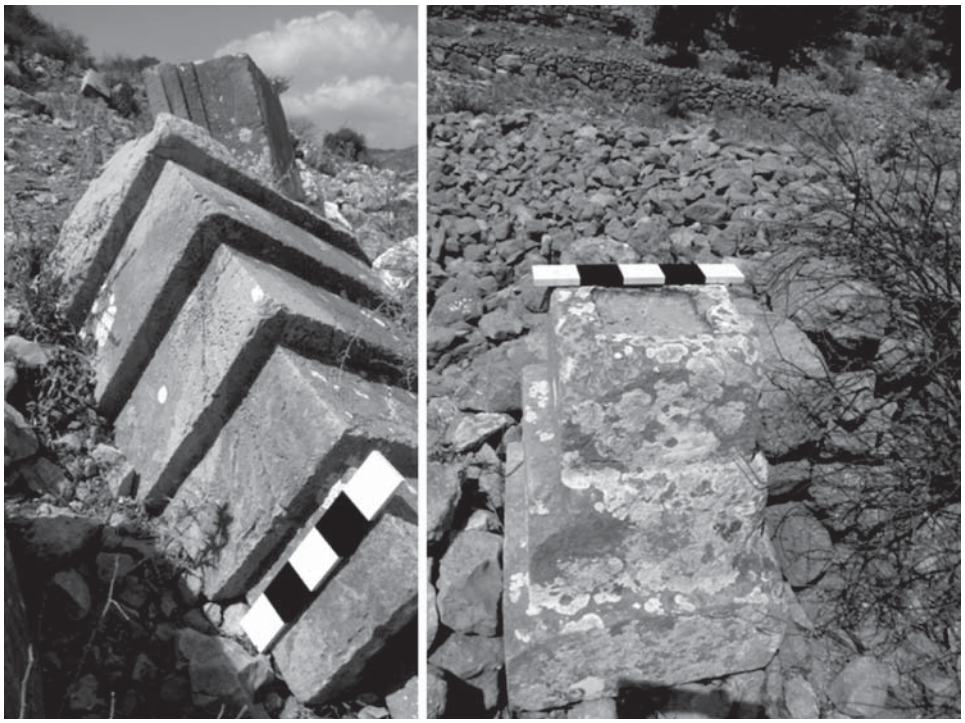

Fig. 5. Stepped monoliths at the Acropolis.

Retroreflectors as pyramidal monoliths

Looking at the structural background, lateral stepped monoliths, sometimes used as gateposts or occasionally as locking blocks, alongside with pyramidal ones, often diagnosed as the altars and/or tomb elements, form the basic architectural repertoire of Phoinix. Pyramidal monoliths, appearing in varying sizes, by and large with three to four steps (Fig. 5), are typical designs of the Peninsula, while they may also be encountered at other localities (Fig. 6). On this matter, Carter drew parallels with Lycian and Egyptian geographies (1982: 178–179)*. Pyramidal stepped monoliths were sufficiently observed in Tymnos, Kasarae, and Hygassos, although almost all detached from their contexts. There are, also, enough of these structures in mainland Greece and the islands (see (Liritzis, Vafiadou, 2005: 32–36)). Pyramidal stepped monoliths with slots on top were supposedly used as grave-markers over the pit graves or pedestal tombs for the commemoration of the deceased, especially the influential individuals (in either off-site slopes or spots away from the visitors); whereas lateral monoliths were possibly part of the sacred buildings, or constructions of a public character. On the other hand, there are not enough data to attach any value to ascriptions such as "hidden" or "strange" to these pyramids, which are often met in tourism channels and internet publications. Much of this information is being used in non-academic media.

The northern sector, particularly the plain strait between the Acropolis and Burgaz Tepe, has been referred to as a necropolis in some sources, owing to a scattering of a handful of pyramidal monoliths (Bent, 1888: 82–83; Hicks, 1889: 47; Carter, 1982: 184–195; Bean, 2000: 168)* and a few more elegant features (see (Oğuz-Kırca, 2014: 301–302)), but is mainly connected with the modern perception of this place. It should be reminded that most of the inscriptions found on the stelae and addressed in the epigraphical corpus (Bresson, 1991: 34–154, No. 135–159) in the *megara* of Fenaket were found outside their original context. With a few blocks that appear on the slopes of the Acropolis, it is quite problematic to mark the area as a burial-space.

Something to be underscored also is that not all the pyramidal monoliths belong to funerary monuments. These could have been used as various architectural features or parts thereof. Pyramidal monoliths could

*His view may not be considered unsuitable. For further pyramids, see also (Oğuz-Kırca, 2015b: 60, fig. 5; 2022a: 1205, 1208).

*To date, two roofed structures have been reported over and around the region: a pyramidal, now vanished mausoleum in Cnidus (of Hellenistic date) (Rumscheid, 1994: Bd. 2, Abb. 60) and the pyramidal tomb locally known as Çağ Baba in Turgut (Hydas) (Bresson, 1991: 85–86, No. 56).

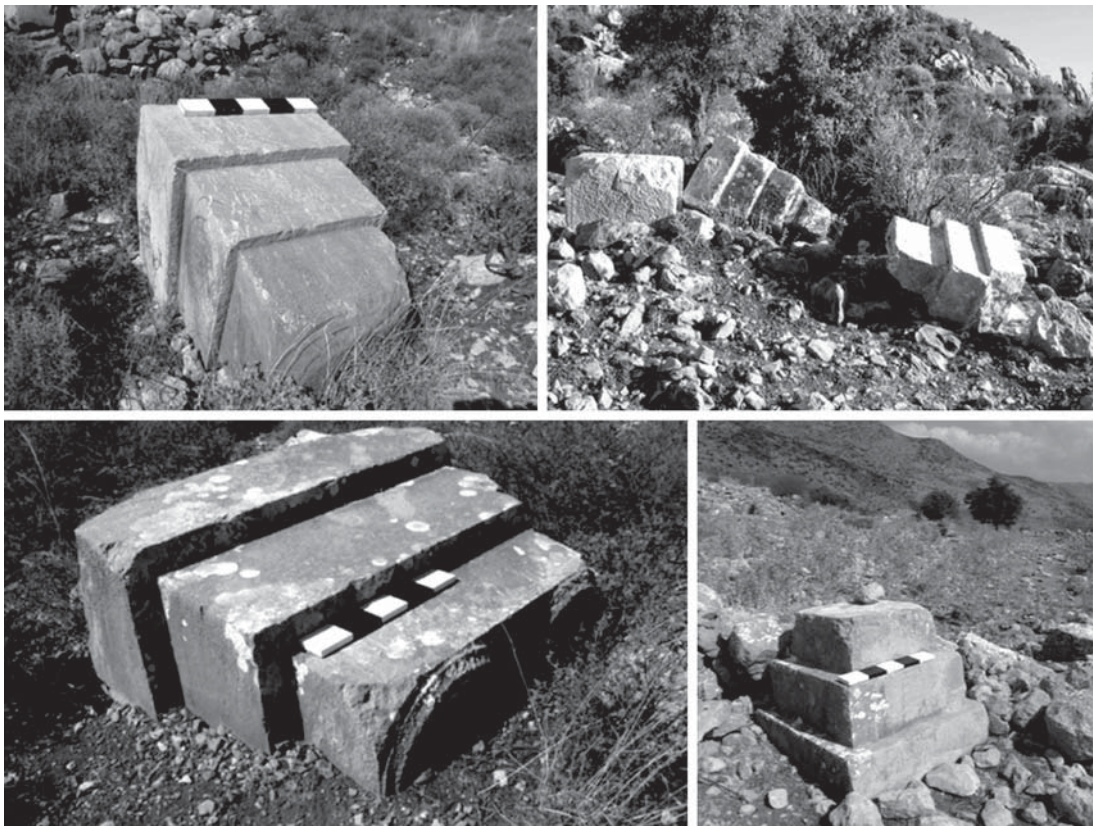

Fig. 6. Pyramidal monoliths of Phoinix and the neighboring *demoi*.

have fallen off a sanctuary situated on elevated ground. Equally possible is that the stone block with the names of Apollo and Eileithyia could have been transported from its original location.

Conclusions

The abandoned territories of the Bozburun Peninsula in the southwestern corner of Asia Minor, which demonstrate evidence of various types of site (often with rural architecture), have been gradually giving a fresh stimulus to the blooming interest of scholars, so far. The very picture of the Phoinix *khora*, for instance, is well represented by the three large-sized farmsteads mentioned above (Oğuz-Kırca, Demirciler, 2015), which at the same time highlight that the countryside was a region controlled by the Kamiran or other Rhodian "vassals". The proximity of the precinct of Apollo to the Acropolis allows for the interpretation of this site as a sanctuary for rural dwellers.

The odds are that, as a landscape protected by divinities like Dionysus and cultivated by the Tloan farmers, Phoinix had a premier role because of the lavish plain of Sindili (embodied by terraces), which was convenient for growing cereals, grapes, olives, and perhaps figs (which are best grown on barren land) and almonds, as it is today. Since agriculture was of primary concern to the Peraian communities, excessively living on fragmented land, the dispersed settlement patterning (see (Oğuz-Kırca, 2014: 289–300, 307)) must have persisted during the late Antique period, too. Also, many terraced plots near Gökçalça suggest the implementation of intensive agrarian activity since the earliest known times around the region.

As a far land of the Karians and a longtime isolated site for centuries, Phoinix was merely one of the *demoi* testifying to the typical stepped pyramids, often appearing as a bunch of relocated, sometimes flipped monolithic blocks here and there, down the Acropolis (but not over the plain of Sindili). These sites contribute to the generation of an idea about the owners' wish to hide out from the transients, rather than showing off their workmanship. When the original outlook of the Mausoleum of Halikarnassos (Pedersen, 1994) as the crescendo of Karian eclectic architecture is redeliberated, pyramidal stepped monoliths may retroreflect to the Classical origins of the region. Evocating the ziggurat morphology in all likelihood, these grave-structures were perceived as vehicles of the spirit of the heroized or deified Late Classical personalities. The dearth of any frieze is explainable

by the financial nonproficiency of the rural landscape and its owners. Alongside the prominent cultic objects, whose symbolism mainly results from the longstanding ties with Rhodes, an implicit statement of Karianism was ensured through authentic architecture, which permitted its durability through the centuries.

In Taşlıca, the days when the agricultural terraces of value as cultural heritage, fields where donkeys and jades (similar to the Przewalski's horse) run, and products such as figs and vine will be brought to eco-tourism, may be near. These will need to be combined with the architectural heritage of the village.

In spite of Kamiran fingerprints, reflected especially in private planning and agrarian focus, as well as through the epithets of some chief deities or goddesses carved onto public walls, Karians seem to have managed to keep their tradition of communication with the other world. The presence of the inscription in Karian script, discovered inside the temple of Apollo, confirms the Karian identity of the *demos*. The pyramidal monoliths of the Peraia and Phoinix must have been typical manifestations of the Karian mentality. This is sufficiently reflected by the aboriginal communities, however inevitably shadowed by the grandest architectural projects of the Hekatomnid dynasty.

References

Badoud N. 2014
The chronology of inscription to the chronology of Rhodian amphora eponyms. In *Pottery, Peoples and Places: The Late Hellenistic Period, c. 200-50 (B.C.) Between the Mediterranean and the Black Sea*, M. Lawall, P. Guldager Bilde (eds.). Aarhus: Aarhus Univ. Press, pp. 17–28.

Bean G.E. 1979
Aegean Turkey. London: E. Benn Ltd.

Bean G.E. 2000
Eskiçağ'da Menderes'in ötesi, P. Kurtoğlu (transl.). İstanbul: Arion.

Bent J.T. 1888
Discoveries in Asia Minor. *Journal of Hellenic Studies*, No. 9: 82–87.

Birch S. 1873
History of Ancient Pottery, Egyptian, Assyrian, Greek, Etruscan, and Roman. London: J. Murray.

Bonfante L. 2003
Etruscan Dresses. Baltimore; London: John Hopkins Univ. Press.

Boydak M. 1985
The distribution of Phoenix Theophrasti in the Datça Peninsula, Turkey. *Biological Conservation*, No. 32: 129–135.

Bresson A. 1991
Recueil des inscriptions de la Pérée Rhodienne (Pérée Intégrée). Paris: Les Belles Lettres.

Caliò L.M. 2011
The Agora of Kamiros: A Hypothesis. In *Η Αγορά στη Μεσόγειο: Από τους Ομηρικούς έως τους Ρωμαϊκούς χρόνους: Διεθνές Επιστημονικό Συνέδριο Κως*, A. Giannikouri (ed.). Αθήνα; Υπουργείο Πολιτισμού και Τουρισμού, Αρχαιολογικό Ινστιτούτο Αιγαιακών Σπουσών, pp. 343–355.

Carter R.S. 1982
The stepped pyramids of the Loryma Peninsula. *Istanbuler Mitteilungen*, No. 32: 176–195.

Chaviaras M., Chaviaras N. 1913
Archaiologike Ephemeris, No. 95: 4.

Cook J.M. 1961
Cnidian Peraea and Spartan coins. *Journal of Hellenic Studies*, No. 81: 56–72.

Dürrbach F., Radet G.A. 1886
Inscriptions de la Péréé Rhodienne. *Bulletin de correspondance hellénique*, No. 10: 245–269.

Foucart P.-F. 1889
Inscriptions Attiques et inscriptions de Rhodes. *Bulletin de correspondance hellénique*, No. 13: 346–367.

Fraser P.M., Bean G.E. 1954
The Rhodian Peraea and Islands. London: Oxford Univ. Press.

Gärtringen F.H., von. 1902
Anhang über die Tloer. *Hermès*, Bd. 37, H. 1: 143–146.

Grossman W., Schmidraml H. 2001
An extract of *Petasites Hybridus* is effective in the prophylaxis of migraine. *Alternative Medicine Review: A Journal of Clinical Therapeutic*, vol. 6 (3): 303–310.

Gyllenbok J. 2018
Encyclopaedia of Historical Metrology, Weights, and Measures. Vol. 1. Cham: Birkhäuser.

Herda A. 2013
Greek (and our) views on the Karians. In *Luwian Identities: Culture, Language and Religion Between Anatolia and the Aegean*, A. Mouton, I. Rutherford, I. Yakubovich (eds.). Leiden; Boston: Brill, pp. 421–507.

Hicks E.L. 1889
Inscriptions from Casarea, Lydae, Patara and Myra. *Journal of Hellenic Studies*, No. 10: 46–85.

Kaya Z., Gümüş C. 2018
Balamba tabiat parkı (Bartın) florası. *Bartın Orman Fakültesi Dergisi*, vol. 20 (2): 311–339.

Kemeç S. 2018
The evaluation of the impacts of the climate change on Datça-Bozburun SPA with geospatial data and techniques. In *Proceedings, 7th International Conference on Cartography and GIS, 18–23 June 2018, Sozopol*, T. Bandrova, M. Konečný (eds.). Sofia: Bulgarian Cartographic Association, pp. 140–147.

Le Guen-Pollet B. 1991
La vie religieuse dans le monde Grec du V^{e} au III^{e} siècle avant notre ère: choix de documents épigraphiques traduits et commentés. Toulouse: Presses Universitaires du Mirail.

Liritzis I., Vafiadou A. 2005
Dating by luminescence of ancient megalithic masonry. *Mediterranean Archaeology and Archaeometry*, vol. 5 (1): 25–38.

May J.M.F. 1950
Ainos, Its History and Coinage. London: Oxford Univ. Press.

Meyer E. 1925
Die Grenzen der Hellenistischen Staaten in Kleinasien. Zürich; Leipzig: Verlegt Bei Orell Füssli.

Oğuz-Kırca E.D. 2014

Restructuring the settlement pattern of a Peraean Deme through photogrammetry and GIS: The case of Phoinix (Bozburun Peninsula, Turkey). *Mediterranean Archaeology and Archaeometry*, vol. 14 (2): 281–313.

Oğuz-Kırca E.D. 2015a

The Ancient population of a Chersonessian Heir: Phoinix (Kersonesoslu bir varisin antik nüfusu: Phoinix). *Tarih Araştırmaları Dergisi*, vol. 34 (58): 445–488.

Oğuz-Kırca E.D. 2015b

The Chora and the Core: A general look at the rural settlement pattern of (Pre)Hellenistic Bozburun Peninsula, Turkey. *Pamukkale Üniversitesi Sosyal Bilimler Enstitüsü Dergisi (PAUSBED)*, No. 20: 33–62.

Oğuz-Kırca E.D. 2016

Tymnos'un kayıp mabedi: Hera ve Zeus'a adanan tapınak neredeydi? *Arkeoloji ve Sanat Dergisi*, No. 151: 231–247.

Oğuz-Kırca E.D. 2022a

Karian fingerprints: Stepped pyramid and script as markers of identity, at home and afield. *International Journal of Science and Research*, vol. 11 (4): 1205–1209.

Oğuz-Kırca E.D. 2022b

Yerel ve Devşirme? İki Kimlik: Hemithea ve Eileithyia. *Belleten*, vol. 86 (306): 427–467.

Oğuz-Kırca, E.D., Demirciler V. 2015

Antik dünyada kırsal ekonomi: Karya Kersonesosu'ndan yeni kanıtlar. *Anadolu*, No. 41: 51–76.

Pedersen P. 1994

The Ionian Renaissance and some aspects of its origin within the field of architecture and planning. In *Halicarnassian Studies I: Hecatomnid Caria and the Ionian Renaissance*, J. Isager (ed.), vol. 1. Odense: Univ. Press of Southern Denmark, pp. 11–35.

Prittchett K. 1946

Month in Dorian calendars. *American Journal of Archaeology*, vol. 50 (3): 258–360.

Robert L. 1983

Une épigramme Hellénistique de Lycie. *Journal des savants*, No. 4: 241–258.

Rumscheid F. 1994

Untersuchungen zur kleinasiatischen Bauornamentik des Hellenismus. Mainz: Ph. von Zabern.

Searchable Greek Inscriptions (PHI): A Scholarly Tool in Progress (The Packard Humanities Institute Project Centers). (s.a.)

Aegean islands, incl. Crete (IG XI–[XIII]): Rhodes and S. Dodecanese (IG XII,1), Annuario della Scuola Archeologica di Atene [ASAA2], Segre & Pugliese Carratelli, Tituli Camirenses (ASAtene 27–29) [Tit. Cam.]. URL: http://epigraphy.packhum.org/inscriptions/main (Accessed August 30, 2021).

Stoddart J.L. 1850

On the inscribed pottery of Rhodes, Cnidus and other Greek cities (read June and November, 1847). In *Transactions of the Royal Society of Literature of the United Kingdom*. 2nd ser., vol. III. London: J. Murray, pp. 1–127.

Tys J., Szopa A., Lalak J., Chmielewska M., Serefko A., Poleszak E. 2015

A botanical and pharmacological description of petasites species. *Current Issues in Pharmacy and Medical Sciences*, vol. 28 (3): 151–154.

Umar B. 1993

Türkiye'deki Tarihsel Adlar. İstanbul: İnkılâp Kitabevi.

Williamson C.G. 2016

A Carian shrine in a Hellenizing world. In *Between Tarhuntas and Zeus Polieus: Cultural Crossroads in the Temples and Cults of Graeco-Roman Anatolia*, M.-P. de Hoz, J.P. Sanchez Hernández, C.M. Valero (eds.). Leuven; Paris; Bristol: Peeters, pp. 75–101. (Colloquia Antiqua; No. 17).

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Medieval Burials at Ryabchikov Klyuch-1, the Kansk-Rybinsk Basin

Previously, burials at Ryabchikov Klyuch-1 on the Kan River near Kansk were dated to the Late Middle Ages (pre-Russian period) and attributed to an autochthonous group. In 2015, two burials were discovered at the cemetery, with the remains of an adolescent girl and a child. A comprehensive analysis of the burial rite and grave goods suggests that the burials date to the 12th century. Numerous archaeological and ethnographic parallels were found. Morphologically, the girl's cranium reveals generally eastern traits, specifically those common in Western Siberian (Uralic and Ob-Irtysh) populations. The cranium was restored, and a graphical reconstruction of the face was made. Burial practices of the 17th–19th century Middle Kan populations are described. They were Ket-speaking Kotts, Turkic-speaking Karagas, and Samoyed-speaking Kamasins. The analysis of sources suggests that the buried people were likely ancestors of the Kotts.

Keywords: Siberia, Middle Yenisei, Kansk-Rybinsk basin, Kan River, Middle Ages, flat graves, Kets.

Introduction

The medieval period of the forest-steppe part of the Middle Yenisei is illustrated by a very limited set of sources (primarily archaeological). These sources quite unevenly describe the cultural and chronological features of the history of the population of this vast region from the 5th to 17th centuries AD, which features are interpreted by the results of studies of several dozen archaeological sites. The general ethno-cultural

characteristics of the Middle Yenisei basin were proposed by O.A. Mitko (1995). The chronological classification of the medieval period of the Krasnoyarsk forest-steppe was developed by S.M. Fokin (2007). The main theoretical inferences of these authors have not undergone significant changes since the defense of the respective dissertations. Materials from the southern taiga zone of Central Siberia pertaining to the early 2nd millennium AD were studied by P.O. Senotrusova (Senotrusova, Mandryka, 2018). The Late Middle Ages (from the Mongolian period to the ethnographically modern period, the 13th to 18th centuries) of the Middle Yenisei were addressed by S.G. Skobelev, who issued a series of publications (Skobelev, 2009; Skobelev, Vybornov, 2019; Skobelev, Zelenina, 2019).

The understanding of this, more than thousand-year long, historical period of a large region of North Asia has to be changed with the accumulation of new findings. The discovery and research of new sites imply the refinement of the chronology of sources, and identification of local variants and new components in the ethno-cultural situation. We believe that the motley ethnic picture of the Middle Yenisei region in the 17th–18th centuries, described in various ethnographic publications, was generated by similarly heterogeneous processes, which could be traced only through archaeological studies.

Among the forest-steppes of the Middle Yenisei, the Kan River basin is a special ecological area. The Kansk-Rybinsk basin, located in the northeast of the Middle Yenisei region, has been one of the northernmost outskirts of the forest-steppe belt of Eurasia for the last 2000 years. The population of this region has historically been closely associated both with the densely populated Khakass-Minusinsk basin, and with the inhabitants of the Eastern Sayan Mountain range, the Cis-Angara taiga, and the western part of the Krasnoyarsk-Achinsk forest-steppe. There are few known medieval archaeological sites in this area. The Kansk burial on Rzhavy Island (Saveliev, Svinin, 1978), and the flat-grave burial grounds of Krasnopolyansky (Kungurov, Kungurova, 2018) and Antsir-1 (Fokin, 2020a) have been studied. Random finds suggest the influence of the Khakass-Minusinsk basin population of the 13th–14th centuries (Kansko-Perevozinskoye) (Kyzlasov, 1983: 75).

This article focuses on the materials from two medieval burials at the site of Ryabchikov Klyuch-1, in the middle reaches of the Kan River (Fig. 1). In the course of archaeological excavations, these objects were identified as late medieval sites and attributed to the third quarter of the 2nd millennium AD (Vybornov et al., 2015). Subsequent research has made it possible to estimate the age of the burials more precisely.

Archaeological materials

The site of Ryabchikov Kluch-1 (recorded as: Karapsel. Ryabchikov Kluch-1 site) was found in 2011 by E.V. Knyazeva, the researcher from the Siberian Federal University. The site is located on the right bank of the Kan, 3.2 km upstream of the boundary of modern town of Kansk and 4.3 km to the southwest of the village of Karapsel. The site occupies a sloping area of the above-floodplain altiplanation terrace. This lies between the eastern face of the ravine of a nameless stream and a high floodplain (about 12–17 m above the water edge). In 2015, an expedition of the IAET SB RAS worked at the site. In the excavation trench, two cultural horizons were established on the basis of the stratigraphy and recovered artifacts associated with a range of chronological periods: from the Neolithic to the Bronze Age and the Early Iron Age, from the Middle Ages to the ethnographically modern period.

The burials are located on the edge of a relatively flat ground on the western outskirts of the above-floodplain altiplanation terrace. This ground rises above a vast

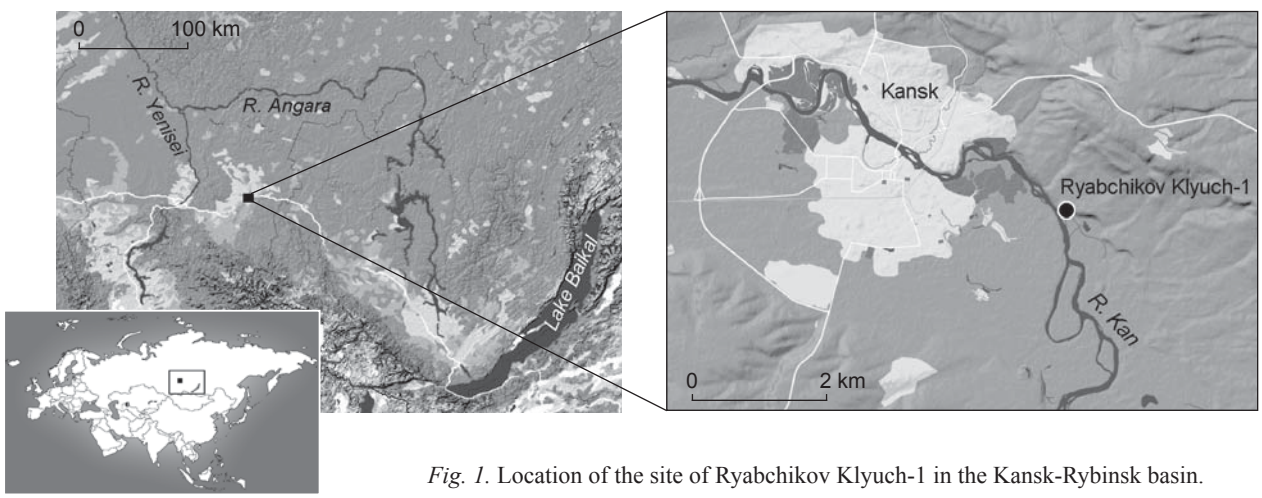

Fig. 1. Location of the site of Ryabchikov Klyuch-1 in the Kansk-Rybinsk basin.

ravine and is close to the turn of the river at a large island. Before the start of excavations, at the level of the daylight surface, there were no signs of burials observed.

The grave-pit of burial 1 (Fig. 2) is rectangular in plan view; its long axis is oriented along the W-E line, with a slight shift to the NW-SE. Its dimensions are 1.8 × 0.9 m, the depth from the level of the modern surface is 0.50–0.55 m. The pit was dug out in the top of a layer of grayish-brown loam. The grave filling contains clods of dense light-yellow loam interlayered with humic gray sandy loam; pieces of charcoal were also noted. The roof of the layer contains remains of wooden planks and birch-bark that covered the grave-pit across its long axis. Along the perimeter, the grave was framed by a rectangular cribwork (the corners have not been preserved) consisting of small poles (5 cm in diameter). The floor was lined with birch-bark, of which small fragments have been preserved.

The grave contained the remains of an adolescent girl aged 14–16, buried in an extended supine position, with her head to the east. The skull is crushed, with its foreface turned to the north. The hands of the deceased were widely spaced (perhaps she was wearing a fur coat) and extended along the body, with the palms down. The anatomical order in places of articulation of the arm bones is disturbed (a consequence of sliding down the slope). The legs were extended, with the feet towards the north.

At the head of the buried girl, two white barrel-shaped beads made of vitreous paste were found (Fig. 3, *6*); a large, eight-petaled convex beige bead (Fig. 3, *7*) was noted in the area of the upper thoracic vertebrae, this bead possibly served as a button for outerwear (fur coat). A string of six cowrie shells (Fig. 3, *5*) was found on the wrist of the left hand. In the area of the right elbow-joint, an openwork cast bronze double-sided disk bearing two dragon images (Fig. 3, *1*), a fragment of an iron item (heavily corroded), a pipe-shaped bead (needle-case?) (Fig. 3, *2*, *3*), and a small fragment of animal rib were discovered. Two articulated caudal vertebrae of a cow were located north of the right knee-joint of the buried girl. A stemmed iron knife was found near the left knee-joint (Fig. 3, *4*).

Burial 2 (Fig. 4) is located 10 m west of burial 1. The grave-pit, rectangular in plan view, is oriented with its long axis along the W-E line. Its dimensions are 1.2 × 0.65 m, the depth is 0.30–0.35 m from the level of the modern daylight surface. In the filling of the pit, clods of dense light-yellow loam, interlayered with humic gray sandy loam, were recorded. The roof contains remains of wooden planks and birch-bark that covered the grave-pit across its long axis. Along the perimeter, the grave-pit was framed by a rectangular cribwork (the corners have not been preserved) consisting of small poles (5 cm in diameter). At the floor, there were fragments of birch-bark.

The buried child, 5–6 years old, was laid on his back, with the head to the east. The skull is crushed, with its foreface turned up. The arms of the buried were bent at the elbows: the right arm was at an angle of 45°, the elbow was laid aside, the hand was on the stomach; the left one was folded and pressed to the body, with the hand over the shoulder. The child's legs were widely spread (more than 90°) and bent at the knees.

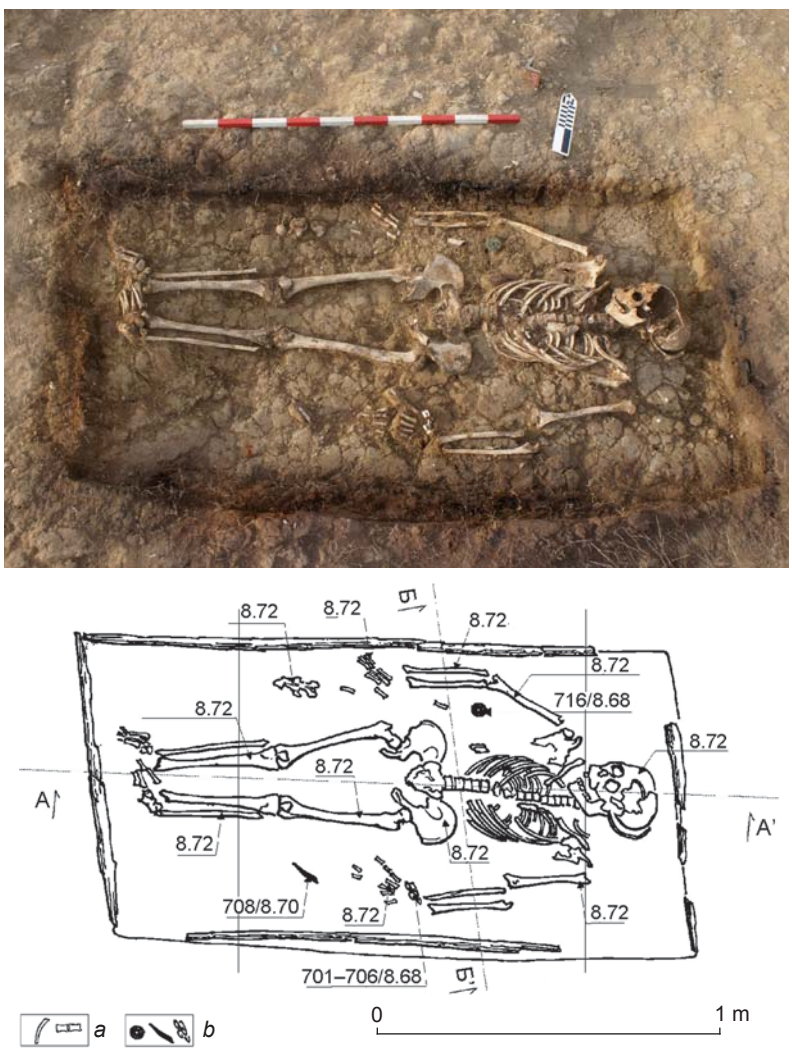

Fig. 2. Burial 1 at Ryabchikov Klyuch-1.
a – fragments of human bones; *b* – grave goods.

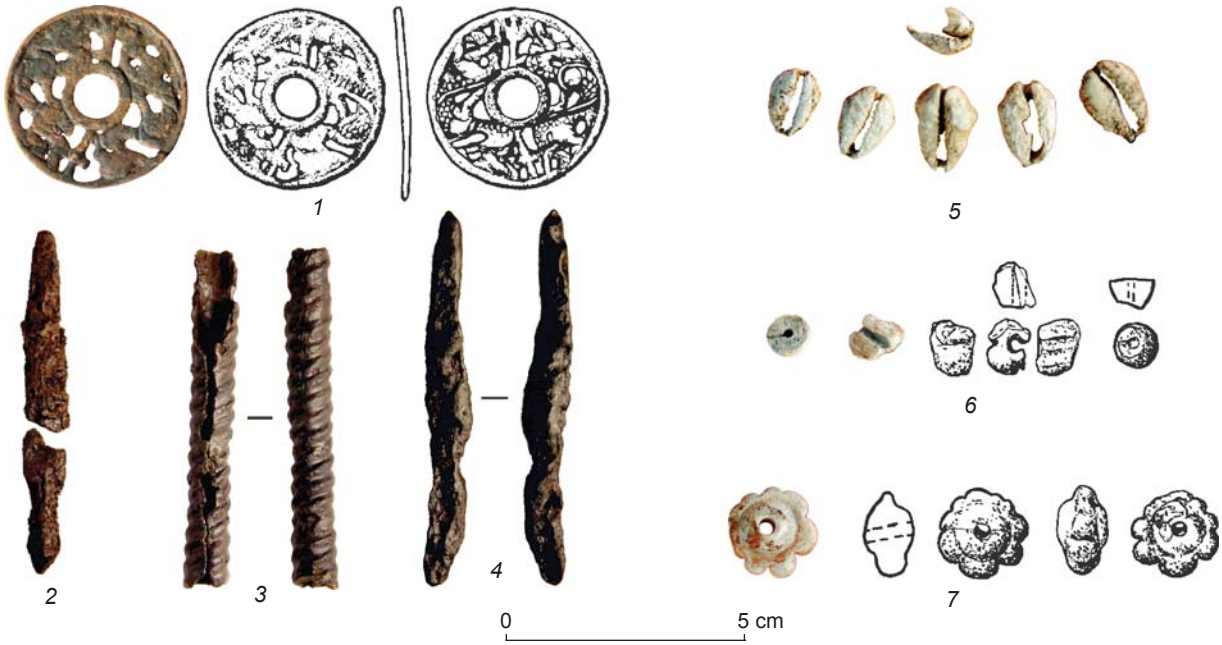

Fig. 3. Items from burial 1.
1 – bronze amulet; *2* – fragment of an iron item; *3* – iron pipe-shaped bead; *4* – iron knife; *5* – cowrie shells; *6, 7* – paste beads.

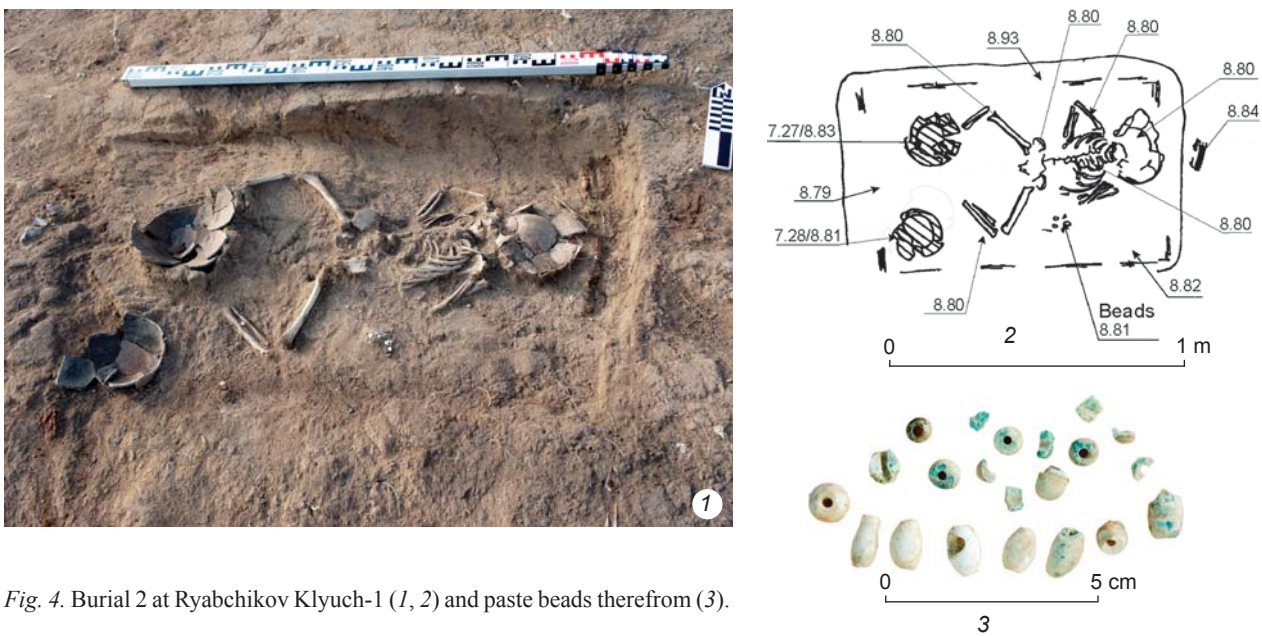

Fig. 4. Burial 2 at Ryabchikov Klyuch-1 (*1*, *2*) and paste beads therefrom (*3*).

Near the left elbow-joint of the buried, 25 lenticular turquoise-colored beads made of vitreous paste were found. At the feet of the buried, there were two open-shaped, hand-made, clay vessels, with rounded rims and flattened bottoms, without decoration.

In sum, the key features of the burials are as follows. The graves are located at the site overlooking the river and distinct in the relief. The grave-pits are rectangular and shallow (0.5 m). There are traces of covering the walls near the bottoms with small beams. Above-ground burial structures are missing, but they could have existed: they probably burned down shortly after the interment, which is why the upper part of the wood cover shows traces of charring, and the grave-pit's filling contains pieces of charcoal. The buried were laid on their backs, with their heads directed upstream to the east. There are grave goods—clothing items, ornaments, ceramic vessels, a knife (household), and cow vertebrae.

