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Editors of the original Russian texts
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T.V. Romanenko

Issuing Editor
Y.A. Zhuravleva

Designer
I.P. Gemueva

Russian texts translated by
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L. Baranova
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A.P. Derevianko
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: derev@archaeology.nsc.ru

Who Were the Chagyrskaya Neanderthals? The Possibility of Their Dispersal Across Central Asia and Southern Siberia

My article in the previous issue, based on findings of archaeological excavations of Paleolithic sites in the Altai, primarily in Denisova Cave, as well as facts concerning the time of origin of Neanderthal anatomy and genetics in Europe, challenged the view, based on the genetic analysis of the Altaian Neanderthals, that they had migrated to the Altai before 175 ka BP and occupied Denisova Cave by turns with Denisovans. In fact, the Neanderthal occupation of the Altai began apparently no earlier than 60 ka BP. Thus far, Neanderthal fossils with a Micoquian Mousteroid industry have been found in three caves: Chagyrskaya, Okladnikov, and Strashnaya. This group of Neanderthals, evidencing the easternmost dispersal wave of those humans in Asia, was termed the Chagyrskaya group.

Keywords: *Chagyrskaya Neanderthals, Obi-Rakhmat, Teshik-Tash, Micoquian, Mousterian, H. s. denisovan, Middle and Upper Paleolithic.*

Introduction

In the late 20th to early 21st centuries, researchers of the Paleolithic of the Altai and adjacent regions in Southern Siberia associated all the Middle Paleolithic industries recovered from Paleolithic sites, including Denisova Cave, with Neanderthals. It was reasonable, because only one taxon—*H. neanderthalensis*—has been known in the European Paleolithic in the Late Middle to the first half of the Upper Pleistocene. The Early Paleolithic industry was attributed to *H. erectus* and *H. heidelbergensis*, and the Middle Paleolithic industry to Neanderthals. The discovery in 1983 of Okladnikov Cave with a Mousterian industry dating back to 45–40 (37) ka BP (Derevianko, Markin, 1992) has enabled the identification of two lithic industries that existed in the Late Pleistocene in the Altai—the Middle Paleolithic industry in Denisova Cave and the industry typologically close to the Mousterian of European Neanderthals in Okladnikov Cave. The genetic analysis of DNA extracted from anthropological remains from Okladnikov Cave has shown that it was inhabited by Neanderthals (Krause et al., 2007). The DNA sequencing of the fossil (Denisova 3) from Denisova Cave led to the discovery of a previously unknown taxon, Denisovan, which was genetically distinct from both anatomically modern humans and Neanderthals (Krause et al., 2010; Reich et al., 2010). In 2007, S.V. Markin discovered Chagyrskaya Cave, containing Neanderthal remains dating to 60 (55)–45 ka BP and associated with the Mousterian industry (Derevianko, Markin, Zykin, 2008, 2009; Derevianko, Markin, Zykin et al., 2013;

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Derevianko, Markin, Kolobova et al., 2018). The lithic industries of Denisovans and Chagyrskaya Neanderthals differed from one another by the main technical and typological indicators of primary reduction, toolkit composition, and tool production techniques (Derevianko, 2001, 2009; Derevianko, Shunkov, Agadjanian et al., 2003).

Chagyrskaya Neanderthals started to disperse in the Altai ca 60 ka ago; their lithic industry was termed Sibiryachikha. The homogeneity of the industry of Chagyrskaya Neanderthals who settled in Okladnikov and Chagyrskaya caves is manifested mainly in the primary reduction (selection of raw materials, preparation of cores for knapping, and production of blanks—mainly flakes of various sizes).

The typological basis of Sibiryachikha toolkits is formed by side-scrapers and *déjeté* tools. The bilaterally worked tools (bifaces) serve as diagnostic elements of the Sibiryachikha lithic industry. The largest number of bifacial tools was found in Chagyrskaya Cave (Derevianko, Markin, Kolobova et al., 2018). According to the researchers, morphological structure of the bifacial tools was dominated by foliate bifaces; there are also segment-shaped, trapezoid, and triangular bifaces. In terms of general morphometric characteristics, bilaterally worked tools are subdivided into bifacial side-scrapers and points. The collection also includes a group of backed knives-scrapers that can be attributed to the Keilmesser backed knives—the marker of the Eastern European Micoquian (Shalagina et al., 2019). In general, the Sibiryachikha industry should be considered as a variant of the Micoquian Mousteroid industry.

The Chagyrskaya and Okladnikov cave sites were seasonal camps of hunter-gatherers, who hunted wild animals in the Charysh and Sibiryachikha valleys and butchered their prey at the sites. Judging by the composition of the large mammal fauna in the Altai, the main object of hunting for the Chagyrskaya inhabitants was bison (54 %), mainly half-adult individuals and females. Some bones bear cut marks produced by the stone tools of Chagyrskaya people. Bison hunting was most likely seasonal, and could have been timed to coincide with the annual migrations of *Bison priscus* herds in the Charysh valley (Derevianko, Markin, Kolobova et al., 2018).

The economic activity of the Chagyrskaya Neanderthals populating Okladnikov Cave was associated with hunting large animals, mainly horses, argali, rhinoceros, bison, and red deer. A significant part of the tools from this site show signs associated with butchering hunting prey.

Who were the Chagyrskaya Neanderthals, what were their origins and dispersal area in Central Asia and Southern Siberia?

Morphology of postcranial remains of the Chagyrskaya Neanderthals

In the Okladnikov Cave bone collection, A.P. Buzhilova (2013) identified the remains of at least two children, one adolescent, and one adult. The researcher believes that the latter two individuals may be of different sexes. The fragments of child bones (Okladnikov 7, 8, and 10) probably belonged to a single juvenile individual (9–12 years old). The two lower dental germs of the third molar M_3 (Okladnikov 4 and 5) correspond to one stage of development, with enamel hypoplasia reaching 1.7–2.0 mm above the tooth neck. Similar age characteristics and identical stress indicators suggest that the teeth belonged to the single individual (Ibid.).

Chagyrskaya Cave yielded remains of five adult individuals. Four isolated deciduous teeth (Chagyrskaya 1, 18, 19, and 20) were lost naturally, so theoretically these could have belonged either to a single adolescent or four different children of various ages (Derevianko, Markin, Kolobova et al., 2018).

Various laboratory studies of the comparatively small number of anthropological finds from the Altai Paleolithic sites have provided a significant amount of analytical data on the morphology of both Denisovans and Chagyrskaya Neanderthals (Viola, 2009; Viola et al., 2011, 2012; Dobrovolskaya, Tiunov, 2011; Mednikova, 2011a, b; 2013a, b; Buzhilova, 2013; Dobrovolskaya, Tiunov, 2013; Mednikova et al., 2013; Dobrovolskaya, Mednikova, 2015).

Remains of the dental system are among the most informative anthropological finds. In Okladnikov and Chagyrskaya caves, teeth of Chagyrskaya Neanderthals of various ages were found; and in Chagyrskaya Cave, also a mandible fragment. Five teeth of adolescents 12–14 years old and children 5–7 years old were recovered from the culture-bearing layers of Okladnikov Cave: the second lower right primary molar m_2 (layer 7), the first lower left premolar P_1, the first (second?) lower left permanent molar $M_{1(2?)}$, the third lower right permanent molar M_3 (layer 3), and the third lower left permanent molar M_3 (layer 2). These finds has revealed the important information relevant to the succession of habitation of the Altai region by representatives of the genus *Homo*. The recovered dental remains were examined by several experts in

physical anthropology, who produced three different interpretations of the taxonomic affiliation of the finds.

According to C. Turner's interpretation, the teeth from Okladnikov Cave bear several markedly Neanderthal features and are more similar to those of European rather than Asian *Homo sapiens neanderthalensis* (Turner, 1988, 1990a, b). V.P. Alekseev studied these fossils later and concluded that their small number and state of preservation do not allow the unambiguous taxonomic diagnosis. In his view, their morphological features are compatible with the hypothesis that they represent anatomically modern humans (Alekseev, 1998).

The dental remains from Okladnikov Cave were later also studied by other anthropologists. All experts noted the difficulty of interpreting the finds. B. Viola noted archaic and Neanderthal features, which were emphasized by a complex occlusal surface, specifically by a complicated pattern of grooves, a marked anterior fossa and the sixth cusp. On the other hand, the first molar from Okladnikov Cave has no epicristid (Zubov, 1992), which is a characteristic feature of Neanderthals (96 % according to S. Bailey (2002)). Viola argued that the third molars of another individual from the same cave demonstrated incomplete formation of the crests, which indirectly indicates the presence of an epicristid. The results of microtomography and virtual 3D reconstruction of the lower permanent molars from Okladnikov Cave allowed the researcher to identify the epicristid on the enamel-dentine junction. Citing a summary by Bailey (2002), Viola emphasizes that this feature brings the finds closer to Neanderthal teeth (2009: 133).

Viola examined two teeth from Chagyrskaya Cave and, despite the incomplete preservation and the obvious crown wear, came to the conclusion that the inhabitants of the cave belonged to the Neanderthal physical type (Viola et al., 2011). The team of authors published the results of a preliminary analysis of the mandible fragment with the teeth found *in situ*: a canine, two premolars, and two molars. The moderate crown wear made it possible to identify the presence of anterior fossa and epicristid on the molars, and the development of metaconid and crest (typical of the Neanderthal dental complex) on the premolars. The researchers believed that this finding linked the Altai hominins with the Neanderthals of Western Europe (Viola et al., 2012).

A.P. Buzhilova (2011, 2013) has carried out the most comprehensive study of the dental remains from Okladnikov and Chagyrskaya caves (excavations of 2008–2012). The analytical data on teeth from these sites were compared with those from Strashnaya and Denisova caves.

A.P. Buzhilova analyzed the available comparatively small collection of fragmented fossils and came to a number of very important conclusions. I will dwell on some of them. The comparative analysis has allowed the scholar to state that Neanderthals from Chagyrskaya Cave occupied an intermediate position between other Eurasian Neanderthals and anatomically modern humans in terms of the diameters of crowns of deciduous teeth. The analysis of the front deciduous teeth revealed a tendency of possible continuity between the Chagyrskaya Neanderthals and certain groups of the Upper Paleolithic population of Siberia (Listvenka, Strashnaya); the findings on the category of molars suggested their proximity to the robust Upper Paleolithic forms of Europe and partly Siberia (Malta). However, further studies are required to clarify these conclusions.

In general, according to Buzhilova, the teeth from Okladnikov and Chagyrskaya caves reveal similarities to those of Paleolithic *H. sapiens* both in terms of crown sizes and phenotypic traits, although some of them can undoubtedly be attributed to Neanderthals. This combination of ancient and more advanced dental characteristics can be considered a distinctive feature of Neanderthals from the Altai caves. "Thus, the dental data confirm the intermediate position of the Chagyrskaya Neanderthals between other Neanderthals of Eurasia and anatomically modern humans, which was earlier identified based on the morphological features of the skeleton" (Buzhilova, 2013: 64).

The morphology of postcranial remains from Okladnikov Cave was best described by M.B. Mednikova (2011b). She examined twelve postcranial bones, including juvenile specimens (humerus, right and left femurs, tarsal navicular bone) and remains of adult individuals (humerus, patella, foot and hand bones). The researcher argued that juvenile bones from Okladnikov Cave in diaphyseal parameters and morphological features are similar to those of the Neanderthal child from Teshik-Tash Grotto. According to the conclusion by D.G. Rokhlin (1949), the age of the Teshik-Tash individual determined by the postcranial skeleton is 7–9 years, and by the degree of teeth eruption 9–10 years. On the basis of these data, Mednikova (2011b: 20) concluded that even taking into account the inter-individual variability in the rate of somatic development, 8–10 years was the most likely age of the Altai child. Judging by the femur size, the body length of the Teshik-Tash child was only

123 cm, and that of the Neanderthal from Okladnikov Cave 129 cm. According to the estimate by Mednikova after the method by (Palkama et al., 1965), the height of both individuals was 138 cm. All the juvenile bones from Okladnikov Cave were of the same age, so she did not exclude the possibility that these belonged to a single individual.

Mednikova carried out a detailed and meticulous analysis of the postcranial remains of adults from Okladnikov Cave and made a generalized description of the Neanderthal skeleton from this cave. It was taken into account that most of the bone fragments probably belonged to women/woman. The level of sexual dimorphism among the Shanidar skeletons (the best studied collection for this trait) was quite high. On this basis, this feature could possibly be extended to the men from Okladnikov Cave. Among late European Neanderthals, the degree of variation in body size between men and women was lower, and Mednikova believed that this fact should also be taken into account (2011b: 72). Judging by the dimensions of medial phalanx of the hand, the body length of men from Okladnikov Cave could have varied in the range of 160–163 cm. The body length of women did not exceed the dimensions known for female Neanderthals in Western Asia—ca 158 cm.

Describing the upper limbs, Mednikova notes that the humeral shaft is smooth, straight and has no torsion. Its section is subtriangular. The medullary cavity is relatively small, its section is oval and anteriorly extended. The cortical layer is robust. The size of the lower epiphysis matches that of the most gracile forms of Middle and Upper Paleolithic humans.

As to the lower limbs, the middle and subtrochanteric part of the femur shaft section is stretched in the medio-lateral direction. The pilaster is presumably absent in adults. A wide gluteal tuberosity and a small femoral neck angle are comparable to those of the early *Homo*. The neck is extremely robust and short. The internal robusticity of the shaft is marked, the lateral walls being especially thick.

Despite the belonging to people of different sexes and ages, including children, the fragments of postcranial bones from Okladnikov Cave show a certain common feature, namely a specific combination of archaic and unique (individual) traits. The morphology of postcranial skeleton of the Sibiryachikha people is very similar to that of Neanderthals, but some archaic features bring them closer to *H. erectus*. The Chagyrskaya paleoanthropes show the least similarity to early anatomically modern humans of the Near East (except for the indices of the shape of the talus).

Mednikova has identified several peculiar features apparently inherent to the Chagyrskaya group. The main factor in the development of these features was the founder effect, which manifests itself as a genetic-automatic process in the conditions of isolation. Another factor could be biological adaptation to the environmental settings in the Altai low and middle mountains. Postcranial bones of these hominins are generally gracile and demonstrate a systemic morphological tendency—widening of articular surfaces, lateral hypertrophy of patella, etc. (Ibid.: 72–73).

Mednikova carried out a comparative analysis and identified nine morphological features of similarity between the Altai group of paleoanthropes and the Neanderthals from Tabun and Shanidar.

1. The humerus of a child from Okladnikov Cave is similar to that of Tabun C1 in terms of the midshaft cross-section index.

2. In the pilastry index (87.18), the right femur of the child from Okladnikov Cave approaches that of Tabun C1, which is flattened in the antero-posterior direction (calculated after (Pearson, 1997: 673)). Such a shape is considered a typical feature of *H. erectus* morphology.

3. The left femur of the Chagyrskaya child reveals a likewise weak extension of the shaft in the lateral view.

4. The humerus of an adult individual from Okladnikov Cave shows similarities with the most gracile forms, among which the closest are the Middle Paleolithic Shanidar 6 and Tabun C1.

5. The patella from Okladnikov Cave is similar in length (height) to the knee-cap of Tabun C1. All other Neanderthals had larger patellas.

6. The right calcaneus from Okladnikov Cave is closest in width and height to Tabun C1.

7. The talus of the adult from Okladnikov Cave is close to Tabun C1 in total length, head and neck length, as well as in the size of the articular facet of the lateral malleolus, which is atypically small for Neanderthals.

8. In terms of articular length and midshaft width, the third or fourth middle phalanx from Okladnikov Cave falls within the variation range of Shanidar males, and in terms of robusticity index it matches the third middle phalanx of Tabun C1. Despite the debate about the location of the Tabun C1 specimen (in layer B or layer C), the age of this individual is within the range of 122 ± 16 to 139 ± 25 ka BP (Bar-Yosef, Callander, 1999; Grün, Stringer, 2000).

9. The damaged medial phalanx of the second digit from Okladnikov Cave shows similarity to Tabun C1

in height (level of flatness) and, to a lesser extent, in width of the head (Mednikova, 2011b: 80–81).

On the basis of all of the above, Mednikova concluded that the mosaic pattern of similarities between the Neanderthal populations of the Levant and Altai may indicate their close genetic relationship. Since these populations belonged to territories and periods remote from one another, one cannot rule out the possible exodus of Neanderthals of such a morphotype from some third, intermediate center (Ibid.: 80–82).

When considering the morphology of the postcranial finds, Mednikova payed special attention to the robusticity of some bones from Okladnikov and Chagyrskaya caves. A special analysis of the hand phalanges of Okladnikov 2, Okladnikov 5, and Chagyrskaya 16-3-12 (the new catalogue number, Chagyrskaya 56c) has been carried out to clarify this issue (Mednikova, Shunkov, Markin, 2017). Cross-sectional geometry of middle phalanges of hand digits 2–4 was estimated by means of microtomography, in order to non-destructively study the internal structure of the specimens. Fossils from Okladnikov and Chagyrskaya caves, as well as the remains of five Neanderthals from Europe, were analyzed.

The La Ferrassie 1, 2, and Abri Pataud specimens were studied using the equipment of the Musée de l'Homme (Paris). All other fossils were scanned using the Xradia Versa XRM-500 X-ray 3D microscope at the laboratory of LLC *Systems for Microscopy and Analysis* (Moscow). The same scanner was previously used for studying the phalanx of the girl from Denisova Cave (Mednikova et al., 2013).

The Neanderthals from Okladnikov and Chagyrskaya caves differed from representatives of Western populations in a number of traits. For instance, the index of robusticity of the walls displays a noteworthy wide range of inter-individual variability, which is typical of both Neanderthals and Cro-Magnons. The degree of corticalization of phalanges is less variable among the European and Siberian male Neanderthals as compared to the female individuals of the same species from Okladnikov and Chagyrskaya caves in the Altai. The range of variation of this trait among the Neanderthals is delimited by these two female individuals: Okladnikov is hypermassive, while Chagyrskaya is hypergracile.

The Chagyrskaya and European Neanderthals demonstrate certain morphological and genetic differences, which emerged through divergence. Neanderthals populated the vast territory of Eurasia with various ecological conditions and, apparently, were often isolated from other groups; hence, they developed significant variability in morphology and lithic industry. Mednikova, having summarized information on the available postcranial remains from the Altai, concluded that in terms of morphology, the Altai Neanderthals demonstrated high inter-individual variability, with certain patterns (Mednikova, 2014, 2015). A proximal foot phalanx and a distal hand phalanx from Denisova Cave (Mednikova, 2011a, 2013a), as well as tubular bones of various individuals from Okladnikov Cave (Mednikova, 2011b), display the thickness of walls that is exceptional even for Neanderthals. Neanderthal postcranial bones from Chagyrskaya Cave were not distinguished by extraordinary internal robusticity (Mednikova, 2013b).

The results of microtomographic analysis of the medial hand phalanges confirm the previous conclusions regarding differentiation of the Southern Siberian Neanderthals into at least two morphological variants (Mednikova, 2015). It has been hypothesized that these variants might be related to different waves of migration of *H. neanderthalensis* to the Altai. On the other hand, it might be a result of genetic contacts of the Neanderthals with hominins of different taxa, for example, Denisovans (Ibid.).

However, as Mednikova and her colleagues note, taking into account the territorial proximity of the said caves, genetic contacts between the groups of cave dwellers cannot be excluded as well. In any case, the wide range of variability is a phenotypic reflection of the complicated history of origin of the Chagyrskaya Neanderthals (Mednikova, Shunkov, Markin, 2017).

The assumption on the possible division of the Chagyrskaya Neanderthals into two groups that independently migrated to Southern Siberia, in my point of view, requires additional argument. I withdrew my name from the authors list of the paper "Robusticity of Hand Phalanges: Relevance to the Origin of the Altai Neanderthals" (Ibid.), because the Chagyrskaya Neanderthals exhibited significant morphological variability. Mednikova (2011b) noted the pronounced gracility of female individuals; it is highly probable that various degrees of robusticity of the bones could be explained by sexual dimorphism. The available sample—fossils from Okladnikov Cave—is clearly insufficient for the fundamental conclusion that there were two or more migration waves of Neanderthals to the Altai. This idea is contradicted, for example, by the fact that the Chagyrskaya and Okladnikov lithic industries show a well-marked continuity of

development, and constitute a single Sibiryachikha industrial technical and typological complex of lithic tools.

M.V. Dobrovolskaya and A.V. Tiunov (2013), based on isotopic analysis data, studied the diet of the Chagyrskaya Neanderthals. Analyses of collagen from bone tissue of the postcranial skeleton remains did not reveal any differences in hominins from Okladnikov Cave—adults and adolescents, men and women. For comparative analysis, collagen was derived from bone tissue of herbivores (Tiunov, Dobrovolskaya, 2011; Dobrovolskaya, Tiunov, 2011). The researchers came to the unequivocal conclusion that the inhabitants of Okladnikov and Chagyrskaya caves hunted animals of certain species. Probably, the diet included fish.

The researchers provide noteworthy information about some aspects of life activity of hominins from Okladnikov and Chagyrskaya caves. The $^{87}Sr/^{86}Sr$ ratio in tooth enamel (Latkoczy et al., 2004) indicates that the Chagyrskaya Neanderthals permanently lived in this area, without leaving it. Favorable environmental conditions obviously ensured rather comfortable living for the people. Moreover, children, adolescents, adults, men, and women were equally provided with food. Indeed, the Chagyrskaya Neanderthals had shelter (cave), surrounded by steppes and forest-steppes inhabited by various animals, including large ungulates; there were constant sources of fresh water and raw materials for making tools. All this contributed to long-term residence at the same place (Dobrovolskaya, Tiunov, 2013).

Genomic sequence of the Chagyrskaya Neanderthals

DNA sequencing of the anthropological remains from Okladnikov Cave has finally determined the taxonomic affiliation of the cave dwellers (Krause et al., 2007). Neanderthal mtDNA was identified in the genome of an adolescent from Okladnikov Cave, which provided the grounds to expand the area of dispersal of this taxon in East Asia. The comparison of the mtDNA sequence of hominins from Okladnikov and Teshik-Tash caves with that of Neanderthals from Europe showed that the Teshik-Tash individual had greater similarity to individuals from Skladina Cave in Western Europe than the Okladnikov Neanderthal. The adolescents whose remains were found in the Altai and Uzbekistan belonged to European and West Asian Neanderthals (Ibid.).

DNA sequencing of the Chagyrskaya 8 phalanx provided important information (Mafessoni et al., 2020). The genetic analysis has shown that the individual lived ~80 ka BP, which contradicts the estimated time of Neanderthal habitation of the cave (60–45 ka BP). According to the available ^{14}C- and OSL-dates for the Chagyrskaya cave site, individuals Chagyrskaya 8 and Denisova 3 lived at approximately the same time.

The researchers note that Chagyrskaya 8 displays more common-derived alleles with Vindija 33.19 (Croatia) and other late Neanderthals from the Caucasus and Europe than with Denisova 5. As compared to Vindija 33.19, Chagyrskaya 8 shares fewer common derived alleles with other Neanderthals who lived in Europe ~50 ka BP, i.e. around the same time as Vindija 33.19. However, Chagyrskaya 8 shares more common derived alleles, than Vindija 33.19, with Denisova 11, a first-generation Neanderthal-Denisovan hybrid (Slon et al., 2018). Vindija 33.19 and Chagyrskaya 8 do not differ in the common derived alleles from Denisova 3; this means that among currently known Neanderthals, Chagyrskaya 8 is most closely related to Denisova 11 (Mafessoni et al., 2020: 15133). Chagyrskaya 8 is less closely related to Vindija 33.19 and other Neanderthals that contributed to the genetic heritage of modern non-African populations.

The coalescent analysis and modeling have shown that individuals Chagyrskaya 8 and Denisova 5 could be part of small subpopulations not exceeding 60 individuals, while analyses of the genome of Denisova 3 indicated that subpopulations of early modern humans and Denisovans were larger than 100 persons, provided that the migration rate between populations does not exceed 1 %.

The researchers concluded that Chagyrskaya 8 was more closely related to Vindija 33.19 and other late Neanderthals of Western Europe than to Neanderthal Denisova 5. The Neanderthals who lived in Chagyrskaya Cave were related to the populations of Neanderthals that migrated from Europe eastwards in the period from 120 to 80 ka BP. Some Neanderthals arrived to the Altai and contacted local Denisovan communities; these contacts resulted, for example, in the appearance of individual Denisova 11, whose father was a Denisovan and mother was a Neanderthal from the group to which individual Chagyrskaya 8 belonged (Ibid.).

At present, paleogenetic studies of the Chagyrskaya Neanderthals appear to be the most effective and large-scale in the genetic studies of this taxon as a whole. Genome sequencing has been carried out on

eleven Chagyrskaya samples and two Okladnikov samples. The results of the whole genome studies of the Chagyrskaya Neanderthals made it possible not only to derive the information on the genome of this population, but also to get an idea of the social organization of the isolated community of Neanderthals at the easternmost border of their distribution area (Skov et al., 2022).

The data on the social organization of the Neanderthal group that were obtained during the study of the Y-chromosome and mtDNA of the remains from Chagyrskaya and Okladnikov caves are of particular interest. As is known, the Y-chromosome is inherited through the paternal lineage, and mtDNA through the maternal lineage. To identify close genetic relationships, the researchers analyzed the cases of mtDNA heteroplasmy. Heteroplasmy can be transmitted from mother to child, and usually persists for at least three generations, so its presence in several individual remains indicates that these had a close maternal kinship (Ibid.: 521).

The derived genetic data have shown that the deciduous (Chagyrskaya 19) and two permanent teeth (Chagyrskaya 13 and 63) belonged to the same male individual, despite the different stages of their growth. Judging by the completely resorbed root of the deciduous tooth, it probably fell out for natural reasons. The researchers also determined that the two specimens—the right-side fragment of the mandible with several teeth (Chagyrskaya 6) and the left lower second incisor (Chagyrskaya 14)—belonged to the same adult individual, as evidenced by morphological similarity and identical mtDNA sequences. Chagyrskaya 12 and Chagyrskaya 8 belonged to the same female individual. It turned out that adult male Chagyrskaya 7 was related by first-degree kinship to female adolescent Chagyrskaya 17. Since these two individuals had different mitochondrial genomes, the researchers concluded that they were father (Chagyrskaya 7) and daughter (Chagyrskaya 17). In addition, the mtDNA of individual Chagyrskaya 7 was identical to that of two other individuals—Chagyrskaya 9 and Chagyrskaya 14. These individuals, as was shown by the analysis of general mtDNA heteroplasia, may have been close matrilineal relatives (fourth degree): they could have had a common grandmother. Close relationships indicate that all three individuals were contemporaries. It was also established that male individual Chagyrskaya 1 and female individual Chagyrskaya 60 were related in the second degree and lived in the cave during the chronologically similar periods. Genetic differences between all the cave inhabitants examined were insignificant. These and other data allowed the conclusion to be made that all the Neanderthals from Chagyrskaya Cave belonged to the same community (Ibid.: 522).

The two individuals from Okladnikov Cave were not related and had no family ties with any of the individuals from Chagyrskaya Cave. Therefore, the Neanderthals from Okladnikov Cave did not belong to the Chagyrskaya community. However, the mtDNA of Okladnikov 15 is identical to those of Chagyrskaya 13, 19, and 63, which were determined to be a single individual. Since mutations accumulate over time, the same mtDNA of different individuals means that the lifetimes of these two individuals were separated by several millennia (Ibid.).

Comparative analysis of nucleotide versions with the previously published Neanderthal genomes has provided important information. Genome of the Neanderthals from Chagyrskaya Cave, with high coverage degree, showed the greatest similarity to Vindija 33.19 (Croatia) among all 13 available Neanderthal genomes. The researchers concluded that although the communities from Chagyrskaya and Okladnikov caves differed genetically, both appeared to be similarly related to European Neanderthals, and were part of the same population. Not a single individual showed traces of recent genetic drift from other Neanderthal populations (Ibid.).

Studies of the genome of the Chagyrskaya Neanderthals helped to clarify the possible number of individuals living at this site. Formerly, it was assumed that Okladnikov and Chagyrskaya caves were inhabited by several dozen Neanderthals each; according to the new data, the total of 15–20 individuals habituated each cave. This number is more consistent with the "living area" of the caves. Furthermore, it turned out that in Chagyrskaya Cave, 60–100 % of women of the total of 20 inhabitants originated from other communities. However, heteroplasmy traits in individuals Chagyrskaya 14 and Chagyrskaya 7 indicates that at least some women remained in their native community.

Thus, anthropological and genetic studies of the Neanderthal remains from Chagyrskaya and Okladnikov caves showed that these hominins belonged to the eastern branch of European Neanderthals, which originated in Western Europe 200–150 ka BP. Western and Eastern Neanderthals, as well as modern humans and Denisovans, interbred and gave birth to fertile offspring (Green et al., 2010; Reich et al., 2011; Fu et al., 2015; and others). It seems reasonable to consider these three taxa not as different species, but

as subspecies of the same species, *H. sapiens sapiens*. It was as a result of their assimilation, with the stem role of African early modern humans, that the modern population originated (Derevianko, 2019, 2022; Derevianko, Shunkov, Kozlikin, 2020).

Possible migration routes of European Neanderthals to the Altai and the issues of the Chagyrskaya Neanderthals dispersal in Central Asia

The anthropological and genetic studies have shown a significant variability in the morphology and genetic sequence of Chagyrskaya Neanderthals, who demonstrate similarity to representatives of this taxon from the Near East and Europe. Hence, the possible route of their migration to East Asia and the dispersal in Central Asia are of considerable interest.

E. Ghasidian and his co-authors (2023) examined the possible route of migration of Neanderthals from the Caucasus to East Asia. Taking into account the physical and geographical data characterizing these regions in the Late Pleistocene, these created a model of the most optimal route of dispersal of the Neanderthals whose remains were found in Okladnikov and Chagyrskaya caves. The researchers proceeded from the assumption that the Caucasian Neanderthals produced two different lithic industries: the Micoquian in the Greater Caucasus and the Mousterian in the Lesser Caucasus. Notably, the Neanderthal Mousterian industry shows great variability: about ten versions have been identified in Europe; the Micoquian industry can be considered one of these. Significant industry variability was recorded among Neanderthal communities in the Caucasus (Lyubin, 1977; Doronichev, 1993; Golovanova et al., 2006, 2022; Doronicheva et al., 2020; and others). Researchers also focused on the natural and climatic situation in the chronological range of 71–57 ka BP (MIS 4). It was the period of a cold and dry climate.

Ghasidian and his colleagues considered two possible routes of migration of Neanderthals from the Caucasus: either along the South Caspian or the North Caspian corridors. During MIS 4, there was a a strong regression of the Caspian Sea due to cooling and aridization of the climate; the water level could drop by about 120–140 m, and large areas were dried up. In the previous period (MIS 5), associated with the Late Khazarian transgression, the level of the Caspian Sea was significantly higher; the researchers argued that the Caspian was connected with the Black Sea (Ghasidian et al., 2023).

The southern route, from Azykh Cave to the eastern Altai, as per the researchers, probably passed along a narrow strip of land between the Caspian Sea and the Alborz Mountains, through the Hyrcanian biogeographical refugium, then along the northern foothills of the Hindu Kush and Pamirs to the Hissar mountain range towards the Tien Shan (Ibid.: 14).

The computer program generated two main parts of this route: the first part began from Azykh Cave in Azerbaijan and ended at Teshik-Tash Cave in Uzbekistan, and the second stretched from Teshik-Tash to the Altai. For the second part of the route, two possible ways were proposed. One involved passing through the northern piedmonts of the Kopetdag, and the other led through the mountain valleys and plains south of the Kopetdag. At the northern foothills of the Hindu Kush, these two routes merged and led to the Altai.

The northern route of the Neanderthal migration began in Mezmayskaya Cave in the Greater Caucasus and ended in Chagyrskaya Cave in the Altai. Judging by the genetic and archaeological evidence, researchers suggested that this was a direct route from Eastern Europe to Siberia. During the period of 70–55 ka BP, Neanderthals could cross the Pontic-Caspian region and penetrate into the southern part of the Greater Caucasus. According to the researchers, no traces of habitation of the Lesser Caucasus by this group of Neanderthals with the Mousterian industry during this period have been found (Ibid.: 13).

Considering two computer models of Neanderthal migration routes to East Asia, the scientists suggested that during the cool period (MIS 4), the south Caspian corridor was more preferable because of favorable living conditions, and was a kind of refugium.

The Okladnikov and Chagyrskaya lithic industries, in some technical and typological criteria (primarily, the presence of bifacially worked tools of the Klausennische and Bockstein types), show the closest similarity to the Eastern European Micoquian (Derevianko, Markin, Kolobova et al., 2018).

The research conducted by Ghasidian and colleagues was certainly based on fundamental studies and interdisciplinary approach. However, when considering the territory of Central Asia as a transit area in the west-to-east migration of Neanderthals with the Micoquian industry, it should be borne in mind that a relatively small amount of anthropological remains has been found in this vast region so far.

The earliest anthropological remains in Central Asia were reported from Selungur Cave, located in the western outskirts of the village of Khaidarakan, in the Osh Region, in the south of Kyrgyzstan (Islamov, Krakhmal, 1995). The cave revealed 13 lithological layers, including 5 culture-bearing horizons yielding 1412 lithic artifacts and a great amount of faunal remains. Cultural layers 2 and 3 contained anthropological remains: layer 2 fragments of the skull cap and isolated human teeth, layer 3 solitary teeth (n=10) and fragments of humerus (Islamov, 1990; Islamov, Krakhmal, 1995). The teeth and fragments of the humerus were analyzed by various researchers (Islamov, Zubov, Kharitonov, 1988; Islamov, Starchmal, 1995; Zubov, Khodjayov, 1997).

On the basis of the derived analytical data on a relatively small number of rather uninformative classes of teeth with severe wear—incisors and premolars—anthropologists tried to determine the taxonomic position of the anthropological finds from Selungur. It was assumed that the individual to which the premolars belonged could be placed between paleoanthropes and archanthropes, with a significant shift from the general evolutionary line due to the exceptionally large values of buccolingual diameter of the crown (Islamov, Zubov, Kharitonov, 1988; Zubov, Khodjayov, 1997). Given the large size of the crown, I believe that this individual can be attributed to the late *H. heidelbergensis* (Denisovan) who migrated around 400–350 ka BP from the Levant to the east and inhabited Central Asia for a long time (Derevianko, 2022).

More information has been derived from the anthropological remains from Obi-Rakhmat layer 16; this layer contained a small number of artifacts of the Obi-Rakhmat industry. Anthropological finds included 6 solitary permanent maxillary teeth and ca 150 small fragments of OR-1 skull (Glantz, Viola, Chikisheva, 2004; Viola, Seidler, Nadden, 2004; Glantz et al., 2008; Bailey et al., 2008). The majority of the fossils were recorded *in situ*, in a small area adjacent to the southern wall of the main excavation trench. Some fossils were identified in the course of washing and sieving of the culture-bearing sediments from the above-mentioned area. The finds were concentrated in an area of 0.5 m^2; however, their fragmentary nature precludes their classification as a burial. No dates have been derived for layer 16, but for the overlying layer 14, subdivided into three horizons, several ^{14}C- and ESR-dates were generated. Horizon 14.1, containing the Upper Paleolithic industry, yielded an uncalibrated date of 48,800 ± 2400 BP (AA-36746), horizon 14.3 two ESR dates (FT 26): 40,600 ± 1600 BP (EU) and 72,800 ± 3700 BP (LU). In my opinion, layer 16 can be dated to ca 60 ka BP or even a younger period.

The teeth and skull fragments have been studied by many anthropologists (Glantz, Viola, Chikisheva, 2004; Viola, Seidler, Nadden, 2004; Glantz et al., 2008; Bailey et al., 2008). Given the morphology of teeth and fragments of skull OR-1, the researchers concluded that the fossil could be definitely attributed neither to modern humans, nor to Neanderthals, nor to archaic *H. sapiens*. "A clear determination of the morphological identity of skull OR-1 is hampered by its heavy fragmentation and the young age of the individual, but the observed morphology suggests a close proximity of OR-1 to humans of the modern anthropological type. The reconstructed left parietal bone is relatively large and thin, and the temporal bone has a relatively modern appearance. This feature of the skull, combined with its gracefulness and large size, the archaic appearance of the teeth, and the unclear morphology of the ear labyrinth, demonstrates a mosaic morphology similar to that of the recently discovered hominin remains from Oase (Romania)" (Glantz, Viola, Chikisheva, 2004: 91–92). Subsequently, based on the results of analysis of the upper dentition of OR-1, anthropologists identified these specimens as Neanderthal.

The taxonomic affiliation of the remains from Obi-Rakhmat Cave should be established with respect to the technical and typological complex of the lithic industry from layer 16, in which OR-1 was found. Continuous development of the lithic industry without any noticeable gaps was noted throughout the entire stratigraphic sequence of the site: from the lowest to the upper layers, the shares of protoprismatic, prismatic, and edge-faceted cores grew up; clear trends towards an increase in the laminar index from bottom to top through the profile (layers 21–7), an increase in the number of microblades, as well as a decrease in the overall dimensions of the blanks were noted; the proportion between types of tools changed—the number of the Upper Paleolithic tools grew up as compared to the Middle Paleolithic ones; primary reduction was characterized by an increase in the number of blade blanks and cores typical of the Upper Paleolithic strategies, with some traces of the Levallois reduction.

The Obi-Rakhmat lithic industry clearly illustrates the process of development of the Upper Paleolithic industry on the basis of the final Middle Paleolithic industry. This stage is tentatively dated to

60–50 ka BP, and the initial Upper Paleolithic is dated to 50–40 ka BP. The Obi-Rakhmat industry demonstrates no common features with the Mousterian of the Neanderthals either in primary reduction or in technical and typological characteristics. It shows the greatest similarity to the Denisova Middle Paleolithic industry (Derevianko, Shunkov, 2004; Derevianko, 2022; and others). I believe that the OR-1 fossils should be classified as *H. s. denisovan*, which retained some morphological traits from the ancestral form common with Neanderthals—*H. heidelbergensis* (Derevianko, 2020).

Both Denisova Cave and Obi-Rakhmat Grotto were inhabited by representatives of the same taxon—*H. s. denisovan*. First, the dentition of the inhabitants of these sites show considerable similarity. Second, the culture-bearing layers of these caves revealed lithic industries with close basic technical and typological features.

Indisputable Neanderthal anthropological remains were discovered in Teshik-Tash Grotto, located in the Baysun-Tau mountain range, 2.7 km from the village of Machay, in the Zautolosh-Darya sai (Uzbekistan). The grotto is situated at an altitude of 6 m above the thalweg of the sai, and 1872 m above sea level. The entrance zone is 7 m high and 20 m wide, the grotto is 21 m long. The grotto was found and explored by A.P. Okladnikov in 1938–1939 (1949).

The anthropological remains of an adolescent from Teshik-Tash have been classified as Neanderthal based on morphological and genetic evidence, but the taxonomic status of the fossils still remains controversial.

The morphological features of the Neanderthal child from Teshik-Tash Grotto have been described in many papers. Before the publication of the monographic description of the morphology of this individual, prepared by M.A. Gremyatsky (1949), and after that, almost all experts in Neanderthal issues expressed their points of view on the features of his morphology, and the significance and place of the find among other anthropological remains of this taxon. Moreover, with the emergence of new facts, some researchers changed their assessments of the significance of the Neanderthal child's skeleton from Teshik-Tash.

According to most researchers, the find shows mixed Neanderthal and East Asian traits (Debetz, 1948; Weidenreich, 1945, 1949; Howell, 1951; Trinkaus, 1983; Trinkaus, Howell, 1979; Gremyatsky, 1949; Thoma, 1973; Wolpoff, 1999; Alekseev, 2007; and others). Anthropologists have various points of view on the presence of European or East Asian features in the morphology of this skull.

I believe that the Neanderthals who settled in the western part of Central Asia migrated from the Near East: their morphological features are close to the Western Asian Neanderthals; their lithic industry is very similar to that of the final stage of the Middle Paleolithic of the Levant. This conclusion is supported by F. Weidenreich, who argued certain similarities of the Teshik-Tash fossil to some skulls from Skhul Cave (especially Skhul 5). He believed that in terms of morphology the Teshik-Tash skull could belong to an advanced hominid intermediate between classic Neanderthals and modern humans, like the Palestinian population inhabiting the Carmel mountain range; though, his frontal part and teeth show some Mongoloid features (Weidenreich, 1949: 160).

A.P. Okladnikov characterized the Teshik-Tash industry as Mousterian with Levallois elements. Y. Nishiaki and O. Aripjanov (2020) have recently examined part of the collection from this site and have come to the conclusion that in the primary reduction Levallois technique was used. Formerly, I had the opportunity to analyze the lithic artifacts from Teshik-Tash, too (Derevianko, 2011). From my point of view, the primary reduction was most often executed by radial flaking of blanks; the subprismatic flaking technique was less common, with the less careful preparation of striking platform and flaking surface. No well-prepared Levallois cores have been found in Teshik-Tash.

Teshik-Tash yielded many blades with regular shape in plan view. For example, cultural horizon 1 produced 32 blades, and cultural horizon 5, 60 blades. The subprismatic cores found in horizon 1 were not intended for the production of such blades: the length of some blades reached 10 cm, while the height of the most well prepared blade core was only 4.3 cm. This means that the cores found in the grotto were heavily exhausted or that the primary reduction was carried out outside, at the raw material outcrops.

Anyway, the Teshik-Tash lithic industry cannot be attributed to the Micoquian type. Moreover, no sites with Micoquian industry have yet been discovered in Central Asia. Judging by the homogeneous nature of the Teshik-Tash technocomplex, all five culture-bearing layers were accumulated over a short period of time; these should be dated to the period of 55–45 ka BP. Thus, the Neanderthal population from Teshik-Tash and the Chagyrskaya Neanderthals roughly belonged to the same chronological range, but produced lithic complexes with different technical and

typological features. Hence, Central Asia could not be regarded a transit area for Neanderthals with the Micoquian industry migrating from Europe to Siberia.

So far, only one site has been discovered in Central Asia (Teshik-Tash), containing the Mousterian industry and the remains of Neanderthal from the population that migrated from the Near East through the Iranian Plateau to this region. Sites with fossils of the Chagyrskaya Neanderthals and the Siberyachikha Mousterian Middle Paleolithic industry have not yet been found in Central Asia.

Noteworthy is a skull fragment discovered in 2006 in the Salkhit area, Mongolia; unfortunately, located outside of the archaeological context. The authors of the first publication devoted to this find determined clear erectoid features in the skull fragment and attributed it to *H. erectus* (Tseveendorj, Batbold, Amgalantugs, 2006).

In May 2006, in the Salkhit valley (Norovlin somon, Khentei aimak), geomorphological and stratigraphic studies were carried out (Derevianko, Tseveendorj, Gladyshev et al., 2007). At that time, the *Bayan-Erdes* company was mining gold in this area; its workers found the skull and transferred it to the Institute of Archaeology of the Mongolian Academy of Sciences. Prior to that discovery, open-pit gold mining had been carried out in the area for 5 years, which led to the complete destruction of a significant part of the loose sediments throughout the profile, up to the weathering crust of the granite base. The study area is located on the eastern spurs of the Khentei Highlands, which topographic features are hilly surfaces, small hills, low mountain massifs, separated by areas of denudation and flat depressions with lake basins.

Several excavation trenches were established in the immediate vicinity to the place of discovery of the skull fragment, in the areas not disturbed by gold miners. The section in the western side of the Salkhit valley was the most informative. The trench was 10 m long and 4.25 m deep, and reached the weathering crust overlain by a horizon of sandy-grus-gravel deposits. The loose sediments were characterized as instable due to an increase in both endogenous and exogenous morphogenesis. The cause of the changes was probably climate change towards warming (Karga period of the Late Pleistocene), which led to an increase in humidity and water supply in the area. This contributed to a more intense erosion-denudation processes leading to accumulation of absolutely unsorted clastic sediments of the deluvial-proluvial origin. A sufficient amount of free flowing water led to the formation of an alluvial-proluvial deposits at this level, which was the former bed of a small watercourse, filled with obliquely layered sandy material. The next horizon, overlying the Karga sequence, was layer 3 of slope genesis. It was likely accumulated during the Sartan period, distinguished by general cooling, lack of free flowing water (non-aquatic origin of these layers), and progressive aridity. The overlying layer 2 was deluvial-proluvial; it was attributed to the Holocene, associated with the formation of soil and plant horizons.

Summarizing the data derived from the analysis of stratigraphic section of the Salkhit valley, we can conclude that the lowermost layer of the loose sediments is not older than the Early Karga period, i.e. 55–50 ka BP. Consequently, the skull cap belongs to a person of the *H. sapiens* type or to an archanthropus whose emergence in that place is absolutely unbelievable, because the geomorphological situation in the vicinity of the Salkhit valley excludes the presence of any ancient deposits which destruction could have led to the transfer of the skull to the bottom of the valley (Ibid.: 92–93).

Subsequent research confirmed the conclusion made during field work in 2006. Initially, the age of the Salkhit skull was estimated to ~23 thousand years; however, the age was underestimated due to poor sample purification. Today, the skull is dated to 34,950–33,900 cal BP (Devièse et al., 2019).

The fragment of the Salkhit skull cap includes an almost complete frontal bone, as well as partially preserved parietal and nasal bones, which show vivid archaic features. On that ground, D. Tseveendorj and his co-authors proposed a new taxon—*Mongolanthropus* (Tseveendorj, Batbold, Amgalantugs, 2007). The comparison, through the multivariate statistical analysis, of the skull size with those of various types of hominins has revealed similarity of the Salkhit skull to the remains of Neanderthals, *H. erectus*, and Asian archaic *H. sapiens* (Kaifu, Fujita, 2012); and the Salkhit hominin was eventually classified as a Late Pleistocene modern human. Even earlier, anthropologists established the relationship of this individual with Neanderthals and *H. erectus* by some parameters, and concluded that in terms of the physical morphology this was a human of the modern type, with apparent erectoid ancestral features (Coppens et al., 2008).

Analysis of three samples of Salkhit skull biomaterial has shown that its mtDNA lineage refers to macrohaplogroup N, which, together with haplogroup M, belongs to the basic mtDNA haplogroups common to all non-African modern humans (Devièse et al.,

2019). As experts note, it is unlikely that the Salkhit mitochondrial lineage, which runs from the root of haplogroup N, directly inherits any modern human mtDNA. Among ancient modern humans, only the mtDNA of the Romanian Oase 1 skull, whose age is ~40 thousand years, falls outside the known N or M sublineages. This indicates the greater mtDNA diversity among Eurasian early modern humans than that of younger and extant populations (Ibid.: 4).

The nuclear DNA sequencing of a fragment of the Salkhit skull has revealed 18 segments of Denisovan origin longer than 0.2 nm in the genome of this hominin; 20 completely similar segments were identified in the genome of a hominin from Tianyuan Cave (Massilani et al., 2020). As per the researchers, the modern people's ancestors who lived in East Asia 40 ka BP met and interbred with Denisovans (Ibid.: 582). Based on this finding, it can be assumed that ca 40 ka BP modern humans met Denisovans (Salkhit), and as a result of introgression, genetic drift occurred from the indigenous population to the migrants. The morphology of the skull from Mongolia differs from similar finds from China.

It has been shown that the DNA of the Salkhit fossil exhibits a large discrepancy with the DNA of anthropological finds from Tianyuan Cave; therefore, the Mongolian hominin can be considered the most likely representative of the Denisovan taxon or a hybrid of a modern human and a Denisovan (Derevianko, 2022).

Thus, the currently available anthropological and archaeological materials suggest that in the Late Middle and Upper Pleistocene, populations of *H. s. denisovan*, practicing various local versions of the Denisova Middle Paleolithic industry, dispersed over the territory of Central Asia. Their lithic industry possibly formed the basis for the convergent development of the Upper Paleolithic in some regions of this part of the continent. Small groups of Neanderthals arrived to this territory from the Near East through the Iranian Plateau. The Chagyrskaya Neanderthals followed a different route from Eastern Europe to the Altai.

The most likely route of European Neanderthals with the Micoquian industry from Eastern Europe to the Altai ran through the northeastern part of the Russian Plain and the northern foothills of the Urals, where sites of the Late Pleistocene with the Mousterian were discovered (Pavlov, 2008; Serikov, Chlachula, 2014). Among these, the Garchi I site, located in the Upper Kama basin (59º04′ N; 56º07′ E), is of the greatest interest (Pavlov, 2008). The available OSL-dates suggest the age of ca 100 thousand years, which, in my opinion, is too old. The lithic industry of the site demonstrates the predominance of products with traces of continuous or partial flat-convex bifacial working: bifacial knives, angular and convergent side-scrapers, points, and foliate bifaces. The small, but distinct lithic collection of the Peshcherny Log site shows similar features (Ibid.: 35). These sites with the Micoquian industry can be considered the evidence of the west-to-east migration of European Neanderthals to the Altai.

Possibility of the Chagyrskaya Neanderthals dispersal across the South Siberian Regions contiguous to the Altai

Archaeological materials dating back to the second half of the Upper Pleistocene in Southern Siberia do not provide convincing data on the possibility of dispersal of the Chagyrskaya Neanderthals across this region. The reasons for this are the small number of sites with long stratigraphic sequences in Southern Siberia and the lack of geochronological data.

The Altai borders on Tuva in the southeast. S.N. Astakhov, one of the famous researchers of the Old Stone Age of Siberia, attributed the Tuva Early Middle Paleolithic to the Levallois-Mousterian or Mousterian, and initially dated this stage to the time not younger than the Karga period, or rather to the optimum within the Lower Zyryan (Murukta) cooling, i.e. up to 80–75 ka BP; later, he proposed an older age—the Early Kazantsevo Interglacial (MIS 5e) (Astakhov, 1986, 1993, 2008).

S.N. Astakhov identified a number of sites of the Sagly group with the final Middle Paleolithic industry; the industry reveals many Upper Paleolithic products manufactured on blades, which fact suggests a significant role of blade flaking. However, due to the lack of stratified sites, it is impossible to detect reliably the continuous development between the Middle and Upper Paleolithic, as well as to identify the chronology. All researchers of the Tuva Paleolithic attributed the Middle Paleolithic industry of the region to the Mousterian. However, in Tuva, despite the presence of some elements reminiscent of Mousterian-type products in the Middle Paleolithic industry, no sites with the Sibiryachikha industry were found.

In Middle Siberia, the Kurtak archaeological region is the best studied area (Drozdov, 1992; Drozdov et al., 2000, 2007). The Kamenny Log-1 and -2 sites have been attributed to the Middle Paleolithic in this region.

The lower culture-bearing layers at these sites, with artifacts representing discoidal reduction, dates back to the Late Early Paleolithic. On the beach surface in excavations 2–4 and in pit 12, despite of the pebble-flake industry, lithic artifacts attributable to the Middle Paleolithic were found.

The earliest artifacts were discovered on the surface and in eroded soil at Kamenny Log (analog to Kazantsevo soil; MIS 5). The primary reduction is represented by radial and Levallois cores; the tool kit includes choppers, chopping tools, various side-scrapers, and Levallois points with well-faceted platforms of the *chapeau de gendarme* type. The combination of tools of the final Early Paleolithic and Middle Paleolithic suggests that this area was simultaneously inhabited by the late *H. erectus* and Denisovans with their Middle Paleolithic industry.

The artifacts from Dvuglazka Cave in Khakassia also demonstrate the evidence of the Levallois reduction strategy—the Levallois points. Z.A. Abramova (1981, 1985) attributed the industry from Dvuglazka bottom cultural layers 5–7 to the Mousterian of the Levallois type. The available radiocarbon dates obtained for layer 6 (39,900 ± 800 BP) and layer 7 (27,200 ± ± 800 BP) are clearly too young. From my point of view, the most probable age of lower cultural layers 6 and 7 in Dvuglazka Cave is 40–45 thousand years. Notably, the Levallois reduction likely emerged in Central Siberia at the initial stage of the Kazantsevo warming (MIS 5e). The Levallois points with faceted bases date back to a younger period (MIS 5b, a); this industry survived till the arrival of early humans in Dvuglazka Cave. The emergence in Central Siberia of the Levallois reduction for the manufacture of Levallois points could have been associated only with Denisovans, because initially the Chagyrskaya Neanderthals did not use this technique. The noted traces of the use of the Levallois reduction by the inhabitants of Okladnikov Cave are associated with the contacts between the Chagyrskaya Neanderthals and Denisovans 45–40 ka BP. This situation does not exclude the possibility of settling of a small group of the late Chagyrskaya Neanderthals in Khakassia.

Conclusions

The Chagyrskaya Neanderthals with the Micoquian industry are the easternmost representatives of the European Neanderthals who migrated to the Altai. This population moved from Europe through its eastern part north of the Caspian Sea, through the Urals, and further to Western Siberia. Divergence and the need to adapt to new environmental conditions in the settlement areas led to the development of morphological and genetic variability, as demonstrated by this group of Neanderthals. Their anthropological remains have so far been found only in three caves: Okladnikov, Chagyrskaya, and Strashnaya. The Mousterian industry of the Chagyrskaya Neanderthals was found in an extremely small area. The possibility of the dispersal of the Chagyrskaya Neanderthals in adjacent regions is the issue requiring further research.

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A.M. Kuznetsov[1] and S.A. Kogai[2]
[1]Irkutsk State University,
Karla Marksa 1, Irkutsk, 664003, Russia
E-mail: golos_siberia@list.ru
[2]Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: kogai@irkutsk.ru

The "Makarovo" Component of Sosnovyi Bor, Southern Angara, Revisited

The paper presents the findings of a revision of a flint assemblage subjected to aeolian corrasion from Sosnovyi Bor horizon VI, southern Angara, in the Angara-Belaya geoarchaeological region. Initially, the industry was attributed to the "Makarovo Paleolithic Horizon" and dated to the pre-Karga/pre-Murukta stage in accordance with the idea of extreme deflation periods in Siberia. Our revision has resulted in a more accurate assessment of the assemblage composition, correcting the views of the toolkit, flaking strategies, and aeolian corrasion of lithics. We challenge the earlier idea that narrow-faced cores were made on bifaces. Instead, the findings indicate the use of volumetric prismatic and flat-parallel cores with a maximal reduction of residual forms. Two types of blanks are described: blades and bladelets. Small tools include burins, implements with a fashioned tip ("nose" or "spur"), retouched blades (the retouch sometimes extends to proximal parts). Signs of aeolian corrasion range from weak luster to completely worn-off facets and pitted surfaces. Chronological and cultural proximity of Sosnovyi Bor to Makarovo IV industries is questioned despite similarities in post-deposition conditions and flaking, because the tool kits are markedly different. The closest parallels are found among Early Sartan small-blade industries of Trans-Baikal and Yeniseian Siberia. Abrasion could have occurred during the cold and arid maximum of the last glaciation. We conclude that the industry dates to the middle stage of the Upper Paleolithic.

Keywords: *Baikal Siberia, Paleolithic, "Makarovo Horizon", corrasion, Sartan age, blade reduction.*

Introduction

Corraded industries of the "Makarovo Paleolithic Horizon" take a special part in the cultural and chronological framework of prehistoric cultures of the Baikal Siberia (Medvedev, Sklyarevsky, 1982). This assemblage, showing technological markers of the blade and microblade edge-faceted reduction, bifacial technique, and tools, such as points, convergent side-scrapers, déjeté scrapers, burins, and chisel-like implements, was attributed to the final Middle and the earliest stage of the Upper Paleolithic, and believed to be older than 70 ka BP (Medvedev, 2001). However, studies carried out in the recent years have demonstrated that certain industries included in this "Horizon" may be associated with much later cultures (Rybin, Meshcherin, 2015; Rybin, Khatsenovich, 2020; Kuznetsov, Molchanov, Kogai, 2023).

It is especially important, therefore, to revisit previously described industries associated with the "Makarovo Horizon". Key among such complexes is

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the lithic industry of culture-bearing horizon (hereafter "horizon") VI of the Sosnovyi Bor stratified site (Medvedev, 1983). The aim of our study is to subject it to a technological and typological revision with a view of assessing its chronology and cultural attribution. In more general terms, the study touches upon the issues of scholarly semiosis (Tetenkin, 2009) by attempting not to reveal the errors made by our predecessors but to adapt previous findings to new paradigms.

Description of the site

The site of Sosnovyi Bor was discovered in 1966 by the Angara Archaeological Team of the Irkutsk State University. It was studied during the field seasons of 1967–1971, 1983, 1997, and 2000–2003 under the direction of G.I. Medvedev, I.L. Lezhnenko, and A.G. Generalov. The site is located on the steep right bank of the Belaya River, at an elevation of 18–22 m above the water's edge. The difference in elevation between the right and left banks near the site is 15–17 m (Fig. 1). Archaeological remains fall within a narrow range 1500 m long and 40 m wide. Mesorelief includes deformed dunes up to 3 m high, occupied by pine forest and oriented in the north-west direction.

The riverbank terrace is formed by tabular dolomite bedrock basement attributable to the Angara suite of the Lower Cambrian (Cm_1an) overlain by boulders and pebbles (layer 9) (Fig. 2). Quaternary deposits consist of two parts: the lower alluvial part covers Jurassic deposits (layer 7); the upper part is of aeolian genesis (layer 3). Stratigraphy shows a distinct unconformity between them (Vorobieva, 1991). Alluvial sands are deformed by cryoturbation; these are scattered and comprise loam inclusions (layer 8).

All culture-bearing layers are incorporated into the aeolian deposits. Isolated finds from horizon I in the base of the modern soil (layer 1) date to the Late Neolithic/Bronze Age; preceramic horizon II is associated with Early Holocene sediments (layer 2) (Lezhnenko, Medvedev, Mikhnyuk, 1982). Underlying horizons III–IV connected with glay sandy loams varying in degree of carbonization,

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

which mark the immature Bølling-Allerød soils of the final Sartan (layers 4 and 5), correlate with different stages of the Mesolithic (ca 12 ka BP) (Medvedev et al., 1971; Vorobieva, 1991). Horizon V, initially interpreted as a "contemporary" of "classic" Malta and then as a Middle Sartan complex, ultimately was attributed to the Bølling-Allerød interstadial (Lezhnenko, 1991; Berdnikova, 2012; Berdnikova, Berdnikov, Vorobieva, 2017). This supposition is corroborated by the presence of the distinct "Yubetsu" component in the lithic assemblage and by the radiocarbon date of 12,390 ± 45 BP (OxA-39086) (Zolotarev, Shegutov, 2020). Bottom horizon VI, assessed as transported, contains variously corraded lithics distributed in isolated patches, highly variable in the concentration of finds (Generalov, Slagoda, 2001). It is associated not with soil rudiments, but with the grus-pebble crust (layer 6) underlying the Sartan sequence of sands, which marks the deflation transect line (Vorobieva, 1991).

Technical and morphological revision of the assemblage

Artifacts were counted and subjected to technological and typological analysis to reveal technologically meaningful

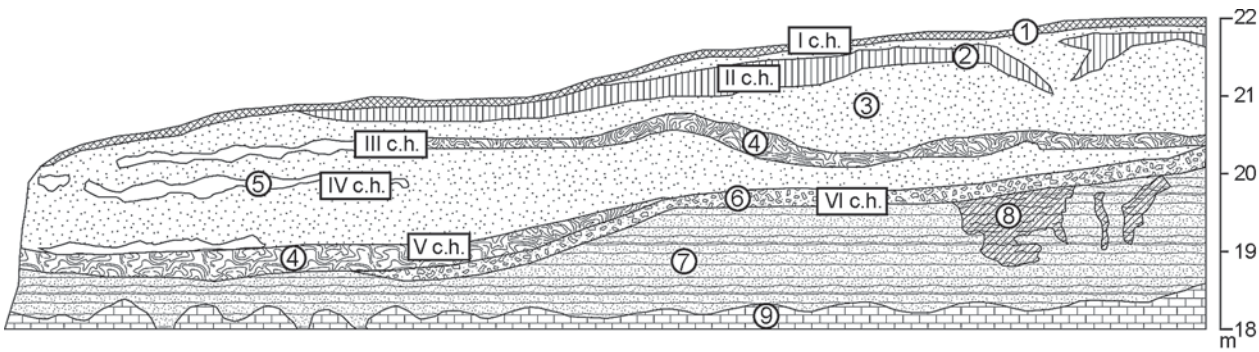

Fig. 2. Combined stratigraphic profile (after (Vorobieva, 2010: 52, fig. 12D)).

criteria required for the reconstruction of knapping strategies (Pavlenok, Belousova, Rybin, 2011). Traces of corrasion were analyzed with regard to qualitative characteristics ("heavy", "moderate", "weak", and "absent") of three variables: luster, erosion, and worn-off facets (Durand, Bourquin, 2013).

Lithic assemblage from horizon VI of Sosnovyi Bor comprises 347 artifacts:

	Spec.	%*
Core-like pieces	7	3.7
Core-trimming elements	57	30.2
Blades	31	16.4
Bladelets	22	11.6
Microblades	1	0.5
Flakes	71	37.6
Debitage	158	45.5

*Proportions were calculated without debris.

The raw material represented by bedded chert of gray-white-black coloration is characterized by fissured structure both along striae and inner cavities. Nodules of this material, small in diameter, were "soldered" into Lower Cambrian dolomites of rock walls, including the basement of the coastal bluff, in the lower reaches of the Belaya.

The flat core technique represented by three artifacts is associated with a simple sequence of unidirectional knapping with a minimal preparation of surfaces (Fig. 3). A single-platform core with two flaking surfaces opposing each other illustrates the volumetric core technique (Fig. 4, *2*). An exhausted flat bilongitudinal core (Fig. 5, *1*) suggests the utilization of narrow-faced cores. Core-like fragments cannot be used for the assessment of reduction technique, but they bear negatives of bladelets.

The assemblage contains various core-trimming elements:

	Spec.	%
Decortication flakes	15	26.3
Working surface rejuvenation flakes	14	24.6
Longitudinal lateral flakes	8	14
Semi-crested blades	6	10.5
Flakes removed from core's base	4	7
Debitage surface preparation flakes	3	5.3
Semi-tablet flakes	2	3.5
Natural lateral flakes	2	3.5
Crested blades	2	3.5
Core convexity maintenance flakes	1	1.8

The number of complete flakes is 24. They illustrate stages of primary reduction such as decortication, shaping of flaking surfaces and striking platforms, maintenance of

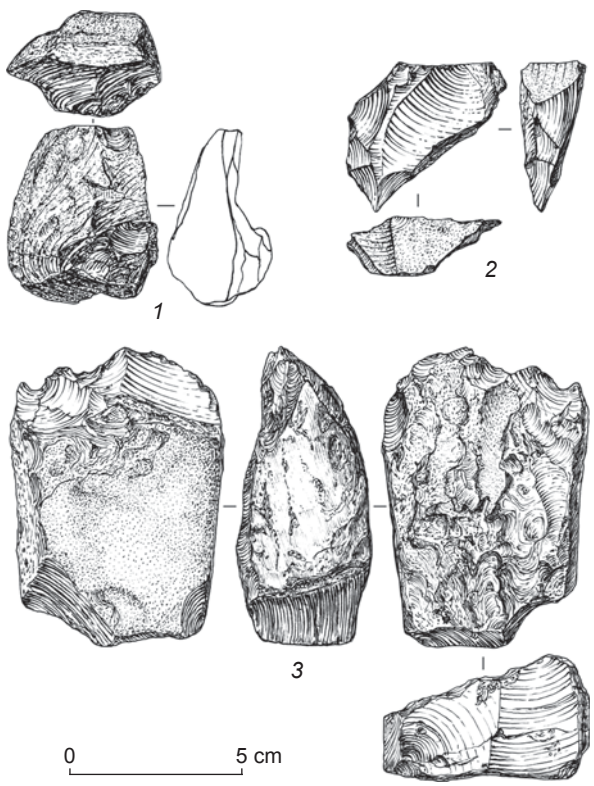

Fig. 3. Flat-faced cores.

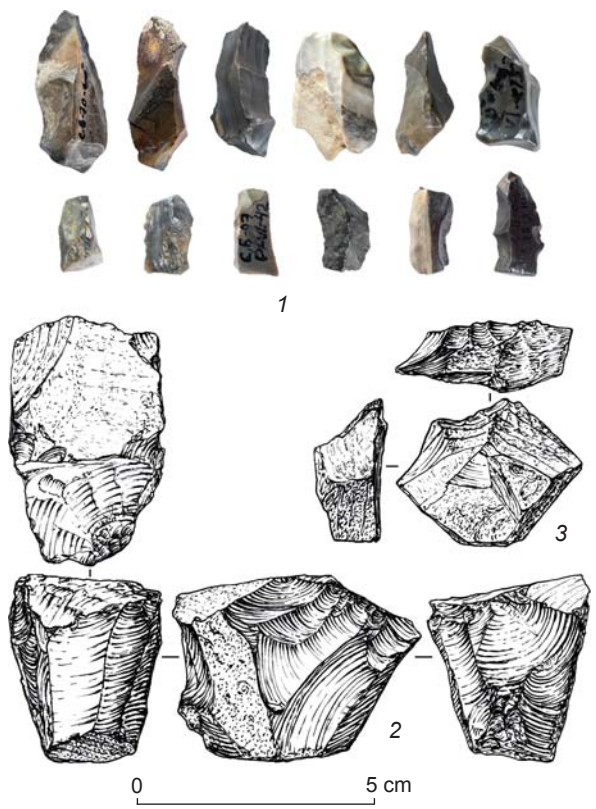

Fig. 4. Longitudinal lateral flakes (*1*); volumetric core (*2*); transverse core rejuvenation flake (*3*).

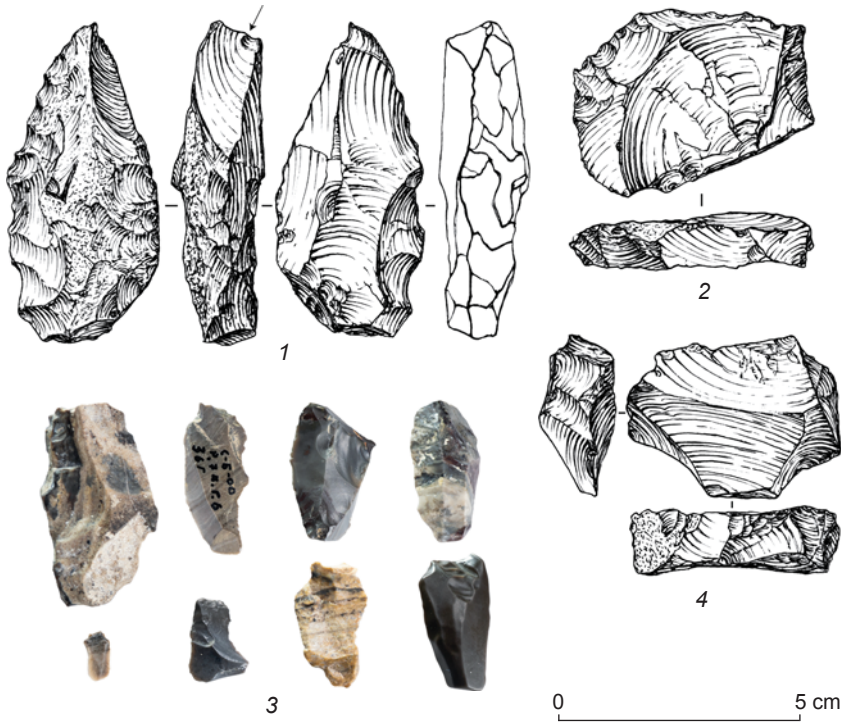

Fig. 5. Narrow-faced core (*1*); longitudinal lateral rejuvenation flake (*2*); blades (*3*); debitage surface preparation flake (*4*).

required core volume, and correction of erroneous flaking (see Fig. 4, *1*, *3*; Fig. 5, *2*, *4*). The artifacts vary in length (25–36 mm) and width (16–39 mm). Residual striking platforms are mostly plain and dihedral (40.7 % each); natural, polyhedral, and unidentifiable platforms are represented by solitary specimens. The depth of striking platforms is 3–7 mm. Isolated specimens demonstrate evidence of trimming of platforms by direct and reverse reduction. Bulbs of percussion are observed on 78 % of the artifacts retaining proximal parts.

