SIBERIAN BRANCH OF THE RUSSIAN ACADEMY OF SCIENCES
INSTITUTE OF ARCHAEOLOGY AND ETHNOGRAPHY

ARCHAEOLOGY, ETHNOLOGY & ANTHROPOLOGY OF EURASIA

Volume 48, No. 3, 2020

DOI: 10.17746/1563-0110.2020.48.3 *Published in Russian and English*

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ARCHAEOLOGY, ETHNOLOGY & ANTHROPOLOGY OF EURASIA

Volume 48, No. 3, 2020

Founded in January, 2000
A quarterly journal in Russian and English

Founders

Siberian Branch of the Russian Academy of Sciences

Institute of Archaeology and Ethnography of the Siberian Branch of the Russian Academy of Sciences

IAET SB RAS Editorial Office and Publishing House
Postal address:
Institute of Archaeology and Ethnography
Pr. Akademika Lavrentieva 17,
Novosibirsk, 630090, Russia
Tel.: (383) 330-83-66
E-mail: eurasia@archaeology.nsc.ru
http://journal.archaeology.nsc.ru

Editors of the original Russian texts
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Issuing Editor
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Designer
I.P. Gemueva
Russian texts translated by
V.A. Baranov
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E.Y. Pankeyeva
E. Winslow
English texts revised by
L. Baranova
P. Magnussen
S. Winslow

Mass media registration certificate
No. 018782 issued May 11, 1999

Passed for printing September 24, 2020
Appearance September 30, 2020
Format 60×84/8. Conv. print. sh. 18.83. Publ. sh. 20.5
Order No. 509. Circulation 100 copies
Open price

IAET SB RAS Printing House
Pr. Akademika Lavrentieva 17,
Novosibirsk, 630090, Russia
http://archaeology.nsc.ru

DOI: 10.17746/1563-0110.2020.48.3.003-032

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Who Were the Denisovans?

We provide a comprehensive summary of data relating to the origin, chronology, and culture of the Denisovans—a separate hominin population, first described in 2010 on the basis of aDNA extracted from fossils found in Denisova Cave, in the northwestern part of the Russian Altai. We cite the results of morphological and genomic studies of the teeth and postcranial bones of those hominins. On the basis of a large series of optical and radiocarbon dates of the Pleistocene strata of Denisova Cave, the timeline for the hominin evolution in that region is reconstructed. The chronology of the evolutionary events based on aDNA is discussed. We provide a detailed description of stone and bone tools, and ornaments made of various materials, from Denisova habitation horizons. It is demonstrated that the Paleolithic cultural sequence in that cave is the most complete in North and Central Asia, spanning the principal stages of human evolutionary history over the last 300 thousand years. Denisovan origins and their role in the emergence of anatomically modern humans are reconstructed on the basis of a large body of archaeological, skeletal, and genetic data relating to Africa and Eurasia. It is concluded that the Neanderthal and Denisovan genetic legacy in the modern human gene pool indicates the existence of several zones in Africa and Eurasia where H. erectus evolution proceeded independently. The same applies to the evolution of lithic technologies.

Keywords: *Denisova Cave, Paleolithic, Pleistocene, paleoanthropology, paleogenetics, Denisovans.*

Introduction

In the last decade, numerous experts in human evolution and the origins of modern humans (physical anthropologists, specialists in paleogenetics, and archaeologists) have been trying to answer the question as to who Denisovans were. The discovery of Denisovan remains was a complete surprise for all of them. In 2010, for the first time, on the basis of the analysis of mitochondrial DNA extracted from a finger phalanx, found in the Pleistocene deposits of Denisova Cave (Fig. 1) in the northwestern part of the Russian Altai, dating to the Initial Upper Paleolithic, a new hominin taxon, genetically very different from both *Homo sapiens* and *H. neanderthalensis*, was described.

Since the early 1980s, specialists from the Institute of Archaeology and Ethnography SB RAS have excavated about two dozen stratified Paleolithic sites in the Altai, revealing several meters thick Pleistocene sequences consisting of up to ten habitation horizons each. Field and laboratory work is being jointly conducted by archaeologists, geologists, paleogeographers, geochronologists, paleontologists, physical anthropologists, paleogeneticists, etc. from major Russian and foreign research centers. To date, a large body of information has been accumulated,

Archaeology, Ethnology & Anthropology of Eurasia 48/3 (2020) 3–32 E-mail: Eurasia@archaeology.nsc.ru