Morphology of the skull from burial 1 and facial reconstruction of the deceased

The cranial vault of the young female is of a rounded shape and a medium length; it is very narrow and short, sub-dolichocranial according to the cranial index (Fig. 5). The outline of the parietal bone displays the shape of a convex curve. The entheseal sites are smooth. The mastoid processes are small and smooth, weakly protruding and facing forward. The supramastoid ridge is weakly pronounced. The frontal part of the outline of the vault is rounded. The shape of the vault in the axial plane is ovoid. The occipital bone is not protruding nor refracted. The nuchal lines are smooth, the external occipital protuberance is not pronounced (1 grade). The vault in general displays some asymmetry. The forehead is fairly sloping, medium-wide, and eurymetopic according to the frontal-transverse index. The frontal eminences are weakly pronounced. The brow-ridges are not protruding with respect to the nasal bridge.

The facial skeleton is of medium width but very tall, leptoprosopic according to the common facial index. The face is prognathic in the vertical plane, and hyperprognathic in the alveolar part. In the horizontal plane, the face is weakly protruding at the level of the orbits, but more strongly protruding in the subnasal area (Table 1). The orbits are of the closed type and display a squared shape. The orbital tubercles are not pronounced. The line of the incision of the eye is slightly inclined internally. The glabellar region is weakly developed (2 grade). The maxillary frontal processes display an oblique frontal orientation.

Fig. 5. Skull from burial 1.

The nose is of intermediate height and width, mesorhinic and very weakly protruding. The nasal process of the frontal bone is very short, wide and trapezoid. The frontonasal angle is smooth. The nasal bones are narrow and of medium length. The nasal bridge is narrow, moderately protruding at the level of *dacryon*, medium-wide, and flat at the simotic

Table 1. **Craniometric data of the female skull from burial 1**

Variable	Value	Variable	Value
1. Cranial length	170	55. Nasal height	50
8. Maximum cranial breadth	131	54. Nasal breadth	25
17. Cranial height from ba.	123	51. Orbital breadth from mf.	44
9. Minimum frontal breadth	93	51a. Orbital breadth from d.	41
45. Bizygomatic breadth	123	52. Orbital height	34
40. Basion-prosthion length	100	77. Nasomalar angle	143.9
48. Upper facial height	73	∠zm'. Zygomaxillary angle	133.9
47. Full facial height	121	32. Frontal profile angle from n.	77
43. Upper facial breadth	99	72. General facial angle	78
46. Midfacial breadth	94	73. Mid-facial angle	81
DC. Dacrial width	18	74. Alveolar angle	67
DS. Dacrial subtense	9	75. Nasal bones inclination angle	65
SC. Simotic width	8	75 (1). Nasal protrusion angle	13
SS. Simotic subtense	2.5	8 : 1	77
20. Cranial height (from porion)	108.7	48 : 45	59.4

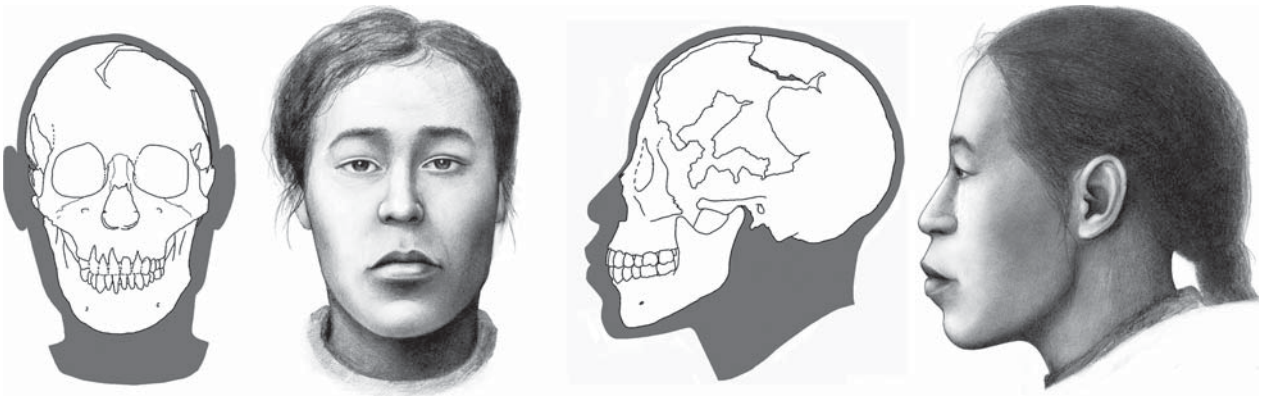

Fig. 6. Facial reconstruction based on the skull from burial 1.

level. The vertical outline of the nasal bridge is straight. The nasal aperture is triangular. The subnasal margin is blunt, of the "infantile" shape. Both sides of the margin are at the same level. The preservation of the anterior nasal spine is poor, but it was likely fairly developed and faced horizontally. The zygomatic bones are small, gracile, and smooth. The canine fossae are shallow.

Both maxillary and mandibular alveolar processes are low and protruding. The teeth are oriented vertically. The skull exhibits a natural form of prognathism of the dental part of the jaws. The dental occlusion is scissor-shaped. The mandible is of medium size. The mental eminence is of an intermediate width in the anterior plane. The frontal outline of the chin is rounded, while it is weakly protruding in the profile view. The mandibular ramus is inclined. The mandibular angles are weakly flared. The lower margin of the mandible is smooth.

The anatomical and morphological description of the skull was carried out following the protocol of the Russian school of facial reconstruction (Gerasimov, 1949, 1955; Lebedinskaya, 1998; Nikitin, 2009). As a result, we obtained a portrait of a girl with a tall but relatively narrow face, an inclined forehead of an intermediate width, and a protruding and prognathic alveolar part of the face (Fig. 6). The eyes are of medium size, with a smooth fold of the upper eyelid, with the line of the incision of the eye slightly inclined internally. The nose, of medium size as well, is weakly protruding in respect to the main plain of the face, its base and tip face anterior, or slightly elevated. The mouth is fairly large and the lips are plump. The chin is of an intermediate size and rounded.

In order to trace the main direction of morphological affinity of the female skull from Ryabchikov Klyuch-1 against a background of variation of North Eurasian peoples, a multidimensional statistical analysis of a large craniometric dataset was performed. Supra-population sample means were calculated employing un-weighted population means, in order to stabilize the pattern of variation and to account for the influence of each of the population samples to the general morphological type of a supra-population mean. In such a way, female samples representing the Baikal, Central Asia, Altai-Sayan, North Altai, Kazakhstan, Ob-Irtysh (Tobol-Baraba Turks), Tom-Narym (Tom-Chulym Turks and Narym Selkup), Ural (Northern Mansi, Northern and Eastern Khanty) anthropological types were summarized. The Yamal-Yenisei anthropological type of the Western Siberian formation included samples of the North Samoyeds (Tundra and Taz Nenets), as well as a composite sample of the North Samoyeds (Nganasan, Nadym Nenets, Yar-sale and Shchuchiya Nenets), and the Kets (after (Gokhman, 1982; Dremov, 1984)). The craniometric data for the populations mentioned above were quoted from (Bagashev, 2017: 356–358, tab. 50).

The first two canonical vectors (CV) of the analysis account for more than 63 % of the total dispersion. The highest values of CV I will be found in samples displaying a wide skull-vault, a tall and horizontally flattened (at both levels) facial skeleton, and a relatively low nasal bridge; and the lowest values vice versa. This combination of traits differentiates Mongoloid and Caucasoid samples. The variation of CV II is associated with the height of the cranial vault and of the nasal bridge.

The distribution of the samples in the morphospace of the first two CVs (Fig. 7) shows that the girl's skull from burial 1 at Ryabchikov Klyuch-1 displays a specific combination of cranial traits and does not show morphological similarity to the reference samples*. Such an outcome of the analysis can be explained by the high intragroup craniometric variation typical of modern humans. All the dimensions of the skull from burial 1, excluding the upper facial height and cranial width, fit into the range of the intergroup variation of the reference female samples.

Summing up the results of the present analysis, it can be broadly concluded that the main morphological features

*The values of the cranial dimensions of the individual from burial 1 were employed "as is", without recalculation to "adult" values. All the reference samples employed were female.

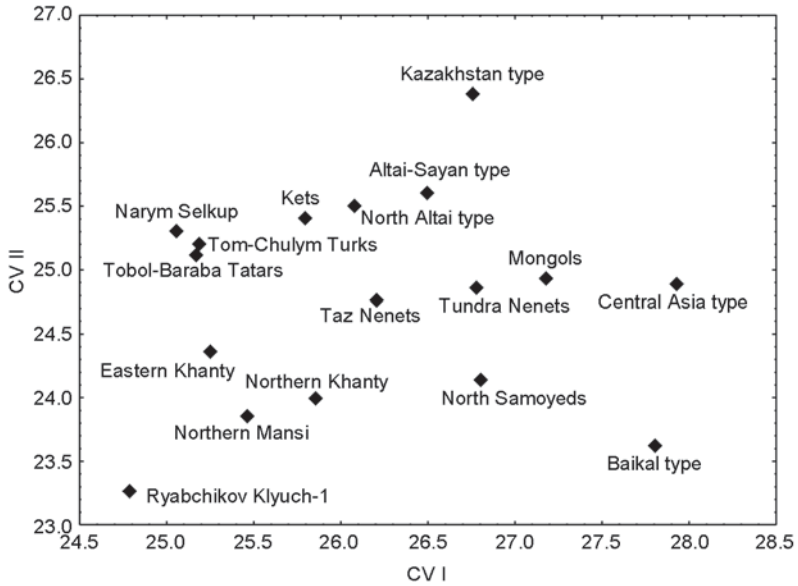

Fig. 7. Location of North Eurasian female groups in the correlation field of canonical vectors I and II.

of the girl's skull from Ryabchikov Klyuch-1 are similar to those of predominantly Mongoloid populations: in particular, the groups of the Uralian and Ob-Irtysh anthropological types of the Western Siberian formation (Table 2).

Discussion

Dating of the burials. Radiocarbon dates*. were generated for burial 1 – 906 ± 43 BP (GV-02781), and for burial 2 – 1048 ± 50 BP (GV-02768). The calibrated date (±2σ, 95.4 %) for burial 1 is 1035–1220 AD, that for burial 2 is 886–1153 AD (11.1 %).

Among the grave goods, an openwork plaque (amulet) with images of dragons deserves special attention. Parallels can be found in the Mongolian period, younger than the 13th–14th centuries. A review of similar Siberian finds was made by P.O. Senotrusova (2021). We can agree that such an item could have appeared in the Kansk-Rybinsk basin no earlier than the 13th century. However, the even earlier appearance of the plaque with dragon images in the Yenisei basin cannot be excluded either, because manufacture of such items began prior to the 13th century. The youngest date of existence for such items is difficult to determine. Such plaques could have been in use until the 17th–18th centuries.

The beads from Ryabchikov Klyuch-1 are close in shape to those from the graves of the 13th–14th centuries at the cemetery of Prospikhinskaya Shivera IV, which varied in composition and possible origin (Valiulina et al., 2017). Cowrie shells have been widely known in the archaeological materials of Siberia since the Early Iron Age; the shells were used for decorating clothes among the peoples of North Asia in the ethnographic period. They were also used as money both in the ethnographic period and in the Middle Ages (for example, in the Yunnan Province ("Kniga"…, 1956: 137)). Ceramic vessels have no decoration, and are open-shaped, with straight rims and flat bottoms. No chronological parallels of such pottery in Siberian archaeology are known.

Thus, the grave goods are younger than the derived radiocarbon dates. The 12th century seems to be the most

Table 2. **Mahalanobis-Rao distances between the skull from burial 1 at Ryabchikov Klyuch-1 and the reference (female) samples**

Ethnic groups, ethnic types	Value
Tobol-Baraba Tatars	17.1441
Tom-Chulym Turks	18.4247
Narym Selkup	19.8798
Eastern Khanty	17.1657
Northern Khanty	16.5969
Northern Mansi	23.5801
Tundra Nenets	22.4949
Taz Nenets	23.0934
North Samoyeds	23.2670
Kets	25.9278
Altai-Sayan type	20.6783
North Altai type	18.8462
Kazakhstan type	28.8972
Central Asia type	26.2945
Baikal type	25.4165
Mongols	22.1000

*Radiocarbon analyses were carried out on the fragments of the ribs of the deceased. Dating was executed at the AMS Laboratory of Budker Institute of Nuclear Physics SB RAS (Rastigeev et al., 2018). Bone samples were subjected to chemical processing and graphitization at the Laboratory for Isotopic Studies of IAET SB RAS and Laboratory for the radiocarbon analyses of the Novosibirsk State University (Lysikov et al., 2018), which currently belong to the Center for Collective Use "AMS Golden Valley". Calibration of the radiocarbon age was carried out through the calibration curve IntCal20 (Reimer et al., 2020) and the program OxCal 4.4 (Bronk Ramsey, 2009; Bronk Ramsey, Lee, 2013).

reasonable date, well-correlated with both radiocarbon determinations and the items' features.

Ethnocultural attribution. The set of grave goods could be associated with a group of pastoralists (judging by the presence of cow bones in the burial) of the pre-Mongolian period. This group should have been included in the system of connections between the population of the forest-steppe region of the Middle Yenisei and the surrounding territories, which is evidenced, most likely, by imported cowrie shells, a bronze amulet, and glass beads. Ceramic dishes do not show evident distinguishing features. It is currently impossible to attribute the buried individuals to any archaeological culture, because no medieval cultures in the Kansk-Rybinsk basin are known. There are also no exact parallels to the discovered burials.

Medieval burials of the population of the Kansk-Achinsk forest-steppe are represented mainly by small cemeteries and single graves. The ethnocultural identification of the youngest burial sites (2nd millennium AD) is based on the historiographic tradition (cremation – the Yenisei Kyrgyz, inhumation – the Kyshtyms), supplemented by the data from written sources and maps of the dispersal of the peoples of Siberia. A grave is usually attributed to a certain ethnic group on the basis of the following information: the grave location, information about the collection of tax (yasak) in the 17th–18th centuries, the areas of dispersal of individual seoks (clans), and the adoption of Christianity by the local population. In the Kansk-Achinsk forest-steppe, there are known burials of the Turkic-speaking Kachins (the Ezerts, according to D.G. Messerschmidt (1962: 165)) and Ket-speaking Arins: Innokentyevsky (Nikolaeva, 1963), Badalyk, Berezka, Vysokoye, Monashka, Solontsy, Shishka (Skobelev, Zelenina, 2019), Startsevo-1, and Antsir-1 (Fokin, 2020b). The cemeteries are located mainly on hills and other high landforms. These are flat-grave burials, some of which are associated with low mounds and masonries. Burials were made through the inhumation rite, in some cases—with the use of fire in the grave (this feature is common for the burials of the Turkic-speaking Kachins and Ket-speaking Arins). The grave-pits are shallow, contain the remains of wooden structures (roof, covering of the bottom and walls) and whole coffins; the use of birch-bark is noted. The buried individuals, with rare exceptions, were placed in graves in the supine position, with their heads to the west, rarely to the east; no connection with the direction of river flows has been recorded. The graves yielded sheep bones and grave goods: pottery, weapons, elements of horse equipment and clothing, ornaments, and cult items.

According to ethnographic data limited by consolidated information from the map by B.O. Dolgikh (1960), in the 16th century, various ethnic groups lived in the Kansk-Rybinsk basin: the Kamasins (Kashins), Kotts, and Karagas. The Kamasins are the Samoyed population of the forest-steppe and taiga zones on the right bank of the Yenisei in the basins of the Kan and Mana. The Karagas (Tofalars) belong to the Turkic peoples of the northern forest-steppe and the Eastern Sayan range. The Kotts are the Ket-speaking population of the Middle Yenisei. It is known that Fort Kansk was set up by the Krasnoyarsk ataman Nikifor (Miloslav) Koltsov in "Kott's land" in 1636 (Prokushev, 1986: 12). Apparently, the Kansk area was called Kott's land, which unequivocally indicates the ethnicity of the majority of its population. Information about the penetration of Turkic-speaking groups (Karagas) into this region dates back to the time of the Russian colonization of Siberia (after the 16th century).

A review of the features of the burials of the Kets, Samoyeds, and Turks of the Late Middle Ages and the Early Modern Age recorded in ethnographic and archaeological materials does not provide solid grounds to identify criteria for a strict ethno-cultural classification of burials made according to the rite of inhumation in the Middle Yenisei. The burials of the Ket-speaking Arins have been studied in the vicinity of Krasnoyarsk. The Arin burials are considered those that do not show the use of fire. These include, for example, the Monashka cemetery, where some of the burials were provided with small masonries and some were not distinguished in relief. The latter had shallow pits with wooden structures (covering of the walls' bottom, roofing, including birch-bark). The buried was placed in the supine position, with the head to the west. Downstream of the Kan River from Ryabchikov Klyuch-1, the Antsir-1 flat-grave burial is known, which has a stone above-ground burial structure and a partial intra-grave cover. The buried person was laid in a narrow pit in the supine position, with the head to the east. The grave goods include stone beads and other ornaments, and an axe. The burial is preliminarily dated to the 16th–18th centuries (Fokin, 2020a).

The burial rite of the Kets was described by B.O. Dolgikh (1961). The common features of the burials and graves at Ryabchikov Klyuch-1 described by him are location of the graves near rivers, orientation of the head to the east, wooden structures, and possibly traces of fire (it was made near the body of the deceased when they started to dig a pit; charred soil and pieces of charcoal were recorded to the north of burial 1 at Ryabchikov Klyuch-1). The distinctive features of the Ket burials: grave-pits are rather deep (about the height of an adult), the bottom and the body are covered with boards; the face of the deceased is turned to the west. Dolgikh noted that, according to A.P. Dulzon, the Chulym Turks buried the dead in the way similar to the Kets, but before placement of the body in the grave, a fire was made in it. Dolgikh considers burial rites of the Shors and Chulyms to be the most similar to those of the Kets.

Late Turkic (judging by the occurrence of the leather case for the umbilical cord—"kin") burials of the

Krasnoyarsk forest-steppe were found at the Badalyk cemetery, in the vicinity of Krasnoyarsk. The Turks of the Minusinsk basin and the adjacent regions practiced cremation (Kyrgyz mounds, Askiz culture), as well as inhumation, sometimes with elements of cremation. A burial in mound 3 at Badalyk (apparently, of the Kacha culture) was topped with a low rounded stone pile. In the grave, there was a structure made of wooden boards (with a bottom and a roof), oriented along the W-S-W – E-N-E line. Birch-bark was used in the roof construction. The buried, in the supine position, was oriented with the head to the west-southwest. The face was turned to the south (materials of excavations by S.G. Skobelev, 1985).

A.Y. Tugarinov (1926: 81) provided a brief ethnographic description of the Kamasin burials. His interviewees informed him that the Kamasins (Kalmazh) practiced inhumation of the dead dressed in their best clothes and with a whole set of grave goods; the buried was wrapped in birch-bark, laid with the head to the west; external structures were absent. Samoyed burials are described in ethnographic records about the northern groups (Selkups) and supported by the data from archaeological excavations of sites associated with the Samoyed population in the Ob region. A common feature of the burials of the Narym Selkups (Tiskinsky cemetery) of the 18th–19th centuries (Bobrova, 2007: 40) and the burials at Ryabchikov Klyuch-1 is shallow graves. The differences are significant: occurrences of group burials (including those in kurgans), orientation of the head to the west, predominance of burials in coffins of various types. However, the Tiskinsky cemetery showed a modified rite of the Ob Samoyeds. G.I. Pelikh (1972: 62–63) identified a type of a more traditional and common burial rite, which reveals features close to those that of Ryabchikov Klyuch-1: the orientation of the buried with their heads upstream the river, the construction of a cribwork.

The available ethnographic data (Olenny narod, (s.a.)) indicate that burials of the Karagas (Tofalars) show similarities to the burials under consideration: shallow graves, covering with bark, building a cribwork (for winter burials), orientation of the dead with the heads to the east, the feet downstream the river, burial in everyday clothes and with a small set of grave goods. A burial of a child at Ryabchikov Klyuch-1 presents a striking difference from the well-known Tofalar burial practices. According to ethnographic data, the Karagas buried children in coffins carved out in logs or hollows of trees. The child's grave in question revealed traces of wood, but this was probably the joisting of the wooden structure in a shallow grave-pit, similarly to that in the girl's burial.

The features of burials of various ethnic groups of the Siberian population in the Late Middle Ages and the Early Modern Age do not provide any unambiguous criteria for determining the ethnicity of the people who left the Ryabchikov Klyuch-1 cemetery. The most important features of the Ryabchikov Klyuch-1 burial rite have parallels in the burial practices of all the main inhabitants of the Kansk-Rybinsk basin prior to the Russian colonization. Apparently, attempts to identify relationships between people living in the same region in the 12th and 16th centuries should take into account the possibility of a complete change of inhabitants. The processes of changing the ethno-cultural situation in Central Siberia during the medieval period are identified by indirect signs that are distinguished in the archaeologically studied burials (anthropological type, processing of the remains, orientation, grave goods, mutual arrangement of structures, etc.). On this basis, generalized groups of "local" and "migrant" populations are described. Apparently, at Ryabchikov Klyuch-1, burials of the ancestors of one of the three main ethnic groups mentioned in the 16th century written sources were found. Comparison of archaeological, ethnographic, and anthropological data makes it possible to attribute the described complexes to the Ket-speaking population.

Conclusions

The burials of a girl and a child found at Ryabchikov Klyuch-1 reflect the traditions of a part of the Kansk-Rybinsk basin population of the 12th century AD. Burial rite is the most important indicator of the ethno-cultural affiliation of the people who made these burials. But a strict classification of burials according to this indicator should be carried out taking into account the fact that the differences, including the ritual ones, between groups of people who spoke the same language, may be more significant than those between neighboring populations speaking different languages.

Burials at Ryabchikov Klyuch-1 were made following the rite of inhumation in shallow pits with wood covering. The dead were oriented with the heads upstream the river, to the east. A comparative analysis of the materials makes it possible to affiliate the buried with the ancestors of one of the ethnographic groups populating this area in the third quarter of the 2nd millennium AD: the Ket-speaking Kotts (who were the most widespread at the early stages of the Russian colonization in the Middle Kan), the Turkic-speaking Karagas, and the Samoyed-speaking Kamasins. The shortest list of the main archaeological and ethnographic features of the burials of these groups shows the complexity and mixed character of their ritual practices and the ambiguity of the archaeological evidence of the burial rite at Ryabchikov Klyuch-1. Most likely, the buried individuals belong to the population that was the ancestor group of the later Ket-speaking people of the Kansk-Rybinsk basin.

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References

Bagashev A.N. 2017
Antropologiya Zapadnoy Sibiri. Novosibirsk: Nauka.

Bobrova A.I. 2007
Selkupy XVIII–XIX vv. (po materialam Tiskinskogo mogilnika). Tomsk: Izd. Tom. Gos. Univ.

Bronk Ramsey C. 2009
Bayesian analysis of radiocarbon dates. *Radiocarbon*, vol. 51 (1): 337–360.

Bronk Ramsey C., Lee S. 2013
Recent and planned developments of the program OxCal. *Radiocarbon*, vol. 55 (2/3): 720–730.

Dolgikh B.O. 1960
Rodovoy i plemennoy sostav narodov Sibiri v XVII veke. Moscow: Izd. AN SSSR.

Dolgikh B.O. 1961
O pokhoronnom obryade ketov. *Sovetskaya arkheologiya*, No. 3: 102–112.

Dremov V.A. 1984
Rasovaya differentsiatsiya ugorskikh i samodiyskikh grupp Zapadnoy Sibiri po dannym kraniologii. In *Problemy antropologii drevnego i sovremennogo naseleniya severa Yevrazii*. Leningrad: Nauka, pp. 106–132.

Fokin S.M. 2007
Kulturno-istoricheskiye protsessy v rannem i razvitom Srednevekovye Krasnoyarskoy lesostepi: Cand. Sc. (History) Dissertation. Tomsk.

Fokin S.M. 2020a
Arkheologicheskiye issledovaniya Krasnoyarskogo krayevogo krayevedcheskogo muzeya. In *Arkheologicheskiye otkrytiya 2018 goda*. Moscow: IA RAN, pp. 456–457.

Fokin S.M. 2020b
Noviye srednevekoviye pogrebeniya v Krasnoyarskoy lesostepi. In *Mezhdistsiplinarniye arkheologicheskiye issledovaniya drevnikh kultur Yeniseiskoy Sibiri i sopredelnykh territoriy: Tezisy Mezhdunar. konf. (Krasnoyarsk, 20–22 okt. 2020 g.)*. Krasnoyarsk: Sib. Feder. Univ., pp. 54–56.

Gerasimov M.M. 1949
Osnovy vosstanovleniya litsa po cherepu. Moscow: Sov. nauka.

Gerasimov M.M. 1955
Vosstanovleniye litsa po cherepu: (Sovremenniy i iskopayemiy chelovek). Moscow: Izd. AN SSSR. (TIE. Nov. ser.; vol. 28).

Gokhman I.I. 1982
Antropologicheskiye aspekty ketskoy problemy: Rezultaty antropometricheskikh i kraniologicheskikh issledovaniy. In *Ketskiy sbornik*. Leningrad: Nauka, pp. 9–42.

"Kniga" Marko Polo. 1956
I.P. Minaev (trans. from Old French); I.P. Magidovich (ed. and intro.). Moscow: Geografgiz.

Kungurov V.A., Kungurova N.Y. 2018
Nekropol pervoy poloviny II tys. v basseyne r. Kan. In *Drevnosti Sibiri i Tsentralnoy Azii*: *(Elektronnoye nauch. izd.)*, V.I. Soenov (ed.). Gorno-Altaysk: Gorno-Alt. Gos. Univ., pp. 69–92.

Kyzlasov I.L. 1983
Askizskaya kultura Yuzhnoy Sibiri: X–XIV vv. Moscow: Nauka. (SAI; iss. E3-18).

Lebedinskaya G.V. 1998
Rekonstruktsiya litsa po cherepu: Metod. rukovodstvo. Moscow: Stariy sad.

Lysikov A.I., Kalinkin P.N., Sashkina K.A., Okunev A.G., Parkhomchuk E.V., Rastigeev S.A., Parkhomchuk V.V., Kuleshov D.V., Vorobyeva E.E., Dralyuk R.I. 2018
Novel simplified absorption-catalytic method of sample preparation for AMS analysis designed at the Laboratory of Radiocarbon Methods of Analysis (LRMA) in Novosibirsk Akademgorodok. *International Journal of Mass Spectrometry*, vol. 433: 11–18.

Messerschmidt D.G. 1962
Forschungsreise durch Sibirien 1720–1727, E. Winter, G. Uschmann, G. Jarosch (eds.). Bd. 1: Tagebuchaufzeichnungen 1721–1722. Berlin: Akad.-Verl.

Mitko O.A. 1995
Naseleniye territorii Srednego Yeniseya v epokhu srednevekovya (VI–XVI vv.): Cand. Sc. (History) Dissertation. Novosibirsk.

Nikitin S.A. 2009
Plasticheskaya rekonstruktsiya portreta po cherepu. In *Nekropol russkikh velikikh knyagin i tsarits v Voznesenskom monastyre Moskovskogo kremlya*. Vol. 1: Istoriya usypalnitsy i metodika issledovaniya zakhoroneniy. Moscow: Izd. muzeyev Mosk. kremlya, pp. 137–167.

Nikolaeva I.B. 1963
Raskopki na territorii byvshego Krasnoyarskogo ostroga. In *Materialy i issledovaniya po arkheologii, etnografii i istorii Krasnoyarskogo kraya*. Krasnoyarsk: Kn. izd., pp. 115–123.

Olenny narod – pokhoronnaya obryadnost karagasov ili tofalarov. (s.a.)
URL: http://etnografia.ru/aborigen/1_tofa/death/tofa_death.htm. (Accessed December 23, 2021).

Pelikh G.I. 1972
Proiskhozhdeniye selkupov. Tomsk: Izd. Tom. Gos. Univ.

Prokushev V.I. 1986
Kansk. Krasnoyarsk: Kn. izd. (Goroda Krasnoyarskogo kraya).

Rastigeev S.A., Frolov A.R., Goncharov A.D., Klyuev V.F., Konstantinov E.S., Parkhomchuk V.V., Petrozhitskii A.V. 2018
Radiocarbon analysis of samples by a 1-MV AMS spectrometer at ion charge state 3+. *Physics of Particles and Nuclei Letters*, vol. 15 (7): 986–989.

Reimer P., Austin W., Bard E., Bayliss A., Blackwell P., Bronk Ramsey C., Talamo S. 2020
The IntCal20 northern hemisphere radiocarbon age calibration curve (0–55 cal kBP). *Radiocarbon*, vol. 62 (4): 725–757.

Saveliev N.A., Svinin V.V. 1978
Pogrebeniye zheleznogo veka na reke Kane. In *Drevnyaya istoriya narodov yuga Vostochnoy Sibiri*. Irkutsk: Irkut. Gos. Univ., pp. 135–149.

Senotrusova P.O. 2021

Nakhodki monetovidnykh amuletov v Sibiri. In *Arkheologiya Severnoy i Tsentralnoy Azii: Noviye otkrytiya i rezultaty mezhdistsiplinarnykh issledovaniy: Sbornik. st., posvyashch. 75-letiyu prof. Y.F. Kiryushina*. Barnaul: Izd. Alt. Gos. Univ., pp. 221–224.

Senotrusova P.O., Mandryka P.V. 2018

Cultural ties across taiga and steppe: Material culture from Medieval Lower Angara River and Prospikhinskaya Shivera IV. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 46 (3): 92–99.

Skobelev S.G. 2009

Predmetnoye soderzhaniye russkikh vliyaniy na materialnuyu kulturu korennogo naseleniya yuga Priyeniseiskogo kraya v pozdnem Srednevekovye – nachale Novogo vremeni (po dannym arkheologii). *Vestnik Novosibirskogo gosudarstvennogo universiteta.* Ser.: Istoriya, filologiya, vol. 8 (3): 231–250.

Skobelev S.G., Vybornov A.V. 2019

Sredniy Yenisey v mongolskoye vremya. In *Genuezskaya Gazariya i Zolotaya Orda*, vol. 2. Kishinev: Stratum Plus, pp. 145–156.

Skobelev S.G., Zelenina E.V. 2019

Arkheologicheskiye pamyatniki arintsev i kachintsev v Krasnoyarskom lesostepnom rayone (XVI–XVIII vv.). In *Narody i kultury Sayano-Altaya i sopredelnykh territoriy: Materialy VI Mezhdunar. nauch. konf., posvyashch. 75-letiyu Khakass. nauch.-issled. inst. yazyka, literatury i istorii (26–27 sent. 2019 g.)*. Abakan: Khakas. kn. izd., pp. 48–58.

Tugarinov A.Y. 1926

Posledniye kalmazhi. *Severnaya Aziya*, bk. 1: 73–88.

Valiulina S.I., Mandryka P.V., Senotrusova P.O., Trifonov A.A. 2017

Busy naseleniya Nizhnego Priangarya v razvitom Srednevekovye (po materialam mogilnika Prospikhinskaya Shivera IV). *Stratum plus*, No. 5: 311–324.

Vybornov A.V., Grachev I.A., Zolnikov I.D., Kartoziya A.A., Markovsky G.I., Slavinsky V.S., Slepchenko S.M., Tsybankov A.A. 2015

Spasatelniye arkheologicheskiye raskopki na mestonakhozhdenii Ryabchikov Klyuch-1 pod gorodom Kanskom v 2015 godu. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XXI. Novosibirsk: Izd. IAET SO RAN, pp. 567–570.

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Chinese Coins from the Early Medieval Cemetery Gorny-10, Northern Altai

We describe a representative series of Chinese coins found during the excavations at Gorny-10, carried out by expeditions from Altai State University in 2000–2003. The coins were found in eight burials (No. 6, 18, 44–46, 48, 62, 66). Because of its composition and diversity, the sample is unusual for North and Inner Asia. It includes 29 specimens, relating to various groups. Apart from coins of the Wŭ-zhū and Kāi-yuán Tōng-bǎo types, which are rather common outside China, there are very rare ones belonging to the Cháng-píng Wŭ-zhū and Wŭ-xíng Dà-bù categories. A numismatic analysis allowed us to date separate burials and the entire cemetery. The lower date of most burials (No. 6, 45, 46, 48, 62, 66) cannot be earlier than AD 581, as evidenced by Sui coins of the Wŭ-zhū type. Burials 18 and 41, where Kāi-yuán Tōng-bǎo coins were found, are later than the 630s. In view of additional data (absence of late issues of Kāi-yuán Tōng-bǎo coins, and results of radiocarbon analysis), burials at Gorny-10 date to late 6th and 7th centuries. Notably, coins were found only in burials of women and children. Their locations suggest that they had been used as head ornaments and parts of belt sets, as well as pendants and amulets.

Keywords: *Chinese coins, cemeteries, Northern Altai, Early Middle Ages, chronology, social history.*

Introduction

One of the most informative groups of imported items discovered during excavations of archaeological complexes in North and Inner Asia is Chinese coins. Such finds are rightfully considered to be an important source for clarifying the dating of objects and establishing the directions of contacts in specific periods. This article describes a collection of Chinese coins assembled during the study of burials at the Gorny-10 necropolis. The rich information capacity of this collection, unique in quantity and composition for the sites of that vast region, results from the fact that in most cases coins were found in undisturbed burials with fairly representative grave goods. This makes it possible to identify some aspects of coin use by the population living at considerable distance from the trading and artisanal centers of China, and to describe the social role of such objects and their place in the worldview of a society of the Early Middle Ages. In addition, the numismatic features became the basis for

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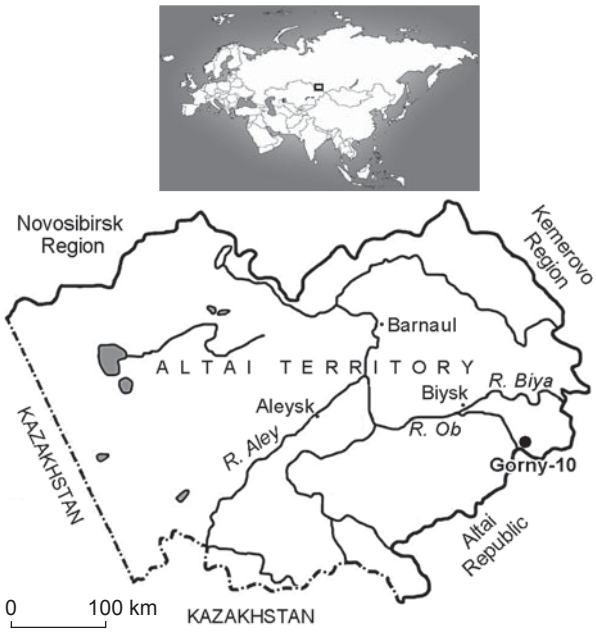

Fig. 1. Location of the cemetery of Gorny-10.

using them as chronological markers both in analyzing individual objects and for establishing the time when the entire necropolis functioned.

Description of sources

The cemetery of Gorny-10 is located on the right bank of the Isha River, in the Krasnogorsky District of the Altai Territory (Fig. 1). In 2000–2003, expeditions from Altai State University and the "Naslediye" Research and Production Center under the leadership of M.T. Abdulganeev and N.F. Stepanova excavated 75 graves at the cemetery. The evidence from this site, which is now one of the basic referential complexes of the Early Middle Ages in the south of Western Siberia, has been described only partially (Abdulganeev, 2001; Seregin, Abdulganeev, Stepanova, 2019; Seregin, Stepanova, 2021; and others).

Coins were discovered during the excavations of eight burials at Gorny-10 (graves No. 6, 18, 44–46, 48, 62, and 66). These items were a part of grave goods in five female burials, and were also found in three children's burials. Each grave contained from one to eight coins. The context of these items should be briefly described.

Grave 6. Coins were found in a paired burial, on the skeleton of a 30–40-year-old female*. Seven items were located between the right elbow-joint and the spine of the deceased; one was on the right humerus.

Grave 18. The object had been almost completely destroyed as a result of modern economic activities. Five Chinese coins were found in the dig.

Grave 44. Two coins were found in the burial of a 4–5-year-old child. One coin was in the place of the right knee; fragments of the second coin were found near the left elbow-joint.

Grave 45. One Chinese coin was found on the right near the skull of a 40–55-year-old female; another coin was discovered in a rodent hole; oxides from the coin were present on the back of the skull.

Grave 46. This object, containing the bones of a child, had been severely damaged in the course of economic activities. Two Chinese coins were found in the western part of the grave.

Grave 48. Three coins were discovered in the burial of a child 6–7 years of age. One coin was in the area of the buried child's belt; two coins, one of which had holes, were located in the neck area.

Grave 62. A Chinese coin was found near the bones of the right hand in the area of the belt of a deceased female 23–25 years of age.

Grave 66. Six Chinese coins were discovered in the burial of a female 25–35 years of age. One coin was on the facial area of the skull; two more were under the skull; the rest were found in burrows to the south of the grave.

Thus, in the cases when the excavations have revealed the initial situation (the complex had not been not disturbed), coins were most often found near the head of the deceased person (graves 45, 48, and 66), on the chest or at the neck (graves 6 and 48), or in the area of the person's belt (graves 6, 44, 48, and 62).

The collection of coins from Gorny-10 includes 29 items belonging to various groups (see *Table*)*. Analysis of the coins and comparison with the available evidence has made it possible to identify these and establish the period of their manufacture.

Analysis of the evidence

Now let us turn to the detailed analysis of the coins found at the cemetery Gorny-10.

Grave 6. All eight coins (Fig. 2) belong to the so-called *Wŭ-zhū* 五銖 type** of the Sui Dynasty; their

*Anthropological identification of all evidence was made by S.S. Tur.

*In addition to the numismatic finds mentioned above, grave 46 of that site contained a Hephthalite coin, which is unique for North and Inner Asia. It is an imitation of a drachma of the Sasanian shah Pērōz I (Seregin, Tishin, Stepanova, 2021).

**Hereafter, when referring to Chinese designations and names, the Chinese characters will be provided only when they are first used in the text; subsequently, the Chinese characters will only be used in special cases when it is necessary for clarity.