Flakes vary in length (15–46 mm) and width (16–29 mm). Only 9 specimens are complete. Dorsal faces demonstrate in roughly equal parts traces of bilongitudinal, convergent, orthogonal, and unidentifiable flaking. Two flakes retained natural surface. Platforms are mostly plain (42.9 %); dihedral platforms are less common (21.4 %); polyhedral and linear platforms are represented in equal parts (14.3 % each); unidentifiable remnant platforms are also available (7.1 %). Evidence of platform trimming by direct reduction is visible on 28.6 % of the flakes. The depth of the platforms vary mostly in the range of 3–4 mm. Bulbs of percussion are present on 71.4 % of the flakes.

Linear dimensions of blades vary in length (17–42 mm) and width (12–24 mm). Only 11 specimens are complete (see Fig. 5, *3*). Dorsal faces of most blades show evidence of longitudinal flaking; isolated specimens demonstrate counter and convergent flaking. Three blades retained natural surface. Most platforms are plain (68.8 %); dihedral and unidentifiable platforms are represented in equal parts (12.5 % each); one blade has a natural remnant striking platform. Rejuvenation of platforms exclusively by direct reduction is observed on 68.8 % of the blades. The depth of the platforms is 2–4 mm. Half of the blades have bulbs of percussion.

Bladelets measure 13 to 15 × 8 mm. Only two of them are complete. Dorsal faces bear evidence of longitudinal flaking. Platforms of complete specimens and those retaining the proximal part are plain, linear or unidentifiable (28.6 % each); one bladelet demonstrates remnant punctiform striking platform. Three specimens bear traces of rejuvenation by direct reduction. The depth of the platforms is 1–3 mm. Five bladelets have bulbs of percussion. The assemblage comprises one microblade. It measures 10 × 5 mm; the dorsal face demonstrates elements of longitudinal flaking; the platform is linear, without traces of rejuvenation or a bulb of percussion.

The toolkit consists of 27 implements. Tools were fashioned on flakes (16 spec.), blades (5 spec.), bladelets (5 spec.), and on a core-trimming flake. Complete tools form 18.5 %. The assemblage contains a series of burins (4 spec.). All of them are of the angle longitudinal single type (Fig. 6, *1*). Two burins were fashioned on the distal parts of blades; two others, on fragments of flakes. Three burins have a single-facetted top; the tip of one burin is double-facetted. Burin spalls are up to 8 mm long.

One of the blades, in addition to a burin facet, bears traces of utilization on the longitudinal edge. Tools with fashioned working tips (6 spec.) are morphologically and technologically amorphous (Fig. 6, *4*). A "spur"/"nose" is fashioned by fine retouch (2 spec.), dorsal trimming (2 spec.), or by notches (2 spec.). In this group, a longitudinal-lateral flake with the trimmed proximal part and reduced bulb of percussion is noteworthy (Fig. 7, *5*). The category of formal tools is represented by fragments of flakes with extensive abrupt retouch (3 spec.) (Fig. 6, *5*; 7, *3*, *4*), a blade with dorsal retouch on the proximal part (see Fig. 6, *3*), a blade with retouch on the longitudinal edge and with opposing natural back, and flakes with retouched notches up to 6 mm wide (2 spec.). The assemblage contains ten unformal tools with use-wear retouch: bladelets (2 spec.), blades (4 spec.), and flakes (4 spec.). Blades and bladelets with a maximum length of 32 and 16 mm, respectively, are represented by complete and fragmented specimens (see Fig. 6, *2*); traces of corrasion on them range from weak luster to smoothing of retouch.

The collections of 1968 and 1971 contain two corraded bifaces. They show scars of later removals (see Fig. 7, *1*, *2*). These artifacts were found in overlying horizons IV and V, though the heads of the excavations interpret them as manuports from horizon VI (Lezhnenko, 1991).

Undiagnosed waste products make up nearly half of finds from horizon VI. Among the noteworthy features of this group are concave/convex negatives (possibly anthropogenic) on opposite faces; certain artifacts are nearly worn-off by corrasion; in one fragment, corrasion degree varies across the surface.

In this study, the quartzite component from horizon VI that does not belong to the "Makarovo Horizon" (Generalov, Slagoda, 2001) was not examined. These products resulted from simple flaking (fracturing) of small and medium-sized pebbles in one transversal or longitudinal plane. The dimensions of the pebbles (2.5 to 3.5 × 5.5 cm) and the fact that these, like numerous cleavage products, were registered only during the 1997 season, raise doubts as to their anthropogenic origin (Ibid.: 95).

Discussion

Archaeological materials from Sosnovyi Bor were examined in several publications describing both the site in general and its Paleolithic horizons. The publications of 1982 summarizing results of the six-year cycle of studies mentioned the small size of collection from horizon VI (n=162), the presence of a single lateral flake, a prismatic core, a retouched blade, and a prismatic microblade (Lezhnenko, Medvedev, Mikhnyuk, 1982). The cultural attribution of finds from the bottom layer and the flaking technique were not specified, because data were scarce. However, it was suggested that the artifacts dated to the early Upper Paleolithic; also, it was proposed for the first time that the Sosnovyi Bor industry resembled that of Makarovo IV.

In 1983, G.I. Medvedev, in his doctoral dissertation, attributed with certainty the finds from horizon VI of

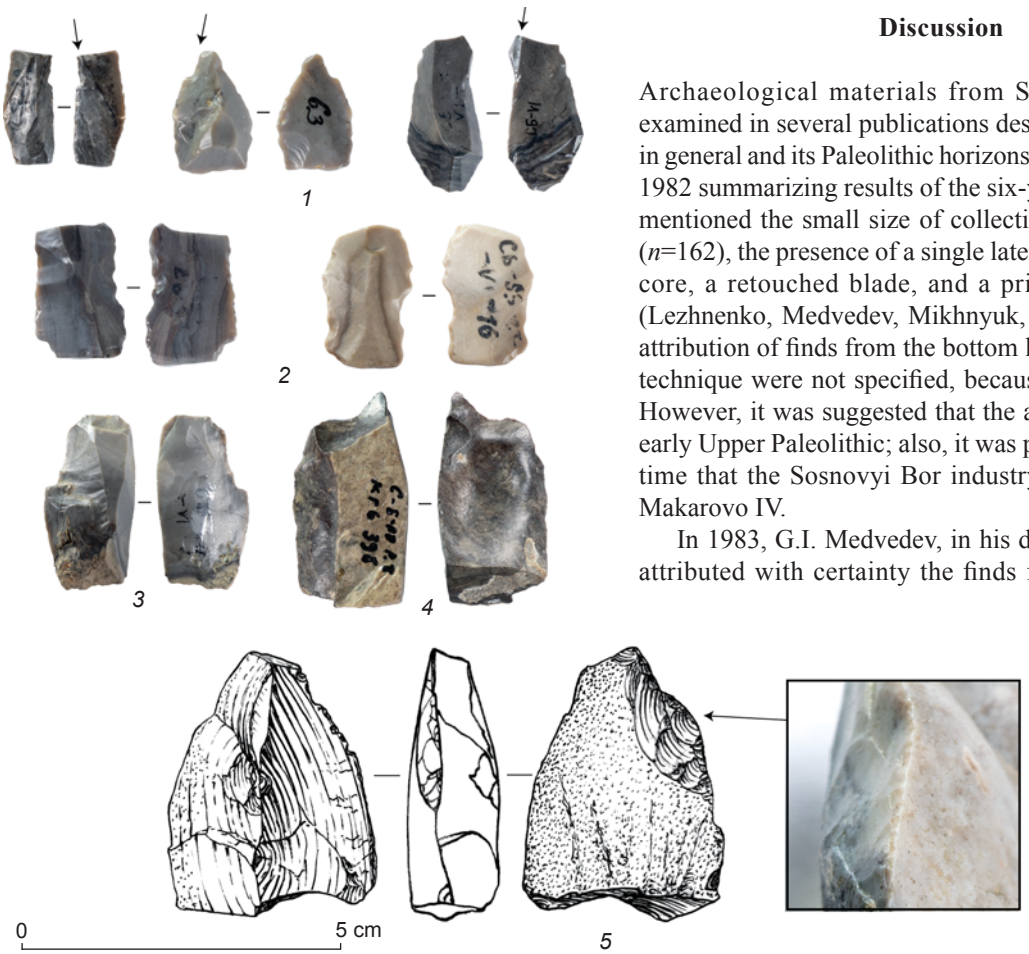

Fig. 6. Burins (*1*); fragments of retouched blades (*2*); blade with dorsal retouch on the proximal part (*3*); "spurred" blade (*4*); flake with abrupt retouch (*5*).

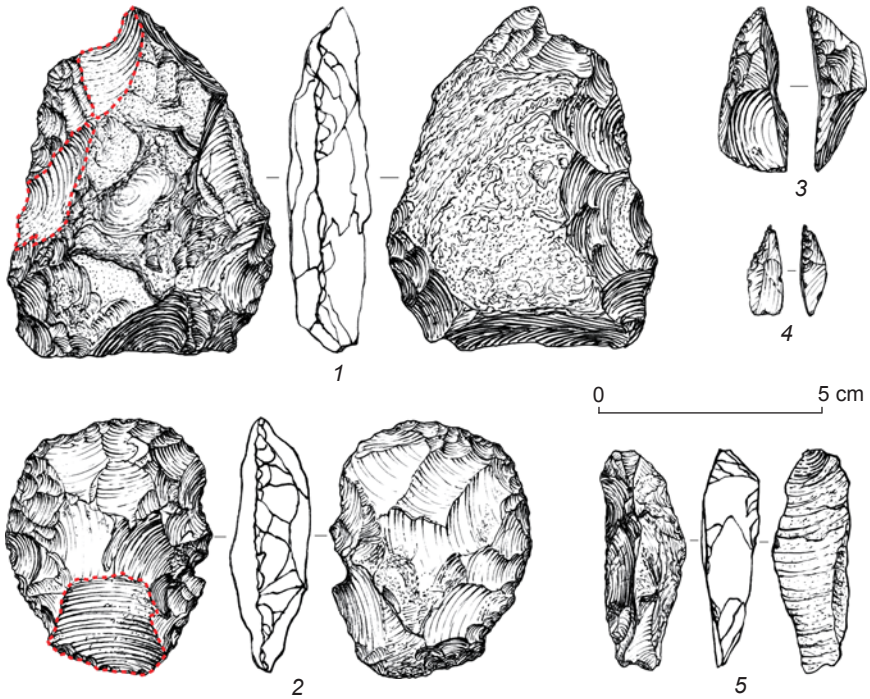

Fig. 7. Bifaces (uncorraded negatives are shown by dashed lines) (*1*, *2*); flakes with abrupt retouch (*3*, *4*); longitudinal-lateral flake with the trimmed proximal part (*5*).

Sosnovyi Bor and lithic industries from Gora Igetei I and Makarovo IV to the "Makarovo Horizon". The attribution was based on stratigraphic and petrographic data, traces of corrasion, and on flaking techniques, particularly, "specific microflaking… utilization of prismatic cores" (1983: 328). The number of artifacts (*n*=176) indicated in this work increased in comparison with the publication of 1982 at the expense of retouched blades, pebble hammerstones, and core-trimming elements. The period of corrasion was dated to 60–40 ka BP (Ibid.: 327).

In 1991, a paper presenting the new findings in study of the Paleolithic horizons at Sosnovyi Bor was published. The collection, reduced to 52 artifacts, was divided into three different age groups, depending on the degree of corrasion (Lezhnenko, 1991). The author noted utilization of radial and parallel flaking, as well as citrus and slice techniques. The lateral flake mentioned in the publication of 1982 was interpreted as a product detached "from a biface that served most likely as a blank for a wedge-shaped core" (Ibid.: 34). The list of finds was supplemented with corraded artifacts from the overlying horizons: two bifaces and a fragment of a microscraper. Based on the analysis of flaking technique and corrasion degree, it was concluded that "horizon VI is chronologically heterogeneous" (Ibid.: 34).

In 2001, a paper was published, in which the composition of the collection (*n*=436) was significantly enlarged due to artifacts excavated in 1997 (Generalov, Slagoda, 2001). These were different-sized flint blades demonstrating parallel and subparallel flaking pattern (104 spec.), including a crested variety; bifaces (4 spec.), including those with a burin facet; an angle burin on a microblade; large flakes retouched on their dorsal faces, possibly end-scrapers (4 spec.); split quartzite pebbles (183 spec.); and quartzite flakes (Ibid.). As compared to previously published data, the number of blades has increased manifold, burins have been identified, and the possibility has been raised that certain tools are end-scrapers. Elaborating on I.L. Lezhnenko's idea, the authors reconstructed a technological evolutionary line, whereby small blades and microblades resulted from the reduction of bifaces, which became preforms of wedge-shaped cores. The corraded bifaces and the "crested blade" mentioned in earlier publications were used as evidence of application of terminal-lateral flaking. Removal of the bulb of percussion was described as a characteristic technique of stone treatment. It was assumed that large flakes resulted from knapping of pebble core-choppers and/or large cores of radial technique of flaking. A flake with scars of radial removals was given as an example (Ibid.: 99).

Our revision has made it possible to identify core-like specimens evidencing flat, volumetric, and possibly, narrow-faced flaking aimed at obtaining small (7–9 mm and 12–14 mm wide) blades. The presence of prismatic blades has been affirmed, though specimens with parallel contours and standardized sections are singular. The suggestion concerning the utilization of bifaces as

preforms for flaking from their narrow face, which was put forward by A.G. Generalov, does not find evidence in the assemblage: the group of core-trimming elements contains neither primary boat-shaped nor secondary ski-shaped spalls reliably confirming the use of such technique. The distal part of the crested flake, which was previously used as an indicator of flaking bifaces and/or wedge-shaped cores, illustrates the technique of shaping an elongate blank by transversal uni- or bifacial removals.

Our revision has revealed a series of burins, retouched blades, including those with natural backs; tools with working tips shaped by trimming or retouching, and flakes with use-wear retouch. The assumption about the presence of microscrapers and end-scrapers on flakes in the industry has not been confirmed. The corraded bifaces can be attributed to the lower complex; however, it is possible that these artifacts were collected from the ground surface elsewhere. Generally speaking, no distinct cultural markers have been observed in the industry; small sizes of tools can be regarded as an additional feature.

Superficial corrasion degree, which I.L. Lezhnenko had used as a chronometric indicator, was likewise revised. Lithics belonging to this industry reveal various degree of luster, smoothed facets, and superficial erosion. The correlation between these variables is relatively low ($r = 0.71$; $r = 0.72$; $r = 0.67$)*. Moreover, the collection contains 11 artifacts without signs of corrasion, though all of them bear the code of horizon VI.

Looking for parallels, we must take into account the view expressed by researchers of Sosnovyi Bor, who claimed that its industry was close to that from Makarovo IV. One of the common features of these sites is the specifics of the culture-bearing layer composed of sand abound in pebbles, gravel, and grus (Aksenov, 2009; Vorobieva, 1991). Traces of corrasion on the artifacts suggest similar post-deposition conditions at both sites. Despite the fact that the industries are based on different raw materials (tabular and clastic concretions at Sosnovyi Bor, and pebbles at Makarovo IV), the common (sub) parallel protoprismatic principle of stone knapping can be traced in the morphological similarity of cores and in the composition of final products (Aksenov, 2009; Rybin, Khatsenovich, 2020). In Makarovo IV collection, crested forms are rare, though this difference can be associated with the specifics of raw materials (Rybin, Khatsenovich, 2020: 298). At the level of tool morphotypes, this contrast is obvious. The collection from Sosnovyi Bor lacks choppers, choppings, typical end-scrapers, or retouched points; though it comprises bifaces absent in Makarovo IV collection. Parallels can be seen only in the group of burins and spurred tools; however, the former constitute just 3 % of all the tools at Makarovo IV (Ibid.: 296, tab. 20).

The comparison of the industry from horizon VI at Sosnovyi Bor with other complexes of Baikal Siberia and contiguous regions makes it possible to attribute it to the middle Upper Paleolithic (MUP). Such attribution is primarily based on the size and "irregular" shape of the blades. Parallels to the Sosnovyi Bor industry in the Yenisei region can be found at the sites of Shlenka, Afanasieva Gora, Achinskaya, Tarachikha, and Novoselova-13 horizon 3. These are small-blade industries, dating to ca 20 ka BP (Lisitsyn, 2000; Kharevich, 2019). In Trans-Baikal, these are industries from Kunalei (horizon 3), Masterov Klyuch (cultural layer 4), and Ust-Menza-6 (cultural layer 4) (Konstantinov, 1994; Meshcherin, 2014; Vikulova, 2023). A certain similarity with the industry of Sosnovyi Bor horizon VI can be found in the collections, representing the "transition" from blade to flake technologies, from horizons 4a and 4b of Tolbor-4 in Mongolia (Rybin et al., 2022).

Most small-blade industries of the Trans-Baikal and Yenisei regions mentioned above comprise carinated artifacts, providing a connection with the key MUP Siberian site—Malta. Corraded artifacts from Stoilo (Kuznetsov, Molchanov, Kogai, 2023) and the industry from the lower horizon of Sosnovyi Bor, in the view of the mentioned authors, form a joint cultural complex together with Malta assemblage. Recent studies of the "classic" Malta industry have revealed evidence of cultural homogeneity of the corraded and non-corraded components (Kuznetsov, Molchanov, 2024).

The main obstacle to attribution of Sosnovyi Bor to MUP is the chronostratigraphic interpretation of the culture-bearing grus-pebble layer as being formed during the Murukta age (Vorobieva, 1991; Generalov, Slagoda, 2001). However, according to S.M. Tseitlin (1979), this layer may well be of the Early Sartan age. In this case, sandblasting of the material could have occurred during the cold and arid maximum of the last glaciation (Sr^{l}_{2}), in the range of ~21–18 ka uncal BP (Vorobieva, 2010). Accordingly, the manufacture of the artifacts and their subsequent "aeolization" could fall in the same climatic and stratigraphic interval. This disagrees with traditional beliefs about corrasion in the archaeology of Baikal Siberia (Medvedev, 2001), but, as the experiments have demonstrated, aeolian traces can emerge without extreme winds or long time intervals (Knight, 2008).

Conclusions

Since the discovery of Sosnovyi Bor, the assessments of age and cultural attribution of materials from its Paleolithic horizons have more than once been revised. Owing to their connection with the "Makarovo Horizon",

*Multiple correlation coefficients were generated with the CORR function in Excel. The sample (n=189) includes all lithics identified as artifacts in which quantitative traits could be estimated.

age estimates of finds from horizon VI were claimed to be older than previously believed. This revision was motivated by the complex stratigraphic situation, the limitations of absolute dating techniques, and the absence of organic remains in horizon VI. Our analysis of the lithic component in this assemblage challenges a number of earlier proposals about the reduction strategy, and allows us to extend the nomenclature of lithics.

The revision indicates the use of prismatic and flat parallel blade flaking. The toolkit includes angle burins, implements with a "spur"/"nose", retouched and notched blades and flakes, and bifaces. In our opinion, there is no typological resemblance between the Makarovo IV and Sosnovyi Bor collections, so there is no reason to attribute the Sosnovyi Bor industry to the "Makarovo Horizon". We propose to date this industry to the Early Sartan age and to attribute it to the middle stage of the Upper Paleolithic, which disagrees with the idea of the pre-Karga/pre-Murukta age of the stratum (Medvedev, 2001). Further studies, in our view, must include a more detailed comparative analysis of aeolian-corraded assemblages of the Angara-Belaya geoarchaeological region.

Acknowledgements

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D.A. Ivanova
Far Eastern Federal University,
Ayaks 10, Russky Island, Vladivostok, 690922, Russia
E-mail: ivanova.dale@dvfu.ru

Archaeological Collections from the Jōmon Period in the Peter the Great Museum of Anthropology and Ethnography (Kunstkamera)

This article presents an analysis and additional description of archaeological items of the Jōmon period from A.V. Grigoriev's collection (No. 1294) at the Department of Archaeology of the Peter the Great Museum of Anthropology and Ethnography (Kunstkamera) RAS in St. Petersburg. The study focuses on the description of decorative motifs and the stylistic attribution of selected samples of pottery. The analysis is based on the published data about the Ōmori shell mound (Tokyo, Honshu Island), visited by Grigoriev in 1878 as a part of the expedition from the Imperial Russian Geographical Society. The early stage of the Japanese archaeology is described with reference to the Ōmori shell mound. Special attention is given to specific features of the Jōmon decorative style. The geographic location of the site suggests that the samples are associated with the Kasori B and Horinouchi styles. Contrary to the Russian tradition, the emphasis is made on stylistic interpretation rather than technology and typology. The combinations of large zonally arranged rectangular designs and spiral motifs are typical of the Kasori B style, to which several samples belong. Others reveal vertically and horizontally arranged patterns consisting of incised arcuate and straight lines, typical of the Horinouchi style.

Keywords: *Japan, MAE, A.V. Grigoriev's collections, Neolithic, Jōmon, pottery.*

Introduction

The last three years have forced many Russian scholars of international archaeology to focus on new research areas. The impossibility of traveling abroad to work with archaeological collections or participate in international expeditions has fostered the search for previously unused sources. Despite the fact that, in most cases, foreign evidence is studied using the published sources, direct work with collections is an important aspect of any scholarly project. The search for new sources often leads to discovering neglected evidence. In our case, it turned out to be unique archaeological collections from the Jōmon period, brought by Russian researchers from Japan in the late 19th–early 20th centuries. This article presents a preliminary analysis of pottery from the collection of A.V. Grigoriev (No. 1294), which is now kept in the Peter the Great Museum of Anthropology and Ethnography (Kunstkamera) (MAE RAS).

Although these archaeological materials from the Jōmon period were transferred to the MAE in the early 20th century and were brought to Russia in the late 19th century, they have been barely mentioned in Russian historiography. An exception is the article by L.Y. Shternberg, *The Ainu Problem*, published after his participation in the Third Pan-Pacific Science Congress in Tokyo in 1926 (Gagen-Torn, 1975: 212–217). Discussing specific features of Ainu ornamentation, along with illustrations from the work of N.G. Munro *Prehistoric Japan* (Munro, 1908), Shternberg provided photos of

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pottery fragments from the Jōmon period in the collection of A.V. Grigoriev: "Fig. 5. Ornamented clay shards found by A.V. Grigoriev in Japan between Yokohama and Tokko [Tokio. – *D.I.*], near lake Ōmori in 1907. MAE, No. 1294" (Shternberg, 1929: 345). For illustrations, Shternberg selected only four pottery fragments out of 131 (No. 20, 33, 54, and 57). These were intended to demonstrate simple forms of ornamentation (zigzags, wavy lines, spirals) that occur both in the Ainu decoration, archaeological collections from Neolithic Japan, and in some cultures of Southeast Asia.

This article continues the research on the pottery complex of the Jōmon period, proceeding from active interest in Japanese Stone Age archaeology in Russian historiography.

A.V. Grigoriev's collections in the MAE: An overview

Specific interest in the collections of A.V. Grigoriev was triggered by the study that the author of this article carried out on the history of the term "Jōmon" in the Russian archaeological literature, as well as the evolution of attitudes towards this period in Japanese and Russian archaeology (Tabarev, Ivanova, 2020). Russian scholars became interested in antiquities of the adjacent regions, including the Japanese archipelago, in the late 19th and early 20th centuries. Initially, ancient cultures of Japan were viewed through the lens of ethnography ("the Ainu problem"). Later, archaeological evidence from the Stone Age began to play a key role. A.V. Grigoriev, I.S. Polyakov, D.M. Pozdneev, K.S. Merezhkovsky, and L.Y. Shternberg were those Russian researchers who could personally study this evidence. Some of these were able to bring collections of pottery and stone tools from the Jōmon period back with them (Ibid.: 64–68). We became interested in the materials of Grigoriev collected during his relatively long stay in Japan.

Alexander Grigoriev (1848–1908) was a scholar with a wide circle of interests (zoologist, botanist, geographer, and ethnographer). He happened to be the first Russian scientist to visit Japan in the late 19th century. As a member of the Imperial Russian Geographical Society, in the spring of 1879, Grigoriev was sent on a scholarly expedition on the schooner *A.E. Nordenskiöld*, which arrived at the port of Yokohama on May 1, 1879, and ran aground off the coast of Hokkaido on June 24.

Taking advantage of the unexpected stop and becoming interested in the history and culture of Japan while still in Yokohama, Grigoriev decided to stay in Japan for almost a year. During that time, he managed to become thoroughly acquainted with landmarks of Tokyo, Yokohama, and Hakodate. Fascinated with the Ainu people, Grigoriev acquired ancient illustrated manuscripts and Ainu household items, made collections of photographs, and compiled an album of sketches. Being interested in zoology, he gathered a collection of fish preserved in alcohol. Grigoriev visited the Ōmori site (Honshu Island) to collect various archaeological items. Safely delivered to Russia, this collection found its place in the Museum of the Russian Geographical Society on October 21, 1880 (Dudarets, 2006). In 1907, the Society transferred the collection to the Peter the Great Museum of Anthropology and Ethnography (Kunstkamera). In the following year, V. Kaminsky compiled the inventory of the collection. An explanatory note was provided on the title page: "A collection of shards, shells, and stone tools from the Japanese midden near Ōmori, halfway between Yokohama and Tokyo, collected by A.V. Grigoriev and received by the museum from the Imperial Geographical Society in 1907. Total of 131 items". Several groups of finds can be distinguished in the collection. The vast majority belong to the Neolithic and include decorated and undecorated pottery fragments, the broken spout of a vessel, individual elements of molded décor, a fragment of an anthropomorphic clay handle (mask) (No. 1–60); stone tools, such as flint end-scrapers, blades, complete and broken spearheads and arrowheads, a sinker, an axe, and flakes (No. 61, 64–80); fragments of animal bones (No. 62, 63); shells (No. 81–129); and medieval artifacts—an iron item (No. 130) and a small scroll (No. 131).

Unfortunately, owing to the fragmentary nature of the pottery collection of Grigoriev and absence of intact vessels, the analysis of morphological and stylistic aspects in this work is only the first step towards a full interpretation and attribution of the material evidence. Unable to compare with the reference complexes of the Jōmon period, we used the data shared by the Japanese colleagues from Tohoku University (Sendai) during consultations intended to find parallels among the variety of the Jōmon pottery styles. A clear link to the site ("…from the Japanese midden near Ōmori, halfway between Yokohama and Tokyo") has made it possible to reduce the options to two styles—*Horinouchi* (*Horinouchi shiki doki* 堀之内式土器) and *Kasori B* (*Kasori B shiki doki* 加曽利B式土器)*. Thus, the data on these pottery styles will be used in the analysis of Grigoriev's collection. In this study, the term "style" is interpreted as a visual characteristic

*The character 式 (*shiki*) has several variants in translation: system, method, type, style, model, form, etc. In the 1930s, it was actively used to denote the variety of the Jōmon pottery. It gained popularity thanks to periodization of the Jōmon proposed by Yamanouchi Sugao. However, the meaning of the term in his works was closer to the concepts of "type" or "example". The tradition of this spelling of names of various pottery complexes continues to this day, but the meaning of 式 (*shiki*) has changed. In my opinion, the closest variant is the term "style".

of the Jōmon pottery, including decorative composition implying a specific system of different combinations of ornamentations within a single stylistic group (Ivanova, 2018: 178).

The concept of style (*yōshiki*様式) within Japanese archaeology evolved throughout the 20th century. It was finally formalized in the works of the outstanding Japanese archaeologist Tatsuo Kobayasi. In general, style is a certain "data package", which can be obtained from analyzing the pottery complex of a region and period. The uniqueness of the Jōmon styles was manifested throughout the entire process of pottery making, and was most clearly expressed in ornamental decoration. Along with the term "style", Tatsuo Kobayasi employed two more terms important for modern Japanese archaeology: "type" (*katashiki* 型式) and "form" (*keishiki* 形式) (Ivanova, Tabarev, 2022: 60–63). Therefore, it is appropriate to describe the pottery from Grigoriev's collection from the perspective of style (focusing on decorative features), rather than technical-typological classification and production technology.

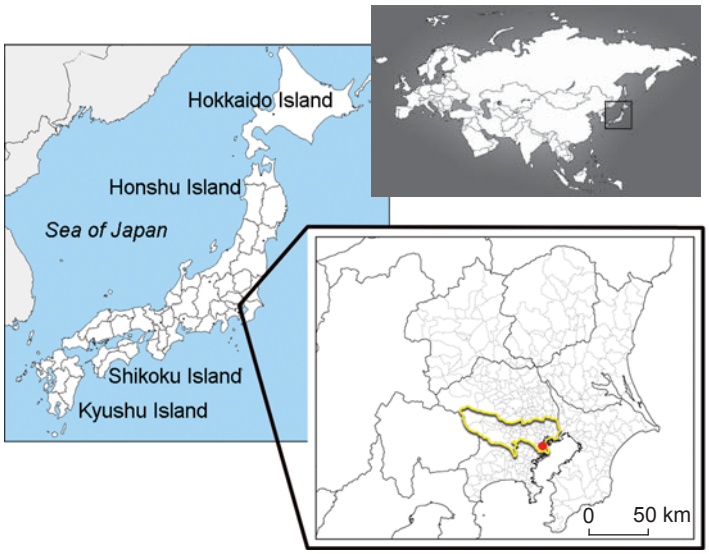


Fig. 1. Location of the Ōmori shell mound.

Historical background: the Ōmori shell mound, and pottery of the *Horinouchi* and *Kasori B* styles

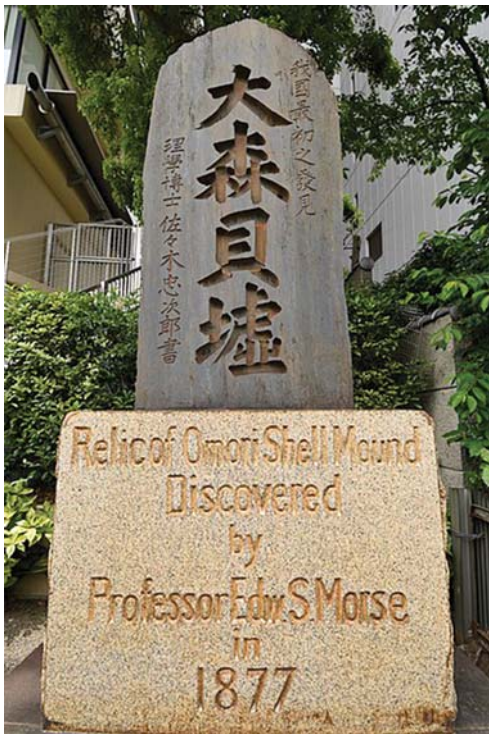
The Ōmori shell mound is located in the Ōta and Shinagawa special wards of the Tokyo metropolitan area (Honshu Island) (Kato Ryoku, 2006: 73; Shin Nihon…, 2020: 66) (Fig. 1). The site was discovered in 1877 by the American zoologist Edward Sylvester Morse, who performed the first scholarly excavations in the history of Japanese archaeology. The emergence of the term "Jōmon" is associated with his name, although in fact, according to the sources, Morse never used this term, and in his report on the Ōmori shell mound from 1879, while describing the pottery, he used the name "cord-marked pottery" (Kobayasi Tatsuo, 2008: 832). The word combination "Jōmon pottery" (*Jōmon doki* 縄紋土器) appeared only in 1886 in the work by Matsutaro Shirai (Tabarev, Ivanova, 2020: 63).

The report by Morse on the Ōmori shell mound (1879) contained many detailed drawings and descriptions of artifacts (primarily pottery), as well as information on their functional features and parallels from other parts of the world (Kobayasi Tatsuo, 2008: 833–839). The total number of artifacts found during four months (from September to December) was 261, including 214 pottery fragments, 6 *doban* clay tablets, 23 tools made of bone and horn, 9 stone tools, and 9 shells. Currently, all the finds belong to important national treasures.

Notably, the Ōmori shell mound was known even before excavations by Morse. In 1872, during the construction of the railway, a layer containing shells and broken pottery became exposed after clearing the eastern part of the plateau where the site was located. Morse paid attention to this layer five years later. There is some evidence that in 1873, while exploring a shell midden in the area between Tokyo and Yokohama, Heinrich Phillipp von Siebold found a stone axe and an arrowhead, which were later included in his collection "Japan in the Meiji Era" and were handed over to the World Museum in Vienna. Thus, Morse might not have been the first Western scholar to explore Ōmori. It is reliably known that H.P. von Siebold continued works at the site in 1877–1878. During his stay in Japan, he studied shell middens and ancient burials over a vast area from Hokkaido to Kyushu. In 1875–1879, his works were published in the German and English languages in Japan, including archaeological studies ("Notes on Japanese Archaeology with Especial Reference to the Stone Age", 1879). The dispute between H.P. von Siebold and E.S. Morse regarding cannibalism among the ancient population of the Japanese archipelago is also well known (Kato Ryoku, 2006: 60–61, 69; Hirata Takashi, 2008: 139).

In the first half of the 20th century, two commemorative steles were set up in Tokyo in honor of the Ōmori shell mound. The first one has the carved inscription "Ōmori shell midden" (*Ōmori kaidzuka* 大森貝塚)* (Fig. 2, *b*). The stele was set up in November 1929 in the Shinagawa area near Ōmori Station (the approximate location of

*The character 塚 (*tsuka*) means 'barrow, mound, hummock'; in the word combination of 貝塚 (*kaidzuka*), it means 'shell heap', especially in the archaeological context.



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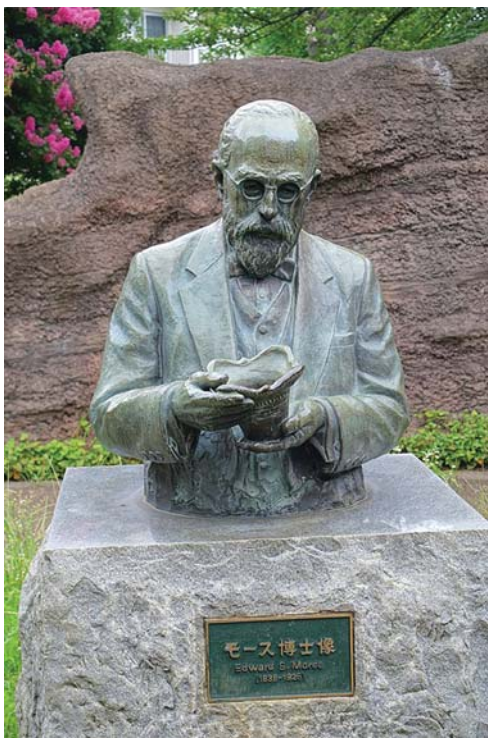

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Fig. 2. Monuments in honor of the first scholarly excavations by E.S. Morse.
a – stele with the inscription "Ōmori shell midden" (*Ōmori kaikyo* 大森貝墟), 1930; *b* – commemorative slab with the inscription "Ōmori shell mound" (*Ōmori kaidzuka* 大森貝塚), 1929; *c* – bust of E.S. Morse in the archaeological park.

the Morse's excavation site). The Japanese politician and businessman Hikoichi Motoyama proposed the idea to honor the merits and contribution of Morse to the development of Japanese archaeology. In April 1930, in the Oota area, near the Tokaido Line railway tracks, a second monument was erected, with the inscription that literally translates as "Ōmori shell mound" (*Ōmori kaikyo* 大森貝墟)* (Fig. 2, *a*). Thus, two commemorative steles are located in neighboring areas, at a distance of about 500 m from each other. This situation resulted from the fact that fifty two years had passed since the discovery of the Ōmori shell mound, during which Tokyo changed beyond recognition, and in his diary, E.S. Morse wrote that the site was located half a mile (about 800 m) from the station (Kato Ryoku, 2006: 4–10, 21).

In 1955, the area around the steles (about 2857 m^2) received the status of a national historical site. Excavations performed in 1979, 1984, 1986, and 1993 over an area of 101,303 m^2 revealed the remains of six dwelling pits 30 cm deep, 132 utility pits, and two hearths. Some parts of the site had a layer of shell heap about 1 m. In 1984, the site of the Morse's original excavation, i.e. around the stele with the inscription "Ōmori shell mound" in the Shinagawa area, was finally established. In 1986, an archaeological park with exhibition was opened there, and a bust of E.S. Morse was set up (Fig. 2, *c*). The main part of the artifacts is kept in the Shinagawa Historical Museum (Ibid.: 81–88).

In addition to a large number of shellfish shells and bones of boar, deer, birds, and fish, the following groups of artifacts were discovered at the site: stone items (spearheads and arrowheads, axes and adzes, dishes,

*In combinations, the character 墟 (*kyo*) is most often translated as 'ruins, vestiges', but the variant 'mound' also exists. In this case, it was necessary to show that different characters were used to name the same monument on the steles in different years.

fragments of staffs, pestles, etc.); pottery and clay items (numerous fragments of vessels, ceramic sinkers, beads, ear disks, small fragments of *dogu* figurines, *doban* clay tablets); items made of animal bones, horns, and fangs (bone knives, needles, piercing tools, fishhooks, harpoons, arrowheads from boar tusks, carved items of horn, etc.); fragments of human bones.

Judging by the pottery assemblage, the Ōmori shell mound was actively used by the local population from the mid-Late to the first half of the Final Jōmon period. Radiocarbon dates obtained from charcoal indicated an interval of 3500–3000 cal BP, which correlates with the time when the *Kasori B*, *Horinouchi*, and *Angyo 3* styles spread on the Kantō Plain (4240–3220 cal BP) (Ibid.: 73; Kobayasi Kenichi, 2019: 111–127).

The material evidence from the Ōmori site included container varieties typical of the Jōmon period, such as deep pots (*fukabachi* 深鉢), shallow pots (*asabachi* 浅鉢), jar-shaped vessels (*tsubogata doki* 壺形土器), and spouted vessels (*chūkō doki* 注口土器) (Akita Kanako, 2008: 596; Kano Minoru, 2008: 591). In some areas where the *Kasori B* pottery was common (mainly in the present-day Saitami and Chiba Prefectures), pots with handles for hanging (*tsurite doki* 釣手土器) were found, but these were not recorded at the Ōmori site (Nakamura Kosaku, 2008: 1065).

The *Kasori B* and *Horinouchi* styles are distinguished by the division of the *fukabachi* vessels into two types: A – with curved or bent neck, B – with concave neck. In Japanese archaeological literature, pots of the former type are designated by the term *asagaogata doki* (朝顔形土器) ‘a vessel with a neck in the shape of a loach bell’; the latter type is called *kyaripā-gata doki* (キャリパー形土器) ‘a vessel with a neck in the shape of a caliper’ (Hosoda Masaru, 2008: 412–416). Notably, all these vessel varieties were typical of the pottery styles of the Middle Jōmon period, thus revealing a continuity of form.

Decoration compositions on the vessels of the *Horinouchi* and *Kasori B* styles included background (cord impressions, “comb”, incised patterns) and main ornamentation. The surface of the vessel was mostly divided into several horizontal ornamental bands, but the *Horinouchi* style also had vertical arrangement of ornamental patterns. Owing to a clear division into bands, the neck, body, and bottom zones are visually distinguished. The main part of the decoration covers the area from the edge of the rim to the middle of the body.

Decorative elements include patterns of incised lines (straight, wavy, or arched), spiral and zoned geometric patterns, linear appliqués (vertical or horizontal), worn imprints of cord, and rows of rectangular or oval-shaped imprints. A combination of decorated and undecorated details is typical. Rubbing and polishing of the surface were used for creating contrast. As with the shapes of vessels, main decorative elements and technical methods emerged as early as in the Middle Jōmon period (Akita Kanako, 2008: 596–597; Kano Minoru, 2008: 587–591; Ivanova, 2018: 176–190).

Overview of the pottery complex and its stylistic features

The greatest interest for stylistic and chronological attribution of Grigoriev’s collection is its pottery assemblage, consisting of 60 inventory numbers and 67 items. We examined the shards and recorded the variants of ornamental patterns. When it was possible to preliminarily restore a part of the vessel from the scattered fragments, the decorative composition was recorded and analyzed.

In this study, 25 fragments were selected from collection No. 1294 (22 inventory numbers: 2, 4–6, 8, 9, 11–15, 33, 34, 41–45, 57–59, 60a–d). The determining factor for selection was clearly legible ornamentation and the possibility of reconstructing individual fragments into larger parts that could provide more information for stylistic interpretation. Some of the fragments could be joined together, thereby providing more accurate data on the decorative composition of the three vessels. The sample also contained individual fragments with clearly legible patterns, making it possible to examine different decorative solutions for the Jōmon vessels.

After systematization of the pottery in accordance with ornamental patterns, twelve fragments from a single pot were identified: No. 4–6, 8, 9, 11–15, 33, and 34. During preliminary reconstruction, we managed to partially restore the neck area and wall of the body (seven fragments out of twelve), which consisted of fragments No. 4–6, 8, 9, 15, and 34 (Fig. 3, *1*). The vessel was visually divided into two parts—the undecorated neck with rubbing traces, and the decorated body. This division was emphasized by a horizontal band additionally decorated with round imprints. Ornamentation was concentrated in the body area. A part of a large decorative element in relief—a multilevel zoned rectangular ornamentation with a spiral motif in the center—has survived. The composition was complemented by rubbed imprint of a cord and rounded imprints. This combination of decorative elements was typical of the *Kasori B* style (Akita Kanako, 2008: 596–597; Shin Nihon…, 2020: 91).

The second vessel, represented by four large fragments, was No. 60a–d (Fig. 3, *2*), belonging to the upper part of the body with an undecorated rim. Decoration was typical of the *Horinouchi 2* style: rows of horizontally and diagonally drawn lines formed a multilevel and multilayered combination of triangles. The general concept was complemented by unornamented zones. Fragment No. 60b preserved a small section of the lower

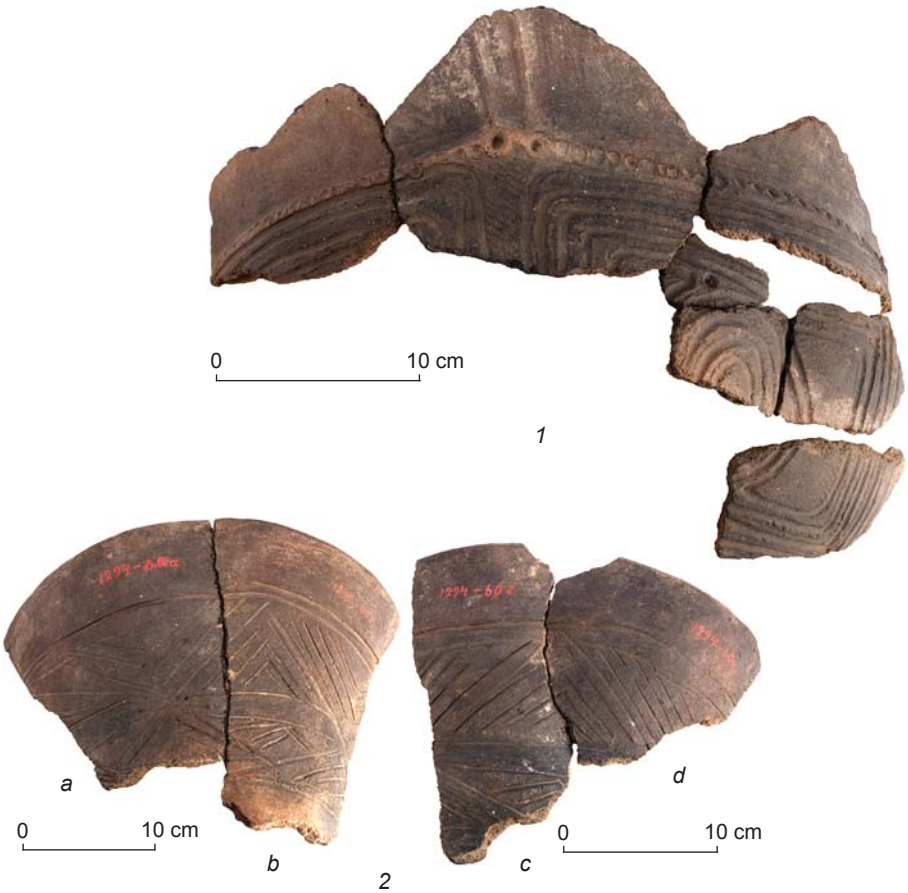

Fig. 3. Reconstruction of parts of vessels. © MAE RAS, 2024.
1 – fragments No. 4–6, 8, 9, 15, and 34; *2* – fragments No. 60a–d.

Fig. 4. Fragments No. 41–45 of one vessel (*1*) and fragment No. 2 (*2*). © MAE RAS, 2024.

part of the body. It was rubbed out like the rim area (Kano Minoru, 2008: 587–588).

Fragments No. 41–45 were parts of the third vessel (Fig. 4, *1*). It was possible to join three fragments out of five. The decorative composition was formed by two variants of ornamentation: rubbed imprints of a cord and a pattern of drawn arcuate lines. This combination of elements decorated the entire surface of the body, leaving the lower part of the vessel plain. According to preliminary data, such composition was typical for the pottery of the *Horinouchi 1 type B* style (Ibid.: 588, 590).

Individual shards also included large fragments with clearly legible patterns. Fragment No. 2 (Fig. 4, *2*) is noteworthy, since the decoration appears not only on the outer surface of the vessel, but also along the inner edge of the neck, decorated with horizontal zoned rectangular ornamentation filled with a drawn pattern of an ellipse-shaped figure with dotted lines in the middle (Fig. 4, *2*, *b*). The decorative elements were separated by a vertical pattern of two concentrically shaped imprints connected by parallel incised lines. However, since pots with internal decoration are rare, ornamentation on the outer surface is more informative (Fig. 4, *2*, *a*). It is a combination of relief pattern and undecorated zones. The decorative elements were made using drawing technique, and presumably had a shape of figure eight and spiral of alternating bands: decorated with cord prints and undecorated with traces of rubbing. Judging by the shape of the ornamentation and the combination of various decorative techniques, it can be assumed that this is a fragment of a *Kasori B* style vessel (Akita Kanako, 2008: 596–597).

Conclusions

Currently, the archives of the Department of Archaeology of the MAE RAS contain five collections of archaeological materials from Japan, which were donated by the Imperial Russian Geographical Society in the early 20th century. In addition to the collection from the Ōmori shell mound (No. 1294), A.V. Grigoriev assembled another collection on the island of Hokkaido (103 stone tools and pottery fragments). This evidence was received by the MAE in 1907, and in 1908 V. Kamensky an inventory of it under No. 822. Collection No. 1295 was brought by I.S. Polyakov from Shinagawa (near Tokyo). Collection No. 1590 includes surface finds from the island of Hokkaido; its author is unknown. The last collection was received in the 1930s (No. 4083). It was gathered by L.Y. Shternberg in different parts of Japan (Nagano, Aomori, and Saitama Prefectures) presumably during his trip to Tokyo for the Third Pan-Pacific Science Congress in 1926.

The collection of archaeological finds from the Ōmori shell mound (No. 1294) gathered by Grigoriev has been stored in the archives of the MAE for over a century. So far, it has been mentioned only once in an article by L.Y. Shternberg (1929) in the context of the "Ainu problem" and not archaeology of the Stone Age in Japan. This indicates the need for additional elucidation of the collection, since only four pottery fragments out of 67 have been described in publications. The description of artifacts in this article and presentation of parallels with styles of the Late to Final Jōmon are only the first steps towards a comprehensive interpretation and attribution of the entire complex of material evidence kept in the collections of the MAE RAS. The study of foreign archaeological collections in the archives of Russian museums at the federal and regional levels is a promising and important research area, especially in the context of modern priorities for the development of the Russian Humanities.

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A.N. Popov[1], J.G. Marcos[2], I.S. Zhushchikhovskaya[3], A.A. Lazina[1], B.V. Lazin[1], Y. Kanomata[4], A.N. Fedorets[1], and T.A. Emelyanova[5]

[1]Far Eastern Federal University,
Ayaks 10, Russky Island, Vladivostok, 690922, Russia
E-mail: poparchaeo@mail.ru, lazina.aal@dvfu.ru, lazin.bv@dvfu.ru, fedorec.an@dvfu.ru
[2]Escuela Superior Politécnica del Litoral,
Campus Gustavo Galindo Velasco, Guayaquil, EC-090150, Ecuador
E-mail: drmarcos@me.com
[3]Institute of History, Archaeology and Ethnography of the Peoples of the Far East,
Far Eastern Branch, Russian Academy of Sciences,
Pushkinskaya 89, Vladivostok, 690001, Russia
E-mail: irina1zh@mail.ru
[4]Tohoku University,
Kawauchi 27-1, Aoba ward, Sendai, 980-8576, Japan
E-mail: yoshitaka.kanomata.d8@tohoku.ac.jp
[5]Pacific Oceanological Institute,
Far Eastern Branch, Russian Academy of Sciences,
Baltiyskaya 43, Vladivostok, 690041, Russia
E-mail: emelyanova@poi.dvo.ru

Revisiting the Correlation Between the Valdivia and San Pedro Ceramic Complexes (Based on Technological Characteristics)

This article presents the results of a study of ceramics associated with the Valdivia and San Pedro complexes at the Real Alto site, southwestern Ecuador. The test sample, studied in 2022, includes fragments of vessels from two morphological and functional groups, relating to the first two phases of the Valdivia culture (bowls and pots) and those representing the San Pedro complex (vessels with necks and a bowl). A comparative analysis was based on identified technological indicators marking various stages of pottery manufacture. Certain differences are seen in the composition of paste and in the hand-shaping of the vessels. Significant differences were revealed in surface treatment and decoration. This is evidenced by the use of colored and plain coating, high-quality solid or matte striped polishing, and complexity of decoration. Distinctive features of firing include the use of different kilns and various atmospheric modes. Parallels include broadly similar firing temperatures. The technological difference between the two morphological and functional groups of the Valdivia complex is that bowls were manufactured with more complex and labor-consuming techniques, whereas pots are technologically somewhat similar to those from San Pedro. Radiocarbon dates (4640–4450 BP) suggest that the two traditions coexisted. Differences may reflect their cultural distinctness.

Keywords: *Ancient ceramics, Formative Period, Valdivia culture, San Pedro complex, Real Alto, Ecuador.*

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Introduction

The site of Real Alto was found by J.G. Marcos in 1971. It is located in the southwestern part of Ecuador (Fig. 1), in Santa Elena Province, in the Verde River basin, on a gentle hill (Lathrap, Marcos, Zeidler, 1977). In 2014–2017, the joint Russian-Ecuadorian archaeological expedition worked at the settlement site of Real Alto (heads A.N. Popov and A.V. Tabarev) (Pamyatnik Real-Alto…, 2015; Tabarev, 2016; Tabarev et al., 2018). An excavation trench (104 m^2) was established in the northeastern part of the site. Six stratigraphic layers were identified (Fig. 2):

1. Dense, cemented, fine-grained sand of gray shades (20–25 cm) with an admixture of grayish-brown sandy loam and alluvial sand of medium and fine

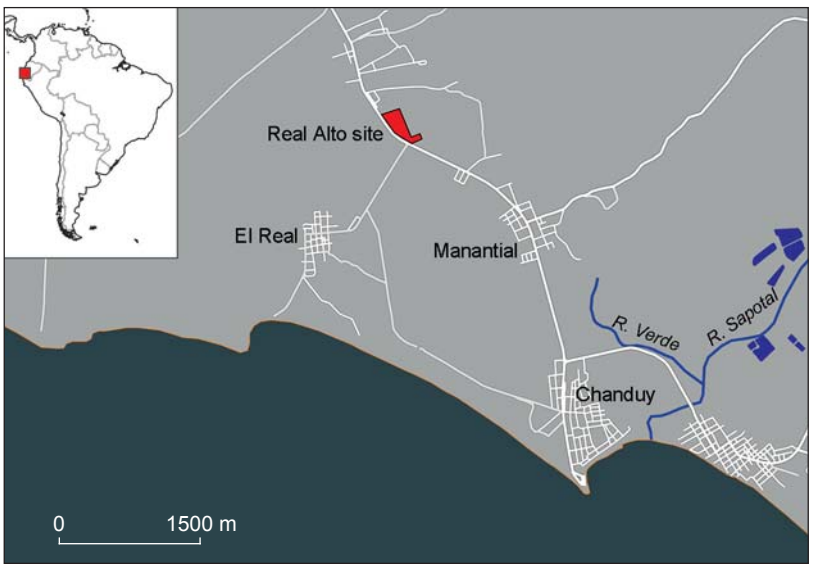

Fig. 1. Location of the site of Real Alto.

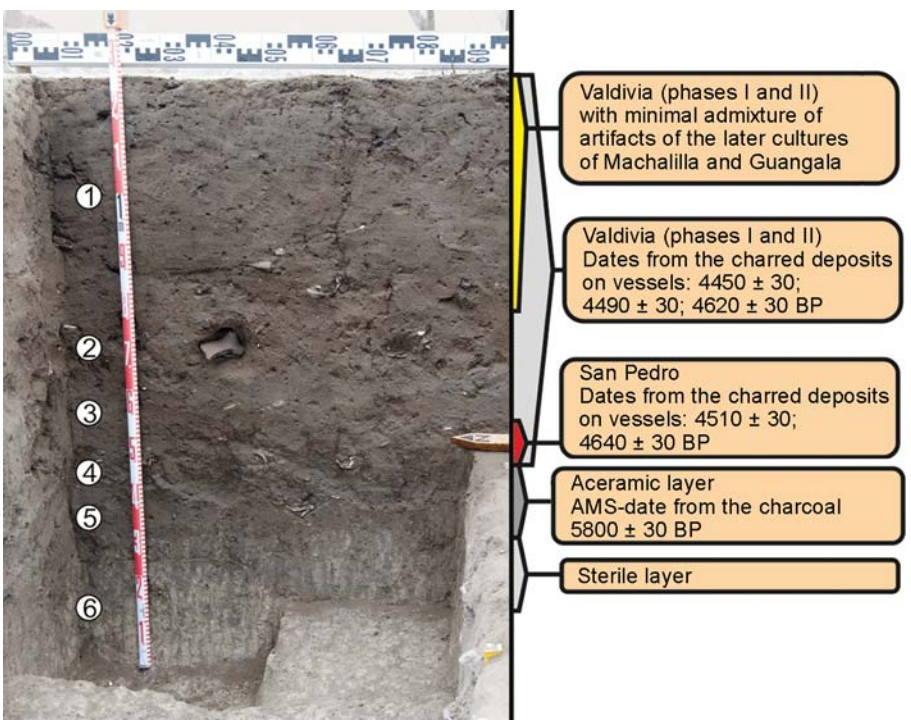

Fig. 2. Stratigraphic column and the stratigraphic position of artifacts with dates.

fractions, and with a soddy-humus horizon containing modern plants' roots; the latter horizon was absent in some portions of the trench, and therefore not identified separately from layer 1 (40–50 cm).

2. Grayish-brown sandy loam with an admixture of alluvial sand of medium and fine fractions, containing *Cerithidea valida* shells and solitary *Anadara granosa* valves (not exceeding 15 % of the layer contents); thickness 12–25 cm.

3. Grayish-brown sandy loam with an admixture of alluvial sand of medium and fine fractions (10–15 cm).

4. Grayish-brown sandy loam with an admixture of alluvial sand of medium and fine fractions, saturated with *Anadara granosa* valves (up to 50 % of the layer's contents); thickness 10–15 cm.

5. Grayish-brown sandy loam with an admixture of alluvial sand of medium and fine fractions (5–10 cm).

6. A virgin layer composed of grayish-yellow cemented sand (30 cm and below).

In these layers, the following materials were found: in the bottom part of layer 1 and in layers 2 and 3, pottery attributable to phases I and II of the Valdivia culture; in the base of layer 3, in the contact zone with layer 4, pottery designated as "San Pedro" by the researchers who discovered it (Bischof, Viteri, 1972: 548); in layer 4 and in the contact zone with layer 5, artifacts of the "aceramic" pre-Valdivian complex (mainly stone products). For the first time, the San Pedro pottery was recovered from a clear stratigraphic context and contained not only single fragments, but also an archaeologically intact vessel. This discovery provided the opportunity to determine its morphological and ornamental features at Real Alto (Tabarev et al., 2018: 10; Tabarev et al., 2021: 77) and to compare it with the ceramics of the Valdivia culture.

There are several hypotheses concerning the chronology of these pottery traditions: the ceramic tradition designated as San Pedro may be a predecessor of the Valdivia (Bischof, Viteri, 1972) or represent a separate cultural phase between the Archaic (Las Vegas culture) and Early Formative (Valdivia) periods (Bischof, Viteri, 2006). Therefore, the studies in 2022 were focused on the comparative analysis of the technical and technological features of the Valdivia ceramics (phases I and II) and the San Pedro complex, in order to establish their cultural and chronological relationship.

Materials and study methods

The test sample includes 40 specimens from the two early phases (I and II) of the Valdivia culture and 11 fragments of San Pedro pottery from the Real Alto collection. The Valdivia test set comprised samples of vessels from two morphological and functional groups: pots with necks (n=19) and wide low bowls with rims folded outward or inward (n=21) (Raymond, 1993; Marcos, 1988: 135–136; 2015: 127–137; Pamyatnik Real-Alto…, 2015: 19–27). Both are characterized by rounded bottoms. The San Pedro test sample includes small vessels with rounded wide bottoms and poorly profiled necks, and one fragment of a bowl.

Visual examination of ceramic samples using a magnifying glass with ×10 magnification and backlight provided certain information about the macro-features: the curvature, texture, and color of external and internal surfaces, outlines and thickness of walls, presence or absence of use-wear traces in the form of charred remains, etc. To get more detailed information on surface texture features, some potsherds from both samples were studied using a light optical microscope with a magnification of up to ×50 at the Engineering and Technology Center of the Institute of Chemistry Far Eastern Branch of the Russian Academy of Sciences (FEB RAS).

Profile polished sections of all ceramic samples were examined using a magnifying glass with ×10 magnification. This method reveals the textural features of ceramic masses, size ranges and patterns of distribution of non-ductile inclusions and holes, and traces of organic impurities (Thuesen, Oldenburg, Iørgensen, 1989).

A petrographic study of transparent thin sections of pottery with a polarizing microscope was carried out on 29 Valdivia specimens and 10 San Pedro fragments. The analysis was carried out in the Laboratory for Micro- and Nanoresearch of the Far Eastern Geological Institute FEB RAS (identification by L.G. Kolesova) and in the Laboratory of Geological Formations of the Ilyichev Pacific Oceanological Institute FEB RAS. Petrographic microscopy reveals the qualitative and quantitative mineralogical composition of the ceramic paste and some optical signs of minerals and rocks associated with the firing temperature (Pentedeka, Dimoula, 2009; Quinn, Burton, 2009).

The SEM-EDS (scanning electron microscopy combined with energy-dispersive spectroscopy) method was used to study four fragments of the Valdivia pottery and six specimens from the San Pedro complex. Scanning electron microscopy determines the features of the ceramic substance's microstructure, in particular the signs of vitrification of the clay fraction caused by firing conditions. Energy dispersive spectroscopy identifies the chemical

elemental composition of a ceramic substance, which depends mainly on the features of the raw materials used (Tite, Maniatis, 1975; Maniatis, 2009; Palanivel, Meyvel, 2010). The microstructure was studied using equipment No. 200556 of the Center for Collective Use of the Far Eastern Federal University and the Electron Microscopy Center of the Zhirmunsky National Scientific Center of Marine Biology FEB RAS.

Selective water absorption testing of the samples, in other words, for the open (relative) porosity, was carried out in order to get additional information about the quality of the pottery under study. It is known that water absorption rate depends directly on the firing temperature and on the density of the ceramic paste (Shepard, 1985: 127–130; Rice, 1987: 230–232).

The study methods used made it possible to obtain a certain amount of information on the technological characteristics of the paste, vessel shaping, surface treatment, and technical and technological features of pottery firing.

Study results

Valdivia ceramics

Paste. Analysis of polished sections has shown the relative textural homogeneity of the paste. Fine- and medium-grained mineral inclusions, with a grain size not exceeding 0.5 mm, are evenly distributed within the ductile substance; larger inclusions, up to 1.0–2.0 mm, are rare (Fig. 3, *1*).

The petrographic analysis has revealed that the paste is composed of approximately equal amounts of ductile clay fraction (particle size ≤ 0.05 mm) and clastic material (particle size > 0.05 mm). The mineral of the clay fraction was presumably attributable to illite of the group of hydromicas. This fraction contains a silty admixture of tiny grains of quartz, feldspars, sometimes iron hydroxides, quite few particles of ore mineral, and other admixtures.

The mineralogical composition of the clastic fraction corresponds mainly to rhyolites, i.e. volcanic rock, very similar in composition to granites. Grains of rhyolite and the rock-composing minerals (quartz, feldspars) together account for the share of 45–50 to 70 % of the total amount of clastic material. There are small shares of fragments of andesites, dacites, and sedimentary rocks (cherts, mudstones, shales). Hornblende from green to brown and red-brown color is a constant admixture (from 1–3 to 15–20 %). Some samples contain tuff and hematite grains.

Characteristic features of the clastic material's texture are the absence of marked differentiation of grain-size ranks and the small number of grains larger than 0.5 mm. Few grains measured 2.0–3.0 mm. From the point of view of the petrography of archaeological ceramics, these features can be interpreted as indicators of the natural origin of non-plastic inclusions in the paste rather than artificial admixtures (Montana, Polito, Iliopoulos, 2009; Martian et al., 2009).

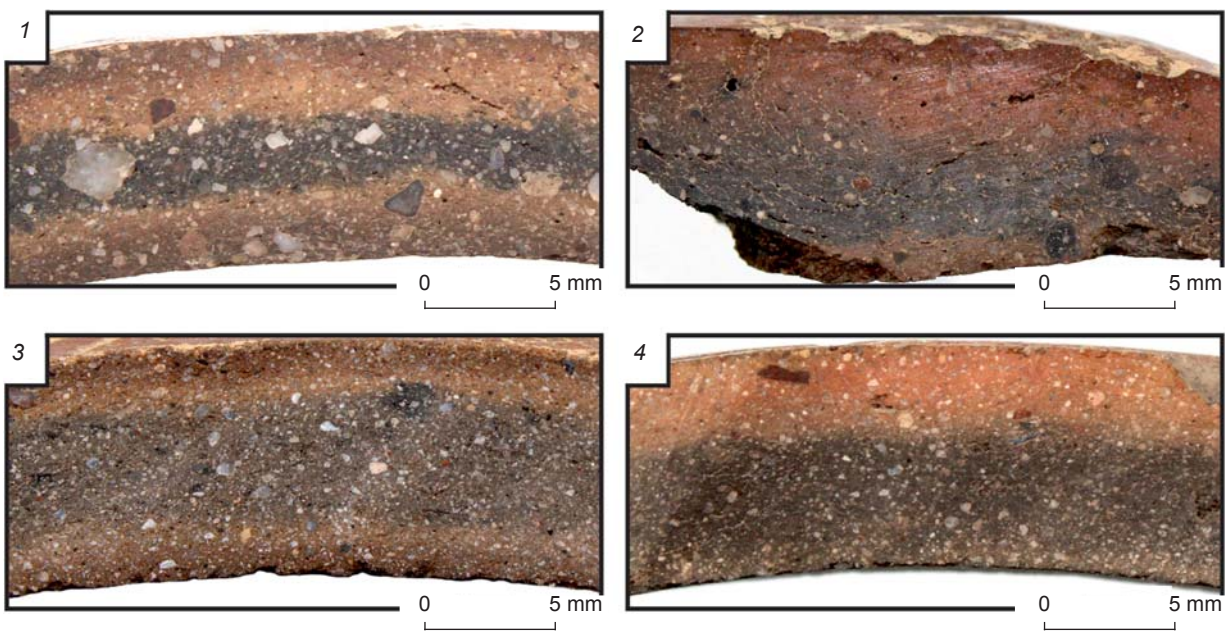

Fig. 3. Profile polished sections of the Valdivia ceramic samples.

The EDS analytical data revealed the proportions of the main elements of the chemical composition of the paste, which determine its properties. The content of alumina (A1) varies in the range of 4.49–14.23 %, that of silica (Si) from 17.38 to 42.57 %. The Al : Si ratio, calculated from average values, is approximately 1 : 3. Such composition characterizes the clay raw material as fusible (Dana et al., 2014). The iron (Fe) content of 1.10–15.47 % corresponds to moderate and high values and is compatible with petrographic finding on the occurrence of iron hydroxides in the ductile fraction, and of hematite inclusions in the clastic material. The share of calcium (Ca) in most of the studied samples varies from 0.32 to 3.82 %, which corresponds to non-carbonate clays (Tite, Maniatis, 1975).

Both morphological and functional groups of pottery show certain similarity in the composition of paste. This can be explained by the fact that the pottery makers used the clays containing similar admixtures of rhyolite or rhyolite-andesite of the parent rock from a single geological region. Rhyolites and andesites are the products of volcanic activity, widespread in the mountainous regions of Central Ecuador, and can well be considered as clay-forming rocks (Hall, Mothes, 2008; Mothes, Hall, 2008). It is possible that the clay raw material preliminarily underwent dry or water refinement, large inclusions were removed, and the purified clay was used as paste, with its chemical and mineralogical characteristics suitable for the technological tasks of pottery making.

Shaping technique. The heavy fragmentation of the artifacts from the test collection provides only for the most general ideas about the techniques of pottery making. Notably, there are no signs of the use of a potter's wheel. As for the probable methods of hand-shaping, these can hardly be identified because no traces of vessel construction have been identified on the surfaces of the potsherds. The possibility of using standard constructing elements, such as bands or wide coils, cannot be excluded. In the process of manufacture, the connecting "seams" and joining areas between the sequentially laid coils can be rubbed and utterly leveled.

The thickness of the product walls is an important feature of the pottery-making technique. No single standard was traced for the potsherds in the collection. The thickness varies in the range of 0.5–1.3 cm. Five samples from the collection reveal a wall thickness in the range of 0.5–0.7 cm; that of most fragments exceeds 0.8 cm. This parameter varies in the range of 1.0–2.0 mm throughout one fragment of a vessel, in rare cases 3.0–4.0 mm. These data show a tendency towards fairly uniform wall-thickness in the course of pottery shaping.