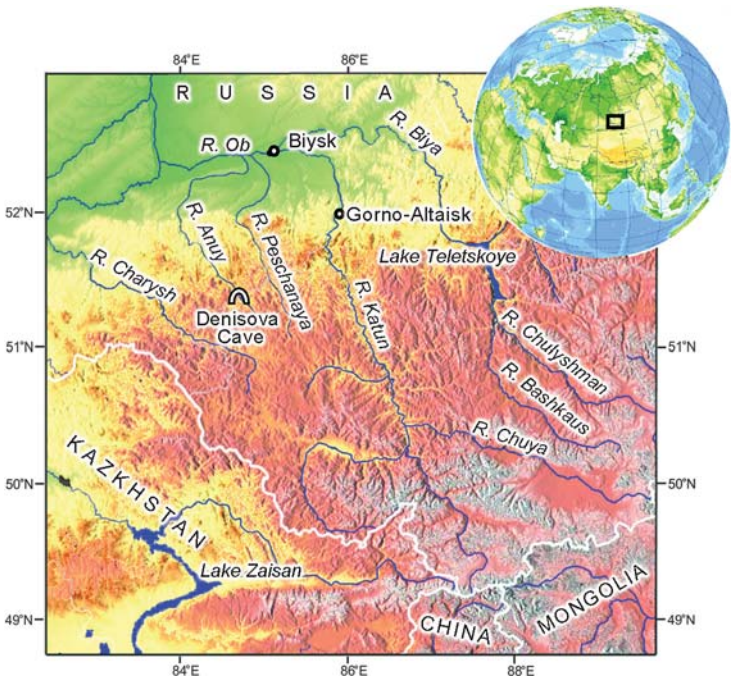

Fig. 1. Location of Denisova Cave.

evidencing the evolution of the Paleolithic cultural traditions in the Middle and Upper Pleistocene.

The most representative materials come from Denisova Cave (Fig. 2), where thirteen habitation layers with Paleolithic artifacts have been described. Owing to an unusually complete stratigraphic sequence, the evolution of the material culture of the cave dwellers has been traced over some 300 thousand years.

Especially intriguing were findings relating to layer 11 of the cave, characterized by the Early Upper Paleolithic blade industry, as well as numerous bone implements, and ornaments made of bone and semi-precious stone. These deposits span the chronological interval between 50–40 ka BP, implying that in the Altai, the Upper Paleolithic emerged earlier than in Europe or Africa. The appearance of stone and bone tools from layer 11 initially suggested their association

Fig. 2. Plan of Denisova Cave.
a – drip-line; *b* – excavations of Pleistocene deposits.

with *H. sapiens*, which was somewhat too early for anatomically modern humans to have appeared in Siberia.

In 2008, a distal phalanx of a girl's little finger was found in the East Chamber of Denisova Cave, in layer 11.2. Part of it was handed to Svante Pääbo, the Head of the Department of Genetics at the Max Planck Institute of Evolutionary Anthropology. Previously, geneticists associated with this institute had demonstrated that the Okladnikov Cave dwellers were Neanderthals (Krause et al., 2007). The sequencing of the mitochondrial and then the nuclear DNA from the Denisova phalanx suggested that the bone belonged to a hitherto unknown hominin, who was termed Denisovan after the eponymous site (Krause et al., 2010). According to the genetic study of the aDNA extracted from the left upper molar from lithological unit 11 in the South Chamber of the cave, the young male to whom the tooth belonged was a Denisovan too (Reich et al., 2010). This tooth shows neither Neanderthal nor modern human apomorphies, suggesting that the Denisovan evolutionary trajectory was different from those of both *H. neanderthalensis* and *H. sapiens*.

The analysis of nuclear genomes of the newly described hominins suggests that they were a sister group of Neanderthals, i.e., their common ancestor was a sister taxon of anatomically modern humans. This means that at least two hominin taxa coexisted with *H. sapiens* in Eurasia: Neanderthals in its western part and Denisovans in its eastern part.

Multidisciplinary studies of materials from Denisova Cave suggest that the evolution of the Paleolithic tradition in that area resulted in the autochthonous emergence of the Upper Paleolithic culture on a Middle Paleolithic basis, indicating not only cultural but biological continuity as well. The analysis of human aDNA from fossil remains unearthed in the cave demonstrates that Denisovans were associated not only with lithological unit 11 and its Early Upper Paleolithic industry, but also with the middle part of the sequence (the boundary of layers 11.4 and 12) and its lower part (layer 22.1), representing various stages of the Middle Paleolithic (Sawyer et al., 2015; Slon et al., 2017b). It follows that those who manufactured both Middle Paleolithic and Early Upper Paleolithic tools were Denisovans. Also, judging by hominin fossils from layers 12 and 11.4 in the East Chamber of the cave, Denisovans coexisted with Neanderthals during the Middle Paleolithic, and occasionally hybridized with them (Mednikova, 2011a, 2013; Prüfer et al., 2014; Slon et al., 2017a, 2018). Despite major stratigraphic gaps, archaeological finds from the Denisova sequence testify to cultural continuity in the evolution of the lithic industries from the Early Middle Paleolithic to the mid-Upper Paleolithic. Although Neanderthal fossils were found in Denisova Cave, no evidence of the Mousterian tradition has so far been detected there, which may tentatively be explained by the interbreeding between Denisovans and Neanderthals. This hypothesis has been supported by the analysis of DNA extracted from a girl's bone from layer 12.3, revealing mixed female Neanderthal and male Denisovan ancestry (Slon et al., 2018).