Chinese coins from graves at the Gorny-10 cemetery

Grave No.	Coin No.	Coin type	Weight, g	Diameter, mm
6	1	*Wŭ-zhū* 五銖	2.08	23.1
	2	"	2.06	23.1
	3	"	1.74	22.9
	4	"	2.17	23.0
	5	"	2.27	22.9
	6	"	2.21	23.3
	7	"	1.97	22.0
	8	"	1.76	22.6
18	1	*Cháng-píng Wŭ-zhū* 常平五銖	3.09	24.2
	2	"	3.56	24.5
	3	*Wŭ-zhū* 五銖	2.09	25.2
	4	"	1.98	22.9
	5	*Kāi-yuán Tōng-bǎo* 開元通寶	3.83	25.0
44	1	"	3.66	25.1
	2*	*Wŭ-zhū* 五銖	…	…
45	1	"	1.63	22.8
	2	"	0.91	22.8
46	1	"	1.74	23.2
	2	"	1.44	23.1
48	1	"	1.38	23.8
	2	"	1.38	23.0
	3	*Wŭ-xíng Dà-bù* 五行大布	2.20	25.1
62**	1	*Wŭ-zhū* 五銖	…	23.0
66**	1	"	…	23.1
	2	"	…	23.0
	3	"	…	23.2
	4	"	…	23.5
	5	"	…	23.5
	6	"	…	23.1

*Fragmented.
**Finds have been lost.

production began in the Kāi-huáng 开皇 era (581–600) and continued till 621. Such Sui coins had weights of slightly more than 3 g, although larger weights are also known (Peng Xinwei, 1994: 194–195, 201, pl. 39, fig. 6). These are distinguished from the coins of this type minted in previous periods by a wide rim and a prominent element ("bar") to the right of the central hole, that is, on the left side of character *wŭ* 五 ("sandglass"). The latter feature was probably also typical of similar coins of the Late Western Wei (after 540 or 546) (Ibid.: 193–194, 200, pl. XXXVIII, fig. 5; Thierry, 1988: 350, [fig.] A, A′, A″ (Western Wei), B (Sui); 1989: 244, No. 76–78 (Western Wei), 79 (Sui); 1991a: 129, note 2, pl. VI, fig. 6, 7; Jen, 2000: 35, 36, No. 129)*. A strong argument in favor of this dating is the fact that 39 *Wŭ-zhū* 五銖 coins with the internal "bar", straight outlines of diagonal

*In this case, according to the features mentioned by F. Thierry (the corners of character *wŭ* 五 expand to the outer rim of the coin; horizontal line of *jīn* 金 element is shifted to the left in relation to the base of its top) (Thierry, 1988: 350, [fig.] A′ (Western Wei); 1989: 244, No. 77), coin No. 4 from grave 6 at Gorny-10 should be dated to 546 AD, and other coins to 540 AD.

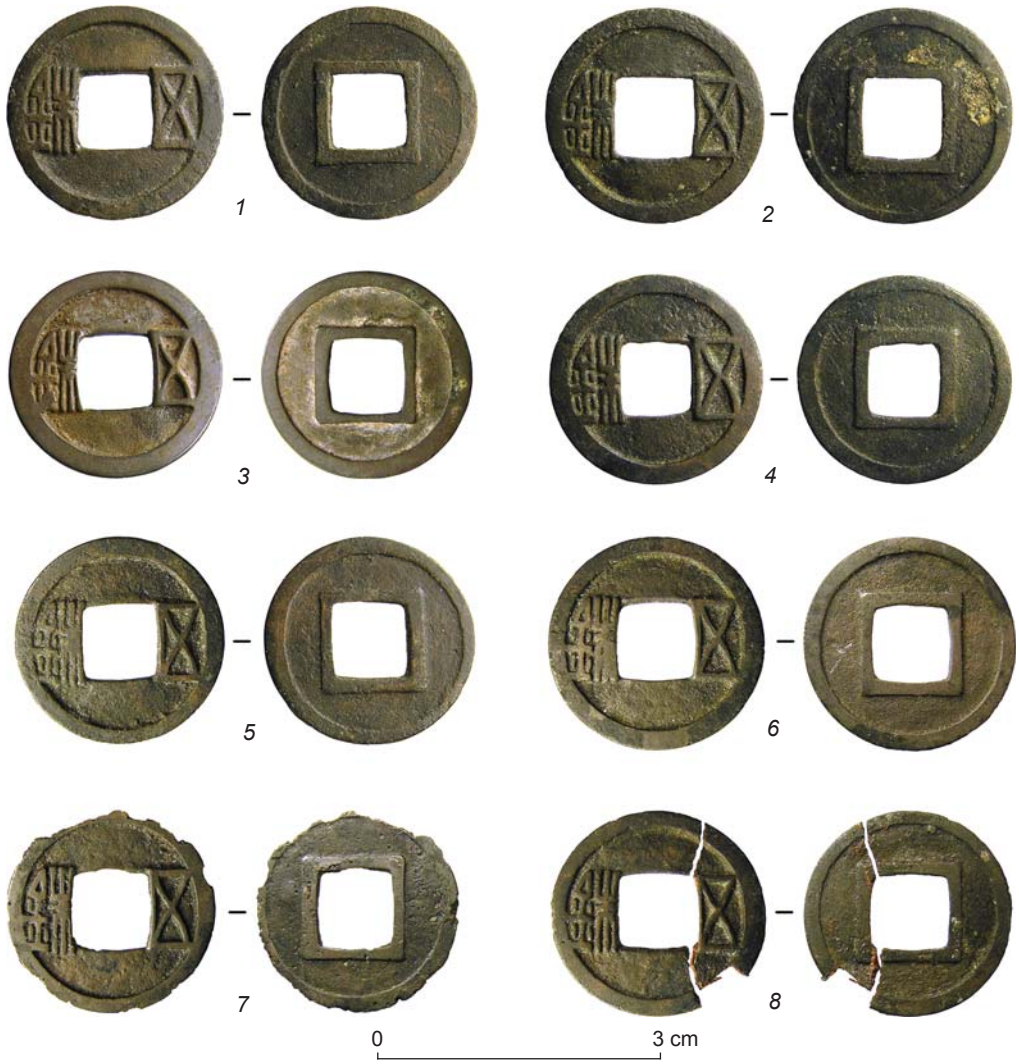

Fig. 2. Chinese bronze coins from grave 6.

lines of the character *wǔ* 五, and beveled top ("arrow") of *jīn* 金 element of character *zhū* 銖 were discovered in the tomb of Hóu Yì 侯義 of Western Wei, dated to 544 AD according to the epitaph (Thierry, 1988: 350–351, [fig.] A″; 1989: 231, 245–246, 244, No. 76). The diameter of such items was 25 mm; their weight was 3.7 g (Wáng Tàichū, 1998).

A stylistically and typologically identical *Wǔ-zhū* coin is known from the Timiryazevo-1 burial mound. Its diameter was 23.5 mm; its weight was 2.1 g. Considering that the weight of Western Wei coins was about 4 g and the fact that such coins, calligraphically similar to Western Wei coins, were used in the Sui period, the authors of the publication dated this item to 589–600 AD (Zaitseva et al., 2016: 294–295). They identified the coin as type 10.26 according to D. Hartill's catalog. However, the design of the top ("arrow") of *jīn* 金 element of character *zhū* 銖 makes it possible to identify the coin as type 10.25 (Hartill, 2005: 94).

Grave 18. This burial is distinguished by the greatest variety of coins. *Cháng-píng wǔ-zhū* 常平五銖 coins (Fig. 3, *1*, *2*) had been issued in Northern Qi starting from the 4th year of the reign of Tiān-bǎo 天保 era (553). They were thin and weighed about 4.2 g (Peng Xinwei, 1994: 194, 200, pl. 38, fig. 10). In the early period of the Sui Dynasty, these coins were permitted to be used along with other coins, as was stated by a special decree of 583 AD. However, already in 584 AD, the situation became more complicated, and in 585 AD the circulation of coins of old types was prohibited (Materialy…, 1980: 119).

Coin No. 3 of the *Wǔ-zhū* type (Fig. 3, *3*). The outer rim of this coin is thin; the stroke of the inscription is thick. The horizontal lines of the image of the character *wǔ* 五 protrude towards the central hole of the coin. In the second character *zhū* 銖, the upper part of *jīn* 金 element is depicted as an equilateral triangle (with solid filling), and halves of its base are equidistant from the middle horizontal line. Four dots in the sectors of the *wáng* 王

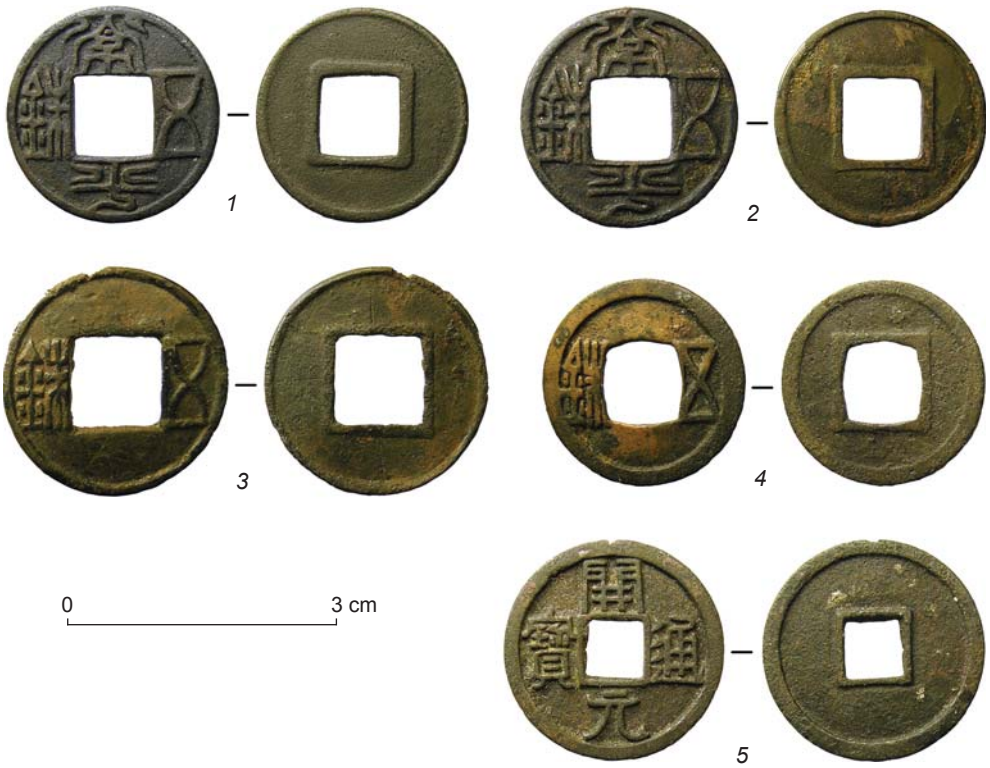

Fig. 3. Chinese bronze coins from grave 18.

radical look like vertical lines. Side lines in the upper part of element *zhū* 朱 are shorter than in the lower part; bends are on the same level as the base of the upper part of the *jīn* 釒 element; they are only slightly rounded in its upper and well-rounded in its lower part. Neither character expands beyond the levels of the upper and lower edges of the central hole. All edges of the hole are beveled on the obverse side of the coin and are edged with a frame on the reverse side. Such features as horizontal lines of character *wǔ* 五, protruding towards the inner hole, and angular bends in the upper part of character *zhū* 朱 are typical of the coins cast by Liú Xuán 劉玄, the ruler of Huái-yáng 淮陽, also known as the emperor Gēng-shǐ-dì 更始帝 (23–25 AD) of Western Han, in the second year of his reign (24 AD) (Peng Xinwei, 1994: 123, pl. 37, fig. 2; Thierry, 1988: 231, 237, No. 39, p. 238). Their diameter is 25 mm; their weight is 2.7–2.8 g (Niú Qúnshēng, 2001)*.

Coin No. 4 is of the *Wǔ-zhū* type (Fig. 3, 4). This coin was identical to the items from grave 6**.

Coin No. 5 is of the *Kāi-yuán Tōng-bǎo* 開元通寶 type (Fig. 3, *5*). It is a coin of the Tang Dynasty, introduced in 621 AD; its original weight was 2.4 *zhū* 銖, which is about 4 g (Peng Xinwei, 1994: 246–248, 262, pl. 40; Thierry, 1991b: 212–213; Hartill, 2005: 103). According to the combination of features (primarily, the slightly trapezoidal shape of character *kāi* 開, and the location and length of its internal vertical lines (*jǐng* 井 element), which do not touch the frame of the inner hole; the average length of the first line in character *yuán* 元 and the shape of the bend in its right "leg", which does not form a hook; the semicircular outlines of the upper element of character *tōng* 通, the shape of its three dots on the left, and the small hook at the end of the horizontal base; and the rounded "feet" of character *bǎo* 寶), this find can be attributed to type I B (according to Thierry) (Thierry, 1991b: 220, No. 5–16: 221). Such coins were produced in 621–718 AD (cf.: (Hartill, 2005: 105), where other criteria are mentioned). These features of type I B make it possible to correlate the coin with the item from a tomb dated to the 21st year of the Zhēn-guàn 貞觀 era

*This identification was confirmed by F. Thierry in correspondence with one of the authors of this article. Now, we express our gratitude to him. Dr. Thierry drew our attention to four additional lines on the reverse of the coin, located radially relative to the central hole. In his opinion, this may indirectly indicate that the coin was used as a medallion.

**The presence of *Wǔ-zhū* coins in burials of a disputed type (or two types) together with coins of the dynasties preceding and following the Sui (especially grave 18, where such coins were found together with *Cháng-píng Wǔ-zhū* and *Kāi-yuán Tōng-bǎo* coins), is an argument in favor of correlating them precisely with the Sui. Their correlation with the Western Wei would make it strange that there were no Sui coins in the burials containing the coins of Northern Qi, Northern Zhou, and Tang.

(10.02.647–29.01.648) (Jen, 2000: 300, No. 5; Thierry, 1991b: 238). Judging by the available data, such coins were minted during the reign of the emperor Tài-zōng (626–649).

Grave 44. Coin No. 1 is of the *Kāi-yuán Tōng-bǎo* type (Fig. 4, *1*). According to the combination of features, it can be described as type I B (according to Thierry, see above).

Coin No. 2 is of the *Wǔ-zhū* type. The available fragments make it possible to identify the typological affiliation of the coin. According to the preserved "bar", it can be correlated with similar items from grave 6 (closer to coin No. 4).

Grave 45. Two *Wǔ-zhū* coins (Fig. 4, *3*, *4*) are similar to the items from grave 6 (and the first one is closer to coin No. 4).

Grave 46. Both coins (Fig. 4, 5, 6) are identical to the items from grave 6 described above.

Grave 48. Two *Wǔ-zhū* coins (Fig. 4, *7*, *8*) are similar to items from grave 6. More rare is coin No. 3 of the *Wǔ-xíng Dà-bù* 五行大布 type (Fig. 4, *2*), which shows additional holes. *Wǔ-xíng Dà-bù* coins began to be minted in Northern Zhou in the 6th month of the 3rd year of the Jiàn-dé 建德 era (05.07–02.08.574). It is believed that their standard weight was about 4.5 g. Owing to the appearance of many counterfeit coins, circulation of *Wǔ-xíng Dà-bù* coins in the border provinces was already terminated in the 7th month of the 4th year of the Jiàn-dé era (23.07–21.08.575) (Peng Xinwei, 1994: 194, 200, pl. 39, fig. 2–3; Thierry, 1991a: 130, 135–136, note 18, pl. 8, fig. 25; Materialy…, 1980: 118). Thierry mentioned a coin weighing 1.75 g, which he identified as false. Since the issue of these coins was terminated in 575 AD, Thierry observed that the weights of such coins would become 61 % lighter over the course of a year (1991a: 136, pl. 8, fig. 26). In the early period of

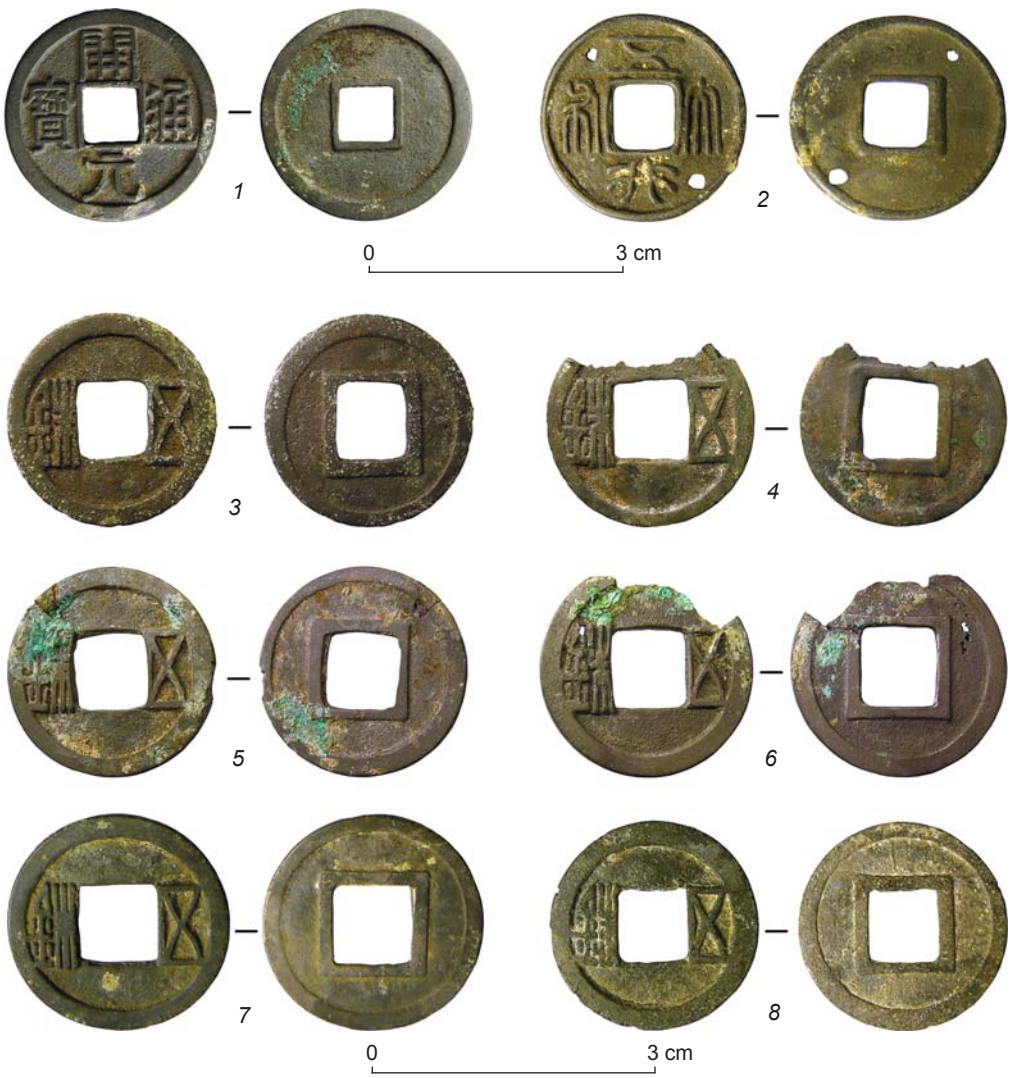

Fig. 4. Chinese bronze coins from graves 44 (*1*), 45 (*3*, *4*), 46 (*5*, *6*), 48 (*2*, *7*, *8*).

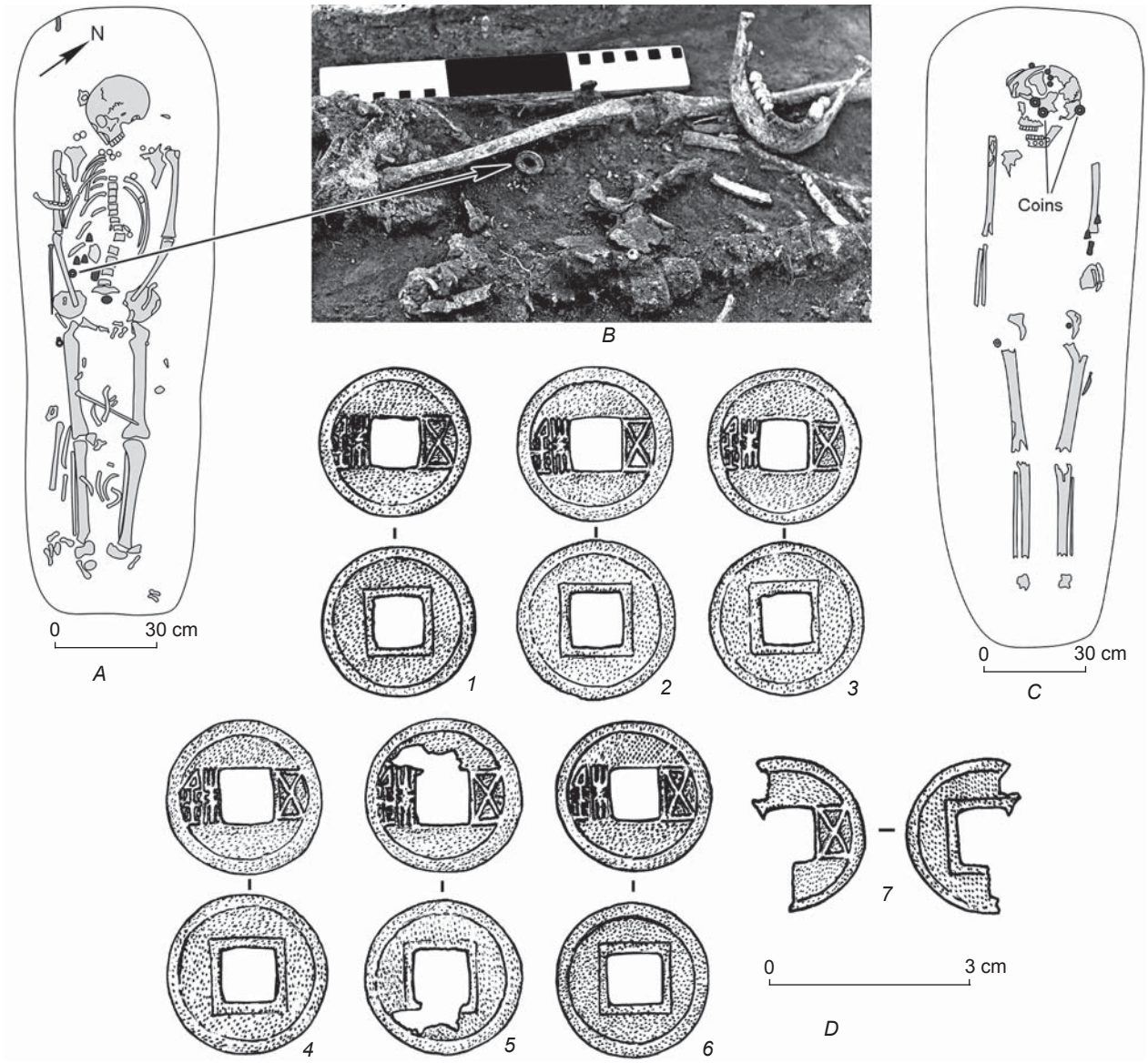

Fig. 5. Plans of burials 62 (*A*) and 66 (*C*), fragment of burial 62 (*B*), and Chinese bronze coins from these objects (*D*).

the Sui Dynasty, the use of *Wŭ-xíng Dà-bù* coins was allowed (decree of 583 AD), but already in 585 AD the circulation of all old coins had been officially banned (Materialy…, 1980: 119).

Grave 62 (Fig. 5, *A*, *B*). The only numismatic find from this object was a *Wŭ-zhū* coin (Fig. 5, *D*, *1*). It has been lost, but on the basis of its features visible on the photograph and the drawing (thick rim and internal "bar"), it can be considered similar to the coins from grave 6. Judging by the surviving evidence, the lost six coins (Fig. 5, *D*, *2–7*) belonged to the same widespread group.

Grave 66 (Fig. 5, *C*). Items No. 1 and 4 (Fig. 5, *D*, *2*, *5*) are closer to coin No. 4 from grave 6.

Discussion

The collection of Chinese coins from burials at Gorny-10 is undoubtedly unique for archaeological sites of North and Inner Asia. First of all, the number of discovered coins is remarkable. Such finds from separate complexes occur extremely rarely at the early medieval sites in this vast region. The collection is also very diverse to include not only fairly common groups of coins (*Wŭ-zhū*, *Kāi-yuán Tōng-bǎo*), but also items that are very rare outside of China (*Cháng-píng Wŭ-zhū*, *Wŭ-xíng Dà-bù*).

Burials from the initial period of the Early Middle Ages in the forest-steppe Altai contained almost no

Chinese coins. At the sites belonging to the time of the Türkic Qaghanates in this region, only one such find (a *Kāi-yuán Tōng-bǎo* coin) has been discovered, at the settlement of Akutikha (Kazakov, 2014: fig. 4). A small series of coins, consisting of about ten *Kāi-yuán Tōng-bǎo* coins, was found in the later burials of the Srostki culture (Gavrilova, 1965: fig. 11, *1*; Abdulganeev, Shamshin, 1990: 104, fig. 2, *4*; Savinov, 1998: 179, fig. 8, *5*; Serov, 1999: Fig. 1–4; Mogilnikov, 2002: 27, fig. 68, *1*; Tishkin, Gorbunov, Serov, 2020). In addition, some accidental finds are known; but their interpretation is difficult owing to the lack of context.

A similar situation occurs in studying early medieval sites in the adjacent territories. Seventeen coins were found in archaeological complexes belonging to the Türks. Almost all of them were *Kāi-yuán Tōng-bǎo*; a *Wǔ-xíng Dà-bù* coin was also found in one burial (Tishkin, Seregin, 2013: Pl. 1). A series of over twenty coins of different groups has been discovered during the excavation of burials in the Novosibirsk region of the Ob (Troitskaya, Novikov, 1998: 30–31; Masumoto, 2001). A little more than ten items have been found at the sites of the early medieval population of the Kuznetsk Basin (Kuznetsov, 2007: 216–217; Ilyushin, 2010).

This overview emphasizes the exclusivity of the collection of Chinese coins from the cemetery of Gorny-10. Analysis of these finds makes it possible to address several aspects in interpreting the evidence from the excavations at the necropolis. Specific numismatic features of the coins are important in clarifying the chronology of both individual objects at the site, and the entire complex. First of all, these determine the *terminus post quem* for specific burials. Judging by the data obtained, the lowest date for the construction of most of the objects (graves 6, 45, 46, 48, 62, and 66) cannot be earlier than 581 AD, as the discovery of the Sui *Wǔ-zhū* coins confirms. Taking into account the remoteness of the forest-steppe Altai from the trading and artisanal centers of China, these coins must have reached the area in the subsequent decades.

Burials in graves 18 and 44, where the *Kāi-yuán Tōng-bǎo* coins were found, were made no earlier than the second quarter–mid 7th century AD*. The secondary factor, which can be used in establishing the chronology of the Gorny-10 cemetery, is the absence of later issues of these coins (which became quite widespread outside of China and have most often been discovered in the sites of North and Inner Asia). This fact serves as indirect evidence that the objects of the complex were built in the 7th century AD. One should also take into account the possible long-term existence of imported metal items. A clear, albeit rather unexpected, example of this is the discovery of *Wǔ-zhū* coins from the early 1st century AD in grave 18.

The above observations about the chronology of the site are confirmed by the published research into the evidence from a number of objects at Gorny-10. Its time of construction has been established as within the late 6th–7th (possibly early 8th) centuries AD (Seregin, Abdulganeev, Stepanova, 2019; Seregin, Stepanova, 2020, 2021; and others). In addition, a similar picture is revealed by the first radiocarbon dating data, which will be presented in a special publication.

It is generally accepted that Chinese coins discovered at the early medieval sites of North and Inner Asia were not the means of payment, but were used as ornaments or amulets (Troitskaya, Novikov, 1998: 30; Masumoto, 2001: 52; Basova, Kuznetsov, 2005: 135; Tishkin, Seregin, 2013: 54–55; Zaitseva et al., 2016: 295–296; and others). Considering the context of individual finds, the evidence of the excavations at Gorny-10 confirms this conclusion. Judging by the available data, in a number of cases, coins, together with other elements (mainly bronze plaques, rarely beads), were a part of a complex of head ornaments (Fig. 5, *C*). The discovery of single coins in the area of the chest or below the neck of the dead suggests the use of such coins as pendants or amulets. In addition, the coins under discussion might have served as elements of belt decoration (Fig. 5, *A*, *B*).

For the population that left the Gorny-10 cemetery, coins had a pronounced sexual context. Such items were found mainly in female burials. Those children's burials where coins were found might have also belonged to girls. Most of the graves with coins contained rich inventory indicating a fairly high status for the deceased during their lifetime—or, in the case of children's burials, the status of their family. In the meantime, such finds were absent from a number of "elite" objects.

Owing to the fragmentary evidence, it is difficult to offer a convincing explanation for such a representative collection of Chinese coins at a single site, given the almost complete absence of such items in the contemporaneous objects of the forest-steppe Altai. Indirect contacts between the periphery of nomadic empires and China certainly existed in the initial period of the Early Middle Ages, as evidenced by the finds from the complexes of the Novosibirsk and Tomsk regions of the Ob, and Kuznetsk Basin. However, the

*Coins from these graves, which can be correlated with the reign of Tài-zōng, can be dated to no earlier than 627 AD, but most likely the lower chronological boundary is later. It is unlikely that Tài-zōng, who came to power in September 626 AD, during the time of the invasion of the Türks, would immediately begin to mint coins during the attack by the Turkic people. The *Kāi-yuán Tōng-bǎo* coins of type I have been found in the tombs of the Tang Dynasty, dated to 635 and 637 AD (Thierry, 1991b: 238–239). The Sogdian coins imitating the Tang models, which were cast in Inner Asia between the establishment of the protectorate of the Tang Empire in 659 AD and the Muslim conquest in the first quarter of the 8th century, are of the same type (Ibid.: 240, 236, No. 102).

complete absence of other items of Chinese import in the burials at Gorny-10 (metal mirrors, silk and lacquer items) is noteworthy. Further analysis of the evidence, and targeted excavations, will make it possible to clarify the complex historical fate of the population that left the sites from the time of the Türkic Qaghanates in the region.

Conclusions

The numismatic collection assembled during the excavations of burials at the Gorny-10 cemetery includes several groups of Chinese coins. The exceptional nature of this collection results both from the large number of items (29 coins) and their variety. They include both fairly common specimens, and coins very rarely found outside the Celestial Empire. Since in most cases coins were found in undisturbed burials, it is possible to make a number of observations about their use by the early medieval population of the forest-steppe Altai. Judging by the evidence, the coins were a part of the head decoration of buried women and children, could have been used as pendants or amulets, and were also a decorative element of the outfit.

Taking into account relatively rich inventory found in burials with coins in almost all cases, and the results of numismatic analysis of the finds, these objects can be considered as referential for establishing the functioning period of the site, and can be used for clarifying the chronology of the archaeological complexes of the Early Middle Ages in the forest-steppe Altai and adjacent territories. It has been established that most of the examined burials were made no earlier than the 590s AD, and two graves with *Kāi-yuán Tōng-bǎo* coins were made later than the 630s AD. Taking into account additional data (lack of later issues of *Kāi-yuán Tōng-bǎo*, first results of radiocarbon analysis), most of the objects at Gorny-10 can be dated to the late 6th–7th centuries AD.

Further research aimed at clarifying the chronology of the known sites from the time of the Türkic Qaghanates in the forest-steppe Altai and adjacent territories seems to be very promising. It is of great importance for reconstructing the directions and dynamics of the contacts between the population inhabiting the periphery of nomadic empires and artisanal and trading centers. Thus, the almost complete absence of coins of the pre-Tang period from the archaeological sites of the Türks in Inner Asia is a strong indication that such items reached Western Siberia via other ways. Expansion of evidence, as well as comprehensive analysis of the already available data, will make it possible to clarify, at a new level, a number of aspects of the ethnic, political, and economic history of that vast region in the Early Middle Ages.

Acknowledgments

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References

Abdulganeev M.T. 2001
Mogilnik Gorny-10 – pamyatnik drevnetyurkskoy epokhi v severnykh predgoryakh Altaya. In *Prostranstvo kultury v arkheologo-etnograficheskom izmerenii: Zapadnaya Sibir i sopredelniye territorii*. Tomsk: Izd. Tom. Gos. Univ., pp. 128–131.

Abdulganeev M.T., Shamshin A.B. 1990
Avariyniye raskopki u s. Tochilnoye. In *Okhrana i ispolzovaniye arkheologicheskikh pamyatnikov Altaya*. Barnaul: Izd. Alt. Gos. Univ., pp. 99–104.

Basova N.V., Kuznetsov N.A. 2005
Ukrasheniya i amulety iz srednevekovykh kurganov Kuznetskoy kotloviny. In *Problemy istoriko-kulturnogo razvitiya drevnikh i traditsionnykh obshchestv Zapadnoy Sibiri i sopredelnykh territoriy*. Tomsk: Izd. Tom. Gos. Univ., pp. 134–136.

Gavrilova A.A. 1965
Mogilnik Kudyrge kak istochnik po istorii altaiskikh plemen. Moscow, Leningrad: Nauka.

Hartill D. 2005
Cast Chinese Coins: A Historical Catalogue. Victoria: Trafford Publishing.

Jen D. 2000
Chinese Cash Identification and Price Guide. Iola: Krause Publications.

Ilyushin A.M. 2010
Monety v srednevekovykh drevnostyakh Kuznetskoy kotloviny. *Vestnik Kuzbassskogo gosudarstvennogo tekhnicheskogo universiteta*, No. 4: 185–188.

Kazakov A.A. 2014
Odintsovskaya kultura Barnaulsko-Biyskogo Priobya. Barnaul: Izd. Barnaul. Yurid. Inst. MVD Rossii.

Kuznetsov N.A. 2006
Monety iz pamyatnikov verkhneobskoy kultury. In *Tyurkologicheskiy sbornik*. Moscow: Vost. lit., pp. 212–222.

Masumoto T. 2001
Kitaiskiye monety iz srednevekovykh pogrebeniy Zapadnoy Sibiri. In *Prostranstvo kultury v arkheologo-etnograficheskom izmerenii: Zapadnaya Sibir i sopredelniye territorii*. Tomsk: Izd. Tom. Gos. Univ., pp. 49–52.

Materialy po ekonomicheskoy istorii Kitaya v ranneye Srednevekovye (razdely "Shi kho chzhi" iz dinastiynykh istoriy). 1980
Moscow: Nauka.

Mogilnikov V.A. 2002
Kochevniki severo-zapadnykh predgoriy Altaya v IX–XI vekakh. Moscow: Nauka.

Niú Qúnshēng. 2001
Liú Xuán Gēngshǐ wǔ-zhū qián. *Qiánbì bólǎn*, No. 4: 26–27. (In Chinese).

Peng Xinwei. 1994
A Monetary History of China (Zhongguo Huobi Shi), E.H. Kaplan (trans.). Bellingham: Western Washington University. (East Asian Research Aids and Translations; vol. 5).

Savinov D.G. 1998
Srostkinskiy mogilnik (raskopki M.N. Komarovoy v 1925 g. i S.M. Sergeeva v 1930 g.). In *Drevnosti Altaya*, iss. 3. Gorno-Altaysk: Gorno-Alt. Gos. Univ., pp. 175–190.

Seregin N.N., Abdulganeev M.T., Stepanova N.F. 2019
Pogrebeniye s dvumya loshadmi epokhi tyurkskikh kaganatov iz nekropolya Gorniy-10 (Severniy Altai). *Teoriya i praktika arkheologicheskikh issledovaniy*, No. 2: 15–34.

Seregin N.N., Stepanova N.F. 2020
Rogovoye stremya iz nekropolya epokhi tyurkskikh kaganatov Gorniy-10 (Severniy Altai). In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XXVI. Novosibirsk: Izd. IAET SO RAN, pp. 603–610.

Seregin N.N., Stepanova N.F. 2021
"Elitnoye" detskoye pogrebeniye epokhi tyurkskikh kaganatov iz Severnogo Altaya. *Stratum Plus*, No. 5: 335–344.

Seregin N.N., Tishin V.V., Stepanova N.F. 2021
Hephthalite coin from an Early Medieval burial at Gorny-10. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 49 (4): 100–108.

Serov V.V. 1999
Nakhodka drevnikh kitaiskikh monet na Altaye. In *Sedmaya Vserossiyskaya numizmaticheskaya konferentsiya, Yaroslavl, 19–23 aprelya 1999 g.: Tezisy dokl. i soobshch*. Moscow: pp. 47–48.

Thierry F. 1988
Wuzhu des Sui ou *wuzhu* des Wei? *Bulletin de la Société française de numismatique*, No. 4: 349–351.

Thierry F. 1989
La chronologie des *wuzhu*, étude, analyse et propositions. *Revue numismatique*, 6e sér., vol. 31: 223–247.

Thierry F. 1991a
La politique monétaire des Zhou du Nord (557–581): Génèse idéologique et nécessités financières. *Revue belge de numismatique*, vol. 137: 127–140.

Thierry F. 1991b
Typologie et chronologie des *kai yuan tong bao* des Tang. *Revue numismatique*, 6e sér., vol. 33: 209–249.

Tishkin A.A., Gorbunov V.V., Serov V.V. 2020
Kitaiskiye monety iz Biyskogo krayevedcheskogo muzeya: Istoriya izucheniya, rentgenoflyuorestsentniy analiz i datirovka. *Teoriya i praktika arkheologicheskikh issledovaniy*, No. 4: 189–197.

Tishkin A.A., Seregin N.N. 2013
Kitaiskiye izdeliya iz arkheologicheskikh pamyatnikov rannesrednevekovykh tyurok Tsentralnoy Azii. *Teoriya i praktika arkheologicheskikh issledovaniy*, No. 1: 49–72.

Troitskaya T.N., Novikov A.V. 1998
Verkhneobskaya kultura v Novosibirskom Priobye. Novosibirsk: Izd. IAET SO RAN.

Wáng Tàichū. 1998
Yǒng-píng wǔ-zhū kǎo-biàn. *Shǎnxī jīnróng*, No. 9: 62–63. (In Chinese).