Surface treatment. Techniques of coating and mechanical processing have been identified. They show a certain differentiation according to the morphological and functional groups of pottery. Two types of surface coating have been noted: colored and plain. The vessels with colored coating show a bright and even red color of various shades. Such coating was present on the exterior surface of most bowl fragments from the collection, sometimes on both sides. One fragment of a vessel with a neck had a red coating on its interior surface. On most samples, the coating looks dense and uniform, and has strong adhesion to the ceramic core. In some cases, the coating layer is poorly preserved.

Optical microscopic analysis has shown that the red coating layer was less than 0.1 mm thick. The coating layer differs from the ceramic body not only in color, but also in greater textural homogeneity. On the surface of the red coating, there is a network of thin cracks, almost invisible to the naked eye. According to the EDS findings for two samples, the red coating contains a basic share of Si and Al and up to 30.0–34.0 % of Fe. The paint could have been prepared on the basis of a ferrous pigment, such as ocher. Ocher in the form of small pieces has been reported from the sites of the Valdivia culture (Pamyatnik Real-Alto…, 2015: 31). Judging by the signs noted above, the color-coating technology has been sufficiently well developed with respect to the properties of the raw materials used.

Plain coating was recorded mainly on the interior surfaces of bowls and both surfaces of vessels with necks. Such a coating forms a layer of aluminosilicate substance, as thin as that with pigments, but with a significantly lower iron content. Probably, a water-clay suspension with a fine texture was used for this coating type.

Mechanical processing aimed at making the walls smooth and shiny was carried out by polishing. Bowls with the red coating are particularly smooth and show an even shine. Striped polishing with a slight gloss is typical of the interior surfaces of bowls with plain coating. The fragments of vessels with necks show no signs of careful surface treatment. Some fragments show faint traces of striped matte polishing.

Ornamentation techniques. From the artifacts in the test collection, impressed and raised types of ornamentation can be distinguished (Fig. 4, *1–6*). Impressed motifs were executed by carving, scratching (sgraffito), combing, and incision. Each technique shows characteristic macrosigns, which are determined through visual examination.

The carving and sgraffito techniques were used in decorating the exterior surfaces of the bowls. Using the technique of cutting on a hard surface, "grooves" were made, with clear and sharp edges without clay overlaps. At the bottoms of the "grooves", vivid longitudinal grooves made by the edges of the working tools are usually clearly visible. The color of the incisions is similar to the color of the ceramic core. In ornamental compositions, "grooves" were usually made mutually perpendicular, in the form of T-shaped or L-shaped figures (Fig. 4, *1*). The sgraffito technique produced straight "hard" lines on the surface, forming a simple net or other patterns. The color of the scratched elements contrasts considerably with the color of the core surface (Fig. 4, *2*).

An important difference between the techniques of carving and sgraffito, popular in ancient and traditional pottery in some parts of the world, is that carving was performed on a hard surface before firing, while sgraffito patterns were performed after firing. That is why the cut ornament does not differ in color from the surface of the fired vessel, and the sgraffito patterns are distinguished by the lighter color (Rice, 1987: 146–147; Hayes, Blom, 1996: 17).

Examples of combed and incised patterns have been recorded on vessels with necks. For the combing, a tool with a serrated working edge was used, which produced parallel rows of grooves on the surface (Fig. 4, *3*). The decoration was carried out over the quite wet walls of the product; there were overlaps of clay on the edges of the grooves. A ceramic fragment with an incised pattern executed by combing with maize grains (Zea mays) over a wet surface is noteworthy (Pamyatnik Real-Alto…, 2015: 25–26); the resulting pattern shows grooves of various width and depth (Fig. 4, *4*). A fragment of a vessel with a neck bears a unique incised decoration pattern. Short grooves 0.2 cm wide were made over a wet surface, judging by the typical overlaps of clay on their edges (Fig. 4, *5*).

A raised ornament was noted on two fragments of vessels with necks. It shows a horizontal row of rounded convexities formed by squeezing out a ductile paste from the inside by maize grains (Fig. 4, *6*) (Zevallos et al., 1977).

Firing. The SEM analysis has revealed several samples with signs of initial vitrification of clay, namely the areas with the so-called fibrous or fiber-like structures, having small sections with tiny closed pores (Fig. 5, *1*). Vitrification in non-carbonate clays, i.e. in clays with Ca ≤ 6.0 %, starts under the temperature of 800–850 °C in an oxidizing environment. An

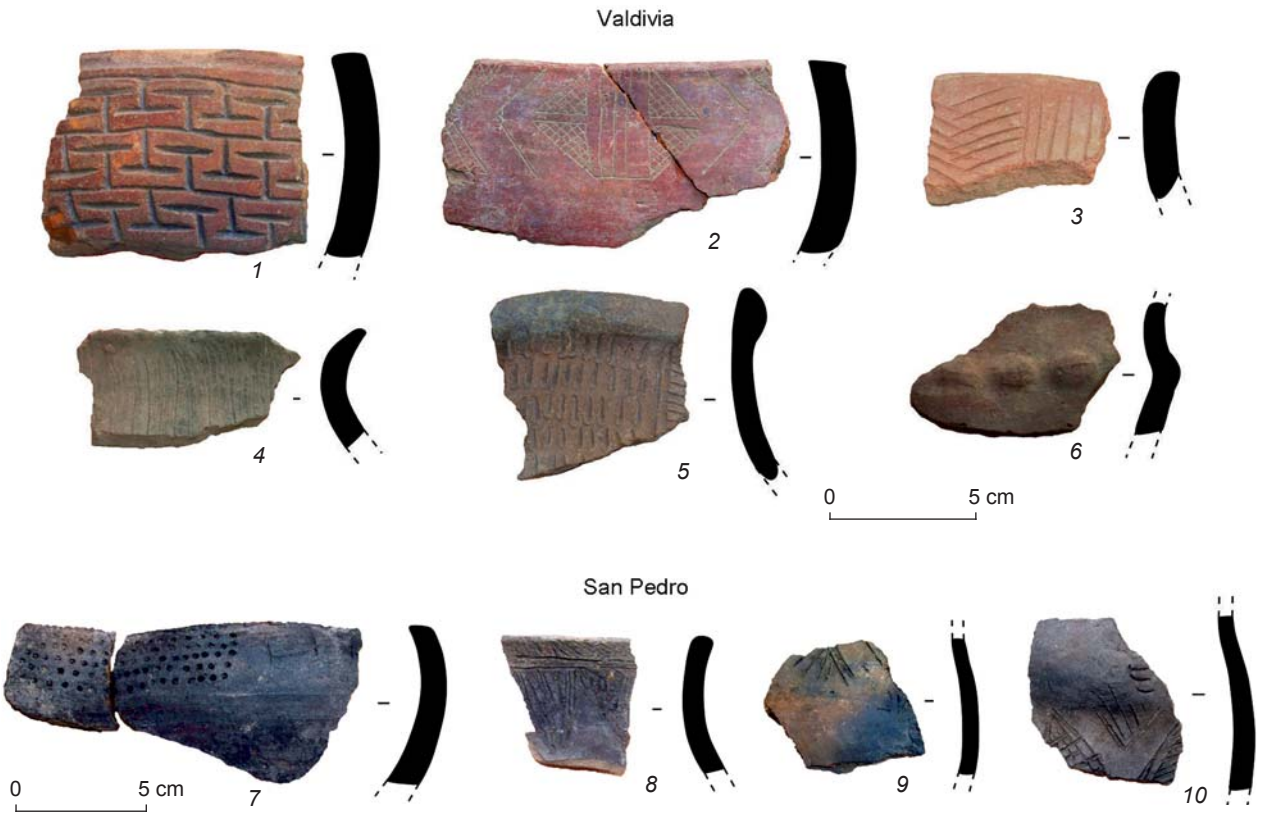

Fig. 4. Ceramic fragments.

atmosphere saturated with carbon leads to a slight decrease in the temperature at which this process begins (Tite, Maniatis, 1975; Maniatis, 2009).

Comparative analysis of colors of polished sections and surfaces indicates the use of various atmospheric modes of firing. Several samples show an even color of "warm" tones on the fracture and both surfaces—the result of firing in an oxidizing environment. On most fragments, various combinations of light and dark gray or black zones were recorded. Option 1: the fracture is dark gray in color, the exterior surface is light (red), the interior is darker, but less dark than the fracture (see Fig. 3, *2*). Option 2: in the middle of the fracture, there is a dark stripe, the marginal zones and both surfaces are light-colored (see Fig. 3, *3*). Option 3: half of the fracture surface and the exterior surface are light-colored, the other half and the interior surface are dark (see Fig. 3, *4*). These options obviously indicate an alternation, during the firing process, of the phases of oxidative mode with free access of oxygen with the phases of saturation of the air with carbon as a product of fuel combustion. Noteworthy is the fact that the exterior surfaces of the bowls are always light, regardless of the color of the fracture. The light color reflects the targeted effect of the oxidative mode at the latest stage of firing.

Taking into account the more or less prolonged exposure of the ceramic products to an atmosphere saturated with carbon during firing, it can be assumed that the firing temperatures did not exceed 800 °C. Available petrographic data on the color features of hornblende grains in the mineralogical composition of ceramics are of certain interest. The above-mentioned color transitions from green to brown or reddish-brown tones may be the result of thermal transformations of this mineral. It is known that at the temperature of 750–850 °C, green hornblende gradually changes its color to various tones of brown (Ignat et al., 2019).

Water absorption tests of the available ceramic fragments showed the results within average values of 5.0–15.0 % (Shepard, 1985: 130). The main value interval is quite narrow—10.5–12.7 %, which suggests a certain "quality standard" of ceramic products. The testing data are consistent with the SEM results showing the signs of initial vitrification. Such features are typical of archaeological ceramics with a water absorption rate of 9.0–11.5 % (Zhushchikhovskaya, 2017).

San Pedro ceramics

Paste. The petrographic analysis has revealed that the paste consists of a clay fraction with particles ≤ 0.05 mm in size and clastic material in approximately equal amounts. The clay fraction is composed of a mineral from the hydromica group, presumably montmorillonite. The clastic material is composed mainly of rhyolite represented by rock fragments, as well as grains of quartz, feldspar, biotite, and hornblende. There is a constant but insignificant admixture of fragments of andesites and sedimentary rocks (cherts, mudstones, opals). Interestingly, some ceramic specimens contain grains of sedimentary rocks with traces of radiolarians—fossilized marine microorganisms.

No clearly defined differentiation between various-size fractions and a small number of grains larger than 0.5 mm has been recorded in the texture of the clastic material. Grains measuring 2.0 mm are rare, and were noted only in some specimens. In general, the textural

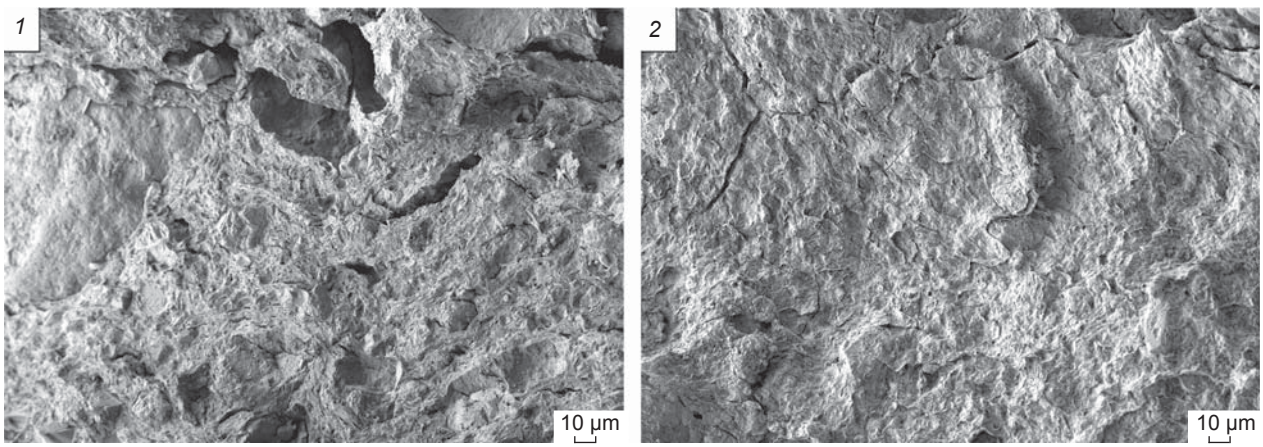

Fig. 5. Microstructure of ceramic paste of vessel fragments of the Valdivia (*1*) and San Pedro (*2*). ×1000 magnification.

features of non-ductile inclusions most likely indicate their natural origin associated with composition of the original clayey raw material.

According to EDS data, the Al content in the ceramic paste is 5.68–15.08 %, Si – 9.74–39.60, Fe – 0.75–26.14, and Ca – 0.46–4.97 %. In general, the chemical composition of the samples is similar to that of the Valdivia ceramics. However, a trend towards higher iron content can be noted.

Shaping technique. The examined samples of San Pedro ceramics do not allow us to identify the signs of certain shaping techniques. Serial observations can be carried out only on the wall thickness of the products. This indicator varies in the range of 0.3–0.8 cm, with an average of 0.4–0.5 cm for most specimens.

Surface treatment. Techniques of plain surface-coating and polishing were identified. Visual examination reveals a thin layer formed by a water-clay suspension on the exterior and interior surfaces. The dull horizontal stripes made with a hard tool are interpreted as polishing marks.

Ornamentation techniques. The analyzed ceramic fragments bear a deep-relief ornament made by incision and embossing techniques (see Fig. 4, *7–10*). The main decorative element is a narrow groove incised on a ductile surface, judging by clay overlaps on its edges. The grooves usually form triangular or rectangular geometric figures (see Fig. 4, *7*, *8*). The embossing technique was used to create a pattern of horizontal rows of rounded impressions (see Fig. 4, *7*). The nature of the imprints suggests the use of a tubular plant stem as an ornamenting tool.

Firing. A characteristic feature of the ceramic fragments is the rather intense black coloring of the surfaces and fractures, which may indicate that the products were subjected to a long-term firing in a smoky atmosphere with a high content of solid carbon. According to SEM data, the microstructure of the ceramic substance of some specimens shows signs of initial vitrification, similar to those recorded for the Valdivia ceramics (see Fig. 5, *2*). The water absorption values are 10.0–10.9 %, which is lower than those of the Valdivian samples. It is known that solid carbon deposited in the pores of ceramics during firing in a smoky atmosphere makes the core more dense and somewhat reduces its water absorption, thereby improving the practical qualities of the product (Avgustinik, 1956). On the basis of the totality of data, it can be assumed that firing temperatures were around 800 °C.

Conclusions

The results of analysis of the pastes of the Valdivia and San Pedro pottery suggest the use of clay raw materials similar in their quality and mined in the same geological area, but probably from different local outcrops. Certain differences in the hand-shaping techniques of the vessels are indicated by such a parameter as wall thickness.

The method of surface treatment of constructed products reveals similarity in terms of techniques for coating the walls with a water-clay compound, and polishing. This is especially noticeable when comparing Valdivia vessels with necks and San Pedro pottery. However, Valdivian bowls demonstrate a more complex set of technological skills, including the use of colored coatings and high-quality solid polishing. Significant differences also concern the ornamentation techniques: the Valdivia pottery, primarily the group of bowls, provides evidence of a much wider range of techniques.

Heat treatment of ceramic products by the bearers of both cultural traditions was presumably executed with the use of firing devices that were similar in technical capabilities and were able to reach a temperature up to 800–850 °C. However, the devices themselves and the principles of their operation could have been different. The alternation of atmospheric modes assumed for Valdivia ceramics corresponds rather to fire baking, while the “smoking” mode for San Pedro ceramics can be correlated with pit firing (Vuković, 2018).

Valdivia specimens demonstrate a certain distinction between the two morphological and functional groups, but generally reflect a fairly consistent set of pottery-making techniques, which conforms with research data (Meggers, Evans, Estrada, 1965: 86–87; Raymond, 1993). The results of the analysis of San Pedro ceramics also indicate well-developed skills in working with raw materials and making vessels with adequate practical qualities.

This study confirms the previously stated assumption that the ceramics of Valdivia and the San Pedro complex belong to different cultural traditions (Kanomata et al., 2019). The peculiarities of the stratigraphic position of these artifacts at Real Alto and the radiocarbon dates derived from charred deposits on the vessels allow us to conclude that the San Pedro ceramic complex and the pottery from the first two phases of the Valdivia culture existed simultaneously in

the period of 4640–4450 BP (Tabarev et al., 2021). Our findings suggest multi-vector Neolithization in Coastal Ecuador. In general, the issue remains quite promising for the continuation of comprehensive archaeological research in this region.

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K.A. Babina[1–3], S.V. Shnaider[1], A.A. Bragina[2, 3], and E.V. Parkhomchuk[2, 3]

[1]ZooSCAn International Research Laboratory, CNRS–IAET SB RAS, IRL 2013, Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: k.babina@g.nsu.ru; sveta.shnayder@gmail.com
[2]"AIsotopes" Isotope Research Laboratory, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: bragina@catalysis.ru; ekaterina@catalysis.ru
[3]Novosibirsk State University, Pirogova 2, Novosibirsk, 630090, Russia

Testing the Sample Preparation Method and Oxygen Isotopic Analysis of Tooth Enamel for the Reconstruction of the Birth Seasonality of Ovicaprines (the Case of Teeth from Istykskaya Cave, Eastern Pamir)

Cyclic variations of $\delta^{18}O$ along the growth line of M2 and M3 molars provide information about the seasonality of enamel formation and thereby about reproductive seasonality in animals, taking into account the time of tooth eruption and full enamel maturation. Determination of birth seasonality of small ruminants is relevant to the reconstruction of pastoralist strategies. Two peaks of reproductive activity per year are one of the most reliable indicators of human control of the small ruminants. As part of this work, for the first time in Russia, a method of sample preparation and analysis of oxygen isotope ratios in the tooth enamel of small ruminants is proposed. Traditionally, breeding seasonality was evaluated by the isotopic analysis of carbonates, the content of which in dental enamel is only 4 %. According to a new approach, oxygen from a sample is converted to gaseous CO by the interaction of enamel with carbon in a helium flow under 1300 °C, enabling one to measure $\delta^{18}O$ in all components of the dental enamel, including phosphates, which make up 90 % of enamel mass and are resistant to diagenesis. In this study, four sample preparation protocols depending on the degree of preservation of teeth and their age were tested: (A) cleaning and sampling of enamel, (B) treatment by H_2O_2, (C) treatment by NaOCl and CH_3COOH, and (D) extraction of Ag_3PO_4. Results show that for assessing seasonality breeding, it suffices to evaluate the lowest and the highest $\delta^{18}O$ along the tooth growth line. If the preservation of sample is good, minimal chemical treatment is enough to observe these extremes.

Keywords: *Isotopic analysis, oxygen, stable isotope ratio, farming, animal breeding, sheep, Central Asia.*

Introduction

The analysis of light stable isotopes (H, C, N, S) is widely applied in archaeological studies (Svyatko, 2016; Makarewicz, Sealy, 2015), mainly for the reconstruction of diet (Post, 2002; Reynard, Hedges, 2008) or mobility (Chala-Aldana et al., 2018) of ancient groups, as well as for the reconstruction of paleoclimate (Bocherens et al., 2011). In most cases, bone and teeth collagen is utilized for the isotopic analysis. In the 2010s, a new paradigm of isotopic studies in archaeology emerged: the analysis of stable isotopes of oxygen and carbon in small ruminants' dental enamel (Balasse et al., 2012). This tissue contains 96 % of hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$) where hydroxyl groups and phosphate ions are partially replaced by carbonate ions. Hydroxyapatite contains ca 4 % calcium carbonate by weight (Ressler et al., 2021). As an object of an isotopic study, dental enamel has two important advantages: fair preservation for thousands of years (as hydroxyapatite is less prone to diagenetic processes than bone and dentine), and high time resolution of the information record. Thus, the analysis of sequential samples taken from the enamel/root junction to the tip provides for detecting cyclical seasonal fluctuations of ^{13}C and ^{18}O in dental enamel (Hermes et al., 2019; Ventresca Miller et al., 2020). The isotopic composition of carbon from enamel carbonates encodes the data on the contribution of plants with C3 and C4 types of photosynthesis to the animal's diet throughout the year (Zazzo et al., 2010). The isotopic composition of oxygen from dental enamel depends mainly on the isotopic compound of water absorbed directly from reservoirs and from plants. As such, it indirectly reflects climatic factors in the area where the animal has been grazing during the formation of enamel (Pederzani, Britton, 2019). The cyclic seasonal variation of $\delta^{18}O$ in dental enamel of ruminants depends on fluctuations of ambient temperature and precipitation during a year (Balasse, 2002).

Determining cyclic variation of $\delta^{18}O$ along the growth line of the molars, accounting for the timing of dental eruption, can point to the period of the full maturation of enamel and, thus, help in reconstructing the birth seasonality (Balasse et al., 2012). The main limitation of this technique is the presence of seasonality in the studied area: only in such cases the observation of cyclic $\delta^{18}O$ variation along the tooth growth line is possible. The second and third molars are utilized for determining the birth seasonality, as these are formed during the first 2.5 years of life in ovicaprines: M2 and M3 fully erupt at ≈1.3 and ≈2.4 years of life, respectively (Geiger et al., 2020). Thus, an isotopic analysis of oxygen along the tooth growth line provides high resolution information regarding the changing seasons during this period. The first molars begin to form before the birth of the animal and fully erupt at ≈0.5 years, while the terms of a complete eruption of the permanent incisors and premolars varies in the range of more than half a year. Thus, the latter are not suitable for determining the birth seasonality of ovicaprines (Silver, 1963).

Sample preparation is the most important stage of the isotopic analysis. It includes purification, sequential sampling, and multi-stage chemical processing. In all the few studies employing isotopic analysis of dental enamel of small ruminants, carbonates are analyzed, which comprise only 4 % of hydroxyapatite by weight. But for getting reliable results on $\delta^{18}O$ in dental enamel samples of varying age and preservation it seems more interesting to analyze the oxygen isotopes ratios in phosphates, as enamel consists of almost 90 % of phosphates. Also, oxygen in phosphate groups is more resistant to diagenesis processes than that in carbonates. There are only few studies on the isotopic analysis of phosphates extracted from sequentially sampled specimens of dental enamel of animals. Cyclic changes of $\delta^{18}O_p$ along the growth line of M2 and M3 of the bison (Bernard et al., 2009), M3 of the pronghorn (Fraser et al., 2021), and M2 of the horse (Fabre et al., 2011) were previously detected. But this method has never been applied for the reconstruction of the birth seasonality of small ruminants before. In this study, we performed an isotopic analysis of oxygen in enamel of second and third molars of the ancient ovicaprines from the archaeological layers of the Istykskaya Cave, as well as modern *Ovis aries* from the neighboring area. A modern technique based on the conversion of enamel oxygen (including that in phosphates comprising 90 % of the enamel samples by weight) into CO through the interaction of the sample with carbon in a helium flow at a temperature of 1300 °C. The results of the oxygen isotopic analysis of the dental samples prepared using various chemical protocols were compared as well.

Material and methods

Samples. Five teeth of ovicaprines from Eastern Pamir were studied. This region is characterized by a

sharply continental climate with short summers and long winters (minimum temperatures reach –47 °C). The mountain landscape is divided by wide rivers. The study area is located at the Istyk River, at an altitude of 4000 m above sea level, in the zone of cryophytic alpine and subalpine meadows. The area is populated mainly by nomadic Kyrgyz migrating three or four times during a year.

Teeth of the domestic sheep (nomadic type of herding) and wild-living ovicaprines were selected for testing the protocol of determining the birth seasonality of small ruminants. The wild ovicaprines' specimens were sampled from the Istykskaya Cave collection (Fig. 1): one from the upper part of the

Fig. 1. Location of Istykskaya Cave (*1*), a view on the Istyk River valley (*2*) and on the entrance to the cave (*3*).

first layer of recent excavations (1920–1520 cal BP, GV-02963), and two from the lower layers excavated by V.A. Zhukov (14–10 ka BP) (Chelovek…, 2021). The season of birth of the wild ovicaprines was late April–May (Fedosenko, Blank, 2001, 2005).

As the degree of contamination of the modern samples (specimens 1 and 2) and the ancient tooth from the upper cave layer (3) was minimal, these were only mechanically cleaned before taking enamel samples. But the two other specimens (4 and 5) were subjected to three different protocols of preparation, including chemical treatment, in order to compare their effectiveness for determining the birth seasonality of the animals.

Sample preparation. *Protocol A—cleaning and sampling of enamel.* This protocol was applied to all the specimens. An engraver (Dremel) and a set of cutters were used. The samples were taken from the lingual side of the tooth from the enamel/root junction to the tip, perpendicular to the tooth growth axis, with increments 1–4 mm and cutting depth ca 1 mm.

Protocol B—treatment by H_2O_2. In order to remove humic substances, enamel samples were placed in 1.5 ml centrifuge tubes (Eppendorf), then 1.0 ml of 30 % H_2O_2 solution was added, and the samples were left at room temperature and stirring in a shaker for 24 hours. After this, the samples were cleaned from the reaction products by sedimentation of enamel using a centrifuge (MiniSpin, Eppendorf), removal of the liquid fraction, adding 1 ml of distilled water, and redispersing.

Protocol C—treatment by NaOCl and CH_3COOH. The way of removing humic substances was different from Protocol B: 1.0 ml of 2 % (wt.) aqueous solution of sodium hydrochloride (NaOCl) was added. The subsequent stages of cleaning the specimens from the reaction products were the same as in Protocol B. "Soft" acidic treatment was carried out to remove exogenous carbonates: 1.0 ml of 10^{-2} M acetic acid solution was added, then the specimens were kept at room temperature and stirring for 4 hours. A solution with a pH of ca 4 was applied in order to avoid sample weight loss. After the acid treatment, the cleaning procedure was repeated until the pH of the wash water reached 5–6. Then the enamel samples were dried at 70 °C for 24 hours.

Protocol D—extraction of Ag_3PO_4. The specimens were first cleaned from organic matter according to Protocol B, and from exogenous carbonates following Protocol C. After this, the samples were kept in 1.5 ml of 20 % hydrogen fluoride solution for 24 hours, then the liquid fraction was separated by centrifugation, and the solutions were brought to pH 5–7 by adding a 20 % ammonia solution dropwise. For extracting silver phosphate, 0.8 ml of 2 M $AgNO_3$ was added dropwise to the solutions. The Ag_3PO_4 samples were washed seven times by successive centrifugation/redispersion in 1.5 ml of distilled water. They were then dried at 70 °C for 24 hours.

Isotopic analysis of samples. Sample powders were weighed on a high-precision analytical scale with a division value of 10^{-6} g (ME36S, Sartorius), and were sealed by 800–1000 μg portions in special silver capsules. Immediately before the analysis, the samples were placed in the autosampler of the FLASH 2000 HCNS-analyzer (Thermo Scientific). The $^{18}O/^{16}O$ stable isotopes analysis was carried out using this device and "Delta V Advantage" gas isotope mass spectrometer. In the pyrolysis mode of the HCNS analyzer, a corundum reactor with a glassy carbon insert filled with carbon granules was used. The IAEA-603 international standard was employed for the determination of the $^{18}O/^{16}O$ ratio: $\delta^{18}O_{VPDB} = -2.37$ ‰. The results were presented relative to calcite from belemnite rostra (PDB) from the Peedee Formation (South Carolina, USA) as follows: $\delta^{18}O_{VPDB} = (R_{exp}/R_{st}-1)\cdot 1000$, where R_{exp} and R_{st} are the $^{18}O/^{16}O$ ratios in the studied samples and the standard, respectively. Results are expressed in per mille (‰).

Results

Comparison of the $\delta^{18}O$ cyclic variations in enamel of *Ovis aries* and ovicaprine (Protocol A). The enamel samples from M2 and M3 of modern *Ovis aries* and M2 of wild ovicaprine 1.5–1.9 thousand years old display marked cyclic correlations between $\delta^{18}O_{VPDB}$ and the distance from the enamel/root junction (Fig. 2). Note that the X-axes in these plots are inverted in order to display the temporal change of $\delta^{18}O$, as teeth eruption and enamel formation progress from the tip to the enamel/root junction. Images of the teeth are placed above the plots: the enamel cuts correspond to $\delta^{18}O$ on the graphs. The cyclic curves of M2 and M3 of the modern animal are depicted with a shift of the area of superposition of parts of the teeth (Fig. 2, *a*) in order to demonstrate the areas formed at the same time. The shift reaches 16 mm. It is possible to estimate what difference in eruption time this distance corresponds to: the maximums of the curves are separated by 23 mm, while their minimums by 19.5 mm. The difference

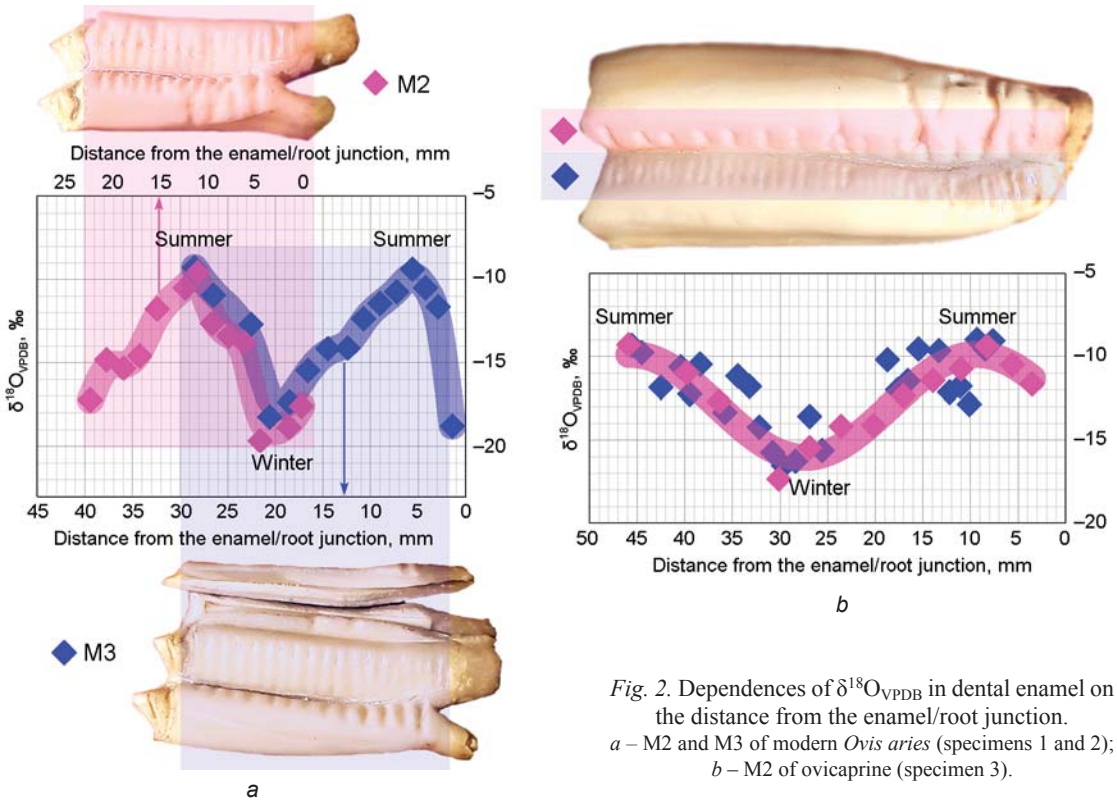

Fig. 2. Dependences of $\delta^{18}O_{VPDB}$ in dental enamel on the distance from the enamel/root junction.
a – M2 and M3 of modern *Ovis aries* (specimens 1 and 2); *b* – M2 of ovicaprine (specimen 3).

can be attributed to the disparity of growth rates during different seasons. Thus, the estimated rate of growth of the teeth is 1.6–1.9 mm/month, and the time lag between the M2 and M3 eruption in *Ovis aries* is 8.5–10.0 months, which corresponds to the literature (Silver, 1963).

We were able to detect the cyclic dependency for the relatively ancient ovicaprine's specimen (Fig. 2, *b*) without any chemical sample preparation, while such a treatment had been carried out in all the previous studies on the determination of $\delta^{18}O$ along the tooth growth line (Balasse, 2002; Balasse et al., 2012; Blaise, Balasse, 2011; Ventresca Miller et al., 2020). Chemical cleaning is an inevitable stage in the analysis of carbonates (employed in most studies on the small ruminants' domestication), since these comprise only ca 4 % of hydroxyapatite, and even subtle contamination with humic substances or/and exogenous carbonates can mask the cyclic correlations. The analysis of phosphate, which is typically employed in climate research, requires a multi-stage treatment for separating the purified Ag_3PO_4. In such studies it is necessary to obtain exact $\delta^{18}O$ specifically in phosphates mineralized during the animals' life, because any small admixture of exogenous substances and carbonates can distort the climate reconstructions.

But when it comes to determining the birth seasonality of animals, the only aim is to fix the cyclic variations along the molars' growth line. It is also important to establish the distance between the enamel/root junction and the extremes corresponding to winter and summer months of the enamel formation. The $\delta^{18}O$ value for the isotopic analysis of an unpurified sample consists of the ratio of oxygen isotopes in phosphates, endogenous carbonates, as well as exogenous organic and inorganic substances. As dental enamel is 90 % phosphate, minor contamination of the specimen from the upper level of Istykskaya Cave did not obstruct fixing a sinusoidal $\delta^{18}O$ fluctuation along the growth line of the molar.

Maximums of the curves correspond to the warmest summer month—July, while minimums to the coldest winter month—January (Balasse et al., 2012). Enamel formation of the second molar of domestic sheep begins around 2 months after birth (Blaise, Balasse, 2011), while its maturation and hence stabilization of the isotopic composition of hydroxyapatite occurs with a shift of ca 5 months in respect to the start of the formation (Balasse et al., 2012). To determine the season of birth of an animal, not only the relative $\delta^{18}O$ value at the tooth tip (minimum or maximum of the curve) is required, but also the shift should be taken into account. In our

case, the curve suggests that the animal (specimens 1 and 2) was born in autumn, as tip of the tooth shows the $\delta^{18}O$ minimum. Unfortunately, there have been no detailed researches on the time of the start of enamel formation in wild ovicaprines so far. But their lambing term is reliably known: early spring. Thus, the curve obtained for specimen 3 suggests that the enamel formation in wild ovicaprines takes 2–3 months, since the maturation of the tissue on the tip of the tooth falls on the warmest period of the year.

Comparison of the cyclic $\delta^{18}O$ variations in enamel of molars of the ancient ovicaprine specimens (sample preparation protocols B, C, D). Specimens 4 and 5 were prepared for the isotopic analysis following the protocols B, C, and D, as contamination of the teeth was substantial due to more than 10,000 years of deposition in the soil. The positions of $\delta^{18}O$ minimums and maximums in respect to the distance from the enamel/root junction are identical for the samples treated according to different protocols (Fig. 3). The areas of sampling for different protocols are highlighted in the image of the M3. The results of the measurements for the specimens subsequently treated with NaClO and CH_3COOH (Protocol C) are presented in relative units, since our first analyzes were carried out without sticking to the international standards.

The shapes of the cyclic $\delta^{18}O$ curves for the specimens subjected to different types of chemical treatment are identical if the samples were taken from the same section of the tooth: all the curves for the M2 (samples from the upper section), blue and green curves for the M3 (also samples from the upper section). The $\delta^{18}O_{VPDB}$ values for phosphates from the specimens after the H_2O_2 treatment were 1–3 ‰ higher than for phosphates extracted from enamel of the respective areas of the M2. The samples taken from different sections of the M3 display a divergence in the shapes of the curves while maintaining the location of the maximums and minimums.

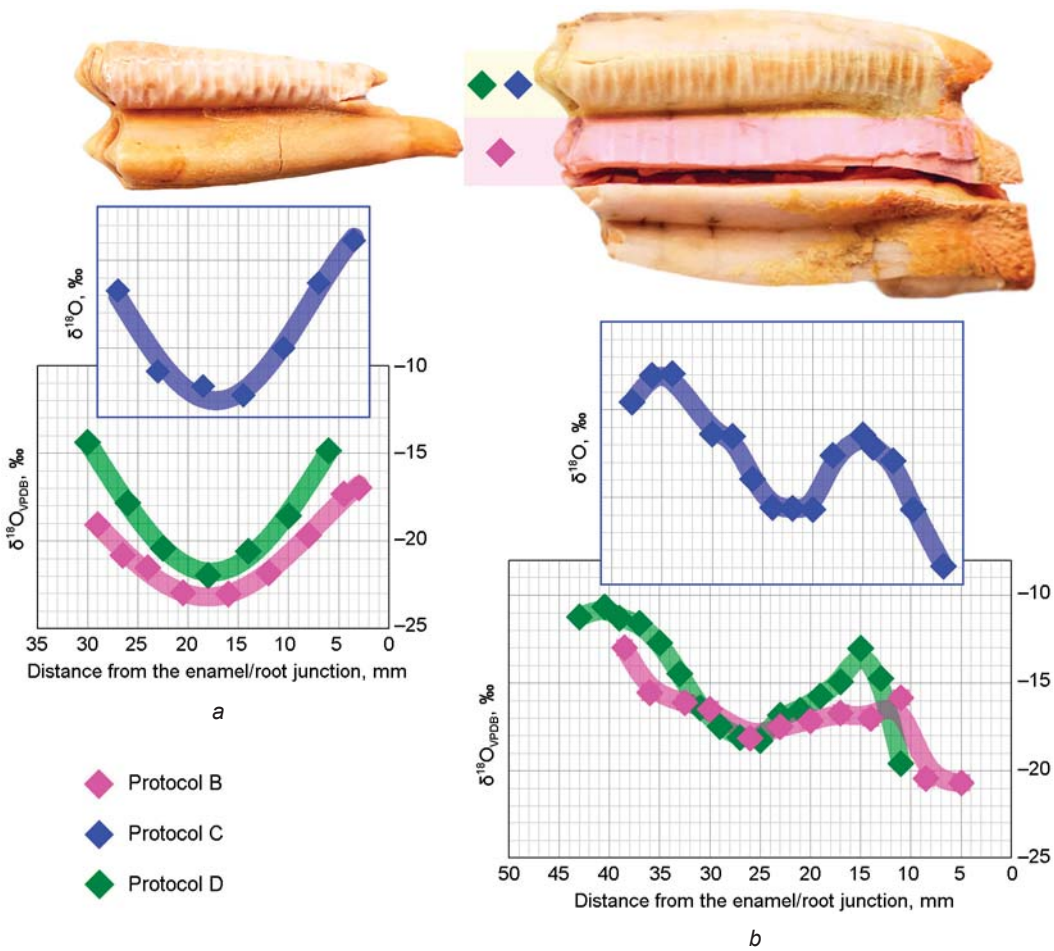

Fig. 3. Dependences of $\delta^{18}O_{VPDB}$ in molar enamel of ovicaprines on the distance from the enamel/root junction after applying different protocols of chemical treatment.
a – M2 (specimen 4); *b* – M3 (specimen 5).

The results for the ovicaprine's second molar confirm that the animal was born in spring, since the maturation of enamel at the tooth tip falls on a warm period. In this case, this process likely occurred during the 3rd to 5th months of the animal's life.

Conclusions

This study outlines a technique of oxygen isotopic analysis of tooth enamel for determining the birth seasonality of ovicaprines. The method is based on the conversion of oxygen of all the enamel components into CO in pyrolysis mode directly in the elemental analyzer. Its advantage as compared to the traditional analysis of carbonates is the high mass content (≈ 96 %) of phosphates in hydroxyapatites and their high resistance to diagenesis processes. Using this technique, it is possible to analyze more than 100 samples a day, and it requires less than 1 mg of the analyzed tissue. It is ideal for oxygen isotopic analysis of hydroxyapatite/phosphates of enamel sampled subsequently as thin strips (1 mm) along the growth line of teeth of small ruminants.

If the aim of the researcher is only to determine the seasonality of animals' birth but not to make paleoecological reconstruction, the information on the position of $\delta^{18}O$ minimums and maximums along the growth line is sufficient. For well-preserved teeth, the extremes can be detected after a minimal chemical treatment with H_2O_2, or even mechanical cleaning only. The method of Ag_3PO_4 extraction is prospective for working with teeth heavily contaminated with exogenous carbonates.

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A.V. Epimakhov[1] and I.P. Alaeva[2]
[1]South Ural State University,
Pr. Lenina 76, Chelyabinsk, 454080, Russia
E-mail: epimakhovav@susu.ru
[2]South Ural State Humanitarian and Pedagogical University,
Pr. Lenina 69, Chelyabinsk, 454080, Russia
E-mail: alaevaira@mail.ru

Radiocarbon Chronology of the Bronze Age Fedorovka Culture (New Data Relevant to an Earlier Problem)

This article presents the results of excavations and dating of the Fedorovka culture cemetery of Zvyagino-1 in the Southern Trans-Urals. It consists of 12 small kurgans, each of which contains from one to three differently arranged graves with cremations. The funerary items include typical Fedorovka clay vessels. We estimated the age of bones of domestic animals found on the area under the kurgan or in graves. The new dates were compared with those generated previously. Statistical analysis has made it possible to assess the time range as being from the mid-18th to mid-15th centuries cal BC (medians of calibrated intervals). Dates of the Alakul-Fedorovka complexes fall in the same time range, illustrating the process of interaction between these two traditions. The results of modeling were compared with the dates of the Andronovo sites in Kazakhstan, the Baraba forest-steppe, and Southern Siberia. The dates were similar, barring those of the more ancient series from Kazakhstan. Dates for the Alakul sites in the Trans-Urals were earlier (19th to 16th centuries cal BC), documenting the long coexistence of the Alakul and Fedorovka traditions. In the Southern Trans-Urals, the former tradition appears to have declined earlier. The question as to whether the Fedorovka tradition survived until the Cordoned (Valikovaya) Ware cultures remains open due to the lack of dates for the Cherkaskul culture, which resembles Fedorovka, while being stratigraphically earlier than the Cordoned Ware cultures.

Keywords: *Southern Trans-Urals, Late Bronze Age, Fedorovka culture, Alakul culture, radiocarbon dating, modeling.*

Introduction

The issue of the relationship between the main cultures of the Andronovo community has been actively discussed since the time of their identification. The Southern Trans-Urals is a key region for the discussion, due to research at eponymous sites in this part of Northern Eurasia. This has led to attempts to extend cultural and chronological findings over a vast territory, including Central and Eastern Kazakhstan. The original model proposed by K.V. Salnikov (1967: 340–351) was adjusted many times, especially in terms of the relationship between the Alakul and Fedorovka traditions. A detailed analysis of arguments for parallel or sequential existence of these cultures is beyond the scope of this article. Ultimately, the issue rests upon the interpretation of the syncretic Alakul-Fedorovka complexes, which are viewed either as evidence of interaction between different population groups (Kuzmina, 1994: 21–22, 32), or as an intermediate link in transformation from one culture to another.

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The supporters of a sequential relationship agree in recognizing the Fedorovka antiquities as originating in later periods (Zdanovich, 1988: 167; Matveev, 1998: 377–378; and others).

The most obvious solution to this endless discussion is to establish the chronological positions of each culture at the level of its region and entire community. Previous efforts have not yet led to generally accepted results. One of the reasons is the extreme paucity of dates for the Fedorovka sites, especially since they have not been actively studied in recent years. Moreover, even though the Fedorovka and Alakul traditions have been well differentiated by the funerary rite, their distinction in research of settlements is problematic.

This study presents new field evidence and radiocarbon dates that have a reliable context. Its objectives are to analyze these dates within the available database on the Fedorovka and Alakul cultures, and to compare them with the results of dating Andronovo evidence from other regions.

The history of accumulation of radiocarbon dates for the Fedorovka culture in the Southern Trans-Urals

The first attempts at establishing the chronology of the Fedorovka culture were made in the early days of the radiocarbon dating of archaeological sites. At that stage, scholars focused on obtaining individual dates; large samples were used (mainly of wood). The final summary for the Andronovo community (Kuzmina, 1994: 372–376) contained relatively few dates (only eight) related to the Fedorovka antiquities of the Urals. Today, cultural attribution of some evidence needs revision. For example, the artifacts from the Novo-Burino and Bolshaya Karabolka cemeteries included recognizable Cherkaskul items, along with those of the Fedorovka culture. It is impossible to rely on this series because of difficulties in determining the context, imperfect methodology, inability to take into account the effect of "old wood", as well as significant discrepancy of dates in relation to each other and with relation to more modern dating results. This can also be applied to the Alakul dates and other series. This problem is by no means limited to the region under discussion. Detailed analysis of old and new dating results for the sites of the Minusinsk Basin has led to rejection of the former for similar reasons (Polyakov, 2022: 221).

Fig. 1. Location of the Fedorovka and Alakul-Fedorovka sites with the available ^{14}C dates.

a – Fedorovka sites; *b* – Alakul-Fedorovka sites. *1* – Cheremukhovy Kust settlement; *2* – Urefty I cemetery; *3* – Zvyagino-1 cemetery; *4* – Kamennaya Rechka III settlement; *5* – Solntse-Talika cemetery; *6*, *7* – Lisakovskiy I and III cemeteries.

The addition of dates for the Fedorovka antiquities were a result of research at the settlement of Cheremukhovy Kust. Four wood samples were studied by scintillation (Matveev, 1998: 363–368). The variation among conventional values amounted to a thousand years, which is clearly unrealistic for a single site. At least one date (UPI-568, 4250 ± 160 BP) was too early, and had a huge standard deviation for the Bronze Age. It falls into statistical outliers when using the range diagram for the medians of calibrated values (see below). There are no formal reasons for excluding the other dates. The discrepancy in the results may exist for many reasons (Bronk Ramsey, 2008), including, as is the case in our discussion, the effect of "old wood", problems associated with selection and storage, and cultural identification of the samples. The pottery complex of the settlement is considered by the authors to be of a single culture, although some of the vessels do not correspond to standard Fedorovka pottery.

Currently, the spread of accelerator measurement technologies has enabled the series of dates of the Fedorovka and Alakul-Fedorovka antiquities of the Urals to be expanded as a result of international projects (Hanks, Epimakhov, Renfrew, 2007; Panyushkina, 2013; Schreiber, 2021) that are focused on establishing a chronological system of the region (Trans-Urals) or microregion (Lisakovsk) (Fig. 1). At the microregional level, it was possible to greatly increase the accuracy

of age determinations for the Alakul sites using the method of coordinating variations or wiggle matching, and establish the internal chronology of the complexes. It has been reliably proven that the Alakul traditions were earlier than the Alakul-Fedorovka traditions in this microregion. Unfortunately, the Fedorovka complexes were dated only using calcined human bones, whereas the relative chronology of the microregion was based on spatial distribution data.

Systematic studies of Andronovo sites in the Baraba forest-steppe (Molodin et al., 2012; Molodin, Epimakhov, Marchenko, 2014) and Minusinsk Basin (Polyakov, 2022: 219–226) have provided a large series of dates. The position of the Andronovo antiquities in periodization systems has been reliably established and expressed in numbers. The Kazakhstan part of the dates is uneven; new dates mainly result from projects aimed at studying the paleogenome of humans and animals. This vast region has a series of only slightly over a hundred dates from all periods of the Bronze Age mostly from its southern and eastern parts. In addition, it is problematic to correlate many dates with a specific culture.

Results of excavations at the Zvyagino-1 cemetery

The Zvyagino-1 kurgan cemetery is located on a high terrace on the left bank of the Koelga River (tributary of the Uvelka River in the Tobol River basin) in Chebarkulsky District of the Chelyabinsk Region. Twelve mounds with a height of 0.3–1.0 m and 7–16 m in diameter were identified. Ten objects were studied during excavations under the supervision of I.P. Alaeva in 2017–2022. Round and oval-shaped kurgans had soil mounds. In four cases, stone enclosures were made on the areas under the mounds (Fig. 2, *2*). Burial structures (up to three under a single mound) included ground pits (sometimes with traces of a wooden cover or walls lined with stone) and stone boxes (Fig. 3, *1*) oriented along the west–east line. In several cases, animal sacrifices were discovered within the enclosures at the level of the virgin soil (cattle and small ruminants). For example, a complex of sacrifices in kurgan 7 was represented by a cattle skull with a mandible lying on four bones of distal limbs. The head and lower part of the animal's legs were apparently used in the ritual.

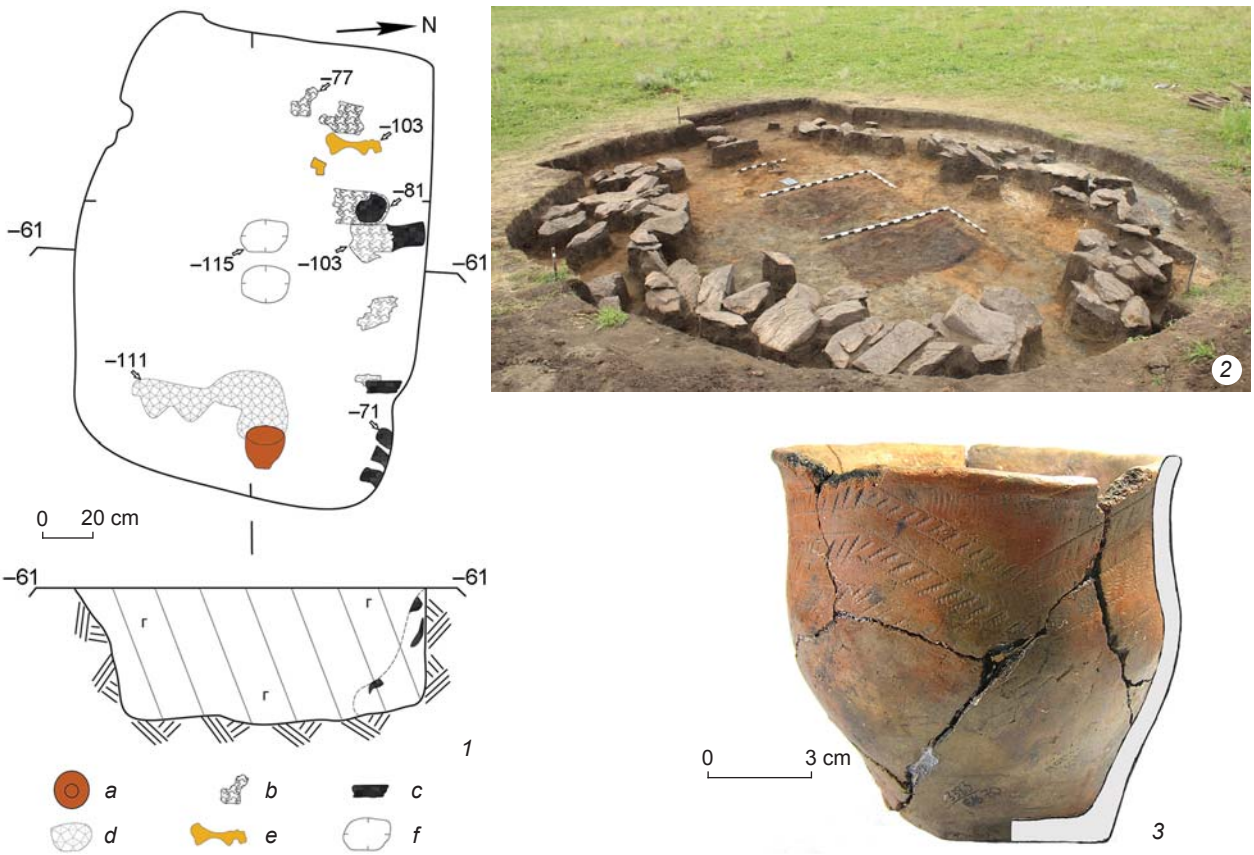

Fig. 2. Plan view and cross-section of burial 1, kurgan 7 at the Zvyagino-1 cemetery (*1*), area of the kurgan (*2*) and ceramic vessel from it (*3*).
a – ceramic vessel; *b* – birch bark; *c* – charcoal; *d* – cremation; *e* – pelvic bone of a horse; *f* – post pit.

Fig. 3. Burial 1, kurgan 1 at Zvyagino-1 (*1*) and ceramic vessel from it (*2*).

Thirteen burials were examined. Almost all showed traces of robbery. The burials were made according to the rite of secondary cremation. The remains of the funerary meal in the graves included horse ribs, as well as cattle and horse pelvic bones (see Fig. 2, *1*; 4, *1*). Burial goods included pot-shaped pottery (from one to three vessels per burial) and clay dishes in two cases. Bronze temple pendants twisted 1.5 times (one with remains of gold foil) were found in two pits.

Specific features of the funerary rite (stone enclosures and boxes, cremation, orientation of graves along the west–east line), and distinctive pottery (see Fig. 2, *3*; 3, *2*; 4, *2*) have made it possible to attribute all of these kurgans to the Fedorovka culture of the Southern Trans-Urals.

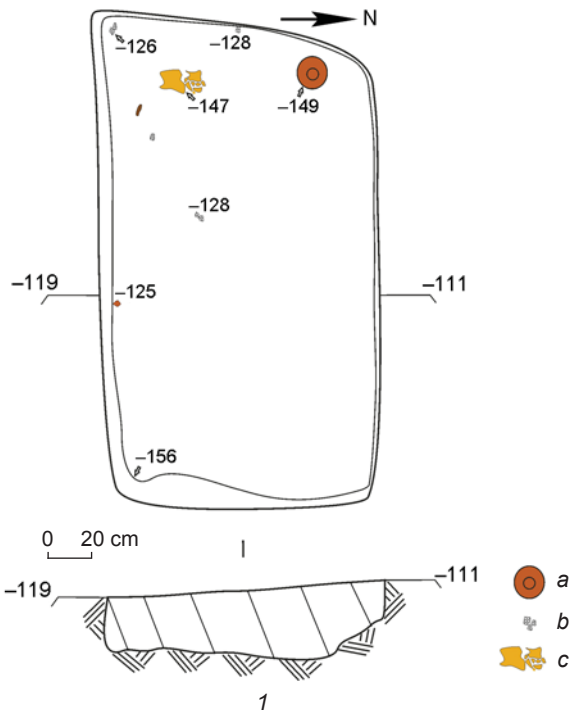

Fig. 4. Plan view and cross-section of burial 2, kurgan 2 at Zvyagino-1 (*1*) and ceramic vessel from it (*2*).
a – ceramic vessel; *b* – cremation; *c* – animal bones.

Results of dating

Animal bones (of horse and cattle) and a tooth were selected for dating from the complexes of sacrifices and burials in three kurgans. Collagen was extracted and other stages of sample preparation were performed at the "Laboratory of Radiocarbon Dating and Electron Microscopy" Center for Collective Use at the Institute of Geography of the Russian Academy of Sciences. Measurements were carried out at the Center for Applied Isotope Studies at the University of Georgia (USA). The results were analyzed using accelerator mass-spectrometry (AMS), with determination of the amount of collagen, and the isotope ratio of nitrogen and carbon. Calibration was carried out using the OxCal 4.4.4 software (Bronk Ramsey, 2017) and calibration curve IntCal20 (Reimer et al., 2020). Statistical outliers were identified using a box-and-whisker plot of the medians of calibrated values. Summing up the probabilities of calibrated values was used to analyze the degree of homogeneity among the samples. The boundary procedure was used to establish the boundaries of the date interval. The new data were added to the Table summarizing dating results (Table 1).

In assessing the reliability of the new data, the current authors proceeded from an analysis of possible distortions, checking the internal consistency of dates and their compatibility with previously obtained ones. Material evidence for producing the new series of dates excluded the freshwater reservoir effect. The amount of extracted collagen was over 1 %, which was sufficient

Table 1. **Results of radiocarbon dating of the Fedorovka and Alakul-Fedorovka sites in the Southern Trans-Urals**

Site	Complex	Index	Evidence	Conventional date, BP	Source
		Fedorovka			
Cheremukhovy Kust, settlement	Dwelling 1, pit 2	**UPI-568**	**Wood**	**4250 ± 160**	(Zakh, 1995)
"	Dwelling 2, pit 1	UPI-560	"	3446 ± 95	(Ibid.)
"	Dwelling 6, pit 2	UPI-564	"	3280 ± 30	"
"	"	UPI-569	"	3605 ± 53	"
Urefty I, cemetery	Kurgan 16, burial 1	OxA-12521	Bone (horse)	3440 ± 30	(Hanks, Epimakhov, Renfrew, 2007)
Zvyagino-1, cemetery	Kurgan 1, burial 1	$IGAN_{AMS}$-9091	"	3390 ± 30	This article
"	Kurgan 2, burial 2	$IGAN_{AMS}$-9092	Bone (cattle)	3300 ± 25	"
"	Kurgan 7, burial 1	$IGAN_{AMS}$-9093	Bone (horse)	3310 ± 25	"
"	Kurgan 7, complex of sacrifices	$IGAN_{AMS}$-9094	Tooth (cattle)	3415 ± 25	"
Lisakovskiy I, cemetery	Enclosure 3, burial 1	Poz-93398	Calcined bone (human)	3280 ± 35	(Schreiber, 2021)
"	Enclosure 9, burial 1	Poz-93400	"	3230 ± 35	(Ibid.)
"	Enclosure 11, burial 1	Poz-93401	"	3195 ± 35	"
"	Enclosure 18, burial 1	Poz-93402	"	3290 ± 35	"
"	Enclosure 17, burial 3	Poz-93404	"	3410 ± 35	"
"	Enclosure 6, burial 1	Poz-93405	"	3255 ± 30	"
		Alakul-Fedorovka			
Urefty I, cemetery	Kurgan 15, burial 6	OxA-12523	Bone (horse)	3345 ± 30	(Hanks, Epimakhov, Renfrew, 2007)
"	Kurgan 30, burial 1	Poz-94211	Bone (human)	3390 ± 35	(Schreiber, 2021)
Kamennaya Rechka III, settlement	Dwelling 1	OxA-12518	Bone (cattle)	3372 ± 29	(Hanks, Epimakhov, Renfrew, 2007)
"	"	OxA-12519	Bone (animal)	3341 ± 29	(Ibid.)
Solntse-Talika, cemetery	Kurgan 6, burial 1	OxA-12520	Bone (cattle)	3347 ± 29	"
Lisakovskiy III, cemetery	Structure 2	AA-78389	Wood	3414 ± 40	(Panyushkina, 2013)

Note. Bold font indicates the statistical outlier.

for reliable measurements (Table 2). The ratio of nitrogen and carbon was in the normal range (2.9–3.6). The most noticeable differences were in the composition of nitrogen isotopes ($\delta^{15}N$), which does not appear to be related to the species of herbivorous domestic animals nor to the sample type. There was probably some difference in the composition of their food. However, the values are in the range of indicators typical of herbivores of the steppe Trans-Urals (Hanks et al., 2018; Svyatko et al., 2022).

One date for the Zvyagino-1 cemetery, obtained from a tooth from the complex of sacrifices in kurgan 7 ($IGAN_{AMS}$-9094, 3415 ± 25 BP) was reliably earlier than the others. There was a second, later date for that kurgan. The difference in the medians was over a hundred years. Nevertheless, the early sample does not look extraneous with relation to the combined series. Based on the reliability of the results, one must assume that the ritual of sacrifice preceded the funerary ceremony, which means that the kurgan area remained without a mound for quite a long time.

In terms of absolute values, the new results are close to those obtained earlier (see Table 1). The summation of probabilities forms an asymmetrical figure shifted towards later dates, although their number is insufficient to make confident conclusions. Determining the boundaries has made it possible to obtain an idea as to the interval of the entire group: 19th–15th centuries BC (by medians). However, the earliest (UPI-569, 3605 ± ± 53 BP) and the latest (UPI-564, 3280 ± 30 BP) dates are not statistically consistent with the series. For this reason, a calculation was made for the dates obtained by means of accelerator technologies. The medians of the modeled boundary intervals delineate the period of 1742–1451 BC (Table 3).

Calculation of interval boundaries for the Alakul-Fedorovka dates (1728–1589 BC based on the medians) has shown that it entirely fit the formed Fedorovka interval, being closer to its early part. Combining the dates of the Fedorovka and the syncretic Alakul-Fedorovka sites did not really change the interval boundaries.

Table 2. **Results of analyzing radiocarbon dates of the Zvyagino-1 cemetery and composition of stable isotopes**

$IGAN_{AMS}$	Collagen, %	C/N_{at}	$\delta^{15}N$, ‰	$\delta^{13}C$, ‰	^{14}C-date (1σ), BP	Calibrated date (95.4 %) BC	Median, BC
9091	17.66	3.18	2.29	–20.37	3390 ± 30	1863–1564	1675
9092	9.24	3.21	2.48	–20.88	3300 ± 25	1618–1510	1567
9093	12.22	3.18	5.24	–20.27	3310 ± 25	1624–1510	1574
9094	6.19	3.17	5.42	–19.84	3415 ± 25	1867–1625	1706

Table 3. **Modeling of the results of radiocarbon dating of the Fedorovka sites in the Southern Trans-Urals**

Index	Calibrated date, BC					
	without modeling			modeled		
	68.3 %	95.4 %	Median	68.3 %	95.4 %	Median
OxA-12521	1871–1689	1879–1632	1746	1758–1689	1781–1641	1716
Poz-93404	1744–1632	1874–1615	1700	1736–1672	1750–1637	1696
$IGAN_{AMS}$-9094	1746–1641	1867–1625	1706	1700–1636	1727–1626	1674
$IGAN_{AMS}$-9091	1736–1626	1863–1564	1675	1661–1619	1696–1610	1642
$IGAN_{AMS}$-9093	1612–1538	1624–1510	1574	1621–1585	1631–1550	1603
$IGAN_{AMS}$-9092	1611–1532	1618–1510	1567	1606–1556	1614–1535	1580
Poz-93402	1609–1511	1631–1456	1559	1580–1527	1600–1516	1553
Poz-93398	1609–1505	1623–1455	1547	1545–1510	1581–1502	1531
Poz-93405	1541–1457	1612–1446	1516	1529–1501	1545–1465	1514
Poz-93400	1518–1447	1607–1421	1488	1516–1472	1527–1451	1497
Poz-93401	1499–1438	1518–1410	1465	1501–1452	1509–1425	1475
Boundary – beginning	–	–	–	1782–1697	1854–1648	1742
Boundary – end	–	–	–	1492–1426	1507–1362	1451

Chronology of the Fedorovka sites in the Trans-Urals (analysis of diachrony and synchrony)

The new data are in close agreement with earlier conclusions about periodization of the local Bronze Age (Molodin, Epimakhov, Marchenko, 2014) and complements the series of AMS dates. Most samples did not suggest an earlier chronological interval. Against this consistent background, it seems unwise to use the dates obtained in the period from the 1970s to early 1990s. In our sample, the dates of the Alakul-Fedorovka and Fedorovka antiquities belonged to the same chronological range. However, it is necessary to note that a limited series from only a few sites was used. In this regard, the method for verification would be diachronic analysis, including an examination of the chronological relationship between the Alakul and Fedorovka traditions. Unfortunately, the dates of the Alakul tradition remain the subject of debate, at least when compared with the Sintashta and Petrovka series, which are supported by solid findings (Krause et al., 2019; Epimakhov, 2020; and others). Many dates for the Alakul sites were obtained by scintillation; there are some contradictions in the dates for closed complexes, etc. The calibrated values showing the mid-3rd millennium BC raise particular doubts. There is no obvious solution to this problem, since a large number of widely varying dates has been accumulated, and choice between them is often made according to different models of cultural genetic processes (Grigoriev, 2021). In this case, we should be limited to the dates obtained in the 2000s for the steppe and forest-steppe Trans-Urals and the steppe Tobol region (the Urefty I, Kulevchi VI, Stepnoye VII, Lisakovskiy I, III, IV, Troitsk-7, Peschanka-2, Alakul, and Subbotino cemeteries, and the settlement of Mochishche). All of these have been published (Hanks, Epimakhov, Renfrew, 2007; Panyushkina, 2013; Poseleniye…, 2018: 100; Krause et al., 2019; Epimakhov et al., 2021; Schreiber, 2021: 161, 193).

All early dates were obtained for one site (the Mochishche settlement) using scintillation. It is possible that the analysis was carried out during a period of some technological failure in the work of one particular laboratory (Marchenko, 2016: 442). Over a half of the remaining 32 dates were obtained from human bones, while the rest, from wood and animal bones. No statistically significant differences were found between the samples. There were four pairs of different types of samples from closed complexes. In all cases, the values were close, or the dates for human bones were later. The procedure for determining the boundaries provided values within the 19th–16th centuries BC (Table 4).

The inclusion of benzene dates, which some scholars insist on (Grigoriev, 2021: 27), would significantly bring down the lower chronological boundary of the Alakul culture. In addition to statistical arguments, there are some conceptual reasons against such an expansion. This version of the calculation creates an insoluble problem of culture correlation. The Alakul sites in the Trans-Urals have been usually attributed to a later period as compared to the Sintashta and Petrovka sites, which have been very reliably dated to the 20th–18th centuries BC. In the forest-steppe to the north and northeast of the Southern Trans-Urals, this period was apparently associated with the Koptyaki population (Chernykh, Korochkova, Orlovskaya, 2017) whose material culture reveals Alakul features. The dates of the Koptyaki sites did not go beyond the turn of the 3rd and 2nd millennia BC. Thus, the adoption of a "long" chronology of the Alakul culture complicates rather than resolves the problem of relationship of traditions in that period.

Table 4. **Modeling of the results of radiocarbon dating of the Alakul sites in the Southern Trans-Urals (Epimakhov, 2023)**

Chronological boundary	Modeled date, BC		
	68.3 %	95.4 %	Median
Beginning	1842–1782	1894–1775	1802
End	1613–1581	1622–1545	1595

There is more clarity in establishing the chronological position of the Alakul and Fedorovka cultures based on AMS dating, at least for the Southern Trans-Urals. The Alakul groups appeared earlier than the Fedorovka population; then, there was a fairly long period of their coexistence and interaction. Our series of dates indicates that the Alakul tradition declined somewhat earlier than the Fedorovka tradition. If we focus on the medians, this occurred in the 16th and 15th centuries BC, respectively.

The next stage, well supported by dates, was associated with the Cordoned Ware cultures. The beginning of that stage was reliably dated to the 14th century BC, and only some dates indicate the late 15th century BC (Epimakhov, Petrov, 2021). Apparently, there were no catastrophic events or abandonment of the area; therefore, the chronological gap may be interpreted two ways. First, a well-recognizable, although almost undated set of Cherkaskul antiquities has been identified in the Trans-Urals. Observations on the relative chronology have made it possible to place these artifacts earlier than the Cordoned Ware evidence (Poseleniye…, 2018: 94, 102). Second, the use of median (average) values for analysis could have made some impact. In fact, the intervals during two-sigma calibration are adjacent and the gap is minimal. For selecting the correct answer, a significant expansion of the database on many cultures, including the Fedorovka and Cherkaskul, is required.

The analysis of evidence from the adjacent areas is complicated by uneven distribution of available dates across the regions, frequent absence of thematic summaries (for example, on the Timber-Grave culture of the Volga-Ural region), problems in correlating specific dates with a specific culture, especially in cases where they were published as a part of large projects on paleogenetics (Narasimhan et al., 2019; Librado et al., 2021). The largest and most reliable series are associated with the Baraba forest-steppe and Minusinsk Basin, which are regions remote from the Trans-Urals. A small sample is available for the Fedorovka antiquities of Kazakhstan.