Geochronology of the Denisova Pleistocene deposits

Consistent studies of key topics of the evolution of *Homo* genus, including the time and routes of initial peopling of the Earth, evolution of the anatomically modern humans, and the development of primitive culture, are possible only on the basis of reliable chronostratigraphic data from the Paleolithic sites under study. These data are especially important in the studies of stratified sites with the long cultural sequence, such as Denisova Cave. A significant series of dates have been obtained in Russian and foreign laboratories, using various techniques, in the course of comprehensive studies of the Denisova Pleistocene deposits. The results of radiocarbon and optical dating carried out recently using the methods of the accelerator mass spectrometry (AMS) and optically stimulated luminescence (OSL) in laboratories of the Oxford and Wollongong Universities are crucially important for the study of geochronology of Denisova Cave.

The most complete chronostratigraphic sequence of the cave sediments was established using the OSL-technique by the team of specialists headed by Profs. R. Roberts and Z. Jacobs from the Center for Archaeological Science at the University of Wollongong (Jacobs Z. et al., 2019). Australian researchers, having profound experience of field works at Paleolithic sites in Africa and Eurasia, during five years have been collecting samples from Denisova Pleistocene deposits for the OSL-dating. On the basis of results of the optical dating of 103 deposits samples, they have produced chronological models of the Pleistocene sequence in three chambers of the cave. Dating of 92 samples was executed on the basis of measurements of more than 280 thousand separate seeds of quartz and potassium-fortified feldspar;

11 samples were dated using the analysis of multigrain aliquots of K-feldspar. Optical dates were calculated using four methods of assessment of the equivalent dose (*De*), and were used for the development of Bayesian model of sedimentation chronology in each cave chamber, with the aim of correlation of layers of the stratigraphic sequences, as well as establishing the complex chronological and climatic interval of the cave peopling by hominins.

At present, the Pleistocene deposits in the Main and East Chambers of the cave are the best studied in terms of archaeology, lithology, biostratigraphy, and chronostratigraphy (Fig. 3). The earliest OSL-date was established for the basal deposits in the East Chamber: 508 ± 40 ka BP for the top part of layer 17.2, and 305 ± 37 ka BP for the bottom part of layer 17.1; as well as 366 ± 43 ka BP for the bottom of layer 22.3 in the Main Chamber.

The earliest archaeological evidence of the cave is associated with the Early Middle Paleolithic artifacts recovered from the dense, light to dark brown loams in layer 22 in the Main Chamber, with the top part of the layer having the OSL-date of 287 ± 41 ka BP. Layer 22 is overlain by culture-bearing horizons 21 and 20, dating to the range from 250 ± 44 to 170 ± 19 ka BP. In the East Chamber, the Early Middle Paleolithic is represented by the dark gray sediments of layers 15 and 14, dating to the range from 203 ± 14 to 187 ± 14 ka BP. Available paleogeographic data of this sedimentation suggest that there were two warm and one comparatively cold climatic phases in the second half of the Middle Pleistocene corresponding to MIS 9–7.