Zaitseva O.V., Kuznetsov N.A., Belikova O.B., Vodyasov E.V. 2016
Zabytiye kompleksy i kitaiskiye monety Timiryazevskogo-1 kurgannogo mogilnika. *Sibirskiye istoricheskiye issledovaniya*, No. 4: 281–301.

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The State of Preservation of the Shakhty Rock Art Site and the Prospects of Its Conservation

This article deals with the preservation of the Shakhty rock art site, discovered in the Eastern Pamirs in 1958 by the leading Central Asian Stone Age researcher V.A. Ranov. The analysis of photographs taken in the Shakhty rock shelter during the 2019 survey revealed the nature of destructive processes at the site due to environmental conditions of the Eastern Pamir highland. The article integrates the results of analysis of Ranov's archives at the Donish Institute of History, Archaeology and Ethnography of the National Academy of Sciences, Republic of Tajikistan. Thanks to Ranov's diaries and photographs, it was possible in 2019 to assess the degree of erosion on the rock surface, and the loss of fragments of painted images over more than 60 years. Emergency areas requiring conservation efforts were identified. Principles of conservation and restoration of rock art are outlined, and an overview of techniques developed for sites of this type in the post-Soviet space in the last quarter of the 20th century is presented. State of the art conservation methods for rock art, which, in the future, can be applied for the preservation of emergency areas at Shakhty, are described. A set of measures is suggested to preserve this site.

Keywords: *Eastern Pamirs, rock art, paintings, Shakhty rock shelter, conservation of rock art sites.*

Introduction

The Shakhty rock shelter is located 40 km southwest of the village of Murgab in the Gorno-Badakhshan Autonomous Region. Here, in 1958, the archaeological group of the Pamir expedition of the Academy of Sciences of the USSR, under the leadership of V.A. Ranov, discovered ancient rock paintings. Ranov attributed this site to the Mesolithic–Early Neolithic period, based on the Mesolithic materials of excavations in the rock shelter, as well as on the images (of boars, bears) depicted on the wall, which were atypical of the high mountain regions of the Pamirs, and the archaic style of their execution (1961). Unfortunately, the finds of the Mesolithic period revealed in the rock shelter cannot be considered direct evidence of the age of the drawings on its walls (Ibid.: 81). There are no data about the habitation of wild boars and bears in the territory of the Eastern Pamirs in the Mesolithic period. Ranov has not found any analogs of the Shakhty rock paintings among the rock art sites in Tajikistan

and adjacent territories, and the remote analogs he cited revealed more differences than similarities, as the scholar himself pointed out (2016: 52–54). In addition, studies of the recent years, including those of Istyk Cave, showed that the process of peopling the high-mountainous regions of the Pamirs began at the end of the Pleistocene, and not in the Early Holocene, as was previously thought. Thus, in the light of recent finds (Shnaider et al., 2019), the earliest date of the drawings in the Shakhty rock shelter may turn out to be even older than previously thought, while the most recent one can be attributed to the Bronze Age (Zotkina, Abolonkova, Alisher kyzy, Sayfulloev, 2022). The discovery of new rock art sites in the Eastern Pamirs indicates the prospects for exploring this territory (Zotkina, Bobomulloev, Solodeinikov et al., 2022). Perhaps, it is the new finds that will be able to shed light on the dating of the drawings in the Shakhty rock shelter. However, clarifying the age of ancient painting certainly requires an integrated approach. It is also important to pay attention to the state of preservation of the rocky surface. Notably, the climatic conditions of the highlands have a special effect on the preservation of archaeological material (Ranov, 1975; Shnaider et al., 2019, 2020). We assume that despite the natural destructive processes that affect the rocks in high-mountain areas, ancient painting is preserved here much better than on the rock art sites in other environmental zones. The "fresh" look of the paint in the Shakhty rock shelter may be due not to the possible renewal or the young age of the images, but to the degree of their preservation in the specific conditions of the highlands. However, this assumption requires a separate study, including one based on monitoring of the state of rock art sites in the region. This work is aimed at partially filling this gap, as well as at developing recommendations on the use of existing stone conservation methods for preservation of ancient painting.

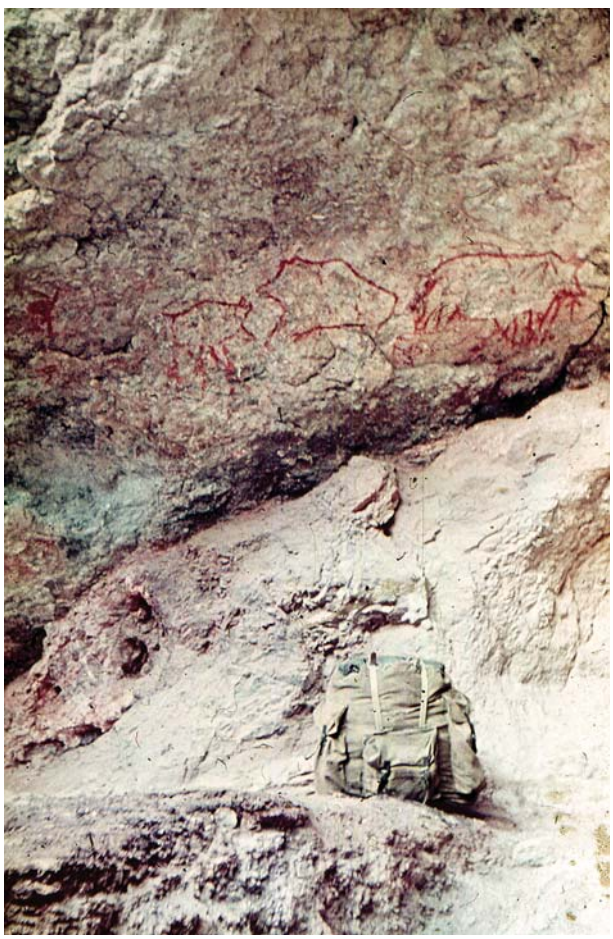

Fig. 1. View of the rock surface with paintings. *Photo by V.A. Ranov, 1958* (slide from the funds of the IIAE NAN RT).

Materials and methods

In the funds of the Donish Institute of History, Archaeology and Ethnography, National Academy of Sciences of the Republic of Tajikistan (IIAE NAN RT), archives of Ranov are kept, including extensive sources, among which are the diaries describing the drawings and the process of excavations in the Shakhty rock shelter, and slides. On the basis of these materials, as well as photographs taken in 2019, and the results of their color filtering (Zotkina, Bobomulloev, Solodeinikov et al., 2022: Fig. 2, *3 a–d;* Zotkina, Abolonkova, Alisher kyzy, Sayfulloev, 2022: Fig. 2), it was possible to determine the degree of intensity of destructive processes that have occurred over the past 60 years, and to draw a conclusion about the prospects for preserving the drawings using modern methods for the conservation of rock art sites and other stone objects.

The Shakhty rock shelter is located in the valley of the Kurteke-sai River, at an altitude of ca 4200 m a.s.l. It is composed of a huge massif of limestone, is open to the east, and is oriented almost strictly to the cardinal points. It is dry, light, well lit by the sun. The width of the entrance is 7.5 m, the shelter goes 6 m deep, the roof height is at least 25–30 m. The drawings are located on the southern wall (Fig. 1). It is inclined by about 45–50° and is composed of reddish-yellow limestones. The images are at a height of 1.6–2.0 m from the floor level, applied with red ocher paint, which has two tones: light-brick and darker burgundy. According to Ranov, the material for paint could have been powdered deposits of ferruginous compounds in the cracks of the cave wall. Judging by the thickness of the lines, the drawings could have been applied with a finger (Ranov, 1958: 27–29, 35). The scholar identified seven figures here, of which only four have been well preserved. Among the interpretable images, he singled out the figures of a wild boar and a bear (or two wild boars), a large animal,

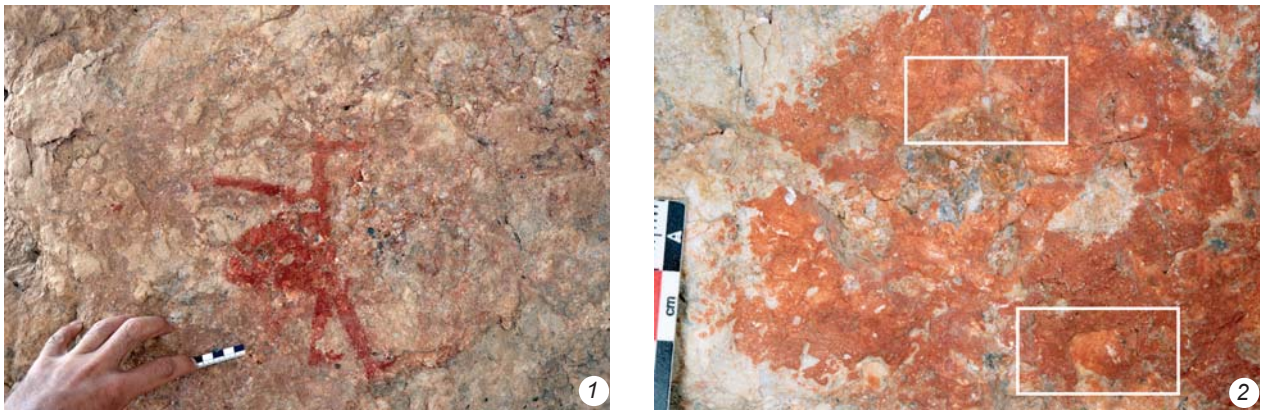

Fig. 2. Photograph of an ornithomorphic figure. *Photo by L.V. Zotkina, 2019* (after (Zotkina, Abolonkova, Alisher kyzy, Sayfulloev, 2022: Fig. 2)).
1 – general view; *2* – area with paint applied to the rocky surface with traces of desquamation.

possibly representative of the bovid family (Bovinae), and an anthropomorphic character, disguised, according to the scientist, as a bird (Ranov, 1961: 71). Surveys of the recent years, using modern methods for detecting poorly distinguishable colored images, indicate the presence here of other images that are traced in half-erased lines (Zotkina, Abolonkova, Solodeynikov et al., 2020). Such preservation is explained by the intensity of scaly exfoliation of the rock—desquamation of limestone due to severe temperature changes, which is typical for the highland regions of the Pamirs. Ranov pointed out the loss of the rocky surface, including the surface with remnants of the pigment: "The wall of the shelter, on which the drawings were applied, is very uneven, rough and, as always in limestone, laminated; individual rough spots protrude above the surface of the rock by 7.5, 3, and 2 cm. There are almost no smooth surfaces" (1958: 29–30). According to the scholar, once, the entire plane of the wall, starting almost from the entrance of the shelter and ending with the narrowest point along the southern wall, was decorated with drawings. This is evidenced by numerous spots of paint, sometimes individual lines or the remains of figures, which are no longer decipherable. Ranov noted that destructive processes continued, as was evidenced by fragments of images with scales fallen out (Ibid.). The results of the 2019 survey also record many losses of the rock surface due to desquamation (Zotkina, Bobomulloev, Solodeinikov et al., 2022: 63). Careful examination of the images reveals areas with paint applied over the previously lost fragments of the surface (Fig. 2). This may indicate, on the one hand, that the process of destruction of the wall with drawings began long before they were created, and, on the other hand, that the images were renewed. The significant traces of the rocky surface loss can also be observed on the painted lines (Fig. 3).

To make decisions related to the conservation work at the site, it is important to understand not only the nature

Fig. 3. Fragment of a zoomorphic image with traces of desquamation over the paint layer (after (Zotkina, Bobomulloev, Solodeinikov et al., 2022: Fig. 2, *3a*), fragment).

of the destruction, but also the intensity of desquamation in the Shakhty rock shelter. Since the rock art sites are located in the open air, we cannot completely eliminate the negative natural impact, and therefore stop the process of the destruction; but with the right approach, it can be significantly slowed down. The first step towards the conservation of the site should be the monitoring of its condition.

The study of the archival materials of Ranov provided insight into the degree of preservation of the wall with drawings in 1958, when they were first discovered. However, the small number of slides of that time and the lack of macro photographs make it impossible to trace the surface desquamation in detail. Nevertheless, a comparative analysis of the images taken in 1958 and 2019 gave some results. When comparing photographs, we used the pigment mapping method (Solodeynikov, 2010) and the DStretch plugin (Harman, 2015).

General principles of conservation and restoration of rock art sites

In recent years, the preservation of rock art sites has increasingly become one of the most important topics (Devlet, 2002; Miklashevich, 2002, 2011; Rogozhinsky, 2004; and others). Researchers often report the destructive processes, paying particular attention to the evidence of vandalism. On the territory of the former USSR, rock art sites became the subject of interest of art restorers only in the last quarter of the 20th century. Their activities are based on proven methods of conservation of stone objects located in the open air. Domestic specialists from the State Research Institute of Restoration (GosNIIR) adapted them to rock massifs with ancient drawings and tested them at Siberian rock art sites. Since 1987, work has been carried out at the sites of the upper Lena basin (Shishkino, Talma, Vorobyevo); in 1992–1999, on the coast of Lake Baikal and its environs (Sagan-Zaba, Orso, Aya, Elgazur, Sakhyurte, Sarma); in 2002–2008, at the Tom, Potroshilovo, and Sulek rock art sites (Ageeva et al., 1993, 1995; Bednarik, Devlet, 1993; Ageeva, Devlet, Rebrikova, 1996; Ageeva, Rebrikova, Kochanovich, 2004; Ageeva, Kochanovich, 2011; and others). We present a brief overview of the experience accumulated to date.

Documentation. When carrying out restoration work on a site, it is of great importance to record objects before, during, and after performing any manipulations. To date, on the basis of the available experience, both restorers and archaeologists have already created some documentation (Rogozhinsky, Khorosh, Charlina, 2004: Pl. 1), including a technology of trace-drawing of the surfaces with images for recording various types of damages (Miklashevich, 2011).

Preventive conservation. The activities of restorers at rock art sites are based on the principles of minimal intervention and reversibility. Therefore, preventive conservation is especially important, implying the maintenance of the natural state of the state. It includes the construction of canopies and overhangs, the installation of drains and drip lines that protect surfaces from water, as well as limiting the accessibility of the site to people and animals by changing the relief, regulating vegetation, limiting traffic, installing fences, gratings, and decking (Davlet, 2002: 104).

Direct methods of conservation. Among them, noteworthy are the structural strengthening of stone; surface treatment that slows down the disintegration of the painting pigment; building up lost fragments or fixing rock crusts; biocidal treatment to protect against damage caused by bacteria, algae, lichens, etc. (Ibid.).

Restoration. Speaking about the restoration of rock art sites, we mean the restoration of the integrity of stones by gluing them together using different adhesive compounds that vary depending on the specific object. At the Tamgaly site, specialists from Kazakhstan carried out a large scope of work on gluing stone fragments with petroglyphs (Charlina et al., 2004).

Thus, today, there are a number of methods aimed at preserving samples of rock art, which are successfully tested on various sites.

Results

The main object of analysis were the photographs of individual images taken in 1958 (Fig. 4). When

Fig. 4. Photographs of images in the Shakhty rock shelter. *Photo by V.A. Ranov, 1958* (slides from the funds of the IIAE NAN RT).

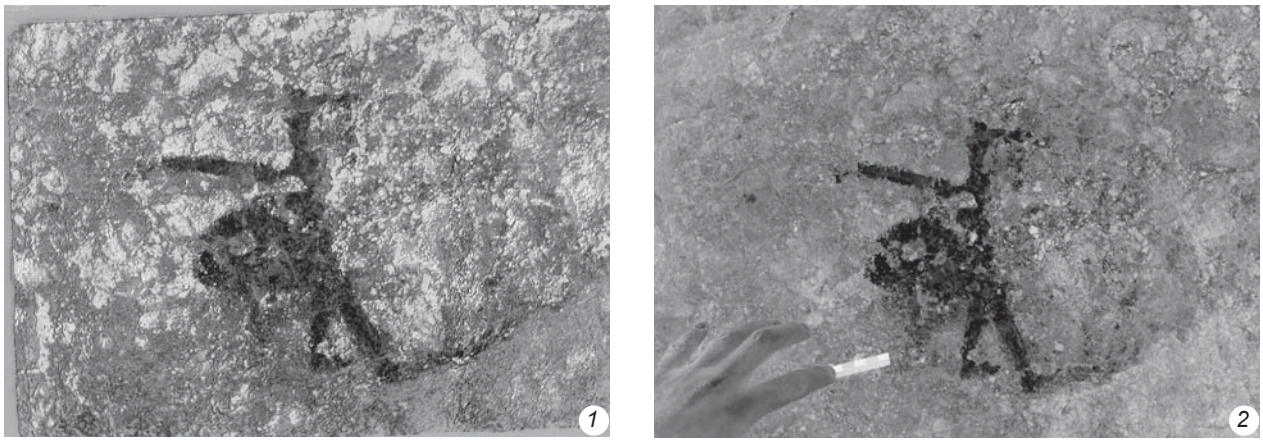

Fig. 5. Pigment maps of the photographs of the ornithomorphic image.
1 – slide by V.A. Ranov, 1958; *2* – photo by L.V. Zotkina, 2019

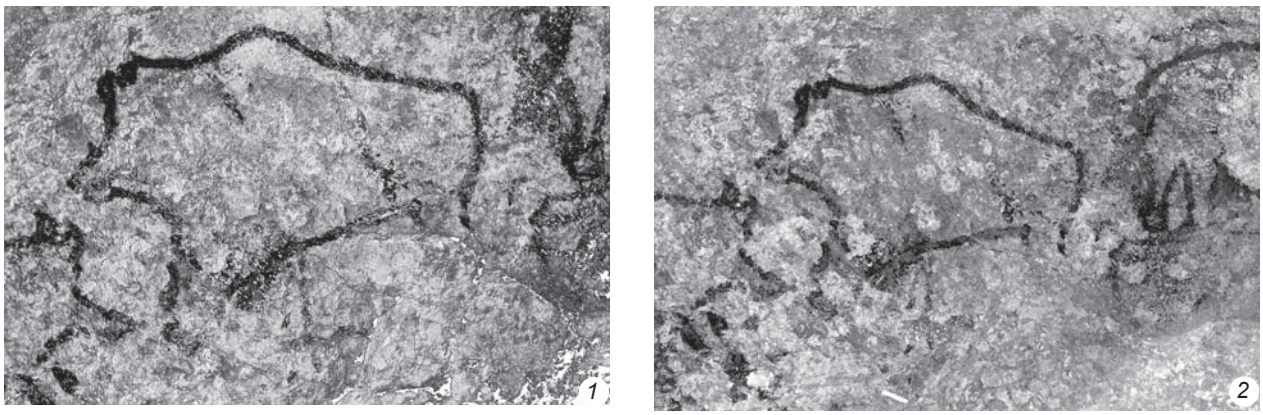

Fig. 6. Pigment maps of the photographs of the zoomorphic image.
1 – slide by V.A. Ranov, 1958; *2* – photo by L.V. Zotkina, 2019

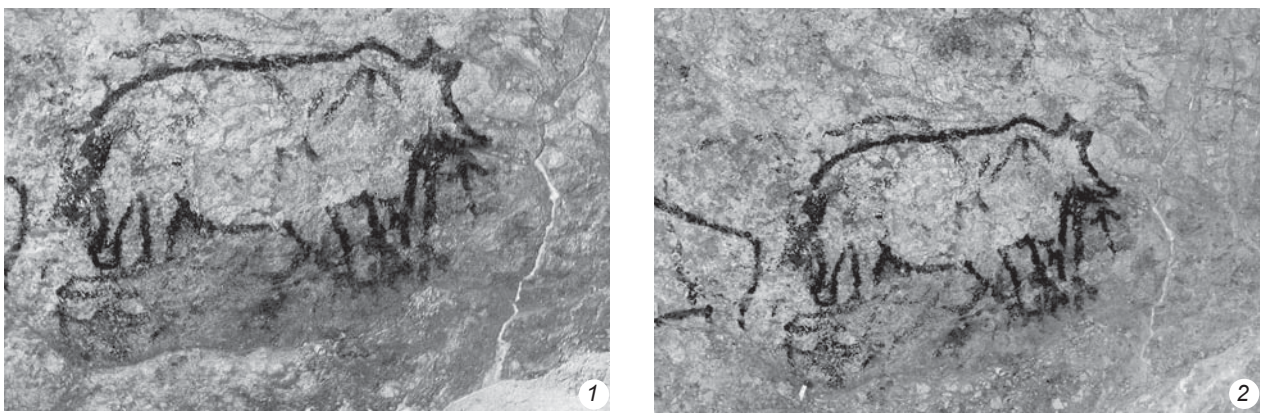

Fig. 7. Pigment maps of the photographs of the zoomorphic image.
1 – slide by V.A. Ranov, 1958; *2* – photo by L.V. Zotkina, 2019

comparing photos of ornithomorphic (Fig. 5) and zoomorphic (Fig. 6) figures of 1958 and 2019, as well as the results of their color filtering, we did not find any losses that could have occurred over the past 60 years. However, owing to the lack of more detailed photographs of 1958, we do not exclude the possibility of destructive changes at the microlevel, which are difficult to identify. The materials available today

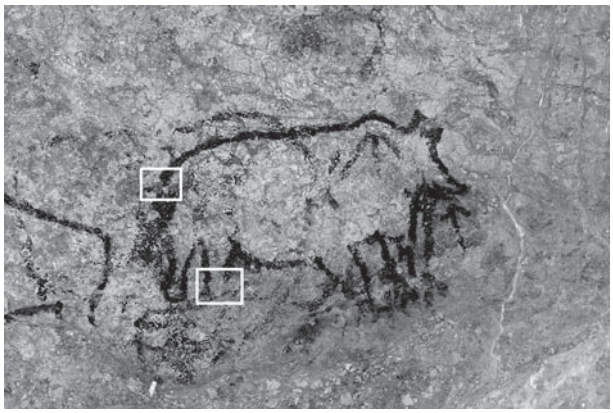

Fig. 8. Pigment map of the photograph of 2019: areas with traces of paint loss that occurred between 1958 and 2019.

show the slight loss of the rock surface with paint layer on another animal image (Fig. 7, 8). Obviously, this section of the rock surface requires conservation to slow down the destruction process.

Discussion

The damaged section of the plane with paint can be reinforced using the direct methods of conservation only. Depending on the features of the rock crust subject to destruction, effective methods can include structural strengthening of the rock and flanging. Structural strengthening of the rock is used in cases when the inter-crystalline bonds of the rock are breaking down. Another form of destruction is longitudinal delamination, when layers of different hardness alternate in the stone. Destructive processes of this type are among the most dangerous. Structural strengthening of the rock is carried out in two ways: by steeping, when a special solution is repeatedly applied using a flat brush; and by injection, i.e. the introduction of a stone hardener directly into the cracks. After these procedures, the strength of the stone structure is checked. The final result can be judged after a month of exposure under natural conditions (Shchigorets, Vlasov, 2018: 47). As materials for strengthening, some experts recommend the use of helium ethers of silicic acid, for example, stone strengtheners from Remmers. They easily penetrate into the depths of the stone, where they turn into a gel-like substance (Ibid.). However, the most promising today, in our opinion, are preparations of the CaLoSiL series of the German company IBZ-Salzchemie GmbH & Co.KG, which contain calcium hydroxide $Ca(OH)_2$ nanoparticles suspended in various alcohols (ethanol, propanol, isopropanol). The average particle size is 150 nm. These preparations act like consolidators and have been successfully tested in a number of European countries in the works with fresco painting (Daehne, Herm, 2013; Giorgi, Dei, Baglioni, 2000; Ambrosi et al., 2001). A significant disadvantage of the use of the structural strengthening of stone surfaces is irreversibility. It is for this reason that works of this kind are carried out extremely rarely, with preliminary testing of the compositions on experimental sites.

In some cases, associated with a significant delamination of the rock crust from the massif, it is possible to use the reversible flanging method developed by the specialists from GosNIIR. It consists in fixing such a crust with a finishing mixture along the edge, without filling the voids formed under it. This technique practically does not affect the moisture- and vapor-exchange between the atmosphere and the inner layers of the rock (Ageeva, Rebrikova, Kochanovich, 2004). The composition of the restoration material varies depending on the type of stone, and it is based on polymeric organosilicon binders (MSN-7, K-15/3, KO-08) (Ageeva, 2003: 54–61).

Conclusions

The limestones of the Eastern Pamirs, owing to environmental features, are subject to the process of scaly flaking of the stone surface; in some cases, desquamation affects larger fragments of the rock crust. However, comparing the obtained results with the destruction at other rock art sites, which took place even over a shorter period, for example, at the Tom Pisanitsa (Miklashevich, 2011), we observed a low intensity of destructive processes on the rock surfaces of the Shakhty rock shelter that occurred from 1958 to 2019.

Taking into account the fundamental principles and experience of conservation and restoration works carried out at other rock art sites, there is a need in a set of measures to preserve the ancient paintings of the Shakhty rock shelter. Further activities should be based on the long-term observations of the object, photographing of the images, including with the use of macro lenses. Particular attention should be paid to areas with signs of destruction and to those that show negative dynamics, judging by photographic materials from 1958 and 2019. Recording of losses and any changes at the site requires the development of a standardized description and making trace-drawings. Identification of an emergency area calls for conservation works based on the methods of structural strengthening of stone and flanging (in case of detachment of large fragments of the rock crust). As a reinforcing material, nanolime (preparations of the CaLoSiL series) seems to be the most promising. At the same time, the structural strengthening method should first be experimentally tested in the area that does not contain images, using alternative materials, such as

Remmers stone strengtheners. Follow-up observations over several years will indicate the prospects for the use of a particular material. Only after that is it recommended to apply consolidating compositions on surfaces with ancient paint. Owing to the exposure of the rock paintings to the natural environment, it is impossible to completely solve the problem of preserving painted images; however, slowing down the processes of destruction by conservation and restoration methods is still possible.

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References

Ageeva E.N. 2003
Konservatsiya i restavratsiya skulptury iz kamnya: Ucheb. pos., S.P. Maslenitsyna (ed.). Moscow: Ros. Gos. Gumanit. Univ.

Ageeva E.N., Antonova E.I., Rebrikova N.L., Sizov B.T. 1993
Shishkinskiye pisanitsy: Rezultaty obsledovaniya i predlozheniya po restavratsii. In *Sovremenniye problemy izucheniya petroglifov*. Kemerovo: Kem. Gos. Univ., pp. 186–189.

Ageeva E.N., Devlet E.G., Rebrikova N.L. 1996
Rezultaty obsledovaniya, perspektivy sokhraneniya i ispolzovaniya pamyatnikov naskalnogo iskusstva ozera Baikal. In *Arkheologicheskoye naslediye Baikalskoy Sibiri*, iss. 1. Irkutsk: Tsentr po sokhraneniyu ist.-kult. naslediya, pp. 111–115.

Ageeva E.N., Devlet E.G., Rebrikova N.L., Sklyarevsky M.Y. 1995
Sostoyaniye pamyatnika naskalnogo iskusstva Sagan-Zaba i perspektivy yego sokhraneniya i ispolzovaniya. In *Naskalnoye iskusstvo Azii*, iss. 1. Kemerovo: Kuzbassvuzizdat, pp. 29–30.

Ageeva E.N., Kochanovich A.V. 2011
Preventivnaya konservatsiya na pamyatnike naskalnogo iskusstva Tomskaya pisanitsa. In *Naskalnoye iskusstvo v sovremennom obshchestve (k 290-letiyu nauchnogo otkrytiya Tomskoy pisanitsy): Materialy Mezhdunar. nauch. konf*., vol. 1. Kemerovo: Kuzbassvuzizdat, pp. 172–175.

Ageeva E.N., Rebrikova N.L., Kochanovich A.V. 2004
Opyt konservatsii pamyatnikov naskalnogo iskusstva Sibiri. In *Pamyatniki naskalnogo iskusstva Tsentralnoy Azii: Obshchestvennoye uchastiye, menedzhment, konservatsiya, dokumentatsiya*. Almaty: Iskander, pp. 116–120.

Ambrosi M., Dei L., Giorgi R., Neto C., Baglioni P. 2001
Colloidal particles of $Ca(OH)_2$: Properties and application to restoration of frescoes. *Lanmuir*, vol. 17: 4251–4255.

Bednarik R., Devlet E.G. 1993
Konservatsiya pamyatnikov naskalnogo iskusstva Verkhney Leny. In *Pamyatniki naskalnogo iskusstva*. Moscow: IEA RAN, pp. 7–24.

Charlina L.F., Yatsenko E.L., Rogozhinsky A.E., Isakov K.T. 2004
Konservatsiya petroglifov v Kazakhstane. In *Pamyatniki naskalnogo iskusstva Tsentralnoy Azii: Obshchestvennoye uchastiye, menedzhment, konservatsiya, dokumentatsiya*. Almaty: Iskander, pp. 128–133.

Daehne A., Herm C. 2013
Calcium hydroxide nanosols for the consolidation of porous building materials – results from EU-STONECORE. *Heritage Science*, vol. 1. URL: https://doi.org/10.1186/2050-7445-1-11

Devlet E.G. 2002
Pamyatniki naskalnogo iskusstva: Izucheniye, sokhraneniye, ispolzovaniye. Moscow: Nauch. mir.

Giorgi R., Dei L., Baglioni P. 2000
A new method for consolidation wall paintings based on dispersions of lime in alcohol. *Studies in Conservation*, vol. 45 (3): 154–161.

Harman J. 2015
Using DStretch for rock art recording. *International Newsletter on Rock Art*, No. 72: 24–30.

Miklashevich E.A. 2002
O proyekte SAIPI po sokhraneniyu, konservatsii i muzeyefikatsii pamyatnikov naskalnogo iskusstva. *Vestnik Sibirksoi assotsiatsii issledovateley pervobytnogo iskusstva*, iss. 5: 7–11.

Miklashevich E.A. 2011
Dokumentirovaniye povrezhdeniy petroglifov Tomskoy pisanitsy. In *Naskalnoye iskusstvo v sovremennom obshchestve (k 290-letiyu nauchnogo otkrytiya Tomskoy pisanitsy): Materialy Mezhdunar. nauch. konf*., vol. 1. Kemerovo: Kuzbassvuzizdat, pp. 128–138.

Ranov V.A. 1958
Otchet o rabotakh Pamirskogo otryada v 1958 g. v grote Shakhty. In *Fondy Instituta Istorii, arkheologii i etnografii im. A. Donisha Natsionalnoy akademii nauk Respubliki Tadzhikistan*.

Ranov V.A. 1961
Risunki kamennogo veka v grote Shakhty. *Sovetskaya arkheologiya*, No. 6: 70–81.

Ranov V.A. 1975
Pamir i problema zaseleniya vysokogornnoy Azii chelovekom kamennogo veka. In *Strany i narody Vostoka*, iss. XVI: Pamir. Moscow: Nauka, pp. 137–167.

Ranov V.A. 2016
Begushchiye po skalam: Naskalniye risunki Pamira. Dushanbe: Donish.

Rogozhinsky A.E. 2004
Regionalniy uchebniy seminar “Pamyatniki naskalnogo iskusstva Tsentralnoy Azii: Obshchestvennoye uchastiye, menedzhment, dokumentatsiya i konservatsiya”. In *Pamyatniki naskalnogo iskusstva Tsentralnoy Azii: Obshchestvennoye uchastiye, menedzhment, konservatsiya, dokumentatsiya*. Almaty: Iskander, pp. 6–7.

Rogozhinsky A.E., Khorosh E.K., Charlina L.F. 2004
O standarte dokumentatsii pamyatnikov naskalnogo iskusstva Tsentralnoy Azii. In *Pamyatniki naskalnogo iskusstva Tsentralnoy Azii: Obshchestvennoye uchastiye, menedzhment, konservatsiya, dokumentatsiya*. Almaty: Iskander, pp. 156–161.

Shchigorets S.B., Vlasov D.Y. 2018
Osnovy prakticheskoy konservatsii pamyatnikov iz kamnya: Ucheb. pos. St. Petersburg: Izd. VVM.

Shnaider S.V., Kolobova K.A., Filimonova T.G., Taylor W., Krivoshapkin A.I. 2020
New insights into the Epipaleolithic of western Central Asia: The Tutkaulian complex. *Quaternary International*, vol. 535: 139–154. URL: https://doi.org/10.1016/j.quaint.2018.10.001

Shnaider S.V., Sayfulloev N.N., Alisher kyzy S., Rudaya N.A., Dedov I.E., Zotkina L.V., Zhukov V.A., Karaev A., Navruzbekov M., Alekseitseva V.V., Krivoshapkin A.I. 2019
Perviye danniye izucheniya mnogosloinogo pamyatnika Istykskaya peshchera (Vostochniy Pamir, Tadzhikistan). In *Problemy arkheologii, etnografii i antropologii Sibiri i sopredelnykh territoriy*, vol. XXV. Novosibirsk: Izd. IAET SO RAN, pp. 293–298.

Solodeinikov A.K. 2010
O metodike fiksatsii naskalnykh izobrazheniy v peshchere Shulgan-Tash (Kapovoy). In *Kulturnoye naslediye Yuzhnogo Urala kak innovatsionniy resurs*. Ufa: Inst. instorii, yazyka i literatury Ufim. nauch. tsentra RAN, pp. 70–85.

Zotkina L.V., Abolonkova I.V., Alisher kyzy S., Sayfulloev N.N. 2022
Naskalnoye iskusstvo Vostochnogo Pamira: Analogii i kontseptsii o vozraste risunkov. *Stratum Plus*. (In press).

Zotkina L.V., Abolonkova I.V., Solodeinikov A.K., Sayfulloev N.N., Shnaider S.V. 2020
Naskalnaya zhivopis grota Shakhty (Vostochniy Pamir): Noviye danniye i perspektivy issledovaniya. In *Trudy VI (XXII) Vserossiyskogo arkheologicheskogo syezda v Samare*, vol. III. Samara: Samar. Gos. Sots.-Ped. Univ., pp. 80–82.

Zotkina L.V., Bobomulloev B.S., Solodeinikov A.K., Abolonkova I.V., Shnaider S.V., Sayfulloev N.N. 2022
Noviye danniye o naskalnom iskusstve Vostochnogo Pamira. *Vestnik Novosibirskogo gosudarstvennogo universiteta*. Ser.: Istoriya, filologiya, vol. 21 (3): 60–72.

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South Russian Settlers of Western Siberia in the Late 19th to Early 20th Centuries, Based on Archival Documents and Field Studies

In cultural terms, as compared to many other Russian groups, the South Russian (Kursk) settlers of Siberia in the late 19th to early 20th centuries were a distinct group, having their own traditional culture but usually no compact settlements. In this work, for the first time, on the basis of the State Archive of the Kursk Region, the ethno-cultural composition of Siberian settlers from that region is examined. Attitudes of South Russian peasants of the post-Reform era to migration are analyzed, reasons underlying their "wanderlust" and their reflection about relocation and ethnic identity are explored. Documents at the State Archive of the Tomsk Region, and the findings of my field studies in 2014–2018 pertaining to the Siberian stage in the history of Russian "Yuzhaks" (Southerners) suggest that their priority was to live side by side with Ukrainian settlers, as they had used to do in their homeland. The reason is that the key role in the early 20th century migrations was played by Russian-Ukrainian frontiersmen—people of "no man's land". At the time of migration to Siberia, those living in the southern Kursk Governorate were Russian Old Believers, Southern Russians, Belarusians, Ukrainians (Little Russians), Russian Cossacks, and "Cherkassians" (Ukrainian Cossacks). The latter preferred to live apart from others, even within a single village. Archival documents and findings of field studies in the Anzhero-Sudzhensky District of the Kemerovo Region, and in the Topchikhinsky and Kulundinsky Districts of the Altai Territory demonstrate that Southern Russians were situationally identical to Ukrainians, as evidenced, for instance, by the frequent shift of surname endings from "-ko" and "-k" to "-ov" and vice versa, depending on migration plans. A conclusion is made that the ethnic diversity of migrants from the Kursk Governorate, the situational equivalence of Eastern Slavic groups in Siberia, as well as marriages with Russian old residents and Ukrainians, were key factors in the formation of local Siberian variants of the South Russian culture.

Keywords: *South Russian settlers, Kursk Governorate, Russian-Ukrainian frontier, factors of migration, Western Siberia, situational identity.*

Introduction

It is quite obvious that only the study of the history of the ethnic/ethno-cultural community of people in time and space makes it possible to come to a conclusion about the stability or, conversely, the instability of its differential features. Mass migrations of South Russian peasants, based on a comparison of materials deposited in the archives in the places of exit and settlement, have hardly been studied. Siberian peasants—migrants from the southern Russian-Ukrainian border provinces, as well as their descendants—have not yet been the objects of special ethnographic research. Perhaps this is due to the fact that the "Yuzhaks" or, as they were called in Siberia,

"Khakhly" culturally occupied an intermediate position between Russians and Ukrainians.

Migration to Siberia was a consequence of the Great Reform of February 19, 1861; it became an exceptional global example of mass movement of the population within the state (Popov, 1911: 249). The construction of the Siberian railway was a turning point in the resettlement business: from 1895, the resettlement began to grow rapidly and culminated in 1908 (Ibid.: 255). How did such a large-scale dispersion of the Russian people within the boundaries of their state (the Russian Empire) affect their ethnic identity, what were the directions of its transformation? We venture to suggest that the resettlement was one of the factors not only for the repopulation of the "Great Outskirts", but also for the actualization of the ethnic identity of the settlers, the emergence of its new forms in the everyday life of the rural population of this period.

The source base of this article has been made up of legal and regulatory documents of various origins, as well as records management materials of governorate (Kursk and Tomsk) institutions. The archival materials identified by this author make it possible to reveal the obvious and hidden reasons for the move, the structure of migrating families, the reflection of Russian/Ukrainian identity in the unstable situation of mass migrations to Siberia, as well as the relationship of the rural population with the official authorities in the territories of exit and in places of arrival. During the research, we used the materials of archives located both in the Asian and European parts of Russia—the places of exodus of the southern Russians. In the State Archive of the Kursk Region (GAKO), 43 cases were worked out; in the State Archive of the Tomsk Region (GATO), there were 40; in the State Archive of Anzhero-Sudzhensk, Kemerovo Region, there were 51 cases. Local history literature was used, including pre-revolutionary publications, from the collections of scientific libraries in the cities of Kursk, Stary Oskol, and Sudzha, Kursk Region.