Seven dates of the Kazakhstan sites (Degtyareva et al., 2022: 68) are associated with the central and southern parts of the region, and combining them should be considered with caution. The early dates were obtained from charcoal from the multilayered settlement of Begash. The rest of the dates were obtained from human bones and wood from the burial grounds in Central Kazakhstan. The medians of the boundaries show a long period of 1834–1611 BC, which is obviously more ancient than the Trans-Urals. We should be limited to this statement due to impossibility of verifying the cultural context of finds from the settlement and the likely influence of human diet on dating results.

Numerous data on the Western Siberian forest-steppe were obtained using various techniques and laboratories. Excluding a number of problematic dates, it was possible to compile an interval of calibrated values within the 18th–15th centuries BC (Molodin, Epimakhov, Marchenko, 2014: 149). However, the authors in the summary publication (Reinhold, Marchenko, Molodin, 2020) mentioned the possibility that the dates from human bones were two hundred years older. This means that the boundaries of the chronological interval could be adjusted quite significantly.

Twenty-four dates were obtained from human bones for the Andronovo sites of the Minusinsk Basin, indicating the period of the 17th–15th centuries BC (Polyakov, 2022: 222). A likely problem with these dates is the untested possibility of the reservoir effect. For the previous (Okunev) and subsequent (Karasuk) periods, checking the date consistency for different types of sources did not reveal any significant impact on the final result (Ibid.: 183, 310). Nevertheless, the possibility of the impact of local factors cannot be completely excluded (Svyatko et al., 2022), which mitigates the definitiveness of the conclusions.

The Andronovo antiquities of Siberia are often viewed as resulting from migration of the carriers of the Andronovo tradition to a foreign environment. This applies to both the Baraba forest-steppe and Minusinsk Basin, where migrants encountered the Krotovo and Okunev populations. This scenario implies a relatively late chronological position of the Andronovo traditions with relation to the Trans-Ural Fedorovka traditions. Comparison with our results does not confirm such a model for the possible reason that the Trans-Ural Fedorovka sites, like the Siberian sites, were not the earliest, and the carriers of these traditions were also a superstratum group, which was incorporated into the Alakul environment and therefore should be considered a subcultural phenomenon (Stefanov, Korochkova, 2006: 126). Furthermore, the problem of locating the origins of the Fedorovka traditions still remains unresolved.

Conclusions

New dating results for the Fedorovka cemetery of Zvyagino-1 expand modern data on this culture. The internal consistency of the dates and their proximity to those previously obtained makes it possible to consider the interval of the 18th–15th centuries BC reliable. The dates of the syncretic Alakul-Fedorovka sites also correspond to the same period and illustrate the time when these two traditions coexisted and interacted. This conclusion does not contradict the previous concepts on periodization of the regional cultures. According to this model, the Alakul culture appeared in the Trans-Urals earlier than the Fedorovka, and they existed in parallel for a long time. Currently available dates indicate the extinction of the Alakul traditions somewhat earlier than the Fedorovka ones. Whether the Fedorovka traditions survived until the Sargary-Alekseyevka period is unclear because of the small number of dates for the Fedorovka sites and almost complete absence of dates for the Cherkaskul culture, which occupies a stratigraphic position in the steppe and southern forest-steppe regions between the Andronovo evidence and the final stage of the Late Bronze Age (late 14th–11th centuries BC).

Comparison with other areas where the Andronovo traditions were found has revealed synchronicity of the sites in the Trans-Urals, Baraba forest-steppe, and Middle Yenisei region. The dates obtained from the Trans-Urals evidence were definitely not influenced by the reservoir effect, yet other series of dates, most of which were obtained from human remains, are less credible, especially since there have been initial indications that such dates were older.

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A.P. Borodovsky
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: altaicenter2011@gmail.com

Metal Spearheads from the Bronze Age— New Finds in the Omsk Region

This study addresses the morphological features and chronology of the Seima-Turbino spearheads found by chance in the Omsk Region. Their chronology evidences both general and specific features of their distribution. Late specimens attest to a long period of their use in Western Siberia. Special attention is paid to rare spearheads with Janus-like anthropomorphic representations, whose style reveals parallels with both Okunev tradition and Bronze Age anthropomorphic toreutics of China. In the forest-steppe and southern taiga areas of the Middle Irtysh, Seima-Turbino spearheads co-occur with molds for their casting, testifying to local manufacture or replication. Consequently, even undocumented specimens can reveal the meridionally directed (south to north) trade routes. The abundance and diversity of Bronze Age spearheads from the Middle Irtysh provide yet another demonstration of this region's significance as one of the centers from which Seima-Turbino bronzes spread across southwestern Siberia.

Keywords: *Bronze Age, southwestern Siberia, Seima-Turbino transcultural phenomenon, spearheads, metal artifacts, trade routes, Middle Bronze Age, anthropomorphic representations.*

Introduction

Metal spearheads are more than just piercing parts of polearms, they are also multifunctional elements, which showed the status of their owner and had a signaling purpose. They can be divided into three groups by their size: large, small, and dart heads (Bochkarev, 2004: 391, 404). Recently, eight Bronze Age spearheads made of non-ferrous metal have been identified in the Omsk Region. These are surface finds, which are currently kept in the "Solyanoi Povorot Redoubt" Museum in the village of Solyanoye in the Cherlaksky District of the Omsk Region (finds from the Shcherbakulsky and Sedelnikovsky districts) and in the Omsk Museum of Education (the item from the vicinity of the village of Bogdanovka in the Gorkovsky District, and three spearheads with hooks from the village of Okunevo in the Muromtsevsky District).

These items will be described proceeding from the southwest (Shcherbakulsky District) to northeast (Gorkovsky and Sedelnikovsky districts) for a number of reasons. First, there is a trend for meridional location of traditional transport communications for southwestern Siberia, including the Middle Irtysh region (Matveev, 2017). Second, the distribution of some metal items from the Bronze Age (shaft-hole axes) in the direction from south to north is quite clear in that area (Borodovsky, 2022: 41). Third, the Omsk Region also extends in this direction. The morphological features of the discovered spearheads manifest obvious chronological differences, which makes it possible to discuss the problems of their

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distribution in different periods of the Bronze Age. This study significantly expands the corpus of sources, including surface finds (Chernykh, Kuzminykh, 1989: 31), and will make it possible to refine reconstructions of development of spearheads during the Bronze Age in southwestern Siberia (Bochkarev, 2004: 398; Tikhonov, 2022).

Materials

Until recently, twelve Bronze Age spearheads were known in the Omsk Region (Fig. 1). Most of these originated from the vicinity of the city of Omsk (6 items from the Rostovka cemetery, one item each from the Rostovka hoard, Okunevo XI site, the mouth of the Tara River, near the Khlebopriemny Punkt, and at Tatarsky Uval) (Matyushchenko, Sinitsina, 1988: 19, fig. 18, *2*, *5*; p. 36, fig. 43, *1*; p. 41, fig. 52, *4*; p. 58, fig. 72, *1*; Chernykh, Kuzminykh, 1989: 68, fig. 28, *3*; p. 69, fig. 29, *1*, *2*; Degtyareva, Neskorov, 2015; Tikhonov, 2022). Today, the number of such finds has increased by another eight items. One spearhead each was found in the Shcherbakulsky and Gorkovsky (village of Bogdanovka) districts and near Omsk; three spearheads were discovered in the Muromtsevsky District (village of Okunevo), and two in the Sedelnikovsky District. New finds require detailed description in the context of reconstructing the general picture of the distribution of piercing pole weaponry in southwestern Siberia.

Fig. 1. Sites with discoveries of Bronze Age spearheads in the Omsk Region.
1 – Shcherbakulsky District; *2* – Omsk and its vicinity; *3* – Gorkovsky District; *4* – Muromtsevsky District; *5* – Sedelnikovsky District.

A severely deformed spearhead made of non-ferrous metal (17.3 × 3.0 cm), with a looped eyelet on a massive socket, continuing to the end of the blade (Fig. 2, *1*), was found during agricultural works on arable land in the Shcherbakulsky District in the south of the Omsk Region. At the base of the socket, there are two bands in slight relief. A similar find of a split-tailed spearhead with a narrow laurel-shaped blade and a side eyelet with a defect of short pour was recently discovered near Omsk, on the left bank of the Irtysh River (Fig. 2, *2*). Another spearhead, measuring 14.3 × 3.0 cm, was found near the village of Bogdanovka, in the Gorkovsky District (Fig. 2, *3*), northeast of Omsk. The length of its blade is 8.5 cm; the width is 3 cm. Their ratio is 1 : 2.8. The blade is narrow and leaf-shaped. The socket is wide and robust. Its length is 5.8 cm; its diameter is 2.8 cm. The ratio of the length of the socket to the entire spearhead is 1 : 2.

Three split-tailed spearheads with hooks were discovered near the village of Okunevo, in the Muromtsevsky District (Fig. 2, *4*–*6*). They are classified as long spearheads (Chernykh, Kuzminykh, 1989: 65), have different sizes (38 × 7; 37.0 × 6.5; 35 × 6 cm), flame-shaped blades, and smooth side-eyelets. The flat surfaces of the hooks are decorated with three rows of bands; their number varies from three to four; two such rows intersect at the base of the hook near the socket. Notably, similar items from burials at the Rostovka cemetery have more robust short sockets and hooks with smooth surfaces (Ibid.: 70, fig. 30, *1*, *2*).

Two bronze split-tailed spearheads with masks on the sockets were discovered in the Sedelnikovsky District, in the north of the Omsk Region (Fig. 2, *7*, *8*). These have different sizes (47.4 × 5.0; 45.3 × 6.5 cm) and sockets broken at the bases of the blades. These items are unique to the Seima-Turbino metal complex.

Discussion

A number of features of the spearheads under consideration allow for their historical and cultural

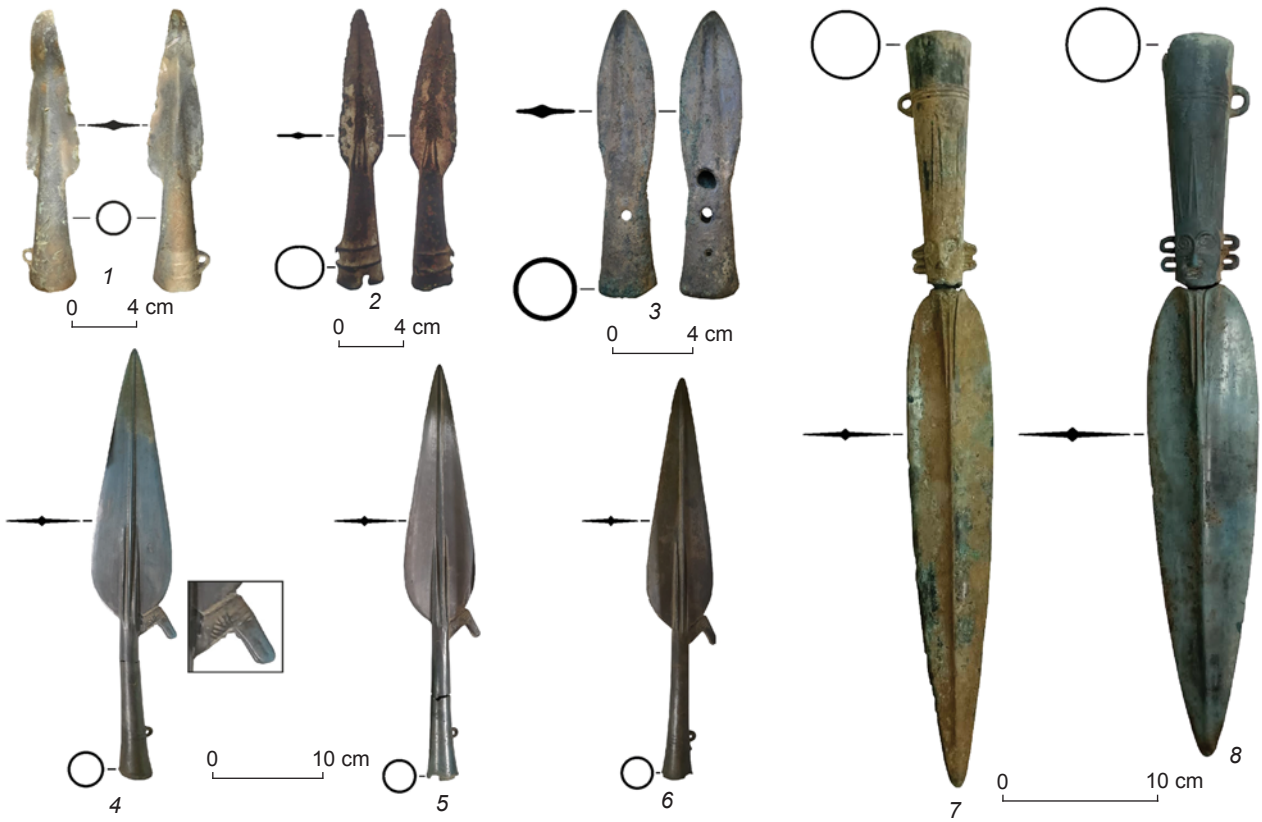

Fig. 2. Spearheads from the Omsk Region.
1 – from the Shcherbakulsky District; *2* – from the vicinity of Omsk; *3* – from the village of Bogdanovka in the Gorkovsky District; *4–6* – from the village of Okunevo in the Muromtsevsky District; *7*, *8* – from the Sedelnikovsky District.

attribution to various periods of the Bronze Age. For example, the presence of a blade shaft with rounded-rhombic cross-section in the item from the Shcherbakulsky District (Fig. 2, *1*) suggests its wide geographical distribution and a late period of existence (Chernykh, Kuzminykh, 1989: 63). However, this item still belongs to the Seima-Turbino spearheads, and even the absence of a split-tailed element does not contradict this attribution (Bochkarev, 2004: 396). Moreover, the presence of an eyelet on the socket indirectly shows that the time of its existence was far from the latest stage (Ibid.: 398). In terms of morphology, the item from the Shcherbakulsky District reveals a certain similarity with spearheads of the KD-46 type, which continued the line of development of the Seima-Turbino bronzes (Chernykh, Kuzminykh, 1989: 157, 158, fig. 81, *1–5*).

Obviously, the non-functional eyelet of the spearhead from the vicinity of Omsk (Fig. 2, *2*) indicates a purely decorative purpose. This feature is completely consistent with the fact that by the mid-2nd millennium BC, eyelets on the sockets became self-sufficient and independent elements of decoration on spears (Bochkarev, 2010: 138). Therefore, this item can be identified as a late spearhead of the Seima-Turbino type. The combination of eyelets and various relief bands on the sockets of spearheads (from the Shcherbakulsky District and vicinity of Omsk) gives grounds to attribute them to the period before the first half of the 2nd millennium BC. A certain robustness, and the presence of short split-tailed rods inclined towards the central axis of rigidity, make the item from the vicinity of Omsk look more similar to spearheads of the "Preobrazhensky" type (Grushin, 2019). Notably, the location of this item in the same spatial context as Rostovka spearheads may also reveal local development of such technological tradition rather than just the duration of existence of the Seima-Turbino bronzes in the Middle Irtysh region (Molodin, 2020: 50, 52; Grushin, 2019).

Geographically, the closest parallel to the spearhead from the village of Bogdanovka in the Gorkovsky District (Fig. 2, *3*) is the spearhead from the Rostovka hoard (Degtyareva, Neskorov, 2015: 32–34, fig. 2, *1*). However, they show some differences in the ratio of the blade and socket length, which was 1 : 1

and 1.5 : 1, respectively. The socket of the spearhead from Bogdanovka has four holes of various sizes. Three of them are located on the same side of the item. The larger and irregularly shaped holes clearly resulted from a short pour of metal during the manufacture of the item, while round holes of small diameter could have been used for fastening the metal spearhead to a wooden shaft with the pin. This method was widely used since the early stages of the Middle Bronze Age (Bochkarev, 2004: 387). A clay mold for casting spearheads of a similar type, with the same fastening system, was found on Lake Issyk-Kul in Kyrgyzstan (Bekhter, Torgoev, 2019: 85, fig. 1, *1*, *2*). The small size of the item from Bogdanovka is typical of the Late Bronze Age (Bochkarev, 2004: 391). Spearheads of this shape made of non-ferrous metal existed for a very long time until the Early Iron Age (Degtyareva, Neskorov, 2015: 32, 33).

According to their morphological features, split-tailed spearheads with hooks from the village of Okunevo in the Muromtsevsky District (Fig. 2, *4–6*) belong to the KD-10 type of the Seima-Turbino bronzes (Chernykh, Kuzminykh, 1989: 67, 69, fig. 29). They are distinguished by ornamentation of the hooks, which in other similar items were usually left undecorated. Ornamentation on several partially intersecting bands is quite rare. Sporadically, it appears on Seima-Turbino spearheads (KD-22 type), celts (K-20 type), and horn handles (Ibid.: Fig. 18, *3*, *4*; 19, *4*; 35, *2*; 110, *25*). Parallels to this kind of decoration on the items of various materials (metal and horn) reflect syncretism of the cultures of the Seima-Turbino phenomenon (Ibid.: 251). Ornamentation on the hooks of spearheads from Okunevo may also imitate braiding with a cord.

The hooks of spearheads from the Middle Irtysh region (Rostovka, Okunevo) have expressed angular outlines. Outside this region, similar spearheads from the Altai Territory (Charysh River) (Ibid.: 70, fig. 30, *3*) and Northern China (the Shenna settlement in Qinghai Province, Xiawangan settlement in Henan Province, city of Anyang in Henan Province) have more smoothly curved hooks (Grigoriev, 2021: Fig. 1, *2*, *3*, *7*, *8*). However, spearheads from China are distinguished mainly by wide blades, whereas the item from the Charysh River has a narrow blade. Thus, these features may be considered as arguments not only for local production (Ibid.: 8), but also for the territorial (eastern) peculiarity of spearheads of Seima-Turbino appearance.

Long and fairly narrow sockets are another interesting feature of finds from the village of Okunevo. Similar sockets are known from the split-tailed spearheads of KD-4 and KD-20 types (Chernykh, Kuzminykh, 1989: Fig. 26, *3*; 34, *1*). This feature may be associated with functions and chronology of these items. In the late 1990s, a split-tailed spearhead without a hook, with a long and narrow socket, was discovered at the Okunevo XI site (Tikhonov, 2022). Until recently, it was believed that such items from the outskirts of Okunevo marked the northern boundary of the distribution of the Seima-Turbino bronzes in the Middle Irtysh basin (Ibid.). However, this boundary has shifted even further north after the discovery of spearheads in the Sedelnikovsky District of the Omsk Region.

The narrow laurel-leaf blade gives a common ground to the finds from Okunevo and the spearhead with a hook found on the Charysh River, in the Altai Territory (Bochkarev, 2010: 125, fig. 1, *9*). Such blades are observed quite rarely in the Seima-Turbino split-tailed spearheads (KD-8, KD-12 types) (Chernykh, Kuzminykh, 1989: Fig. 28, *3*, *4*; 31, *1*). Also note the assumption that spears with narrow blades were in use somewhat earlier than those with wide blades (Lin Meicun, Xiang Liu, 2017: 4). This is hardly the case, since both varieties existed in both Western and Eastern Eurasia for a considerable period of time (Grigoriev, 2021: 9). For instance, spearheads with narrow blades were a part of the Lubny hoard (Ukraine), belonging to the turn of the Bronze and Iron Ages (Klochko, 2009: 155, fig. 6, *3*, *4*; 10, *1–4*).

Split-tailed spearheads of the Seima-Turbino appearance with narrow laurel-leaf blades also have some regional features. For example, the "Preobrazhensky" type of such items is distinguished in the Ob-Irtysh region (Grushin, 2019). Their blades look narrow and long; the teeth of the split tail are short and converge on the central reinforcement rib (Molodin, 2020: 51, fig. 1, *4*). This feature appears on the spearhead from the vicinity of Omsk (Fig. 2, *2*), while the short split tail at the base of the blade is only slightly tilted towards the central reinforcement rib on two items from the Sedelnikovsky District (Fig. 2, *7*, *8*). Both of these types of spearheads, as well as spearheads with wide blades and relatively long split-tailed teeth, which do not converge at the central reinforcement rib (items from Okunevo), have been discovered in the Middle Irtysh region. The latter are similar to split-tailed spearheads of the "Rostovka" type (Grushin, 2019). This fact outlines the boundaries of the local existence of various kinds of Seima-Turbino spearheads in southwestern Siberia.

Finds from the Sedelnikovsky District show a number of unique features. These include double looped protrusions on the sockets, which may have served as additional eyelets. Such an element is extremely rare in the Seima-Turbino spearheads. An example is a spearhead from Rostovka (Chernykh, Kuzminykh, 1989, fig. 31, *2*), as well as a casting mold discovered on the Irtysh River (Mikhailov, 2012). The most similar paired double eyelets appear on the item from Xian (Shaanxi Province, China) (Kiselev, 1960).

The Janus-like masks on the sockets deserve special attention (Fig. 3, 4). Such images usually occur in several varieties, including identical masks, faces expressing opposite emotional states, and masks of characters of various ages or genders (Tishkov, 2017: 157). Anthropomorphic images on the sockets of spearheads from the Sedelnikovsky District, which were represented on one item, are almost identical. The eyes of the masks are round on the long spearhead and ellipsoidal on the short spearhead. The images of "three-horned" headdresses are also distinctive. The ends of the rays are rounded on the long spearhead (Fig. 4, *1*, *3*) and pointed on the short spearhead (Fig. 4, *4*, *6*).

Geographically, the closest parallel to the Janus-like images under consideration is a stone staff from the Ir River, which was accidentally discovered in the Krutinksky District of the Omsk Region (Ibid.: Fig. 3). This item was dated to a wide period from the Bronze Age to the Early Iron Age. A Janus-like pommel made of non-ferrous metal from the Bronze Age is known from China (Junxian County, Henan Province, Xingdun, grave M 21) (Komissarov, 1988: 44). Taking into account other indirect parallels in Chinese Bronze Age evidence to anthropomorphic decoration on spearheads from the Sedelnikovsky District, their similarity with the pommel decoration of

Fig. 3. Janus-like masks on the sockets of long (*1*, *2*) and short (*3*, *4*) spearheads from the Sedelnikovsky District.

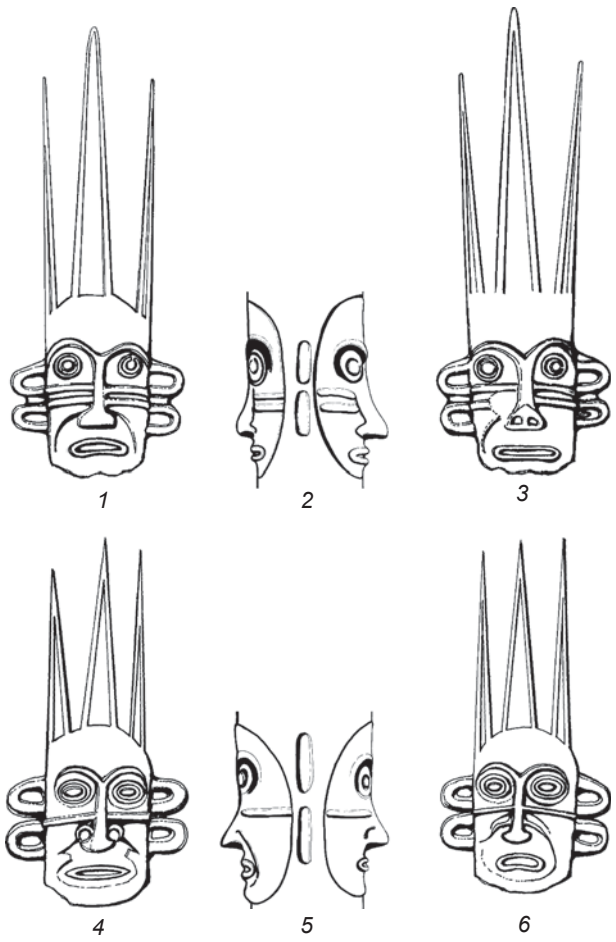

Fig. 4. Drawings of Janus-like masks on the sockets of long (*1–3*) and short (*4–6*) spearheads from the Sedelnikovsky District.

the Ir stone staff may well be regarded as an argument for the chronological contemporaneity of these items from the Omsk Region. An interesting hypothesis is that stone anthropomorphic staffs from the Middle Irtysh region and Xinzyang belonged to ritual attributes of the Seima-Turbino foundry workers (Solovyev, Cheremisin, Komissarov, 2022: 81).

Depiction of masks on high-status items could have been associated with the tradition of apotropaic objects. Notably, the best position for viewing anthropomorphic masks on the sockets of spearheads is the placement of spearheads with their points down. In this case, these items are more functional as *assegais*, i.e. short swords or massive daggers. Weapons of this type from the Bronze Age are known among the finds from Yakutia (Senele, Ukulaan) (Istoriya Sibiri, 2022: 506, fig. 262, *4*, *5*).

Anthropological features of masks on the sockets of spearheads from the Sedelnikovsky District, including significantly protruding noses, relatively large eyes and "ears", deserve special attention. These features show some similarity with anthropomorphic toreutics of China (Jinsha and Sanxingdui in Sichuan Province), dating back to the 12th–10th centuries BC (Deng Yiuke, 2007: 37; Stafutti, Romagnoli, 2015: 16, 36, 37). However, the anthropological features of these images are clearly of non-Chinese origin (Stafutti, Romagnoli, 2015: 37).

It is equally important that three-dimensional masks on the sockets of spearheads from the Sedelnikovsky District show clear parallels to anthropomorphic images on the pottery from the Samus-4 settlement in the Tomsk stretch of the Ob (Esin, 2009: 11, fig. 28, 29, 34, 39, 59, *8*; 62, *19*). Among their fairly rich varieties, the Samus mask with the triangular central "ray" and protrusions on the cheeks is especially close to the items under discussion (Ibid.: fig. 64, *20*; p. 400, pl. 1, 134). It should be emphasized that this image on the pottery from Samus-4 occurs only once, and can be correlated with the Okunev pictorial tradition (Esin, 2002: 54; 2009: 229). This is important, since the round eyes of masks on the sockets of spearheads from the Sedelnikovsky District show a clear resemblance to the Okunev iconography (Molodin, 2021: 276, fig. 1, 4, 14). This eye shape differs significantly from the almond-shaped eyes on golden masks and anthropomorphic toreutics of Bronze Age China (Deng Yiuke, 2007: 37; Stafutti, Romagnoli, 2015: 16, 36, 37). In addition to the pottery, images of the three-rayed headdress appear on stone sculptures (at the pass of the watershed of the Tyoya and Tashtyp Rivers, and on the bank of the Baza River) (Novozhenov, 2012: Fig. 87, *2*; Bogdanov, 2022: Fig. 8, *9*).

Currently, the three regions in southwestern Siberia (Yenisei region, Ob region, and Middle Irtysh region) where images with various headdresses have been found can be distinguished on the basis of the anthropomorphic imagery of the pre-Andronovo period of the Bronze Age (Molodin, 2021: 278, 279). In this form, masks on the sockets of spearheads from the Sedelnikovsky District appear as quite rare not only in Middle Irtysh region, but also in Upper Ob region. This fact significantly expands our understanding of specific aspects of the iconography in one of the westernmost areas of anthropomorphic artwork left by the cultures of the Early to Advanced Bronze Age in Western Siberia.

Another distinctive feature of Janus-like masks on the sockets of spearheads from the Sedelnikovsky District is the presence of one (Fig. 4, *4–6*) or two (Fig. 4, *1–3*) transverse bands in the center. These bands do not cross the line of the back of the nose, while on ritual wooden masks from Xiaohe (Northern China) and Okunev stone steles in Khakassia (Molodin, 2022: 135, fig. 1, *1*, *2*, *4*, *6*; Bogdanov, 2022: 52, fig. 6, 7) they pass through the entire face. Therefore, the Janus-like masks on the sockets of spearheads from the Sedelnikovsky District reveal some individuality in rendering this Okunev tradition, which may have been due to the geographical remoteness of the Middle Irtysh region and indirect contacts with that culture. In this regard, we should also mention the hypothesis as to the signs of migration of a small group of the Okunev population demonstrated by the ornamental ceramic tradition at Samus-4 in the Upper Ob region (Esin, 2002: 54).

Noteworthy are the expressed nasolabial folds in relief on the masks on the sockets of spearheads from the Sedelnikovsky District. In real life, these appear on human faces for a number of reasons, including age-related changes, active facial expressions, and exposure to hot climate. The nasolabial folds are also very explicit in the three-dimensional anthropomorphic imagery from Samus-4 (Molodin, 2021: 276, fig. 1, *14*).

Similarities in a number of details of the artistic imagery make it possible to correlate the masks on the sockets of spearheads from the Sedelnikovsky District, as well as their Samus and Okunev parallels, with a particular pictorial tradition (Marshak, 1971: 16, 17).

Conclusions

The proportions of the Seima-Turbino split-tailed spearheads, which were recently discovered in the Omsk Region, cannot always be a decisive argument in establishing their cultural affiliation. For example, if we consider the ratio of the blade's length and the socket's length (from the mouth to the base of the blade) in the Seima-Turbino split-tailed spearheads of 2 : 1 to be some standard value (Mikhailov, 2022: 554), then the above-mentioned items from the Omsk Region do not look standard at all. This parameter is 1.47 : 1 in the spearheads from the vicinity of Omsk, 1.6 : 1; 1.64 : 1, and 1.7 : 1 in the spearheads from Okunevo, and 2 : 1 and 1.9 : 1 in the spearheads from the Sedelnikovsky District. However, if we use indices (D2/D1 × 100, where D1 is the length of the spearhead and D2 is the length of the blade) as distinctive features of the Seima-Turbino items (Bochkarev, 2010: 130), the results will be completely different: 59, 62, 65, 67, 73, and 75, respectively. The Turbino spearheads have predominantly long blades (indices 65–70–75), while Seima spearheads have mostly medium-sized blades (indices 55–60–65). Moreover, no items with the lowest indices (51–55) have been found among the Turbino spearheads, and no items with extremely high indices (71–75) have been found among the Seima spearheads (Ibid.: 131, fig. 7). Judging by these parameters, the spearheads from the Omsk Region are similar to the Turbino spearheads. In addition, the reinforcement ribs in the split-tailed spearheads from the Shcherbakulsky, Muromtsevsky, and Sedelnikovsky districts do not extend beyond the blade shafts, which was also typical of the Turbino spearheads (Bochkarev, 2004: 394).

The absolute chronology of both Seima-Turbino bronzes and specific varieties of split-tailed spearheads (KD-10 type), even obtained by scientific methods (radiocarbon and dendrochronological dating), is still debatable (Grigoriev, 2021: 5). For example, burials 8 and 34, and the hoard near burial 24 at Rostovka, containing split-tailed spearheads with hooks (KD-10 type), were dated to the 22nd–20th and 22nd/21st–18th centuries BC on the basis of skeletal remains (Marchenko et al., 2017: 289, fig. 2). The general chronology of the entire necropolis was established in the range of 23rd–19th centuries BC, while the probable interval of the Seima-Turbino transcultural phenomenon was the 18th century to 1600/1550 BC (Grigoriev, 2021: 5). The split-tailed spearheads, recently discovered in the Omsk Region, obviously belong to different periods and show a number of unique features. The main feature is the presence of Janus-like anthropomorphic masks with ray-like headdresses on the sockets of the spearheads from the Sedelnikovsky District, since such images have never occurred in the decoration of the Seima-Turbino spearheads. The Sedelnikovsky spearheads may well be the westernmost manifestation of such an artistic phenomenon. The anthropomorphic images on the sockets of the spearheads from the Sedelnikovsky District obviously fit the trend of both cross-cultural interaction in the Bronze Age and adaptation to the local conditions (Molodin, 2020: 51). The presence of the Samus-Okunev "artistic" hybrid on these items clearly reflects the contemporaneity of the Okunev and Seima-Turbino metalworking traditions (Chernykh, Kuzminykh, 1989: 248).

The effect of the Seima-Turbino phenomenon on the production of spears can be observed until the Late Bronze Age. Among other features, this is manifested in the preservation of eyelets at the base of the spearhead socket both in Eastern Europe (Chernichenko, 2016: 113) and Western Siberia. This feature is present in the items from the south of the Omsk Region (Shcherbakulsky District). Southwestern Siberia belongs to the Eurasian regions, where the effect of the Seima-Turbino tradition persisted for quite a long time. This territory was among the centers of rapid distribution of items belonging to the Seima-Turbino bronze casting complex (Chernykh, Kuzminykh, 1989: 31, 247; Chernichenko, 2016: 117). Moreover, the Middle Irtysh region is distinguished not only by its saturation with Seima-Turbino bronzes (Chernykh, Kuzminykh, 1989: 31), but also by their adaptation to the local environment, including the emergence of special varieties of items (Kuzminykh, 2011; Molodin et al., 2018; Molodin, 2020: 50).

The density of the spatial distribution of such finds in the meridional direction makes it possible to trace the cultural and landscape boundaries in the Late Bronze Age, as well as main directions in the movement of ancient populations, which used natural corridors as routes of communication. The Irtysh and its tributaries played a crucial role in the distribution and adaptation of the Seima-Turbino bronzes in Western Siberia (Molodin et al., 2018: 56).

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D.A. Artemyev[1], M.N. Ankushev[1], I.S. Stepanov[1], N.B. Vinogradov[2], I.P. Alaeva[2], P.S. Ankusheva[1, 2], L.N. Koryakova[3], and A.M. Naumov[4]

[1]South Ural Federal Scientific Center of Mineralogy and Geoecology, Ural Branch, Russian Academy of Sciences, Ilmensky Reserve, Miass, 456317, Russia
E-mail: artemyev@mineralogy.ru; ankushev_maksim@mail.ru; ivanstep208@yandex.ru; polenke@yandex.ru
[2]South Ural State Humanitarian and Pedagogical University, Pr. Lenina 69, Chelyabinsk, 454080, Russia
E-mail: vinogradov_n@mail.ru; alaevaira@mail.ru
[3]Institute of History and Archaeology, Ural Branch, Russian Academy of Sciences, S. Kovalevskoi 16, Yekaterinburg, 620108, Russia
E-mail: lunikkor@mail.ru
[4]MPI Ozersk City District "City Museum", Pr. Pobedy 2, Ozersk, 456780, Russia
E-mail: anton_naumov_74@mail.ru

The Geochemistry of Unalloyed Copper Metallurgical Group Indicates Copper Ore Sources in the Late Bronze and Early Iron Ages of the Urals

Trace elements in copper artifacts from Late Bronze and Early Iron Age sites in the Urals, formerly attributed to the metallurgical group of "chemically pure" copper, were analyzed using the method of laser ablation inductively coupled plasma mass spectrometry. The metal of which artifacts included in this group are made reveals geochemical markers suggesting that "pure" copper actually falls into several subgroups. The PCA analysis of the results identifies 11 clusters corresponding to various sources of copper ores and their mixtures. At least seven principal associations can be linked to copper deposits of different geological types and origin: Au-Te-Bi, Au-Se-Te-Sb, Fe-Co-Ni-As-Sb, Fe-Co-Ni -Zn, Se-Co-Fe, Ag-Pb-Ni, and Sb-Pb-Zn-As. Also, several mixed associations reflect the fusion of copper items and metal scrap initially obtained from different sources: Sn-Pb, Fe-Co-Ni-Zn + Sn, Fe-Co-Ni + Au-Te-Bi-Ag, Fe-Co-Ni + Au-Te-Bi + Sn. A separate association, for which the ore source remains unknown, consists of artifacts characterized by a low content of trace elements, jointly making up less than 0.01 wt%. The largest sample in the Late Bronze Age "pure copper" group falls within the Sn-Pb cluster representing a mixture of local copper and imported Sn-containing copper scrap. Judging by trace elements, the main sources of ore in the "pure copper" group of the Itkul and Sarmatian cultures were the Gumeshki mine and another unidentified source. Both could have been used already in the Final Bronze Age.

Keywords: *Copper geochemistry, trace elements, deposits, metallurgical group, Urals, Late Bronze Age, Early Iron Age.*

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Introduction

The chemical composition of copper items has been a subject of active research in world archaeometry for over sixty years. The first essential studies in Russia were carried out by E.N. Chernykh (1966, 1970) and were subsequently continued by other scholars (Chernykh, Kuzminykh, 1989; Degtyareva, Kuzminykh, 2003; Degtyareva, 2010; and others). The fundamental work by E.N. Chernykh (1970) summarized the results of many years of research on chemical composition of metal, slag, and ores in the Urals. He was the first scholar who did a comprehensive study of metallurgy of the Bronze Age metal-bearing cultures and established the main metallurgical groups typical of this region, such as "pure" copper, tin bronze, and arsenic-antimony bronze. Since then, the division into metallurgical groups which can be easily identified by various methods of chemical analysis has been widely followed in Russian archaeological and archaeometric studies. To distinguish the sources of copper raw materials, a dozen of chemical groups of copper (cuprous sandstones, Tashkazgan, Elenovka-Ush-Katta, Volga-Kama, Volga-Ural, Sosnovo-Mazinsk, Altyn-Tyubinsk, Seima-Turbino, etc.) were proposed and compared with various communities and habitation areas.

Such classification of chemical groups based on the distribution of specific elements is still widely used in Russian archaeology. The "pure copper" group in the Bronze Age is often correlated with cuprous sandstones of the Cis-Urals (Kargaly, 2007: 94), and in the Early Iron Age, with the Gumeshki mine (Beltikova, 2005). Although arsenic copper of the Trans-Urals is often correlated with the Tashkazgan group (Chernykh, Kuzminykh, 1989: 172), this ignores similar high-arsenic deposits whose use during the Bronze Age is confirmed by radiocarbon dating (Ankusheva et al., 2022). The tables indicating the chemical composition of copper and bronze artifacts provided in the studies in most cases are not interpreted in any way or are considered subjectively, without their correlation with the known sources and mines.

The above classification of the chemical groups of copper is often insufficient to accurately identify sources of copper raw materials, and its implementation is complicated by a number of factors:

1. The content of trace elements in copper depends on the type of the ore. Pure carbonate (azurite-malachite), carbonate-silicate (+chrysocolla and relicts of host rocks), or sulfide (chalcocite-covellite) ores from the secondary enrichment zones and their mixtures even from the same deposit at different operational sections may give different concentrations of impurities in copper alloys.

2. In a case of similar genesis and ore formation of deposits, their geochemical features are difficult to distinguish without additional (e.g., isotopic) analysis methods.

3. Technological features of copper smelting, such as alloying and flux addition, greatly distort the original geochemical picture of ore sources by introduction or depletion of some elements.

4. Refining copper, its remelting, mixing scrap copper from various sources, or using sophisticated furnace charge ultimately complicate the identification of original sources of copper raw materials.

When analyzing metal composition of ancient artifacts, little attention is usually paid to the metallurgical group of "pure" copper, although it occurs in all archaeological cultures of Eurasia, and in some places predominates. In most cases, "pure" copper was also smelted in primary ore-processing, which is important for analyzing the products of ancient metallurgy (slag, primary ingots, etc.). In archaeometallurgical studies, "pure" copper is often referenced as metal with small amount of trace elements which, in most cases, are difficult to determine because of the limited resolution of instruments for non-destructive analysis (X-ray fluorescence, microprobe, etc.). High-precision destructive methods (spectral, mass spectrometry, etc.) have the advantage of determining significantly lower concentrations, which is important to identify the sources of copper ore, as well as correlations and markers of mixing ores or metal from several sources.

This study is intended to establish indicator associations of trace elements in the "pure copper" group, which mark a specific source of copper ore in the Urals. This enables the division of copper artifacts from the Late Bronze Age and Early Iron Age into geochemical groups reflecting the use of ore from various geological and genetic types of deposits. The novelty of this work is a new method for identifying copper sources and determining the level of mixing copper alloys during the secondary melting of copper scrap, which has been proposed for the first time in the Russian archaeometric research.

Materials and methods

This study analyzed copper items, ingots, splashes, and drops from various sites of the Bronze Age (2nd millennium BC) and Early Iron Age (1st millennium BC), associated with the Sintashta, Petrovka, Alakul, Srubnaya, Cherkaskul-Mezhovo, Fedorovka, Sargara-Alekseevka, Itkul, and Sarmatian cultures (Fig. 1; see *Table*). The "pure copper" group included copper artifacts that contained <0.5 wt% impurities of As, Sn, and Fe, suggesting that the alloying components must have not been intentionally added. The final sample included 117 specimens.

The samples were prepared by selecting small fragments (up to 1–3 mm) through drilling or sawing off, which were then placed in epoxy resin blocks and polished with diamond pastes. To establish geochemical features of trace elements in copper artifacts, laser ablation inductively coupled plasma mass spectrometry was used. All measurements were taken using an ultraviolet Nd:YAG laser (213 nm; flux density of 4.0–5.5 J/cm^2; frequency of 10 Hz). He was used as carrier gas in the cell with flow rate of 0.6–0.7l /min. Ar with flow rate of 0.9–0.95 l/min was the carrier gas in the mass spectrometer.

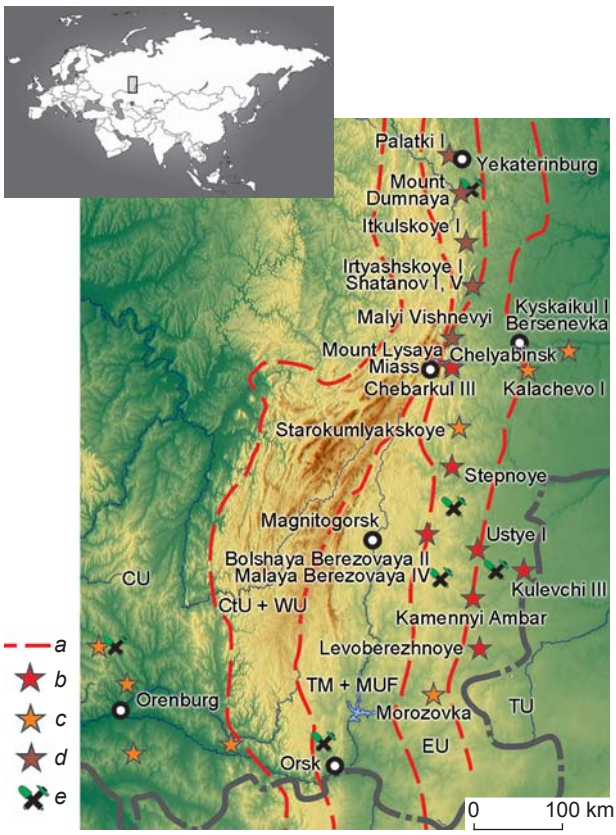

Fig. 1. Referential sites of the Bronze Age and Early Iron Age of the Urals with the examined artifacts.
a – boundaries of the main geological structures in the Urals: CU – Cis-Urals, CtU+WU – Central Uralian and West Uralian megazones, TM+MUF – Tagil-Magnitogorsk megazone and the Main Uralian Fault, EU – East Uralian megazone, TU – Trans-Urals; *b* – settlements of the Late Bronze Age; *c* – locations of artifacts of the Late Bronze Age; *d* – settlements of the Early Iron Age; *e* – known ancient mines of the Bronze Age and Early Iron Age.

The samples were analyzed using the linear mode (laser beam diameter of 100 μm, line length of 600 μm, and beam speed of 10 μm/s), and in the point mode (with diameter of 100 μm), for small-sized samples. The mass spectrometer was calibrated with reference international standard samples NIST SRM-610 and SRM-612. The amount of molecular oxide ions ($^{232}Th^{16}O/^{232}Th$) did not exceed 0.4 %. The $^{238}U/^{232}Th$ ratio was close to 1:1. The chemical analysis was calculated using the Iolite software package (Paton et al., 2011) following standard approaches (Longerich, Jackson, Günther, 1996), and Cu^{65} as an internal standard normalized to 100 % of the total number of components. Elemental contents were calibrated using the NIST SRM-610 and NIST SRM-500 (unalloyed copper) reference materials. The calibration standard was analyzed every 10–18 points to account for instrumental laser and mass spectrometer drift. Upon spectra processing, the elements were identified, and the contents of ^{57}Fe, ^{59}Co, ^{60}Ni, ^{65}Cu, ^{66}Zn, ^{75}As, ^{77}Se, ^{107}Ag, ^{118}Sn, ^{121}Sb, ^{125}Te, ^{197}Au, ^{208}Pb, and ^{209}Bi were calculated using NIST SRM-500 as an external standard sample. Measured concentrations of ^{118}Sn and ^{197}Au in copper are "representative", since they are not certified according to NIST SRM-500. Further, they were calculated according to NIST SRM-610.

The SAS JMP Pro software package was used for statistical processing of the final results of determining the contents of trace elements, which involved the principal component method and the factor analysis. The content of the selected 13 trace elements in copper (Fe, Co, Ni, Zn, As, Se, Ag, Sn, Sb, Te, Au, Pb, and Bi) was normalized using the logarithmic transformation of J. Aitchison (1982), making it possible to group the data that differ by several orders of magnitude. All of these elements except Fe can be used to establish the origin of metal, since they pass from ore to metal without significant decrease in concentration (Pernicka, 2014: Table 11.1). However, note that elements such as Zn, As, and Sb undergo sublimation, and their contents would decrease when copper is remelted.

Sample of artifacts made of "pure" copper from various sites of the Bronze Age and Early Iron Age in the Urals

Site / place of discovery	Period	Archaeological culture	*n*	m
Ustye I	LBA	S, P	38	25
Kulevchi III	LBA	P, A	23	20
Chebarkul III	LBA–FBA	A, ChM	12	8
Kamennyi Ambar	LBA–FBA	S, P, Sr, A, ChM	5	5
Malaya Berezovaya IV	LBA–FBA	A, ChM, SA	5	2
Bolshaya Berezovaya II	LBA–FBA	A, F, ChM, SA	4	1
Kyskaikul	LBA	A	3	2
Starokumlyakskoye	FBA	ChM	3	3
Kalachevo I	FBA	ChM	1	1
Morozovka, a.f.	FBA	ChM	1	1
Priuralye, a.f. (ingots)	LBA	Sr, A	10	10
Irtyashskoye I	EIA	I	8	8
Mount Lysaya	EIA	I	7	7
Mount Dumnaya	EIA	I	6	6
Itkulskoye I	EIA	I	4	4
Shatanov V	EIA	I	2	2
Shatanov I	EIA	I	3	1
Malyi Vishnevyi	EIA	I	1	1
Petrogrom	EIA	I	1	1
Priuralye, a.f.	EIA	Sm	12	9

Notes: *n* – number of examined artifacts, *m* – number of artifacts made of "pure" copper. LBA – Late Bronze Age, FBA – Final Bronze Age, EIA – Early Iron Age; a.f. – accidental finds.

S – Sintashta, P – Petrovka, A – Alakul, ChM – Cherkaskul-Mezhovo, Sr – Srubnaya, SA – Sargara-Alekseevka, F – Fedorovka, I – Itkul, Sm – Sarmatian.

Results and discussion

Trace elements in copper. Even the "chemically pure" copper sometimes contains various impurity elements in significant quantities, which may indicate the sources of ore, alloying impurities, fluxes, as well as smelting methods and techniques. Some of them dissolve in copper melt, integrating into the copper structure; others (e.g., Sn, As, and Pb) at high contents may form their own mineral phases and phases with copper. Some elements (Bi, S, Se, and Te) occur in copper as microinclusions of their own mineral phases, and this may lead to their increased concentrations if bulk methods of analyzing the chemical composition are applied.

Elements completely soluble in copper include Ni, Au, Rh, Pt, Pd, and Mn, which form a continuous series of solid solutions with copper due to a similar crystal structure (Drits, Bochvar, Guzei, 1979: 5). Highly soluble elements (limited solubility in copper, atomic % is indicated in parentheses) include Zn (38.3), Ga (20.3), Al (19.7), Co (13), Ge (11.4), In (10.9), Ti (9.6), Sn (9.1), Ir (8), As (6.8), Sb (5.8), Hg (5), Ag (4.9), P (3.4), Fe (2.94), and Cd (2.1) (Diagrammy…, 1996: Vol. 1, p. 37, 135, 265, 837; 1997; vol. 2, p. 15, 240, 243, 249, 256, 259, 263, 287, 306, 323, 337, 352). Slightly soluble elements include Cr (0.89), V (0.8), Tl (0.27), Pb (0.09), O (0.036), S (0.017), Se (0.009), Bi (0.006), and Te (0.004). Mo, Os, Re, Ru, and C have negligible solubility in copper (Ibid., 1996: Vol. 1, p. 636, 713; 1997; vol. 2, p. 112, 275, 285, 287, 288, 299, 301, 311, 331, 341, 345). Most of the elements of the latter two groups most often appear in copper alloys as their own mineral microinclusions, which can be determined by optical and scanning electron microscopy. For example, high oxygen concentration will be associated with oxide phases (cuprite, tenorite); S, Se, Te, with sulfides (chalcocite, covellite); Bi, with bismuthine or native forms;

Pb, with its own immiscible phase. The content of the lithophile elements in the copper alloy, which are almost insoluble in copper, is negligible and may result from the capture of slag silicate phases by the metal. The majority of impurity elements are often present in ancient copper in significantly smaller quantities than those that could be dissolved (In, Ga, Co, Cd, etc.), which is associated with the composition of ores and weakly reducing conditions of the metallurgical process.

The division of elements into groups that reflect the sources of copper or are associated with metallurgical processing technologies is another important issue. E. Pernicka (1999) included Au, Ag, Bi, Ir, Ni, Os, Pd, Pt, Rh, and Ru into the former group, and combined Al, B, Be, Ca, Cr, Cs, Fe, Ga, Ge, Hf, K, Li, Mg, Mn, Mo, Na, Nb, P, Rb, S, Sc, Si, Sr, Ta, Ti, Th, U, V, W, Y, Zr, and rare earth elements, which most often enter silicate slag during processing of copper ore, into the latter group. A number of elements, such as As, Cd, Co, In, Hg, Re, Sb, Se, Te, Tl, as well as Sn, Zn, and Pb at low contents, may reflect both source and technologies. However, in our opinion, in the type of analysis used, poorly soluble Os, Rh, Ru, and Re should be excluded from marker elements. Conversely, Ba, typical of cuprous sandstones of the Urals (Artemyev, Ankushev, 2019), Ga and Ge as possible rare impurities in sulfide ores, U appearing in metal from the Caucasus (Ryndina, Ravich, 2012), as well as Se and Te as important markers in oxidation zones of many copper deposits, should be added to marker elements. A special role is played by the buffer elements S and Fe. On the one hand, they reflect the technological aspect of copper processing, e.g. stages, temperatures, and redox conditions; on the other hand, they indicate the use of different types of ores, such as oxide-carbonate, sulfide chalcocine, or chalcopyrite varieties.

Fe, Co, Ni, Zn, As, Se, Ag, Sn, Sb, Te, Au, Pb, and Bi were selected as indicator elements for the metal of the Urals. Zn, which is contained in "pure" copper of ancient artifacts from the Urals in small quantities, as well as Os, Hg, and Cd absent from it, are not typical of local copper ores. They demonstrate high volatility in the metallurgical process resulting in negligible quantities, and may not reflect the geochemical type of the deposit used. The contents of rare earth elements, platinum group metals, as well as U, Mn, Tl, Cr, Mo, Ge, Ti, and V, in most of the studied samples were below the detection boundary.

Principal component analysis and sources of "pure" copper

Analysis of chemical composition of artifacts made of "pure" copper using the principal component method has shown a distribution into several main groups, often intersecting along one component, but separated along others (Fig. 2).

Unmixed groups. Au-Te-Bi. Three artifacts from the Bronze Age sites of the Trans-Urals belong to one of the main groups of "pure" copper not "contaminated" with a metal from other geological and genetic sources of ore. The same association, combined with others, occurred in at least four other groups (see below). Thus, together with them, it is the most common variation in the sample. The group is distinguished by low content of Fe (<0.015 wt%) and high content of Bi (up to 0.1 wt%), Au (up to 70 ppm), and Te (up to 40 ppm). In a binary diagram, it can often be distinguished by higher concentrations of Au and Te, and lower concentrations of Fe. The Au-Te-Bi association could have been associated with ores of porphyry-gold deposits of the East Uralian megazone (Seravkin, Minibaeva, Rodicheva, 2011), which contain epithermal vein copper mineralization with bismuthides and gold tellurides.

Fe-Co-Ni-As-Sb. This group, corresponding to metal from a single source, includes three Late Bronze Age artifacts from the Southern Trans-Urals. The probable sources of copper for the Fe-Co-Ni-As-Sb correlation association were copper ore deposits associated with ultrabasites (for example, Ishkininskoye (Geologiya…, 2009: 168)), which still cannot be assigned to a specific geological and genetic type (pyrite, porphyry, or skarn). With a larger sample, it may be possible to identify a specific source more accurately.

Se-Co-Fe. A small group of Late Bronze Age items from the Southern Trans-Urals (5 spec.) shows high concentration of iron (which also correlates with cobalt and nickel) and selenium. High content of Se is a relatively good indicator since it rarely occurs in copper deposits of the Urals. High concentrations of Se in slags (in chalcosine, covellite, and the associated reduced copper) have been found at the fortified settlements of Kamennyi Ambar and Konoplyanka I located near each other on the Karagaily-Ayat River, and at the Sarlybai settlement in Mugodzhar Hills (Artemyev, Ankushev, 2019; Ankushev et al., 2021). The probable source of copper for the artifacts of this

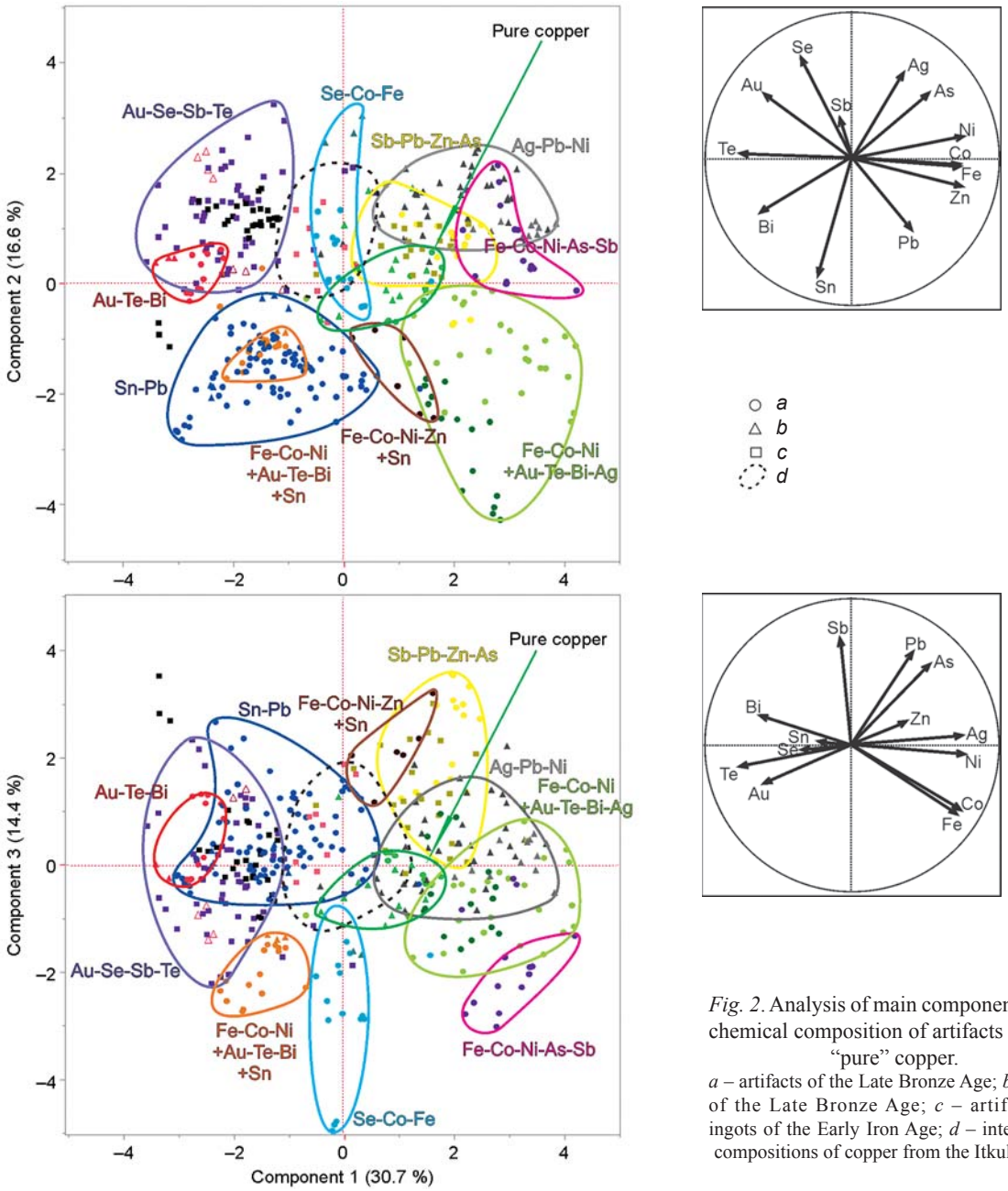

Fig. 2. Analysis of main components in the chemical composition of artifacts made of "pure" copper.
a – artifacts of the Late Bronze Age; *b* – ingots of the Late Bronze Age; *c* – artifacts and ingots of the Early Iron Age; *d* – intermediate compositions of copper from the Itkul culture.

group was the zone of secondary sulfide enrichment of the so far unidentified porphyry copper deposit in the volcanogenic strata of the East Uralian megazone. Possible candidates may be the Mikheevskoye porphyry copper deposit located near the fortified settlements or the Novonikolaevskoye copper-skarn deposit with the well-known mine of the Bronze Age (Ankusheva et al., 2022: 7–9).

Au-Se-Sb-Te. The source of copper ore—the Gumeshki copper-skarn deposit, which was actively mined in the Early Iron Age—has been reliably established for this correlation association (metal from the Itkul and Sarmatian cultures, and two ingots from Kamennyi Ambar). The metal contains high concentrations of Se and Te. This association occurs in slags and in copper artifacts from the sites of the Itkul culture, such as settlements on Mount Dumnaya (near the Gumeshki mine), Itkulsky I, Palatki I, and settlements on Lake Irtyash (Irtyashskoye I and Shatanov I). Two ingots from the settlement of Kamennyi Ambar and slags of the Mezhovo-Cherkaskul period at Levoberezhny (unpublished data) may testify to the earlier use of such metal in the Bronze Age.

This group also includes the majority of the accidentally discovered Sarmatian artifacts, which are kept in the Chesma Museum of Local History (Alaeva et al., 2023). This confirms the previous suggestion about the main role of the Itkul metallurgy in supplying the nomadic societies of the Southern Urals (Tairov, 2019: 198).

Ag-Pb-Ni. This reliably established association is typical of the copper ingots of the Urals (10 spec.), which were most often smelted from carbonate-sulfide nodules of cuprous sandstones, widespread in the Orenburg Region (Lurie, 1988: 29; Artemyev, Ankushev, 2019). Copper is characterized by significant purity; only S, Ag, and Pb are present in high concentrations, which is caused by numerous drops of sulfides with microinclusions of native silver and galena. The content of other trace elements is insignificant.

Sb-Pb-Zn-As. This correlation association may be related to stratiform deposits in sedimentary and volcanogenic-sedimentary strata. Artifacts with this association (3 spec.) were found at steppe and forest-steppe sites of the Late Bronze Age, and in the southern area of the Itkul culture. The source of copper ore has not been reliably established, but it could have been the Kolpakovskoye deposit, which has copper, polymetallic, and brown-iron ore occurrences in the Transuralian megazone (Snachev V.I., Snachev A.V., 2018). According to I.A. Talitskaya, numerous "Chud mines" were known in the valley of the Bagaryak River (1953: 291–294). These mines can be correlated with these ore occurrences. As opposed to stratiform deposits of the Urals, the metal is distinguished by low concentrations of Ag and higher concentrations of Pb, Zn, and Sb.

Mixed groups are represented by alloys obtained from smelting the copper of various origins or using the ore from several sources.

Sn-Pb. This is the largest group of the examined artifacts made of "pure" copper (23 spec.). These items are typical of the Bronze Age sites in the Southern Urals, belonging to the Petrovka, Alakul, Cherkaskul, and Mezhovo cultures, such as Kulevchi III (8 spec.), Ustye I (6 spec.), Starokumlyakskoye (3 spec.), Chebarkul III (2 spec.), Bolshaya Berezovaya (1 spec.), Malaya Berezovaya (2 spec.), and Kalachevo I (1 spec.). Copper shows the increased content of Sn and Pb (from 0.01 to 0.3 wt%) and their mutual correlation, which may reflect unintentional mixing of scrap of tin bronzes and copper while remelting metal items. Tin content is quite high for all known Uralian copper ores (in the metal obtained from them and in copper metallurgical slags, it usually does not exceed 10 ppm, and only in isolated cases, 50–80 ppm), but not enough to significantly affect the physical and mechanical properties of the finished metal and to indicate deliberate introduction of a tin-containing component.

The principal components of chemical composition of items in this group were analyzed, except for Sn and Pb, which had the greatest impact on clustering. As a result, four subgroups were identified. Three of them have parallels in copper items of other groups (Fig. 3). The Au-Te-Bi association, as mentioned above, corresponds to copper ores of epithermal porphyry-gold deposits of the East Uralian megazone. The Au-Ni-Co-As association is typical of orogenic gold deposits in ultrabasites of numerous suture zones of the Southern Urals, with the largest being the Main Uralian Fault zone. The Fe-As-Co-Ni association is related to the previous one, but differs by the absence of gold and increased iron content. It may reflect the use of ores from copper-iron-skarn deposits in ultrabasites, where magnetite concentrations are always high. The Fe-Zn-Ag association is not typical of copper ores of the Urals. It reflects the geochemical markers associated with admixture of tin bronzes imported from other regions (the Altai or Central Kazakhstan) (Berdenov, 2008).

Fe-Co-Ni-Zn + Sn. This group (two items from the Kulevchi III settlement) is distinguished by a mixture of copper associated with oxidation zone of copper pyrite deposits, with a small amount of tin-containing alloys. The presence of zinc may indicate the volcanogenic-sedimentary genesis of copper ores. The fact that the relative amount of zinc is higher than its content in the majority of other artifacts reveals that metal was not remelted too often, since zinc actively sublimes during the process. Copper pyrite deposits widely appear in the Urals structures. The best known Bronze Age mine in basaltoids was described at the Bakr-Uzyak deposit (Chernykh, 1970: 40).

Fe-Co-Ni + Au-Te-Bi + Sn. This group includes artifacts from the settlements of Chebarkul III (3 spec.) and Ustye I (3 spec.). Because of high tin content, their chemical compositions are similar to the Sn-Pb group, although include additional correlation associations (Fe-Co-Ni and Au-Te-Bi). The intersection of Fe-Co-Ni and Au-Te-Bi associations may indicate mixing of the metal from at least three sources associated with copper-skarn and porphyry-gold-copper deposits. This metal shows high Fe content (up to 0.9 wt%).

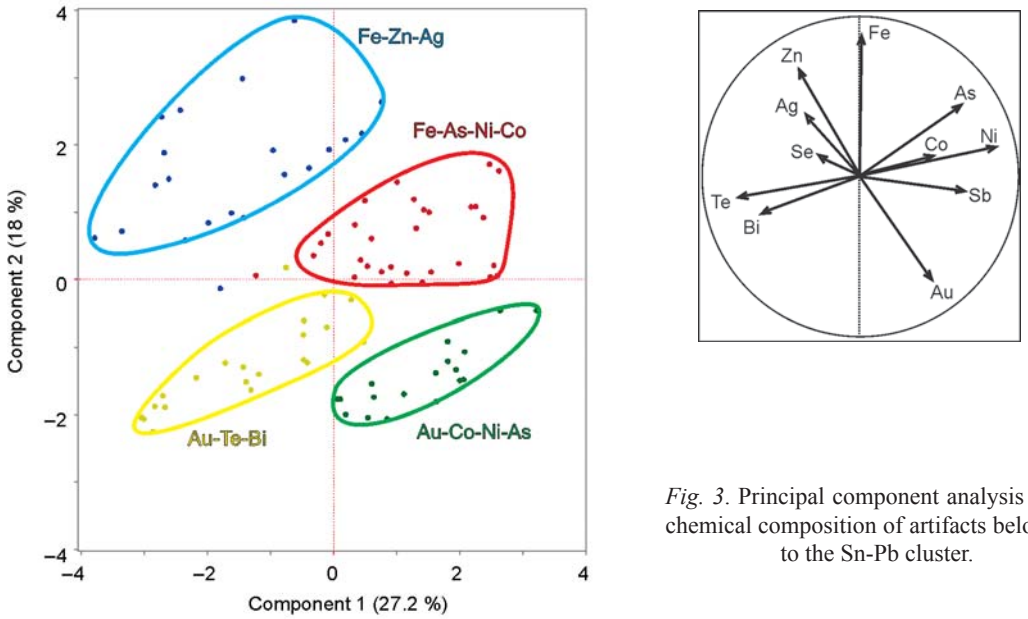

Fig. 3. Principal component analysis of the chemical composition of artifacts belonging to the Sn-Pb cluster.

Fe-Co-Ni + Au-Te-Bi-Ag. In terms of correlation series, this group is similar to the previous one. It includes 12 items from the settlements of Kulevchi III (2 spec.) and Ustye I (10 spec.). In the latter case, a large number of artifacts of this group at a single site with well-developed metal production (Drevneye Ustye…, 2013) shows the proximity of the copper ore sources that have such correlation series. As mentioned above, one of them may be associated with numerous porphyry-gold-copper epithermal deposits in volcanites and ultrabasites (beresite-listvenite formation).

Pure copper. The metal of this group has a relatively high purity as compared to the entire studied sample. The contents of trace elements do not exceed 0.01 wt%, while those of microtrace elements (Co, Zn, Sb, Se, Te, Au, Bi) do not exceed 0.001 wt%. This group includes ingots and artifacts from Late Bronze Age settlements in the steppe Trans-Urals (7 spec.). The copper purity most likely resulted from the use of sorted carbonate (azurite-malachite) ores, which have a smaller isomorphic capacity with respect to many impurity elements as opposed to silicate and sulfide components of ore charge. Such metal is difficult to correlate with specific ore sources.

Conclusions

Chemical composition of artifacts from the Bronze Age and Early Iron Age sites of the Urals, which belonged to the metallurgical group of "pure" copper, has geochemical markers allowing for the identification of several geological and genetic groups of deposits, i.e. sources of copper ore. We could identify seven main correlation associations: Au-Te-Bi, Fe-Co-Ni-Zn, Fe-Co-Ni-As-Sb, Se-Co-Fe, Au-Se-Te-Sb, Ag-Pb- Ni, and Zn-Pb-Sb-Ni.