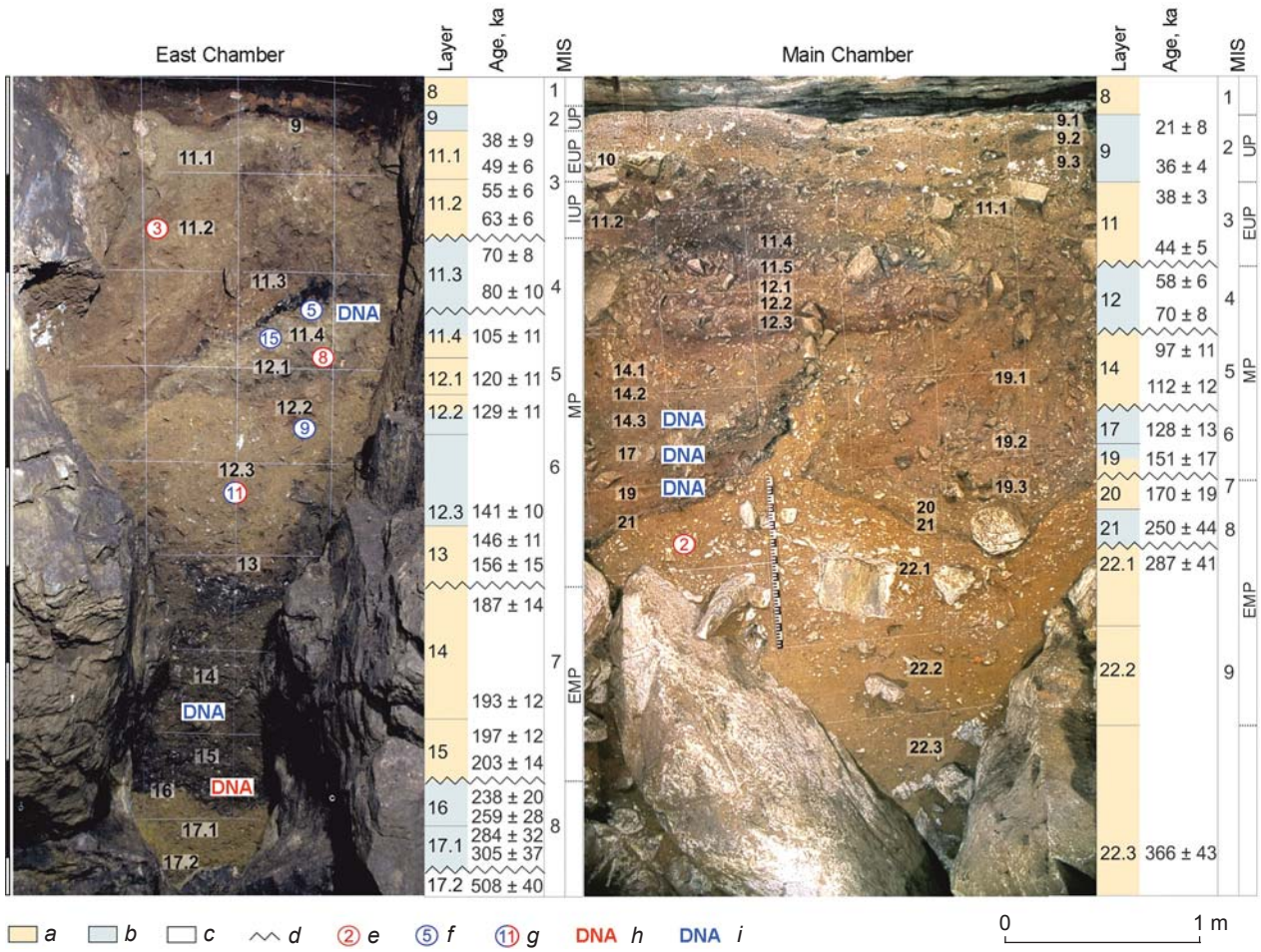

Fig. 3. Pleistocene deposits in the East Chamber and Main Chamber of Denisova Cave. Beginning and end of sedimentation is modeled using the Bayesian method on the basis of optical time estimates (after (Jacobs Z. et al., 2019)).
Climatic conditions: *a* – relatively warm; *b* – relatively cold; *c* – no data; *d* – sedimentation gap. Fossils: *e* – Denisovan, *f* – Neanderthal, *g* – hybrid. DNA from deposits: *h* – Denisovan; *i* – Neanderthal.
UP – Upper Paleolithic; EUP – Early Upper Paleolithic; IUP – Initial Upper Paleolithic; MP – Middle Paleolithic; EMP – Early Middle Paleolithic.

The next stage of the Middle Paleolithic is illustrated by the lithic industries from layers 19–14 in the Main Chamber and layers 13–11.4 in the East Chamber. These were OSL-dated to 156 ± 15 to 105 ± 11 / 97 ± ± 11 ka BP. The available chrono- and biostratigraphic data suggest that these deposits were formed after a long sedimentation gap during the last glaciation in the Middle Pleistocene and in the period of the last interglacial in the Early Upper Pleistocene, which periods correspond to MIS 6 and 5.

The terminal stage of the Middle Paleolithic is represented by the lithic industries of layer 12 in the Main Chamber and layer 11.3 in the East Chamber. The OSL age of these deposits has been established in the range of 80 ± 10 to 58 ± 6 ka BP, which corresponds to the cold period of MIS 4.

The thick series of the Middle Paleolithic cultural deposits in the Main Chamber of the cave was covered upon the long-lasting sedimentation gap with layer 11, and in the East Chamber (also after sedimentation gap) with layers 11.2 and 11.1, containing the Early Upper Paleolithic artifacts. Over 50 dates obtained using the radiocarbon and OSL analysis are available for these deposits. The AMS-dates for the upper part of the Pleistocene deposits were obtained from the charcoal and bones samples bearing signs of working, at the Research Laboratory for Archaeology and the History of Art (University of Oxford), by Profs. T. Higham and K. Douka. For the recent five years, these researchers have participated in the multidisciplinary studies at Denisova Cave (Douka et al., 2019).

The most early Upper Paleolithic complex, including (apart from lithic artifacts) a bone needle; ornaments of bone, semi-precious stone, and ostrich eggshell, as well as a distal phalanx of a little finger of the Denisovan *Denisova 3*, was associated with layer 11.2 in the East Chamber. The OSL age of this complex is 63 ± 6 to 55 ± 6 ka; the AMS-dates are in the range of 50,300 ± 2200 years BP (OxA-V-2359-16) to 35,400 ± 900 years BP (OxA-30005).