The methodological basis of this study was formed by historical-ethnographic and historical-situational approaches. Content analysis of texts from archival sources was used as an analytical method. We are of the opinion that the study of the nature and motives of colonization movements allows us to take a fresh look at the nature of ethnocultural formations and the mechanisms of interethnic relations. In this regard, it seems important that Russian culture is characterized by the principle of a complementarity of cultures—mobility and rootedness, i.e. such a combination that fosters in a person both love for a "little homeland" and at the same time free identification, i.e. does not contradict spatial mobility (Krylov, 2009: 276).

When working with materials related to South Russian settlers, it is important to take into account that this population was not homogeneous in ethnocultural terms. In different historical periods, the southern steppes were settled by Russian and non-Russian migrants from Northeastern Russia, the Polish-Lithuanian Commonwealth, etc. Since ancient times, the southern territories of Russia (former Orel, Voronezh, Kursk governorates) were the scene of clashes between the Eastern Slavs and nomads (Khazars, Pechenegs, Polovtsy (Cumans), and Tatars) and were known as the "wild field". At the end of the 15th century, the royal clans of Vorotynsky, Odoevsky, Belsky came here, with their entire estates, across the Lithuanian border. Later, the core of the steppe settlers were service people. In the second half of the 16th century, Cossacks came in the service of the Moscow sovereign (Bagalei, 1887: 140). In the 16th–17th centuries, during the struggle of the Moscow State with the raids of nomads, the "wild field" was repopulated, and the ethnographic features of the population took their shape. Among the settlers there were many fugitives, like peasants from the territories of the future Tula, Moscow, Kaluga, Kostroma, Vladimir governorates, as well as villagers fleeing the "Lithuanian ruin" (Chizhikova, 1998: 31, 32). Simultaneously with the free migrations, the governmental repopulation of these lands went on: migrants from Lithuania were sent here for military service (Bagaley, 1887: 369). Ethno-cultural composition of the population of Southern Russia was formed, in addition to service people (*odnodvortsy*), free "walkers", and serfs resettled from other places, also by the residents of villages that survived from the time of the Tatar raids, these villages being located away from Tatar roads, in forest areas, and being therefore not subject to destruction (Ibid.: 201–237). According to the data of the First General Census of Population of 1897, in the Kursk Governorate, Russians made up 77.29 %, and Ukrainians 22.26 % (Chizhikova, 1998: 34).

Let us turn to the analysis of archival data on groups and individual families of the Kursk settlers, whose numbers in the early 20th century surpassed many other "seekers of a better life" in Siberia.

Resettlement from the Kursk Governorate

In the 1860s–1870s, according to the materials of the "Kursk Governorate Board for Peasant Affairs" (GAKO. F. 68, Inv. 1, Vol. 1, fol. 41, 150, 151, etc.; Vol. 2, fol. 40, 76, 168, etc.), migrations from South Russia to Siberia were not popular. At this time, the peasants, including the *odnodvortsy**, most often filed petitions for moving to the nearby Astrakhan, Yekaterinoslav, Orel, Poltava,

**Odnodvortsy*—a social class of paramilitary landowners that lived on the southeastern borders of the Russian State. The right to own land was called "quarter ownership".

Fig. 1. Fair in the city of Sudzha, Kursk Governorate. Postcard (www.filokartist.net).

Stavropol, or Kharkov governorates. In the European part of the country, the problem of land shortage was acute for peasant farms, but the possibility of solving it through the development of Siberian territories was not discussed (GAKO. F. 68, Inv. 1, Vol. 1, fol. 41, 150, 151, 155, 341, etc., Vol. 2, fol. 40, 76, 168, 294, 297, etc.). The list of state-owned peasants of the Timsky District and the villages of Vyazovoe, Chuevo, and Ukolova of the Starooskolsky Uyezd, who expressed in 1861 a desire to move to Western Siberia, has been preserved (GAKO. F. 68, Inv. 1, Vol. 1, fol. 41). There are few materials on the resettlement of temporarily liable peasants*, for example, P.G. Zhidovtsev, P.N. Mozgovoy from Grayvoronsky Uyezd, etc. (GAKO. F. 68, Inv. 1, Vol. 1, fol. 411). There are single references to the exile of peasants to Siberia by the decision of rural societies, for example, A. Paukova, the "house serf" (domestic servant) of the Shchigry landowner P.A. Yudin, was exiled "for bad behavior" (1861–1863) (Ibid.: Fol. 41). Among various kinds of petitions, there are documents about those who wished to return, with the mention of Tobolsk and Yenisei governorates.

A completely different perception is created by archival materials of the 1880s–1890s. There are numerous cases and lists of people who wanted to move to Siberia. By the end of the 1890s, in all cities of the Kursk Governorate—Kursk, Belgorod, Dmitriev, Putivl—and especially in the uyezds, there was an increase in population, both officially Orthodox and Old Believers (Kursky and Belgorodsky uyezds, Korocha, Miropolye, Fatezh, Shchigry, etc.) (O dvizhenii naseleniya…, 1904: 68). It is no coincidence that it was at this time that the issue of scarce land arose: it was not enough not only for family divisions, but also for undivided families (i.e. parents and grown-up children), as evidenced by the numerous cases related to the disputes on this topic (GAKO. F. 68, Inv. 1, D. 8608, 3913).

The move was planned by the peasants of the southern uyezds of the Kursk Governorates—Belgorodsky, Novooskolsky, Sudzhansky, Timsky (Fig. 1). According to the data on the resettlement movement in the governorate for 1899, among those who went to Siberia, residents of the Timsky Uyezd predominated (1165 souls of both sexes (s.b.s.)), and almost all of them moved to the Tomsk Governorate (the number of returnees is negligible). Peasants of Starooskolsky, Putivlsky, and Kursky uyezds also settled mostly in the Tomsk Governorate. In contrast, people from the Sudzhansky Uyezd, who went to the Tomsk Governorate, mainly returned to their places of origin. Those who left Novooskolsky Uyezd (1042 s.b.s.) settled in the Yenisei and Tomsk governorates in approximately equal proportions. Natives of the Rylsky Uyezd preferred the Yenisei region (Ibid.: 78).

State-owned peasants predominated among the applicants for the move. Even though the country was going through the agrarian reform of P.A. Stolypin,

*Temporarily liable peasants—former landlord peasants who received personal freedom, in accordance with the reform of 1861, but did not buy out the land from the landowner.

and pursuing a policy of mass migration of residents of European Russia to Siberia, the permission to move to other regions of the Russian Empire was given by the local authorities not to everyone. In 1887–1889, three out of twelve families that applied to leave the village of Velykaya Rybitsa, Miropolskaya Volost, Sudzhansky Uyezd (hereafter only the volosts of the Sudzhansky Uyezd are indicated), were denied, apparently due to the fact that they had land plots sufficient for the livelihood of families in their homeland (6, 3, and 9 dessiatins, respectively) (GAKO. F. 68. Inv. 2, D. 3672, fol. 7, 25, 78–83). The request of state-owned peasants G.A. Golentovsky, S.A. Golentovsky, S.V. Golentovsky, and A.R. Golentovsky (village of Fanasyevka, Ulankovskaya Volost) was declined (Ibid.: Fol. 113–115). Applications to leave were submitted by fifteen families from the village of Vishneva, Belovskaya Volost, but almost half of them were denied with no explanation (Ibid.: Fol. 19, 66–70).

Documents have been preserved recording a request to move from the state-owned peasants of the village of Sukhodol, Belovskaya Volost (Ibid.: Fol. 116–119). The request of the widower Ivan Egorovich Kostin, who lived in the village of Krivitskiye Budy, Cherno-Oleshanskaya Volost, together with six children, the wives of two older sons, and two grandchildren (a total of eleven people, who had five dessiatins of land) was granted (Ibid.: Fol. 120–121).

From the peasants, including Old Believers, of the settlement of Zapselye, Miropolskaya Volost, a request to leave was filed by the following: V.V. Logvin, I.S. Svetlichny, Y.S. Roenko, S.Y. Shcherbina, I.S. Roenko, F.P. Mikhailichenko, I.G. Marnichenko, P.M. Kamenko, I.A. Pleskachev, V.K. Poddubny, temporarily liable peasant K.P. Galaika (Ibid.: Fol. 20, 21, 71v–74). Out of eleven families, only the family of P.M. Kamenko, with two small children and four dessiatins of land, was denied. Among the peasants who applied in the village of Tolsty-Loug, Daryinskaya Volost, there were probably also Old Believers, if we take into account their names: Luppa Ivanov Pugovkin, Moisey Mikhailov Zherelov, Evstraty Timofeev Lyakhov, Ivan Ivanov Vasilitsky, Pantilimon Pavlov Tkachev, Leonty Savelyev Shesterikov (soldier), Yakov Platonov Novikov, Yakov Alekseev Shesterikov (Ibid.: Fol. 88–91). Out of thirteen requests for relocation, only six were satisfied, including the petition of a soldier and his family, who owned four dessiatins of land.

Former serfs also applied for resettlement, for example, those previously owned by landowner Mikhail Kolminov (village of Vasilyevka, Miropolskaya Volost) (Ibid.: Fol. 75–77). All received positive responses. Among those who wanted to leave their place of residence were the former peasants of the landowner Sergei Dinisov Korogodov from village of Ivanovka-Rubanshchina, Zamostyanskaya Volost (Ibid.: Fol. 26, 63v–64). The former serfs of the landowner Markiza Tertsiya also wished to move: the families of G.G. Surzhenko, Y.Z. Dekhtyareva, I.E. Shevchenkova (village of Knyazhy, Zamostyanskaya Volost) (Ibid.: Fol. 84–85). All were denied with no explanation.

A separate list of former "*house serfs*" from various villages of Ulankovskaya, Rzhavskaya, and Malo Loknyanskaya volosts, Sudzhansky Uyezd, has been preserved, who petitioned for their resettlement to the Tomsk Governorate. The former house serfs of the landowner Lieutenant Ivan Nikolaevich Zelenin also filed the petition (Ibid.: Fol. 24). Their property included, as a rule, a hut with some yard structures, sheep, and sometimes a cow. Former house serfs did not own horses (Ibid.: Fol. 57v–58).

For resettlement to Siberia, it was required not only to submit an application, but also to provide information on arrears, funds received from the sale of the applicants' property, etc. (GAKO. F. 68, Inv. 2, D. 4971, fol. 155). One of the preserved complaints, dated 1871, was filed by a non-commissioned officer, V.F. Grazhdankin, to the Ragozetskaya Volost government, which forbade the resettlement of his relatives, peasants, from Repets, a village in Timsky Uyezd, to the Tomsk Governorate (GAKO. F. 68, Inv. 1, Vol. 1, fol. 297). When making decisions on resettlement, the commission probably took into account the size of the land allotment per capita (family member), although this indicator was not decisive either. The peasants appealed to the Governor of Kursk with a request to give an answer as soon as possible to the resettlement petition filed a year ago to the Tomsk Governorate, "so that we do not live in poverty with our families and are not left without subsistence" (GAKO. F. 68, Inv. 2, D. 3672, fol. 7r–7v).

According to data for 1890, "on arrears, time of their accumulation, and the means of petitioners, attributed to the peasants of the Belgorodsky Uyezd of the Muromskaya Volost (now the Belgorod Region – **the Author**) applying for resettlement to the Tomsk Governorate" (GAKO. F. 68, Inv. 2, D. 4971, fol. 1), there were few arrears—mostly small amounts of zemstvo dues. The money that the petitioners were supposed to receive from the sale of their property ranged from 50–60 to 500–600 rubles.

The archival materials reflect obvious and hidden reasons for the resettlement of the Kursk peasants in distant Siberia, data on the composition of the families of "seekers of happiness", etc. The GAKO stores many appeals to "Mr. Indispensable Member of the Belgorodsky Uyezd Board for Peasant Affairs of the Kursk Governorate" of 1890, from peasants, about "permission to resettle in the Tomsk Governorate and legal assistance" (Ibid.: Fol. 3–26). For example, the Maslov peasants Petr Andreev, Petr Nikiforov, and Ivan Mikhailov (as part of a group of 48 families) wrote about their desire to move

with three families "in number of nine males and thirteen females to the lands of the Cabinet of His Majesty, located in the districts of Barnaul, Biysk, and Kuznetsk… in which there will be free land" (Ibid.: Fol. 3). The patronymics of the Maslov settlers are different; apparently, they were not brothers, but relatives of varying degrees of kinship or namesakes. All the 48 families indicate the same reasons for resettlement: "we have the smallest amount of land, fringe earnings are insufficient and meager owing to the populousness". However, many of the people named in this list later refused to resettle (Ibid.: Fol. 93, 94, 90, 105, 106, 107). One of the refusal letters of 1891 from the peasants of the above list has been preserved: "…we all unanimously respond that we do not want resettle in the designated governorate because of the lack of funds, and humbly ask the Government not to attach any importance to our petition for resettlement, in which we sign: Maslov, Zemlyachenko, Gashchenko, Bezbenko, Trofimov, Lozin, Ishchenko, Danilov, Danshin" (Ibid.: Fol. 108). In this file, there is no information about whether these peasants applied again for permission to resettle in Siberia. Noteworthy, in the departure lists, the Russified surnames of peasants are indicated (for example, Gashchenko became Gashchenkov, Ishchenko Ishchenkov, etc.), but in the documents with a refusal to move, the former Ukrainian surnames are given.

Petitions for resettlement in Siberia came from the peasants of the village of Arkhangelskoye, Belgorodsky Uyezd, Muromskaya Volost—Stefan Ivanov Zemlyachenko, Nikita Semenov Sukhoivanov, Fedor Maksimov Zemlyachenko, Sergiy Ivanov Gashchenkov, and others. In all the appeals, the text was drawn up uniformly: "We, the aforementioned peasants, consisting of twelve families of 37 males and 30 females, have a desire to move to the Tomsk Governorate, to the lands belonging to the Cabinet of His Majesty, located in the districts of Barnaul, Biysk, and Kuznetsk, that is, in those that will be free for settlement. Moreover, we undertake to pay all duties for the Land we receive, in accordance with the existing Law. At the same time, we explain that we peasants from our landowner Count Gendrikov received as a gift the land of 22 and 1/2 sazhens for each person entered in a census list… For the reasons stated, namely, the extreme lack of land, meager earnings, and great populousness, inconvenient for farm management, we all humbly ask Your Highness to make an order for legal assistance in allowing us to transfer us to the Tomsk Governorate…" (Ibid.: Fol. 4r–4v). Similar petitions, written as a blueprint, also came from other peasants.

Applications on resettlement in the Tomsk Governorate were submitted by the residents of many other places in the Belogorsky Uyezd, Muromskaya Volost—the village of Nelidovka (often mentioned are the names of Kleopov, Shcherbakov, Goduev, Lazarev, Kudryavtsev, Markov, Shuvaev, etc.), village of Mazikino (Pisarev, Sharapov, Shlyakhov, Rastvortsev, Mazikin), village of Shlyakhova (Shlyakhov, Orekhov, Kazmin), village of Melikhovo (Lazarev, Gridchin, Podporinov, Uvarov), village of Sheino (Shein, Lazarev, Merzlikin, Ogurtsov), village of Dalny Igumnov (Shekhanin, Panov, Ryzhikov, Morozov, Shumov), etc. (Ibid.: Fol. 10–13). As we see, in these villages, applications were submitted mostly by the people with Russian surnames, ending with "-ov". In the settlement of Novaya Tavolzhanka, Belgorodsky Uyezd, Shebekinskaya Volost, families with Ukrainian surnames filed documents on the resettlement—Shchelkun, Kutsenko, Gerashchenko, Shelest, Sheika, Kolenko, Kabluchka, Smyk, Dzyuba (?), etc. (Ibid.: Fol. 27). Judging by the names, among those who wanted to move from the Kursk Governorate, there were many Ukrainians. However, as noted above, the situation was not so clear-cut. For example, a resident of the village of Staraya Tavolzhanka, originally listed as Smyk, later began to register himself according to the Russian tradition as Smykov (Ibid.: Fol. 29, 49); Ovcharenko from the village of Churaeva later turned out to be registered as Ovcharenkov; alternating are also the surnames Nikitchenko(v), Boglchenko(v), Danilchenko(v), Furs(ov), etc. (Ibid.: Fol. 27, 29v, 36, 37, 39, 40, 41, 42).

In 1889, large groups of peasants from the Belgorodsky Uyezd declared the desire to change their place of residence: the village of Titovka, Shebekinskaya Volost – 13 families (43 males and 39 females), settlement of Bezlyudovka – 83 families (225 males and 210 females), etc. Residents of the Sabyninskaya Volost also tried to leave: the settlement of Raevka (Denisov, Timofeev – 10 s.b.s., Gamanchenkov – 8 s.b.s.), the settlement of Olkhovaty (Emelyan Ivanov Lukin – 7 s.b.s.), the settlement of Znamensky (Semen Kazmin Kirzunov – 6 s.b.s.); the village of Bezsonovka (Bezsonovkaya Volost) (Kovalev, Soloviev, Vlasov, Pryadkin, Bezpyatov, Seleznev, Shevchenko, etc.); the village of Igumenka (Starogorodskaya Volost), etc. (Ibid.: Fol. 37, 54, 56, 58, 71, 72).

Individual petitions usually came from families with many children, who had grown-up sons and at the same time possessed extremely small allotments of land. As an example, we cite the fragment of submission by I.D. Timofeev: "…a petition addressed to His Excellency Mr. Governor of Kursk from the family of Ioann Denisov Timofeev. My family consists of: me, the petitioner, Ioann Denisov Timofeev, 45 years old, my wife Evdokiya Lukyanova, 42 years old, children sons Roman, 23 years old, Ioann, 21 years old, Semen, 18 years old, Prokofy, 4 years old, Afanasy 1/2 years old, daughters Anna 8 years old, Maria 6 years old, Roman's wife Ekaterina Fedorova 20 years old; in total, ten s.b.s. We owned land in the amount of 2 and 3/4 dessiatins of soul land-right" (Ibid.: Fol. 73). Owing to the "lack of land", a resident of the settlement of Znamensky, Kirzanov, the father of three

adult sons, filed a petition: "…me, the petitioner, 60 years old, my wife Marfa Vasilyeva, 55 years old, sons Stefan, 21 years old, Fedor, 19 years old, Pavel, 16 years old. Stefan's wife Alexandra Nikiforova, 20 years old; in total, six s.b.s. We owned land of 1 and 1/10 dessiatins" (Ibid.: Fol. 76). However, as follows from some documents, the move could be explained by the desire not only to strengthen their financial situation, but also to protect their sons from military service.

Let us look at the preliminary stages of preparation for resettlement. Correspondence between the governor of Kursk and the manager of state property in Western Siberia has been preserved, from which it follows that local authorities took seriously and responsibly the issue of resettlement. In 1891, from the Tomsk Governorate a letter was sent to the governor of Kursk, with the following content: "On behalf of the Minister of State Property, Deputy Minister of State Secretary Vishnyakov, on whose permission the submission of Your Excellency dated July 21 of this year No. 6601 was communicated, suggested that I allocate, for the use by 315 families of peasants of the Belgorodsky Uyezd of the Kursk Governorate, the state land from the plots of the Tomsk Governorate intended and suitable for this purpose (January 28, 1891, Omsk)". An urgent request was made to provide nominal lists of the aforementioned settlers, indicating the place of their registration, the number of male souls in their families, and also "what category of rural inhabitants they belonged to at home, that is, whether they were the former property of landowners or state-owned peasants" (Ibid.: Fol. 79r–79v). The letter also reported on the allotted lands and on the need for registration: "I consider it necessary to add that state-owned plots in the Baimskaya Volost of the Mariinsky District of the Tomsk Governorate have been allocated for the placement of the above-mentioned settlers, and that upon arrival in the Mariinsky District, the settlers should contact the general foreman, Court Counsellor Rozinov" (Ibid.: Fol. 79v). Further, a request was expressed that "the exit certificates issued to the migrants should be kept by them until they arrived at the places of new settlement and handed over only to the official of the resettlement detachment…" (Ibid.). In the second half of May 1891, with the opening of navigation along the rivers of Siberia, it was planned to send migrants with the first steamboat from Tyumen to Tomsk, or by land from Tyumen along the Siberian highway through Tomsk to Mariinsk, located near the Baimskaya Volost (Ibid.).

The issued certificate for the right to resettle limited the time of departure for the peasants. This allowed the authorities to regulate migration flows in order to avoid unnecessary influxes of the population. The time of use of the exit certificates was also limited. The order of the Kursk governor stated: "if somebody fails to use his/her travel permit within 2 months from the date of issue, it will be taken away" (Ibid.: Fol. 81).

From the above documents, it can be seen that sometimes the Kursk people refused to be resettled. The peasants explained this decision by the fact that they did not immediately understand that they had to move at their own expense. Here is a typical letter with the justification of refusal to the Shebekinskaya Volost board: "…at present, we do not want to move to that governorate, and also to accept permit for resettlement, because resettlement was allowed to us not at the expense of the treasury, as we supposed, but at our own expense, with only the reduced fare for travel by rail, in witness whereof, I have hereunto set my hand. February 12, 1891" (Ibid.: Fol. 109–120).

Nevertheless, quite large groups went on a long journey, as was stated in reports to the authorities. Here is a message about the departure of families from their native places in the Belgorod region: "…On the 16th of this May, migrants left their homeland to settle on the state lands of the Tomsk Governorate of the Mariinsky District of the Baimskaya Volost, according to the permission of the Ministry of Internal Affairs, the peasants of the Novaya Tavolzhanka settlement of the Shebekinskaya Volost of the Belgorodsky Uyezd in number of 21 families, namely: Fedor Ivanov Neporozhny, Nikita Alekseev Kolenko, Alexei Ivanov Kolenko, Kozma Petrov Dzyuba, Ivan Kozmin Shevkun, Fedor Dmitriev Fursa, Sidor Fedorov Kabluchka, etc." (Ibid.: Fol. 121).

Parents with adult children, as well as young and newborn children, one-, two-, and three-generation families, went to new lands. However, according to archival documents, not all migrants reached their destination. Here is one of the preserved documents of the Ministry of Internal Affairs, with the appeal of the Zemstvo Chief to the Kursk Governorate Board: "…I have the privilege to provide two travel permits No. 413 and 417, taken away from the peasants of the Novaya Tavolzhanka settlement of the Belgorodsky Uyezd, Fedor Dmitriev Fursa and Anton Alekseev Smyk, as those who failed to use their right for resettlement and returned back to their homeland owing to the lack of funds to move to the place of resettlement. Zemstvo Chief, signature. June 11, 1891" (Ibid. L. 125).

On the basis of the available materials, it is difficult to judge whether the peasants did reach the Tomsk Governorate, according to the nominal list, or not; for this end, it is necessary to analyze the local documents, in the archives of the Tomsk Region.

Resettlement of the Kursk people

Kursk Governorate occupied the first place in the resettlement movement in 1885–1889: those who left it

Fig. 2. South Russian settler (top right) with Siberian peasants. *Photo by M.A. Krukovsky*. 1912. MAE archives.

accounted for 43 % of the total number of migrants; in 1890–1894, the second place (14 %) after the Poltava Governorate; in 1895–1899, the third place (7 %); and in 1900–1904, it was the fifth (6 %) (Pereseleniye v Sibir…, 1906: 15). According to the data of the Resettlement Administration, in 1896–1914, 279,695 s.o.s. of migrants and walkers left the Kursk Governorate, of which 67,948 people "moved in the opposite direction", i.e. returned (Itogi pereselencheskogo dvizheniya…, 1916: 2). For the majority of the Kursk peasants, the process of resettlement included two stages: the first was passage to the Tomsk Governorate to the migration point, the second (after two years or more) was settlement in the villages to the south of this area, mainly in the Altai Mountains District (Fig. 2, 3).

The arrival of the Kursk people to the Siberian lands was reflected in a number of names of settlements and entire regions of Western Siberia, for example, Sudzhensky Uyezd of the Tomsk Governorate, the settlement Kursky in the Bagansky District of the Novosibirsk Region, the village of Kursk in the Kulundinsky District of the Altai Territory, etc. Family legends have been preserved about the Kursk people as the founders of new settlements. We have heard many such stories in the villages of Alekseevka, Parfenovo, and others in the Topchikhinsky District of the Altai Territory (Semenova, 2010) (Field Materials of the Author (FMA), 2015). In the "Final Settlement and Volost Cards of the All-Russia Agricultural Census of 1916–1917" preserved in the GATO, various volosts of the Tomsk Governorate show lists of settlers of the Tomsky Uyezd, Sudzhenskaya Volost*, but unfortunately, only general information about the settlers is given, without indicating the places of their exit (GATO. F. 239, Inv. 17, No. 4, 8, etc.). The first field expeditions in the village of Sudzhanka, Yaysky District, Kemerovo Region, did not reveal the descendants of the Kursk migrants; only the name of the street "Kursk Territory" remained after them (FMA, 2016). Possibly, in the past, southern migrants changed their rural place of residence to urban and contracted to work in mines, as evidenced by some personal cards of workers of 1940 kept in the Anzhero-Sudzhensk city archives (City Archives of Anzhero-Sudzhensk, Kemerovo Region (GAAS), F. 69, Inv. 2, Vol. 27, fol. 37, etc.).

Here are some examples of migrations in the late 19th and early 20th centuries. According to A.A. and N.A. Vaganov, Kursk migrants arrived in the early 1880s in Burlinskaya Volost, Barnaulsky Uyezd** from Stakanovskaya, Krasnopolyanskaya, Pokrovskaya, Khokhlovskaya, Nikolskaya volosts of the Shchigrovsky Uyezd, Afanasyevo-Pokhonskaya, Uspenskaya volosts of the Timsky Uyezd, and Srede-Opochenskaya Volost of the Starooskolsky Uyezd. The nearby Ordinskaya Volost of the Barnaulsky Uyezd*** accepted Kursk people from Stakanovskaya, Nikolskaya, Verkhdoymenskaya

*Now, Anzhero-Sudzhensky District of the Kemerovo Region.

**Now, the Pankrushikhinsky District of the Altai Territory.

***Now, the Ordynsky District of the Novosibirsk Region.

Fig. 3. Settlers from the Kursk Governorate. *Photo by M.A. Krukovsky*. 1911–1913. MAE archives.

volosts of the Shchigrovsky Uyezd; Legostaevskaya Volost of the Barnaulsky Uyezd* was populated by settlers from Kotovskaya and Baranovskaya volosts of the Starooskolsky Uyezd (1882: 19, 68, 103). Peasants from the Kursk Governorate that arrived in 1897–1907 in the village of Karasevo, Gondatievskaya Volost, Tomsky Uyezd**, at the time of the agricultural census accounted for about half of the village population: 45 out of 100 households (h/h) (GATO. F. 239, Inv. 16, D. 117, No. 24) (Fursova, 2003: 100). In 1907–1914, families of settlers from the Kursk, Orel, and Tambov governorates founded the villages of Sovinovsky and Sukhinovsky, Gondatievskaya Volost, Tomsky Uyezd (Ibid.: No. 49, 50***) (Ibid.: 98).

Those migrants who arrived in the village Funtiki, Barnaulsky Uyezd, Barnaul Governorate****, founded a separate settlement of Makaryevsky (Makaryevka). Makaryevsky was dominated by the people from the Kyiv Governorate (23 h/h) and Kursk Governorate (11 h/h); at the beginning of the 20th century, their neighbors were the less numbered people from Perm (4 h/h), Voronezh (3 h/h), and Tambov (3 h/h) governorates, etc. (Ibid.: No. 3). In the Community of Nikolskoye, Alekseevskaya Volost, Barnaulsky Uyezd (385 h/h), located not far from Makaryevka, most of the population were settlers from Kursk, and fewer from Orel, Tula, and Chernigov (Ibid.: No. 4).

Modern residents of these settlements retain their founding histories, which, on the one hand, were similar to one another, because they developed as a reflection of social, political, and cultural processes of their time, and on the other hand, they were unique, due to specific situations and circumstances. For example, the Kursk people chose to settle in what was considered an old-resident village: Voznesenskoye, Pokrovskaya Volost, Barnaulsky Uyezd. In 1888, approximately 25 families from Oboyansky Uyezd of the Kursk Governorate arrived here. They were allowed to settle in the dacha area of this village. The new settlement was called Malinovy Log (Shvetsov, 1899: 17). The rapidly growing new settlement disturbed the old residents and, after disputes and lawsuit, was annihilated by decision of the administration. One part of the Kursk people moved to the village of Voznesenskoye (where the migrants from the Sudzhanskaya Volost, Kursk Governorate, also arrived), and the rest dispersed to the neighboring villages.

The settlement of Rodina, Pokrovskaya Volost, was founded in 1891 by 15 families of peasants from Graivoronsky Uyezd, Kursk Governorate (Shvetsov, 1899: 51). For the most part, the people of Kursk were dissatisfied with this place, and dispersed for the winter to other villages. Only four Belevtsev families remained in the village. In the summer of 1892, when a large party of Poltava peasants (104 families) arrived in the neighboring village of Yaroslavtsev Log, the Kursk people offered them to unite in the village of Rodina. A year later,

*Now, the Iskitimsky District of the Novosibirsk Region.

**Now, the Bolotninsky District of the Novosibirsk Region.

***These settlements do not currently exist.

****Now, the Topchikhinsky District of the Altai Territory.

15 more families from Chernigov and 5 families from Kharkov joined them.

Not far from the city of Barnaul, settlers from Kursk and Kharkov founded the villages of Chudskiye Prudy and Abramova Dubrava of the Kasmalinskaya Volost, Barnaulsky Uyezd, as indicated by S.P. Shvetsov, on St. Peter's Day (1899: 64). The village of Utichye, Karasukskaya Volost, Barnaulsky Uyezd, was also founded in 1888 by Kursk migrants—by two families from Oboyansky Uyezd. The peasants, with their permissive certificates, were on their way to the Mariinsky District, but taking into account the stories and recommendations of local old residents, they changed their route. They liked the place at Lake Utichye, and the following year more than 20 Kursk families arrived here, and later, settlers from Kursk, Tambov, Poltava, and Kharkov governorates (Ibid.: 75, 76).

Peasants from Kursk were also settling in the already existing villages. For example, the village of Mikhailovsky of the Lyaninskaya Volost, Barnaulsky Uyezd, was founded in 1888 by 30 families from the Poltava Governorate; in the 1890s, 90 families arrived here from the Kursk Governorate (Novoskolsky, Karochansky, and Putivlsky uyezds), 80 families from the Saratov Governorate, 20 more families from Poltava (Pereyaslavsky Uyezd), and five families from Chernigov (Ibid.: 132).

Conclusions

The archival materials in the places from where the settlers derived, are interesting because they reveal the post-reform village atmosphere in southern Russia; the obvious and hidden reasons for resettlement; the structure, social and ethno-cultural composition of a population ready to migrate to Siberia. As follows from the GAKO documents, not all peasants who submitted a petition were granted permission to move; the reasons for the refusal could be a poor financial situation, or, on the contrary, the sufficiency of land plots in their ancestral home.

In many cases, they moved in large family groups, with adults and small, even newborn, children, brothers and sisters, nephews, etc. Judging by the composition of the families, the elderly did not plan to move; according to the documents, the oldest members of the migrant families were 60–65 years old. According to the recollections of the descendants of the migrants, the elderly members of families hardly adapted to life in a new place, and "because of longing" returned to their native places. It is obvious that Siberia was attractive for those representatives of the rural population of the southern outskirts of Russia who were not the most disadvantaged groups. These were the middle-class peasants, whose family groups included several sons. As follows from some documents, one of the reasons for the move could have been the desire of the heads of families to help their sons to avoid military service, which might be considered a hidden motive for migration.

The Kursks people who arrived in Siberia, like other South Russian settlers, were the carriers of not only their regional "Kursk" identity ("Kursk nightingales"), but also of an all-Russian, as well as specific ethno-cultural, local, and class identities (Old Believers, Cossacks, Sayans, etc.), which can probably explain the existence of many popular collective nicknames among the Kursk peasants in their motherland and in Siberia (Zanozina, Larina, 2004: 35). According to the GAKO documents, migrants arrived in Siberia mainly from the southern regions of the Kursk Governorate—Timsky, Starooskolsky, Novooskolsky uyezds, etc. South Russian and Ukrainian peasants who moved to Siberia often changed their surnames, adding the ending "-ov" to them, apparently in the hope of becoming more Russified and thus adapting. Were such actions accompanied by a change of identity? Such a situational identity was inherent in people for whom the (external) change of identity was not difficult; in terms of differential characteristics of their culture, they occupied an intermediate position between Southern Russians and Ukrainians.

In Barnaulsky Uyezd, as well as in other places in the south of Western Siberia, the Kursk peasants began their Siberian history together with other southern Russians, but especially often with Poltavites, Kyivites, etc. Joint co-residence with the Ukrainian population fully corresponded to the previous situation in the historical homeland, the so-called "culture of rootedness" (Chizhikova, 1988: 24). In cases where migrants were settled with old residents, conflict relations often arose; although, in 1916, marriages of old residents and settlers were already common (as a rule, a bride was from an old resident family, and a groom was a migrant). The most striking example of this is the emergence of families from the people of Kursk and Tomsk, or Kiev and Tomsk. Subsequently, this led to the formation of the Siberian (local and regional) variants of the South Russian culture (Fursova, 2016: 550). At the same time, the Kursk migrants, who came in groups of families from the same places and even settlements, were carriers of specific ethno-cultural traditions that did not imply mutual hostility with neighbors of Ukrainian origin. All this in the future became the reason that the "Yuzhaks", owing to the processes of acculturation, "dissolved" among the Russian old residents and Ukrainian settlers.

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References

Bagalei D.I. 1887
Ocherki iz istorii kolonizatsii stepnoy okrainy Moskovskogo gosudarstva. Moscow.

Chizhikova L.N. 1988
Russko-ukrainskoye pogranichye: Istoriya i sudby traditsionno-bytovoy kultury. Moscow: Nauka.

Chizhikova L.N. 1998
Etnokulturnaya istoriya yuzhnorusskogo naseleniya. *Etnograficheskoye obozreniye*, No. 5: 27–44.

Fursova E.F. 2003
Etnokulturnoye vzaimodeistviye vostochnoslavyanskikh starozhilov i pereselentsev Priobya, Baraby, Kulundy po materialam kalendarnykh obychayev. In *Problemy izucheniya etnicheskoy kultury vostochnykh slavyan Sibiri XVII–XX vv*. Novosibirsk: AGRO-SIBIR, pp. 80–129.

Fursova E.F. 2016
Vzaimovliyaniya v svadebnoy obryadnosti u sibiryakov kursk-chernigovskogo proiskhozhdeniya v pervoy treti XX veka. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XXII. Novosibirsk: Izd. IAET SO RAN, pp. 550–552.

Itogi pereselencheskogo dvizheniya za vremya s 1910 po 1914 g. (vklyuchitelno). 1916
N. Turchaninov, A. Domrachev (comp.). St. Peterburg: Izd. Pereselench. upr.

Krylov M.P. 2009
Regionalnaya identichnost naseleniya Yevropeiskoy Rossii. *Vestnik Rossiyskoy akademii nauk*, vol. 79 (3): 266–277.

O dvizhenii naseleniya v Kurskoy gubernii za 1899 god. 1904
Kurskiy sbornik s putevoditelem po gorodu Kursku i planom goroda. Kursk: Izd. Kur. gub. stat. komiteta, pp. 68–79.

Pereseleniye v Sibir. 1906
Pryamoye i obratnoye dvizheniye pereselentsev semeinykh, odinokikh, na zarabotki i khodokov, iss. XVIII. St. Petersburg: Izd. Pereselench. upr.

Popov I.I. 1911
Pereseleniye krestyan i zemleustroistvo Sibiri. In *Velikaya reforma*. *Russkoye obshchestvo i krestyanskiy vopros v proshlom i nastoyashchem*, vol. IV. Moscow: pp. 249–267.

Semenova O.N. 2010
Iz istorii osnovaniya stareishikh sel na territorii Topchikhinskogo rayona. In *Rodnaya storona*. Barnaul: Pyat plus, pp. 17–40.

Shvetsov S.P. 1899
Materialy po issledovaniyu mest vodvoreniya pereselentsev v Altaiskom okruge. Barnaul: [s.n.]. (Rezultaty statisticheskogo issledovaniya v 1894 g.; No. 11. Iss. II: Opisaniye pereselencheskikh poselkov).

Vaganov A.A., Vaganov N.A. 1882
Khozyaistvenno-statisticheskoye opisaniye krestyanskikh volostey Altaiskogo okruga. [s.l., s.n.].

Zanozina L.O., Larina L.I. 2004
Arkhaichniye kollektivniye prozvishcha kurskikh krestyan. In *Etnografiya Tsentralnogo Chernozemya Rossii*. Voronezh: Istoki, pp. 35–39.

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A Case of Chronic Maxillary Sinusitis in a Late Neanderthal Population of the Altai Mountains

We describe a likely case of chronic maxillary sinusitis (CMS) in a Neanderthal skeletal sample from Chagyrskaya Cave, in the Altai Mountains. Signs of CMS were recorded in the Chagyrskaya 57 specimen, which is a fragment of a left maxilla. Alveoli of the upper first molar are partially preserved, and so are the second and third upper molars, with adjacent parts of the walls, and the floor of the maxillary sinus. The fragment was found in layer 6b, dating to 53,100–51,100 BP. We analyze the factors that had caused the development of the disease, and assess its etiology. In the 3D-model, generated by computed microtomography, and in the original specimen, porotic changes were registered, situated at the fracture line of the alveoli of M^1, lost post-mortem, and near the vestibular roots of both preserved molars. Also, there were isolated bone spicules, 1.0–2.6 mm in size. These signs indicate incipient CMS, evidently caused by chronic periodontal disease combined with a deep alveolar recess of the maxillary sinus. As the periodontal gap expanded, several small nutrient foramina, piercing the bottom of the sinus, merged. As a result, several oro-antral channels formed, whereupon the infection spread into the maxillary sinus. Since the deep alveolar recess is observed in the vast majority of Neanderthal crania with published images or reconstructed maxillary cavities, it can be assumed that Neanderthals were predisposed to odontogenic CMS.