Most of the Late Bronze Age artifacts under study contain a mixture of copper from deposits of different types. The largest sample is the Sn-Pb cluster indicating a mixture of local copper alloys and imported tin copper or bronze. Copper smelted from the ores of the Uralian deposits usually contains no more than 0.005 wt% of tin. In a number of the examined copper artifacts, it is higher, but still not enough to change the physical properties of the resulting metal (0.01–0.5 wt%), meaning that tin was not intentionally added. This likely reflects the fusion of copper and bronze scrap when smelting copper from different sources.

The As-Sb-Co-Ni-Au-Te-Bi correlation typical of arsenic bronzes of the Sintashta-Abashevo period is rare in our sample, and may indicate their fusion (in the form of scrap) with the higher-purity copper.

Two main sources of copper ore have been determined using the composition of "pure" copper of the Early Iron Age Itkul culture. One source may be correlated with the Gumeshki deposit, while the other source has not yet been established. The use of Gumeshki ores is also confirmed by inclusions of garnet (andradite) in copper slags discovered on

Mount Dumnaya and at the Itkulskiy I settlement (Stepanov et al., 2023). Chemical composition of the Itkul copper corresponds to that of the metal found among the Sarmatian nomadic communities of the Southern Urals, and finds geochemical parallels in the evidence from the sites of the Late Bronze Age.

We can see the prospects for further studies in expanding the sample accompanied by creation of a database linked to geographical locations of the examined sites and the corresponding copper artifacts, which would make it possible to predict location of sources of copper ore in the deposits of various geological and genetic types more accurately. One of the methodological conclusions is the expected low effectiveness of searching for possible sources of copper ores using lead isotopes, caused by a large share of artifacts made of smelted scrap copper originating from a variety of ore sources, as demonstrated in our study. High lead concentrations particularly severely distort the signal from a copper ore source.

Acknowledgments

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N.N. Seregin, A.A. Tishkin, S.S. Matrenin, T.S. Parshikova, and S.S. Tur
Altai State University,
Pr. Lenina 61, Barnaul, 656049, Russia
E-mail: nikolay-seregin@mail.ru; tishkin210@mail.ru; matrenins@mail.ru; taty-parshikova@yandex.ru; tursvetlana@mail.ru

New Data on Armed Conflicts in the Altai During the Rouran Period: The Choburak I Cemetery

This study focuses on a burial at a Rouran period cemetery, Choburak I, in the Chemalsky District, Republic of Altai, where altogether twelve burials were excavated by an expedition from the Altai State University. In kurgan 34a, a burial of a 30–35-year-old male with a horse was excavated. The burial goods included weapons, items of horse harness, utensils and domestic artifacts. The head of the buried individual had been replaced by the cranium of a ram, and certain postcranial bones revealed multiple injuries inflicted by a cutting weapon. The burial is attributed to the Dàlián tradition, associated with the Bulan-Koba culture. The analysis of the burial goods and a radiocarbon estimate suggest that the burial dates to the middle or second half of the 4th century AD. Injuries testify to armed conflicts, in which males had taken part, and support the belief that violence in the Altai was high during the Rouran period. The case is interpreted as one of decapitation. Given the parallels in adjacent regions, is can be hypothesized that the head of a ram had been used as a basis for a mask. Apparently, this peculiar custom was associated with the ritual in which the missing bodily part was replaced in specific cases of violent death.

Keywords: *Burial, Rouran period, Altai, armed conflicts, injuries, ritual practice.*

Introduction

The intensity of armed conflicts significantly increased after the collapse of the Xianbei state in Central Asia in the second half of the 3rd century AD and the aggravated struggle for military and political leadership in this vast region in the 4th–5th centuries. A reflection of these processes in the Altai is multiple injuries on the bones of the deceased people with no traces of healing (chopped, cut, and puncture wounds, decapitation, scalping, cutting off limbs), which have been observed during excavations at burial sites of the Bulan-Koba culture. Interpretation of evidence of armed violence (Tur, Matrenin, Soenov, 2018; Seregin, Demin et al., 2022; and others), demonstrating the increased level of social tension in the region, shows the importance of further research to specify the nature of the clashes between different groups of the Bulan-Koba population and identify the possible participation of foreign groups therein. It should be recognized that such research, which is of great importance for reconstructing the processes of ethnic and cultural interaction, depends significantly on enrichment of high-quality anthropological evidence. This article presents and analyzes new data on armed conflicts in the Altai during the Rouran period, obtained from the excavations of burial mounds at the Choburak I site. Moreover,

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interpretation of this unusual new evidence requires addressing some aspects of the history of the nomads of that period associated with their specific material and spiritual culture.

Fig. 1. Location of the Choburak I site.

Description of sources

The burial and memorial complex of Choburak I is located south of the village of Yelanda, in the Chemalsky District, Republic of Altai (Fig. 1). A small necropolis, consisting of 12 graves under burial mounds, was fully explored at that site during the works of the expedition from the Altai State University (Seregin, Tishkin et al., 2022). These objects, practically invisible on the modern surface, were compactly located in the northern part of the site next to the earlier burial mounds of the Chalcolithic and Early Scythian period, and not far from the Turkic enclosures. The most unusual among the studied burials, which belonged to the Bulan-Koba archaeological culture, was a burial in kurgan 34a.

This object was the last in a row of four mounds over the burials of males of different ages. A flat stone placement, measuring 4.2 × 3.9 m and reaching 0.4 m high, consisted of fragments of torn stone and pebble boulders. Larger boulders were along its outer contour, forming a suboval crepidoma oriented with its longitudinal axis along NW–SE (Fig. 2, *a*). The grave pit, measuring 4.13 m long and 1.2–1.6 m wide, filled with pebbles and stones of various sizes, was within the boundaries of this stone placement. The walls of the pit narrowed significantly as its depth increased. Accordingly, at the level of the bottom, its length was 3.1 m and width was 0.95–1.13 m.

In the northwestern part of the grave, at a depth of 0.9 m from the ancient level, there was an undisturbed burial of a male 30–35 years of age, placed on his back, with his legs stretched out and his arms slightly bent at the elbows (Fig. 2, *b*). The skull and first five cervical vertebrae were missing. The skull of a young ram (identified by N.A. Plasteeva from the Institute of Plant and Animal Ecology of the SB RAS) was discovered in the place of the head of the deceased. The ram's skull was set on a base and thus imitated a single whole with the postcranial human skeleton (Fig. 3, *a*, *b*). The buried person was accompanied by abundant burial goods. On the left side of the skeleton, there was a composite bow, with the surviving seven horn onlays on the upper (near the shoulder), central (in the projection of the pelvis), and lower (in the thigh area) parts of the wooden core (Fig. 4, *1–7*). A compact cluster of iron arrowheads (at least 10 items) was discovered near the left humerus (Fig. 4, *8–16*, *19*). Some of these were equipped with bone whistles (Fig. 4, *22*). An iron quiver hook was also found there (Fig. 4, *17*). Fragments of two short-bladed iron knives of different sizes (Fig. 4, *20*, *21*), a part of an awl (Fig. 4, *18*), an iron clasp in the form of a twisted 8-shaped link, as well as intact and destroyed iron plates, which might have been the parts of the sheath, were found on the right side during the examination of the pelvic bones. An iron round-bottomed cauldron surviving in large fragments (see Fig. 3, *c*) was in the area of the knee joints.

The buried person was accompanied by the burial of a riding horse, placed on the left side, with strongly bent limbs and oriented with its head to the northwest. The horse skeleton was located "at the feet" of the deceased male and covered almost half of his skeleton (see Fig. 2, *b*). Iron bits (Fig. 5, *1*) were in the horse's jaws, and iron bridle parts were near the skull (Fig. 5, *2–5*, *7*, *9*, *11*). Fragments of horn edging from the cantle were found on the spine (Fig. 5, *8*). An iron item—plate with a loop fastening (Fig. 5, *6*)—lay next to them among the ribs. The horn girth buckle, with the surviving movable prong (Fig. 5, *10*, *12*), was a little lower. A clasp, also made of horn, was found under the horse's pelvic bones (Fig. 5, *13*).

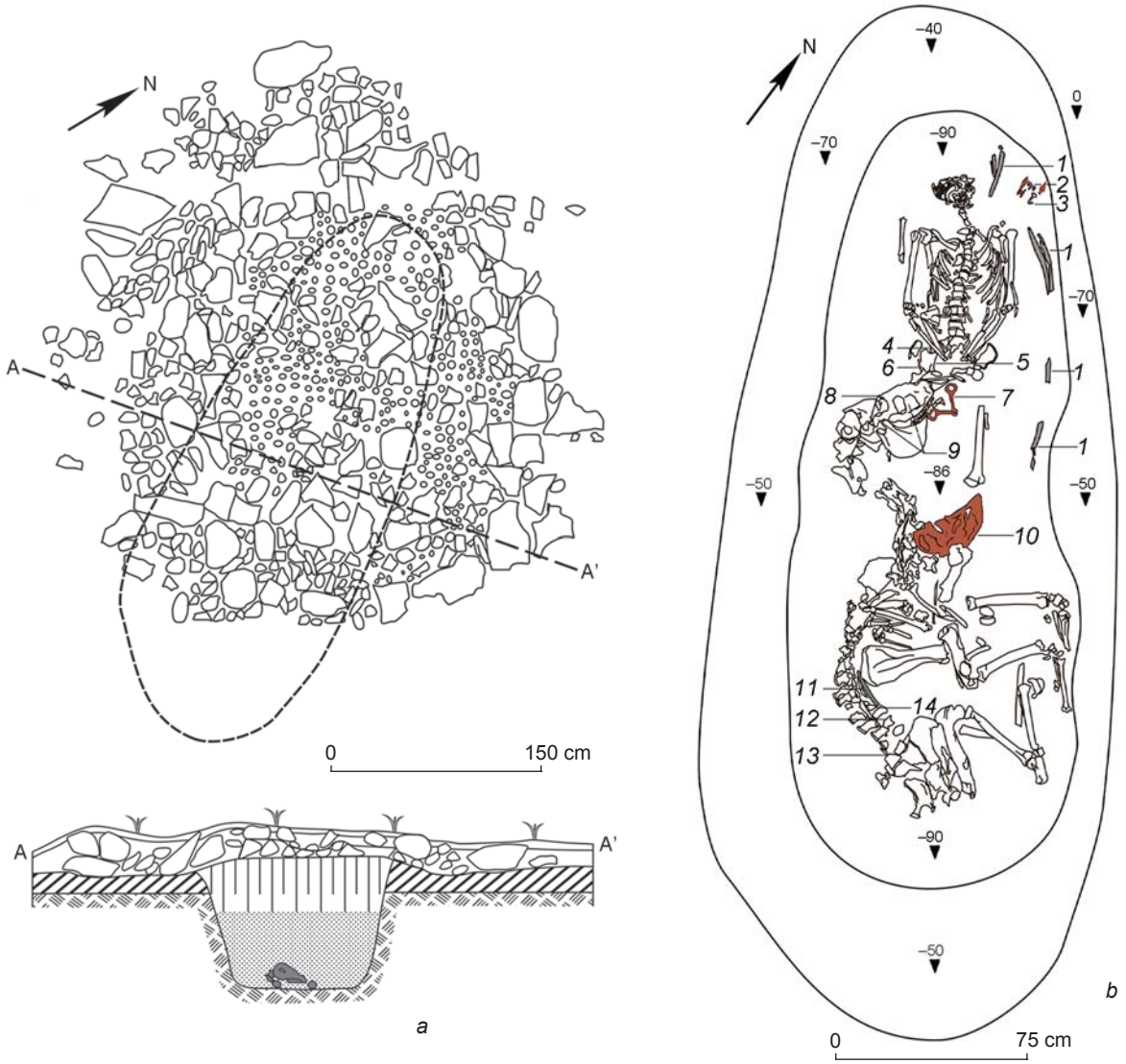

Fig. 2. Kurgan 34a at the Choburak I cemetery.
a – plan view and cross-section of the burial structure; *b* – plan view of the male burial with horse.
1 – bow onlays; *2* – arrowheads; *3* – quiver hook; *4* – short-bladed knives; *5* – belt set; *6* – awl; *7* – bit; *8* – bridle buckle; *9* – bridle elements; *10* – cauldron; *11* – saddle edge; *12* – girth buckle; *13* – clasp; *14* – element of horse harness.

Notably, the same-type cut and chopped traumatic injuries were observed on some bones of the postcranial skeleton (Fig. 6). Three of these were located on the anterior and lateral surfaces of the femurs, two in the upper part of the pubis, and two more on the T10 and T11 vertebral bodies. In all cases, there were no traces of healing. There could have been more traumatic injuries, but because of severe taphonomic destruction of some skeletal elements, especially the ribs and vertebral processes, the possibilities of identifying them were very limited.

Analysis of evidence

Distinctive elements of funerary rite, revealed by excavations of kurgan 34a at Choburak I (location of objects in rows, small mound, suboval crepidoma, shallow grave-pit, individual inhumation on the back, orientation of the deceased to the western sector, the accompanying burial of a horse "on top" of the deceased), make it possible to attribute this burial to the Dàlián funerary tradition of the Bulan-Koba archaeological culture (Seregin, Matrenin, 2016: 161–162).

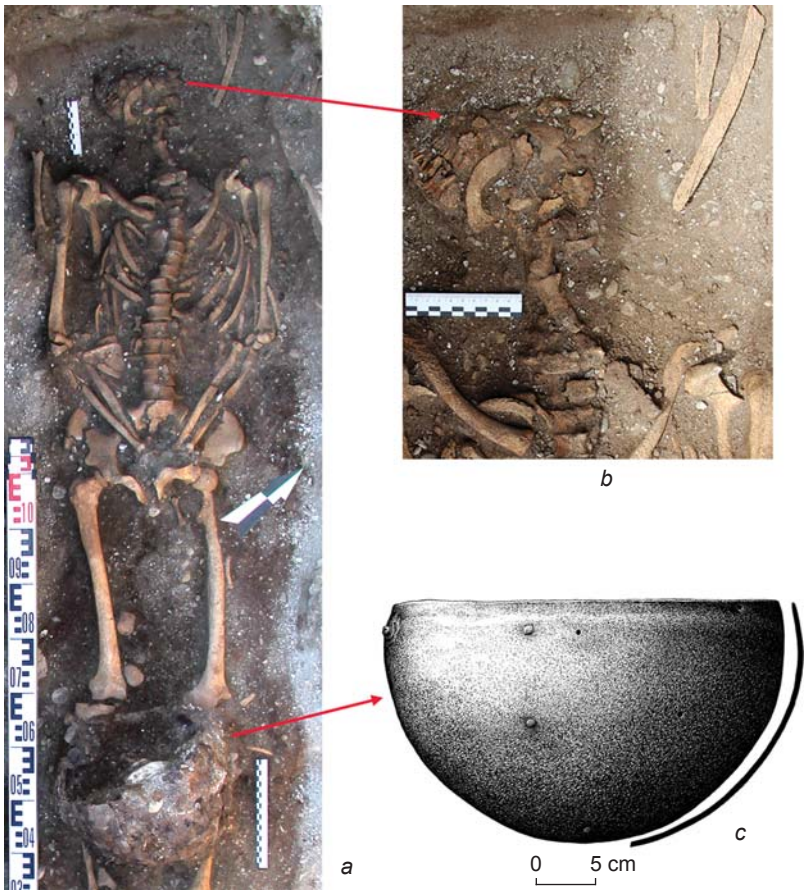

Fig. 3. Burial in kurgan 34a.
a – view of the human burial after studying the accompanying horse burial; *b* – ram's skull combined with the postcranial human skeleton; *c* – reconstruction of the iron cauldron.

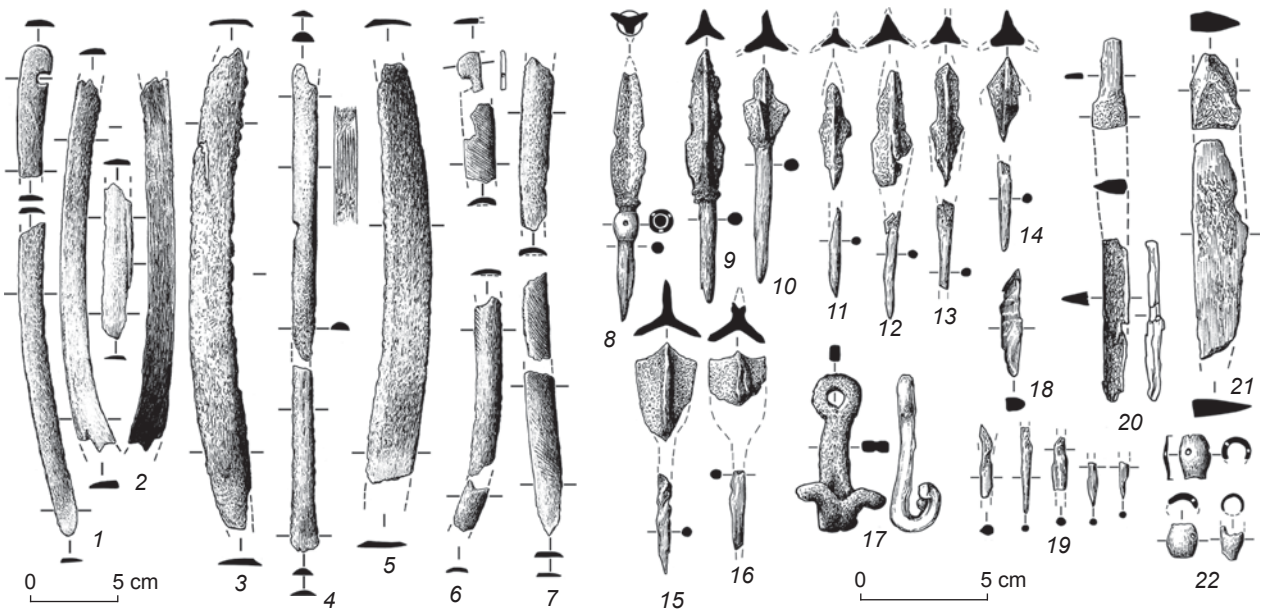

Fig. 4. Weaponry, military equipment, and tools from the burial.
1–7 – bow onlays; *8–16* – arrowheads; *17* – hook-clasp; *18* – awl; *19* – fragments of arrowhead tangs; *20*, *21* – knives; *22* – whistles.
1–7, *22* – bone, horn; *8–21* – iron.

Fig. 5. Riding horse harness from the burial.
1 – bit; *2–5*, *7*, *9*, *11* – bridle elements; *6* – fastening; *8* – saddle edging; *10* – girth buckle; *12* – prong of this buckle; *13* – clasp. *1–7*, *9*, *11* – iron; *8*, *10*, *12*, *13* – bone, horn.

The burial goods consisted of various categories of items (see Fig. 4, *5*), including chronologically informative finds, such as tiered arrowheads of the Southern Siberian tradition (see Fig. 4, *8*, *9*, *12–13*) and a cauldron (see Fig. 3, *c*), which were dated to not earlier than the 3rd century AD; a girth buckle with a movable prong (see Fig. 5, *10*), a quiver hook with a V-shaped transverse bar (see Fig. 4, *17*), and saddle edging (see Fig. 5, *8*), typical of the sites of the 4th to early 6th century AD; bits with 8-shaped loops (see Fig. 5, *1*) and hemispherical bridle plates with pin fastening (see Fig. 5, *7*, *9*), similar to the items dated to the second half of the 4th–5th centuries AD (Kyzlasov, 1969: Fig. 21, *9*; Hudiakov, 1991: Fig. 30, *5*; Raskopki…, 1997: Fig. 17–19, 22–25; Soenov, 1998: Fig. 1; Tishkin, Matrenin, Schmidt, 2018: 49, 52–53, 64, 115–117, pl. 30, *5*, *7*, *9*; and others). A quadrangular arrowhead was quite unusual (see Fig. 4, *16*). It was reminiscent of Early Turkic broadheads of the second half of the

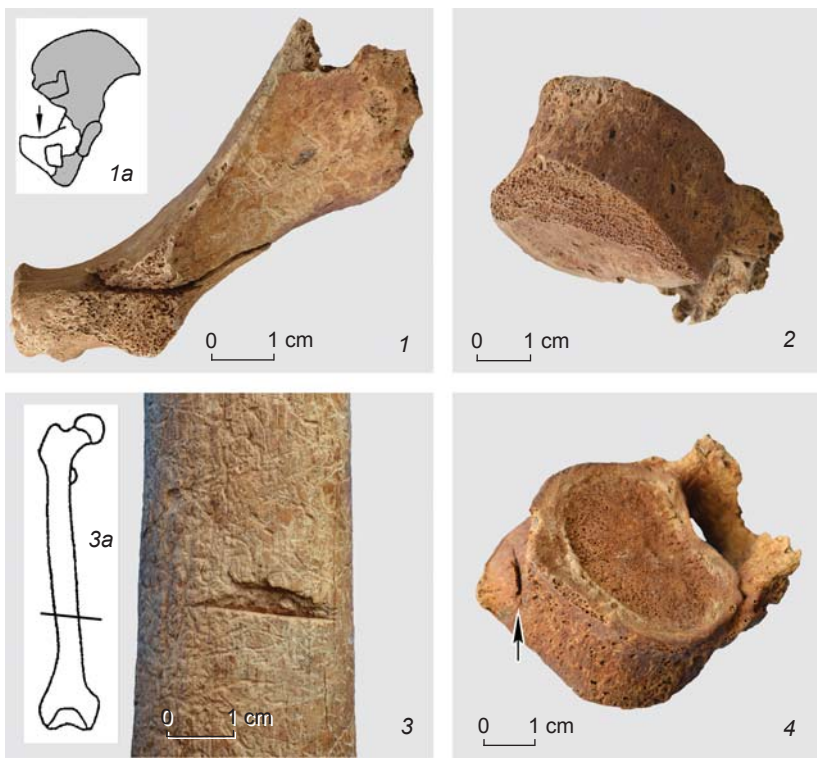

Fig. 6. Traumatic injuries on the bones of the male skeleton.
1 – on the left pubic bone, top view (*1a* – location of the injury, drawing); *2* – on the lower surface of the T10 vertebral body; *3* – on the anterior surface of the right femur (*3a* – location of the injury, drawing); *4* – on the anterior surface of the T11 vertebral body.

Results of radiocarbon dating of the samples

Lab. code	Sample	AMS-date, BP	Calibrated date (2 σ), AD
UBA-40778	Human bone	1681 ± 23	328–415
UBA-40779	Horse bone	1734 ± 25	244–381
UBA-45474	Ram bone	1703 ± 21	257–397

5th to the first half of the 7th century AD (Gorbunov, 2006: 39, fig. 26, *3*, *7*, *8*). The remaining categories of items had a wider period of existence within the 2nd–5th centuries AD. The general appearance of the burial goods allowed us to date kurgan 34a to the mid–second half of the 4th century AD. This conclusion does not contradict the results of the radiocarbon analysis (see *Table*) carried out in the ^{14}CHRONO Center for Climate, the Environment, and Chronology (Belfast, Northern Ireland; analyst S.V. Svyatko).

Numerous cut and chopped injuries on the bones of the postcranial skeleton suggest that the male buried in kurgan 34a became a victim of armed violence. Judging by the locations of these injuries, these were caused by sword blows from the front. Unfortunately, the C6 and C7 vertebrae were poorly preserved, so it is unknown whether they had any traces of mechanical impact associated with beheading. In addition to the burial under discussion, two more burials of men with injuries inflicted by long-bladed weapons were examined at Choburak I. This evidence indicates participation of the male part of the local group of nomads, who left this small cemetery, in armed conflicts.

Discussion

Decapitation, recorded in the burial in kurgan 34a, is of the greatest interest. By now, single burials of beheaded males belonging to the population of the Bulan-Koba culture of the Altai have been reliably documented during excavations at the Airydash-1, Verkh-Uimon, and Stepushka sites (Soenov, 2017: 117–120; Tishkin, Matrenin, Schmidt, 2018: 27, fig. 26; 28, *1*; Tur, Matrenin, Soenov, 2018: 134–138). This evidence demonstrates not only a relatively high tension between individual groups of the Altai nomads in the 4th–5th centuries AD and probable conflicts with foreign groups, but also special military rituals (Tur, Matrenin, Soenov, 2018: 134–136). In this context, it should be emphasized that the beheading of a defeated enemy not only implied intimidation of the living relatives, but also had a deep sacred meaning, apparently associated with deprivation of the deceased of a full-fledged body as a condition for transition to the afterlife. The cruelty of the decapitation ritual was most likely practiced mainly in relation to the population of a foreign culture, which was not included in clan ties.

Outside the Altai, a fairly high percentage of burials of beheaded people of different sexes, who died in military clashes, were found in Tuva during excavations of cemeteries of the 2nd–4th centuries AD (Weinstein, 1970: Fig. 110; Dyakonova, 1970: Fig. 75, 79, 121; Murphy, 2003: 86–87; and others). For example, five cases of decapitation were identified in the evidence from the Aimyrlyg XXXI site. In two cases (one female and one male), the body was buried with a severed head. In three other cases (one female and two males), the skull was missing (Murphy, 2003: 86–87). Moreover, a large number of skeletons from that site had multiple cut and chopped injuries caused by a sword. Several cases of decapitation were found during the study of anthropological evidence from the Tunnug-1 site of the Kokel culture (Milella et al., 2021).

Considering the fragmentary information about the worldview of the Bulan-Koba people, interpretation of this distinctive ritual of replacing a person's head with a ram's is very problematic, and any conclusions are only tentative. However, some evidence suggests that such manipulations were not isolated instances in the ritual practice of the Altai-Sayan population in the late 1st millennium BC to the first half of the 1st millennium AD. A possibly similar situation occurred at the Tunnug-1 site mentioned above. One of the females (skeleton 67) was buried without her head; an iron knife and a sheep vertebra lay in place of the missing skull (Ibid.). The results of studying a clay mask from a burial of the Tes culture at the Shestakovo necropolis (Kemerovo Region, excavations by A.I. Martynov), using computed X-ray tomography at the Institute of Nuclear Physics SB RAS, were even more revealing. The analysis has shown that a "portrait of a man" was sculpted on the ram's (sheep's) skull (Polosmak, 2010: 84–85).

That study also contains numerous testimonies on the important role of sheep in the beliefs of carriers of many cultures in different chronological periods (Ibid.: 85–88).

Turning to interpretation of the evidence from kurgan 34a at Choburak I, note that the ram's head, together with a part of its neck, was "connected" to the torso of a person, imitating a single whole. This extreme manipulation with the body of the deceased was clearly caused by the circumstances of violent death. As one of the hypotheses, we may assume that the ram's head in this case was used as a basis for making a mask that replaced the lost human head. The absence of traces of such an item in the burial might have resulted from the poor preservation of organic materials, which is also typical of other objects at the cemetery. It seems possible to view such a procedure as an example of implementing forced partial mannequinization of a person for performing the valid rite of passage of the deceased to the afterlife.

Conclusions

The burial of a beheaded male in kurgan 34a at the Choburak I cemetery was done by the carriers of the Dàlián funerary tradition of the Bulan-Koba culture of the Altai. The appearance of the things found in the burial makes it possible to date it to the middle–second half of the 4th century AD, which agrees with the results of radiocarbon analysis of bone samples from the grave.

Most of the cut and chopped injuries without traces of healing, which were found on the postcranial skeleton of a deceased person, were made with a sword. The evidence of trauma demonstrates involvement of the population which left the Choburak I necropolis in conflicts using bladed weaponry, and a high level of armed violence in the Altai during the Rouran period. However, there is insufficient evidence to reconstruct the nature of these clashes in more detail and solve the problem of the possible participation of foreign groups in the conflicts. The evidence on replacing the human head with the ram's head, discovered in the burial, is also quite fragmentary. There are reasons to assume a ritual of replacing a lost body part, possibly due to the circumstances of a violent death. Expanding the existing corpus of sources, primarily through targeted excavations of archaeological sites, will make it possible to study various aspects of the military history of the nomads of the Altai and adjacent territories in the late 1st millennium BC to first half of the 1st millennium AD in more detail, and to understand better the understudied worldview of this population, which is reflected in ritual practices.

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N.V. Leshchenko and Y.G. Nikitin
Institute of History, Archaeology and Ethnography of the Peoples of the Far East,
Far Eastern Branch, Russian Academy of Sciences,
Pushkinskaya 89, Vladivostok, 690001, Russia
E-mail: nina8.56@mail.ru; urgen55@yandex.ru

New Findings Relating to Bone Processing from Chernyatino-2, Primorye

The article provides a detailed account of faunal materials from the Chernyatino-2 settlement in Russian Primorye. For the first time, a large series of bone blanks from a Bohai (698–926 AD) site is described, enabling us to reconstruct bone-processing techniques and types of tools used, expanding our knowledge of bone-working craft of that region. A detailed classification of bone and antler artifacts of domestic manufacture is presented. Certain artifacts are quite unusual. There are items relating to winter movement and hitherto unknown musical instruments, extending our knowledge of medieval Far Eastern musical culture. Also, we detail the species composition and proportion of domestic and wild animals. Predominant families and genera of fish are listed. The findings are discussed with reference to the role of environment in medieval subsistence strategy.

Keywords: *Chernyatino-2 settlement, Bohai State, bone and antler processing, hunting, fishing*

Introduction

The settlement of Chernyatino-2 is located on the first above-floodplain terrace on the right bank of the Razdolnaya River, 2 km southwest of the village of Chernyatino, Oktyabrsky District, Primorye Territory (Fig. 1). The river terraces rise to a height of 7.0–7.5 m above the water edge. Chernyatino-2 was discovered in 1997 (Nikitin, 1997: No. 43). In the east, the site is delimited by the abrupt bank of the Orlikha River, which gently bends to the west, and 100 m northwards joins the Razdolnaya River. The western border of the settlement is marked by a shallow ravine; in the south, the site reaches the gentle slope of the hill where the fortification site of Chernyatino-3 (Neolithic – Bronze Age – Early Middle Ages) is located. The Early Medieval cemetery of Chernyatino-5 is situated 1.5 km to the west of Chernyatino-2, and the ancient settlement of Sinelnikovo-1 (Neolithic – Bronze Age – Early Iron Age – Early Middle Ages) 3 km eastwards from it. On the opposite bank of the Razdolnaya, about a dozen other multi-layered sites are located.

Chernyatino-2 stretches along the left bank of the Orlikha for approximately 150 m from northwest to southeast, and along the edge of the first above-floodplain terrace of the Razdolnaya for 250 m from southwest to northeast. Its area is at least 37,000 m^2. Stationary excavations of the site were carried out from 1998 to 2008 under the leadership of Y.G. Nikitin. A joint Russian-Korean research project was carried out at Chernyatino-2 in 2007–2008 under the agreement on scientific cooperation between the Institute of History, Archaeology and Ethnography of the Far Eastern Branch of the Russian Academy of Sciences, the Korea National University of Cultural Heritage, and the Far Eastern State Technical University. Professor Jung Sukbae took part in the preparation of analytical materials on the study of heating systems (ducts) (Jung Sukbae, Nikitin, 2012).

V.V. Gasilin (Institute of Plant and Animal Ecology, Ural Branch of the Russian Academy of Sciences), Cho Taesop, and Lee Chungmin (Korea National University of Cultural Heritage) carried out identifications of the recovered osteological collections. Most of the artifacts mentioned in the article have been attributed to the Middle and Late Bohai (800–900 AD).

General stratigraphic position and main established features

The total excavation area at the site exceeds 400 m^2. The study has shown that Chernyatino-2 is a rather complex archaeological site containing several cultural horizons of various thicknesses and states of preservation, belonging to various historical and cultural periods from the Neolithic to the period of the Bohai State (698–926 AD). The total depth of the cultural layer reached 1.8–2.0 m in some areas. The cultural deposits, comprising gray and brown sandy loams of various shades, are underlain by a virgin layer of the light brown alluvial loam. The excavations revealed traces of digging and reconstructions of the Bohai period, which caused disturbances in the stratigraphic sequence in certain sections of the site, showing redeposited layers and artifacts shifted over the cultural layer (Nikitin, 1999: No. 291; Arkheologicheskiye issledovaniya…, 2008: Vol. 1: 27–51; Nikitin, Jung Sukbae, 2009: Vol. 1: 27–28).

The stratigraphic sequence at the settlement included five soil horizons: 1 – turf layer, gray sandy loam; 2 – mixed arable layer below the turf (dark gray and brown loam); 3 – dark brown or dark gray loam; 4 – yellowish-brown, light brown, or grayish-brown loam; 5 – light brown virgin alluvium.

The cultural layers of the Bohai, the Early Iron Age (Krounovka culture), and the Bronze Age have been established at the site. The Bohai has been recorded starting from horizon 2. Many features noted in layers 2–4 have been attributed to the Bohai: dwellings 2 (with kang heating system) and 3, ash pit 3, and all rubbish pits containing Bohai and Mohe ceramics. At the top level of layer 4, the Krounovka cultural horizon was noted; but since the upper part of the layer was significantly destroyed by Bohai pits, the Krounovka features (remains of dwellings, accumulations of plaster, and a pottery kiln) have been clearly recorded only in the lower part of the layer.

Features reliably correlated with the pre-Bohai Mohe were not noted at the site, although typical Mohe ceramics were found in significant quantities, most of them in rubbish pits and ash pits, mixed with fragments of Bohai wheel-made ceramics. Hence, the recovered items belong specifically to the Bohai, the same as all the Mohe vessels found.

Fig. 1. Location of Chernyatino-2.

Over the years of research at the site, an enormous amount of osteological materials has accumulated. The available collections were sorted out and analyzed, which made it possible to move on to systematization and determination of the species and quantitative composition of animals. The classification used was previously developed for the analysis of bone artifacts from the Bohai sites of Primorye (Leshchenko, Boldin, 1990). All available types of blanks were also analyzed. Traceological, photoanalytical, and comparative approaches were used. The digital long-focus USB-microscope Andonstar A1 with ×500 magnification and a 2 MP sensor were used. During the study, the techniques of processing (cuts, saw cuts, holes, underworking angle, and grinding) of working surfaces of blanks or finished products have been traced in detail.

Bone and antler blanks

Four representative series (S) of blanks have been identified.

S I – blanks with a working surface prepared by a one-sided cut at an angle of 45° (*n*=74). This series includes both robust specimens with slightly rounded or slightly pointed working ends, ranging in size from 7.1 × 0.7 × 0.2 to 14.7 × 3.8 × 1.0 cm (Fig. 2, *1*, *5–10*), and miniature ones, from 4.9 × 1.8 × 0.5 to 6.5 × 1.6 × 0.3 cm (Fig. 2, *2–4*). The working edge could be chopped off, sawed off, cut off, but it was always clearly prepared and sharpened.

Fig. 2. Blanks of S I (*1–10*) and S II (*11*) categories.

S II – blanks with a working surface cut off at two sides at an angle of 45°–60°. Specimens with a chopped or trimmed end were identified (*n*=31). Dimensions of the artifacts vary from 4.1 × 1.8 × 0.3 to 12.2 × 2.2 × 0.5 cm (Fig. 2, *11*).

S III – plates (*n*=46) with traces of cutting or sawing, varying from 5.4 × 2.4 × 0.7 to 12.8 × 2.5 × 2.2 cm. This series shows a variety of shapes and techniques of surface treatment. It includes straight and long hollow bones, with traces of cutting; blanks for bow plates, with clear traces of sawing on one of the ends, the upper part was cut obliquely; rectangular plates, evenly sawn at both ends.

S IV – antler blanks (*n*=52). Hunting provided these raw materials for crafts (Fig. 3). The antlers of roe deer, wapiti, and other ungulates were processed. The dimensions of the blanks vary from 6.8 × 4.8 × 0.7 to 15.5 × 2.3 × 1.8 cm. Traces of sawing, knife cutting, and underworking of ends were identified. Many blanks show recesses in the working part of the intended tool.

Each series of blanks is specific both in morphology and manufacturing technique. Semi-finished products are especially important in the identification of bone and antler working techniques (Izyumova, 1949: 16). Preparation of the blank and fashioning it to the finished product are of great importance in the *chaîne opératoire* of manufacturing a bone item. Various operations including chopping, cutting, sawing, drilling, and grinding are carried out at this stage. After that, the product is finished and ornamented (Peters, 1986: 23).

Bone and antler artifacts

Three Bohai dwellings were excavated at Chernyatino-2. In the immediate vicinity of the dwellings, three large rubbish pits were identified; each contained a significant number of animal bones (Fig. 4). In addition, many bones of animals, birds, fish, and mollusk shells (Fig. 4), as well

Fig. 3. Antler blanks.

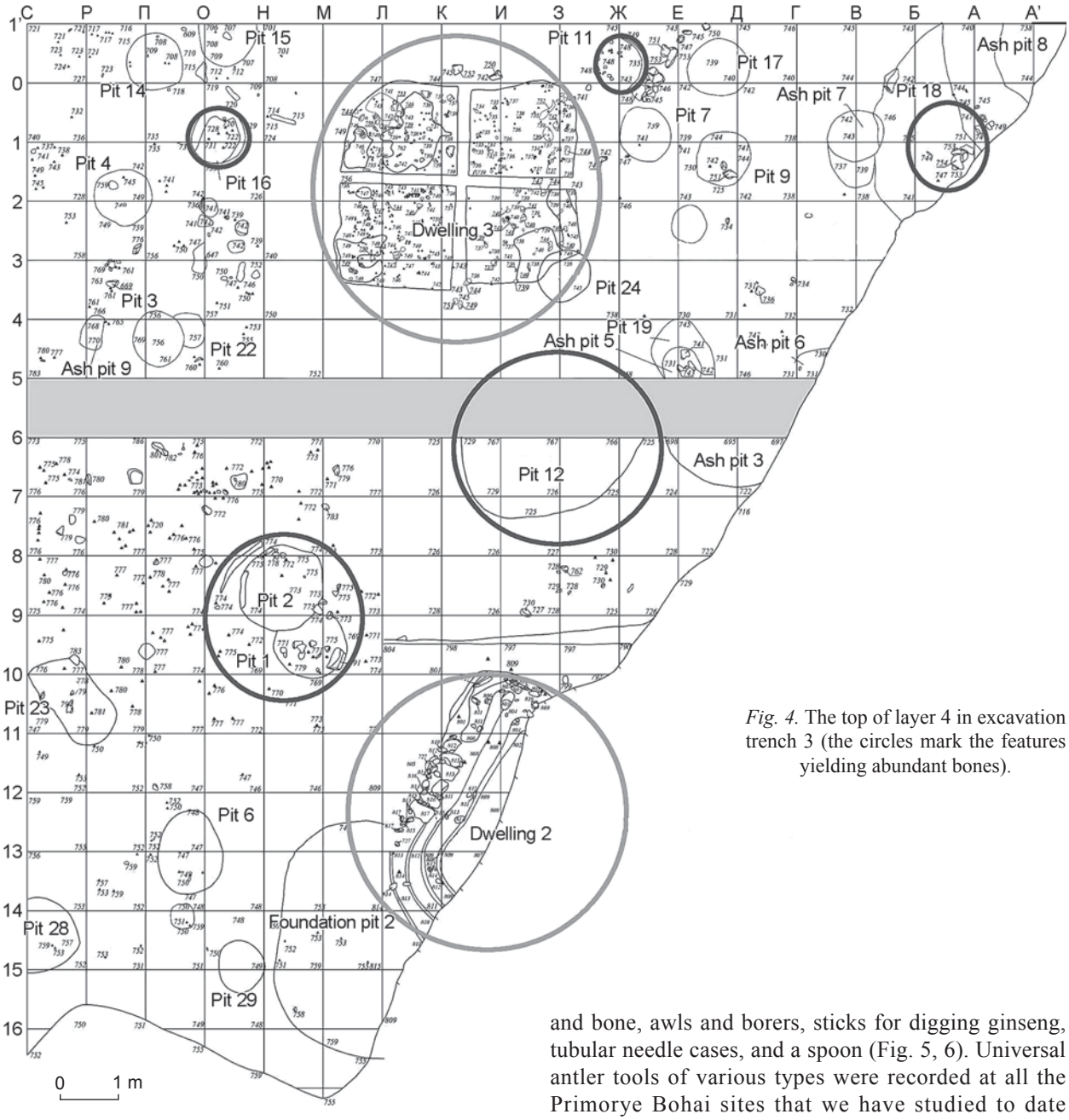

Fig. 4. The top of layer 4 in excavation trench 3 (the circles mark the features yielding abundant bones).

as bone and antler artifacts, were found in the filling of the foundation pit in dwelling 3, with a central hearth and holes from surrounding posts. We have classified the recovered materials into four groups: tools and household utensils; items of combat and hunting equipment; toiletries and ornaments; and items for games and cult. The products were made from various skeletal bones and antlers of domestic and wild animals: cows, sika deer, roe deer, and pig. Antlers, ribs, pelvic and tubular bones were mainly used.

At the site, in dwellings, utility structures, and in the neighborhood area, there were composite and on-laid handles, various universal tools made of antler and bone, awls and borers, sticks for digging ginseng, tubular needle cases, and a spoon (Fig. 5, 6). Universal antler tools of various types were recorded at all the Primorye Bohai sites that we have studied to date (Fig. 6, *12*, *13*). One surface of these tools is flat and smoothed, especially at the base, the opposite surface is convex. On the flat surface, there is always a specially made or natural depression with a diameter of 0.9–1.7 cm. The edge of the handle is prepared by a cut; some items have a hanging hole. Particularly carefully made specimens show serrated ends. The lengths of such tools vary in the range of 8.2–22.0 cm. Such tools could have been used to untie knots and to weave rough products. The depression on the flat side made it possible to push something through with a blow from above, and the serrated end, to pull it through. Some tools of this category could also have been used as "flint drills" (Medvedev, 1986: 60, fig. 33, *17*).

Fig. 5. Bone and antler items.
1 – handle; *2* – ornamented onlays; *3–5* – awls, borers; *6*, *10*, *11* – tools; *7*, *8* – bow onlays; *9* – sticks for digging ginseng; *12* – pipe.

The collection of bone artifacts from Chernyatino-2 is very typical of Bohai sites in Primorye (Leshchenko, 2010, 2012, 2018). Items of combat and hunting equipment include arrowheads and bow onlays. Residents of the settlement wore various personal ornaments and amulets made of bone and antler. Elements of clothing, belt sets, and household goods were often decorated with ornamented plates and sewn-on discs. Bone was used as a raw material in decorative and applied arts. Chernyatino-2 dwellers produced tools, household utensils, jewelry, musical instruments and even "skates". The latter are not much different from ordinary winter skates, in terms of use, but are made from a cattle shoulder bone (Fig. 7). The glenoid cavity of the left scapula connecting to the humerus is crushed, and a round hole is cut out on the split part of this bone; the laces could be threaded through this hole to secure the skate to the shoe. The collection of musical instruments found at medieval sites in Primorye (Leshchenko, Prokopets, 2015) was supplemented by a pipe blank (see Fig. 5, *12*). The polished product had recesses for holes, marked and cut with a knife, which subsequently had to be drilled.

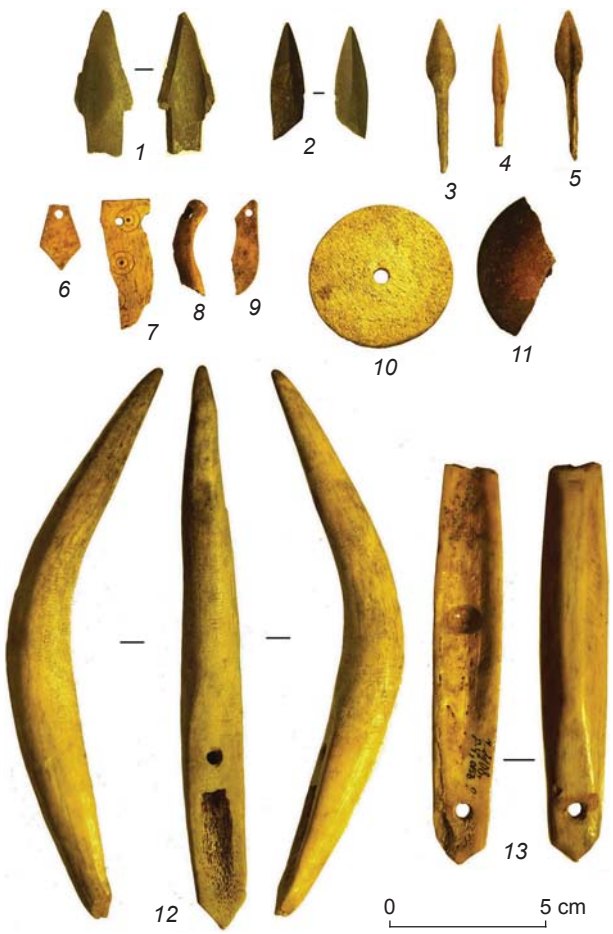

Fig. 6. Bone and antler items.
1–5 – arrowheads; *6–9* – ornamented onlays; *10* – sewn-on disc; *11* – spindle whorl fragment; *12*, *13* – universal tools.

Bone-processing techniques

We have collected together all the currently available material related to the processing of bones from Chernyatino-2. The use of a digital long-focus USB microscope with ×500 magnification has made it possible to trace the process of blanks and products manufacture in great detail. The angles of underworking, cutting, sawing, making holes, grinding—all these operations were recorded (Fig. 8). The surface treatment process and sharpening techniques have been identified in detail. For example, S I blanks showed a one-sided sharpening, sawing, cutting, and a rounded or pointed working end; and S II had

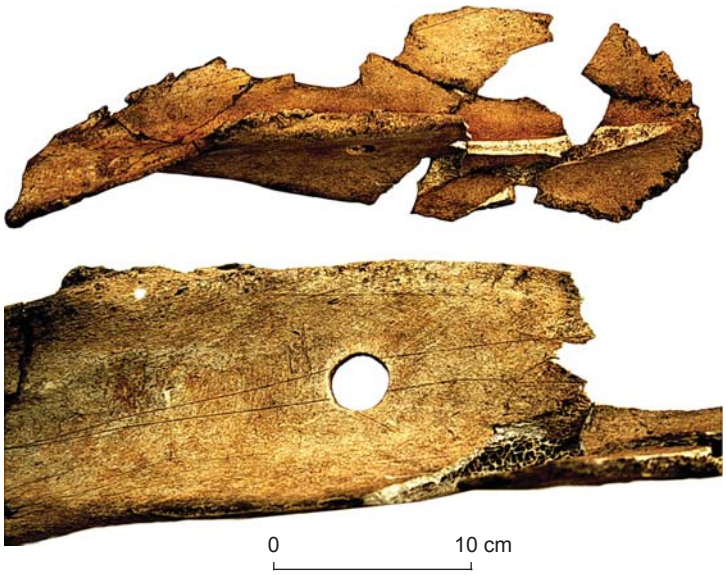

Fig. 7. "Skates".

a double-sided cutting of the working surface, which extended the functions of the intended product. In S III, saw- and knife-cuts of ends at an angle of both 90° and 45° were recorded. In S IV, the working material was ungulate antlers, which were most often used for crafts. In this series, traces of sawing, cutting, making holes and recesses have been recorded. All techniques of surface finishing are confirmed by archaeological finds from the site.

Species and quantitative composition of animals

The assemblage of osteological remains of the site is abundant. In one of the 2007 collections alone, there are 3096 animal bones. This provides reliable grounds to draw conclusions about the species composition of wild and domestic animals. The share of bones of pig, cow, horse and dog exceeds a half of the total amount of bone remains of domestic animals (53.1 %). The highest is the proportion of pig bones (skulls, jaws, vertebrae, ribs, humerus, ulna, radius, femur, ilium, scapula, etc.). The majority of these animals were young, aged 1–2 years. The second-large category is dog bones (skulls, mandibles, fragments of vertebrae, ribs, etc.); these were found in almost every pit, which suggests a significant role for dogs in the life of the dwellers. A similar situation was noted at the Maiskoye fortified settlement of the Jurchen culture (12th to early 13th century) (Alekseeva, Besednov, Ivliev, 1996; Alekseeva, Gasilin, 2015: 444) in the Khankaisky District of Primorye (ca 115 km northwest of Chernyatino-2). The cow bone remains constitute the third-large category. It includes phalanx bones, fragments of humerus, femur, and vertebrae, including three consecutive cervical vertebrae with obvious marks from an axe or large knife resulting from the head being cut off the body. The smallest share is horse bone remains (*n*=7): tibia, fibula, metacarpal, coronoid bones, teeth, and phalanx bones. The interior surfaces of the phalanx bones show traces of skinning (Cho Taesop, Lee Chungmin, 2008).

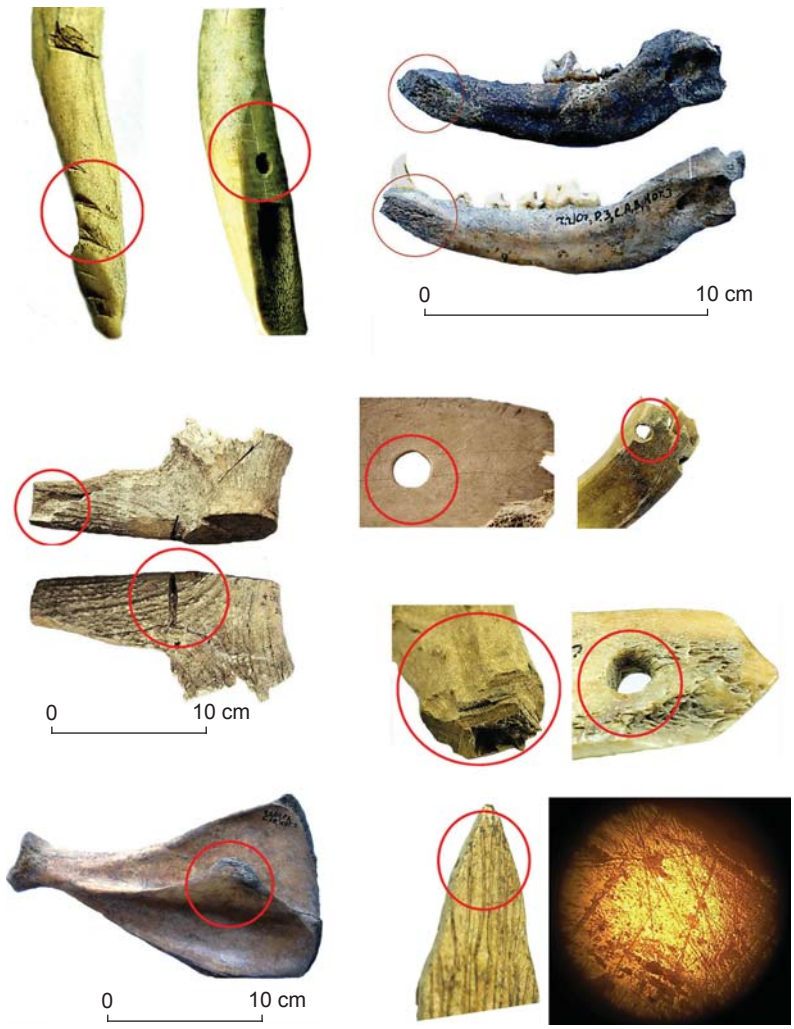

Fig. 8. Traces of processing on artifacts.

Wild animals are represented by 16 species. Such diversity indicates that hunting was one of the leading activities in the subsistence strategy of the settlement's inhabitants. The remains are dominated by bones of red, sika, and roe deer. The category of predators includes bear and weasel; that of the small mammals includes hare. Notably, 11 species of wild animals are classified as land mammals. Four species of birds were identified.

In residential and utility areas, 1403 fish bones were found, which make up 45.3 % of the total amount of bone remains. Typically, the number of fish bones found at Bohai archaeological sites in Primorye is small. This settlement is distinguished not only by their large number, but also by the variety of fish species represented. The location on the Razdolnaya River bank provided excellent opportunities for the development of fishing and shellfish picking (Nikitin, Saenko, Lutaenko, 2016; Nikitin et al., 2019). The most numerous species of fish is skin-carp. In only one pit, the bones belonging to 100 individuals were found.

Conclusions

The settlement of Chernyatino-2 yielded an enormous number of blanks and artifacts made of bone and antler. These were found both in dwellings and in cellars, utility pits, and in courtyard areas. This shows the popularity of bone carving in the settlement. Bone-processing tools found at the site include small files with short serration for longitudinal and transverse dissection of bone, and knives for cutting and scraping. Various whetstones and grinding stones were used for surface refining and sharpening.

The diverse fauna in the vicinity of the settlement created opportunities for the production of various household utensils from hunting waste. Antlers, tubular bones, and animal ribs were used as raw materials. For example, S III blanks are various plates from ribs sawed or cut off in certain places. Such plates could have been used as handles, and smaller ones as onlays. S IV series consists of antler blanks. This fabricating material has a denser structure than bone. Therefore, it was first softened, and then transverse slices were sewn off. Large antler blanks were often used to make universal tools, and smaller round ones to make "whistles". Among the finished products made of bone and antler, there were a musical instrument and an item relating to the mode of movement in winter time, which are quite rare for the Bohai sites in Primorye.

Osteological collections revealed the composition of domestic and wild animals and the importance of hunting and fishing for the settlement dwellers, who made maximum use of natural resources in their subsistence strategy. Chernyatino-2, along with other early medieval sites, shows the dependence of the economic activities of population on the location and geographic environment of the settlement.

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I.V. Zhurbin
Udmurt Federal Research Center,
Ural Branch, Russian Academy of Sciences,
T. Baramzinoy 34, Izhevsk, 426067, Russia
E-mail: zhurbin@udm.ru

Boundaries, Structure, and Integrity of the Occupation Layer at the Gordinskoye I (Guryakar) Fortified Settlement, Udmurtia (9th–13th Centuries), According to Multispectral Imaging

Science-based studies at Gordinskoye I (Guryakar) fortified settlement in northern Udmurtia (9th–13th centuries AD) were carried out. The occupation layer had been largely destroyed by plowing. The statistical analysis of multispectral images and segmentation of the generated images of vegetation distribution make it possible to assess the integrity of the occupation layer. The preliminary conclusion about the presence of its parts, varying in thickness, is based on the analysis of the configuration of areas of segmented multispectral images and the correspondence of diverse segments to relief features. Assessment of archaeological context and of the preservation of occupation layer (superficially disrupted, replaced, or transported) is possible only with the use of geophysical and soil studies and targeted excavations. The available reference data allow us to interpret individual segments present solely on the flat surface of the promontory. The assessment of the parameters of the occupation layer within the entire survey area is possible through the extrapolation of properties of vegetation segments with known characteristics. Based on the totality of data, it can be assumed that the built-up area of Guryakar was limited by the outer fortification line. A thick occupation layer is localized on the promontory, within two inner structural parts of the site. Two other parts of Guryakar, situated between the residence area and the outer fortification line, were probably used for utility purposes and manufacture. The deposition of the medieval occupation layer was less intense there. Additional markers of the fortifications, delimiting the boundaries of the settlement's structural parts, are vertically oriented linear areas of the transported layer on slopes of the promontory.

Keywords: *Medieval settlements, multispectral imaging, statistical analysis, interdisciplinary studies, superficially disrupted, replaced, transported occupation layers.*

Introduction

Remote sensing offers a considerable extension of the limits of archaeological studies (Lasaponara, Masini, 2012; Luo et al., 2019). This technique allows us to examine not only the territory of sites, but also large surrounding area. In the conditions of surfaces flattened by plowing, typical for archaeological sites in central Russia and western Urals, vegetation traits of the occupation layer (density and length of the modern plant cover) can be more informative. One of the factors accounting for the diversity of vegetation across the site area and in its vicinities is the content of anthropogenic organic remains in the occupation layer. Multispectral imaging makes it possible to subdivide the territory of the settlement and surrounding area by differences in the vegetation cover. The consecutive comparison with geophysical, soil, and archaeological data allows the interpretation of the diverse

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areas (Luo et al., 2019; Mozzi et al., 2016; Wadsworth, Supernant, Kravchinsky, 2021).

At sites of the Cheptsa culture (9th–13th centuries, northern Udmurtia), three types of the occupation layer were identified (Zhurbin, Borisov, Zlobina, 2022). In the superficially disrupted layer, only lower horizons are preserved *in situ*, while upper horizons are destroyed by plowing. The replaced layer is viewed as the extreme condition of the previous one, where only the bottom parts of structures dug into the parent material are preserved. The destroyed upper horizons are distributed over the site's territory and surrounding area; erosional processes transport them into subordinate forms of landscape. The presence of the transported layer in combination with superficially disrupted and replaced ones serves as evidence of an archaeological site.

Principle findings of studies at the Guryakar fortified settlement

The Gordinskoye I fortified settlement of Guryakar is considered a key medieval center in the Cheptsa River basin (Ivanova, 1998: 218–224). The site is located on the southwestern outskirts of Gordino village (Balezinsky District of Udmurtia), on a promontory of a bedrock river terrace (Fig. 1). Owing to the close proximity to Guryakar village, the settlement was subjected to a heavier distraction than other Cheptsa sites. The 1615 inventory books mention a "meadow at Fort Gordinskoye" (Luppov, 1958: 189). In the late 19th century, the area was plowed, while the territory of the outer rampart was occupied by a peasant vegetable garden (Pervukhin, 1896: 53). M.G. Ivanova, who in 1979 conducted the first and the only large-scale excavations there, also mentioned that the settlement area had been plowed (1982). Initially, it was believed that there were two fortification lines protecting the settlement (Pervukhin, 1896: Fig. 35, 36). Later on, V.A. Semenov (1957: 34, 35) made an assumption about the third fortification line. At present, the fortifications are hardly visible in the landscape because of many years of plowing (Arkheologicheskaya karta…, 2004: 119, 120).

As the archaeological data are scarce, interdisciplinary studies have been conducted at the site (Fig. 1): aerial photography (visible range and multispectral imaging), resistivity and magnetometry surveys, and soil coring (with assessment of the granulometric composition and chemical and biological properties of cores).

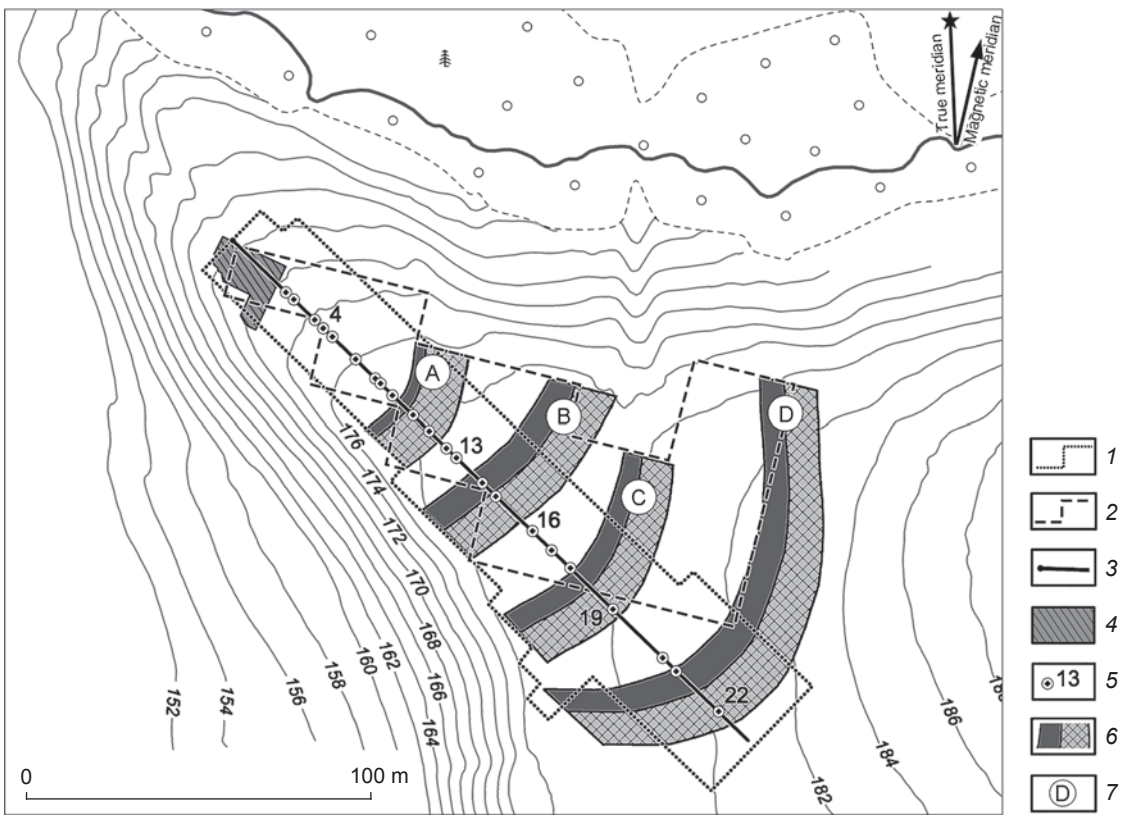

Fig. 1. Topographic plan of the Gordinskoye I fortified settlement of Guryakar (base by N.G. Vorobieva, *Finko* LLC; addition by R.P. Petrov, Udmurt Federal Research Center, Ural Branch, Russian Academy of Sciences).
1 – resistivity survey; *2* – magnetometry survey; *3* – electrical resistivity tomography profile; *4* – excavation; *5* – soil cores; *6* – fortifications; *7* – fortification lines.

The comparison of data received by independent science-based methods and by excavations provided fundamentally new information for the reconstruction of Guryakar (Zhurbin, 2020: 84–96). In particular, the interdisciplinary studies have revealed the fourth fortification line. The layout of all structural elements of the settlement was reconstructed. It was suggested that although the Guryakar area had expanded more than once, the uninterrupted occupation and utility zones had remained within the promontory part, being limited by the inner fortification line (A) without expanding beyond the next one (B). A thick occupation layer was recorded there. A quite different situation can be observed in the outer part of the settlement (between B and C, C and D fortification lines): the occupation layer is more homogeneous, and the density of geophysical anomalies is far less. The structure of this sort normally corresponds to utility and production zones of medieval settlements. This reconstruction coheres with the results of archaeological studies carried out at other Cheptsa settlements, where various zones differ in the thickness and structure of the occupation layer. Soldyrskoye I fortified settlement of Idnakar most vividly demonstrates these tendencies. All structural parts were examined there by large excavated areas (Ivanova, 1998: 30, 66, 71–73, 81–85). Excavations at Kushmanskoye (Uchkakar) (Zhurbin, 2020: 98, 99) and Vesyakarskoye (Vesyakar) (Ibid.: 107–111) fortified settlements also revealed dissimilarities in layouts and in the thickness of culture-bearing deposits in different zones.

Methods

Aerial photography in the visible range (Fig. 2, *a*) was carried out using a Supercam S350-F unmanned

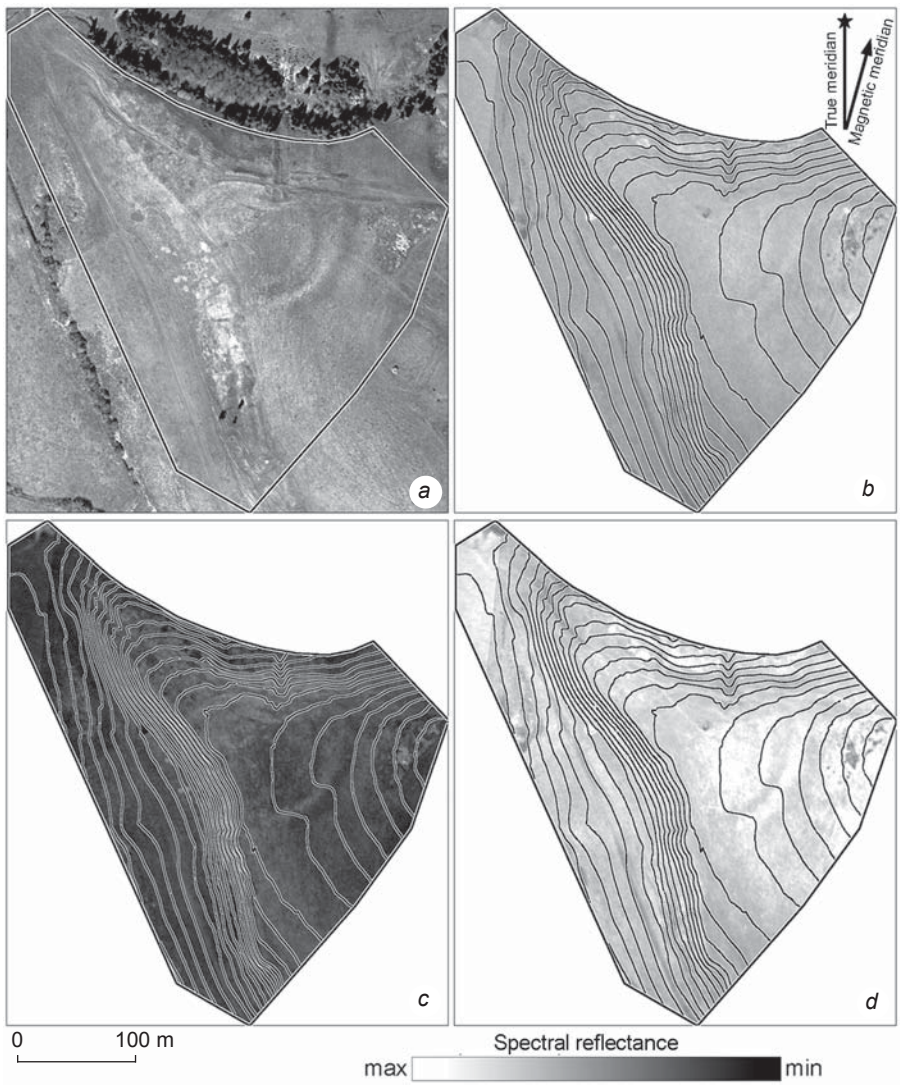

Fig. 2. Orthophotomap of Guryakar (*a*) and reflection maps in Green (*b*), Red (*c*), and NIR (*d*) bands.