There are several dates available for various parts of the cave deposits: the OSL-date of 49 ± 6 to 38 ± ± 9 ka BP and AMS-date of 47,900 ± 3100 years BP (OxA-29855) for layer 11.1 in the East Chamber; AMS-dates of 48,900 ± 1800 years BP (OxA-V-2359-18), 51,200 ± 2200 years BP (OxA-V-2359-17), 48,650 + 2380/– 1840 years BP (KIA 25285 SP 533.D19) for layer 11 in the South Chamber. The deposits of layer 11 in the Main Chamber of the cave are comparatively younger: the age of the five lithological sublayers (11.5–11.1) was determined in the range of 44 ± 5 to 38 ± 3 ka BP using OSL technique; the AMS-dates fall within the range from >50,400 years BP (OxA-34728) to 32,150 ± 450 years BP (OxA-33086). In addition, bone artifacts associated with the stone tools within this layer were directly dated. The bone point from layer 11.4 in the Main Chamber was dated to 42,660–48,100 cal years (OxA-30271); the elk tooth pendant from layer 11.2 in the East Chamber to 42,450–49,710 cal years (OxA-30963) (Ibid.). These assessments suggest that the said artifacts can be attributed to the oldest items of this type discovered so far in Northern Eurasia.

The top part of the Pleistocene deposits in Denisova Cave contains lithological layer 9 with the Middle Upper Paleolithic industry. The age of this layer in the Main Chamber was assessed as 36 ± 4 to 21 ± 8 ka BP using the OSL technique.

The geochronology of the anthropological remains discovered in the cave is of special interest. Their probable age was assessed using the Bayesian method, based on the chronometric (OSL- and ^{14}C-dates), stratigraphic, and genetic data, for which purpose the chronological models were developed (Ibid.). The modeling of the oldest bone of the Denisovan *Denisova 2* from layer 22.1 in the Main Chamber produced the date of 122,700–194,400 years. The date of the molar of the Denisovan *Denisova 8*, recovered at the border of layers 12 and 11.4 in the East Chamber is estimated in the range of 105,600–136,400 years. The modeled age of the youngest bone of the Denisovan *Denisova 3* from layer 11.2 in the East Chamber is 51,600–76,200 years. Molar *Denisova 4* from layer 11.1 in the South Chamber differs from the sample *Denisova 3* only in two mtDNA mutations; hence, it has the same age.

The Middle Paleolithic layers in the East Chamber also yielded anthropological remains of Neanderthals and a bone of the girl-hybrid of a Neanderthal mother and a Denisovan father. The Neanderthal samples *Denisova 5* and *Denisova 15* from lithological layer 11.4 were dated to 90,900–130,000 years, and the phalanx *Denisova 9* from layer 12.3 to 119,100–147,300 years. The bone *Denisova 11* belonging to the daughter of Neanderthal mother and Denisovan father was identified among the indeterminable bone fragments from layer 12.3; the modeled age for this bone was 115,700–140,900 or 79,300–118,100 years.

The Neanderthal DNA was recorded in the deposits of lithological layers 19, 17, and 14 in the Main Chamber, with the OSL-age from 151 ± 17 to 97 ± 11 ka, as well as layers 14 (193 ± 12 to 187 ± 14 ka) and 11.4 (105 ± 11 ka) in the East Chamber. The Denisovan DNA was discovered in the deposits of layer 15 in the East Chamber, dated to 203 ± 14 to 197 ± 12 ka BP.

The modeled dates of the anthropological fossils are generally well correlated with the optical age of the cave deposits. The only exceptions are the molar *Denisova 2* from layer 22.1 in the Main Chamber, and possibly the bone of the hybrid *Denisova 11* from layer 12.3 in the East Chamber. Subsequent studies will provide additional data explaining the divergence between the modeled and the optical age of these samples; although, this partial discrepancy does not affect the general pattern of the cave peopling. The modeled age of the oldest Denisovan fossils suggest that this population emerged in the south of Siberia as early as 195 ka BP, and according to the OSL-dates of the sediments ca 300 ka BP. Judging by the youngest bone remain of Denisovans, this population survived in the Altai until ca 50 ka BP. The age of the Middle Paleolithic layers of the cave, yielding Neanderthal remains, including the bone revealing mixed female Neanderthal and male Denisovan ancestry, falls within the range of 193 ± 12 to 97 ± 11 ka BP. According to these data, both populations inhabited the northwestern Altai for a long time, had contacts, and hybridized with each other.