Keywords: *Chronic maxillary sinusitis, Neanderthals, Chagyrskaya Cave, paleopathology, archaeology, Middle Paleolithic.*

Introduction

Chronic maxillary sinusitis (CMS) is a persistent long-term inflammation of the mucous membrane of the maxillary sinuses, of an infectious or allergic nature (Arefieva et al., 2014: 11). This is one of the most widespread chronic respiratory diseases in the world today (Slavin, Spector, Bernstein, 2005; Brook, 2009). In most

cases, CMS does not pose a direct threat to life, but its manifestations can cause noticeable physical discomfort. These include obstructed nasal breathing, headaches, and general weakness; and during exacerbations, purulent discharge from the nose, sometimes fever; although it can also be asymptomatic (Arefieva et al., 2014: 26; Sipkin et al., 2013: 83–84).

Unlike many other respiratory diseases, CMS can be relatively easily detected in ancient skeletal remains. The mucosa of the sinus is so tightly related to the periosteum that it actually forms one unit with it; thus, its inflammations rapidly spread to bone tissue. This leads to a chronic inflammation of the walls of the sinus (osteitis), the structure of the bone tissue becomes heterogeneous and exhibits foci of osteosclerosis, osteoporosis, and remodeled bone tissue. These signs can be detected by visual examination of the maxillary sinus, or reconstructed by computed tomography (CT) images (Boocock, Roberts, Manchester, 1995; Sundman, Kjellström, 2013; Biedlingmaier et al., 1996; Erdogan, Fidan, Giritli, 2016; Mafee, Tran, Chapa, 2006; Georgalas et al., 2010; Momeni, Roberts, Chew, 2007; Snidvongs et al., 2014).

In ancient populations, CMS is considered a marker of cumulative stress of a multifactorial nature. A variety of factors stimulating an increase or a decrease in the prevalence of the disease in archaeological samples has been suggested in the literature: anthropogenic air pollution, adverse social conditions, climatic and geographic factors, etc. (Zubova, Ananyeva, Moiseyev et al., 2020; Zubova, Moiseyev, Ananyeva et al., 2022; Lewis, Roberts, Manchester, 1995; Roberts, 2007; Panhuysen, Coenen, Bruintjes, 1997). But those hypotheses are based mainly on the study of modern human populations of the last two millennia (Teul et al., 2013; Sundman, Kjellström, 2013; Roberts, 2007; Lewis, Roberts, Manchester, 1995; Panhuysen, Coenen, Bruintjes, 1997), while the prevalence and dominating factors of the epidemiology of CMS in earlier ages and in different species of the genus *Homo* have not been studied to date.

This work describes a possible case of CMS in a Neanderthal sample from Chagyrskaya Cave in the Altai Mountains. To the best of our knowledge, there is only one more described case of CMS in Neanderthals detected in the Neanderthal 1 individual (Schultz, 2006). The main goal of the present study is to explore the factors that have led to the development of the recorded chronic inflammation in the maxillary sinus, and to determine the etiology of the disease.

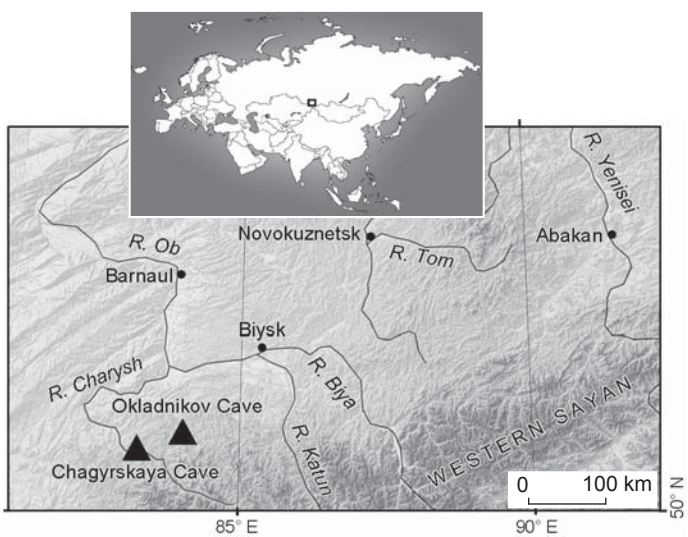

Fig. 1. Location of the caves with the remains of the late Neanderthals in the Altai.

Materials and methods

The bone fragment that is the focus of the present study (Chagyrskaya 57) was found in the Chagyrskaya Cave, in layer 6b. The site (51°26′34.6″ N; 83°09′18.0″ E) is located on the left bank of the Charysh River, in the foothills of the Tigirek ridge, in the northwestern Altai (Fig. 1). This karst cavity of northern exposure is located in the low mountains, at an altitude of 353 m above sea level, and 19 m above the river level.

Chagyrskaya Cave is renowned for its collection of Neanderthal remains—the largest one in North Asia. The cave was inhabited during ca 10 thousands years (59–49 ka BP) by a small population that was genetically closer to the late European Neanderthals than to the ancient Altaian groups of the species known from Denisova Cave (Denisova 5) (Mafessoni et al., 2020; Kolobova et al., 2020; Vernot et al., 2021). Evidence of the presence of late Neanderthals in the Altai was also found in Okladnikov Cave. Both archaeological and paleogenetic data suggest that these two caves were exploited by the same population. According to direct dating, the caves were inhabited simultaneously at the final stage of using Chagyrskaya, and at the early stage of populating Okladnikov (Kolobova, Shalagina, Chabai et al., 2019; Skov et al., 2022).

Chagyrskaya Cave was located on the route of seasonal migrations of large herbivores, and is thought to have been a base and hunting camp for Neanderthals. It was used at the end of the summer and at the beginning of the autumn season, when its inhabitants hunted female and young bisons (Kolobova, Chabai, Shalagina et al., 2019; Kolobova et al., 2020). The whole cycle of game utilization, including the extraction of bone marrow and making numerous bone tools, took place in the

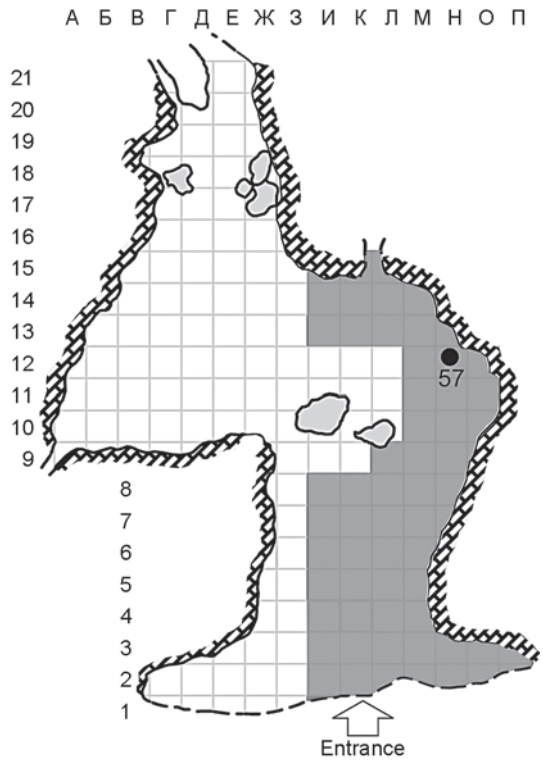

Fig. 2. Scheme of Chagyrskaya Cave indicating the location where specimen 57 was found (the area of the excavation is depicted in gray).

cave. Almost the whole cycle of stone tool manufacture was also recorded at the site. This included production/trimming of high backed bifaces and convergent scrapers (Baumann et al., 2020; Shalagina et al., 2020).

Recent paleogenetic studies have demonstrated that the Chagyrskaya Neanderthals lived in small isolated family groups, which included closely related individuals (i.e. father-daughter, cousins). This fact indirectly suggests that the cave was inhabited for a short period of time. According to the existing genetic models, the Neanderthal groups were patrilocal and exchanged females (Skov et al., 2022). The Neanderthals from Chagyrskaya also had genetic contacts with the Altaian Denisovans, as was shown by detecting a first generation hybrid between the two species (Slon et al., 2018).

Layer 6b is a grayish-brown silty dense porous carbonate silt sediment containing rare angular limestone fragments, bone fragments, lithic artifacts, and river pebbles. The lower boundary is erosive. The layer has a colluvial genesis and includes the remains of material culture moved from the layers 6c/1, 2. From the taphonomical point of view, this layer represents the remains of a hyena's breeding-den. The Chagyrskaya 57 specimen was found in sq. H-11 of the main chamber of Chagyrskaya Cave (Fig. 2). In this and neighboring squares, 42 more anthropological specimens were detected (Skov et al., 2022). According to the genesis of layer 6b, the Chagyrskaya 57 specimen, as well as the others, was moved from layers 6c/2, 1, from deeper areas of the cave, owing to a colluvial transfer. Direct dating of bone remains produced four AMS-dates beyond the scope of the method (>49,000 and >52,000 BP), and OSL-dates fitting into the range between 53,100 and 51,100 BP (Kolobova et al., 2020).

Chagyrskaya 57 (Fig. 3) is a fragment of a left maxilla with the sockets of the roots of the first molar partially preserved; and the second and third molars, and the surrounding structures of the anterior and posterior walls and the floor of the maxillary sinus fully preserved. The length of the fragment is 30.2 mm, width 18.3 mm, height 23.7 mm. The maximum height of the preserved part of the anterior wall of the sinus is 7.1 mm, posterior wall 5.5 mm (taken from the floor of the sinus).

MicroCT scanning of the specimen was carried out in the X-Ray Diffraction Research Center of St. Petersburg

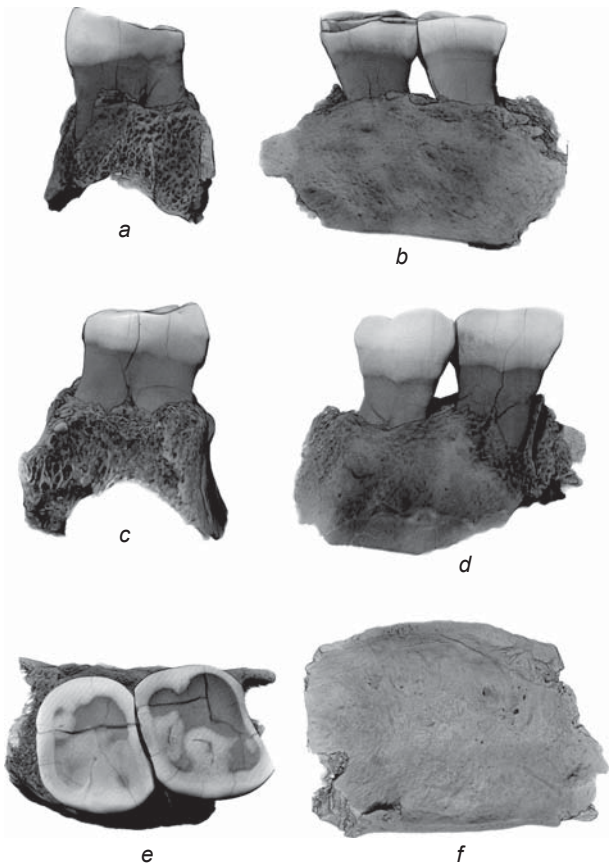

Fig. 3. 3D-model of the Chagyrskaya 57 maxillary fragment. *a* – mesial norm; *b* – lingual; *c* – distal; *d* – vestibular; *e* – occlusal; *f* – view from the side of the floor of the maxillary sinus.

State University, using Bruker SkyScan-1172 with the following settings: tube voltage 100 kV, amperage 100 μA, aluminum filter 0.5 mm, rotation step 0.25°, resolution 6.64 μm/pixel. Processing of the raw images and creation of a 3D-model of the fragment were carried out in NRecon and CTAn (Bruker-micro CT, Kontich, Belgium), respectively.

The manifestations of CMS were observed both in the 3D-model and the original specimen: osteoporotic and bone-remodeling loci on the floor and internal walls of the sinus. We employed a protocol scoring the manifestations of the disease as four grades (score 0 to 3), depending on the severity of the lesions: 0 – complete absence of pathological changes; 1 – subtle manifestations of osteoporosis: small clusters of pits or bone spicules 1 to 3 mm in length and occupying an area less than 1.5 cm^2; 2 – remodeled bone tissue and spicules occupy an area of 1.5 to 2.5 cm^2, merge with each other, and form network-like structures; 3 – lesions occupy a half of one of the walls of the sinus or more (Sundman, Kjellström, 2013: Fig. 2).

Infection of the sinus mucosa can occur in various ways: rhinogenic, hematogenous, or odontogenic (Mukovozov, 1982: 105). An attempt to differentiate between these etiologies was made for the specimen from Chagyrskaya. But this attempt, unfortunately, was seriously limited by the nature of the data available. With hematogenous etiology, the infection penetrates into the sinuses through the circulatory system, which is observed in severe infectious diseases such as typhoid, influenza, or scarlet fever. As these diseases do not produce specific skeletal markers, it is virtually impossible to diagnose a hematogenous infection in bone specimens.

Rhinogenic sinusitis develops with respiratory infections and certain types of allergies. It can be differentiated by the presence of signs of inflammation in the nasal cavity and ostiomeatal complex, bilateral damage to the sinuses, and the spread of inflammation not only to the maxillary, but also to other paranasal sinuses (Ibid.: 110). For the Chagyrskaya 57 individual, only a single fragment of the maxillae is present, making the determination of uni- vs. bilateral localization of the inflammation, as well as the description of the ostiomeatal complex, impossible.

Odontogenic forms of the disease develop as a result of the penetration of the microorganisms of the oral cavity into the maxillary sinus through the channels forming as a result of resorbtion of the alveolar bone owing to a long course of chronic periodontitis, chronic periodontitis, or osteomyelitis (Buskina, Gerber, 2000; Abrahams, Glassberg, 1996). Unlike those of a rhinogenic or a hematogenous etiology, such forms of the disease can be easily detected in skeletal specimens. In order to diagnose these, the presence of a chronic disease of the dentition must be confirmed, and the channels of oro-antral communication through which the infection penetrated into the sinus should be detected.

In order to determine the possible odontogenic nature of CMS in the Chagyrskaya 57 specimen, a protocol for scoring pathological manifestations of the dentition was employed. The protocol included the fixation of deposits of supragingival calculus, ante-mortem dental trauma, signs of initial and secondary caries, enamel hypoplasia, and markers of chronic periodontitis in the original specimen. Manifestations of the periodontal disease were described following Ogden (2007), whose protocol permits differentiation of chronic inflammations and normal age changes of periodontal tissue or dental roots related to the compensatory reaction to lowering of the dental crowns due to attrition. The 3D-model of the specimen was used to determine the presence or absence of: the oro-antral fistula; hypercementosis on the teeth-roots; expansion of the periodontal space; and changes in the structure of the compact of alveolar cells and in the sequesters of bone tissue marking inflammatory processes of various etiologies.

Results

The floor of the maxillary sinus of the Chagyrskaya 57 individual exhibits porotic changes located at the fracture line of the socket of M^1 (lost post-mortem) and in the area of the vestibular roots of both preserved molars. The lesions spread towards the central part and the deepest point of the floor (Fig. 4). The minimum area affected by osteoporosis is 1.12 cm^2, which corresponds to score 1 of the severity of CMS manifestations, but does not reach the threshold of 1.5^2 cm necessary for the registration of score 2. It can be suggested that the area affected by osteoporosis could have been larger if the first molar had been preserved, but the morphology of the observed bone changes confirms a weak development of the disease. Besides osteoporosis, the preserved part of the sinus displays only isolated bone spicules (1.0 to 2.6 mm), localized closer to the posterior wall and not forming continuous structures.

Of all of the dental pathologies that could have been potential sources of pathogens, only chronic periodontal disease of moderate severity (grades 3–4 according to the Ogden scale (2007)) was observed in Chagyrskaya 57. The lesion suggesting the presence of periodontal disease was resorbtion of the maxillary alveolar margin. Another manifestation of the disease was widening of the periodontal fissure between M^2 and M^3 (Fig. 5). The distance between the mesio-lingual root of the second molar and the wall of the alveolus is 0.45 mm, while the same distance from the disto-lingual root is 0.28 mm. The lesions are stronger pronounced in M^3, where the

Fig. 4. Pathological changes of the floor of the maxillary sinus.

Fig. 5. Widening of the periodontal gap of the second molar.

periodontal gap reaches 0.6 mm near the mesio-lingual root, and 0.36 mm near the vestibular root.

None of the apical parts of all of the alveoli display the loci of inflammatory destruction of bone tissue that are typically observed during the growth of granulation tissue or the formation of cystogranuloma. In addition, subtle deposits of dental calculus were observed in the vestibular walls of both molars in the area of the maximum crown width.

Several channels connecting the sinus and molar alveoli were detected in the CT images, despite the absence of apical inflammations (Fig. 6). Two of the channels were observed in the area of the mesio-vestibular root of M^2: one was rounded, 0.6 mm in diameter; the second was 0.2 mm in width and 0.4 mm in length. One more channel (0.3 mm in diameter) was found in the socket of the disto-vestibular root. Very small penetrating openings were also detected in the floor of the socket of the lingual root of the third molar. The emergence of these channels is related to the anatomy of the maxillary sinus of the Chagyrskaya 57 individual. Despite the small size of the fragment from Chagyrskaya, it was possible to observe enlargement of the alveolar recess, accompanied by an alveolar pocket. The deepest point of the floor of the sinus is lower than the apexes of the molar roots (Fig. 7); thus, their sockets are separated from the sinus only by a narrow layer of compact tissue pierced by small nutrient foramina. The thickness of this layer at the points where the roots approach the cavity of the sinus varies from 0.1 to 0.3 mm. As the periodontal gap was widening, some of the foramina merged forming oro-antral channels through which the infection spread from the oral cavity to the sinus.

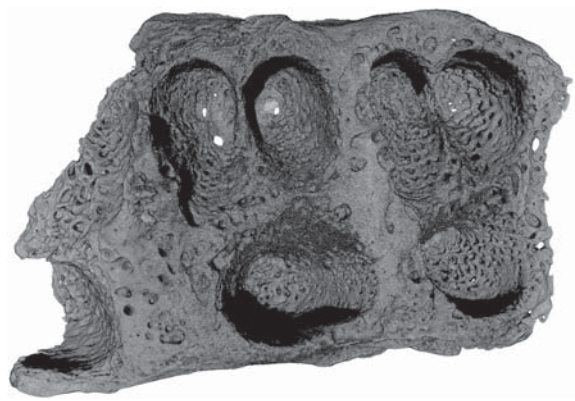

Fig. 6. Oro-antral channels in the alveoli of the upper permanent molars.

Fig. 7. Position of the floor of the maxillary sinus with respect to the apexes of the roots of the upper molars.

Discussion and conclusions

The bone lesions observed in the studied specimen point toward CMS of odontogenic etiology of an initial to middle stage of severity. Chronic periodontal disease, accompanied by the presence of an alveolar pocket of the maxillary sinus, was the likely cause of developing of CMS. This is the second published case of this pathology in Neanderthals. The first one was detected in the Neanderthal 1 individual (Schultz, 2006), where signs of inflammation accompanied by the formation of tumor-like objects in the zygomatic cavity were observed (Schultz, Schmidt-Schultz, 2015: 976–977). When the latter study was published, the prevalence of CMS was typically explained by anthropogenic air pollution and adverse social conditions; in particular, living in a cave implying constant inhalation of smoke from a fire was suggested as the main cause of the disease (Ibid.). But as has been demonstrated recently, the influence of the factors mentioned above on the prevalence of CMS cannot be confirmed statistically for archaeological samples (Zubova et al., 2022). Thus, the link between the maxillary sinus pathology of Neanderthal 1 and the low air quality in the cave is not as clear. The state of preservation of that specimen does not permit an assessment of the possible influence of odontogenic infection on the development of CMS.

Our analysis of the Chagyrskaya 57 specimen has shown that the pathology of the sinus had, most likely, an odontogenic origin. Two groups of factors were crucial for the emergence of the disease. The first is the anatomical features of the maxillary sinuses, namely the excessive development of the alveolar recess. Such morphology is considered one of the main factors predisposing to the development of odontogenic sinusitis in modern humans (Glazyev, Piskunov, 2017: 38); though, according to clinical data, it is observed only in 17 % of patients (Emelyanova, 2017: 16). The second group of factors includes the causes of chronic periodontal disease. These are mainly genetic predisposition, the presence of concomitant medical diseases, and poor oral hygiene causing the accumulation of pathogens that destroy connective tissue and cause bone loss (Clarke, Carey, 1985; Jenkins, Kinane, 1989).

At present, we are not able to carry out an analysis that would determine the statistical significance of the factors listed above across the whole Neanderthal species: the two published cases are clearly insufficient for this purpose. However, the literature on the subject suggests that an anatomical predisposition to CMS could be one of the features of the pathological status of *Homo neanderthalensis*. There is a consensus that a large size of the maxillary sinuses is typical of Neanderthals (Tattersall, 2002: 55; Buck et al., 2019: Pl. S3). The number of publications of photo images of CT reconstructions of Neanderthal's maxillary sinuses is as low as 6–7 specimens, even in the studies specifically aimed at describing the morphology of this structure (see, e.g., (Zollikofer et al., 2008; Buck et al., 2019)). But in all the cases when the quality of an image permits a thorough assessment, a deep intrusion of the alveolar recess into the alveolar process of the maxilla, similar to that in Chagyrskaya 57, can be observed. This is true for Guattari 1 (Buck et al., 2019: Fig. 8), La Chapelle-aux-Saints, La Ferrassie 1 (Ibid.: Pl. S3), Forbes' Quarry 1 (Rae, Koppe, Stringer, 2011: Fig. 1; Zollikofer et al., 2008), Spy 1 (Schwartz, Tattersall, 1996: Fig. 2), Artenac 1 (Mann et al., 2007: Fig. 1b). Thus, it can be reasonably suggested that at least these individuals were susceptible to the development of CMS. Such a predisposition is most clearly pronounced in the individual from Artenac 1, displaying, according to the published image, porotic changes and numerous vascular impressions in the floor of the maxillary sinus (Ibid.). At the moment, we will refrain from detecting the presence of CMS in that specimen, but it can be assumed that further research will confirm the diagnosis. The abundance of dental pathologies in Neanderthals (Spikins et al., 2019; Sergi, Ascenzi, Bonucci, 1972; Condemi et al., 2012; Topić, Raščić-Konjhodžić, Sajko, 2012; Lozano et al., 2013; López-Valverde et al., 2012; Dean et al., 2013) provides additional arguments, and further increases the likelihood of high prevalence of odontogenic CMS in that species.

Owing to the absence of necessary data, it is difficult to say at present how important was the biological stress associated with CMS for the adaptive strategies of Neanderthals. The two available cases had entirely different consequences for the affected individuals, and thus, exerted different adaptive pressures on the populations. The lingering inflammation of the maxillary sinus in the Neanderthal 1 specimen, which was probably recurrent and accompanied by suppuration, is thought be an indirect cause of the death of the individual owing to the suppression of his immune system (Schultz, Schmidt-Schultz, 2015: 977). But there is no reason to suggest a marked decrease in the viability of the Chagyrskaya 57 individual, since CMS in this case was significantly weaker and likely proceeded with minimal manifestations, or asymptomatically.

An additional complication of discussing this issue is the absence of an objective possibility of identifying evidence of special care for individuals with chronic diseases, including CMS, in the Middle Paleolithic populations. Many cases of severe injuries and diseases were described in Neanderthals. Healing of such morbid conditions implied, theoretically, a serious contribution of fellow tribesmen to the care of the sick. There is evidence of possible medicinal use of some inedible plants containing anti-inflammatory and pain-relieving

substances (Hardy et al., 2012). Also, the presence of natural antibiotics from mold fungi that develop on plant debris was detected in the dental calculus of Neanderthals (Weyrich et al., 2017). However, it is still practically impossible to determine how much the special care helped the recovery of the patient in each specific case, and how much healing was due to the individual's strength of body and its immunity. The presence of traces of medicinal plants in the dental calculus of some individuals also cannot be directly linked with their specific diseases. The plants might have been used accidentally or for religious or magical purposes, while their healing properties remained unknown to the Neanderthals.

Summing up, on the basis of our analysis of the Chagyrskaya 57 specimen and published data it is possible to hypothesize that Neanderthals were anatomically predisposed to the development of odontogenic chronic CMS. Such a predisposition could have been related to the higher, as compared to modern humans, prevalence of enlargement of the alveolar recess of the maxillary sinus. The assessment of the influence of CMS on the level of biological stress in the Neanderthal populations awaits further research relying on a more representative sample.

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References

Abrahams J.J., Glassberg R.M. 1996
Dental disease: A frequently unrecognized cause of maxillary sinus abnormalities? *American Journal of Roentgenology*, vol. 166: 1219–1223.

Arefieva N.A., Vishnyakov V.V., Ivanchenko O.A., Karpishchenko S.A., Kiselev A.B., Kozlov V.S., Kozlov R.S., Kosyakov S.Y., Kochetkov P.A., Lopatin A.S., Nakatis Y.A., Otvagin I.V., Piskunov G.Z., Polyakov D.P., Turovsky A.B. 2014
Khronicheskiy rinosinusit: Patogenez, diagnostika i printsipy lecheniya (klinicheskiye rekomendatsii). Moscow: Prakt. meditsina.

Baumann M., Plisson H., Rendu W., Maury S., Kolobova K., Krivoshapkin A. 2020
Neandertalian bone industry at Chagyrskaya cave (Altai, Russia). *Quaternary International*, vol. 559: 68–88.

Biedlingmaier J.F., Whelan P., Zoarski G., Rothman M. 1996
Histopathology and CT analysis of partially resected middle turbinates. *Laryngoscope*, vol. 106: 102–104.

Boocock P., Roberts C.A., Manchester K. 1995
Maxillary sinusitis in medieval Chichester, England. *American Journal of Physical Anthropology*, vol. 98: 483–495.

Brook I. 2009
Sinusitis. *Periodontology 2000*, vol. 49: 126–139.

Buck L., Stringer C.B., MacLarnon A., Rae T.C. 2019
Variation in paranasal pneumatisation between Mid-Late Pleistocene hominins. *Bullétins et Mémoires de la Société d'Anthropologie de Paris*. URL: https://doi.org/10.3166/bmsap-2019-0056

Buskina A.V., Gerber V.K. 2000
K vorposu o klinicheskoy klassifikatsii khronicheskogo odontogennogo gaimorita. *Vestnik otorinolaringologii*, No. 2: 20–22.

Clarke N., Carey S. 1985
The aetiology of chronic periodontal disease: An alternative perspective. *Journal of American Dental Association*, No. 110: 689–691.

Condemi S., Tardivo D., Bruno F., Ricci S., Giunti P., Longo L. 2012
A case of osteolithic lesion on an Italian Neanderthal jaw. *Comptes Rendus Palevol*, vol. 11: 79–83.

Dean M.C., Rosas A., Estalrrich A., García-Tabernero A., Huguet R., Lalueza-Fox C., Bastir M., de la Rasilla M. 2013
Longstanding dental pathology in Neanderthals from El Sidrón (Asturias, Spain) with a probable familial basis. *Journal of Human Evolution*, vol. 64 (6): 678–686.

Emelyanova A.N. 2012
Klinicheskoye znacheniye variantov anatomicheskogo stroyeniya verkhnechelyustnoy i lobnoy pazukh: Cand. Sc. (Medicine) Dissertation. Kursk.

Erdogan E., Fidan V., Giritli E. 2016
Radiologic imaging in chronic sinusitis. *Different Aspects of Rhinosinusitis*. URL: https://smjournals.com/ebooks/different-aspects-rhinosinusitis/chapters/DARS-16-05.pdf

Georgalas C., Videler W., Freling N., Fokkens W. 2010
Global Osteitis Scoring Scale and chronic rhinosinusitis: A marker of revision surgery. *Clinical Otolaryngology*, vol. 35: 455–461.

Glazyev I.E., Piskunov I.S. 2017
Anatomicheskiye predposylki razvitiya odontogennogo verkhnechelyustnogo sinusita. *Rossiyskaya rinologiya*, No. 3: 35–41.

Hardy K., Buckley S., Collins M.J., Estalrrich A., Brothwell D., Copeland L., García-Tabernero A., García-Vargas S., de la Rasilla M., Lalueza-Fox C., Huguet R., Bastir M., Santamaría D., Madella M., Wilson J., Fernández Cortés A., Rosas A. 2012
Neanderthal medics? Evidence for food, cooking, and medicinal plants entrapped in dental calculus. *Naturwissenschaften*, Bd. 99: 617–626.

Jenkins W.M., Kinane D.F. 1989
The 'high risk' group in periodontitis. *British Dental Journal*, No. 167: 168–171.

Kolobova K.A., Chabai V.P., Shalagina A.V., Krajcarz M.T., Krajcarz M., Rendu W., Vasiliev S.K., Markin S.V., Krivoshapkin A.I. 2019
Exploitation of the natural environment by Neanderthals from Chagyrskaya Cave (Altai). *Quartär*, vol. 66: 7–31.

Kolobova K., Roberts R., Chabai V., Jacobs Z., Krajcarz M., Shalagina A., Krivoshapkin A., Li B., Uthmeier T., Markin S., Morley M., O'Gorman K., Rudaya N., Talamo S., Viola B., Derevianko A. 2020
Archaeological evidence for two separate dispersals of Neanderthals into Southern Siberia. *PNAS*, vol. 117 (6): 2879–2885.

Kolobova K.A., Shalagina A.V., Chabai V.P., Markin S.V., Krivoshapkin A.I. 2019
Signification des technologies bifaciales au Paléolithique moyen des montagnes de l'Altaï. *L'Anthropologie*, vol. 123 (2): 276–288.

Lewis M.E., Roberts C.A., Manchester K. 1995
Comparative study of the prevalence of maxillary sinusitis in Later Medieval urban and rural populations in Northern England. *American Journal of Physical Anthropology*, vol. 98: 497–506.

López-Valverde A., López-Cristiá M., Prados-Frutos J.C., Gómez de Diego R., de Vicente J., Cutando A. 2012
Oral pathology in the Iberian Neanderthals. *African Journal of Biotechnology*, vol. 11 (23): 6359–6363.

Lozano M., Subirà M.E., Aparicio J., Lorenzo C., Gómez-Merino G. 2013
Toothpicking and periodontal disease in a Neanderthal specimen from Cova Foradà site (Valencia, Spain). *PLoS ONE*, vol. 8 (10). URL: https://doi.org/10.1371/journal.pone. 0076852

Mafee M.F., Tran B.H., Chapa A.R. 2006
Imaging of rhinosinusitis and its complications: Plain film, CT, and MRI. *Clinical Reviews in Allergy and Immunology*, vol. 30: 165–186.

Mafessoni F., Grote S., de Filippo C., Slon V., Kolobova K.A., Viola B., Markin S.V., Chintalapati M., Peyregne S., Skov L., Skoglund P., Krivoshapkin A.I., Derevianko A.P., Meyer M., Kelso J., Peter B., Prüfer K., Pääbo S. 2020
A high-coverage Neandertal genome from Chagyrskaya Cave. *PNAS*, vol. 117 (26): 15133–15136.

Mann A., Vandermeersch B., Delagnes A., Tournepiche J.-F. 2007
Human fossil remains from the Mousterian levels of Artenac (Charente). *Comptes Rendus Palevol*, vol. 6: 581–589.

Momeni A.K., Roberts C.C., Chew F.S. 2008
Imaging of chronic and exotic sinonasal disease: Review. *American Journal of Roentgenology*, vol. 189 (suppl. 6): 35–45.

Mukovozov I.N. 1982
Differentsialnaya diagnostika khirurgicheskikh zabolevaniy chelyustno-litsevoy oblasti. Leningrad: Meditsina.

Ogden A. 2007
Advances in the palaeopathology of teeth and jaws. In *Advances in Human Palaeopathology*, R. Pinhasi, S. Mays (eds.). Chichester: John Wiley & Sons, Ltd, pp. 283–307.

Panhuysen R., Coenen V., Bruintjes T. 1997
Chronic maxillary sinusitis in medieval Maastricht, the Netherlands. *International Journal of Osteoarchaeology*, vol. 7: 610–614.

Rae T.C., Koppe T., Stringer C.B. 2011
The Neanderthal face is not cold adapted. *Journal of Human Evolution*, vol. 60: 234–239.

Roberts C.A. 2007
A bioarcheological study of maxillary sinusitis. *American Journal of Physical Anthropology*, vol. 133: 792–807.

Schultz M. 2006
Results of the anatomical-palaeopathological investigations on the Neanderthal skeleton from the Kleine Feldhofer Grotte (1856) including the new discoveries from 1997/2000. *Rheinische Ausgrabungen*, vol. 58: 277–318.

Schultz M., Schmidt-Schultz T.H. 2015
Paleopathology: Vestiges of pathological conditions in fossil human bone. In *Handbook of Paleoanthropology*. Berlin, Heidelberg: Springer, pp. 969–981.

Schwartz J.H., Tattersall I. 1996
Significance of some previously unrecognized apomorphies in the nasal region of *Homo neanderthalensis. PNAS*, vol. 93: 10852–10854.

Sergi S., Ascenzi A., Bonucci E. 1972
Torus palatinus in the Neanderthal Circeo I skull. A histologic, microradiographic and electron microscopic investigation. *American Journal of Physical Anthropology*, vol. 36: 189–197.

Shalagina A.V., Kharevich V.M., Mori S., Bomann M., Krivoshapkin A.I., Kolobova K.A. 2020
Rekonstruktsiya tekhnologicheskikh tsepochek proizvodstva bifasialnykh orudiy v industrii Chagyrskoy peshchery. *Sibirskiye istoricheskiye issledovaniya*, No. 3: 130–151.

Sipkin A.M., Nikitin A.A., Lapshin V.P., Nikitin D.A., Chukumov R.M., Kryazhinova I.A. 2013
Verkhnechelyustnoy sinusit: Sovremenniy vzglyad na diagnostiku, lecheniye i reabilitatsiyu. *Almanakh klinicheskoy meditsiny*, No. 28: 82–87.

Skov L., Peyrégne S., Popli D., Lasi L.M.N., Devièse T., Slon V., Zavala E.I., Hajdinjak M., Sümer A.P., Grote S., Bossom A.M., López D.H., Nickel B., Nagel S., Richter J., Essel E., Gansauge M., Schmidt A., Korlevic P., Comeskey D., Derevianko A.P., Kharevich A., Markin S.V., Talamo S., Douka K., Krajcarz M.T., Roberts R.G., Higham T., Viola B., Krivoshapkin A.I., Kolobova K.A., Kelso J., Meyer M., Pääbo S., Peter B.M. 2022
Genetic insights into the social organization of Neanderthals. *Nature*. (In press).

Slavin R.G., Spector S.L., Bernstein I.L. 2005
The diagnosis and management of sinusitis: A practice parameter update. *Journal of Allergy and Clinical Immunology*, vol. 116: 13–47.

Slon V., Mafessoni F., Vernot B., Filippo C. de, Grote S., Viola B., Hajdinjak M., Peyrégne S., Nagel S., Brown S., Douka K., Higham T., Kozlikin M.B., Shunkov M.V., Derevianko A.P., Kelso J., Meyer M., Prüfer K., Pääbo S. 2018
The genome of the offspring of a Neanderthal mother and a Denisovan father. *Nature*, vol. 561: 113–116.

Snidvongs K., Earls P., Dalgorf D., Sacks R., Pratt E., Harvey R.J. 2014
Osteitis is a misnomer: A histopathology study in primary chronic rhinosinusitis. *International Forum of Allergy and Rhinology*, vol. 4 (5): 390–396.

Spikins P., Needham A., Wright B., Dytham C., Gatta M., Hitchens G. 2019
Living to fight another day: The ecological and evolutionary significance of Neanderthal healthcare. *Quaternary Science Review*, vol. 217: 98–118.

Sundman E.A., Kjellström A. 2013
Chronic maxillary sinusitis in medieval Sigtuna, Sweden: A study of sinus health and effects on bone preservation. *International Journal of Osteoarchaeology*, vol. 23 (4): 447–458.

Tattersall I. 2002
The case for saltational events in human evolution. *The Speciation of Modern Homo sapiens*: *Proceedings of the British Academy*, vol. 106: 49–59.

Teul I., Lorkowski J., Lorkiewicz W., Nowakowski D. 2013
Sinusitis in people living in the medieval ages. In *Neurobiology of Respiration: Advances in Experimental Medicine and Biology*. Dordrecht: Springer, pp. 133–138.

Topić B., Raščić-Konjhodžić H., Sajko M.Č. 2012
Periodontal disease and dental caries from Krapina Neanderthal to contemporary man – skeletal studies. *Acta Medica Academica*, vol. 41 (2): 119–130.

Vernot B., Zavala E.I., Gómez-Olivencia A., Jacobs Z., Slon V., Mafessoni F., Romagné F., Pearson A., Petr M., Sala N., Pablos A., Aranburu A., Castro J.M.B., de Carbonell E., Li B., Krajcarz M.T., Krivoshapkin A.I., Kolobova K.A., Kozlikin M.B., Shunkov M.V., Derevianko A.P., Viola B., Grote S., Essel E., Herráez D.L., Nagel S., Nickel B., Richter J., Schmidt A., Peter B., Kelso J., Roberts R.G., Arsuaga J.-L., Meyer M. 2021
Unearthing Neanderthal population history using nuclear and mitochondrial DNA from cave sediments. *Science*, vol. 372 (6542).

Weyrich L.S., Duchene S., Soubrier J., Arriola L., Llamas B., Breen J., Morris A.G., Alt K.W., Caramelli D., Dresely V., Farrell M., Farrer A.G., Francken M., Gully N., Haak W., Hardy K., Harvati K., Held P., Holmes E.C., Kaidonis J., Lalueza-Fox C., de la Rasilla M., Rosas A., Semal P., Soltysiak A., Townsend G., Usai D., Wahl J., Huson D.H., Dobney K., Coope A. 2017
Neanderthal behavior, diet, and disease inferred from ancient DNA in dental calculus. *Nature*, vol. 544: 357–361.

Zollikofer C.P.E., Ponce de Leon M., Schmitz R.W., Stringer C.B. 2008
New insights into Mid-Late Pleistocene fossil hominin paranasal sinus morphology. *Anatomical Record*, vol. 291: 1506–1516.