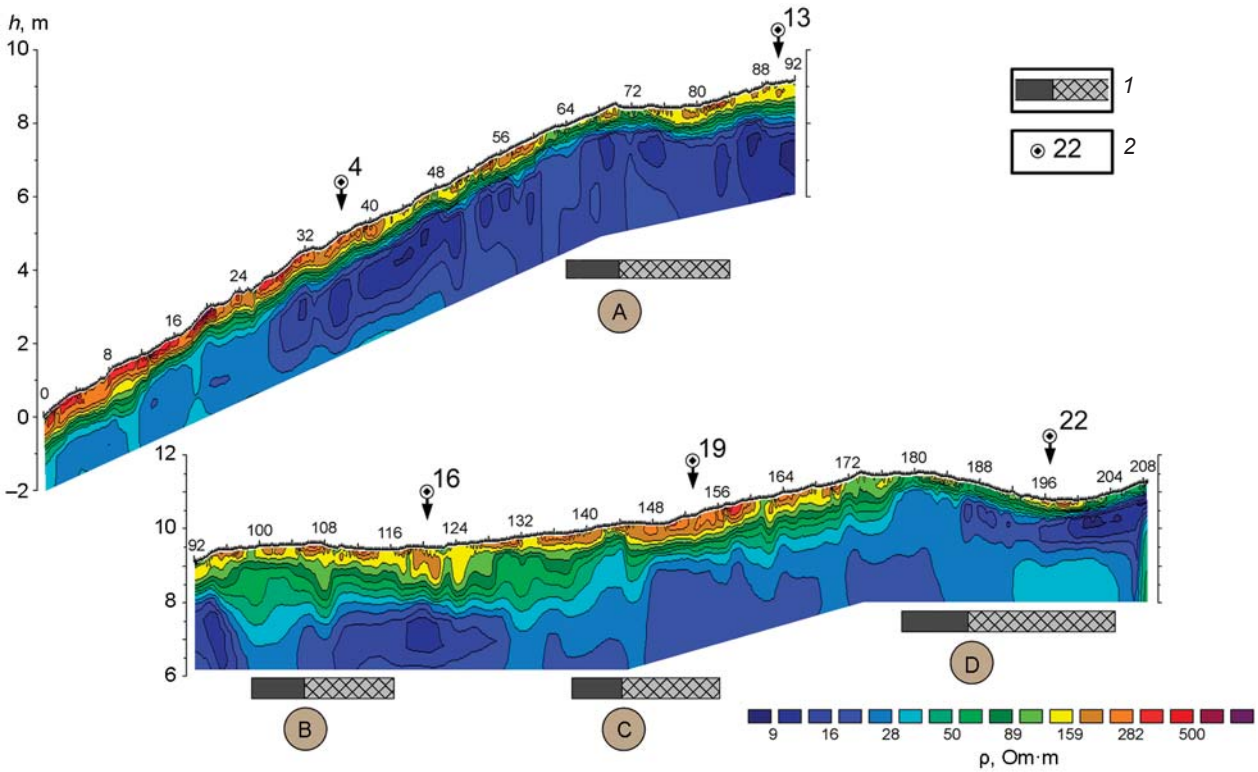

Fig. 3. Geoelectric section.
1 – fortifications; *2* – soil cores.

aerial vehicle (*Finco* LLC, Izhevsk). A high-precision topographic plan of Guryakar was thus made; coordinate referencing of geophysical study areas, soil coring points, and excavation area was performed (see Fig. 1). A series of images made with a multispectral camera in Green, Red, and NIR bands (see Fig. 2, *b–d*) was received. These make it possible to assess changes in the vegetation corresponding to areas varying in thickness of the occupation layer.

Terrestrial geophysical survey was carried out, using resistivity and magnetic prospecting methods (Zhurbin, 2020: 87–89). In order to reconstruct the deep structures of the revealed anomalies and to assess the thickness of the occupation layer, the electrical resistivity tomography data were used (Fig. 3). Geophysical methods, as compared to aerial photography, provide the information only about a fragment of the study area—a flat surface of the promontory (see Fig. 1).

Soil coring of areas varying in geophysical characteristics was carried out (Derendyaev, 2018: Suppl. 1). Soil cores were taken on the line of the electrical resistivity tomography profile (see Fig. 1), which made it possible to compare results of the soil studies with geophysical data. The analysis of granulometric composition and morphology of soils along the whole length of the core provided an opportunity to assess the thickness and structure of culture-bearing deposits (Fig. 4). Examination of chemical and physical properties of the soil samples (pH, urease activity, content of phosphates, magnetic susceptibility) gave ground for delimiting residential and utility zones of the settlement (Zhurbin, Borisov, 2020).

Multispectral imaging: segmentation and interpretation of data

All the images received demonstrate contrasting differences between vegetation on the flat surface and on the promontory slopes. Modern disturbances, such as a garbage dump in the eastern part of the area, field roads, and pits, are also visible. In Green band (see Fig. 2, *b*), only these elements are distinct, while the rest of the image is virtually homogeneous. In distinction from it, Red and NIR bands (see Fig. 2, *c*, *d*) demonstrate areas of varying vegetation cover. For example, in Red band, the zone of patchy vegetation is located on the promontory part of the site, approximately up to fortification line C (see Fig. 1). The rest of the territory (with the exception of an arciform area, possibly corresponding to the buried base of a rampart in line D) is rather homogeneous. This part differs significantly in reflectance from the promontory part. In NIR band, the vegetation cover is displayed in more detail. In the promontory part and

between fortification lines C and D, numerous local inhomogeneities are located. A rather homogeneous zone separates these areas. Outside fortification line D, the concentration of inhomogeneities significantly reduces. Results of multispectral imaging on the whole supplement the image in the visible range (see Fig. 2, *a*). However, the raw images do not allow us to determine reliably the location of areas differing in thickness of the occupation layer.

To evaluate the tendencies in the distribution of the occupation layer across the site and the adjoining area, statistical analysis was used (Zlobina et al., 2021), including Haralick's algorithm, principal component analysis, and segmentation through k-means clustering. Segmentation implies finding non-overlapping areas of the image, each of which is characterized by similar properties such as intensity and density of vegetation, as well as thickness and saturation of the occupation layer. Results were interpreted by comparing the revealed segments with reference samples.

Given the plowing, to which the site area was subjected over many years, and the accompanying erosion, the content analysis of the segments must be carried out with regard to the relief (flat surfaces on the promontory and below versus slopes). Also, reference samples make it possible to interpret only segments on the surface of the promontory. Therefore, the assessment of the occupation layer in the remaining parts of the site is based on the extrapolation of segment properties with known parameters.

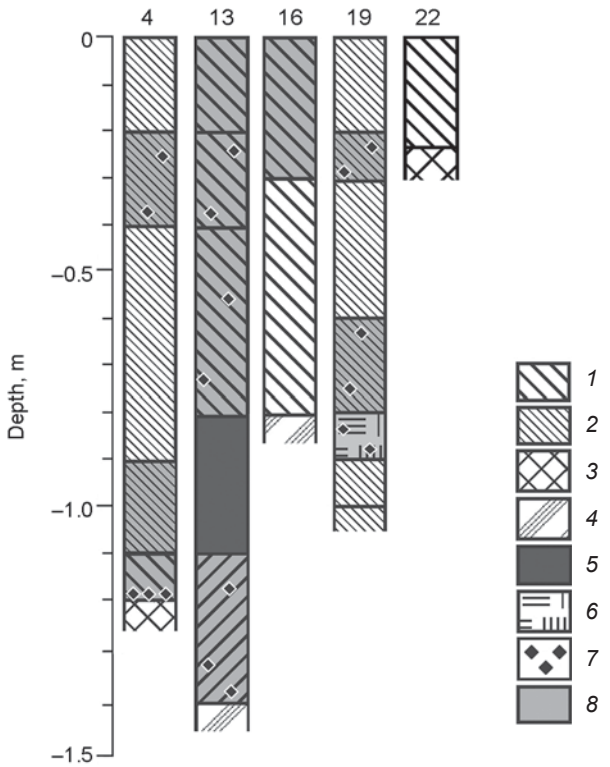

Fig. 4. Lithological structure of typical cores (drilling and interpretation by A.V. Borisov, Institute of Physicochemical and Biological Problems in Soil Science, Russian Academy of Sciences, Pushchino).

1 – silty loam; *2* – sandy loam; *3* – clay; *4* – marl; *5* – burnt clay; *6* – wood residues; *7* – coal; *8* – layers with artifacts.

In the promontory part, including fortification line B, patches of class 1 vegetation prevail (Fig. 5, *a*). Geoelectric section shows considerable thickness of the occupation layer (see Fig. 3). This estimation is confirmed by the results of soil coring (see Fig. 4, cores 4 and 13). It also accords with archaeological observations: near the eastern side of the excavation, the thickness of culture-bearing deposits outside the deepened objects reaches 1.2 m (Ivanova, 1982: Fig. 5). The maximum resistivity in the whole section (see Fig. 3, 0–42 m diapason) testifies to the high concentration of remains of anthropogenic activities in the humified layer of the promontory part. The analysis of chemical and physical properties of soil samples also points to this (Zhurbin, Borisov, 2020: Tab. 7). A synchronous rise in magnetic susceptibility and phosphate content in the area within fortification line A indicates the intense residential use. The highest values of these properties were recorded in culture-bearing deposits preserved *in situ* under the topsoil horizon. The totality of reference data suggests that in the promontory part, the segments of class 1 mark a thick superficially disrupted layer saturated with remains from anthropogenic activities.

Areas of class 2 vegetation are few and adjoin the segments of class 1 (see Fig. 5, *a*). On the basis of resistivity level, it can be conjectured that these correspond to a thinner superficially disrupted layer with high content of anthropogenic activity remains.

Segments of class 3 vegetation (see Fig. 5, *a*) are characterized by medium values of resistivity (see Fig. 3, 120–180 m diapason) and by the thick humified layer (see Fig. 4, cores 16 and 19). This can be possibly explained by small amount of anthropogenic activity remains. The range of magnetic susceptibility and quantity of phosphates are significantly lower there (Ibid.) and close to values from the soil horizons of the bottom part of the occupation layer in the promontory area (buried soil on which the residential zone was formed). Such values might be determined by relatively small anthropogenic impact over these territories (possibly, utility and production zones of Guryakar). The lower building density is evident in the layout of the settlement reconstructed by the complex geophysical survey (Zhurbin, 2020: Fig. 2.34). Hence, the segments of class 3 vegetation can be classified as a thick superficially disrupted layer with a low concentration of anthropogenic remains. This situation prevails between fortification lines B and D.

The segments of classes 1–3 occupy the whole flat surface of the promontory, up to fortification line D.

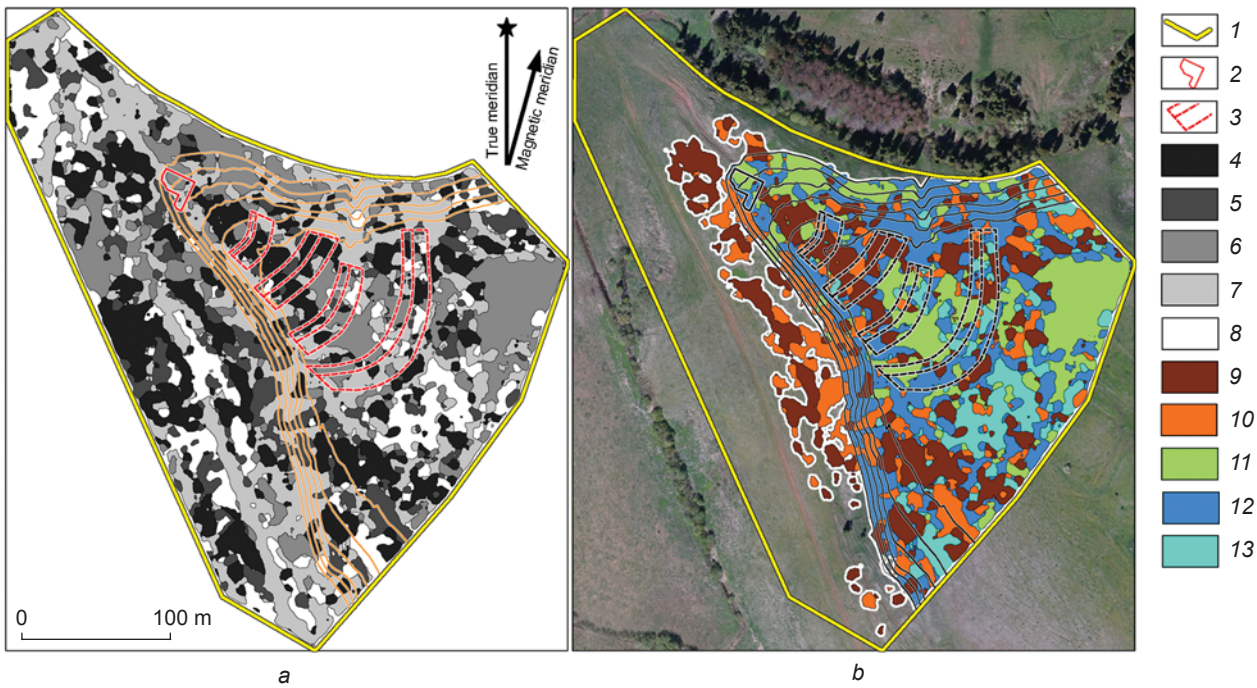

Fig. 5. Results of segmentation (*a*) and interpretation of the segments (*b*).
1 – boundaries of the statistical analysis area; *2* – excavation; *3* – contour of fortifications; *4–8* – areas of vegetation of classes 1 (*4*), 2 (*5*), 3 (*6*), 4 (*7*), and 5 (*8*); *9*, *10* – saturated superficially disrupted and transported layer (thick and thin, respectively); *11* – thick unsaturated superficially disrupted layer; *12* – replaced layer; *13* – areas with minor anthropogenic transformation.

Vegetation cover of class 4 prevails along the perimeter of this territory, in the area passing from the flat surface to slopes. In such areas, an intensive transit of soil and ground material to subordinated landforms is observed. Therefore, in these segments, culture-bearing deposits show a low thickness of humified layer (see Fig. 3, 188–208 m diapason). The situation of this sort is evident in core 22 (see Fig. 4), where the parent material is overlain by the topsoil only, that corresponds to the replaced cultural layer.

An absolute majority of class 5 segments are located on the flat surface of the promontory outside fortification line D and on flat areas of the Cheptsa River flood plain (the western periphery of the study area) (see Fig. 5, *a*). Configuration and large size of these segments, as well as their location, suggest that these are areas of natural environment that were not exposed to severe anthropogenic impact.

The tendencies in the vegetation distribution on the hill slope require special consideration. Segments of classes 1 and 2 are visible on the southwestern slope of the promontory. Their distinctive features are the linear shape and location along the settlement ground delimited by fortification line D. Notably, on the slopes outside this line, only local segments of classes 1 and 2 are present. The location and configuration make it possible to correlate them with transported occupation layer that was shifted by horizontal erosion into subordinate landforms. This speculation is based on the results of studies conducted at another Cheptsa settlement–– Kushmanskoye III (Zhurbin, Borisov, Zlobina, 2022). The statistical analysis of organic carbon content, number of thermophilic bacteria, activity of urease and phosphatase enzymes in soil samples has shown that the transported occupation layer retains chemical and biological traits of the initial horizon. The vegetation cover in areas of the transported layer is therefore comparable with the vegetation of segments in the superficially disrupted layer (classes 1 and 2 for Guryakar).

Conclusions

Assuming that tendencies in the distribution of the occupation layer within the site and the adjoining area mirror the thickness of the initial cultural deposits, the structure and boundaries of Guryakar can be interpreted as follows (see Fig. 5, *b*). The built-up area of Guryakar was presumably limited by the outer fortification line. In this zone, the vegetation is rather homogeneous: large parts of the superficially disrupted layer (classes 1–3) are surrounded by segments of the replaced horizon (class 4). The vegetation structure changes significantly outside fortification line D. Areas of all the revealed classes are represented there. Segments of vegetation correlating with a weakly humified layer (classes 4 and 5)

prevail. Areas of the transported layer (linear in shape) on the promontory slopes (classes 1 and 2) can serve as another evidence attesting to the presence of the original culture-bearing deposits. Their location corresponds to the identified segments of the superficially disrupted layer. Accordingly, the uninterrupted area of the transported layer on the slopes can correspond to the residence zone, where the thickest and the most saturated deposits were formed.

Additional markers of the fortifications, delimiting the boundaries of the settlement's structural parts, are the vertically oriented linear areas of the transported layer on slopes of the promontory. Their origin is presumably connected with water erosion, when intensive water streams flowing down the moats provide the transit of the occupation layer destroyed by plowing to the areas below the moat's mouth. At Guryakar, such areas are located on the southern slope of the promontory, below fortification lines C and D. The location of all the fortifications at the settlement was determined through the multidisciplinary geophysical and soil studies (Zhurbin, 2020: 89–94).

The initial thickness of the occupation layer in various structural parts of the site is marked by the thickness and saturation of the remaining cultural deposits. The most significant superficially disrupted layer has been revealed in the promontory part delimited by fortification line B. In the area separating lines B and D, the preservation of cultural deposits is much worse. The inner structural parts of Guryakar (delimited by fortification lines A and B) are presumably residential and utility zones, with a thick occupation layer containing numerous materials of anthropogenic origin. The outer parts (delimited by fortification lines C and D) were probably used for utility purposes and manufacture. The medieval occupation layer was formed less intensively there. This supposition agrees with the layout of Guryakar reconstructed on the basis of geophysical and soil study findings (Ibid.: Fig. 2.34).

The generally tentative conclusion about the presence of the occupation layer varying in saturation and thickness can be based on the analysis of configuration of the segmented multispectral images and on the correspondence of various segments to topographic features. The assessment of the archaeological context and of the preservation of deposits (superficially disrupted, replaced, or transported) can be made only with the use of reference samples resulting from geophysical and soil studies and excavation findings.

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Y.N. Garkusha, A.V. Novikov, and A.V. Baulo
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: garkusha_y@list.ru; Novikov@archaeology.nsc.ru; bau194@yandex.ru

Miniature Anthropomorphic Sculptures from Ust-Voikary: Chronology, Context, Semantics

We publish a sample of anthropomorphic sculptures unearthed in 2012–2016 at the Ust-Voikary fortified settlement in the circumpolar zone of Western Siberia. This is one of the permafrost sites, where artifacts made of organic materials are well preserved. The vast majority of the sculptures are made of wood, two of sheet metal, and one from a limonite concretion. Four main categories are identified: busts, heads, relatively full anthropomorphic figurines, and masks on sticks. Most of the sculptures follow the tradition of Ob-Ugric art, while a few can be attributed to Samoyedic art. Some figurines have additional elements such as rows of notches and diamond-shaped signs. According to ethnographic data, these signs endowed the sculptures with a sacral status. The finds have a clear archaeological, architectural, and dendrochronological context. Most were discovered in cultural layers dating to the early 1500s to early and mid-1700s. The artistic style is analyzed, and parallels are cited. The sculptures are compared with 18th to early 20th century ethnographic data. The connection of most figurines with dwellings, their small size and style show that they all belong to the ritual wooden anthropomorphic sculpture and were attributes of domestic sanctuaries. They fall into two main categories: family patron spirits and ittarma—temporary abodes of souls of the dead.

Keywords: *Ust-Voikary, northwestern Siberia, northern Khanty, anthropomorphic sculpture, patron spirits, ittarma.*

Introduction

Archaeological sites with the permafrost cultural layer in northwestern Siberia have exceptional information potential for studying the culture of the indigenous population of the region. Such sites are the main source of information concerning the history of wooden sculpture by the local population. These are Nadym and Polui promontory forts, and the Ust-Voikary fortified settlement, which are dated to the second third of the 2nd millennium AD. Currently, a total of more than 150 miniature wooden anthropomorphic sculptures originating from these sites has been recorded. About half of these have been recovered from the Ust-Voikary fortified settlement in the southwestern part of the YaNAO; the site was excavated in 2003–2008 and 2012–2016 (Garkusha, 2020). The data from the dendrochronological analysis have shown that this settlement was populated in the range from the turn of the 13th–14th centuries to the 19th century (Gurskaya, 2008). The population of the fort has been tentatively identified as Ugric-Samoyedic with a certain admixture of the Komi-Zyryan component (Martynova, 1998: 82; Perevalova, 2004: 231–233). About 30 items discovered at the site in 2003–2008 were published in the electronic catalog of the Shemanovsky Museum-Exhibition Complex (Salekhard). This article introduces 48 anthropomorphic figurines found during the excavations in 2012–2016. Almost all the items were made of wood; two pieces are from sheet metal, one figurine is

Archaeology, Ethnology & Anthropology of Eurasia 52/2 (2024) 108–118 E-mail: Eurasia@archaeology.nsc.ru

fashioned on a disc-shaped limonite concretion*. Thus, the relatively small excavation area at Ust-Voikary fortified settlement revealed ca 80 anthropomorphic images. An explanation of this concentration can be found in the famous message of V.F. Zuev (1947: 41) about his trip to the Obdor Territory (in 1771): "Everyone in the chum, including women and girls, has his or her own idol, sometimes two or three, whom they amuse every day according to their custom".

Typology of anthropomorphic figurines

The first typological classification of the anthropomorphic images was made for the materials from the Nadym and Polui promontory forts (Kardash, 2009: 188–189; 2013: 200–201). Three types have been identified: I – masks on sticks, II –sculpture, III – monumental sculpture. Type II has been further subdivided into three sub-types: 1) busts, 2) sculpture proper; and 3) multi-faced images. The proposed typology does not seem correct concerning the terms. The term "sculpture" refers to the common technique of producing the images, rather than to their morphology. S.V. Ivanov referred to the works of art historians and wrote: "Sculpture (from the Latin *sculpere* 'carve', 'cut')… means 'carving', 'cutting out', 'hewing', i.e. a process in which a craftsman, in one way or another, using one tool or another, removes excess parts of the piece of wood or stone he is processing, gradually giving the remaining solid mass the necessary shape" (1970: 5). Thus, all the analyzed images belong to one category—anthropomorphic sculpture. In this regard, we find it appropriate to propose a different typology.

We subdivided the miniature anthropomorphic wooden sculptures from Ust-Voikary into the following categories: 1) busts; 2) heads; 3) relatively full anthropomorphic figures; 4) masks on sticks; 5) dubious (bearing signs of anthropomorphism). Further typology is based on the presence or absence of additional details.

Busts (Fig. 1; 2, *1–4*, *6*, *10–13*). This is the largest category. Busts include sculptural three-dimensional images of the upper part of a human figure—chest-high or waist-high images. Anthropomorphic features are imparted by modeling the head, neck, and shoulder girdle, often with the addition of relief individual facial features, mainly the lines of eyebrows and nose. Sometimes, eyes and mouth are also shown. In some figures, only eyes are depicted with pinpoint punctures (Fig. 2, *3*). One of the bust figurines shows the arms rendered by triangular protrusions (see Fig. 1, *13*); in the other figurine, the arms are only outlined (see Fig. 1, *9*). Sometimes, the body bears ornamentation in the form of various notches and geometric figures. The height of the figurines ranges from 7 to 15 cm.

According to the design of the upper part of the head, the busts are subdivided into two types: with a pointed head (see Fig. 1, *1*, *3*, *5*, *7–14*; 2, *1*, *11*, *12*) and "round-headed" (see Fig. 1, *2*, *6*; 2, *2–4*, *6*). The head of one of the busts was partially destroyed; hence, its shape is indeterminable (see Fig. 1, *4*). One of the figurines is noteworthy: its head is significantly large, while the body is shown only by a fragment of the shoulder girdle (see Fig. 2, *1*).

Heads (Fig. 3). These are the intentionally produced images of separate heads with detailed facial features. Three images show modeled necks (Fig. 3, *3*, *4*, *6*). The images are 3–12 cm high, 4–7 cm on average. By the design of the upper part of head, four types have been distinguished: 1) pointed head (Fig. 3, *3–5*, *7*, *8*), in two cases, the lower part of head is also pointed (Fig. 3, *7*, *8*); 2) heads with two "spikes" (Fig. 3, *2*), an additional design feature is two protrusions in the lower part of the head, which are compositionally symmetrical with the "spikes"; 3) heads with a number of protrusions ("crown") on top (Fig. 3, *6*); 4) with a flat top (Fig. 3, *1*), an additional design feature is two elongated "spikes" in the lower part.

Relatively full anthropomorphic figurines (see Fig. 2, *5*, *7–9*). These images show not only modeled heads, necks, shoulder girdles (sometimes also arms, see Fig. 2, *5*), but also legs. By the design of the upper part of the head, only one type can be distinguished—with a pointed head (see Fig. 2, *9*). Two figurines show conventionally modeled heads, with their facial features not visible. There is a figurine with a missing head. The body might show horizontal notches. The height of the figurines ranges from 6.5 to 14.5 cm.

Masks on sticks (after (Kardash, 2009: 188; 2013: 200)) (Fig. 4). The iconography is distinguished by the absence of a body (there are no features of head, neck, shoulder girdle, or legs). The masks are carved on planed sticks. In four cases, the sticks are deliberately pointed or straight in the lower part. All images in this category belong to one type—that with a pointed head. The only relief facial features are brow-lines and nose. Some sticks bear horizontal notches below the masks. The items exhibit great variability in size: from 3 to 27 cm. The height of the majority of the products is ca 10–11 cm. By the number of depicted masks, two types have been distinguished: one-faced (Fig. 4, *3–6*) and multi-faced (Fig. 4, *1*, *2*). In one case, five masks are located vertically on one side of the stick; in the other, two masks are located symmetrically on the opposite sides of the stick.

Dubious (bearing anthropomorphic features) (Fig. 5, *1–4*). This category includes four items without a morphologically convincing set of anthropomorphic

*We are grateful to A.V. Vishnevsky, Senior Researcher at the Sobolev Institute of Geology and Mineralogy SB RAS, for identification of the rock.

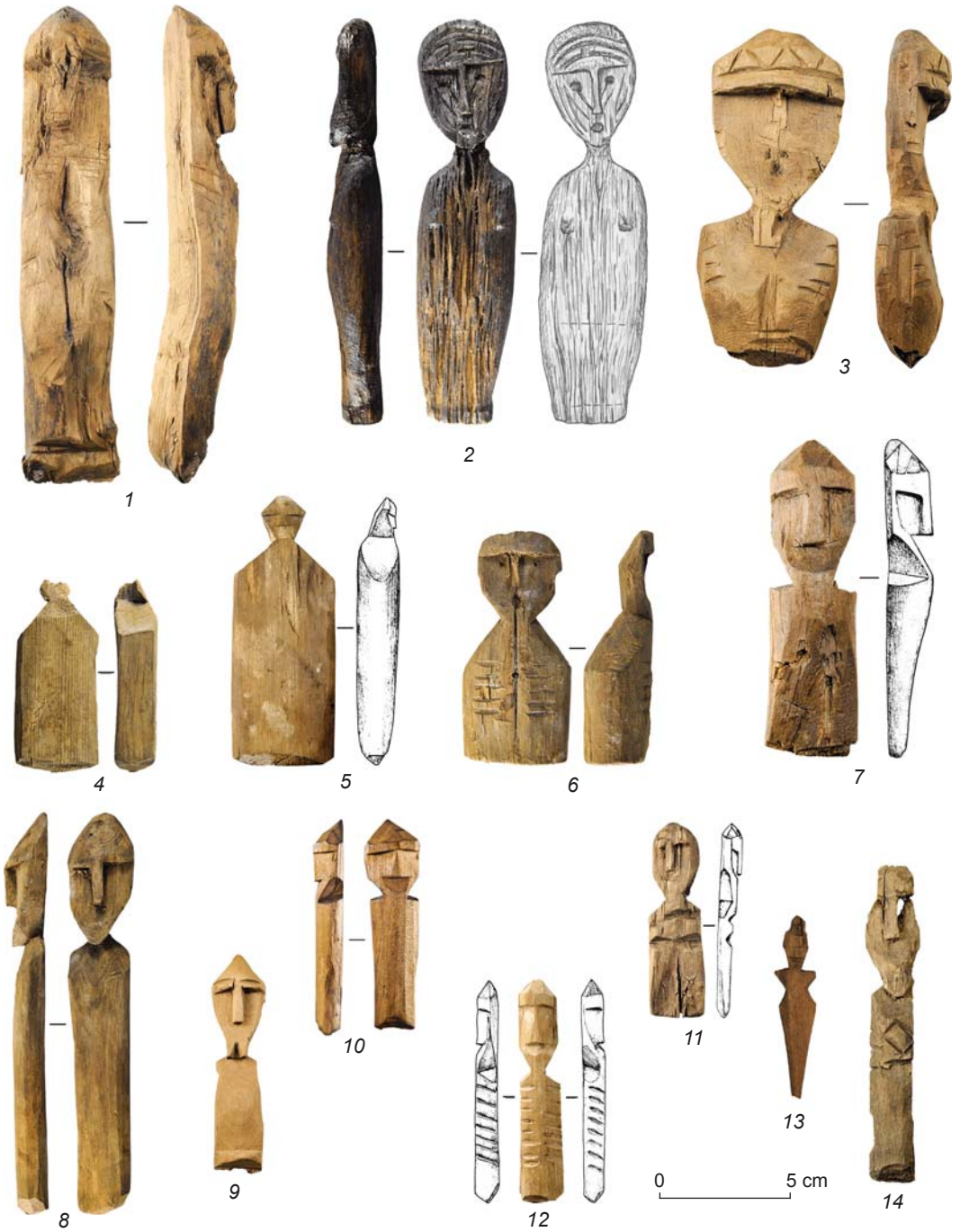

Fig. 1. Busts.
1, *11*, *12* – layer dated to the second half of the 16th century; *2*, *3*, *13*, *14* – layer from the first half of the 16th century; *4*, *9* – layer from the 17th century; *5*, *6* – layer from the mid-17th century; *7* – layer from the early 17th century; *8*, *10* – layer from the first third of the 16th century.

features. Nevertheless, these images display certain signs of modeling the head (sometimes, arrow-shaped) and the shoulder girdle. The morphologically close images are apparently those of souls of the dead from the 19th-century burials in the Lower Ob region (Murashko, Krenke, 2001: Fig. 150, *1*, *2*).

Chronology and location of anthropomorphic images

The dendrochronological analysis has shown that the dwellings containing the figurines were built in the range from the early 16th to the mid-18th century (Garkusha,

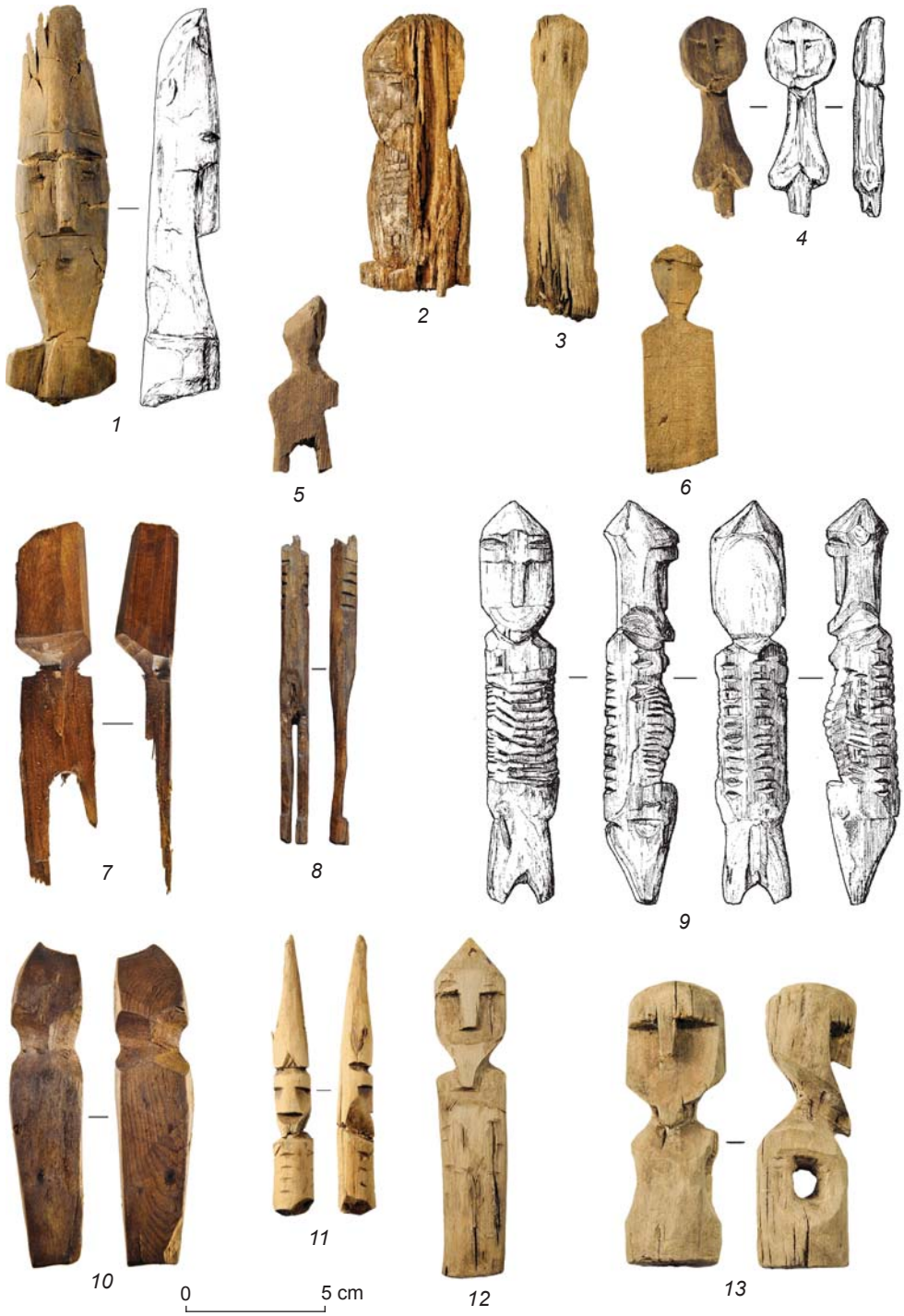

Fig. 2. Busts (*1–4*, *6*, *10–13*) and relatively full anthropomorphic figurines (*5*, *7–9*).
1, *9*, *11* – layer from the first half of the 17th century; *2* – layer from the second half of the 17th century; *3*, *5*, *12*, *13* – layer from the first half of the 16th century XVI; *4*, *8* – layer from the first third of the 16th century; *6*, *10* – layer from the late 15th to early 16th century; *7* – layer from the second half of the 16th century.

2022). The dwellings were constructed in tiers of various heights. The dates of wood samples from inter-dwelling space generally correspond to the chronology of a specific building horizon containing several dwellings. The derived dates establish a chronological link to the places of origin of the figurines in particular sections of the inter-dwelling cultural layer. These chronological estimations are not applicable to the figurines discovered on the slopes

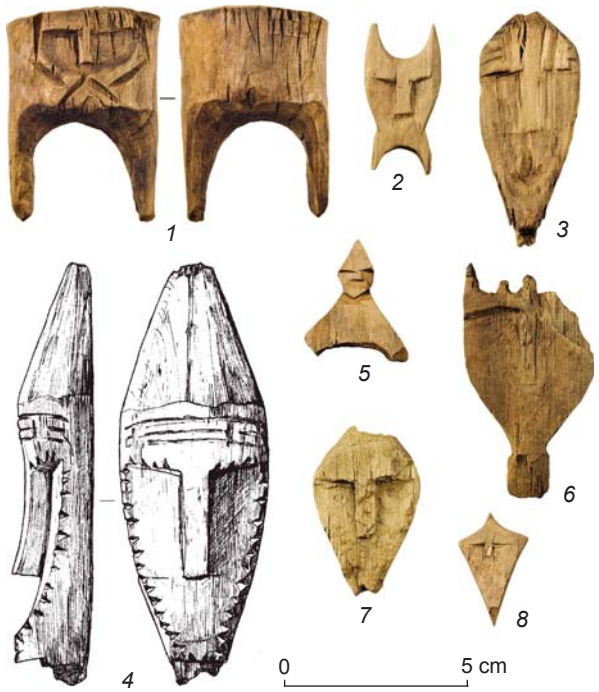

Fig. 3. Heads.
1 – layer from the 16th century; *2* – layer from the first half to mid-17th century; *3*, *5*, *7*, *8* – layer from the first half of the 16th century; *4* – layer from the second half of the 17th century; *6* – layer from the 16th–17th century.

of the hill containing the site, because their position is obviously random (in the analyzed sample, only one figurine comes from the slopes).

Any direct extrapolations of the dates of the buildings to the context of discovery of the figurines are incorrect owing to the arbitrary accumulation of the filling of the destroyed dwellings. The leveling of the area for new construction over the destroyed buildings was carried out by piling up a layer of mixed small woodworking residues (chips, etc.), which were the main structural element of the cultural deposits. Obviously, the fill material originated from the areas outside the dwellings. In such a situation, the inclusion of items in the filling may be accidental.

Chronological references of areas of infill containing artifacts are reasonably acceptable when the item is deposited between the dated tiers of various structural elements (for example, planking) or near the level of a wooden floor. If the floor of the dwelling is a section of cultural layer not covered with wood, then the attribution of the artifact to the corresponding building is conditional. An additional argument for establishing a reliable upper chronological limit of the layer containing the item is the date of the overlying structure. The overwhelming majority of the figurines under study were recovered from a clear archaeological and architectural context, with a chronological reference to the sections of the containing layer. More than a third (38 %) of the artifacts were recovered from inter-dwelling space; the rest were found in buildings classified as residential owing to the presence of a fireplace. The number of figurines found in the dwellings, regardless of their size, is small: usually one or two (with the exception of building 7/2). Some buildings did not yield any figurines.

The relative architectural integrity of the interior layouts of the dwellings makes it possible to evaluate the spatial distribution of the items in the room. First, it

Fig. 4. Masks on sticks.
1 – layer from the second half of the 16th century; *2* – layer from the 17th century; *3*, *5* – layer from the 16th century; *4* – layer from the middle to second half of the 17th century; *6* – layer from the 16th–17th century.

Fig. 5. Wooden figurines of the "dubious" category (*1–4*), and items made from other materials (*5–7*).
1 – layer from the 16th century; *2*, *3*, *7* – layer from the first half of the 16th century; *4* – layer from the second half of the 16th century; *5* – layer from the first half of the 18th century; *6* – layer from the 17th century.

concerns large houses, where the main structural elements of spatial organization are clearly visible: the area in front of the entrance, bunks along the perimeter of the dwelling or along its side walls, the central part of the room, the area adjacent to the hearth, etc. In small residential buildings, for example, the availability of bunks or wooden floors is not reliably identified.

In a number of cases, the lack of adequate stratigraphic markers between adjacent tiers of buildings prevents reliable attribution of items to a certain dwelling. This situation is due to the fact that tiers of new buildings of the same type arose directly on the ruins of the previous constructions, with a slight variation in the boundaries. In this regard, the "complex of buildings" category was introduced, which defined a combination of artifacts from different stratigraphic levels of a conventionally identified macro-structure. The tiers with the most clearly identifiable remains of structural elements of buildings have been regarded as upper and lower boundaries of the complex. The relevant chronology was established based on the results of dendrochronological analysis.

The complex of buildings 7/1–7/2*, existing from the early 16th to the beginning of the second third of the 18th century, revealed the greatest number of sculptures (21 spec.). The tiers of the complex are formed by frame-and-post dwellings identical in their design and interior space organization. Similar buildings have been recorded, in particular, during excavations of Fort Nadym (Kardash, 2009: 56–57). The main features of the buildings are as follows: a fenced central heated room; an open hearth in the center; a "gallery"—a passage formed by the external walls of the dwelling and the fencing of the central room. We consider the long use of the complex of buildings 7/1–7/2 as a possible explanation of the presence of the largest number of sculptures here. Among these, 18 items are associated with the early building 7/2 used mainly in the 16th century.

Anthropomorphic figurines occur all over the area of dwelling 7/2 (Fig. 6). At the same time, some of them were associated with the areas traditionally connected with ritual ceremonies**, or were included into collection of items intended for the performance of various rituals. One of the sacred zones is the hearth—the object of special treatment and ritual actions in the Ob Ugrians. The hearth has the form of a wooden rectangular frame with a marked fire pit and a small "utility" compartment. In the latter, along with household utensils, items for ritual purposes were found: wooden zoo- and ichthyomorphic images, and figurines for playing *tos-cher-voi*. There was also an anthropomorphic sculpture here (see Fig. 1, *14*).

Another cluster of items was found in the "gallery" area located opposite the entrance to the dwelling. This included a birch-bark mask, a large wooden model of a broadsword, votive arrowheads, the parietal part of a deer skull, and two anthropomorphic images (see Fig. 2, *12*, *13*). Two more figurines were found in the immediate vicinity of the cluster (see Fig. 2, *3*; 5, *7*), which allows us to combine them into a single unit. One of the items is a fragment of a silhouette made of iron. This set could initially have been stored in some kind of container such as a birch-bark box or canvas bag (later, Russian chests were used for this purpose) and pertain to family attributes associated with the veneration of heroic ancestors and the cult of the bear (see, e.g., (Kannisto, 1958: 314)).

*In 2012–2016, a new continuous numbering was adopted in recording new objects.

**I.N. Gemuev developed a scheme for the vertical and horizontal division of living space in the Ob Ugrians in the 17th–20th centuries. The main sacred elements of a dwelling were entrance, hearth, attic, cellar, and a wall opposite the entrance with adjacent upper bunks or a corner shelf for arranging the cult attributes of the family (Gemuev, 1990: 23–28).

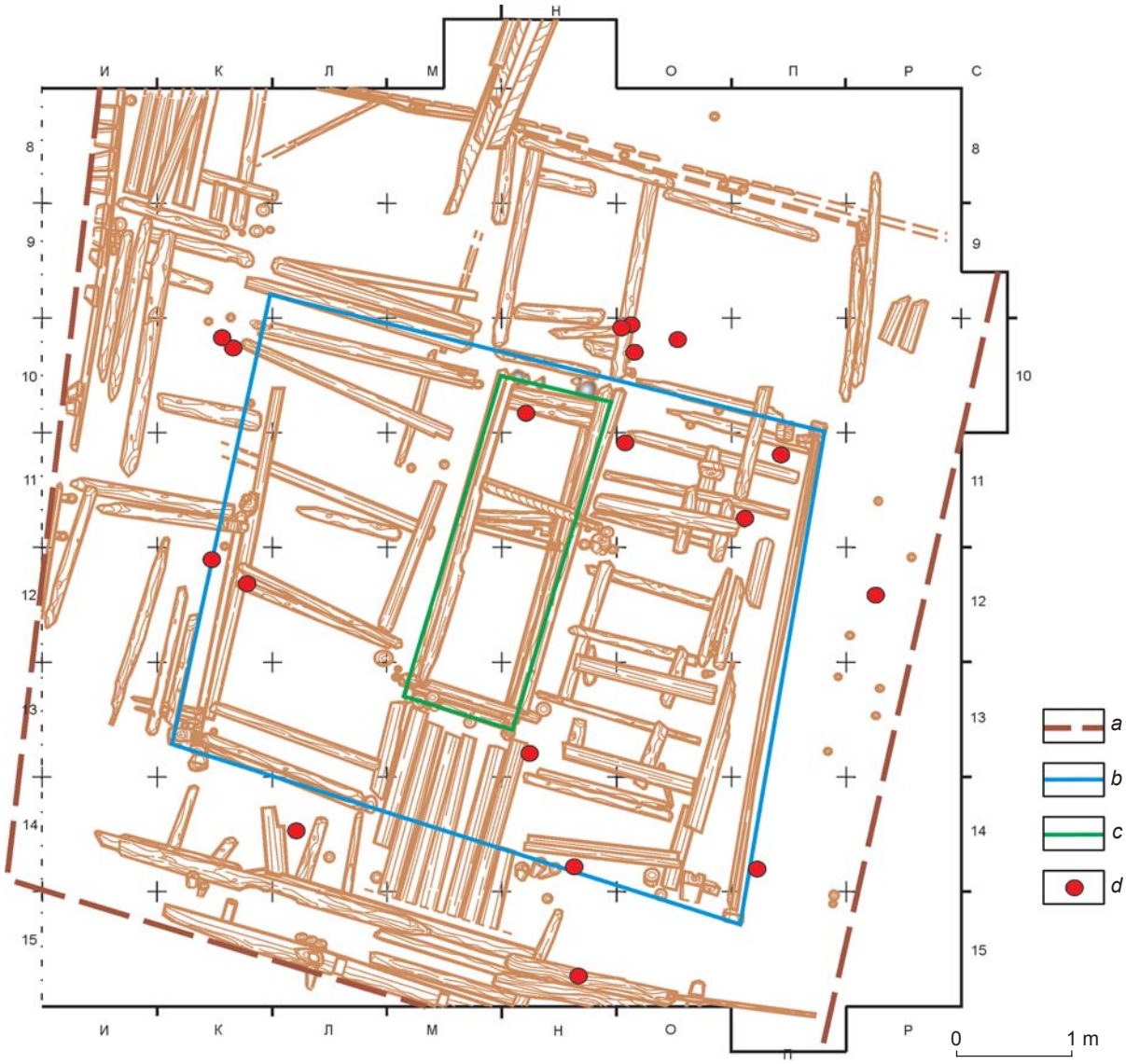

Fig. 6. Scheme of arrangement of the sculptures in dwelling 7/2 (the 16th century).
a – external boundary of the dwelling; *b* – boundary of the central room; *c* – hearth area; *d* – locations of figurines.

The indicated part of the "gallery" also revealed other ritual items or those close to them in purpose. Sculptures of animals, votive weapons, and many figurines for the *tos-cher-voi* game were found here in clusters of several dozen items.

In the entrance area, between the tiers of floorboards, a stick bearing five carved masks was found (see Fig. 4, *1*). Other anthropomorphic images belonging to different categories were also found in the area of building 7/2 (see Fig. 1, *1*, *3*, *7*, *11*, *12*; 2, *5*, *9*; 3, *3*, *5*, *7*, *8*; 4, *1*; 5, *2*).

The discoveries of figurines *in situ*, in a specially designated place near the wall opposite the entrance, were reported from the contemporaneous dwellings in other "Ostyak" towns. In particular, the figurine from building 3 of the trading quarter of the Polui promontory fort* was found in a small rectangular pit planked with the boards used for bunk construction (Kardash, 2013: 201).

Items associated with building 7/1, which dates back to the second half of the 17th century (see Fig. 1, *5*; 3, *2*; 4, *4*), were found in various parts of the "gallery" and the main room. Only one anthropomorphic image—a figurine made from a concretion (see Fig. 5, *5*)—was found in the log building 7 (built at the beginning of the second third of the 18th century), which was the latest cons truction of the complex under consideration. The figurine lay

*According to the dendrochronological findings, the building was used throughout the 16th century (Goryachev, Myglan, Omurova, 2013: 374–375).

between the boards of the bunks arranged along the wall opposite the entrance.

Figurines were also found in other specific areas of dwellings: a wooden structure resembling a long rectangular "trough" of boards leading through a hole in the wall opposite the entrance onto the hillside. It was discovered during the clearing of building 8 in 2004–2005; the structure was interpreted by N.V. Fedorova as a drain (2006: 15).

Parallels

The collection under consideration contains specimens very similar to one another. This is a morphologically close pair of wooden figurines with elongated shoulder girdles (see Fig. 1, *4*, *5*). One more figurine, with a larger and more thoroughly prepared head, is also similar to them (see Fig. 1, *6*). These items were found in a small area in the layer attributed to the 17th century. Two head images show similar appearance, in which the edges of facial parts are rendered with notches. One artifact (see Fig. 3, *4*) was discovered in the area adjacent to building 7/1; the other was recorded among the materials from the first stage of field research at the site (Istoriya Yamala, 2010: 216).

Certain parallels in the specific design of individual elements of the images are found among the materials from other old towns. In particular, the figurines from Ust-Voikary (see Fig. 1, *9*) and Nadym (Kardash, 2009: 273, fig. 3.77, *7*) show a similar design of the chin: it is marked by a protrusion divided into two parts by a deep vertical notch. The relatively full figurine executed in the extremely stylized way also finds its parallels (see Fig. 2, *7*). The images of souls of the dead from the Lower Ob region cemeteries of the 19th century show similar forms (legs and head are marked, but facial features are not shown) (Murashko, Krenke, 2001: Fig. 149, 150, *3*, *4)*.

An item from the "head" category, with an unusual shape, has been classified as a fragment of some kind of product (see Fig. 3, *5*). Its configuration resembles the top of handles decorated with a mask from the Polui promontory fort (Kardash, 2013: 244, fig. 3.26, *1, 4*). However, the Polui items are made of horn and are more robust. Perhaps the Ust-Voikary artifact is an imitation of such a handle.

In 25 % of the figurines, the body is decorated with vertical rows (usually two) of short notches placed close to the sides. There is a popular hypothesis that the rows of notches symbolize human ribs (Ivanov, 1970: 25, 54). This interpretation is possible when the rows are arranged in that way, but their different position makes it doubtful. For example, one of the figurines shows the notches made in the "belly" area (see Fig. 1, *3*); the other bears the rows of notches tightly covering all sides of the torso (see Fig. 2, *9*).

In a number of images, the notch ornament is complemented by a diamond-shaped sign (in one case, with the inserted second diamond) located in the middle part of the body. It occurs on both anthropomorphic and zoomorphic figurines. This symbol has been recorded on oriental silver bowls with images of people and animals at least since the medieval period (Spitsyn, 1906: Fig. 7, 9, 22, 25). According to the ethnographic data on the Ob-Ugric populations, the diamond on anthropomorphic images provides a certain semantic status (a sign of sacredness, a symbol of vitality) (Ivanov, 1970: 25, 41; Gemuev, Sagalaev, 1986: 19; Baulo, 2016: 68).

Only one figurine was identified as a depiction of woman (see Fig. 1, *2*). Its facial part is rendered with carved lines along the face outline. Perhaps this motif conveys make-up or a tattoo. The figurine was discovered in one of the small buildings of the early 16th century. No parallels are known to this artifact.

The mask with a "crown" (see Fig. 3, *6*) has analogs in medieval bronzes of the Middle and Lower Ob region (Baulo, 2011: 72). As a rule, "crowns" have three protrusions topped with zoo- and anthropomorphic images. In our specimen, the protrusions are damaged, but judging by their density, there were five or six of them. The item was discovered in the inter-dwelling space, in the layer from the 16th–17th centuries. This anthropomorphic figurine is semantically close to the image with the front part of its flattened headdress rendered with three (the fourth is marked) cut out triangles (see Fig. 1, *3*). On the one hand, the motif can be interpreted as a way of conveying a three-rayed "crown", on the other, it can be considered as a grid motif characteristic of bronze tiaras found at the Kulai and Parabel cult places. N.V. Polosmak and E.V. Shumakova (1991: 16–18) believe that such tiaras could have decorated wooden idols of the Ugrians.

A peculiar miniature sculptural image of a head was found in the central room of building 7/1, in the layer from the first half of the 17th century (see Fig. 3, *2*). The upper and lower flat ends of the artifact bear pairs of pointed protrusions at their sides. Among the images of representatives of the Ugric pantheon, found in sanctuaries (mainly Mansi), both anthropomorphic figures, with their heads crowned with horn-like protrusions, and anthropozoomorphic ones have been occasionally found. In a similar way are rendered the ears of an eagle owl in the image of *Yipyg-oyka* ('old eagle owl'), the patron saint of one of the Mansi villages (Gemuev, Sagalaev, 1986: 10, 11, fig. 4). Cone-shaped protrusions were noted at the anthropozoomorphic figurine found at the sacred site of Shchakhel-Torum (Gemuev, 1990: 136, fig. 121, p. 137). Similarly to the above parallels, our artifact shows one of the ways of depicting an imaginary creature combining the features of a human and an animal (probably, an ornithomorph).

Planed long sticks with masks form a special category (see Fig. 4). There could be several masks located on different parts of the stick. Materials from other "Ostyak" towns contain figurines with two or three masks rendered in a traditional way, vertically (Kardash, 2009: Fig. 3.78, *3*; 2013, fig. 3.51, *8*). Among the Nenets, sculptures with seven masks were widespread (Ivanov, 1970: 73–77). More robust figurines with seven faces (*yalyani*) (about 1 m high) have also been reported from the northern Khanty (Ibid.: Fig. 18, 19). Complex compositions are also known among miniature sculptures. For example, a multi-headed figurine from Nadym is supplemented with images of several faces (Kardash, 2009: Fig. 3.77, *1*). Notably, multi-faced compositions were also depicted on various ritual items: handles of Khanty shamanic tambourines were decorated with seven masks (Baulo, 2016: Fig. 123); the same is true for the Nenets tambourines (Ivanov, 1970: Fig. 85). Eight faces are represented on the ledge of a plank item from Nadym, interpreted as a shelf for cult items (Kardash, 2009: Fig. 3.75, *2*).

Anthropomorphic figurines forged or cut from sheet metal (see Fig. 5, *6*, *7*) are rarely found among the cult attributes of the Ob Ugrians. Noteworthy are iron figurines from an excavation at the memorable site of Satvikly (Gemuev, Sagalaev, 1986: 107, fig. 98, *1–3*). The height of a full figurine is ca 11 cm; the upper part of the other figurine is missing.

We do not know any parallels to the artifact made from a limonite nodule (see Fig. 5, *5*). It is a disk with a diameter of 6.0–6.5 cm, with a protrusion on which the mask was carved. The artifact is ca 9 cm high*.

None of the figurines was associated with remains of textile items. At the same time, ethnographic data suggest that clothing is an important element in the design of wooden anthropomorphic figurines used for cultic purposes. Clothing exerts a significant influence on the interpretation of images in domestic sanctuaries of the Ob Ugrians and Samoyeds (Baulo, 2016: 190; Khomich, 1966: 202–204). However, solitary archaeological finds from the collections of "Ostyak" towns indicate that there were exceptions in this tradition, which could be the result of evolution of the perception of anthropomorphic images. The above-mentioned figurine from building 3, in the suburbs of the Polui promontory fort, was placed in an improvised box on a piece of board covered with fabric, and then with a layer of grass; actually, the figurine was naked (Kardash, 2013: 201).

The practice of using miniature anthropomorphic sculptures without specially prepared clothing, or fabric elements imitating it, possibly had a certain spread in ancient times. The absence of such elements can be assumed at least for the figurines whose surface is mostly covered with notches (possibly, for conveying outer fur clothing), and for multi-faced images. An argument in favor of the archaic nature of this approach to the design of sculptures (without prepared clothing) may be wooden and horn anthropomorphic figures from the Ust-Polui sanctuary (1st century BC to 1st century AD). The figurines are made in quite a realistic style; some show outerwear or its elements (a fur coat with a hood, a composite belt) (Fedorova, 2014: 65, fig. 2, *6–10*).

*For more details about the artifact made from a nodule, see (Novikov et al., 2023).

Comparative analysis of the Ust-Voikary archaeological finds and ethnographic data from the 18th to early 20th century

Wooden anthropomorphic figurines from the 18th–20th centuries have been found in domestic sanctuaries of northern Khanty in the basins of several rivers: Kazym (Beloyarsky District of Khanty-Mansi Autonomous Okrug–Yugra), Polui (Priuralsky District of the Yamal-Nenets Autonomous Okrug (YaNAO)) (Baulo, 2016: Fig. 130, 131, 191–196), Malaya Ob, Synya, and Voikar (Shuryshkarsky District of the YaNAO) (Ibid.: Fig. 59, 68, 70, 80, 184–190). Similar images associated with the cult of ancestors were found in the burials of the 19th century cemetery of Khalas-Pugor (Murashko, Krenke, 2001: 64).

The ritual sculptures are subdivided into two main categories: images of family patron spirits and *ittarma*—temporary abodes of souls of the dead. The former are a bust or a full figure with arms and legs (some have a diamond-shaped sign on the chest and notches indicating ribs). Their heads are round (for female characters) or pointed; eyes, nose and mouth are carved. A characteristic feature of Ugric iconography is the T-shaped line of the eyebrows and nose. Noteworthy is the depiction of a nose in some figurines, which is not straight, but noticeably widening downward (see Fig. 1, *10*, *12*; 2, *11*). S.V. Ivanov repeatedly mentioned this feature in his descriptions of the Nenets sculptures, without endowing it with exclusivity (1970: 77–79).

Since the veneration of patron spirits is based on the cult of heroic ancestors, male images are typically shown with a conical or flat helmet on their heads. Pointed heads of the sculptures are traditionally considered the signs of male images. However, this interpretation is not always unambiguous. In different groups of the Ob Ugrians, both northern and southern, female images with heads of conical shape are known (Ibid.: 26, fig. 11, p. 28, fig. 13, p. 31, fig. 17, *1*; Kardash, 2009: Fig. 3.77, *7*; 2013, fig. 3.51, *2*). A significant part of the sculptural images from the fortified settlement of Ust-Voikary demonstrates the signs of Ugric family patron spirits (see Fig. 1, *1–3*, *6–12*, *14*; 2, *1*, *2*, *9*, *11–13*; 3, *1*, *4*; 4, *1*, *2*, *5*).

Sticks with masks are more often referred to as images of the Samoyedic affinity (see Fig. 4, *1–4*, *6*). In the collection under consideration they make up a small proportion (ca 10 %). The largest number of such images was found in Fort Nadym (44 % of the finds from 1998–2005) (Kardash, 2009: 188). Notably, two figurines (see Fig. 4, *1*, *4*) were uncovered from the filling of the complex of buildings 7/1–7/2.

Ittarma of northern Khanty in the 20th century was represented mostly by an anthropomorphic image cast of lead (Baulo, 2016: Fig. 276–278), or more rarely, made of wood (Ibid.: Fig. 279–280). Wooden ritual figurines are more typical of northern Mansi (Gemuev, 1990: 44–47, 53–55). Wooden cores for *ittarma* dominated until the early 20th century. For example, such figurines were discovered in 78 burials of the 19th century in the Lower Ob basin (Murashko, Krenke, 2001: 64–65). The *ittarma* of northern Mansi is carved from a flat wooden plate in the form of a bust with the head. These features make it possible to attribute six images from Ust-Voikary to this category (see Fig. 1, *4*, *5*; 2, *3*, *6*, *7*; 5, *2*). Most of them were found in dwellings, which correlates well with the tradition of the Ob Ugrians to keep *ittarma* at home for a certain period of time (different for different local groups), after which, in most cases, the souls of the dead pass into the category of ancestral spirits protecting the family (Gemuev, 1990: 206–212).

Replacement of the wooden *ittarma* by the lead ones in the northwestern Siberia in the 20th century can be explained by the import of shot during the transition to firearms in hunting. In general, it can be noted that the sizes of idols associated with domestic sanctuaries became larger in the 18th–20th centuries than those found at the Ust-Voikary fortified settlement.

Conclusions

One of the results of the study of archaeological sites with the permafrost cultural layer was the accumulation of a corpus of sources on traditional sculptures of the peoples of northern regions of Western Siberia in the Middle Ages and Modern Age. The use of a dendrochronological approach in age estimations of constructions at Ust-Voikary fortified settlement made it possible to establish the lower boundary of existence of wooden anthropomorphic sculptures at the turn of the 15th–16th centuries. Analysis of the figurines under study has shown that as early as that time, Ugric populations in northwestern Siberia used a certain set of stylistic techniques known from sculptural images of an ethnographically modern period. Among them, noteworthy are vertical rows of notches on lateral sides of the body, and representation of a diamond-shaped sign. The presence of such elements on the figurine endowed it with a sacral status.

The small size of the figurines (mostly not exceeding 15–16 cm) and their location in the dwellings' interior areas indicate that the uncovered items are attributes of domestic sanctuaries. According to their purpose, they can be subdivided into two main groups: images of family patron spirits, and *ittarma*—temporary abodes of souls of the dead. Most sculptures follow the tradition of Ob-Ugric art; others can be attributed to Samoyedic art. The occurrence of sculptural images associated with both the Ugric and Samoyedic populations in close proximity to one another is typical of all the studied northern "Ostyak" towns.

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A.Y. Mainicheva
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: annmaini@gmail.com

Russian Orthodox Churches "Under the Bells": Semantic Features and Origin of the Worldview

The religious foundations underlying the construction of Russian Orthodox churches "under the bells", and the meaning and role of this notion, are analyzed with reference to the traditional worldview. Architectural features of such churches are described. They belong to a rare type, and have been constructed in Russia from the 14th century to the present time. Their multiple meanings, influenced by Byzantine and European traditions, related to the key Orthodox notions, are analyzed. The most basic of these was the idea of the ladder, symbolizing spiritual growth, as evidenced by dedication of churches "under the bells" to the Stylites, to preachers developing key Orthodox notions, and to converts engaged in spiritual maturation, as well as to miracles believed to influence human life in a profound way. Dedications to miracles and miraculous icons, associated with military glory, and to canonized warriors, patrons of the military, are based on the idea of the victorious and life-giving cross. The image of the bell as a divine messenger is embodied in the tradition of placing bells right above the liturgical space, making perception of the "voice of God" by the flock more direct. A conclusion is reached that the pillar-like edifices of churches "under the bells" represent the most meaningful elements of the Russian worldview, marking the Orthodox cultural landscape, whose central idea is that of spiritual maturation and triumphant Christian faith.

Keywords: *Churches "under the bells", semantics, worldview, symbols, cultural landscape, Orthodoxy, dedication of the altar.*

Introduction

The traditionality of Russian Orthodox church buildings is a fundamental research issue associated with various material and spiritual aspects of culture. As cult buildings and places of worship, churches constitute an integral part of the cultural landscape, which provides the materialized historical basis for a specific ethnic and cultural area. As religious institutions, churches embody spiritual and ethnic core of historical cultural tradition of people. Church buildings play an important role in shaping the worldview of ethnic communities by setting people's strategies and behavior patterns. All this forces us to address carefully specific aspects of the emerging and functioning of various types of churches. The typological diversity of Russian Orthodox churches includes some rare types, such as churches "under the bells", which have a belfry level. This article is the first comprehensive study of the spiritual and religious principles behind the creation of Russian churches "under the bells", based on a specially developed author's methodology that makes it possible to analyze the data taking into account not only architectural features of churches, but also their altar dedications. The array of information about churches "under the bells" was assembled from the author's field

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materials, published sources, the database "Churches of Russia" (http://temples.ru), Sobory.ru, collections in the Shchusev State Museum of Architecture, and the Corpus of Architectural Monuments and Monumental Art of Russia (http://svodokn.ru/).

Churches "under the bells" in their historical context

Churches "under the bells" show some architectural features that unite them into a separate type known only in Rus and Russia. Regardless of the building material of walls or style (Moscow style, or imitations of Western Baroque, Classicism, Eclecticism, or Russian-Byzantine style), these have a compact area, a pillar-like appearance, and a division into levels. The level of the bells is located above the main space of the church, directly below the dome. Such structures can be considered the predecessors of hipped churches (Wagner, 1995: 23; Istoriya…, 1994: 311). Many churches "under the bells" are well known. The list of them, although far from being complete, gives us a general idea of their altar dedications.

The first church "under the bells" was the Church of St. John Climacus in the Moscow Kremlin, built in 1329 and rebuilt as the bell tower of Ivan the Great in the 17th century (Ukazatel…, 1916: 18–19). In the 15th–17th centuries, the following churches were built: the church dedicated to the Descent of the Holy Spirit in the Trinity-Sergius Lavra, that dedicated to Archangel Gabriel (later known as St. George's Bell Tower) in Kolomenskoye, two churches in the bell tower of the Novodevichy Convent in Moscow (one under the bell tower, dedicated to Sts. Barlaam and Joasaph, the other on its middle level, dedicated to the Holy Apostle John the Theologian (Ibid.)), the church dedicated to the Crucifixion of Christ in Aleksandrovskaya Sloboda (Svod pamyatnikov…, 2004), that dedicated to the Annunciation in the Ferapontov Monastery, that dedicated to Archangel Gabriel in the Kirillo-Belozersky Monastery, that dedicated to the Three Hierarchs in the Prilutsky Monastery, that dedicated to the Holy Prophet Elijah in the village of Teykovo (Ivanovo Region), and that dedicated to the Ascension of the Lord in the Snetogorsk Convent in Pskov.

In the 18th century, there appeared the church dedicated to Symeon the Stylite in the Moscow Danilov Monastery above the Holy Gates, the gate church dedicated to Sts. Zechariah and Elisabeth (Antonova, 2016), and the church dedicated to the Tikhvin Icon of the Mother of God above the Holy (Northern) Gates of the Moscow Donskoy Monastery.

In the 19th century, the churches of St. John Climacus (Donskoy Monastery) in Moscow, the Holy Martyr Youth Maximilian (later known as the "Great Chrysostom") in Yekaterinburg, the Holy Warrior Theodore Stratilates at the Menshikov Tower in Moscow, and the Exaltation of the True and Life-Giving Cross of the Lord in the village of Vozdvizhenskoye near the Trinity-Sergius Lavra were built.

In the late 20th century, active construction of churches recommenced after a long break. In 1995–2006 and 1999, two churches were built dedicated to the Holy Martyr Grand Duchess Elisabeth in the village of Opalikha in the town of Krasnogorsk in Moscow Region, one dedicated to St. Innocent, Metropolitan of Moscow in Beskudnikovo in Moscow (1997–2005), and one to the Life-Giving Holy Trinity in the village of Ershovo in Odintsovsky District of Moscow Region (1999).

In the 21st century, churches "under the bells", dedicated to St. George the Victorious in the Donskoy Monastery (2000) (Vostryshev, Rogozina, Svetozarsky, 2005: 54–55), St. Alexis, Metropolitan of Moscow in the village of Toporkovo in Moscow Region (2001–2002), Great Martyr Panteleimon the Healer at the Central Military Clinical Hospital of the Federal Security Service of the Russian Federation in Moscow (2003–2004), St. Sergius of Radonezh and Holy Martyr Great Duchess Elisabeth in Yekaterinburg (2007–2014), and Holy Martyr and Warrior Victor of Damascus in the city of Kotelniki in Moscow Region (2009–2011) were built. There are plans to build a church dedicated to the Prudent Robber Rakh in St. Petersburg.

Siberian churches "under the bells" are much less known. In the Irkutsk Diocese, in the 18th–19th centuries, churches with one of the altars under the belfry level were built. An example is the church of Sts. Procopius and John, the Ustyug Wonderworkers (1740–1767), with the altar dedicated to Archangel Michael on the lower level of the bell tower (Kalinina, 2000: 137–138). The church of the Intercession of the Most Holy Theotokos and Presentation of the Lord (early 19th century) had three altars: the altar under the bell tower was dedicated to Holy Martyr Hermolaus of Nicomedia (Ibid.: 134–135). However, owing to the placement of altars under the level of the bells, they cannot be fully considered traditional churches "under the bells". In terms of their structural features, only two churches of the Irkutsk Diocese—the wooden Transfiguration church (in the camps) and the stone church of St. Innocent—can be described as churches "under the bells". The church of the Transfiguration of the Lord was built in the area of military camps in the 1880–1890s (Ibid.: 148). It was a centric tiered building with a tent-like ending of the belfry level. A mission center and church dedicated to St. Innocent, Bishop of Irkutsk, appeared in 1884–1890 in the village of Alar, where a Buddhist datsan functioned in the 19th century (Ibid.: 169).

The ladder as a pillar of spiritual perfection

The analysis revealed several closely interrelated features in the architectural structure, placement, and reasons for building and dedicating churches "under the bells", which were associated with ideologically rich religious mythologemes. Noteworthy is the dedication of the first church "under the bells" to St. John Climacus, called John of the Ladder from the title of his work "The Ladder of Divine Ascent" ("The Ladder of Paradise") (see (Prepodobniy Ioann Lestvichnik…, 2013)). In his book, the path of ascending the "ladder of spiritual perfection" is described as the ideal of monastic life. The image of the ladder is associated with the need for perfecting on the path to God and gradual ascent along the way as if taking steps. One of the many examples of the image of a ladder in Holy Scripture as a path to the palace of God is the vision of Jacob: "And he dreamed, and behold a ladder set up on the earth, and the top of it reached to heaven: and behold the angels of God ascending and descending on it. And behold, the Lord stood above it… And Jacob awaked out of his sleep, and he said, 'Surely the Lord is in this place; and I knew it not'. And he was afraid, and said, 'How dreadful is this place! This is none other but the house of God, and this is the gate of heaven'" (Gen. 28:12–17). In the Patristic literature, the idea of gradual adoption of virtuous life is illustrated by the argument that first one "must place their foot upon the first steps and from there always mount upon the next, until by a gradual progress they have ascended to the height attainable by human nature" (see (Svyatitel Vasiliy Velikiy…, 2014: 9)) (Fig. 1). According to some testimonies, the dying words of N.V. Gogol were: "Ladder, give me a ladder" (see (Yakutskiye eparkhialnye vedomosti, 1889: 384)). Is not it possible that he meant the ladder of spiritual development, which leads to heaven?