Hominin fossils

The first hominin fossil was discovered in the Pleistocene layers of Denisova Cave in 1984. This was a deciduous molar from lithological layer 22.1 in the Main Chamber, later named *Denisova 2* (Shpakova, Derevianko, 2000). In the same year, layer 12 in the Main Chamber yielded a tooth, which was initially identified as a permanent upper incisor of a hominin (Turner, 1990; Shpakova, Derevianko, 2000), but later, on the basis of comparative analysis, was attributed to a bovid (Viola et al., 2011). In 2000, a permanent upper molar, named *Denisova 4*, was unearthed from layer 11.1 in the South Chamber of the cave; in 2008, a distal phalanx of a girl's little finger (*Denisova 3*) was found in layer 11.2 of the East Chamber; and in 2010, fragments of a crown of the permanent upper molar (*Denisova 8*) were discovered in the bottom part of lithological layer 11.4, bordering with layer 12. The sequencing of the mitochondrial and nuclear DNA from the *Denisova 3* phalanx and then from the *Denisova 2*, *4*, and *8* molars, carried out under the guidance of Svante Pääbo at the laboratory of the Max Planck Institute of Evolutionary Anthropology, suggested that the fossils represent a previously unknown hominin species, named *Homo altaiensis* alias Denisovan. The new taxon was initially described on the basis of genetic rather than morphological criteria (Krause et al., 2010; Reich et al., 2010; Meyer et al., 2012; Sawyer et al., 2015; Slon et al., 2017b).

In 2010–2012, Neanderthal fossils were discovered in the East Chamber: proximal phalanx of the left little toe (*Denisova 5*) and a morphologically indeterminable bone fragment (*Denisova 15*) in layer 11.4, a distal phalanx of the third or fourth digit of the left hand in layer 12.3 (*Denisova 9*) (Mednikova, 2011a, 2013; Prüfer et al., 2014; Slon et al., 2017a), and a morphologically indeterminable bone fragment belonging to the F1 hybrid of a Neanderthal mother and a Denisovan father (*Denisova 11*) (Slon et al., 2018).

The identification of *Denisova 5* and *9* phalanges as those of Neanderthals was based on the morphological and genetic analyses, whereas the generic and specific attribution of morphologically indeterminable bone fragments *Denisova 11* and *15* became possible only after the ZooMS analysis followed by the sequencing of aDNA (Brown et al., 2016). The preservation of the endogenous DNA in fossils from Denisova Cave is generally very good. In certain specimens, its content exceeded 70 % (Ibid.), and that of bacterial DNA relating to microbes existing on bones after burial is 30–40 % (Reich et al., 2010). Normally, less than 1 % of endogenous DNA can be extracted from Late Pleistocene fossils (Viola, Pääbo, 2013).

In sum, Denisovan fossils available for morphological analysis to date include a distal phalanx of the hand and three teeth (Fig. 4).

Denisova 3. Distal phalanx of the little finger of a juvenile from layer 11.2 in the East Chamber. In order to conduct the genomic analysis at two independent laboratories, the specimen was cut into two parts. The initial analysis of the proximal part, carried out at the Max Planck Institute of Evolutionary Anthropology, showed that the bone had been distally broken ~2 mm below the unfused proximal epiphyseal line. In modern man, the proximal epiphyses of distal phalanges normally begin to fuse with the shafts at the age of 13.5 years in females and 16 years in males, so the individual must have been younger. The age estimate is not quite accurate, but judging by the maximum width of the proximal shaft (7.5 mm) and by the maximum height (5.1 mm), this was a child no older than 6–7 years of age (Reich et al., 2010). Later, at the Institute Jacques Monod in Paris, a group of researchers headed by E.A. Bennett and E.M. Geigl, combining the photographs of the distal part of the phalanx and the three-dimensional model of the proximal parts (epiphysis and remains of the dorsal shaft), generated a virtual reconstruction

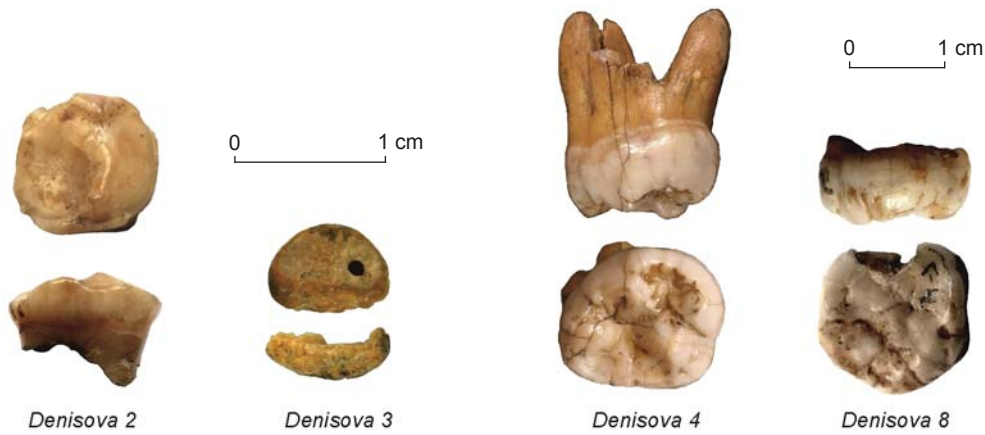

Fig. 4. Denisovan fossils.

of the entire phalanx in the dorsal and palmar views (Bennett et al., 2019). As the morphometric analysis of the reconstructed specimen demonstrated, both the size and the shape of the phalanx are within the variability limits in anatomically modern humans, thus linking Denisovans to *H. sapiens*. Because the distal phalanges of the little fingers of Neanderthals are markedly different, showing distinct apomorphies, a revision of micro-CT scans and photographs of the proximal fragments (articular surface and the semi-ring representing the dorsal half of the diaphysis) was conducted, and photographs of the distal fragment were compared with distal phalanges of Pleistocene hominins and recent humans at various developmental stages.