Zubova A.V., Ananyeva N.I., Moiseyev V.G., Stulov I.K., Dmitrenko L.M., Obodovskiy A.V., Potrakhov N.N., Kulkov A.M., Andreev E.V. 2020
The use of computed tomography for the study of chronic maxillary sinusitis: Based on crania from the Pucará De Tilcara Fortress, Argentina. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 48 (3): 143–153.

Zubova A.V., Moiseyev V.G., Ananyeva N.I., Stulov I.K., Andreev E.V. 2022
Chronic maxillary sinusitis recorded in archaeological samples: Geographical distribution and predisposing factors. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 50 (1): 147–157.

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Analysis of 3D-Models of Artificially Deformed Crania, Using Geometric Morphometry

The study of artificially deformed crania is complicated by difficulties in analyzing curvilinear shapes without reliable reference points for measurement. Methods of geometric morphometrics (GM) help to solve this problem. We generated 3D-models of deformed crania (26 male and 19 female) from burials of different chronological periods of the Okunev archaeological culture (Verkhniy Askiz I, Uybat III and V, Uybat-Charkov, Itkol I and II), Southern Siberia (2600–1700 BC). Using the Landmark IDAV software, each model was transformed into a set of six traditional craniometric landmarks and 450 semi-landmarks regularly distributed over the entire surface of the braincase. For further processing with the Procrustes and principal component analysis, functions of several R-packages (Morpho, Geomorph, and Arothron) were employed. Crania from early Okunev burials were found to have a small deformed area around lambda, spanning the posterior parts of parietal bones and the upper part of the occipital squama. In crania from later Okunev burials, the deformation extends on the parietal area, causing the reduction of cranial height owing to a lesser curvature of the parietal segment. The lateral walls of the braincase, the frontal squama, and the lower part of the occipital squama in such crania are more convex.

Keywords: *Craniology, artificial cranial deformation, geometric morphometrics, 3D-models, Okunev culture.*

Introduction

Artificially deformed crania are much rarer employed in craniometric studies than undeformed skulls (Tiesler, 2012: 33; 2014: 4). One of the reasons for this is the difficulty of describing varying patterns of deformation of such crania, using traditional typological schemes (Natahi et al., 2019; Kazarnitsky, Kapinus, Grigoriev, 2021). Another reason is the influence of the deformation on the initial size and shape of the crania, which obstructs the use of their data for studying population history. But the advent of novel methods of morphometric analysis—geometric morphometrics (GM) (Bookstein, 1991, 1997; Slice, 2005; Vasiliev, Vasilieva, Shkurikhin, 2018; and others)—stimulates researchers to turn back to this "inconvenient" object of study (Mayall, Pilbrow, 2018; Natahi et al., 2019; Gromov, Kazarnitsky, 2020; and others).

Unlike "traditional" morphometrics (TM), GM does not employ linear measurements, but rather

coordinates of landmarks placed on objects of any shape, including those problematic for measuring. An additional advantage of GM is the possibility to exclude the influence of the absolute dimensions, which is possible at the stage of central adjustment, scaling, and rotation. Multidimensional statistical methods, including the principal component analysis (PCA), are applicable for analyzing GM data in just the same way they are for TM data (Vasiliev, Vasilieva, Shkurikhin, 2018: 33–124).

In this study, we turn to the collections of crania of the Okunev archaeological culture, known for their artificial deformation (Zhirov, 1940; Benevolenskaya, Gromov, 1997; Gromov, 1998). The history of the study of deformation in those collections reflects the development of methods for describing the shape of the cranial vault. The Okunev culture occupied the Minusinsk basin in Southern Siberia from the 26th to 18th centuries BC (Maksimenkov, 1965; Vadetskaya, 1986: 27–36; Polyakov, Svyatko, 2009). Sites of this culture can be divided into several chronological horizons, gradually changing one another during the continuous development of the culture over a long period of time (Lazaretov, 2019). Three of those horizons contained cranial collections of a satisfactory sample size: the early Uibat (26th–25th centuries BC) and Tas-Khazaa (24th century BC), and the relatively late Chernovaya (22nd–20th centuries BC).

The first mention of the deformed crania from the Okunev Ulus cemetery was made by E.V. Zhirov (1940) in the time when the term "Okunev culture" had not yet been coined. This conclusion by Zhirov was based on visual assessment of the shape of the skull—an easy and convenient though subjective method. Further, Zhirov developed a visual scheme of classification of the types of artificial deformation (Ibid.). However, the absence of objective criteria was likely the reason why later, when the Okunev archaeological culture was singled out by G.A. Maksimenkov (1965), some researchers expressed doubts regarding the cause that produced the specific shape of the Okunev skulls (Alekseev, Gokhman, Tumen, 1987). Only a morphometric study employing metric variables describing the occipital and parietal regions of the cranial vault (indexes of the shape and height of the occiput) was able to demonstrate the artificial nature of the changes in the shape of Okunev skulls (Benevolenskaya, Gromov, 1997). But those indexes have a disadvantage of being dependent on the reference points of the coordinate system put forward by Y.D. Benevolenskaya (1976: 25–28) for describing the occipital region of the skull. If the deformed area does not fit into the region containing the reference points (i.e. the pole of the occiput and the projection of the *opistion* point on the sagittal suture), the identification of the deformation becomes impossible (Gromov, 2004).

The next step in studying the artificially deformed crania of the Okunev people was related to the transition from measuring single linear distances and calculating their indexes to studying the shape of the sagittal outline in general. This became possible due to the use of GM methods. These are particularly relevant, because in the Okunev skulls, the deformed area can be rather small and then only subtly affects the shape of the vault. In such cases, the severity of the deformation cannot be described via linear measurements.

Our analysis of the sagittal outlines of the deformed crania has demonstrated systematic differences in the patterns of deformation in the early and late Okunev samples (Gromov, Kazarnitsky, 2022). The deformed area in the skulls from the earlier horizons is relatively small and is placed near *lambda*. It affects the upper part of the occipital squama and the posterior part of the parietal bones, while it likely does not affect the height of the vault. In the later samples, the deformation is stronger pronounced and covers almost the whole parietal region, decreasing the vertical diameter of the skull. However, the variation of the sagittal outline does not reflect all the consequences of the artificial deformation. In order to obtain information regarding the variation of the cranial vault in general and to develop a protocol for analyzing 3D-models, we performed 3D-scanning of the same collections.

Material and methods

Well-preserved skulls displaying visually discernible signs of deformation were selected from the samples of the Okunev culture. The high requirements to the state of preservation have led to a reduction of the sample size as compared to our previous research of the sagittal outlines (Gromov, Kazarnitsky, 2022): 26 male and 19 female skulls were studied instead of 35 and 28, respectively. Crania from the following sites were sampled: Verkhny Askiz I, Uibat III and V, Uibat-Charkov, Itkol I and II (excavated by S.V. Khavrin, A.A. Kovalev, I.P. Lazaretov, A.V. Polyakov, S.V. Morozov). All the collections are presently kept at the Museum of Anthropology and Ethnography RAS.

The skulls were scanned using the RangeVision Spectrum device and the RangeVision ScanCenter NG 2021.2 software, using a medium-sized calibration field. The precision of placing a 3D-landmark was 0.06 mm; projector resolution 1280 × 800 pixels; camera resolution 2048 × 1536 pixels. Each 3D-model was initially exported as a cloud of 1.5 to 2.0 points in the PLY format (3–4 millions of polygons). But later, lighter models (22,500 points, 45,000 polygons) proved to be more convenient.

As our main objective was to analyze variation of the cranial vault, the facial parts of the 3D-models were removed during obtaining the sample via the tools available in RangeVision ScanCenter NG. The need for this removal was related to our intention to use the virtual digitizer of the Geomorph package in R. But later, preference was given to the Landmark IDAV software, and the step of removing the facial parts turned out to be redundant.

Further, the PLY-files were converted to the ASCII format in order to present the raw data as a text rather than a binary document. This was necessary to process the data in various programs, i.e. Landmark IDAV or R-Studio. The type of formatting was changed in MeshLab via switching off the "Binary encoding" variant of extension when exporting a file.

The shape of an object can be described in GM using two types of landmarks. The first is landmarks in a narrow sense, which are placed on homologous elements of the shape defined by strict morphological criteria. Landmarks of this type, in turn, can be divided into three categories: points at the contact between homologous elements; points of maximum curvature (concavity or convexity); and marginally delimiting points. The traditional craniometric points (Alekseev, Debets, 1964: 41–48) all belong to this first type of landmarks. The second type (semilandmarks) was developed for describing smooth spherical or extremely complex shapes, and was, thus, more suitable for our study. Semilandmarks are the points placed at an equal distance from each other along a line connecting "true" landmarks (of the first type). The more semilandmarks are placed the better their array describes the outline of an element of shape; therefore, landmarks of this type are sometimes referred to as "outline semilandmarks" (see (Vasiliev, Vasilieva, Shkurikhin, 2018: 46–53; Pavlinov, Mikeshina, 2002)).

Both types of landmarks were employed in the present study. Six anatomical landmarks and 450 semilandmarks were placed on each of the 3D cranial models in Landmark IDAV (Wiley, 2006). The following craniometric points were employed (Alekseev, Debets, 1964: 45–47): 1) frontomalare orbitale, left; 2) nasion; 3) frontomalare orbitale, right; 4) porion, right; 5) opistion; 6) porion, left. The surface delimited by those points (excluding the cranial base) was evenly filled with semilandmarks divided into two symmetric networks (patches) covering the left and right sides of the cranial vault, 225 (15 × 15) semilandmarks each (Fig. 1). The coordinates of the landmarks and semilandmarks were exported in

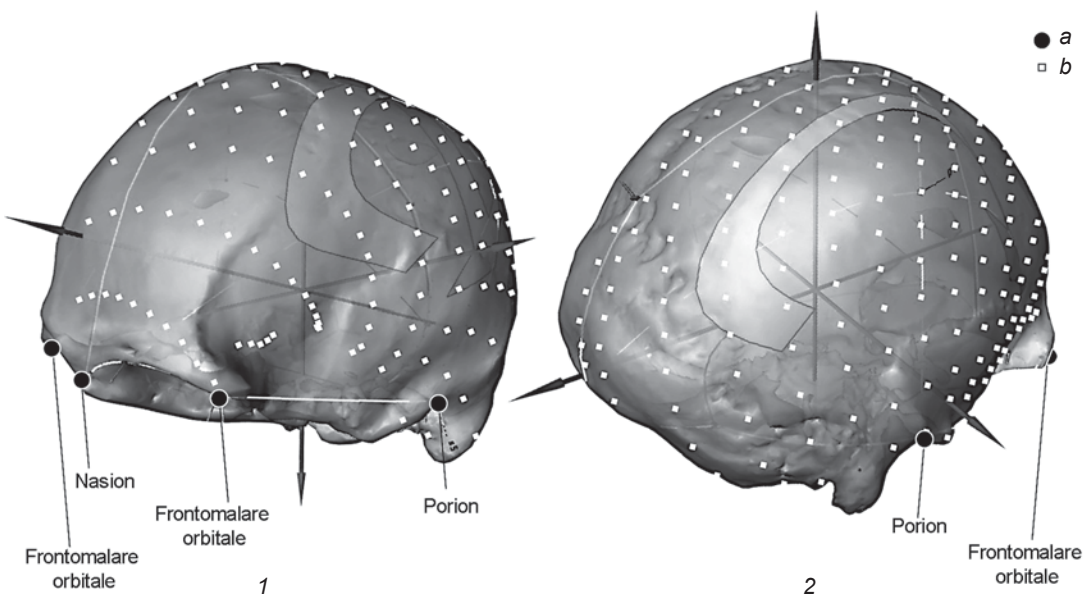

Fig. 1. Landmarks (*a*) and semilandmarks (*b*) on a 3D-model of the cranial vault.
1 – left patch; *2* – right patch.

the PTS format for individual skulls, and in the DTA format for the whole sample.

The following procedures of the Generalized Procrustes Analysis (GPA), including calculation of the mean shape and Procrustes coordinates, PCA, and visualization of the main trends of variation as "heat maps" were carried out in R-Studio. The R language for statistical analyses targets a wide range of users, which makes it relatively easy to master and employ. A large number of open-source program packages have been created to date, using this language. All the functions of R are available for editing and addition by any researcher. By using various packages and editing existing functions, it is possible to develop new statistical algorithms for particular research aims. There are a number of GM packages for creating databases and statistical analyses in R. Three of these were employed in this study: Morpho/Rvcg, Geomorph, and Arothron (Schlager, 2017; Adams, Otarola-Castillo, 2013; Antonio et al., 2021).

Results and discussion

Most of the analyses were carried out in the Morpho and Rvcg packages, created by the same author (Schlager, 2017) and related to each other. The first of the packages contains functions for employing the GM techniques. The second, an immediate extension of the first, can be used for modeling and surface warping. The Geomorph package (Adams, Otarola-Castillo, 2013) largely duplicates the functions of Morpho, and could be used as the main tool of the analysis. However, in this study, we employed only one function of Geomorph, absent in Morpho—computation of a mean 3D-model.

The Arothron package (Antonio et al., 2021) was rather an accessory tool, containing some additional functions widening the possibility of presenting and visualizing the results. This package was specifically developed for visual presentation of anthropological objects. Some of its functions are related to working with 3D-models, virtual reconstructions, and restoration of skeletal elements, while others facilitate the visual representation of the results. One of the functions can be used for creating "heat maps", which demonstrate local differences in shape via mapping some areas of the object as "warm" (mainly orange) or "cold" (mainly blue) colors.

The algorithm of working in R we followed in this study can be broadly divided into three stages: import of the data, statistical analysis, and visualization of the results in the form of plots and "heat maps". Morpho and Geomorph were used for the first two stages, while some functions of Arothron and other graphic editors were employed at the third stage.

The *read.ply* and *read.pts* functions were utilized for importing the data to the workspace of R. These functions upload PLY-files of 3D-models and PTS-files containing landmark and semilandmark coordinates. These raw data were then transformed to arrays using the *list2array* function of Morpho in order to prepare the data for further operations.

The mean shape (i.e. the configuration of landmarks describing the average shape of a particular sample) was calculated at the second stage by the *ProcGPA* function of Morpho. It was extracted using the *aggregate* and *vecx* functions, and then a PCA was carried out employing the *procSym* function of the same package. The PCA values for individual skulls, as well as the proportion of the total variance described by the PCs, were exported for drawing scatterplots in an external graphics editor.

At the last stage, the "heat maps" visualizing the morphological changes associated with particular PCs were created. The areas displaying the highest level of morphological variation are depicted in the 3D-models via the gradations of color (Fig. 2–4), ranging from red and orange (maximum and intermediate expression of a trait—the degree of convexity of an area of the cranial vault in this particular case) to violet and blue (weak or the weakest convexity of an area). The areas exhibiting no shape change were colored in white.

Building a "heat map" requires an averaged 3D-model, and coordinates of the mean shape and the individuals displaying extreme values of the PCs. The averaged 3D-models were created in Geomorph, using the model of one of the skulls in the sample whose shape was the closest to the mean shape. Such skulls have been detected using the *findMeanSpec* function, and then the averaged 3D-model was calculated by *warpRefMesh*. The extraction of the extreme morphological variants was beginning with the creation of the shapes representing the maximal and minimal values of the PCs, using the *restoreShapes* function in Morpho. These were further transformed employing the thin-plate spline interpolation (Morpho, *tps3d*). When all the necessary data were extracted, the "heat maps" representing the "poles" of the morphological variation in the sample were created using the *localmeshdiff* function of Arothron.

The algorithm outlined above was employed for exploring the trends in variation of the 3D-models of the deformed crania from the Okunev burials.

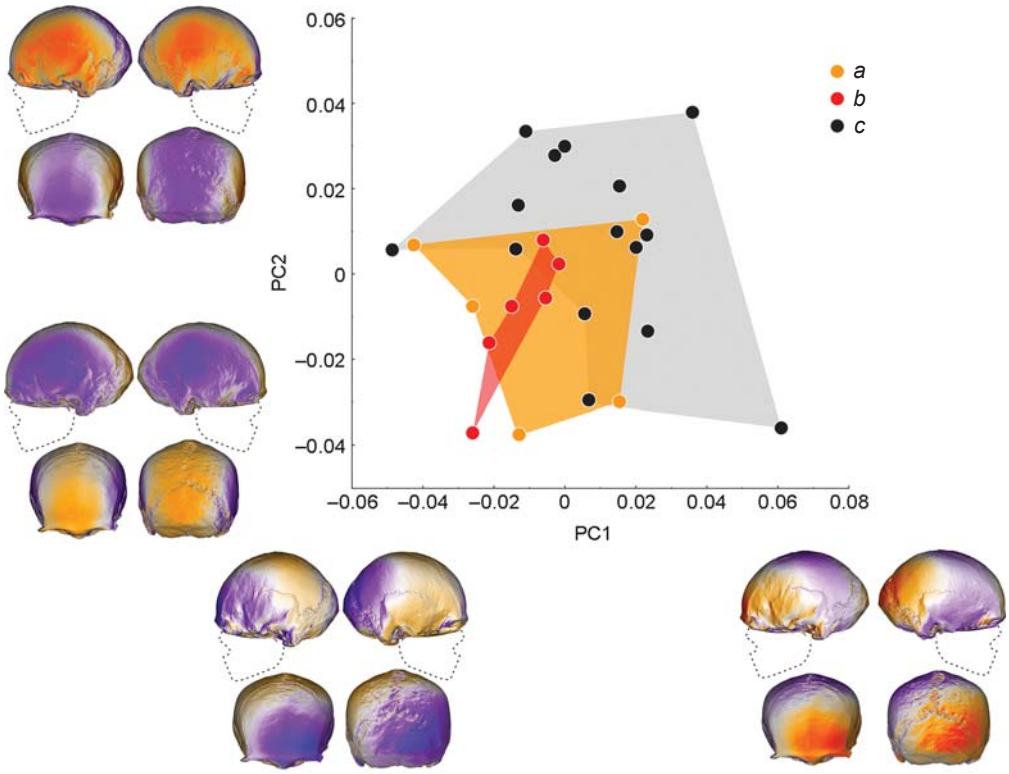

Fig. 2. Principal component analysis of the male sample (PC1 and PC2).
a – Uibat chronological horizon; b – Tas-Khazaa chronological horizon; *c* – Chernovaya chronological horizon.

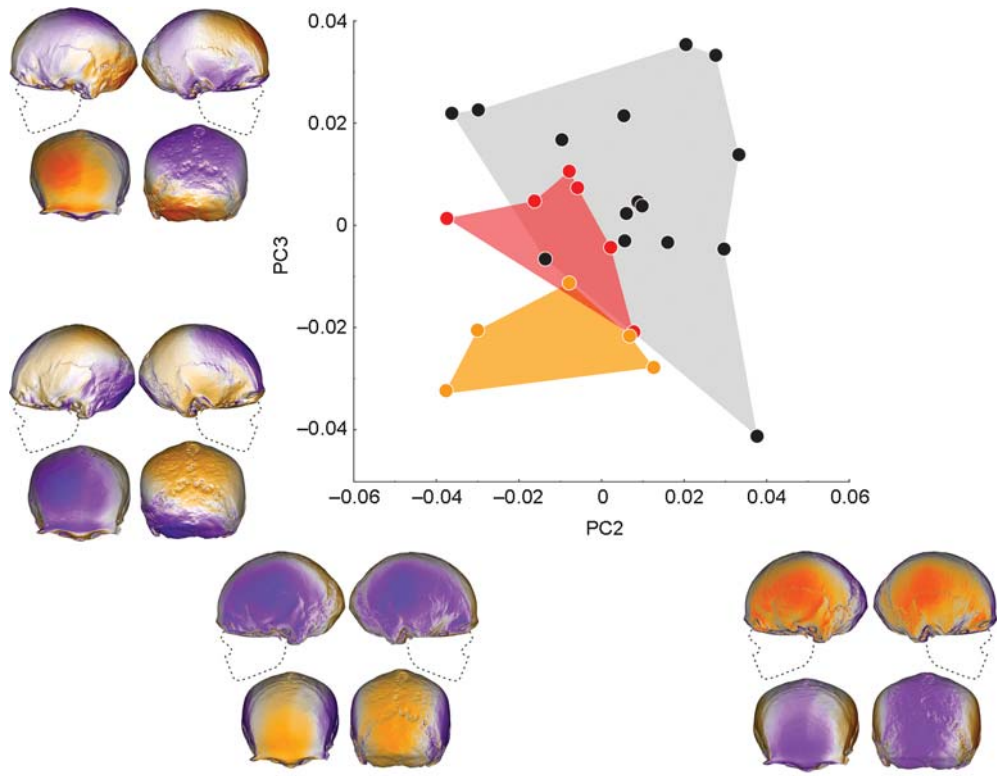

Fig. 3. Principal component analysis of the male sample (PC2 and PC3).
Legend same as on Fig. 2.

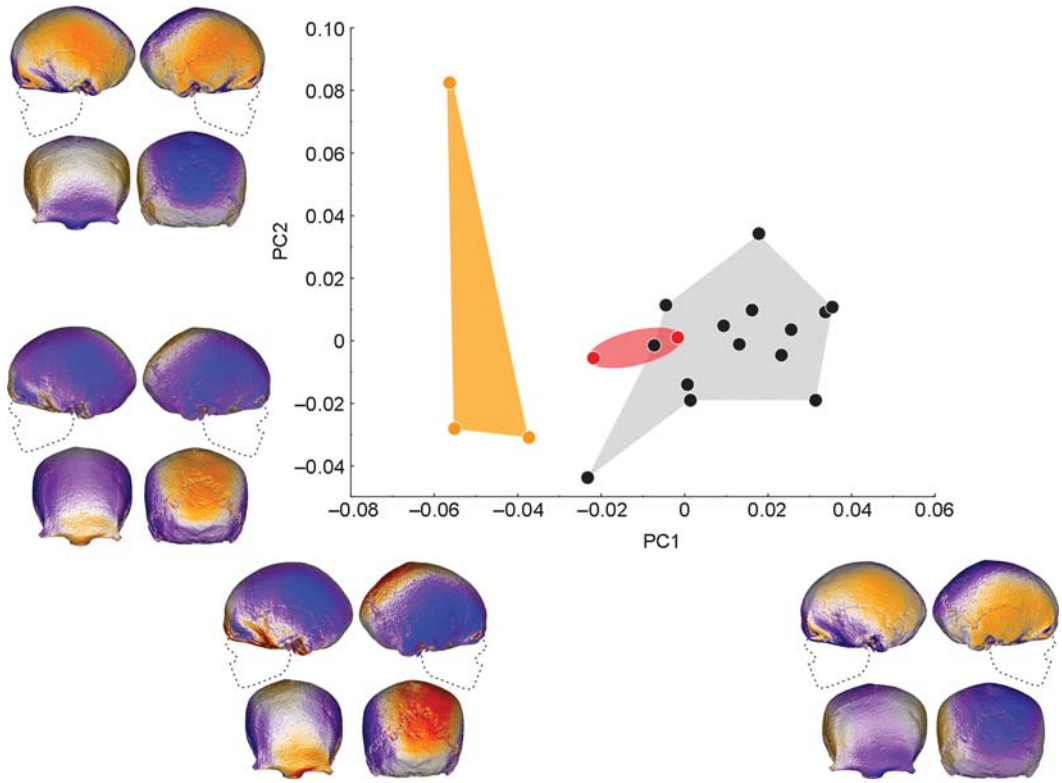

Fig. 4. Principal component analysis of the female sample (PC1 and PC2).
Legend same as on Fig. 2.

The first three PCs of the analysis of the Procrustes coordinates in the male sample account for 38 % of the total variance: PC1 – 15.4 %; PC2 – 12.6 %; PC3 – 10.1 %. The "heat maps" of the cranial models are depicted near the respective axes of the plot (Fig. 2–4) in four projections: left and right lateral, frontal, and occipital. The maps show the shapes associated with minimal negative and maximal positive values of the PCs.

The "heat maps" show that PC1 (see Fig. 2) describes the change from relatively tall vaults (with a more prominent parietal area) to relatively low crania (more bossing in the frontal and occipital parts). PC2 (see Fig. 2, 3) is associated with the variation of the sagittal outline and the width of the vault: a more convex sagittal outline (according to the position of the orange zones along the sagittal axis) is correlated with flatter lateral walls of the vault, and *vice versa*. These two PCs (see Fig. 2) together account for almost a third of the total variance, and demonstrate the difference between the individuals belonging to the early and late Okunev burials. The former (Uibat and Tas-Khazaa) are usually relatively tall, while the latter (Chernovaya) exhibit a relatively low cranial vault and more convex temporo-parietal areas.

The degree of occipito-parietal flattening is described by PC3 (see Fig. 3): this feature ranges from weak flattening, accompanied by a relatively high parietal curvature, to strong flattening, with more bossing frontal bone and the lower part of the occipital squama. The skulls of the three chronological horizons display the clearest separation in the plot (see Fig. 3): not only are the early groups different from the late groups, but also the two early samples are distinct. The chronologically earliest individuals from Uibat exhibit a combination of the least pronounced occipital-parietal flattening and the least convexity of the lateral walls with a tall cranial vault.

The analysis of the female sample has shown a clear separation of the skulls from different chronological horizons along the first PC, which accounts for 21 % of the total variance (see Fig. 4). This axis describes the variation trend from tall cranial vaults with the least flattening of the parietal bones and the upper part of the occipital squama (with the lateral walls of the walls being vertically oriented) towards relatively low crania displaying a weaker height of the curvature of the vertex (with the temporo-parieatal areas being more convex or bossing). The individuals from Uibat occupy the former pole of PC1, while the skulls from

Chernovaya occupy the latter. The two chronologically intermediate individuals from Tas-Khazaa appeared to be morphologically intermediate as well.

Thus, our analysis of 3D-models of the deformed crania of the Okunev people has demonstrated a gradual change in their morphology at the transition from the early to late periods of the development of the culture, which was likely associated with a modification of the construction of the cradle and/or some accessories placed therein (Benevolenskaya, Gromov, 1997: 293). The pattern of morphological changes with time is the same for males and females.

Conclusions

The analytical algorithm put forward in the present study fosters the application of GM methods for the analysis of 3D-models with free-ware R packages and the Landmark software. The advantages of the algorithm were demonstrated using an example of a sample of deformed crania of bearers of the Okunev archaeological culture. We can recommend using this algorithm in morphological studies of any objects, both biological and archaeological.

Our analysis has shown the differences in the localization of the deformed areas in the Okunev skulls from different chronological horizons. The study of the 3D-models has demonstrated that the increase in the severity of the parietal deformation (which is typical of the individuals from later burials) led to a decrease in the height of the cranial vault due to a flattening of its parietal region, and to an increased convexity of the lateral walls of the skull, frontal bone, and lower part of the occipital squama. Nevertheless, most of the features of shape differentiating the skulls of the early and late horizons reside in the mid-sagittal plane of the vault.

References

Adams D.C., Otarola-Castillo E. 2013

Geomorph: An R package for the collection and analysis of geometric morphometric shape data. *Methods in Ecology and Evolution*, vol. 4 (4): 393–399.

Alekseev V.P., Gokhman I.I., Tumen D. 1987

Kratkiy ocherk paleoantropologii Tsentralnoy Azii. In *Arkheologiya, etnografiya i antropologiya Mongolii (kamenniy vek – epokha rannego zheleza)*. Novosibirsk: Nauka, pp. 208–241.

Alekseev V.P., Debets G.F. 1964

Kraniometriya: Metodika antropologicheskikh issledovaniy. Moscow: Nauka.

Antonio P., Costantino B., Silvia C., Marina M., Paolo P., Alessio V., Pasquale R. 2021

Arothron: An R package for geometric morphometric methods and virtual anthropology applications. *American Journal of Physical Anthropology*, vol. 176 (1): 144–151.

Benevolenskaya Y.D. 1976

Problemy etnicheskoy kraniologii: Morfologiya zatylochnoy oblasti cherepa. Leningrad: Nauka.

Benevolenskaya Y.D., Gromov A.V. 1997

Morfologiya zatylochno-temennoy oblasti cherepov okunevskoy kultury. In *Okunevskiy sbornik*. St. Petersburg: Petro-RIF, pp. 288–293.

Bookstein F.L. 1991

Morphometric tools for landmark data: Geometry and biology. Cambridge: Cambridge Univ. Press.

Bookstein F.L. 1997

Landmark methods for forms without landmarks: Morphometrics of group differences in outline shape. *Medical Image Analysis*, vol. 1 (3): 225–243.

Gromov A.V. 1998

K voprosu ob iskusstvennoy deformatsii cherepov okunevskoy kultury. In *Sibir v panorame tysyacheletiy: Materialy Mezhdunar. simp.*, vol. 1. Novosibirsk: IAET SO RAN, pp. 147–156.

Gromov A.V. 2004

Temennaya i zatylochno-temennaya deformatsiya u drevnego naseleniya sredneyeniseiskikh stepey: Morfologiya i obryad. In *OPUS: Mezhdistsiplinarniye issledovaniya v arkheologii*, iss. 3. Moscow: Izd. IA RAN, pp. 162–170.

Gromov A.V., Kazarnitsky A.A. 2020

Shulluktepa: Deformatsiya golovy kak populyatsionniy marker. In *Naseleniye rannego zheleznogo veka i Srednevekovya Severnoy Yevrazii po materialam muzeinykh kollektsiy*. St. Petersburg: MAE RAN, pp. 575–595. (Sb. MAE; vol. LXVII).

Gromov A.V., Kazarnitsky A.A. 2022

Iskusstvennaya deformatsiya golovy u rannikh okunevtsev. *Arkheologicheskiye vesti*, iss. 34: 266–274.

Kazarnitsky A.A., Kapinus Y.O., Grigoriev A.P. 2021

Ob iskusstvennoy deformatsii cherepov stepnykh kultur epokhi bronzy. *Stratum plus*, No. 2: 307–318.

Lazaretov I.P. 2019

Khronologiya i periodizatsiya okunevskoy kultury: Sovremennoye sostoyaniye i perspektivy. *Teoriya i praktika arkheologicheskikh issledovaniy*, No. 4: 15–50.

Maksimenkov G.A. 1965

Okunevskaya kultura v Yuzhnoy Sibiri. In *Novoye v sovetskoy arkheolog*ii, E.I. Krupnov (ed.). Moscow: Nauka, pp. 168–174. (MIA; No. 130).

Mayall P., Pilbrow V. 2018

Generalized Procrustes analysis of an ontogenetic series of modified crania: Evaluating the technique of modification in the Migration Period of Europe (4th–7th century AD). *American Journal of Physical Anthropology*, vol. 166 (1): 156–169.

Natahi S., Coquerelle M., Pereira G., Bayle P. 2019

Neurocranial shape variation among Tarascan populations: Evidence for varying degrees in artificially modified crania in pre-Hispanic West Mexico (1200–1400 AD). *American Journal of Physical Anthropology*, vol. 170 (3): 418–432.

Pavlinov I.Y., Mikeshina N.G. 2002

Printsipy i metody geometricheskoy morfometrii. *Zhurnal obshchey biologii*, vol. 63 (6): 473–493.

Polyakov A.V., Svyatko S.V. 2009
Radiouglerodnoye datirovaniye arkheologicheskikh pamyatnikov neolita – nachala zheleznogo veka Srednego Yeniseya: Obzor rezultatov i noviye danniye. In *Teoriya i praktika arkheologicheskikh issledovaniy*, iss. 5. Barnaul: Izd. Alt. Gos. Univ., pp. 20–56.

Schlager S. 2017
Morpho and Rvcg – Shape Analysis in R: R-Packages for geometric morphometrics, shape analysis and surface manipulations. In *Statistical Shape and Deformation Analysis*. New York: Academic Press, pp. 217–256.

Slice D.E. 2005
Modern Morphometrics in Physical Anthropology. New York: Kluwer Academic / Plenum Publishers.

Tiesler V. 2012
Studying cranial vault modifications in ancient Mesoamerica. *Journal of Anthropological Science*, vol. 90: 33–58.

Tiesler V. 2014
The Bioarchaeology of Artificial Cranial Modifications. New Approaches to Head Shaping and its Meanings in Pre-Columbian Mesoamerica and Beyond. New York: Springer.

Vadetskaya E.B. 1986
Arkheologicheskiye pamyatniki v stepyakh Srednego Yeniseya. Leningrad: Nauka.

Vasiliev A.G., Vasilieva I.A., Shkurikhin A.O. 2018
Geometricheskaya morfometriya: Ot teorii k praktike. Moscow: KMK.

Wiley D.F. 2006
Landmark Editor 3.0. IDAV. Davis: Univ. of California.

Zhirov E.V. 1940
Ob iskusstvennoy deformatsii golovy. *KSIIMK*, iss. VIII: 81–88.

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Dental Data on the Origin of the Early Iron Age Bolshaya Rechka Population in the Upper Ob Area, and the Differentiation Between the Kamen and Bolshaya Rechka Cultures

This dental study addresses the origin of the Bolshaya Rechka people in the Novosibirsk region of the Ob, with reference to the migration of Saka and Sarmatian tribes from the southwest. I compare dental features of southern Kamen and northern Bolshaya Rechka populations inhabiting the entire Upper Ob area. Dental samples from eleven Bolshaya Rechka cemeteries were studied. Findings indicate heterogeneity. Nearly all samples evidence admixture between eastern and western groups. That from Bystrovka-3 takes a separate position, revealing more eastern traits along with those marking the Southern Siberian Upper Paleolithic complex. The results enable us to evaluate the role of Saka and Sarmatian migrants from Kazakhstan, Cis-Urals, and Tian Shan. This role appears to have been relatively minor and likely indirect, upholding the ideas advanced by archaeologists. Bolshaya Rechka and Kamen populations (the latter culture was thought to include the former) are biologically distinct. Bolshaya Rechka displays continuity with local Early Bronze Age groups. The main component of the Kamen population of forest-steppe Altai, on the other hand, was introduced by Saka and Sarmatian immigrants, who, evidently, had not reached the Novosibirsk region of the Ob. Rather than moving on northwards along the Ob from the forest-steppe Altai, they turned west, toward the Tobol-Irtysh watershed.

Keywords: *Upper Ob area, Bolshaya Rechka culture, Kamen culture, Early Iron Age, Saka migration, dental anthropology.*

Introduction

The tribes inhabiting the Upper Ob basin in the Early Iron Age are typically considered as representatives of two archaeological cultures: either Bolshaya Rechka or Kamen. The former was initially described by M.P. Gryaznov based on the materials from the burial sites of the forest-steppe Ob region. According to the scholar, that culture had developed from the cultural traditions of the preceding population of the area (Gryaznov, 1956: 44).

However, following research has demonstrated substantial cultural heterogeneity of the Upper Ob ancient tribes. Expanding on this idea, V.A. Mogilnikov and A.P. Umansky in the early 1980s suggested singling out the Kamen culture (Mogilnikov, 1997: 4). The main argument for this was the prevalence, in the grave goods of the Altaian tribes, of the cultural traits associated with the Saka and Sarmatians of present-day Kazakhstan (Ibid.: 4–8). The researchers did not limit area of that newly described culture to the forest-steppe part of Altai, but

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extended it to the whole Upper Ob area, which provoked a discussion regarding the relationship between Kamen and Bolshaya Rechka complexes. T.N. Troitskaya, A.P. Borodovsky, and N.V. Polosmak opposed the extension of the area of the Kamen culture. According to them, the influence of the Saka and Sarmatians on the formation of the Bolshaya Rechka populations was indirect and rather weak. The origin of the traditions of the Bolshaya Rechka culture, as it was pointed out by Gryaznov, was related to the local Late Bronze Age groups (Troitskaya, Borodovsky, 1994: 104; Polosmak, 1987: 101–102). An attempt of solving this issue was made by Troitskaya, who suggested to consider all the Upper Ob tribes of the Early Iron Age as parts of the same Bolshaya Rechka cultural and historical community, but also to separate this into several local variants: Kamen (Novosibirsk and Barnaul regions of the Ob), Staroaleiskoye (along the Ob River, from the mouth of Anui to the mouth of Chumysh), and Kizhirovo (Tomsk region of the Ob and the north of the Novosibirsk region of the Ob) (Troitskaya, Novikov, 2007: 96–97).

The employment of anthropological data could have facilitated solving the question regarding the relationship between Bolshaya Rechka and Kamen populations via the study of biological distances between those groups. However, there is a notable disproportion between the numbers of studied and published samples, most of which come from Kamen culture sites. Previous research on cranial metrics and dental traits has shown that the population of the Kamen culture from the forest-steppe Altai has actually formed under a substantial influence from the Saka of the Southeastern Aral Sea region and Central Kazakhstan (Rykun, 2013: 165; Leibova, Tur, 2020). But the Novosibirsk region of the Ob remains *terra incognita* from the anthropological point of view. Previous studies were based on scarce samples from single burial sites (Alekseev, 1958; Dremov, 1970; Rykun, 2013: 19–21; Kishkurno, Zubova, 2015; Kishkurno, 2018a, b). All those authors pointed to the typological pattern of admixture in the samples of the Bolshaya Rechka culture. But owing to the paucity of data, it has not been possible to describe the anthropological composition of the Bolshaya Rechka community of the Novosibirsk region of the Ob in full. The aim of this study was a reconstruction of the history of this population, employing all available dental samples.

Material and methods

Dental specimens from 11 burial sites were sampled (Table 1). These were studied using the standard dental non-metric protocol by A.A. Zubov (1968, 2006) and employing the markers of generalized archaic (Zubova, 2013a). Only the permanent dentition was studied, the sexes were pooled. The individual method disregarding the side of observation was employed for scoring the traits. Seven small samples from some burial sites were pooled together.

The Pearson's χ^2 criterion was used to assess the significance of the difference between local populations. The intergroup comparisons was carried out in Statistica for Windows, version 10.0, via the principal component analysis based on trigonometrically transformed frequencies of eight dental traits: shoveling (I^1), hypocone reduction (M^2), Carabelli cusp (M^1), six-cusped and four-cusped forms of M_1, four-cusped forms of M_2, distal trigonid crest (M_1), deflecting wrinkle of the metaconid (M_1). Neolithic, Bronze, and Early Iron Ages samples from Siberia, Volga-Ural region, Kazakhstan, and Aral Sea were employed as reference.