The idea of monastic asceticism is clearly manifested in the iconography of images of Sts. Symeon, Alypius, and Daniel the Stylites. Icons with the images of the Holy Stylites have been painted since the times of early Christianity. The tradition of their creation came to Rus through Byzantium ca the 13th century. A Stylite with a scroll, cross, or book was depicted in monastic garb, on a pillar, which in some cases had a ladder interpreted as a symbol of ascension from the teaching of John Climacus (Simeon Stolpnik…, (s.a.)). This is how iconography connects the images of a pillar and ladder. The reason for placing pillar-like churches (not necessarily with altars dedicated to the Holy Stylites) in monasteries becomes clear. This emphasized the idea of the ascetic feat of the monks.

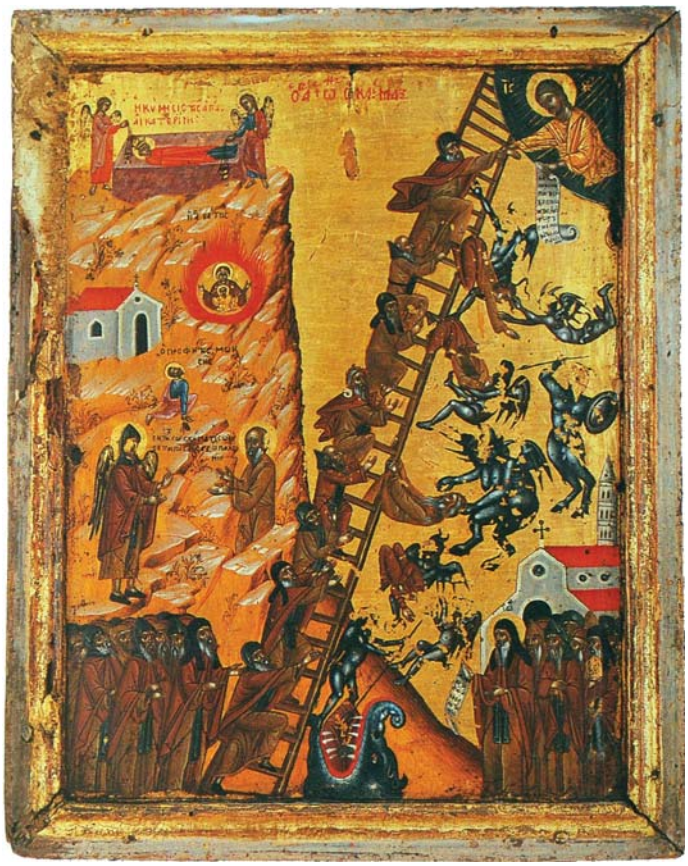

Fig. 1. Ladder. Icon (Akafistnik…, (s.a.)).

The scope of this article does not make it possible to mention all reasons for the dedication of each church "under the bells". The reader may consult the rich literature on this issue, including the lives of saints, patristic treatises, etc., and we will provide only a general summary. The idea of spiritual perfection and participation in the supreme power was reflected in dedications of churches "under the bells" to miraculous events, such as the Descent of the Holy Spirit, the Ascension of the Lord, and the Transfiguration of the Lord, as well as to saints who acquired the true Christian faith, believed in a miracle, or were engaged in missionary work, dissemination, and interpretation of the basic tenets of Christianity (for example, altars dedicated to Sts. Barlaam and Joasaph, St. Zechariah and Elisabeth, the Holy Apostle John the Theologian, the Three Holy Hierarchs (Sts. Basil of Cappadocia, Gregory of Nazianzus, and John Chrysostom), the Holy Apostles Peter and Paul, St. Nicholas the Wonderworker, St. Prince Vladimir Equal-to-the-Apostles, the Holy Martyr Hermolaus of Nicomedia, St. Alexis, the Metropolitan of Moscow, St. Sergius of Radonezh, or St. Innocent, Bishop of Irkutsk).

The motif of a pillar was typical not only for churches "under the bells", but also for tiered and hipped churches. Moreover, according to the conclusion of M.E. Vengerova, who analyzed churches of the 10th–15th centuries, their architecture embodied the image of a pillar—intangible, formed by the internal space of the building, extending from the ground to the central point of the vault of the central dome, and ending with "representation of God, round in plan view, like the image of heaven descending to earth, that very 'presence of God on earth' about which the Holy Fathers spoke" (2018: 29–30). The theological marking of churches began with the "life-giving pillar" (Ibid.: 23, 36–37). The pillar is somehow represented in the architecture of churches of various types, which indicates its importance from an ideological perspective.

The Cross as a life-giving, victorious pillar

What are the semantics behind the concept of the "life-giving pillar"? To answer this question, we need to recall that in Byzantium, during the Iconoclasm, the Cross, symbolically representing the resurrected Christ, was depicted in the central dome of churches. After the victory of icon veneration, the Cross was replaced by the image of the Pantocrator (Vereshchagina, 2019: 441). This tradition compels us to turn to the concept of the Life-Giving Cross—the main Christian relic whose visualization suggests a pillar-like structure. According to Christian doctrine, the Cross upon which the Savior was crucified, is the Life-giving True Cross (Ibid.: 438). Churches of the Crucifixion and Exaltation of the Cross were dedicated to it. The image of the Cross was also reflected in the dedication of the church of the Prudent Thief Rakh who, according to the legend, was crucified at the right hand of Christ and believed in Him before death.

In the Byzantine tradition, veneration of the Cross was associated with an important event in Christian history—the miraculous vision of the Emperor Constantine the Great before the upcoming battle. The sign of the Cross with the inscription "By this sign you will conquer!" appeared to him, as well as Christ who commanded him to make a banner similar to that seen in heaven and to use it for protection against attacks from the enemies (Ibid.). As a result, a military banner was made in the form of four-pointed cross, which became the state banner of Byzantium. In addition, according to his Life, Constantine ordered that three crosses should be made after the image that appeared to him in a dream, that the inscription "Jesus Christ the Victor" should be placed on each of them, and that they should be set on a marble pillar (!) (Ibid.). After Empress Helena acquired the Wood of the True Cross, a part of that relic was sent to Constantinople to Constantine, who ordered to make several true crosses. One of them contained a particle of the life-giving wood and became a reliquary. It is known as the "cross of Constantine", which was kept in the Imperial Palace and was used in court ceremonies (Shalina, 2005: 133–163). It was also called the "victorious cross", since it was associated with the idea of victories of the Emperors, primarily over the infidels, and was considered a symbol of the triumph of rulers (Grabar, 2000: 55–67).

Churches "under the bells", possibly owing to the symbolism of the Cross as a bringer of victory, received dedications of altars to miracle-working icons, which granted defeat of the enemy, to miraculous events, which ensured victory or were associated with military glory, and to holy warriors, who were considered in Russian culture to be protectors and victorious patrons of the military. Examples include altars dedicated to the Tikhvin Icon of the Mother of God, the Smolensk Icon of the Mother of God, the Intercession of the Mother of God, the Annunciation, the Holy Life-Giving Trinity, the Image of Christ Not Made-by-Hands, the Holy Great Martyr George the Victorious, St. Warrior Theodore Stratilates, leaders of the angelic hosts Holy Archangels Michael and Gabriel, one of the Holy Youths of Ephesus Martyr Warrior Maximilian, and the Holy Martyr Warrior Victor of Damascus. In this regard, it is justified to build churches "under the bells" at military bases. Churches "under the bells" are also built at healthcare institutions, which have departmental affiliation with the Federal Security Service, Ministry of Internal Affairs of the Russian Federation, etc. Various and non-obvious dedications of altars of the churches should not delude us, since any church, according to the rules, is dedicated to God, and specific aspects of its consecration are related to individual issues (the wishes of those who donated to build the church, the commemorative function of a church, decisions and choice of bishops, etc.). The above-mentioned dedications, typical of churches "under the bells", correspond not only to this type of church.

There are dedications of churches "under the bells" to Old Russian Sts. Princes Boris and Gleb, and St. Prince Vladimir, Equal to the Apostles. This reveals a connection with the Byzantine tradition—the motif of the "victorious cross" of Emperor Constantine symbolized the triumph of representatives of power. Nevertheless, there may be other possible semantic suggestions for justifying the dedications in the context of the history of Orthodoxy (Fig. 2).

Ringing of bells—the "voice of God"

The main feature of churches "under the bells"—placement of the belfry level above the central part

Fig. 2. Sts. Boris and Gleb with scenes of lives. State Tretyakov Gallery, Moscow, Russia. Inv. No. 28757 (Drevnerusskaya zhivopis…, 1958: Pl. 33).

Fig. 3. Church of St. Innocent in the village of Alar (Lyubimov, 1914: 217).

of the space under the dome—also requires some discussion. The ringing of bells is the voice of the church (Proshchenko, 2011: 56), without which any Orthodox church is unthinkable. It is not for nothing that in the Soviet period, closure of churches was accompanied by the mandatory removal of their bells (Kozlov, 1994; Tosin, 2009). Bells acted as heralds of Christian values, and covered a wide surrounding area with their ringing. It was believed that an imaginary, semantically rich staircase-pillar led to the bell as the "voice of God". This was embodied in the architecture of churches "under the bells": the sound came directly from the place where the liturgy was being performed, emphasizing its significance. The image-oriented structure of churches is reminiscent of pillars as the most ancient structure for hanging bells, and everything ancient is of enduring value for religious and mythological forms of thinking.

The brief history of the appearance of bells in Rus makes it possible to identify some of the reasons for the spread of churches "under the bells" (see (Proshchenko, 2011)). In Byzantine Christianity, bells did not play a very important role. In the Russian culture, they appeared thanks to Europeans, who became the first bell casters on Russian requests. In Old Russian chronicles, bells were first mentioned in the 11th century. In the 12th century, bells began to be cast in Rus, but this production stopped completely during the Tatar-Mongol invasion. Only in the early 15th century was bell casting revived in the northeast of the Russian State, and then in Moscow, where the "Cannon Yard", producing cannons and bells, was organized. Churches "under the bells" appeared and became widespread in the 14th–15th centuries, usually in the areas where casting production flourished and stylitism was especially revered. Churches became conductors of essential concepts, which retained their importance in the subsequent periods also in other Russian regions.

Numerous examples reveal the symbolic importance of bells for church life. Two churches may be mentioned specifically. The dedication of the Great Chrysostom or Church of St. Maximilian in Yekaterinburg not only testifies to the veneration of St. John Chrysostom, but also indicates the "golden voice" of its bells. According

to the original plan, this church building was supposed to serve as a bell tower for a larger church, but owing to the lack of funds it was built in the 19th century as a church "under the bells" with two altars (dedicated to St. Young Maximilian and St. John Chrysostom). People call the church "Great Chrysostom" not only because of its height and volume, but also because of the loud chimes of bells, which can be heard even on the distant outskirts of the city (for more details, see (Voroshilin, 1995)). The symbolism of the aforementioned church in the village of Alar is also noteworthy. Its appearance embodies the imagery associated with Christian concepts: a central dome in the form of a bell served as a symbol of the Christian message. Bells were placed under the dome, on the belfry level. This symbolism, striking in its artless straightforwardness, implied an unambiguous perception of the church by the proselyte audience as embodiment of the triumph of Orthodoxy (Fig. 3).

Conclusions

Russian Orthodox churches "under the bells" are distinguished by sophisticated semantics based on a combination of the image of bell as the "voice of God" and embodiments of the life-giving pillar—the ladder and the Cross, which reflect the ideas of spiritual perfection leading to God. Altars of churches are dedicated to the miraculous events of the Christian doctrine, which have a transformative basis (the Descent of the Holy Spirit, the Ascension of the Lord, the Transfiguration of the Lord); saints revered in Orthodoxy, who became the theorists interpreting and developing the concepts of the doctrine; and missionaries and preachers, as well as those who miraculously believed in Christ and followed the path of spiritual development. The idea of victory brought by the Cross continued the tradition of Byzantium and was embodied in the dedication of altars to miraculous events and miraculous icons associated with military glory, and to holy victorious warriors, as well as patrons of the military. The combination of Byzantine religious traditions with European practices of making and using bells, adapted to Russian culture, gave rise to typologically unique images of churches "under the bells". The concepts materialized in the buildings were isolated from notions of everyday life, and gave new semantic coloring to the picture of the Russian world. Pillar-like buildings of churches "under the bells", where the belfry levels are placed above the liturgical spaces, serve as acoustic and visual markers of the cultural landscape where the identity of the Orthodox world is formed. This identity is characterized by concepts of spiritual maturation and the triumph of the Christian faith.

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V.A. Burnakov
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: venariy@ngs.ru

The *Tree-Clan-Individual* Concept in Traditional Khakas Culture (Late 19th to Mid-20th Century)

On the basis of ethnographic, folk, and linguistic materials, most of them newly-introduced, the "tree-clan-individual" concept in the Khakas culture is reconstructed and analyzed. The status and image of the tree in their traditional mythological and ritualistic system is assessed. Notions of man and his environment were related to anthropomorphic reasoning, by which natural objects, such as trees, were endowed with human attributes. In their religious-mythological views the tree was identified with a person, with the crown of the tree being the head, the trunk being the body, branches as being arms, sap as being blood, etc. Trees were believed to be either male or female. In the traditional consciousness, human life scenarios were closely paralleled to those of trees. The vegetative code was used to refer to various psychophysical, mental, and other human phenomena. Social norms included special rules in dealing with trees, used in logging. In essence, a tree had to be dealt with like a humanlike being. In mythological thinking, felling a tree was to some degree tantamount to murder. Souls of specific individuals or groups were likewise associated with trees, so each Khakas seok (clan) had a sacred tree. It was an integral part of the burial rite. The tree, then, was a key element in the ideological structure, having a broad semiotic field.

Keywords: *Khakas, traditional worldview, tree cult, seok-clan, man, ancestor cult.*

Introduction

Structuring is a way to comprehend and appropriate the surrounding space. In the traditional consciousness, this process ultimately leads to the worldview where each object is endowed with individual characteristics. Moreover, the perception of each natural element and identification of the corresponding features in it is determined by its practical significance and benefit for the people. The nature of Khakassia is rich in forests, which have not only utilitarian, but also great spiritual and symbolic value for the local people. Therefore, it is not accidental that the tree and its image play an important role in the Khakas traditional culture.

In the worldview and ritual practices of the Khakas people, trees organize space thereby performing a structuring function. Moreover, serving as the axis of the universe, the tree both connects different worlds and personifies the model of the universe and acts as a sacral center, which is the focal point of life. Most of the traditional rituals that "ensure" interaction with the upper and lower worlds were and are still performed at a tree or at its symbols—a hitching post, pole, etc. Among the common people, veneration of the tree has reached its highest level, i.e. deification. Therefore, many popular predictions and beliefs are associated with the tree.

This topic has attracted many scholars, who have used field ethnographic and literary evidence to

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analyze various aspects of the tree cult among the Khakas people (Borgoyakov, 1969; Usmanova, 1980; Traditsionnoye mirovozzreniye…, 1988; Butanaev, 2003: 40–41; Burnakov, 2006: 18–19; and others). However, less than all aspects of this topic have been adequately studied. For example, the concept of "tree-clan-individual" (*agas-söök-kizi*) in the worldview of the Khakas people has not yet been the topic of a special study. Note that the term "concept" is understood as a mental unit enrooted in the language of the people, which reflects a set of traditional beliefs about nature, society, and man. In this article, we will specifically discuss the views linked to the associative series of "tree-clan-individual" and the related social normative and ritual practices in the Khakas culture.

Anthropomorphization of the tree and mythical "dendronization" of man

Traditional worldviews typically reveal the phenomenon of revitalization and spiritualization of nature, in particular of the tree (Khakas *aғac*). The Khakas people perceive trees as living beings, and transfer human characteristics to them. In Khakas popular mythology, this is reflected in one of their old riddles: *Chirimde chirlig, churttyg polgabyn, peer kilip, moinyma pag sugylҷykh* (*taigadan' agylgan agas*) 'In my homeland, I had land and a place to make camp. When I came here, I found myself with a rope around my neck (a tree brought from the taiga)' (Domozhakov, 1951: 65). The similarity noted between the tree and man is not at all accidental. In the religious and mythological consciousness, the process of comprehension of the surrounding world is often accompanied by drawing certain parallels and often endowing some of its objects with human features. For example, humanization of the tree is expressed in its external anthropomorphization—discerning the outline of the human body and some elements of human anatomy in it. For instance, the crown of a tree is called *agas pazy* 'the head of a tree' among the Khakas people. A tree branch is designated by the word *salaa*, one of the meanings of which is 'human finger'. The hollow of a tree and the female genital organ have identical names—*kӱӈӱr/kӱӈӱre*. The word *tamyr* has the meaning of 'blood vessel' in human and animal bodies, and 'tree root' (Khakassko-russkiy slovar, 2006: 216, 348, 434, 587). For a person in a traditional society, it seems natural to think that blood flows in the "veins" of trees, which is similar to human blood. According to a Khakas myth, when people tried to cut down a birch tree, blood flowed from it, and the tree spoke in human language; therefore, the tree became a revered object for the Khakas people (Butanaev, 2014: 113).

The anthropomorphized image of the tree is common for Khakas popular riddles, for example: *Agas arazynda akh plattyg khys odyrcha* (*pazyna khar chaap pargan tökpes*) 'a girl wearing a white scarf is sitting in the forest (a tree stump in the winter)'; *chazyda chalaas ool turcha* (*hastyrygy chokh agas*) 'a naked man is standing on the steppe (a tree with its bark removed)'; *khalbakh-khulbakh khulakhtyg, khara ninҷi chachakhtyg* (*nymyrt*) 'it has drooping ears and hands made of black beads (a bird cherry tree)' (Domozhakov, 1951: 68, 69, 71). In the mythological consciousness, a single tree corresponds to an individual, while the forest is associated with a group of individuals. A similar link appears in the following riddles: *Khan kharlap tur—khalykh chon pazyryn tur* (*childe agastarnyn' chaikhalgany*) 'the khan is angry, and all the people bow down (trees swaying in the wind)'; *kham khamnapcha, khamykh khoorai pazyryncha* (*chil, agastar*) 'the shaman performs his ritual, and all the Khongor people pray (the wind and trees)' (Ibid.: 68; Butanaev, Butanaeva, 2008: 302).

In their cultural worldview, external seasonal changes in a tree's appearance determine its human likeness. Plant defoliation is identified with a regular change of clothing and dramatic change in a person's social status. This association is reflected in the following riddles: C*haigyda khatanҷylyg, khyskhyda sabyrlyg* (*pӱrlig agas*) 'it wears a sheepskin coat in the summer and a *shabur* (a cloak made of coarse cloth) in the winter (a deciduous tree)'; *khyskhyda chokh, chaigyda pai* (*agas*) 'a poor man in the winter; a rich man in the summer (a tree)' (Butanaev, Butanaeva, 2008: 303, 321; Mudroye slovo…, 1976: 124). Another manifestation of tree anthropomorphization in Khakas folklore is the image of the autumn falling of the leaves as a dialogue between two people who personify the tree and the leaves which fall from it: "Where are you going, my little Khalba? Don't murmur, I'll come again in a year, my little Sirbetey" (Butanaev, Butanaeva, 2008: 321).

These ideas apply to both the external features of a tree and to internal qualities inherent in a person. People believe that trees have a soul and mind, the ability to communicate with each other, and even to move. Like people, they can experience deep feelings and emotions, for example, cordiality and hostility, joy and pain, shed tears and even curse a person (Burnakov, 2006: 184). Trees are often credited with the best human qualities, such as compassion, responsibility, hospitality, etc. Such ideas are reflected in the following folklore text: "A man went hunting. He decided to spend the night

near a tree. At night, he heard a bird settle on the tree and say: 'My chick is sick. Please heal it!' And the tree replied: 'How can I go to you? Can't you see, I have a guest spending the night? If I leave, there will be only bare steppe. So I cannot help you now'. It turns out that this tree was a *kham-agas* 'a shaman tree'" (Ibid.: 141).

The religious and mythological consciousness of the Khakas people reveals a reverse process of symbolic "dendronization", i.e. transferring the image of the tree to traditional everyday habits and lifestyle of people, social relationships, and directly to an individual person. For example, the word *agas-tas* is often used in the Khakas language to designate a courtyard and buildings (Khakassko-russkiy slovar, 2006: 27). It literally is translated as 'wood-stone' and unambiguously indicates the respective natural materials used for building the household structure. However, this word has a wider meaning. In the beliefs of the people, the human dwelling, such as the yurt (Khakas *ib*) is the embodiment of the image of a tree. It is known that until the late 19th century, both permanent polygonal and mobile rounded frame-type yurts were widespread among the Khakas people (Pallas, 1788: 566; Karatanov, 1884: 619). Both types of buildings were based on timber. The roofs of permanent buildings were usually covered with larch bark or birch bark. In the summer, mobile dwellings were almost completely wrapped in birch bark on the outside. In the traditional consciousness of the Khakas people, both types of buildings were associated with the tree. The idea of the "tree-house" was also embodied in the epic poems of the people:

Akh chazynyn' istinde chörip,
Altyn pÿrlig pai tirekti
Körip tapkhan anɥada alyp.
Pai tirekser pastyr-paryp,
Pidi chookhtapcha alyp-chakhsy:
"Izin'-paiyn' par polza – azyl-khal!!
Izin'-paiyn' chokh polza – chabyl-khal!"
Ÿr dee, as taa polbanda –
Altyn tirek azyl-pargan.
Alyp töreen Saiyn-Mirgen
Andar kipe-salgan anɥada.
Saiyn-Mirgen körip-turza –
Alton sÿrmezi argazyna chaiylgan,
Ilig sÿrmezi in'nine chaiylgan,
Aidan' aryg abakhai chakhsy
Anda churtapchatkhan poltyr

'Walking along the white steppe,
[On] the sacred poplar with golden leaves,
The mighty warrior fixed [his] gaze.
[Coming to] the sacred poplar,
Thus spoke the best of the mighty warriors:
"[If you] have riches, be opened!
[If you] do not have riches, be closed!"
After some time,
The golden poplar opened up.
Saiyn-Mirgen, born of a mighty warrior,
[Immediately] went inside.
Looking around, Saiyn-Mirgen sees
[With] sixty braids spread across her back,
With fifty braids spread over her shoulders,
Purer than the moon, the greatest of beauties,
It turns out that she lives there'

(Kilchichakov, 1946: 96)*

The "tree-house" association appears in the following popular riddles: *Chil tibiretpes sal tirek* (*ib/tura*) 'a sawn poplar tree which the wind will not move (a yurt/house)'; *tigeii tizik, isti khurttyg* (*ib*) 'the crown has a hole in it; the inside has worms (a yurt)' (Butanaev, Butanaeva, 2008: 309, 310, 327, 328).

Transferring the image of the tree and some of its features to a social organization and directly to an individual is the most distinctive and widespread phenomenon in the Khakas culture.

Tree – *seok* (clan)

In ethnography, sacralization of the tree in some cases has been viewed as phytolatry, which is a manifestation of totemism. In the traditional culture of the Khakas people, like many other peoples, the image of the tree is firmly associated with the genealogy and origin of the clan/person. The clan tree is associated with the person's ancestor. These views go back to an archaic myth of the Khakas people about the emergence of the world and man, where the tree appears as the progenitor of mankind. The myth speaks of the initial appearance of two birches on earth: one of them was a man (*Adam*—the father); the other was a woman (*Ymai*). People originated from their union (Katanov, 1907: 552). According to the authors of the well-known work *Traditional Worldview of the Turkic Peoples from Southern Siberia* (Traditsionnoye mirovozzreniye…, 1988: 20), behind this imagery, one can discern the supreme deities of the ancient Turkic pantheon—Tengri and Umai. The relationship between the tree and person is also expressed in Khakas folklore by the frequent use of words indicating the relationship between people, such as mother, father, brothers, etc., when the protagonists address plants (Takhpakhtar, 1970: 25; Butanaev, Butanaeva, 2008: 303, 321; Sugɥul Mirgen, 2018: 216, 226).

*Here and throughout this article the author's translation from the Khakas into Russian was translated into English by V.A. Baranov.

In the Khakas culture, family and clan interconnections and interrelationships are often described with plant metaphors. The Khakas language contains some vestiges of archaic ideas about the arboreal nature of man: the verb *tamyrlanarga* meaning 'to give a shoot, to branch' is used when speaking not only about trees and other plants, but also about a person and his clan (Khakassko-russkiy slovar, 2006: 587). This identification can be seen in one of the traditional good wishes (*algys*), where family and clan structures are directly likened to roots: "Let the moon shine before you (O people), and let the sun shine all around! Let not the vile devil turn out the sixty branches of your roots [that is, clan]!" (Katanov, 1907: 564–565). People thus say about a lonely person who does not know his ancestors and relatives: *Chilegezi chokh kizi* 'a person without roots' (Khakassko-russkiy slovar, 2006: 967). In addition, it is not by accident that the protagonist of an epic tale asks a rhetorical question that is a hint at his natural origin, lamenting his parentless childhood with the following words:

Alyp kizi chookhtapcha:
– Ya, azyraan ada pilbedim,
Abydyp, öskirgen iӌe pilbedim.
Khatyg agastyn khoolynan tÿskem me

'The mighty warrior says:
I did not know the father who raised [me],
I did not know the mother who nurtured me.
Have [I] come down
From the hollow of a solid tree'

(Khan Kiӌigei, 1958: 132).

For the Khakas people, the clan tree and clan-*seok* (Khakas *söök* 'bone') are not only interconnected, but act as key dual concepts. Identification of the Khakas people is based on seok affiliation and principle of commonality with the clan tree—*sööktin' agazy* or *chula/shula*. For example, the seok *tag khargazy* 'the Mountain Kargins' honors the larch as a clan tree. The names of the Khakas seoks contain designations of various natural objects, such as mountains, rocks, animals, birds, etc., many of which are endowed with totemic features. Yet, not a single Khakas seok has a name of a tree, which may indicate a clear separation of the concepts of seok and clan tree in the Khakas culture. However, the close and deep relationship between the seok and clan tree contributed to the fact that in the ordinary consciousness they were equally used for clan-based self-identification, sometimes even replacing each other. Half a century ago, in the everyday speech of the Khakas people, one could often hear expressions such as *pistin' söögibys tyt/khazyn'/kharagai*… '[the tree] of our seok is the larch/birch/pine…', *pistin' sööktin agazi ös* 'our clan tree is the aspen', *pistin' agazi tal* 'our [clan] tree is the purple willow', *pistin' chula/shula tyt* 'our clan tree is the larch'; *Alakhtay chony – tirek* 'the clan of the Alakhtaevs is the poplar' (Usmanova, 1980: 101–102).

The Khakas people explained the interdependence of these concepts by the simultaneity of their emergence. In the traditional consciousness of the people, the origin of the tree and clan goes back to the mythical era of the first creation. Old timers would say: *Agas pÿtkennen' söök pastaltyr* 'when trees appeared on the earth, then seoks (the Khakas clans) arose' (Butanaev, 1999: 17). It is clearly not by chance that images of the tree and bones (*söök*), a real anatomical element, are also the same in the Khakas popular riddles (Katanov, 1907: 242). The community of people associated with a particular tree was much larger, more global and, perhaps, more archaic than the seok (Usmanova, 1980: 103). Under the umbrella of a single "clan tree", such a community could include from one or two to several dozen seoks. According to V.Y. Butanaev, the following trees are most often considered sacred among the Khakas people: the birch is the ancestral tree of 25 seoks (*khaskha*, *akh pÿrÿt*, *khyrgys*, *akh sokhkhy*, *akh piltir*, *saiyn*, *akh chystar*, *khalar*, *ulug ygy*, *shush*, *ulug azhyg*, *ulug khamnar*, etc.), the larch is of 22 seoks (*saiyn*, *puga*, *tom*, *khara piltir*, *khyzyl*, *khara tayas*, *chilei*, etc.), the pine of 14 seoks, the poplar of 4 seoks (*turan*, *khobyi*, *chonmai*, *pögeӌi*), and the fir tree (*syby*, *puigan*) is of 4 seoks (*aba*, *khara sor*, *khamnar*, *khyrgys*). The purple willow was the clan tree of two seoks (*argyn*, *ygy*), the bay willow of three seoks (*kharga*, *taban*, *sug khakhpyny*), the yellow willow was of seok *saryglar*, the spruce of seok *khyzyl khaya*, the bird cherry tree of seok *tom*, the Siberian pine of seoks *khobyi* and *turan*, and the rowan tree was of seok *kiӌin'* (Butanaev, 2014: 112).

In the past, the system of societal organization by the principle of a clan tree played an important role in regulating the social life of the Khakas people. This was expressed mainly in the marriage regulations of exogamy. For example, marriage unions between the representatives of different seok trees were considered the most preferable. "When [a young couple] met, they asked each other: 'What kind of tree does your seok have?' People of the same tree could not marry, because they were relatives (Chuchunova (Chebodaeva) Daria Pavlovna, village of Ust-Kindirla)" (Archive of the Museum of Archaeology and Ethnography of Siberia, Tomsk State University (hereafter, AMAES TSU), No. 818-2, fol. 4); "A youth could not marry a girl if

she was of the same tree as he (Samrina (Tutatchikova) Olga Alekseevna, born in 1888, aal of Artanov)" (AMAES TSU, No. 682, fol. 4).

Among the people, each "tree" clan had its own specific features, which may be illustrated by the reasoning of an elderly Khakas woman: "Each clan took a tree for itself. Our clan took the *tyt* (larch), …because the tribe considered itself to be stronger and more resilient than others. This tree does not rot as quickly as the rest of the trees (Sazanakova Vera Nikolaevna, born in 1908, village of Bolshaya Seya)" (AMAES TSU, No. 681-3, fol. 22). An ironic assessment of qualities of another clan is manifested by popular jokes where the image of their clan tree often appears: "The worst of the trees is the bay willow; the worst water is plain water; the worst of birds is the shrike; the worst of people is the seok *khakhpyna*"; "the smoke of the yellow willow is acrid; the tongue of saryglars (that is, the "yellow" clan) is acrid" (Butanaev, Butanaeva, 2008: 208; 2010: 152).

Children "inherited" their tree, as with their seok, exclusively through the male line (Usmanova, 1980: 103). This traditional regulation remained unchanged even in cases of interethnic marriages, which can be illustrated by the categorical statement of an elderly Khakas man: "The Khakas people belonged to the *tyt* (larch). If the father was a Khakas and mother was Russian, the *shula* (clan tree) would still be the *tyt*. The children would also be *tyt* (Karazhakov Andrey Mikhailovich, age 90, village of Ust-Parnaya)" (AMAES TSU, No. 678-1, fol. 18).

According to tradition, the daughter-in-law was expected to treat her husband's clan tree with the same reverence as her in-laws. Vestiges of such social and normative attitudes have survived in folklore evidence. For example, in one folklore account, an elderly woman explained to her daughter-in-law the rules of behavior in relation to objects revered by the family and clan, which were perceived as older relatives of the young woman's husband. Trees were also mentioned in this list (Katanov, 1907: 303). Notably, a strict verbal rule of *chaiyt*—circumlocution ('do not call them by name')—was strictly applied to all of these objects, and substitute names were used to denote them. Moreover, in the traditional Khakas society, the daughter-in-law strictly adhered to the custom of *khazynalas*—avoiding the older, paternal relatives of her spouse. This practice is reflected in an old riddle where a plate of wood, obviously not by chance, acted as the symbol of a daughter-in-law: "A chip thrown from the door does not reach the front corner (a daughter-in-law hiding from her father-in-law)" (Ibid.: 239).

Sacralization of the tree by the Khakas people was based on its perception as the first ancestor and guardian of soul of the clan. This is why the Khakas people called their clan trees *söök chulazy*/*shulazy* 'clan soul/soul of the clan' (Usmanova, 1980: 100). In the views of this people, as well as other Turkic peoples of Southern Siberia, the word *chula*/*shula* denotes one category of the human soul, which life, health, well-being, and longevity depend on. According to the traditional beliefs, the lifespan of a person and his tree are interconnected. It is believed that while the clan tree is alive, death does not threaten a person, and vice versa. This idea reappears in the myth "Puga Möke" where the protagonist of the same name bequeathed, after his death, to bury the thumb of his right hand separately from his body. He also warned his children that if birch trees grew at the burial place of his thumb, his descendants would live long and happily. As long as the birches grew, everything would be fine with their relatives. In the end, everything was exactly as he predicted (Katanov, 1907: 498–499).

The subject of trees growing from the bodies of buried people—the embodiments of their souls or vital forces—frequently appears in Khakas folklore. It indicates that in the traditional worldview of the people, posthumous reincarnation of a person was a continuous circle of life and death. A tree or mountain was in the center of this cycle. A combination of these images often occurs. The practice of planting trees on the graves of deceased relatives, most often infants, was probably associated with these ideas. Its original semantics have been lost over time and have become subject to reinterpretation. This, for example, can be evidenced by the information given by an elderly Khakas: "A birch tree was placed (planted) for unbaptized children instead of a cross. If a birch or larch grew from seeds (brought by the wind) on a person's grave, it was believed that this person was happy (Amzarakov Nikolay Vasilyevich, born in 1912, village of Kyzlas)" (AMAES TSU, No. 680-3, fol. 18).

According to the religious and mythological beliefs of the Khakas people, the death of a clan tree is directly correlated with that of one of their relatives. People believe that having a dream about an old tree falling foreshadows the death of an elderly person, while a young tree falling indicates the death of someone of the same age. Elderly Khakas people supported their beliefs with the following examples: "If someone from the Khobyi clan sees in a dream that a larch is falling, someone from that clan definitely will die (Borgoyakova Liza Pavlovna, born in 1915, village of Chakhsy Khonykh)" (AMAES TSU, No. 680-8 a, fol. 30); "We have a belief that if a *khazyn'* (birch tree) falls, someone from the Shor clan will die. The Shor clan is the Kolchikovs; they have the *khazyn'* (as their clan tree)

(Burnakov Nikolay Gavrilovich, born in 1897, village of Otty, Askizsky District of Khakassia" (Ibid.: fol. 37); "The Balykovs have the *akh khazyn* tree (white birch). If you see in a dream that the birch forest is being felled, someone from the Byuryut seok will die (Tarakanova Yekaterina Nikolaevna, born in 1908, village of Kapchaly)" (AMAES TSU, No. 681-5, fol. 25); "Once in a dream I saw how a large, leafy birch tree fell across the door of my neighbor Alexey Chaptykov. The next day, Alexey indeed died (Samrina (Tutatchikova) Olga Alekseevna, born in 1888)" (AMAES TSU, No. 682, fol. 4); "If you have a dream that a birch tree falls down, someone from the Kapsargin clan will die. If you have a dream that a poplar tree falls down, someone from the Alakhtaev clan will die (Alakhtaeva Taisya Viktorovna, born in 1930, village of Chaptykov)" (Ibid.: fol. 5–6); "I once saw a young thin forest in a dream. A larch tree fell. I thought that one of our own clan would die. This, indeed, happened. If an old rotten tree falls down, an old person will die (Kokov Semyon Konstantinovich, age 90, aal of Malyi Kobezhikov)" (AMAES TSU, No. 818-2, fol. 25).

According to the traditional Khakas rules, a person should not cut down his clan tree for domestic needs. Otherwise, it was believed that the perpetrator and those close to him would face inevitable negative consequences fraught with illness and death. In case of urgent need, people asked representatives of other seoks to cut down such a tree. Further, cutting down any tree (and not just the clan tree) among the Khakas people was done by strictly adhering to rules. For example, it was forbidden to cut down after sunset, since it was believed that the plants slept at that time. Before felling it, one had to warn the tree "to not catch it off guard". To do this, people lightly tapped it with the butt of the axe, explained their intention, and gave an apologetic speech (Patachakov, 2006: 23–24; Burnakov, 2006: 18, 179, 181, 182, 184). Woodchips had to be placed on the stump for further symbolical "revival" of the tree and as a way of removing the blame from the hewer for what he did. The tree was allowed to be felled strictly towards the sun. The compliance with this rule was believed to ensure that the tree that was being cut down had the opportunity to say goodbye to the sun. In this harvesting practice, signs of the human likeness of the tree appear again in the form of a natural analogy with the traditional funerary rite of the Khakas people. Its integral element is the act of "farewell" of the deceased with the heavenly body. Before lowering the deceased into the grave, the coffin lid has to be removed, so that the person could "say goodbye" to the sun.

In the Khakas worldview, the tree as the source and focus of life and strength of the clan was also the last refuge of man. According to archaic religious and mythological logic, the tree gave life to man. At the end of life, man returns to his original state. Therefore, it is not at all accidental that in folk songs, the process of a person's death is identified with his return to his ancestral abode, i.e. to the trees:

Azar-parar kÿnimde
Adam pol khaldyn', kharagai.
Alton azyr sinin' salaan'
Aiga sustalzyn, kharagai.
Irter-parar kÿnimde
Iҷem pol khaldyn, kharagai.
Ilig sinin' chilegen'
Chilge pik turzyn, kharagai

'[On] the day of [my] transition [to the other world]
[You] will become father [to me], [my] pine tree.
Sixty of your forked branches,
My pine tree, [let] the rays of the moon illuminate.
[On] the day of [my] exodus [to the other world]
[You] will become mother [to me], [my] pine tree.
Let fifty of your roots
Stand strong against the wind, [my] pine tree'

(Takhpakhtar, 1970: 25).

This worldview was embodied in the Khakas funerary tradition, which steadily survived until the mid-20th century. The deceased was buried in a dugout coffin (Butanaev, 1996: 156; Burnakov, 2009: 527), made from a solid tree trunk, which was split in half with the middle part removed. In the traditional consciousness, placing the deceased into a block of wood symbolized complete merging of his body with the tree. Therefore, people used to say about a deceased person: *khatyg agastyn özeni pol pardy* 'he became the core of a solid tree' (Butanaev, 2011: 684). The coffin (*khomdy*) was often called *kizi agazy*/*agaҷy* 'a human tree or tree for a person' (Butanaev, 1999: 17). Therefore, the process of making a coffin was denoted by the expression "making a tree for the deceased" (Katanov, 1907: 353).

The Khakas people most often made coffins from larch, pine, birch, or poplar trees. These tree species were chosen because they were clan trees to a large number of seoks. In addition, these were most suitable for creating dugout coffins due to their physical parameters. Each Khakas seok, whenever possible, used exclusively its "clan tree species" for burials. For instance, the Kachilorovs (seok *khan'*) made hollowed logs from birch trees; the Chichinins (seok *chon'mai*), from poplars; the Chebodaevs (seok *piltir*), from larch trees; the Chaptykovs (seok *khaskha*), from aspens, etc. (Borgoyakov, 1969: 10–11). The representatives

of seoks having no direct "clan" relations with the *tyt* tree were also allowed to be buried in larch logs. These people were mainly those whose sacred trees (for example, the willow, rowan, or bird cherry tree) could not be used for making full-sized coffins because of insufficient thickness of the trunk. This custom was based on the fact that the larch, just as the birch, was perceived as the sacred tree of all people, and served as a universal symbol of man.

Tree – individual

The correlation of the tree with the image of a person is the most important aspect in the perception of the tree in the Khakas culture. In the popular worldview, the ontogeny of the tree duplicates the complete lifecycle of a person: embryonic—seed, childhood—sprout, juvenile—young tree, maturity—fertile tree, old age—dried-up tree, and death—broken or fallen tree with upturned roots. Vestiges of such ideas can be seen in the following subject of folk tales: the protagonist deceives the main deity of the lower world Erlik Khan to eat young willow branches instead of babies, and ordinary trees instead of young people. Rotten trees replace old people for him (Katanov, 1907: 522–523).

These ideas appear both indirectly and directly in the oral folk art of the Khakas people. The semantic parallel "tree-individual", in its indirect form, is widespread in numerous proverbs, for example: *agyryg kizi tynga pik, ygyrakh agas chilge pik* 'a sick person is strong in his soul; a creaking tree is strong in the wind', that is, a sick person will not die soon, and a creaking tree will not fall soon; *agyryg kizi ainaa pik, ygyros agas chilge pik* 'a sick person does not succumb to demons; a creaking tree does not succumb to the wind', that is, the tree will not fall quickly, and evil powers will not defeat the person; *köndei agas kÿgdÿridir, khortykh kizi titridir* 'a hollow tree hums; a cowardly person shakes'; *chalgys agas chilge kibrek, chalgys kizi kiziden' khortykh* 'a lonely tree is afraid of the wind; a lonely person is afraid of people', etc. (Butanaev, Butanaeva, 2008: 259, 264, 274, 276, 284, 298).

A direct expression of the identification of trees with a person appears in a folk riddle where a person is associated with a log having nine holes (Katanov, 1907: 238). In this regard, the phraseological expression, which often appears in Khakas folklore, takes on a completely different, deeper, meaning: *tögee polza, tögege pararbyn* 'if it's a log, I'll go [get married] to a log' (Ai Khanat, 2018: 411). This expression is usually perceived as an abstract metaphor associated with the marriage tradition of the Khakas people. It testifies to the hopeless situation of a young girl—the lack of right to choose when concluding marriages and her complete subordination to the will of her parents. This statement of a girl in symbolic form indicates her consent to marry any man proposed as a groom by her parents.

In Khakas folklore, the image of a man does not always appear in a direct phytomorphic form. Identification of man with a tree is often manifested through comparison with a tree rather than directly: "Is there a tree that has not grown crooked / is there a man who has grown without fear?"; "A tree does not grow without crookedness; a man does not live without deception"; "A tree will grow from a yellow willow growing on pebbles, if the pebbles do not crush it; a man will grow up from an orphan who goes to work as a farm laborer, if the creator helps"; "Khan Myoke fell from his horse / like a dead tree, he is burning / like a resinous tree, he is crackling" (Katanov, 1907: 420; Butanaev, Butanaeva, 2008: 193, 276; Khan Mirgen, 2018: 48).

In oral folk art, such plant symbolism is often used in ironic form to describe physical features and mental capacities of the protagonist. For example, the height of the protagonist is often compared to the height of a tree:

Altyn-Sabakh chachazy
Tapsap-khalchykh mynnan':
"Tun'mam, Aidolai, saga
Chogar turgan togys chayan
Tirekche syn pirgen,
Tikpeche sagys pirben!"

'[His] elder sister Altyn-Sabakh
Said in anger:
"Younger brother Aidolai,
Nine supreme chayans
Gave you the height of a poplar
[Yet] they did not give you the intelligence
[even of] a tree stump!"'

(Aran-chula…, 1946: 49).

In the traditional beliefs of the people, the spine being the basis of the human skeleton is the embodiment of his personal physiological tree of life and core of his vital force. The Khakas epic poems typically manifest a correlation between the size of the protagonist's spine and some other parts of his body with the tree. In our opinion, comparative phytomorphic hyperbolization, designed to enhance the perception of his appearance is of secondary importance. The protagonist has *a priori* an arboreal nature. A typical scene in the epic poems is breaking the backbone and other bones of the defeated

enemy. At the same time, the death of the protagonist is consistently likened to the death of a tree:

Ölbes Khara Khannyn'
Os agascha oorkhazyn
Olystyra tudybyskhan,
Khazyn' choony khabyrgalaryn
Khazyra-pÿge tartybyskhan

'The undying Khara Khan
Whose spine was [the size of] an aspen tree
Twisted [himself] in different directions,
His large ribs [the size of] a birch tree
Broke in different directions'

(Kurbizhekova, 2011: 154)

Tazyr Mirgen Khan Mirgennin
Aryg tynyn sygara tastaan
Syyt tabyzy istile khalgan.
Ulug agas uskhanɥa pildirgen,
Ulug alyp östep azyp-ölgen

'Tazyr Mirgen took Khan Mirgen
And knocked out [his] pure soul throwing [him to the ground]…
The sound of crying was [immediately] heard.
It seemed [as if] a large tree was broken,
The mighty warrior, groaning, passed [into the other world]—and died'

(Khan Orba, 1989: 167).

The Khakas culture uses the image of a tree that has no clear signs of sex; therefore, it is equally associated with both male and female principles. In flirtatious songs, which are essentially the dialogues of young people, a slender tree is a common image of girlhood. Here is an example:

"The guy: 'Come out, come out, Khan's daughter! I will look at your stature, Khan's daughter'.

The girl: 'After looking at my stature, what do you want? Haven't you seen a slender tree?" (Khakasskiye narodniye takhpakhi, 1980: 44). Further, it is no coincidence that the situational emotional state of the girl in folklore is conveyed through the metaphor—"a young and flexible tree which was doused with water" (Altyn-Aryg, 1988: 28, 269).

The plant code is common in marriage traditions. Felled young birch trees are an attribute of every Khakas wedding, and serve as an embodiment of female symbolism. In the social normative culture of the Khakas people, the choice of a bride is compared to mechanical processing of wood: "A tree cannot be hewn without an axe; a girl cannot be taken to marriage without knowing her disposition" (Tak v Sibiri…, 1964: 28).

Female tree symbolism widely appears in small genres of folklore, such as riddles: *Iki tirek ton'khar turlar* (*tulun'nar*) 'two poplars stand upside down (a woman's braids)'; *uzun agas pazynda ulug khus odyrcha* (*tÿlgÿ pörik*) 'a large bird sits on the top of a tall tree (a female matchmaker's hat made of fox fur)'; *pis khazyn' arazynan' ai sygyp odyr* (*chÿstÿk*) 'the moon comes out between five birches (a women's traditional ring with an eyelet)' (Domozhakov, 1951: 74, 77). The characteristics of some personal qualities of a woman, sometimes negative, are often reflected in folk proverbs and sayings through the image of a tree, for example: "A branchy tree can be clinging; a woman can be tenacious"; "A spreading tree can have branches; a woman can be meddlesome" (Ungvitskaya, Mainogasheva, 1972: 249; Butanaev, Butanaeva, 2008: 287).

In the Khakas tradition, a mature tree is often identified with the fertile feminine principle. In folk songs, the phytoanthropomorphic image is often endowed with pronounced erotic symbolism. For example: "Should I climb a bare birch tree? Will you let me touch your bare breasts?"; "The top of the birch tree is lumpy, while the black female organ is smooth! The top of the poplar is tuft-shaped, while the deep female organ is smooth!" (Katanov, 1907: 321, 421). In the religious and mythological consciousness of the Khakas people, the tree personifies the feminine essence with its typical properties of fruitfulness and childbearing. Accordingly, the idea of isomorphism between a tree and woman formed the basis of ritual practices aimed at increasing fertility. These include the ritual of *Khoɥa-khan oiyn* 'The play of the fertility deity Khocha-khan'. The high point of this sacred ritual was symbolic intercourse of the leader of the ritual with a birch tree. He hugged the tree and imitated the act of copulation with the help of a wooden phallus (*khoɥa*). At the same time, the participants in the ritual sprinkled the birch tree with sacrificial home-brewed beer (*khoɥa pozazy*) and asked for the fertility of people, livestock, and prosperity of life (Butanaev, 2014: 246).

In the Khakas mythology, the image of a tree-woman is associated with maternal function. Human life develops in the womb of a woman. Vestiges of these ideas appear in the folklore story about placing children inside a tree where they grow up:

Tizip papgan chas palalar
Altyn saryg söötke kirze.
Ala kharakhtyg kizi
Palalarny körbeɥen' poltyr.
Chas palalar anda össin!
Saryɜ söötin' ictinde össin!

'If newborn babies who were taken away
Enter a golden yellow willow tree,
The man with gray eyes

Won't see the children, as it turns out.
Let newborn babies grow there!
Let them grow inside the yellow willow!'

(Sugчul Mirgen, 2018: 216).

It is quite natural that the plant code extends to children in the oral folk art of the Khakas people. The comparison of phyto- and anthropomorphic images is often found in the Khakas folk proverbs and sayings. The traditional judgment about a child and need for his upbringing from a very early age is conveyed through the image of a young flexible tree: *chas agasty khuraalaakhkha eg, palan'y kichigden' ÿgret* 'bend a fresh tree before it dries, teach a child from childhood'; *agasty chaskha pÿk, palany chaskha ÿgret* 'bend a tree from the shoot, teach a child from a young age' (Abdina, 1994: 7; Butanaev, Butanaeva, 2008: 259, 276).

Conclusions

The provided evidence suggests that sacralization of the tree is typical of the traditional spiritual culture of the Khakas people. In their worldview, the tree is one of the modules that constitute the image of the world and of the person. Nature is comprehended and its events are interpreted both through anthropomorphization of its objects and symbolic "dendronization" of man. The subject-object relationship between man and nature is expressed in the concept of "tree-clan-individual" based on identifying a person with a specific tree and a group of people with a specific type of trees. This is reflected in the mythological and ritualistic system of the Khakas people. Despite transformations in the worldview of the people and reframing of many of its aspects, a respectful attitude towards trees continues to this day.

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E.F. Andalas[1], T.K.S. Dewi[2], I.B.P. Manuaba[3], and Itaristanti[4]

[1]Universitas Muhammadiyah Malang,
Tlogomas 246, Lowokwaru, Malang, 65144, Indonesia
E-mail: eggy@umm.ac.id
[2]Universitas Sebelas Maret,
Sutami 36, Jebres, Surakarta, 57126, Indonesia
E-mail: trisnadewi22@yahoo.com
[3]Universitas Airlangga,
Airlangga 4-6, Gubeng, Surabaya, 60115, Indonesia
E-mail: ibteram@yahoo.com
[4]Institut Agama Islam Negeri Syekh Nurjati Cirebon,
Perjuangan, Kesambi, Cirebon, 45132, Indonesia
E-mail: itaristanti@syekhnurjati.ac.id

The Oral Panji Story Rendered by the Javanese Mask Puppet Show

This study focuses on the rendition of the oral Panji Story, registered in Unesco's Memory of The Word Register in 2017, by the Javanese Mask Puppet Show. We demonstrate that in telling the story, the performer does not use a prepared script. The story is "fluid", with several variations and innovations based on the performer's interpretation. Its composition depends on both the context of the performance and its length. In Javanese culture, the creativity of the performer (dalang) extends only to the way he renders the story, whereas its title and the order of events are a "public property". The nyantrik method is a mode whereby the tradition is passed down from one generation to another. The method not merely ensures the transfer of the performer's knowledge and experience to other people, but maintains the connection with the Almighty. We analyze the specificity of rendering an oral story in traditional performing art.

Keywords: *Composition, Javanese Mask Puppet Show, Panji Story, knowledge transfer, oral tradition.*

Introduction

Indonesia is a multicultural country. There are 1340 ethnic groups in Indonesia, and each ethnicity has its cultural products. Therefore, the country is rich in cultural expression (Rianti et al., 2018; Santyaningtyas, Noor, 2016). An example of this is the "Panji Story", included into Unesco's Memory of The World Register in 2017 (Tol, 2019). This original Javanese story appeared in the Majapahit Kingdom period (Poerbatjaraka, 1968: 404; Munandar, Susantie, 2014). The narrative is about the love affair between Panji Inu Kertapati, prince of the Jenggala Kingdom, and Sekartaji (or Candrakirana), princess of the Kediri Kingdom. The romance between them is covered up with secrecy and disguise, requiring the characters to travel on an adventure to find each other. Along the way, they will encounter enemies who are eventually defeated. At the end of their journey, they finally meet and get married.

Panji stories have been viral among Southeast Asian people up to the present day, spread widely to various archipelago regions, and even to mainland Southeast

Asia, namely Java, Bali, Palembang, Makassar, Lombok, Malaysia, Cambodia, and Thailand (Fang, 2013: 115–116; Kieven, 2014: 29–30; Poerbatjaraka, 1968: 408–410; Zoetmulder, 1994: 532–533). This is shown by the many variations of Panji stories found in ancient manuscripts and even folk tales. For the written version (manuscript), at least 239 Panji manuscripts are known, 140 of which are Javanese Panji (Kaeh, 1989: 349–357). Furthermore, many other variants of the oral narrative have not been documented. Several fairy tales can be classified as Panji stories, including *Keong Emas* (Golden Snail), *Timun Emas* (Golden Cucumber), *Panji Laras*, *Andhe-andhe Lumut*, and *Kethek Ogleng* (Arrogant Monkey) (Saputra, 2014). Therefore, it is not wrong for Robson (1971: 12–13) to call Panji stories a genre.

The Panji Story is still used as a basis for performance in various places in Java: for example in the Malang Mask Puppet Show, staged by *padepokan** Mangun Dharma, namely *lakon*** *Lahire Panji* (The Birth of Panji). This title, unlike others, centers on the love story of Panji Asmarabangun's parents, Panji Amiluhur and Dewi Sakyaningrat. This play is an exciting phenomenon to study, because the source of the story is an oral tradition living in the community. Therefore, the existence of The Birth of Panji must be inextricable from people's sociocultural life, which preserves historical and artistic elements handed down intergenerationally. This story was composed, transmitted, and performed orally.

The Birth of Panji, staged in the Mask Puppet show, raises several questions, such as how the performer composed his story and how the story is transmitted intergenerationally. It is based on the fact that the Panji Story used as the basis of the performance does not have a standard text (script). The Panji Story used only comes from memory of the performance. The performer learns the story orally, remembers it, performs it, and teaches it to the next generation. Moreover, the Panji Story performance in the mask puppet show is presented as a drama dance. Therefore, understanding the cultural aspects of society inherited from ancestral oral traditions is very important.

Early research on the Panji Story was primarily concerned with its origins. W.H. Rassers suggests the historical relationship between The Panji Story and the life of King Airlangga as the ruler of East Java at the beginning of the 11th century AD, as well as between Ken Angrok, the founder of the Singasari Kingdom, and Raden Wijaya, the founder of the Majapahit Kingdom, a possible prototype of Panji (1922: 132–136). In addition, C. Berg (1928: 189–190) claims that the Panji Story circulated between 1277 and 1400 AD. On the other hand, R.M. Poerbatjaraka (1968: 404) said that it originated during the height of the Majapahit Kingdom, and spread across the archipelago long after. The question of when the Panji Story was formed in the archipelago is still being debated.

Research on the ancient manuscripts of the Panji Story has also been carried out, such as the efforts to translate it by Rassers (1922: 14–19) and Poerbatjaraka (1968: 3–369). K.H. Saputra (1998: 1–136) investigated the structure of the Panji Story variants. Furthermore, researchers are investigating the Malang Mask Puppet Show. These studies can be grouped into five categories according to their focus. The first includes the analysis of the structure and meaning of symbols in the show (Astrini, Amiuza, Handajani, 2013; Hidajat, Pujiyanto, 2014; Minarto, 2010), the second, analysis of the changes in, and functions of, mask puppet show (see, e.g., (Prasetyo, 2004)). The third groups combines the researches on the transformation aspects of Panji Story in the Malang Mask Puppet Show (see, e.g., (Hikmah (2011: 11)), the fourth, researches that explore the historical-sociological aspects of the Malang Mask Puppet Show (see, e.g., (Kamal, 2010)). The fifth group studies the systems of values in the Malang Mask Puppet Show (see, e.g., (Sumintarsih et al., 2012: 60–90)).

In the previous studies of Panji stories and Malang Mask Puppet Show, the problem of their oral version has never been addressed. It can also be seen that various approaches are used in studying the Malang Mask Puppet Show, but as a product of oral culture, aspects of orality are ignored. The research is not based on performance but is text-oriented. The data taken are also independent of the context and process of its creation, so that the story of Panji in the Malang Mask Puppet Show derived from oral tradition is considered the same as written literature, even though these are in fact very different. The performer remembers the stories from the previous performer. The stories come from the oral sources of his predecessors. In his performances, the performer does not use the raw text (script) as the medium of the dialogue, but derives the story solely from his memory. That's why each story can have many variations. This phenomenon differs from the modern form of drama performance, which uses the standard text as dialogue memorized by the actors.

This study aims to further knowledge of oral tradition by investigating characteristics of the orality of Panji tales. This research is essential to do for several reasons. First, an oral product handed down by word of mouth will be lost if not recorded. Second, since no standard text exists, each performance allows for a re-creation process, which was, however, overlooked in previous research. Third, although there have been earlier studies

*In the Javanese language this means a housing complex with a large enough area provided for learning and teaching specific knowledge and skills, for example, self-defense, music, dance, and so on.

**The term *lakon* in Javanese culture is the equivalent of the word "drama" from the Western tradition.

on mask puppet shows, such research has centered on the structural and semiotic aspects of the performance, while the tale has been overlooked. Fourth, a new perspective on this phenomenon can be used to preserve and develop cultural tourism.

The Story of Panji and padepokan in Malang

The relationship between Panji Story and performing arts, especially drama-dance, in the East Java region has been very long. Since the collapse of the kingdoms in Central Java, in the 10th–11th centuries AD, a performance art known as *rakĕt* has emerged in East Java (Soedarsono, 1990: 5). Unlike the *wayang wwang,* which performs the stories of Rāmāyana and Mahābhārata, *rakĕt* features the Panji Story. *Rakĕt* is another name for *gambuh* in Bali (Robson, 1971: 33). In fact, in *Nāgarakĕrtāgama,* written by Mpu Prapanca, it is stated that King Hayamwuruk and his father (Kertawardhana) often participated in *rakĕt* performances at court (Soedarsono, 1990: 7). This provides evidence that *rakĕt,* or mask dance, was popular among the nobility at the time. However, mask performance art in East Java, initially royal, has evolved into folk art along the way (Sumintarsih et al., 2012: 27). The growth of Mask Puppet performances in the region ended with the fall of the Majapahit Kingdom and the relocation of the kingdom's center to Demak, Central Java. One of the reasons is that the Demak Kingdom developed a culture with an Islamic style. Nevertheless, the development of masks in the period of the Islamic kingdoms did not stop. Sunan Kalijaga is known as the creator of mask shows (Sumarsam, 2003: 47; Sumintarsih et al., 2012: 27). It explains the popularity of mask shows nowadays, particularly after Islamization in Java.

Mask Puppet Show is claimed to have first arisen in Malang in the early 20th century AD. The Regent of Malang at that time, Suryo Adi Ningrat, wrote that in 1928, the development of masks in the Malang Regency was very rapid. Many famous players come from Pucangsanga Village, Tumpang District (Hidajat, 2008: 17–18). The source of evidence on the development of mask puppet show in Malang comes from Pigeaud (1938: 79–158). This is a dramatic performance acted by dancers wearing masks, moving along a storyline narrated by a *dalang**. The *dalang* acts as the story's composer and the characters' narrator. Dancers react to anything the *dalang* says. Apart from the aesthetics of the dance, this performance has a significant literary element.

This performance has many different names. Some refer to it as *Topeng Dhalang* (*Dalang* Mask) (Timoer, 1979: 1), *Drama-Tari Wayang Topeng* (Drama-Dance of Puppet Mask Show) (Supriyanto, Pramono, 1997: 1–8), or *Wayang Topeng Malang* (Malang Mask Puppet Show) (Hidajat, 2008: 29). In the local community, this performance is known as *Topeng Panji* (the Panji Mask), which is followed by the name of the *padepokan*, such as "Topeng Panji Jabung" (Panji Mask of Jabung) or "Topeng Panji Kedhungmangga" (Panji Mask of Kedhungmangga) (Timoer, 1979: 1–4). Malang residents refer to this show as the Panji Mask Show, since it incorporates the Panji narrative into each performance.

Throughout the research that has been done on the history of the development of the Mask Puppet Show in Malang, there is still no recent research that can refute the existence of the figure named Reni, a pioneer of this performance (Hidajat, 2008: 17–18; Murgiyanto, Munardi, 1979: 14; Sumintarsih et al., 2012: 28; Supriyanto, 1994: 6; Supriyanto, Pramono, 1997: 5). Reni was a famous *dalang*, mask engraver, and skilled dancer. He was from Polowijen village. Reni was an employee of the Malang Regency Office, led by the Regent of Malang named Suryo Adi Ningrat, who ruled from 1898 to 1934 (Supriyanto, Pramono, 1997: 6). With his fame as a mask artist, a plantation head, named Mr. Peng, invited him to perform a mask puppet show. Along with its development, the famous mask puppet association in Malang was born in Pucangsongo village, covered in the Tumpang regency. According to Soleh Adi Pramono, the informant, contemporaneously with Reni there lived a man named Ruminten, who came from the Pucangsongo village. It is believed that the mask puppet shows originated in that village in the early 20th century. Ruminten, who was a Mpu Kris (*kris* 'dagger maker'), a puppet master, and a mask maker, requested Rusman from the Kemulan village to become a masked puppet dance instructor (Ibid.: 6–7). The informant confirmed this statement: "Rusman, who came from Kemulan Hamlet, Tulus Ayu village, is the grandfather of Ki Soleh Adi Pramono". S.M. Murgiyanto and A.M. Munardi (1979: 13) state that "Rusman is also known as Tirto". The is confirmed by the informant, who added that Rusman was also known as Tir. In Javanese culture, it is expected that parents be called a name based on the name of their first child. Mr. Rusman had a child named Tirtonoto. Hence, he was also addressed as Pak Tirto or Grandpa Tir.

During his lifetime, Mr. Tirto did not only teach his artistic skills to his son, but also to many other people. It is known that almost every mask puppet figure in Malang has dealt with him, such as Mr. Kangsen and his father from Jabung village, Mr. Samud from Pucangsanga

*A person who plays and tells a story on stage. However, the task of a *dalang* is not only related to performance. He also has to execute rituals that are said to be a medium for removing bad luck from the cured person. In Javanese society, *dalang* is also believed to have supernatural powers that can help cure magical ailments.

village, Mr. Rakhim from Glagahdawa village, Mr. Sapari from Jatiguwi village, and Mr. Kiman (Karimun's Father) from Kedungmangga village (Ibid.). Therefore, it can be understood that right up to the present, there are mask puppet art *padepokan*s in these areas.

The composition of Panji Story: past and present

The Birth of Panji story, staged in the Mask Puppet show, is a piece of oral tradition. The plot and dialogues of the characters in the show are based on the utterances of performer, who acts as the narrator and dialogue speaker for the characters in the story. The *dalang* is a crucial figure who governs everything relating to the show (see *Figure*). If we look at this fact, it can be seen that the *dalang* is the story's creator, constantly recreating it in performance. This view differs from those that have existed so far, for example in the folkloristic discipline, which considers a story as a communal product. Here, communal is the *pakem* (convention), while the aspect of creating performances is individual. The convention relates to the rules regarding the course of the performance, not about the storyline. *Dalang* string storylines are based on their memory and interpretation of a story. There is creativity in creating a story. This fact further confirms Finnegan's conclusion (1991: 10–12; 2012: 117) that oral tradition is a product of individuals who are part of society.

The Birth of Panji performance, which was played at Mangun Dharma *padepokan*, was composed and performed by Ki Soleh Adi Pramono. He was the performer and owner of Mangun Dharma. He had a vital role as a *dalang*, not only as a composer of the stories but also responsible for the entire performance. Story composition is carried out only by the *dalang* without interference from others.

The storyline used in the show remains the same from the past to the present. The differences can be caused by external factors, such as the education and technology obtained by the *dalang*. In the past, the process of composing a story was carried out without using tools such as the order of the performer's play written on a piece of paper. According to the informant, many *dalangs* are *wuto sastra* (cannot read and write). The show has only a few tools, such as loudspeakers and other electronic devices. In the current context, there are various advances in the story-creation process: for example, the inclusion of characters in the show that did not exist before, such as the masks of an elephant, a striped tree frog, and a dragon.

Comparing the development of the story's composition from the past to the present, it can be seen that no standard form is considered the final text. It is possible to have many narrative versions under the same title. The tale is created both before and during the show. This finding enriches our knowledge about the composition of oral tradition, apart from its being created during performances

Performance of the Panji Story at the Malang Mask Puppet Show.

(Lord, 1971: 17), or memorized (Andrewjezki, Lewis, 1964: 45–46; Johnson, 1979).

Before the performance, the *dalang* will assign the sequence of the play to the puppets so that they remember the order in which they act. This is significant for the act, since it is connected to the setting of the location, the characters, and the dance steps planned for the performance. On the other hand, the elements of the tale or language utilized are generated spontaneously based on the *dalang's* memories while the performance is in process. The story, composed by the *dalang*, is followed by the movements of the puppets performing in the show. Therefore, the story played in one show will never be the same as the other.

The *dalang's* ability to compose a narrative throughout the show is dependent on the circumstance and duration of the performance. As mentioned above, the text evolves and changes with each performance. Based on the three data points on the performance of Panji Story collected in three distinct scenarios and obtained in different situations, it can be shown that the composition of the story performed by the *dalang* varies. In the most complete story, there are 19 characters and a lot of events. In the two other stories, some of these are omitted. During the show, the *dalang* is bound by the timeframe, which limits the performance. In the second story, there are only nine characters. Even less of them (six) are in the story of an everyday situation. The differences can also be seen in the story-shaping structure used by the *dalang* to fill in each event he will stage. In each show with a different context, the *dalang* will always create a new story. Each of them is a reworked version of the main tale.

The story created by the performer belongs to the performer. However, the title and storyline can be used by anyone. Nevertheless, the audience recognizes each performer's style in telling the story. The uniqueness of Javanese culture is that the *dalang's* creativity is solely related to storytelling, while the title and order of the plot become public property.

The transmission of Panji Story

Transmission is one of the essential aspects of oral tradition research, which determines the difference between written literature and oral tradition (Finnegan, 1992: 106–108; Lord, 1971: 129, 137). Oral tradition is passed down orally through word of mouth. There is only a process of telling stories and listening without help from other media, such as writing. Although the issue of this matter has received much attention, the way the inheritance of the tradition is carried out is still a question, considering that each culture has its own conventions. Hence, Finnegan (1979: 52) states: "There is no single process in oral transmission applicable to any type of literature".

The Panji story used in the Mask Puppet Show is a story that comes from oral tradition. Therefore, the characteristics possessed by this oral text are different from the written version of Panji Story. As oral tradition, the story comes from the storyteller's memory. He has also obtained, or learned, stories verbally by listening to people who had told him, or remembering them from seeing a performance. The play Birth of Panji, staged in the Mask Puppet Show, was the creation of the Ki Soleh Adi Pramono. The Story is oral tradition created and performed orally. As a dance-drama performance, the role of a *dalang* as a composer and a storyteller is fundamental. Therefore, it is very important how a *dalang* acquires a story.

The only way of transmitting the Panji Story is by *nyantrik*—a traditional method of learning something in Javanese culture. Culturally, *nyantrik* is more than just acquiring skills from others, as in formal education. *Nyantrik* is a service rendered to a teacher in exchange for the skills he has provided. Furthermore, the *nyantrik* is linked to supernatural aspects. The teacher's evaluation of his pupils (*cantrik*) is tied to supernatural concerns. A *cantrik* will help with any work. If the teacher is a farmer, he will help with the work in the fields, and when the show is held, he brings the teacher's equipment. After a few years, he is tested.