The comprehensive analysis has demonstrated that the phalanx belonged to an adolescent female, whose age at death, judging by modern standards, was approximately 13–16 years. In terms of maximum length, *Denisova 3* is closest to the phalanges of modern humans. The asymmetry of the ungual tuberosity and the shaft's curvature in the dorsal view suggest that the specimen may be from the right hand. The comparison of morphological information relating to *Denisova 3* with that relating to Neanderthals, early anatomically modern humans, and recent modern humans from France and Belgium dating to the periods from the Neolithic to the Middle Ages links it to modern humans and opposes it to Neanderthals. Thus, while the nuclear DNA of this individual is closer to that of Neanderthals, the morphology of her hand bone is essentially modern (Ibid.).

The dental morphology of Denisovans, in contrast, is more archaic. The descriptions of teeth from various stratigraphic horizons of the cave are given below in descending order of their geological age.

Denisova 2. Deciduous left lower second molar (dm_2) from layer 22.1 in the Main Chamber. Initially, this was described as a deciduous right lower molar (Turner, 1990), but later the attribution was changed (Shpakova, Derevianko, 2000). The crown is completely abraded (grades 5–6), the roots are missing. In modern populations, similar changes in dental structure are typical of the age 10 ± 2.5 years. The occlusal surface has two abrasion platforms: anterior, smaller in size (1/3 S), inclined toward the mesial edge of the crown, and posterior (2/3 S), with a marked lowering of the level toward the distal edge and a small cup-like depression in the disto-lingual part. The enamel cingulum is 1–2 mm high, the cervix and part of the cervical portion of the mesial root are preserved. On the vestibular part of the crown, there are large dents in the enamel, and smaller ones in the disto-lingual corner of the crown. The anterior abrasion platform of the occlusal surface is delimited by a small preserved stretch of the first furrow on the exterior side. A large distal contact-facet is situated very low and evidences a prolonged and strong pressure from the crown of the first permanent molar, which had not yet erupted to its maximum height. In modern children, this tooth erupts from the alveole at 6 ± 2 years of age. Given the degree of abrasion, and disregarding the existing hypothesis about the earlier dental development, the child's age at death (or at the time when the tooth was lost) can be estimated at approximately 10 years. However, the low position of the distal facet, implying that the position of the first permanent molar was low, suggests either that the child's age was about 6–7 or that the complete eruption of the deciduous molar from the alveole was retarded. Given these estimates relating to two sets of teeth, the most acceptable estimate of age at the time of tooth loss is 7–8 years by modern standards (Ibid.).

According to other experts, the age of *Denisova 2* might correspond to 10–12 years in modern children (Slon et al., 2017b).

Denisova 8. Permanent left upper third molar (M^3) from the bottom part of layer 11.4 near the border with layer 12 in the East Chamber. On the basis of the shape of the crown and the presence of a distinct oblique crest (a trait peculiar to upper molars) this tooth has been identified as the upper molar of a male (Sawyer et al., 2015; Zubova, Chikisheva, Shunkov, 2017). The anterior half of the crown is worn off; the protocone reveals a small exposed area of dentine, whereas no wear is seen on the distal part of the crown. The absence of the distal interproximal facet suggests that this is either the third or the second molar (in the latter case, the third molar had not yet erupted). Normally, by the age when upper second molars in Neanderthals and *H. heidelbergensis* showed the same degree of eruption as in *Denisova 8*, the adjoining third molars had already erupted from the alveole and the interproximal facets were present. Therefore, the specimen might have been the second molar of an individual with a congenital absence of M^3. This condition has been evidenced in late Asian *H. erectus* and Middle Pleistocene hominins.

Denisova 8 is very large—its length is more than three standard deviations larger than that of Neanderthal and modern human teeth, falling in the variation range of Pliocene hominins. Only two Late Pleistocene individuals exhibit third molars of comparable size: one is the Early Upper Paleolithic anatomically modern human *Oase 2* in Romania (Trinkaus et al., 2003; Trinkaus, 2010), the other, a hominin with a mosaic morphology *Obi-Rakhmat-1* in Uzbekistan (Glantz et al., 2008; Bailey et al., 2008).