Table 1. **Dental samples of the Bolshaya Rechka culture**

Site	Sample size, individuals	Date
Verkh-Suzun-5	29	4th–2nd centuries BC
Bystrovka-1	19	Second half of the 1st millennium BC
Bystrovka-2	135	5th – early 2nd centuries BC
Bystrovka-3	117	3rd–1st centuries BC
"26 iyunya"	1	5th–3rd centuries BC
Milovanovo-2	2	4th–3rd centuries BC
Milovanovo-3	2	2nd–1st centuries BC
Milovanovo-8	6	2nd–1st centuries BC
Noviy Sharap-1	4	5th–4th centuries BC
Noviy Sharap-2	8	4th–3rd centuries BC
Krokhalevka-5	2	Second half of the 1st millennium BC

Characteristics of the Bolshaya Rechka sample

The sample displays moderate frequencies of I^1 and I^2 shoveling (Table 2). A few cases of double shoveling and vestibular convexity of I^1 were observed. The frequency of the distal crest of the upper canines is increased. The prevalence of the Carabelli cusp of M^1 and accessory distal cusps of M^1 is moderate. The reduction of the hypocone of M^2 is rare. A case of anterior and a case of posterior fovea of M^1 were detected. The cingulum of M^1 is rare.

The lower canines exhibit a moderate frequency of the distal accessory ridges. A few cases of the styloid cusps in the distal parts of P_1 and P_2 were observed. While the prevalence of six-cusped M_1 is increased, the frequency of $M_2$4 is lower, and the four-cusped form is extremely rare. The following traits are found seldom: tami M_1, distal and middle trigonid crests of M_1. The prevalence of the deflecting wrinkle of the metaconid of M_1 is greatly

Table 2. **Frequencies of the main dental phenes**

Trait	Verkh-Suzun-5		Bystrovka-1		Bystrovka-2		Bystrovka-3		Composite sample		Total	
	n (*N*)	%	*n* (*N*)	%	*n* (*N*)	%	*n* (*N*)	%	*n* (*N*)	%	*n* (*N*)	%
Maxillary dentition												
Shoveling I^1	2 (7)	28.57	0 (3)	0	7 (32)	21.87	5 (8)	62.5	3 (9)	33.33	17 (57)	29.82
Shoveling I^2	4 (8)	50	1 (9)	11.11	24 (43)	55.81	7 (12)	58.33	4 (9)	44.44	40 (81)	49.38
Vestibular shoveling I^1	0 (7)	0	0 (3)	0	3 (46)	6.52	2 (12)	16.66	0 (7)	0	5 (75)	6.66
Vestibular convexity I^1	1 (6)	17	0 (3)	0	3 (43)	6.97	0 (14)	0	0 (8)	0	4 (74)	5.4
Distal ridge C	6 (7)	85.71	4 (6)	66.66	38 (41)	92.68	15 (16)	93.75	7 (9)	77.77	70 (79)	88.6
Carabelli cusp M^1	8 (17)	47	1 (14)	7.14	16 (77)	20.77	17 (53)	32.07	8 (23)	34.78	50 (182)	27.47
Hypocone reduction (3, 3+) M^2	7 (20)	35	2 (13)	15.38	19 (79)	24.05	4 (52)	7.69	3 (23)	13.04	34 (185)	18.37
Accessory cusp (c5) M^1	8 (19)	42.1	2 (3)	66.66	13 (37)	35.13	12 (36)	33.33	3 (12)	25	38 (107)	35.51
Anterior fovea M^1	0 (8)	0	0 (2)	0	0 (20)	0	1 (15)	6.66	0 (6)	0	1 (51)	1.96
Posterior fovea M^1	0 (8)	0	0 (4)	0	0 (33)	0	1 (25)	4	0 (8)	0	1 (68)	1.47
Cingulum M^1	3 (21)	14	0 (15)	0	2 (100)	2	0 (62)	0	0 (26)	0	5 (229)	2.18
Mandibular dentition												
Distal ridge C	3 (12)	25	1 (3)	33.33	25 (42)	59.52	8 (18)	44.44	7 (13)	53.84	44 (88)	50
Distostylid P_1	0 (11)	0	0 (10)	0	1 (65)	1.53	4 (36)	11.11	2 (17)	11.76	7 (109)	6.42
Distostylid P_2	1 (10)	10	0 (10)	0	1 (48)	2.08	0 (23)	0	1 (17)	5.88	5 (119)	4.2
$M_1$6	2 (11)	18	2 (6)	33.33	9 (43)	20.93	3 (32)	9.37	1 (10)	10	17 (99)	17.17
$M_1$4	0 (11)	0	0 (6)	0	1 (43)	2.32	1 (32)	3.12	0 (10)	0	2 (99)	2.02
$M_2$4	6 (8)	75	1 (2)	50	25 (37)	67.56	15 (26)	57.69	9 (17)	52.94	53 (86)	61.62
Tami M_1	3 (19)	15.78	0 (11)	0	3 (67)	4.47	4 (45)	8.88	2 (18)	11.11	11 (156)	7.05
Distal ridge of the trigonid M_1	0 (14)	0	0 (8)	0	1 (40)	2.5	4 (29)	13.79	0 (7)	0	5 (96)	5.21
Middle ridge of the trigonid M_1	1 (14)	7.14	0 (7)	0	1 (39)	2.56	2 (30)	6.66	0 (6)	0	4 (96)	4.16
Deflecting wrinkle of the metaconid M_1	3 (13)	23	1 (2)	50	9 (21)	42.85	5 (20)	25	0 (4)	0	36 (59)	61.01
Anterior fovea M_1	0 (9)	0	1 (2)	50	0 (22)	0	2 (18)	11.11	0 (2)	0	3 (53)	5.66
Posterior fovea M_1	0 (11)	0	0 (2)	0	0 (29)	0	1 (18)	5.55	0 (3)	0	1 (63)	1.58
Cingulum M_1	2 (21)	9.5	0 (15)	0	7 (91)	7.69	6 (61)	9.83	2 (23)	8.69	17 (211)	8.05

increased, while the cingulum and anterior and posterior fovei of M_1 are observed very rarely.

Turning to the local groups, some morphological heterogeneity of the Bolshaya Rechka population of the Novosibirsk region of the Ob should be pointed out (Table 2). All the local samples, except for Bystrovka-3, display an intermediate western-eastern morphology. The lower prevalence of the traits of the Eastern dental stock at Bystrovka-1 can be explained by the low sample size. The feature sharply contrasting Bystrovka-3 to other Bolshaya Rechka groups is an increased frequency of shoveling (I^1) and the distal trigonid crest (M_1). The differences between the samples from Bystrovka-3 and Bystrovka-2 are statistically significant: $p = 0.02$ for shoveling (I^1) and $p = 0.04$ for the distal trigonid crest.

The Verkh-Suzun-5 and Bystrovka-2 samples display a southern dental complex (Zubov, 2006: 59–62), namely a combination of the vestibular convexity of I^1, middle trigonid crest of M_1 and tami at M_1 (Table 2). The same complex is present at Bystrovka-3 as well, but as a combination of tami M_1 and the epicristid of M_1. The presence of such dental patterns in the Bolshaya Rechka groups could be a result of contacts with contemporaneous migrant tribes from the south and south-west. Alternatively, the complexes might be inherited from preceding autochthonous population, e.g. from the descendants of the groups of the Early Bronze Age Odino culture displaying similar dental patterns (Zubov, Chikisheva, Molodin, 2016).

One more component was specific only for the sample from Bystrovka-3, where increased frequencies of six-cusped M_1 are found in combination with some archaic morphological features: anterior and posterior fovei of M_1 and an enlarged cingulum of M_1 (Table 2). Such a complex goes back to the Upper Paleolithic populations of Southern Siberia (Afontova Gora II, Listvenka) (Zubova, Chikiseva, 2015b), but is also found in the Neolithic groups from the Baraba forest-steppe (Zubova, Chikiseva, 2015a) and some Odino samples (Zubov, Chikisheva, Molodin, 2016). The presence of this complex likely points to an increased proportion of the autochthonous component in the sample from Bystrovka-3.

Discussion

An intergroup comparison of the Early Iron Age dental samples revealed the following results (Fig. 1). The first two principal components (PC) account for approximately 52 % of the total variance. The first PC (33.77 % of total variance) distinguishes groups (Table 3) displaying high frequencies of the Carabelli cusp (M^1), six-cusped M_1, deflecting wrinkle of metaconid (negative values of PC1) from the samples exhibiting an enhanced gracile complex (positive values of PC1). The second PC (19.01 %) arranges the populations according to the west-east gradient (Table 4).

The samples of the Bolshaya Rechka culture occupy the area of negative values of PC1. Most of these also display negative values of PC2, while the sample from Bystrovka-3 exhibits a positive value along this axis (Fig. 1). Such a pattern of differentiation seems logical, as the latter sample displays the highest proportion of the traits associated with the Eastern dental stock.

The Bolshaya Rechka populations plotted quite separately from the reference samples. The closest groups among them are Verkh-Suzun-5 and Bystrovka-2. These are also similar to the sample from Stantsiya Kazanovskaya-1 belonging to the Tagar culture (Fig. 1). The latter was previously shown to possibly have tight connections with the Early Iron Age populations of the Upper Ob area (Kishkurno, 2021). All the local samples mentioned above are also similar to an extent to the groups of the Sargatka culture from the basins of Tobol, Irtysh, and Ishim rivers. The sample from the Bystrovka-1 cemetery is found in the margin of the plot (Fig. 1), while Bystrovka-3 displays some similarity to the groups of the Kulai culture from the Novosibirsk region of the Ob and to the samples from the burial sites of the Korgantas type (Fig. 1). This latter observation can be explained, first, by increased frequencies of the traits of the Eastern dental stock in this particular sample, which is untypical for the Saka in general (Beisenov et al., 2015: 111); and second, by the low size of this sample, which makes it a rather poor representative of the respective population. The populations of the Kamen culture from the forest-steppe Altai plot compactly in the center of the graph (Fig. 1), being part of a large cluster that includes samples of the Early Sarmatians, Sauromatians, and Saka from various areas. These groups do not exhibit similarity to the Bolshaya Rechka populations.

The first two PCs of the analysis comparing the samples of the Kamen and Bolshaya Rechka cultures with the Neolithic and Bronze Age populations (Fig. 2) account for approximately 45 % of the total variance. The first PC (29 %) differentiates groups with higher frequencies of "eastern" traits (positive values of PC) from those displaying accentuation of the reduction complex (negative values). The second PC (16.52 %) separates populations showing a high frequency of the distal trigonid crest of M_1 (positive values) from samples exhibiting high prevalence of the deflecting wrinkle of the metaconid of M_1 (negative values).

In this analysis, the groups of the Bolshaya Rechka culture are dispersed more compactly (Fig. 2) as compared to the previous plot with the samples of the Early Iron Age (see Fig. 1) occupying the area of positive values of PC1 and negative values of PC2. All the autochthonous Neolithic and Bronze Age Siberian populations occupy the same area of the graph.

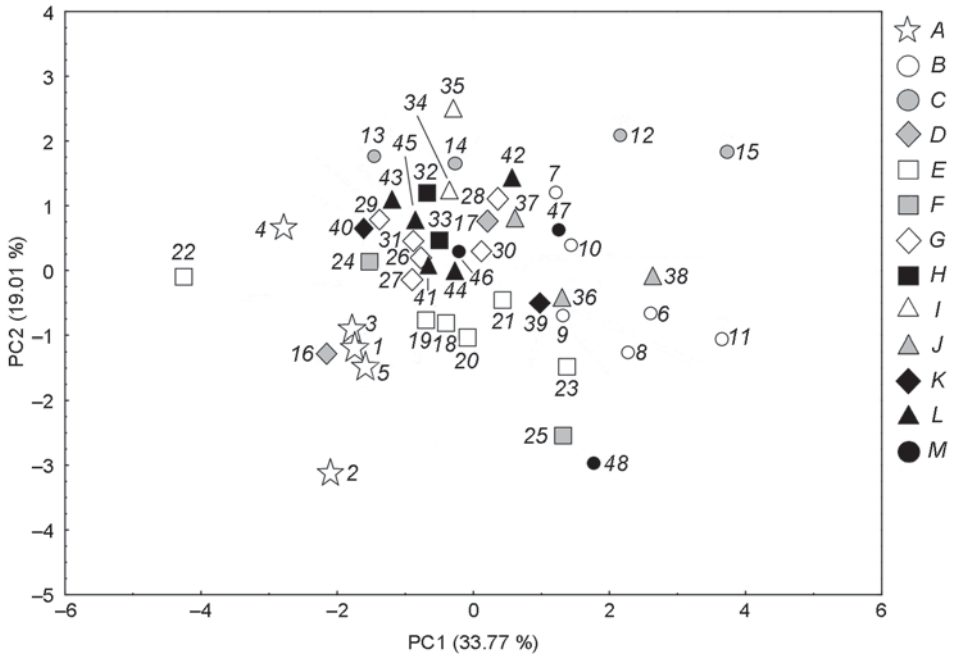

Fig. 1. Results of the principal component analysis of the Early Iron Age dental samples.
A – Novosibirsk region of the Ob: *1* –Verkh-Suzun-5, *2* –Bystrovka-1, *3* – Bystrovka-2, *4* – Bystrovka-3, *5* – composite sample (author's data); *B* – the Altai Mountains: *6–10* – Pazyryk culture of valleys of the rivers of Ulandryk (*6*), Yustyd (*7*), Barburgazy and Buguzun (*8*), Ukok plateau (*9*), valleys of the middle reaches of the rivers of Chuya, Ursul, and Katun (*10*), *11* – Kara-Koba group of sites; *C* – Tuva: *12*, *13* – Aldy-Bel culture (*12* – Arzhan-2, *13* – Kopto), *14* – Uyuk-Sagly culture, Dogee-Baary II, *15* – Dogee-Baary II (2nd century BC to 1st century AD) (Chikisheva, 2012); *D* – Khakass-Minusinsk Basin: *16* – Tagar culture, Stantsiya Kazanovskaya-1 (Kishkurno, 2021), *17* – Tagar culture (Rykushina, 1977; Postnikova, 1974); *E* – Tobol-Irtysh watershed: *18–21* – Sargatka culture of the Tobol basin (*18*), Irtysh basin (*19*), Ishim basin (*20*), Baraba forest-steppe (*21*) (Sleptsova, 2021), *22* – Kashino culture (Sleptsova, Yudakova, 2021), *23* – Gorokhovo culture (Sleptsova, 2021); *F* –Novosibirsk and Tomsk regions of the Ob, Kulai culture: *24* – Kamenny Mys (Kishkurno, Sleptsova, 2019), *25* – Aldygan (Aksyanova, Bobrova, Yakovlev, 2004); *G* – forest-steppe Altai, Kamen culture: *26* – Maslyakha-1, *27* – Novotroitskoye-1, -2, *28* – Kamen-2, *29* – Rogozikha-1, *30* – Obyezdnoye-1, *31* – Kirillovka-3; *H* – Barnaul region of the Ob, Staroaleiskoye culture: *32* – Firsovo-14, *33* – Obskiye Plesy-2, Tuzovskiye Bugry (Leibova, Tur, 2020); *I* – lower Syr-Darya River, Dzhetyasar culture: *34* – Kosasar-2 (Rykushina, 1993a), *35* – Kosasar-3, Tompakasar, Bedaikasar (Rykushina, 1993b); *J* – Western Kazakhstan, early nomads: *36* – 6th–4th centuries BC, *37* – 4th–3rd centuries BC, *38* – 3rd–1st centuries BC (Kitov, Mamedov, 2014); *K* – Central Kazakhstan: *39* – Tasmola culture, *40* – sites of the Korgantas type (Beisenov et al., 2015); *L* – Cis-Urals: *41* – Sarmatians of the 4th–2nd centuries BC (Pokrovka X), *42* – Sarmatians of the 2nd–4th centuries AD (Pokrovka X) (Suvorova, 2008), *43* – Sauromatians of the Southern Urals (Novy Kumak) (Segeda, 2006), *44* – Sauromatians of the Southwestern Urals (Kazy-Baba) (Bagdasarova, 2000), *45* – early Sarmatians of the Southern Urals (Lebedevka) (Segeda, 2006); *M* – Tian Shan area: *46* – the Saka people of Semirechye, *47* – of Tian Shan, *48* – of Alai (Kitov, Tur, Ivanov, 2019).

Table 3. **Factor loadings on the first two principal components of the analysis of the Early Iron Age dental samples**

Trait	PC1	PC2
Shov I^1	–0.37	0.61
Cara M^1	–0.68	0.28
Hypocone 3, 3+M^2	0.67	–0.12
$M_1$6	–0.78	–0.27
$M_1$4	0.56	0.47
$M_2$4	0.53	0.45
Dtc M_1	–0.30	0.75
Dw M_1	–0.60	–0.02

Table 4. **Factor loadings on the first two principal components of the analysis of the Neolithic and Bronze Age dental samples**

Trait	PC1	PC2
Shov I^1	0.50	0.48
Cara M^1	0.24	–0.29
Hypocone 3, 3+ M^2	0.13	0.21
$M_1$6	0.67	–0.26
$M_1$4	–0.86	0.06
$M_2$4	–0.75	0.04
Dtc M_1	0.44	0.51
Dw M_1	0.21	–0.80

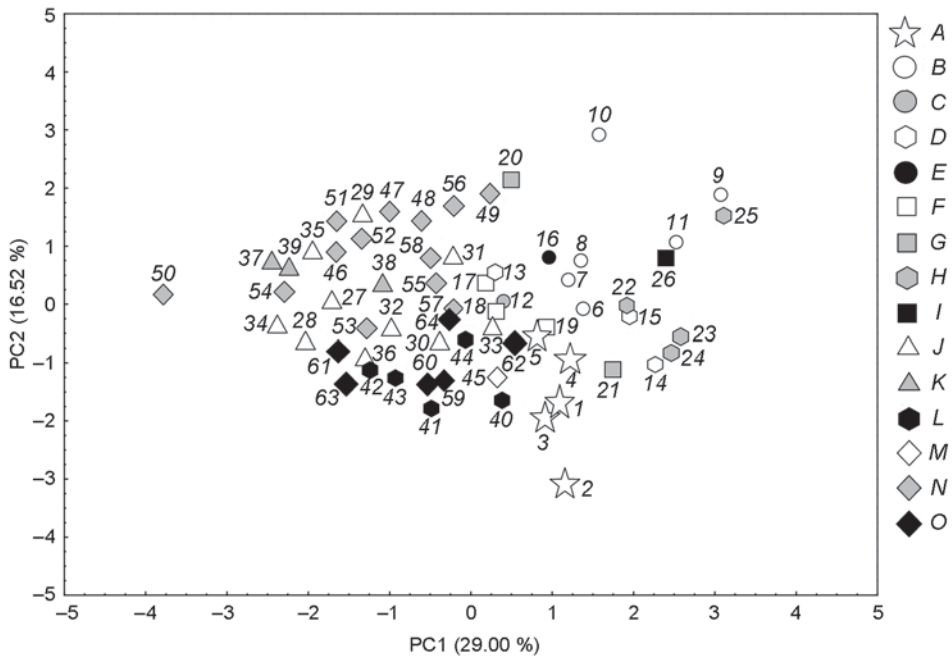

Fig. 2. Results of the principal component analysis of the dental samples of the Bolshaya Rechka culture of the Novosibirsk region of the Ob, Kamen culture of the forest-steppe Altai, and Neolithic and Bronze Age groups of Eurasia.

A – Novosibirsk region of the Ob: *1* –Verkh-Suzun-5, *2* –Bystrovka-1, *3* – Bystrovka-2, *4* – Bystrovka-3, *5* – composite sample (author's data); *B* – the Neolithic of the south of Western Siberia: *6–8* – Middle Irtysh culture (*6* – Vengerovo-2a, *7* – Protoka-1, *8* – Sopka-2/1), *9*, *10* – Kuznetsk-Altai culture (*9* – Solontsy-5, *10* – Ust-Isha, Lebedi-2, Vaskovo-4), *11* – Bolshoy Mys culture (Itkul) (Zubova, Chikisheva, 2015a); *C* – Early Iron Age of the Baraba forest-steppe: *12* – Ust-Tartas culture; *D* – Early Bronze Age of the Ob-Irtysh watershed, Odino culture: *13* – Sopka-2 (Chikisheva, 2012), *14* – Preobrazhenka-6, *15* – Tartas-1 (Zubova, Chikisheva, Molodin, 2016); *E* – Early Bronze Age of the Baraba forest-steppe: *16* – Krotovo culture (Sopka-2); *F* – Middle Bronze Age of the Baraba forest-steppe, Late Krotovo culture: *17* – Sopka-2 (Chikisheva, 2012), *18* – Cherno-Ozerye I, *19* – Borovyanka-17; *G* – Middle Bronze Age of the Omsk region of the Irtysh: *20* – Rostovka, *21* – Okunevo-7 (Zubova, 2014); *H* – Bronze Age of the Khakass-Minusinsk Basin, Okunev culture: *22* – Verkh-Askiz, *23* – Uibat-5 (Zubova, 2013b), *24* – Chernovaya VIII (Zubov, 1980), *25* – Itkol (Zubova, 2013b); *I* – Bronze Age of the Altai Mountains: 26 – Karakol culture (Chikisheva, 2012); *J* – Middle Bronze Age of the south of Western Siberia: *27–35* – Fedorovka culture of the Kuznetsk Basin (*27* – Titovo-2, *28* – Chudinovka-1, *29* – Tanai-12), of the Tomsk (*30*) and Novosibirsk regions (*31*) of the Ob, forest-steppe Altai (*32*, *33*), Baraba forest-steppe (*34* – Preobrazhenka-3, *35* – Abramovo-4, Sopka-2, Vengerovo-1, Grishkina Zaimka, Vakhrushevo-5 (Zubova, 2014)), *36* – Andronovo culture of the Altai Mountains (Tur, 2009); *K* – Middle Bronze Age of the Omsk region of the Irtysh and Kazakhstan, Alakul culture: *37* – Ermak-4 (Zubova, 2014), *38* – Tasty-Butak, *39* – Maitan, Nurtai, Lisakovsky (Zubova, 2011); *L* – Bronze Age of the Southern Urals: *40* – Sintashta culture, *41* – its Ural variant, *42* – Petrovka culture, *43* – sites of the Alakul timber-grave cultural type, *44* – Alakul culture (Kitov, 2011); *M* – Middle Bronze Age of the Khakass-Minusinsk Basin: *45* – Karasuk culture (Rykushina, 2007); *N* – Late Bronze Age of the south of Western Siberia: *46–53* – Irmen culture of the Kuznetsk Basin (*46* – Zhuravlevo-1–4, *47* – Zarechnoye-1, *48* – Tanai-2, -7, *49* – Vaganovo-2), of the Tomsk (*50*) and Novosibirsk regions (*51*) of the Ob, forest-steppe Altai (*52*), Baraba forest-steppe (*53*), *54–56* – Pakhomovo culture of the Tumen region of the Tobol (*54*), Baraba forest-steppe (*55* – Stary Sad, *56* – Preobrazhenka-3, Grishkina Zaimka, Sopka-2, Protoka), *57* – Elovka culture of the Tomsk region of the Ob, *58* – Korchazhka culture of the Kuznetsk Basin (Zubova, 2014); *O* – Early Iron Age of the forest-steppe Altai, Kamen culture: *59* – Maslyakha-1, *60* – Novotroitskoye-1, -2, *61* – Kamen-2, *62* – Rogozikha-1, *63* – Obyezdnoye-1, *64* – Kirillovka-3 (Leibova, Tur, 2020).

The samples from Verkh-Suzun-5 and Bystrovka-2 plot between the clusters of populations of the Okunev and Odino cultures from Western Siberia, on one hand, and the groups of the Southern Uralian Sintashta culture, on the other hand. The similarity with the Odino samples may suggest that the Bolshaya Rechka people inherited some "southern" features from that population (Zubova, Chikisheva, Molodin, 2016). Bystrovka-1 is separated from other samples, and only tends to have some affinity with Verkh-Suzun-5 and Bystrovka-2. The sample from Bystrovka-3 plots between two small clusters, one of which includes Okunev and two Western Siberian groups (Preobrazhenka-6 and Okunev-7), while the second comprises the composite sample of the Bolshaya Rechka culture and a group of the Late Krotovo culture from Borovyanka-17. The latter two plot close to the zero of both coordinates, where populations of the Kamen culture from Rogozikha-1 and of the Andronovo (Fedorovka) culture from Rubleovo-8 are found together, with some Ust-Tartas and Late Krotovo (Cherno-Ozerye I) groups (Fig. 2).

Almost all the Kamen samples from the forest-steppe Altai plot together with the Caucasoid populations of the Southern Urals and Kazakhstan and those of the Andronovo (Fedorovka) culture from the south of Western Siberia (Fig. 2). This supports the conclusion arrived at by N.A. Leibova, who suggested that the Caucasoid groups from the south-west had played the major role in the formation of the Kamen population. But here, two samples (from the Rogozikha-1 and Kirillovka-3 cemeteries) stand alone. These show more similarity to the Western Siberian groups, in which the prevalence of Mongoloid features was previously noted (Leibova, Tur, 2020: 182). Thus, one can suggest that a part of the Kamen groups from the forest-steppe Altai and the Bolshaya Rechka populations from the Novosibirsk region of the Ob had different origins.

Conclusions

A synthesis of the results of archaeological and anthropological research permits a thorough consideration of the processes that were taking place at the Upper Ob during the Early Iron Age. According to the first discipline, the material culture of the Saka and Sarmatians was widespread across the region. But for the forest-steppe Altai this trend was stronger (Mogilnikov, 1997: 4–8) than for the Novosibirsk region of the Ob (Troitskaya, Borodovsky, 1994: 104). Such a situation raised the question of if the Saka and Sarmatian populations were influencing the local groups directly, and if a new archaeological culture—Kamen—must be singled out. The study of anthropological data has shown that the tribes of the forest-steppe Altai were related with the migrants from the south-west. It seems likely that the local population had direct contacts with the Saka and Sarmatians, and those contacts led to a transformation of the both cultural traditions and the anthropological composition of the autochthons. The Bolshaya Rechka tribes from the north (Upper Ob area) have adopted much less southern cultural traits, which can be explained, according to T.N. Troitskaya, by either indirect contacts between the northern and southern groups or by a low frequency of such contacts (Ibid.). The archaeological data show that the Bolshaya Rechka groups had trade connections with the neighbors, which stimulated the introduction of some foreign traits into their material culture (Ibid.; Polosmak, 1987: 101–102).

The results of the study of dental data from the Early Iron Age cemeteries of the Novosibirsk region of the Ob confirm and expand this concept. The principal component analysis has shown that the formation of the Bolshaya Rechka tribes was not connected with the migration of the Saka and Sarmatians that bypassed this area. Their anthropological composition emerged on the basis of the local Siberian population of preceding periods. The influence of migrant groups apparent in the material culture of the Bolshaya Rechka groups could be indirect only (Troitskaya, Borodovsky, 1994: 104). Such contacts were probably mediated by the Western Siberian populations, namely those of the Sargatka traditions in the west and the Kamen culture in the south. Thus, the concept of the formation of the Bolshaya Rechka tribes first put forward by M.P. Gryaznov (1956: 44) and later supported by T.N. Troitskaya, A.P. Borodovsky, and N.V. Polosmak has been confirmed by the results of the present analysis of dental traits.

The anthropological composition of the Bolshaya Rechka groups was not entirely homogenous: they exhibit a dental pattern intermediate between the Western and Eastern dental stocks. The prevalence of markers of the latter is greatly increased in the sample from Bystrovka-3, which displays markers of the Southern Siberian Upper Paleolithic dental complex (Zubova, Chikisheva, 2015b). This complex was inherited from the most ancient Siberian populations and was widespread in the Neolithic and Bronze Age populations of the Baraba forest-steppe (Zubova, Chikisheva, 2015a; Zubova, Chikisheva, Molodin, 2016). Furthermore, the samples from Verkh-Suzun-5 and Bystrovka-2 display some “southern” features that were likely received from the Early Bronze Age Odino groups.

The population of the Kamen culture of the forest-steppe Altai differed substantially from that of the Bolshaya Rechka culture. While the formation of the latter was not related to migrant tribes, the Saka component was predominant in the population of the Kamen culture according to both craniometric and dental data. Thus, results of the present study support the view that the Bolshaya Rechka and Kamen sites do not belong to the same population, and should not be combined in a single archaeological culture.

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References

Aksyanova G.A., Bobrova A.I., Yakovlev Y.A. 2004
Mogilnik Aldygan – nekropol rannego zheleznogo veka kulaiskoy kultury. *Vestnik antropologii*, iss. 11: 54–75.

Alekseev V.P. 1958
Paleoantropologiya Altaya epokhi zheleza. *Sovetskaya arkheologiya*, No. 1: 45–49.

Bagdasarova N.A. 2000
Savromaty Yugo-Zapadnogo Priaralya po materialam mogilnika Kazybaba. In *Antropologicheskiye i etnograficheskiye svedeniya o naselenii Sredney Azii*. Moscow: Stariy sad, pp. 78–112.

Beisenov A.Z., Ismagulova A.O., Kitov E.P., Kitova A.O. 2015
Naseleniye Tsentralnogo Kazakhstana v I tysyacheletii do n.e. Almaty: Inst. arkheologii im. A.K. Margulana.

Chikisheva T.A. 2012
Dinamika antropologicheskoy differentsiatsii naseleniya yuga Zapadnoy Sibiri v epokhi neolita – rannego zheleza. Novosibirsk: Izd. IAET SO RAN.

Dremov V.A. 1970
Materialy k antropologii bolsherechenskoy kultury. *Izvestiya laboratorii arkheologicheskikh issledovaniy*, iss. 2. Kemerovo: pp. 99–108.

Gryaznov M.P. 1956
Istoriya drevnikh plemen verkhney Obi po raskopkam bliz s. Bolshaya Rechka. Moscow: Izd. AN SSSR. (MIA; No. 48).

Kishkurno M.S. 2018a
Odontologicheskaya kharakteristika antropologicheskoy serii iz mogilnika Verkh-Suzun-5 rannego zheleznogo veka s territorii Novosibirskogo Priobya. *Vestnik Novosibirskogo gosudarstvennogo universiteta*. Ser.: Istoriya, filologiya, vol. 17. Iss. 5: Arkheologiya i etnografiya: 137–149.

Kishkurno M.S. 2018b
Proiskhozhdeniye nositeley kamenskoy kultury Novosibirskogo Priobya po odontologicheskim dannym iz mogilnika Bystrovka-3 (III–I vv. do n.e.). *Camera praehistorica*, No. 1: 134–147.

Kishkurno M.S. 2021
Odontoskopicheskaya kharakteristika serii tagarskoy kultury iz kurgannogo mogilnika Stantsiya Kazanovskaya-1. In *Problemy arkheologii, etnografii i antropologii Sibiri i sopredelnykh territoriy*, vol. XXVII. Novosibirsk: Izd. IAET SO RAN, pp. 459–467.

Kishkurno M.S., Sleptsova A.V. 2019
Noviye danniye po odontologii naseleniya kulaiskoy kultury Novosibirskogo Priobya. *Vestnik arkheologii, antropologii i etnografii*, No. 4: 140–151.

Kishkurno M.S., Zubova A.V. 2015
Kraniologiya nositeley verkhneobskogo varianta kamenskoy kultury po materialam mogilnika Verkh-Suzun-5. *Vestnik arkheologii, antropologii i etnografii*, No. 3: 92–103.

Kitov E.P. 2011
Paleoantropologiya naseleniya Yuzhnogo Urala epokhi bronzy: Cand. Sc. (History) Dissertation. Moscow.

Kitov E.P., Mamedov A.M. 2014
Kochevoye naseleniye Zapadnogo Kazakhstana v rannem zheleznom veke. Astana: Izdat. gruppa fil. Inst. arkheologii im. A.K. Margulana.

Kitov E.P., Tur S.S., Ivanov S.S. 2019
Paleoantropologiya sakskikh kultur Prityanshanya (VIII – pervaya polovina II v. do n.e.). Almaty: Khikari.

Leibova N.A., Tur S.S. 2020
Odontologicheskiye osobennosti naseleniya lesostepnogo Altaia skifskogo vremeni. *Vestnik arkheologii, antropologii i etnografii*, No. 4: 171–186.

Mogilnikov V.A. 1997
Naseleniye Verkhnego Priobya v seredine – vtoroy polovine I tysyacheletiya do n.e. Moscow: IA RAN.

Polosmak N.V. 1987
Baraba v epokhu rannego zheleza. Novosibirsk: Nauka.

Postnikova N.M. 1974
Odontologicheskaya kharakteristika kraniologicheskikh seriy Minusinskoy kotloviny. In *Rasogeneticheskiye protsessy v etnicheskoy istorii*. Moscow: Nauka, pp. 243–250.

Rykun M.P. 2013
Paleoantropologiya Verkhnego Priobya epokhi rannego zheleza (po materialam kamenskoy kultury). Barnaul: Izd. Alt. Gos. Univ.

Rykushina G.V. 1977
Odontologicheskaya kharakteristika naseleniya karasukskoy kultury. *Voprosy antropologii*, iss. 57: 143–154.

Rykushina G.V. 1993a
Materialy po odontologii dzhetyasarskoy kultury: Gruntoviye pogrebeniya mogilnikov Kosasar 2, Kosasar 3, Tompakasar i Bedaikasar. In *Nizovya Syrdaryi v drevnosti*. Iss. III: Dzhetyasarskaya kultura. Pt. 2: Mogilniki Tompakasar i Kosasar. Moscow: IEA RAN, pp. 194–205.

Rykushina G.V. 1993b
Odontologicheskaya kharakteristika cherepov iz sklepov dzhetyasarskoy kultury (Altynasar 4, Tompakasar, Kosasar 3). In *Nizovya Syrdaryi v drevnosti*. Iss. II: Dzhetyasarskaya kultira. Pt. 1: Sklepy. Moscow: IEA RAN, pp. 243–252.

Rykushina G.V. 2007
Paleoantropologiya karasukskoy kultury. Moscow: Stariy sad.

Segeda S.P. 2006
Ranniye sarmary Yuzhnogo Priuralya po dannym odontologii (na materialakh mogilnika Lebedevka). In *Drevnosti Lebedevki (VI–II vv. do n.e.)*. Moscow: Vost. lit., pp. 155–159.

Sleptsova A.V. 2021
Proiskhozhdeniye naseleniya Zapadnoy Sibiri rannego zheleznogo veka po dannym odontologii. *Vestnik arkheologii, antropologii i etnografii*, No. 4: 163–175.

Sleptsova A.V., Yudakova V.S. 2021
K voprosu o proiskhozhdenii nositeley kashinskoy kultury Zapadnoy Sibiri rannego zheleznogo veka (danniye arkheologii i odontologii). *Camera praehistorica*, No. 2: 106–123.

Suvorova N.A. 2008
Odontologicheskaya kharakteristika rannikh kochevnikov Yuzhnogo Priuralya po materialam mogilnika Pokrovka 10 (predvaritelnoye soobshcheniye). In *Stepnoye naseleniye Yuzhnogo Priuralya v pozdnesarmatskoye vremya: Po materialam mogilnika Pokrovka 10*. Moscow: Vost. lit., pp. 87–95.

Troitskaya T.N., Borodovsky A.P. 1994
Bolsherechenskaya kultura lesostepnogo Priobya. Novosibirsk: Nauka.

Troitskaya T.N., Novikov A.V. 2007
Skifo-sibirskiy mir. Novosibirsk: Geo.

Tur S.S. 2009
Odontologicheskaya kharakteristika naseleniya andronovskoy kultury Altaya. *Izvestiya Altaiskogo gosudarstvennogo universiteta*, No. 4: 228–236.

Zubov A.A. 1968
Odontologiya: Metodika antropologicheskikh issledovaniy. Moscow: Nauka.

Zubov A.A. 1980

Kharakteristika zubnoy sistemy v cherepnoy serii iz Okunevskogo mogilnika. *Paleoantropologiya Sibiri*. Moscow: Nauka, pp. 9–18.

Zubov A.A. 2006

Metodicheskoye posobiye po antropologicheskomu analizu odontologicheskikh materialov. Moscow: Etno-Onlain.

Zubova A.V. 2011

The dentition of the Alakul people, with reference to their origin. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 3: 143–153.

Zubova A.V. 2013a

Predvaritelniye rezultaty izucheniya arkhaichnoy sostavlyayushchey odontologicheskikh kompleksov naseleniya Yevrazii epokhi neolita. *Vestnik antropologii*, No. 4: 107–127.

Zubova A.V. 2013b

Dental affinities of the Irmen people, Western Siberia. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 3: 132–139.

Zubova A.V. 2014

Naseleniye Zapadnoy Sibiri vo II tysyacheletii do nashey ery (po antropologicheskim dannym). Novosibirsk: Izd. IAET SO RAN.

Zubova A.V., Chikisheva T.A. 2015a

Nonmetric dental trait distribution in the Neolithic populations of Southwestern Siberia. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 43 (3): 135–143.

Zubova A.V., Chikisheva T.A. 2015b

The morphology of human teeth from Afontova Gora II, Southern Siberia, and their status relative to the dentition of other Upper Paleolithic Northern Eurasians. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 43 (4): 135–143.

Zubova A.V., Chikisheva T.A., Molodin V.I. 2016

Perviye rezultaty sravnitelnogo analiza odontologicheskikh kharakteristik populyatskiy odinovskoy kultury: K voprosu o yuzhnykh migratsiyakh. In *Problemy arkheologii, etnografii i antropologii Sibiri i sopredelnykh territoriy*, vol. XXII. Novosibirsk: Izd. IAET SO RAN, pp. 292–298.

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AN SSSR – USSR Academy of Sciences

ASGE – Archaeological Collection of the State Hermitage Museum

BAE – Boguchany Archaeological Expedition

BAR – British Archaeological Reports

CNRS – Centre National de la Recherche Scientifique

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

IA RAN – Institute of Archaeology, Russian Academy of Sciences (Moscow)

IAET SO RAN – Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences (Novosibirsk)

IEA RAN – Institute of Ethnography and Anthropology, Russian Academy of Sciences (Moscow)

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

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

KSIIMK – Brief Communications of the Institute for the History of Material Culture

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

MIA – Materials and Investigations on Archaeology in the USSR

PNAS – Proceedings of the National Academy of Sciences

SAI – Collection of Archaeological Sources

TIE – Transactions of the Institute of Ethnography

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