There are no restrictions on the age or religion professed by a *cantrik.* People of any religion, race, or age can learn. During *nyantrik*, several practices must be done. All the ordinances and rituals performed during *nyantrik* are based on Javanese ordinances, not on Islamic ordinances. During the birthday, the *cantrik* is told to do the *tirakats* (fasting). Fasting for Javanese people had become a part of life; even before Islam entered the Land of Java, "fasting traditions" already existed with various purposes (Yana, 2010: 31). Fasting is considered a medium that can be used to connect with supernatural forces. The purpose of fasting is to strengthen the mind and influence the strength of the universe by practicing concern or feeling mental pain in the form of preventing physiological needs (Haryanto, 2013: 25). It is believed that a man is able to master the power of the universe to draw closer to nature and the Almighty.

There are two models to be *dalang*: the real (hereditary) *dalang*, and the *poncobuwono* (ordinary) *dalang*, not of *dalang* descent. Our informant is a real *dalang* because, on the basis of his lineage, his father (Mr. Sapari) was a *dalang*, and his mother (Mrs. Siami) comes from a family of shadow puppet masters in Blitar.

Typically, the distinction between real *dalang* and ordinary *dalang* is based on their authorization to perform puppetry. According to the informant's experience, an ordinary *dalang* can perform *pangruwatan* (a ritual

ceremony in Javanese culture aimed at removing evil or saving something from a nuisance) as long as he is deemed capable. But first, he must do *ngelakoni* (the conditions that must be done with Javanese *tirakat*). The informant said there was once someone, not from the descendants of the *dalang*, who wanted to be a *dalang*. However, eventually, it no longer worked. He stopped halfway and got married. There is a belief that the one with the right to do *pangruwatan* is the real *dalang*. Therefore, the *pangruwatan* is called the *pangruwatan of* the real *dalang*. On the other hand, there is a belief that God will always produce *dalang* through the cycle of descent.

The requirements for becoming a *dalang* are not limited by one's bloodline alone. The transmission process is based on a person's intention and earnestness to become a puppet master. A *dalang* is not only required to be able to master the procedures for the performance: he must master the dance, the rules, and many plays of a performance. That is, he has to learn many stories as his performance material. The most important thing is to master all kinds of Panji Stories, considering that exactly this play is performed in the mask puppet show.

Conclusions

Previous research has shown that the Panji Story is a classic story of Javanese people that developed in the Majapahit period. Although it is recorded in written form, the Mask Puppet Show is based on an oral tradition. The nature of the *dalang's* performance does not use the raw text (script) as the medium of the dialogue; he speaks aloud. The *dalang* tells the story in his show based solely on aspects of his memory. Panji Story as used in the mask puppet show is "fluid", with several variations and innovations in the form of *sanggitan* (a ritual of holding back one's passions to cultivate one's mind). Based on temporal and stage considerations, there are advances in which the performance's duration is not a whole night but several hours, and stage changes formerly performed in the courtroom are now performed on stage. In the Birth of Panji stage, it is found that the story is composed orally, not only before but also during the performance. In the process of composing the story, it was found that several contexts influenced the *dalang*, namely the situation and the length of the performance. In passing on this oral tradition, the mode of transmission used is *nyantrik*—the traditional way of acquiring knowledge. There are two types of inheritance: real *dalang* and ordinary *dalang*.

This research is limited to one type of Panji Story in one traditional performance. More comprehensive research needs to be done into other types of Panji stories, such as fairy tales or other types of Panji Story plays on other traditional performances. Research on the revitalization of performances, dance aesthetics, the history of the development of Panji Story in mask puppet performances, and efforts to preserve traditional arts need to be carried out.

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A.G. Kozintsev
Peter the Great Museum of Anthropology and Ethnography (Kunstkamera), Russian Academy of Sciences, Universitetskaya nab. 3, St. Petersburg, 199034, Russia
E-mail: alexanderkozintsev@yandex.ru

The Origin of the Karasuk People: Craniometric Evidence

Measurements of 24 male cranial samples associated with the Karasuk culture were compared with those of 56 other samples using multivariate methods. On the dendrogram, the Karasuk cluster includes the Mongun-Taiga people, Saka, Sauromatians, Tauri, and a group from Sialk B. In the two-dimensional projection, this cluster is intermediate between the Andronovo and Okunev clusters, testifying to the admixed nature of the Karasuk population. In people associated with the Classic Karasuk tradition and in the north of the Karasuk area, the Okunev component predominates, whereas in members of the Kamenny Log tradition and in the south of the area, the proportion of the Okunev and Andronovo components is closer to equal. The use of twelve Andronovo samples conclusively disproves the belief that the sole ancestors of the Karasuk people were Andronovans. Mechanisms whereby Okunev aborigines were assimilated by Andronovo immigrants are discussed.

Keywords: *Siberia, Bronze Age, Karasuk culture, Andronovo culture, Okunev culture, Cimmerians, Scythians, Kets.*

In memory of Natalia Chlenova and Galina Rykushina

Introduction

Karasuk is one of the post-Andronovo cultures. This does not imply, however, that it originated solely on the basis of Andronovo. Certain experts ascribe an important role in Karasuk origins to both Andronovo immigrants and Okunev natives (Vadetskaya, 1986: 61–63; Rykushina, 2007: 15, 20). Others believe that the key role was played by Andronovans whereas the contribution of the Okunev people was negligible (Poliakov, 2022: 211, 226, 245, 249, 290, 316; Gromov, 1995, 1996, 2002: 108, 110, 133). Both latter authors argue that the Karasuk population had descended from Andronovo migrants of the second wave from the west rather than from their predecessors—the Andronovo (Fedorovka) people of the Minusinsk Basin. A.V. Poliakov (2022: 290) associates the migrants with the Alakul tradition.

A direct bearing on our topic has the opinion voiced by Y.G. Rychkov (1969: 158–159): in terms of craniometry, Karasuk people were allegedly indistinguishable from recent Pamiris—Goranis, Ishkashimis, Wakhanis, and Rushanis. Were that true, the contribution of Okunevans to Karasuk origins would be quite unlikely, contrary to what the analysis shows. Another problem would concern the participation of Andronovans, whose light pigmentation has been demonstrated both directly, by genomic data (Keyser et al., 2009), and indirectly, by data relating to modern groups of Southern Siberia, which retain a high share of Andronovo genetic legacy and are markedly depigmented, in contrast to darkly pigmented Pamiris (Rychkov, 1969: 148–149). Were the Karasuk people really identical to Pamiris? And did they resemble groups with a high content of Andronovo component—Saka and Sauromatians? I.V. Perevozchikov (1971) noted

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other geographically remote parallels to Karasuk people, namely, inhabitants of Central Iran buried at Sialk B*, and Tauri, representing the Kizil-Koba culture of Crimea. The search for those parallels was motivated by a hypothesis advanced by N.L. Chlenova (1971), postulating the affinties between the Karasuk people and Cimmerians.

A different direction of ties is revealed by comparing the Karasuk group with those relating to the contemporaneous Mongun-Taiga culture of Tuva. These people were later shown to resemble those of Karasuk craniometrically (Alekseyev, Gokhman, Tumen, 1987) while displaying only isolated cultural parallels with them (Chugunov, 1994; Poliakov, 2022: 240). In view of the attempts to localize the Karasuk homeland in Xinjiang (Alekseyev, 1961: 160; Rychkov, 1969: 158) it should be asked if the earliest published Bronze Age pre-Karasuk group from that region—Gumugou (Han, 1986)—displays Karasuk parallels.

Differences between Karasuk subsamples, specifically those between the Classic Karasuk group and that representing its "atypical"—Kamenny Log, or Lugavskoye—variety (Kozintsev, 1977: 15–29; Rykushina, 2007: 86), are poorly understood. G.V. Rykushina pointed to the "Andronovo" tendency of the culturally atypical group, whereas I wrote about its "Tagar" tendency, which, in essence, is the same. Is this the only craniometric difference between the two culturally distinct varieties of Karasuk? The spatial variation within the Karasuk people requires further study too: according to A.V. Gromov (1995; 2002: 103, 112–114), southern Karasuk groups resemble only the Andronovo populations of Kazakhstan and the Upper Ob, while those of northern Karasuk differ from them. Initially, Gromov ascribed this difference to Okunev admixture (1995), but later he questioned its existence (2002: 110, 115). Finally, the hypothesis about the Yeniseian affinities of the Karasuk language (Chlenova, 1969) raises a question as to whether a physical resemblance exists between the Karasuk people and the sole extant group speaking a Yeniseian language—Kets.

These questions can be approached on the basis of a cranial database, which has significally expanded in the recent years (this especially concerns the Andronovo samples), and with the help of modern statistical techniques.

Material and methods

The total number of male samples included in the analysis is eighty, and they represent the following cultures, stages, and regions**.

1. Karasuk culture, Classic variety (Rykushina, 2007: 93);
2. Karasuk culture, Kamenny Log variety (Ibid.);
3. Atypical Karasuk group (samples No. 4–7 pooled) (Kozintsev, 1977: 18–20);
4. Same, Northern group—Kamenny Log burials on the Karasuk River (Ibid.);
5. Same, Malye Kopeny III (after G.F. Debetz, unpublished) (Ibid.);
6. Same, Fedorov Ulus (after (Alekseyev, 1961)) (Ibid.);
7. Same, Eastern Minusinsk group—Lugavskoye (Beya) burials on the right bank of the Yenisei, south of the Tuba (after G.F. Debetz and V.P. Alekseyev) (Ibid.);
8. Karasuk culture, Northern group (Rykushina, 2007: 74)*;
9. Same, Southern group (data by Rykushina (Ibid.) and Gromov (1991, 1995), relating to samples No. 20–24 are pooled);
10. Same, Yerba group (Rykushina, 2007: 74);
11. Same, left bank group (Ibid.);
12. Same, right bank group (Ibid.);
13. Same, Khara-Khaya (Ibid.: 96);
14. Same, Tagarsky Ostrov IV (Ibid.);
15. Same, Kyurgenner I (Ibid.);
16. Same, Kyurgenner II (Ibid.);
17. Same, Karasuk I (Ibid.);
18. Same, Severny Bereg Varchi I (Ibid.);
19. Same, Sukhoye Ozero II (Ibid.);
20. Same, Arban I (Gromov, 1991);
21. Same, Beloye Ozero (Gromov, 1995);
22. Same, Sabinka II (Ibid.);
23. Same, Tert-Arba (Ibid.);
24. Same, Yesinskaya MTS (Ibid.);
25. Andronovo (Fedorovka) culture, Northern, Central, and Eastern Kazakhstan (for sources of data about Andronovo samples No. 25–36, see (Kozintsev, 2023b));
26. Same, Baraba forest-steppe;
27. Same, Rudny Altai;
28. Same, Barnaul stretch of the Ob, Firsovo XIV;
29. Same, Barnaul-Novosibirsk stretch of the Ob;
30. Same, Chumysh River;
31. Same, Tomsk stretch of the Ob, Yelovka II;
32. Same, Kuznetsk Basin;
33. Same, Minusinsk Basin;

*Perevozchikov mentions Sialk A and B, but in fact only the later Sialk B sample, measured by G.F. Debetz (see below), is available.

**Certain Karasuk groups overlap because of disagreements between archaeological classifications used by various craniologists. In cases where a sample had been studied or rearranged by several experts, the latest source is indicated—one from which the data were taken.

*Hereafter the Classic versus Kamenny Log (Lugavskoye/Beya) cultural attribution of samples is not specified. The first reason is disagreement between archaeologists (Rykushina used the classifications by E.B. Vadetskaya, G.A. Maksimenkov, and P.M. Kozhin, whereas I employed those elaborated by M.P. Gryaznov and especially N.L. Chlenova). The second reason is that many samples include crania from burials of both cultural varieties.

34. Andronovo (Alakul-Kozhumberdy) culture, Southern Urals and Western Kazakhstan;
35. Andronovo (Alakul) culture, Northern, Central, and Eastern Kazakhstan;
36. Same, Omsk stretch of the Irtysh, Yermak IV;
37. Okunev culture, Khakas-Minusinsk Basin, Tas-Khazaa (Gromov, 1997);
38. Same, Uybat (Ibid.);
39. Same, Chernovaya (Ibid.);
40. Same, Verkh-Askiz (Ibid.);
41. Ust-Tartas culture, Baraba forest-steppe, Sopka 2/3 (for sources of data about samples No. 41–48, see (Kozintsev, 2021));
42. Same, Sopka 2/3A;
43. Odino culture, Sopka 2/4A;
44. Same, Tartas-1;
45. Same, Preobrazhenka-6;
46. Krotovo culture, Classic stage, Sopka 2/4B, C;
47. Late Krotovo (Cherno-Ozerye) culture, Sopka 2/5;
48. Same, Omsk stretch of the Irtysh, Cherno-Ozerye-1 (Dremov, 1997: 83, 85);
49. Pamiris, Goran, 13th–14th centuries (Rychkov, 1969: 202–205);
50. Same, Ishkashim, 14th–16th centuries (Ibid.);
51. Same, Wakhan, 15th–16th centuries (Ibid.);
52. Same, Rushan, 18th century (Ibid.);
53. Saka, Eastern Kazakhstan, 7th–4th centuries BC (Ginzburg, Trofimova, 1972: 121);
54. Same, Kirghizia, 7th–4th centuries BC (Ibid.: 130);
55. Sauromatians, Lower Volga and Southern Urals, 6th–4th centuries BC (Balabanova, 2000: 35);
56. Sialk, Central Iran, period VI, necropolis B, 8th century BC (the date is documented by A.I. Ivanchik (2001: 168) and I.N. Medveskaya (2013); measurements by G.F. Debetz, published by T.P. Kiyatkina (1968));
57. Tauri, Crimea, Kizil-Koba culture, 8th–5th centuries BC (Sokolova, 1960);
58. Mongun-Taiga culture, Karasuk period, Tuva, pooled (Alekseyev, Gokhman, Tumen, 1987);
59. Same, Baidag III (Ibid.) (V.A. Semenov and K.V. Chugunov (1987) attribute the cemetery to the earliest stage of the Mongun-Taiga culture, when the funerary rite was closest to that of Karasuk culture; see also (Chugunov, 1994));
60. Gumugou, early 2nd millennium BC, Xinjiang (Han, 1986);
61. Kets (Gokhman, 1982) (samples No. 61–80 are recent);
62. Tobol-Irtysh Tatars (Bagashev, 2017: 218–219);
63. Baraba Tatars (Ibid.: 218);
64. Tomsk Tatars (Ibid.);
65. Chulym Tatars (Ibid.: 217);
66. Southern Khanty (Ibid.: 216);
67. Eastern Khanty (Ibid.);
68. Northern Khanty (Ibid.);
69. Northern Mansi (Ibid.);
70. Nenets (Ibid.: 220);
71. Selkups (Ibid.: 217);
72. Kyzyl Khakas (Ibid.: 219);
73. Beltir Khakas (Alekseyev, 1960);
74. Sagai Khakas (Ibid.);
75. Koibal Khakas (Ibid.);
76. Kachin Khakas (Ibid.);
77. Shors (Bagashev, 2017: 220);
78. Teleuts (Ibid.: 219);
79. Kumandins (Ibid.);
80. Tubalars (Ibid.).

The trait battery includes 14 measurements—cranial length, breadth, and height, minimal frontal breadth, bizygomatic breadth, upper facial height, nasal and orbital height and breadth, naso-malar and zygo-maxillary angles, simotic index, and nasal protrusion angle. Data were processed using canonical variate analysis, and Mahalanobis distances corrected for sample size (D^2_c) were calculated. The distance matrix was subjected to cluster analysis and nonmetric multidimensional scaling. The CANON package by B.A. Kozintsev and the PAST package by Ø. Hammer (version 4.05) were employed.

Results

On the two-dimensional projection (Fig. 1), and on the dendrogram*, the Karasuk cluster (I) is in the center, surrounded by five others. It does not overlap with the Andronovo cluster (II) and is strictly intermediate between it and the Okunev cluster (III). Also, the Karasuk cluster is intermediate between the Pamiri cluster (VI) and the aboriginal Siberian supercluster, which consists of the ancient groups of Baraba (IV) and recent Western Siberian ones (V). The latter two clusters overlap nearly completely in the two-dimensional plot, although the dendrogram differentiates them better.

The Karasuk cluster includes all Karasuk samples except two—Eastern Minusinsk (No. 7) and Arban I (No. 20). Both fall within the recent Western Siberian cluster, Arban being likewise close to ancient Baraba groups. Also, the Karasuk cluster includes two Mongun-Taiga samples (No. 58 and 59), two representing Saka (No. 53 and 54), Sauromatians (No. 55), Tauri (No. 57), and the Early Iron Age series from Sialk B (No. 56). The latter, despite taking a peripheral position within this cluster, is very close to certain Karasuk groups such as those from Beloye Ozero (No. 21) and Yesinskaya MTS (No. 24). The Pamiri (VI) and the Karasuk (I) clusters

*It is not shown here because of its large size, but can be obtained by e-mail on request, and the same concerns the distance matrix.

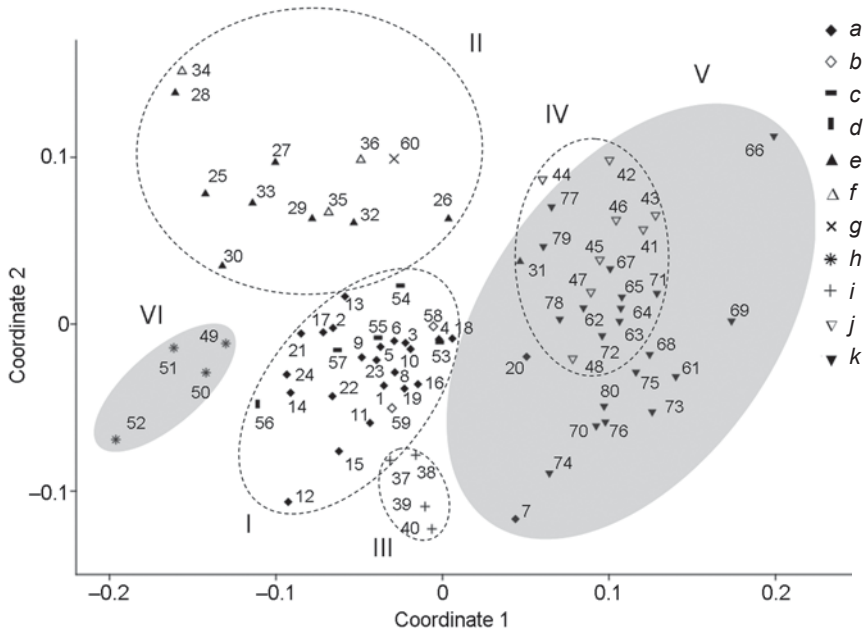

Fig. 1. Position of centroids of male cranial samples on the plane of nonmetric multidimensional scaling. See text for group numbers.
a – Karasuk; *b* – Mongun-Taiga; *c* – Saka, Sauromatians, Tauri; *d* – Sialk B; *e* – Fedorovka; *f* – Alakul; *g* – Gumugou; *h* – Pamiris; *i* – Okunev; *j* – ancient Baraba; *k* – recent Western Siberian.
I–IV – ancient clusters (shown by dashed contours): I – Karasuk; II – Andronovo; III – Okunev; IV – Baraba. V, VI – recent clusters (shown by spots): V – Western Siberian; VI – Pamiri.

are separated by a gap—contrary to what Y.G. Rychkov (1969: 158–159) claimed, Pamiris are in no way identical to Karasuk people (for the single exception, see (Kozintsev, 2023a)).

The Andronovo cluster (II) includes all groups associated with this culture except one—from Yelovka II (No. 31), which is close to autochthonous groups of Baraba. The Fedorovka samples (No. 25–33) do not differ from those representing the Alakul variety (No. 34–36). The same cluster includes a group from Xinjiang (No. 60).

The comparison of two Karasuk samples formed by Rykushina on the basis of their cultural affiliation (Fig. 1), shows that the group representing Classic Karasuk (No. 1) is closer to the Okunev groups, whereas the Kamenny Log sample (No. 2) displays an Andronovo tendency (Fig. 1). My Atypical Karasuk group (No. 3), composed with the help of other archaeologists (see above), deviates from that representing Classic Karasuk not only towards Andronovans, but also towards aboriginal Western Siberian populations (see below).

Let us specify the relative similarity between the Karasuk people and the twelve Andronovo groups, on the one hand, and four Okunev groups, on the other (Fig. 2). Average Mahalanobis distances with their standard errors for the Classic Karasuk group are as follows: 9.56 ± 1.08 versus 3.26 ± 0.79, respectively (Mann–Whitney $U = 0$, $p = 0.004$). Classic Karasuk people, then, are three times closer to the Okunev people than to Andronovo people. The Kamenny Log sample, on the other hand, is equally removed from both (Andronovo, 6.10 ± 0.74; Okunev, 5.48 ± 0.67, $U = 22$, $p = 0.86$). Which of the two Karasuk groups is closer to Andronovans? The answer is obvious—Kamenny Log (Wilcoxon paired samples test, $W = 73$, $p = 0.005$; same for my Atypical group: $W = 78$, $p = 0.0005$). As regards Okunevans, there is no difference between the two Karasuk groups: $W = 10$, $p = 0.13$ in both cases.

Let us examine the geographic variation within the Karasuk population (Fig. 3). The Southern Karasuk group (No. 9) is actually somewhat closer to Andronovans than is the Northern group (No. 8), but the difference is insignificant (7.93 ± 0.99 as against 9.00 ± 1.20, respectively; $W = 63$, $p = 0.064$). Nor is there any difference relative to Okunevans (5.35 ± 0.80 versus 3.19 ± 0.83, respectively; $W = 10$, $p = 0.13$). If Andronovans are compared with Okunevans, the Southern Karasuk group is somewhat closer to the latter, but the difference is insignificant again ($U = 8$, $p = 0.058$). The Northern Karasuk group, by contrast, is significantly closer to Okunevans ($U = 1$, $p = 0.002$). The Northern Karasuk people, therefore, are nearly thrice closer to Okunevans (3.19) than to Andronovans (9.00). In the Southern Karasuk people, the same tendency is observed, but the difference is small and insifnificant (5.35 versus 7.93, respectively).

As we have seen, the Classic Karasuk group is on average much further from Andronovans than from Okunevans. Could certain Andronovo groups still be close to Karasuk people? As the plot (Fig. 4) shows, those least removed from Classic Karasuk are Fedorovka Andronovans of the Kuznetsk Basin, Baraba, and Chumysh. In the case of Kamenny Log (Fig. 5), those closest are Fedorovka Andronovans of Rudny Altai, Kuznetsk Basin, and Chumysh. The Northern Karasuk group is least removed from Fedorovka Andronovans of the Barnaul-Novosibirsk area, Yelovka, and Chumysh (Fig. 6); and the Southern Karasuk group, from Fedorovka Andronovans of Chumysh and Kuznetsk Basin, and from Alakul

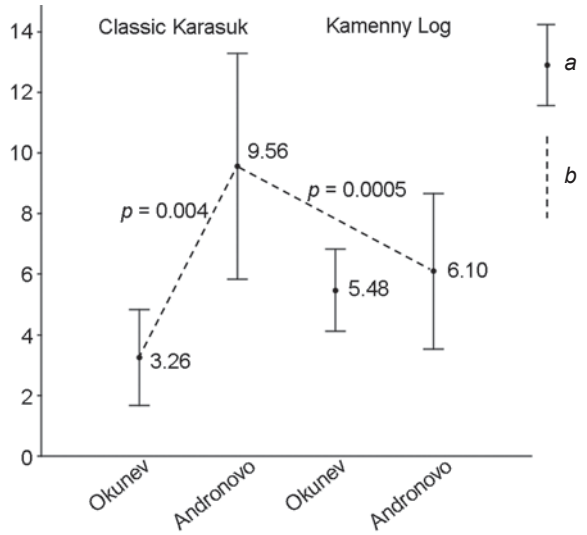

Fig. 2. Average Mahalanobis distances (D^2_c, shown by dots) of Karasuk samples (Classic and Kamenny Log) from those of Okunev and Andronovo.
a – average distances with standard deviations, *b* – significant differences.

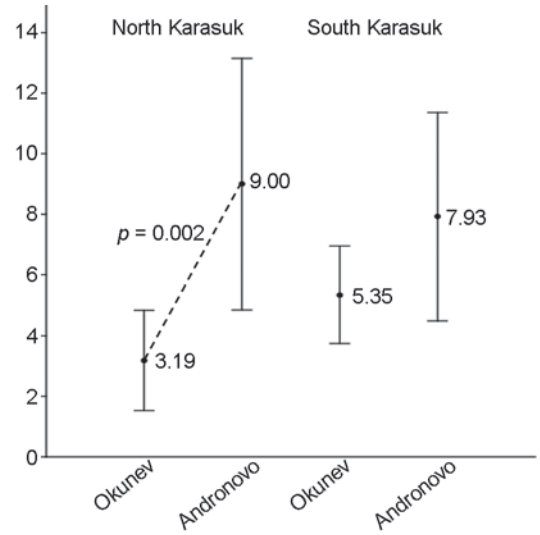

Fig. 3. Average distances of Karasuk samples (northern and southern) from those of Okunev and Andronovo.
See Fig. 2 for explanations.

Fig. 4. Distances between the Classic Karasuk sample and those of Andronovo.
See text for group numbers. A – Alakul, F – Fedorovka.
a – distance averaged across all Andronovo groups; *b* – 95 % confidence interval for the mean; *c* – minimal resemblance; *d* – maximal resemblance.

Andronovans of Northern, Central, and Eastern Kazakhstan (Fig. 7). In all four comparisons (see Fig. 4–7), then, one of the first three places is taken by Fedorovka people of Chumysh, and in three comparisons, those of the Kuznetsk Basin. Both regions border on the Minusinsk Basin in the west. Interestingly, among the samples especially close to Classic and Northern Karasuk, there are two Andronovo groups where the autochthonous Siberian tendency is the strongest—Baraba and Yelovka (see Fig. 1).

Eleven of the twelve parallels mentioned above relate to Fedorovka Andronovans. But because we have nine Fedorovka groups and three associated with Alakul, craniometry gives no reason to ascribe a special role in Karasuk origins to the Alakul people.

As concerns similarity with Classic and Northern Karasuk groups, even

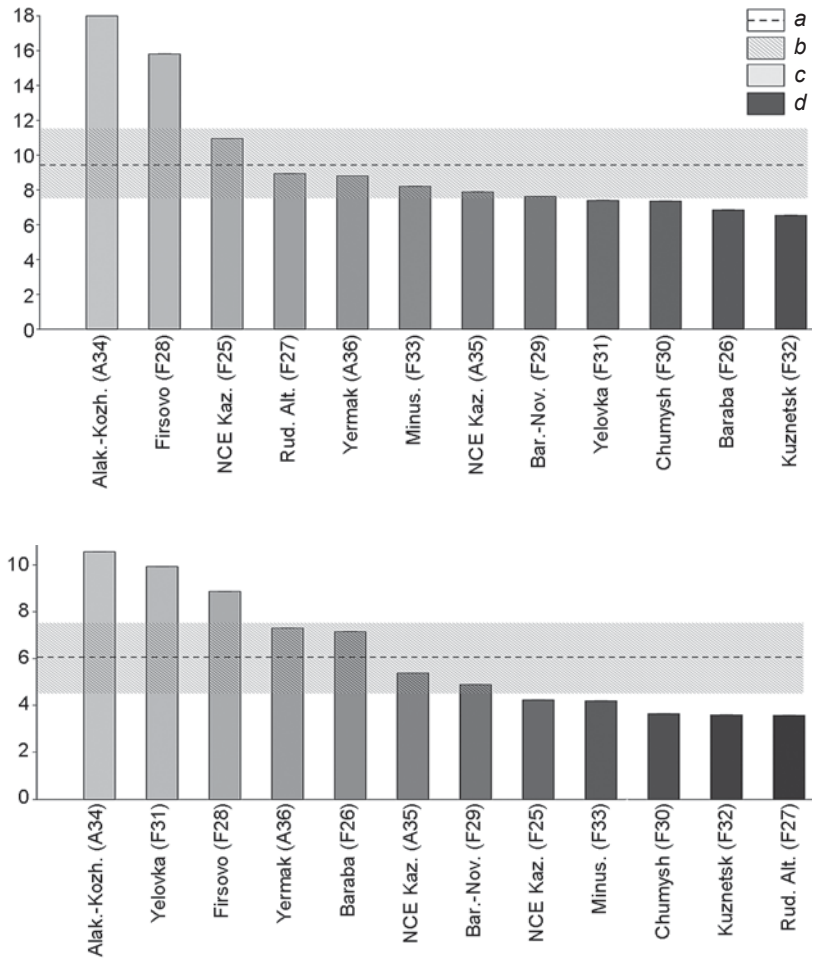

Fig. 5. Distances between the Kamenny Log sample and those of Andronovo.
See Fig. 4 for explanations.

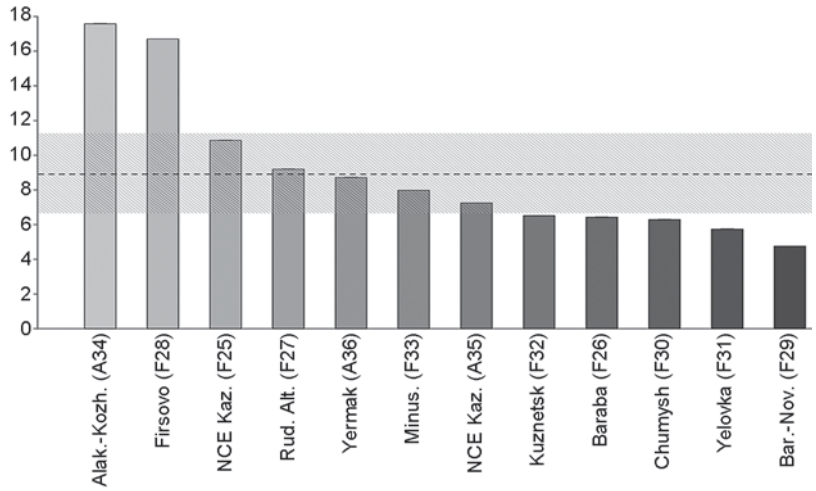

Fig. 6. Distances between the northern Karasuk sample and those of Andronovo. See Fig. 4 for explanations.

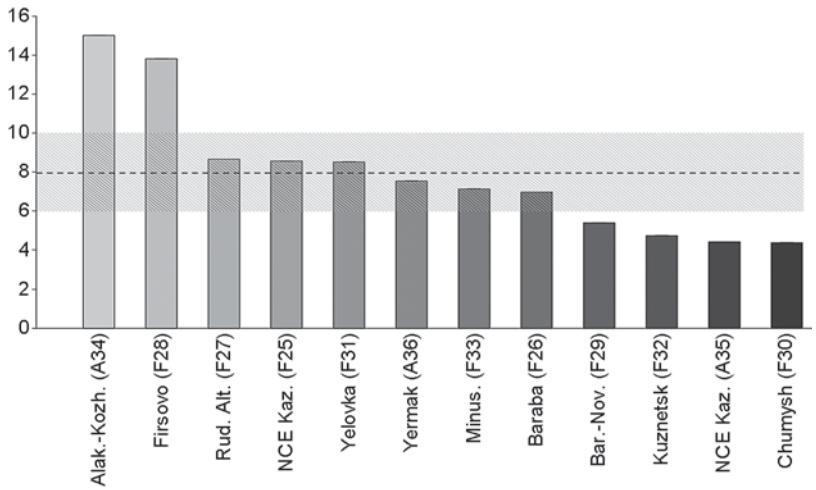

Fig. 7. Distances between the southern Karasuk sample and those of Andronovo. See Fig. 4 for explanations.

those Andronovans closest to them are still closer to any Okunev group, with one exception (see below). In the case of Kamenny Log, the proportion is reverse, and with regard to Southern Karasuk people, the position of Okunevans is different: earlier ones (Uibat and Tas-Khazaa) are closer to them than are the closests Andronovans, whereas later ones (Chernovaya and Verkh-Askiz) are further.

The Ket connection is not supported by craniometry (see Fig. 1). Among the twenty modern Western Siberian groups, those closest to Karasuk people when averaged across their 24 samples are, in the decreasing order of similarity, Teleuts (No. 78), Sagai Khakas (No. 74), Tobol-Irtysh Tatars (No. 62), Kumandins (No. 79), and Nenets (No. 70), wehereas Kets (No. 61) take the 18th position—third furthest. Comparison with separate Karasuk samples does not reveal any noticeable parallels with Kets. The only exception is the sample from Arban I, which is quite aberrant due to its eastern tendency. But Arban, too, is no closer to the Kets than to Tobol-Irtysh and Baraba Tatars, Kyzyl Khakas, and Teleuts.

Discussion

Results of the analysis lend no support to the idea that the sole ancestors of the Karasuk people were Andronovans. The main reason behind this fallacy was the paucity of data. Now we have twelve samples from various parts of the Andronovo distribution area, and not a single among them is closer to the Classic Karasuk group than are any of the four Okunev samples. Comparison with the Northern Karasuk group reveals one exception: Andronovans of the Barnaul-Novosibirsk area are somewhat closer to it than are Okunevans of Chernovaya. In other cases, the situation is the same as with the Classic Karasuk group. The situation with the Kamenny Log and Southern Karasuk is different (see above).

Another reason that could have led the researchers astray was the oft-cited fact that Karasuk is a post-Andronovo culture—a chronologically correct observation, which archaeologists sometimes interpreted following the "post hoc ergo propter hoc" logic. Actually, not only do the Karasuk and Andronovo clusters not coincide, but, moreover, they do not overlap: not a single one among the 24 Karasuk samples falls within the Andronovo cluster (see Fig. 1). Such a rapid and sharp transformation of physical type without visible reasons is absolutely impossible. Hence, it follows that Andronovans can be considered neither the sole nor even the main ancestors of Classic and Northern Karasuk people. To what extent do these two groups composed by Rykushina overlap is not clear. Anyhow, she arrives at the same conclusion (2007: 15–16).

In 1968, G.F. Debetz asked N.L. Chlenova, "And one more thing about the Okunev and the Karasuk people: why are they similar against all odds?" (Chlenova, 1977: 96). Today we know that they are not just similar, but also genetically related (Damgaard et al., 2018, Suppl. Mat.: 25). Results of craniometric analysis are in excellent agreement with the idea that Karasuk people are an outcome of the Okunev-Andronovo admixture. The

map in Poliakov's book (2022: 229), where the earliest Karasuk sites take a central position, being, in his words, "squeezed" (Ibid.: 310) between the Andronovo sites north of the Karasuk area and Okunev ones south of it, shows a striking resemblance with my plot (see Fig. 1). Apparently, the central area was the place where the most intense admixture and assimilation processes took place, resulting in the formation of the Karasuk group.

Archaeological data, however, suggest that the role of Okunevans in Karasuk origin was minor*, and that it can be traced only beginning from stage II, and only in the south of the Minusinsk Basin (Ibid.: 245, 291). According to craniometric data, by contrast, resemblance with Okunevans is the most distinct in the north of the Karasuk area. What could account for that? To all appearances, Andronovo migrants, who were geographically "squeezed" (see above) and experienced a shortage of women, rapidly mixed with aborigines (Okunevans), who were militarilly inferior to migrants and were assimilated by them. Owing to demographic disbalance, many native females remained outside the admixture process, whereas assimilation involved all. As a result, Okunev substratum affected the physical type of the newly formed Karasuk group, but not its culture**. In the north, the numerical predominance of aborigines over immigrants was insufficient to prevent invasion, but sufficient to maximize the substratal contribution to the admixed and assimilated Karasuk population of that area. In the south, the situation was different (see below). I used only data on male crania, but Rykushina (2007: 16), who studied the entire Karasuk material, concludes that the Okunev substratum had entered the Karasuk gene pool mainly through the female line. This should be expected under the assimilation hypothesis.

Denying the participation of Okunevans in Karasuk origins, Poliakov (2022: 245) refers to the absence of their cultural traces in the center of the Minusinsk Basin in the Late Bronze Age. But argumentum ex silentio cannot be considered critical, because before the Andronovo invasion, the Okunev distribution area had been much larger, and at the late stage Okunev burials became archaeologically "invisible" (Ibid.: 178). Also, assimilation could have taken part outside the Minusinsk Basin as well (Molodin, 1992), and could have involved relatives of Okunevans rather than themselves (Kozintsev, 2021).

In the view of Gromov (1996; 2002: 112), the idea of a relationship between Karasuk people and Okunevans disagrees with cranial nonmetric data. This mainly concerns type II of the infraorbital sutural pattern (IOP II), the low occurrence of which sharply opposes Okunevans to both the Andronovans and the Karasuk people. The problem with this argument is that the heritability of these traits is unknown, and so is their distribution in admixed groups. Unlike the situation with measurements, an intermediate status of hybrids with regard to nonmetric traits cannot be taken for granted. A high frequency of IOP II in the Karasuk people could be due to dominance. This idea is indirectly supported by facts relating to certain admixed groups. The physical type of Uzbeks results from the admixture of "Mediterranean" aborigines of Southwestern Central Asia (in whom IOP II is normally rare), on the one hand, with Andronovans and Eastern Central Asian Mongoloids (the frequency of the trait is very high in both those populations), on the other. Uzbeks, too, display a high rather than intermediate frequency (Kozintsev, 1988: 84). It is likewise high in Pamiris (Ibid.), whose physical type is generally "Mediterranean" despite the likely contribution of Andronovans to their origin (Ginzburg, Trofimova, 1972: 304). The light pigmentation of the latter is recessive, which may account for the dark pigmentation of Pamiris. In short, I see no reason to regard IOP II as a key indicator in this situation*.

As regards the Andronovo component, Poliakov's and Gromov's conclusion is supported: the principal contribution belonged to a new wave of Andronovo migrants from the west rather than to local Andronovans of the Minusinsk Basin. Especially distinct are ties between the Karasuk people and Fedorovka Andronovans of the Chumysh and the Kuznetsk Basin. But still, in Classic and Northern Karasuk groups, those ties are less apparent than those with Okunevans. Craniometry provides no indications that Andronovans associated with the Alakul tradition had played a special role in Karasuk origins.

Rykushina's Kamenny Log sample (No. 2) is much closer to Andronovans than is the earlier Classic Karasuk (No. 1), and the same is true of my Atypical Karasuk sample (No. 3)**. The probable reason is the

*On the other hand, the Alakul migration, to which the critical role in this process is ascribed, turns out to be just one of the factors (Poliakov, 2022: 249), whereas no culture immediately ancestral to Karasuk can be found in other territories. In view of this fact alone, one might consider Karasuk origin a mystery, were it not for craniometric evidence.

**For the scarce archaeological evidence of the Okunev involvement, see (Lazaretov, Poliakov, 2008; Poliakov, 2022: 234, 238).

*In a later publication, Gromov (2009) integrated the findings of analyses based on two systems, craniometry and cranial nonmetrics. As a result, the Karasuk people joined not only Andronavans, but even Afanasyevans, having taken an intermediate position between morphologically undifferentiated Siberian autochtones and the Tagar people. I don't believe that such a result discredits our method, shown to be informative in various situations (see, e.g., (Kozintsev, Moiseyev, 1995; Kozintsev, 2004)). Rather, one should remember that too many contrasting groups are not easily separated with the help of just two principal components.

**The degree of overlap between those two samples (that of Kamenny Log was composed by G.V. Rykushikna following

third Andronovo migration wave—this time from the south, i.e., from Xinjiang via Mongolia, down the Upper Yenisei (Lazaretov, Poliakov, 2008; Poliakov, 2022: 311). According to Poliakov, it is from them that the Karasuk (in his terms, "Late Bronze Age stage 2") people received the Shang dynasty bronzes, which were absent in the region at the earlier stage*. Interestingly, the Gumugou group (No. 60), which, according to the radiocarbon date, is earlier than Andronovo and shows no cultural parallels with it, is unambiguously Andronovo-like in terms of craniometry (see Fig. 1). Its closest parallels are Fedorovka Andronovans of Rudny Altai and the Kuznetsk Basin. This fact, along with absence of cranial similarity between Karasuk people and Pamiris, disagrees with the idea that Karasuk physical type is more ancient than the Karasuk population itself and had originated outside the Minusinsk Basin.

My Atypical Karasuk sample, as compared to the Classic Karasuk group, is shifted not only towards Andronovans but also towards Western Siberian natives (see Fig. 1). Because it was formed after the instructions by N.L. Chlenova, I should mention an observation made by I.P. Lazaretov (1996) about the Mongun-Taiga component in Chlenova's Lugavskoye culture. Indeed, both Mongun-Taiga samples (No. 58 and 59) display a shift towards the autochthonous Western Siberian supercluster**, as does the Karasuk group from Severny Bereg Varchi I (No. 18), identical with them. The Karasuk sample from Arban I (No. 20), where certain burials show Lugavskoye features (Ibid.), even falls within this supercluster. The same applies to my Eastern Minusinsk group (No. 7), which includes crania from Lugavskoye—the cemetery eponymous for that culture (Kozintsev, 1977: 26–27).

A marked heterogeneity of the Karasuk population, which includes distinctly "eastern" individuals (one of whom resembles Glazkovo people of the Baikal area), has also been demonstrated by genomic analysis (Jeong et al., 2018; Karafet et al., 2018). At the same time, at least two of the Karasuk females display a European autosomal profile and alleles responsible for light eye color (Keyser et al., 2009). The evident reason is Andronovo legacy. Indeed, as noted above, Andronovo samples closest to those of Classic and Northern Karasuk include two groups with the maximal expression of the "eastern" tendency—Baraba and Yelovka. Apparently, they are Siberian natives assimilated by Andronovans.

The fact that Saka, Sauromatians, and Tauri are members of the Karasuk cluster is understandable. Other members include early nomads of the Altai, Tuva, Mongolia, and the Aral region (Kozintsev, 2000). Apparently, admixture between Andronovans and Okunevans was but an episode in a chain of large-scale gene flow and admixture processes extending over large parts of Northern and Central Asia. Their repercussions are traceable in regions situated as far west and southwest of their center as Crimea and Iran (Sialk B), where the presence of Cimmerians is documented by both written and archaeological sources (Chlenova, 1971; Pogrebova, 2001). Incidentally, the date of Sialk B—the 8th century BC—coincides with the end of the Karasuk culture (Lazaretov, Poliakov, 2008)*. However, as regards its origin, those parallels are useless because of being late. The only exception are the Mongun-Taiga people—contemporaries of the early Karasuk people (Kovalev et al., 2008), differing from them culturally while being very similar craniometrically.

Could the Karasuk people have descended from those associated with the Seima-Turbino tradition, who had lived earlier? Regrettably, crania from Seima-Turbino burials at Rostovka (Solodovnikov et al., 2016) and Bulanovo (Khokhlov, 2017: 100, 293) are of little use, because they are few, poorly preserved, and problematic with regard to sex. Prima facie, those people could have been related

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the instructions by E.B. Vadetskaya and G.A. Maksimenkov, whereas Atypical Karasuk was based on the ideas of M.P. Gryaznov and N.L. Chlenova) is not clear, and the same applies to the Karasuk-Lugavskoye and Lugavskoye stages, according to Poliakov. Anyhow, both "atypical" samples are later than Classic Karasuk, and both are closer to Andronovans.

*An opposite view was voiced by E.N. Chernykh (2013: 293): Chinese bronzes are replicas of Karasuk prototypes.

**Mongun-Taiga ancestors could include the Transbaikal Mongoloids, not represented in my database (Tsybiktarov, 2018); by the way, I.I. Gokhman (1980) initially linked Mongun-Taiga crania from Baidag III with those from the slab-graves of the Transbaikal region. The small Mongun-Taiga sample from Western Mongolia (Alekseyev, Gokhman, Tumen, 1987) does not resemble any of the groups known to me, including the "slab-grave" people.

*A special analysis of the Cimmerian aspect of the Karasuk problem (Chlenova, 1971) is beyond the scope of this study. Possible Cimmerian connections, apart from those mentioned by Perevozchikov (1971), were discussed with regard to a cranium from a Novocherkassk burial in Ukraine (Kruts, 2002) and to those associated with the Chernogorovka culture of the Don Basin, also displaying Karasuk features (Batieva, 2011: 21). If it could be demonstrated that groups resembling Karasuk people really included Cimmerians, this would shed light on the Cimmerian versus Scythian controversy, because attempts at distinguishing these two peoples archaeologically have failed (Ivanchik, 2001: 281). At the same time, the cranial difference between the Karasuk people and those similar to them, on the one hand, and the pre-Scythian Chernogorovka population of Ukraine, cranially resembling Scythians, and Scythians themselves, on the other, is quite sharp (Kruts, 2002; Kozintsev, 2007). The fact that in a recent genetic study, Chernogorovka burials of the Dniester area are mentioned as Cimmerian without any qualification (Krzewińska et al., 2018, Suppl. Mat.: 8–9) shows the negligence with which certain geneticists handle the material they are using.

to Okunevans and, consequently, to those associated with Karasuk, as Chlenova (1977) believed. However, they are separated from Karasuk by a chronological gap. Even deeper roots of the aboriginal component within Karasuk could probably be revealed by comparison with Neolithic inhabitants of the Krasnoyarsk-Kansk forest-steppe and the Middle Irtysh (Kozintsev, 2021). Lack of physical resemblance between Karasuk people and Kets is all the more disappointing because Chlenova's hypothesis has been supported by genomic analysis: among all modern Siberian populations, those genetically closest to Karasuk people are Kets (Flegontov et al., 2016).

Conclusions

1. The Karasuk population is unambiguously admixed. It had apparently originated on the Middle Yenisei by admixture between Okunev aborigines and Andronovo immigrants. The assimilation of the former by the latter resulted in a greater contribution of the Okunev substratum to the physical type of the early Karasuk people than to their culture.

2. In representatives of the Classic Karasuk culture and those living in the north of the Karasuk area, the Okunev component clearly outweighs that introduced by the Andronovo migration, probably because the aborigines were more numerous than the immigrants. In the Kamenny Log group and in the south of the Karasuk area, the proportion of the two components is closer to equal. The likely reason was the third wave of Andronovo migration, this time from the south, as archaeological criteria suggest.

3. If the Karasuk people originated in situ, as the hypothesis states, then the Andronovo component had evidently been introduced from the west by immigrants of the second wave rather than inherited from those of the first wave.

4. The Karasuk population could as well have originated elsewhere by admixture between Andronovans and some native Siberian group akin to Okunevans. Affinities with natives of the Baraba forest-steppe are discernible only in the minority of Karasuk groups.

5. Groups physically resembling those of Karasuk are the Mongun-Taiga people of Tuva, Saka of Kazakhstan and Kirghizia, Sauromatians, Tauri of Crimea, and those buried at necropolis B of Sialk (likely Cimmerians). All of them had evidently originated in the course of admixture processes involving Andronovo tribes and Siberian natives related to Okunevans.

6. It is not true that Karasuk people were indistinguishable from recent Pamiris.

7. Affinities between Karasuk people and Kets could not be supported by cranial analysis.

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“I am a Chinese Archaeologist”: On the 70th Anniversary of Academician Wang Wei

The title quotes lyrics of the outstanding archaeologist of the People’s Republic of China, Academician Wang Wei. He composed several songs dedicated to his favorite field of knowledge: “Member of Archaeological Team”, “Yangshao Ray”, and a well-known song “Sanxingdui, Sanxingdui” about one of the most interesting Bronze Age sites in China; Academician Wang Wei participated in the works at the site. The scientist believes that every significant archaeological culture and major archaeological site should have its own “anthem”. And he is doing his best to ensure that the number of established important archaeological sites and cultures will grow.

Wang Wei was born in Changchun into a family of intellectuals on May 4, 1954. His family approved of his interest in music and singing. Wang Wei’s youth fell on the period of the Cultural Revolution; therefore, after graduating from high school in January 1970, he, like many other young people at that time, was sent to one of the villages of Nong’an County, Jilin Province, where he worked in a production team until January 1972. Upon returning home, Wang Wei worked first as a metal worker, then as deputy chairman of the trade union committee at the Changchun Boiler Plant; after joining the Communist Party of China in 1974, he served as a deputy secretary of the Party Committee of the Liuyuan People’s Commune in Changchun for about a year, in 1977–1978. This is how leadership skills were developed.

In 1978, Wang Wei entered the History Department (majoring in archaeology) of Jilin University, where he specialized under the general guidance of the outstanding archaeologist Prof. Zhang Zhongpei. In 1982, after graduating from university, he was employed by the Institute of Archaeology of the Chinese Academy of Social Sciences (CASS) in Beijing, where he has been working to the present day. At the Institute, Wang Wei made a career starting from junior researcher to director; he headed the institute in 2006–2017. In addition, from 1998 to 2012, Wang Wei was the dean of the Faculty of Archaeology at the Graduate School of the CASS, and from 1999 to 2016, he was the editor-in-chief of the journal *Kaogu* (*Archaeology*). In 2011, he was elected a full member of the Chinese Academy of Social Sciences, and since 2018 he has headed the Department of Historical Sciences of the CASS. In 2008, the scientist was elected a deputy chairman, and in 2013, a chairman of the Board of

the Archaeological Society of China. Since 2012, he has been a Chairman of the Expert Council on Archaeology of the National Social Science Fund of China. As a visiting specialist and professor, Wang Wei collaborated with the Peking, Fudan, Nanjing, and Jilin universities; since 2017, he has been heading the Center for the Study of Ancient Civilizations at Henan University (in Zhengzhou); since 2023, he has been an honorary director of the Institute of Ancient Civilizations at Nanjing University.

Academician Wang Wei’s major research interests include the Bronze and Early Iron Ages archaeology of China (the Xia, Shang, and Zhou Dynasties, according to traditional chronology), the issues of emergence of civilizations and early intercultural contacts in East Asia, as well as the archaeology of Japan in the Early Metal Age and Sino-Japanese cultural relations in antiquity. In

addition, he published several papers addressing the issues of early Chinese jade studies.

In 1982–1987, Wang Wei took part in the excavations of the settlement site and burial ground of Liulihe of the Western Zhou period in the Fangshan District in Beijing, where the Yan Kingdom and its capital were situated. His special field of interest was the study of *che-ma keng* (pits with chariots and horses—sacrificial structures within the elite tomb complexes).

In 1987–1990, the scientist was sent by the Institute of Archaeology of the CASS to Japan to complete his internship at the Institute of Archaeology in Kashihara, Nara Prefecture, and at the Ibaraki University, where he mastered not only the classic *kambun*, but also the spoken Japanese language. In Japan, Wang Wei participated in the excavations of the mansion of Prince Nagaya-no Okimi in the capital city of Heijō-kyō of the Nara period, the Fujinoki Mound in Nara Prefecture, shell mounds in Chiba Prefecture, and others. In January 1995, he got his doctorate degree in literature (D. Litt.) at Kyushu University for the monograph "A View from China on the Yamatai State and Political Power Among the *Wa* People" published in Japanese in 1993. In this study, on the basis of the analysis of archaeological materials, the researcher traced the process of development of Japanese statehood in 200–500 AD, examined the state origins and prerequisites, its social basis, and, most importantly, made a comparison with the emergence and development of early Chinese states.

In 1995–1996, Wang Wei worked as a visiting researcher at the School of Humanities and Social Sciences at Waseda University (Tokyo), where he wrote a dissertation entitled "The Distribution of Early Iron Products and the Exchange of Iron Technologies in East Asia" (the dissertation was published as a monograph in Beijing in 1999). This study covered the period from the 4th century BC to the 6th century AD, and presented the analysis of background and historical significance of the emergence and spread of iron processing technologies as the most important factor in the development of civilizations in the East Asian region. Wang Wei defended his dissertation at the Graduate School of the CASS in July 1996 and was awarded the degree of Doctor of Philosophy (PhD). Thus, he became the first Chinese archaeologist to hold two academic degrees gained in China and Japan.

In 1996–1998, Wang Wei led excavations of the palace area of the Shang fortified settlement in Yanshi, Henan Province. The excavations revealed one of the earliest representations of such features of traditional Chinese architecture as the central position of palace and the axial layout of city. The remains of palace buildings from the Early Shang period were uncovered at the site; the constructions formed a *siheyuan*-type building characteristic of traditional Chinese architecture (location of buildings around the courtyard, with the entrances facing the courtyard). The results of excavations in Yanshi were listed among the 10 most important archaeological discoveries in China in 1997 and were awarded the 2nd degree prize of the National Administration of Cultural Heritage for achievements in the archaeological field research. The derived archaeological data were used in the implementation of the nationwide Xia-Shang-Zhou Chronology Project, where Wang Wei supervised the thematic program "Study of the Chronology of the Site and Cemetery of Liulihe of the Western Zhou Period" (1996–2000).

In 2000, the scientist conducted excavations at the site of Zhouyuan, Shaanxi Province, where the remains of large buildings of the Early Zhou period were arranged symmetrically along the north-south axis, probably being the ruins of an ancestral temple. This research project was awarded the 3rd degree prize of the National Administration of Cultural Heritage for achievements in archaeological field research.

In 2003–2004, Wang Wei carried out large-scale excavations at the site of Xiaomintun on the territory of the Yin capital (Yinxu) in Anyang, Henan Province, where dwellings, bronze foundries, and a cemetery of the Late Shang period were found. The study expanded significantly the current knowledge about the culture, economy, and social structure of the Late Shang, and won the 2nd degree prize from the National Administration of Cultural Heritage for success in archaeological field research. Wang Wei became the only Chinese archaeologist to be awarded this prestigious prize three times.

In 2001–2018, Academician Wang Wei led the implementation of the first five stages of the key scientific and technical project "Study of the Origins of Chinese Civilization", which was included in the program of the Tenth Five-Year Plan for National Economic and Social Development of the PRC. In addition, he was the leader of several projects of the Chinese Academy of Social Sciences: "Study of the Influence of Environmental Changes on the Evolution of Human Lifestyle and the Development of Civilization in the Middle and Lower Reaches of the Yellow River" (2000–2004), "Origins and Early Period of Development of ancient Chinese Civilization" (2001–2005), co-head of the Joint Sino-American research project "Study of the Location of Settlements in the Yellow River Basin in the Anyang Region, Henan Province" (1999–2002), the Joint Sino-German project "Comprehensive Study of Bronze Age Cultures in the Northwestern Region of China" (2000–2005), the Joint Sino-Japanese project "Archaeological Research on Intercultural Contacts in East Asia in Prehistory" (2001–2003), as well as the leader and participant in other major Chinese and international research programs. In 2012–2021, he was the leading

expert of the National Social Science Fund project "The Origin of the Mongols and the Imperial Mausoleums of the Yuan Dynasty"; in 2020–2022, he led a group of experts who acted as scientific consultants during the excavations at Sanxingdui (Guanghan County, Sichuan Province).

Wang Wei took part in many joint archaeological research projects in Germany, Egypt, Uzbekistan, Honduras, and other countries. He was elected a corresponding member of the German Archaeological Institute (in 2001) and a foreign member of the Society for American Archaeology (in 2006). Wang Wei participated in scientific events in Russia and Siberia, made a presentation at the international conference "Terra Scythica" in 2011; he was a co-organizer and participant in the international symposium "Multidisciplinary Methods in Archaeology: The Recent Achievements and Prospects" in 2015; he joined the editorial boards of the journal "Archaeology, Ethnology and Anthropology of Eurasia" and the oriental studies issues of "Vestnik NSU. Series: History, Philology".

Wang Wei was elected to the 12th (2013–2018) and 13th (2018–2023) National People's Congress (NPC). He was a member of the Education, Science, Culture and Public Health Committee at the 13th National People's Congress.

Academician Wang Wei has published over 100 major scientific papers and two monographs. He was also one of the authors and editors of two volumes of the fundamental summarizing work "The Archaeology of China" — "The Age of Xia and Shang" (2003), and "The Period of Two Dynasties" (2004), these books were awarded the Guo Moruo Prize of the 1st degree.

In recent years, Wang Wei quitted some administrative duties and passed his responsibilities onto his students and associates; he focused on scientific and popularization activities. He prepares monographs and creates large television programs and documentaries that attract attention of tens of millions of his compatriots to archaeology. Wang Wei's creative activities are on the rise, same as the Chinese archaeology as a whole. Let us wish Academician Wang Wei new scientific discoveries and new songs of course!

A.P. Derevianko, V.I. Molodin,
S.A. Komissarov, Wang Peng, M.A. Kudinova

AN SSSR – USSR Academy of Sciences

BAR – British Archaeological Reports

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

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

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)

KhakNIIYALI – Khakass Research Institute of Language, Literature and History (Abakan)

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

SPbGU – Saint Petersburg State University (St. Petersburg)

TIE – Transactions of the Institute of Ethnography

TKAEE – Tuva Complex Archaeological and Ethnographic Expedition

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

UFNC RAN – Ufa Scientific Center of the Russian Academy of Sciences (Ufa)

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

UrO RAN – Ural Branch of the Russian Academy of Sciences

YANAO – Yamal-Nenets Autonomous Okrug

YNC RAN – Southern Scientific Center, Russian Academy of Sciences (Rostov-on-Don)

Alaeva I.P., Senior Researcher, South Ural State Humanitarian and Pedagogical University, pr. Lenina 69, Chelyabinsk, 454080, Russia. E-mail: alaevaira@mail.ru; https://orcid.org/0000-0001-8322-5835

Andalas E.F., Assistant Professor, Universitas Muhammadiyah Malang, Tlogomas 246, Lowokwaru, Malang, 65144, Indonesia. E-mail: eggy@umm.ac.id; https://orcid.org/0000-0002-0107-7849

Ankushev M.N., Junior Researcher, South Ural Federal Scientific Center of Mineralogy and Geoecology, Ural Branch, Russian Academy of Sciences, Ilmensky Reserve, Miass, 456317, Russia. E-mail: ankushev_maksim@mail.ru; https://orcid.org/0000-0001-9628-5546

Ankusheva P.S., Junior Researcher, South Ural Federal Scientific Center of Mineralogy and Geoecology, Ural Branch, Russian Academy of Sciences, Ilmensky Reserve, Miass, 456317, Russia; Senior Researcher, South Ural State Humanitarian and Pedagogical University, pr. Lenina 69, Chelyabinsk, 454080, Russia. E-mail: polenke@yandex.ru; https://orcid.org/0000-0002-1826-9919

Artemyev D.A., Researcher, South Ural Federal Scientific Center of Mineralogy and Geoecology, Ural Branch, Russian Academy of Sciences, Ilmensky Reserve, Miass, 456317, Russia. E-mail: artemyev@mineralogy.ru; https://orcid.org/0000-0003-1813-8932

Babina K.A., Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, ZooSCAn International Research Laboratory, CNRS–IAET SB RAS, IRL 2013, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia; Senior Lecturer, Novosibirsk State University, Pirogova 2, Novosibirsk, 630090, Russia. E-mail: k.babina@g.nsu.ru; https://orcid.org/0000-0001-6612-678X

Baulo A.V., Leading Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: bau194@yandex.ru; https://orcid.org/0000-0001-8379-3760

Borodovsky A.P., Leading Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: altaicenter2011@gmail.com; https://orcid.org/0000-0002-6312-1024

Bragina A.A., Junior Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia; Assistant, Novosibirsk State University, Pirogova 2, Novosibirsk, 630090, Russia. E-mail: bragina@catalysis.ru; https://orcid.org/0000-0001-9256-0475

Burnakov V.A., Senior Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: venariy@mail.ru; https://orcid.org/0000-0001-9636-3081

Derevianko A.P., Professor, Scientific Director, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: derev@archaeology.nsc.ru; https://orcid.org/0000-0003-1156-8331

Dewi T.K.S., Associate Professor, Universitas Sebelas Maret, Sutami 36, Jebres, Surakarta, 57126, Indonesia. E-mail: trisnadewi22@yahoo.com

Emelyanova T.A., Leading Researcher, Pacific Oceanological Institute, Far Eastern Branch, Russian Academy of Sciences, Baltiyskaya 43, Vladivostok, 690041, Russia. E-mail: emelyanova@poi.dvo.ru; https://orcid.org/0000-0002-4790-7270

Epimakhov A.V., Professor, South Ural State University, pr. Lenina 76, Chelyabinsk, 454080, Russia. E-mail: epimakhovav@susu.ru; https://orcid.org/0000-0002-0141-1026

Fedorets A.N., Senior Lecturer, Far Eastern Federal University, Ayaks 10, Russky Island, Vladivostok, 690922, Russia. E-mail: fedorec.an@dvfu.ru; https://orcid.org/0000-0001-9007-3171

Garkusha Y.N., Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: garkusha_y@list.ru; https://orcid.org/0000-0002-0935-0213

Itaristanti, Associate Professor, Institut Agama Islam Negeri Syekh Nurjati Cirebon, Perjuangan, Kesambi, Cirebon, 45132, Indonesia. E-mail: itaristanti@syekhnurjati.ac.id

Ivanova D.A., Researcher, Associate Professor, Far Eastern Federal University, Ayaks 10, Russky Island, Vladivostok, 690922, Russia. E-mail: ivanova.dale@dvfu.ru; https://orcid.org/0000-0002-2873-6664

Kanomata Y., Associate Professor, Graduate School of Arts and Letters, Tohoku University, Kawauchi 27-1, Aoba ward, Sendai, 980-8576, Japan. E-mail: yoshitaka.kanomata.d8@m.tohoku.ac.jp; https://orcid.org/0000-0002-9970-2015

Kogai S.A., Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: kogai@irkutsk.ru; https://orcid.org/0000-0003-4232-9587

Koryakova L.N., Chief Researcher, Institute of History and Archaeology, Ural Branch, Russian Academy of Sciences, S. Kovalevskoi 16, Yekaterinburg, 620108, Russia. E-mail: lunikkor@mail.ru; https://orcid.org/0000-0003-4861-344X

Kozintsev A.G., Chief Researcher, Peter the Great Museum of Anthropology and Ethnography (Kunstkamera), Russian Academy of Sciences, Universitetskaya nab. 3, St. Petersburg, 199034, Russia. E-mail: alexanderkozintsev@yandex.ru; https://orcid.org/0000-0002-0165-8109

Kuznetsov A.M., Researcher, Siectific Research Center "Baikal Region", Irkutsk State University, Karla Marksa 1, Irkutsk, 664003, Russia. E-mail: golos_siberia@list.ru; https://orcid.org/0000-0003-0903-4728

Lazin B.V., Senior Researcher, Educational and Scientific Museum, Far Eastern Federal University, Ayaks 10, Russky Island, Vladivostok, 690922, Russia. E-mail: lazin.bv@dvfu.ru; https://orcid.org/0000-0003-2785-4260

Lazina A.A., Chief Specialist, Educational and Scientific Museum, Far Eastern Federal University, Ayaks 10, Russky Island, Vladivostok, 690922, Russia. E-mail: lazina.aal@dvfu.ru; https://orcid.org/0000-0002-3597-8231

Leshchenko N.V., Researcher, Institute of History, Archaeology and Ethnography of the Peoples of the Far East, Far Eastern Branch, Russian Academy of Sciences, Pushkinskaya 89, Vladivostok, 690001, Russia. E-mail: nina8.56@mail.ru; https://orcid.org/0000-0002-5945-1530

Mainicheva A.Y., Leading Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: annmaini@gmail.com; https://orcid.org/0000-0002-0784-4252

Manuaba I.B.P., Professor, Universitas Airlangga, Airlangga 4-6, Gubeng, Surabaya, 60115, Indonesia. E-mail: ibteram@yahoo.com; https://orcid.org/0000-0002-9269-6425

Marcos J.G., Professor, Escuela Superior Politécnica del Litoral, Campus Gustavo Galindo Velasco, Guayaquil, EC-090150, Ecuador. E-mail: drmarcos@me.com

Matrenin S.S., Senior Researcher, Altai State University, pr. Lenina 61, Barnaul, 656049, Russia. E-mail: matrenins@mail.ru; https://orcid.org/0000-0001-7752-2470

Naumov A.M., Director, MPI Ozersk City District "City Museum", pr. Pobedy 2, Ozersk, 456780, Russia. E-mail: anton_naumov_74@mail.ru

Nikitin Y.G., Head of Museum of Archaeology and Ethnography, Institute of History, Archaeology and Ethnography of the Peoples of the Far East, Far Eastern Branch, Russian Academy of Sciences, Pushkinskaya 89, Vladivostok, 690001, Russia. E-mail: urgen55@yandex.ru; https://orcid.org/0000-0003-3012-3688

Novikov A.V., Senior Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: Novikov@archaeology.nsc.ru; https://orcid.org/0000-0002-6418-1061

Parkhomchuk E.V., Senior Researcher, Head of the Center for Collective Use "Geochronology of Cenozoic", Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, Kutateladze 7/3, Novosibirsk, 630090, Russia; Acting Head of Chair, Novosibirsk State University, Pirogova 2, Novosibirsk, 630090, Russia. E-mail: ekaterina@catalysis.ru; https://orcid.org/0000-0003-2200-884X

Parshikova T.S., Deputy Director, Museum of Archaeology and Ethnography, Altai State University, pr. Lenina 61, Barnaul, 656049, Russia. E-mail: taty-parshikova@yandex.ru; https://orcid.org/0000-0001-5078-8244

Popov A.N., Director, Educational and Scientific Museum, Far Eastern Federal University, Ayaks 10, Russky Island, Vladivostok, 690922, Russia. E-mail: poparchaeo@mail.ru; https://orcid.org/0000-0002-1423-8410

Seregin N.N., Laboratory Head, Altai State University, pr. Lenina 61, Barnaul, 656049, Russia. E-mail: nikolay-seregin@mail.ru; https://orcid.org/0000-0002-8051-7127

Shnaider S.V., Senior Researcher, ZooSCAn International Research Laboratory, IRL 2013, CNRS–Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: sveta.shnayder@gmail.com; https://orcid.org/0000-0003-2230-4286

Stepanov I.S., Researcher, South Ural Federal Scientific Center of Mineralogy and Geoecology, Ural Branch, Russian Academy of Sciences, Ilmensky Reserve, Miass, 456317, Russia. E-mail: ivanstep208@yandex.ru; https://orcid.org/0000-0002-7380-921X

Tishkin A.A., Professor, Department Head, Altai State University, pr. Lenina 61, Barnaul, 656049, Russia. E-mail: tishkin210@mail.ru; https://orcid.org/0000-0002-7769-136X

Tur S.S., Head of the Cabinet of Anthropology, Museum of Archaeology and Ethnography, Altai State University, pr. Lenina 61, Barnaul, 656049, Russia. E-mail: tursvetlana@mail.ru; https://orcid.org/0000-0002-0616-6525

Vinogradov N.B., Professor, South Ural State Humanitarian and Pedagogical University, pr. Lenina 69, Chelyabinsk, 454080, Russia. E-mail: vinogradov_n@mail.ru

Zhurbin I.V., Chief Researcher, Udmurt Federal Research Center, Ural Branch, Russian Academy of Sciences, T. Baramzinoy 34, Izhevsk, 426067, Russia. E-mail: zhurbin@udm.ru; https://orcid.org/0000-0002-7715-0459

Zhushchikhovskaya I.S., Leading Researcher, Institute of History, Archaeology and Ethnography of the Peoples of the Far East, Far Eastern Branch, Russian Academy of Sciences, Pushkinskaya 89, Vladivostok, 690001, Russia. E-mail: irina1zh@mail.ru; https://orcid.org/0000-0003-1469-6013