Denisova 4. Permanent left upper second or third molar ($M^{2/3}$) from layer 11.1 in the South Chamber (Reich et al., 2010; Zubova, Chikisheva, Shunkov, 2017). The tooth evidently belonged to a young male. Its preservation is very good except for the apical part of the disto-buccal root. The crown, intersected by several cracks, is very high and has bulging buccal and lingual walls. In the occlusal view, the crown is rounded and tapers distally. It is slightly skewed lingually in the distal part, but is morphologically different from the crowns of the Neanderthal upper molars with their lingually projected hypocones and rhomboid shape.

The roots are relatively short (the length of the lingual root is 12.4 mm from the cervix, and that of the mesio-buccal root, 12.7 mm). The lingual root is very robust and lingually widened, and the two buccal roots are only slightly divided. The crown is very large (mesio-distal diameter, 13.1 mm, bucco-lingual diameter, 17.7 mm). As a third molar, its size exceeds most standards for fossil hominin taxa except *H. habilis* and *H. rudolfensis*, and is only comparable with Australopithecine standards. As a second molar, it is larger than those of Neanderthals or early modern humans, but smaller than those of *H. erectus* and *H. habilis*.

In sum, the morphological features of the Denisovan teeth indicate a very conservative evolutionary model, supporting the idea that a distinct hominin population existed in the Altai, differing from both *H. sapiens* and *H. neanderthalensis* not only genetically but morphologically as well.

Findings of genomic studies

The study of ancient DNA has demonstrated that Denisovan genomes differ from the standard human genome by 11.7 %, whereas the difference between the genomes of Neanderthals from Vindija, Croatia, and modern humans is 12.2 %. In terms of nuclear DNA, Denisovans and Neanderthals are sister taxa, opposed to *H. sapiens* (Reich et al., 2010). Genomic studies indicate the presence of 1.5–2.1 % of Neanderthal ancestry in the mitochondrial and nuclear genomes of modern non-Africans. Denisovans, on the other hand, did not participate in the supposed admixture between Neanderthals and anatomically modern humans, but 3–6 % of their ancestry is present in the gene pool of modern inhabitants of Southeast Asia, Australia, and Oceania (Reich et al., 2011).

The study of mitochondrial genomes suggests that the Denisovans separated from the Neanderthals ~640 ka BP, and from *H. sapiens*, ~1 Ma BP (Reich et al., 2010). On the basis of the analysis of nuclear DNA, on the other hand, the Denisovan-Neanderthal split occurred 430 ka BP or so (Meyer et al., 2014), whereas their common ancestors separated from those of *H. sapiens* about 800 ka BP (Meyer et al., 2012).

The results of another study are compatible with two scenarios of hominin evolution in the Pleistocene (Prüfer et al., 2014). According to the first, the common ancestor of *H. sapiens*, Neanderthals, and Denisovans lived ca 553–589 ka BP, and that of Neanderthals and Denisovans, 381 ka BP. According to the second scenario, the common ancestor of all the three species lived 550–765 ka BP, and the split between Neanderthals and Denisovans took place 445–473 ka BP.

The lithostratigraphic and geochronological studies of layers where the fossils were found in Denisova Cave attest to the prolonged existence of Denisovans in the Altai. After comparing the number of nucleotide substitutions in all Denisovan mitochondrial genomes and the mutation rate of modern human mtDNA, it was concluded that the *Denisova 8* specimen is 60 thousand years older, and *Denisova 2* 100 thousand years older than the *Denisova 3* and *Denisova 4* specimens (Sawyer et al., 2015; Slon et al., 2017b).

Thus far, remains of Denisovans have been discovered only in one cave. However, judging by complete mtDNA sequences, the level of their genetic diversity is higher than that in seven Neanderthals from various regions of Western and Central Europe, while being lower than in modern humans (Sawyer et al., 2015). Consequently, the Denisovan population could have been larger and more diverse than the Neanderthal population; moreover, it had an extremely wide geographic distribution—from North Asia to the tropical zone of East and Southeast Asia (Meyer et al., 2012; Prüfer et al., 2014).

The Denisovan genomes included alleles that, in modern humans, control dark skin, brown hair, and brown eyes (Meyer et al., 2012). Also, the high-coverage genome of the individual whose DNA was extracted from the *Denisova 3* phalanx revealed a component received from an unknown hominin, whose ancestors separated from those of Neanderthals, Denisovans, and modern humans 1–4 Ma BP (Prüfer et al., 2014). This ancestry is apparently present in several Denisovans in various proportions. Because the nuclear genome of *Denisova 8* is much further from the *Denisova 3* genome than from that of *Denisova 4*, the *Denisova 8* population, which existed earlier, could have been the carrier of such a component, controlling, for instance, large size (Sawyer et al., 2015).

To evaluate the taxonomic position of the Denisovans, it is important to note that the genomes of modern Australian aborigines and Oceanians contain 5–6 % or so of Denisovan ancestry, whereas in American and mainland Asian natives its proportion is minute—just 0.2 % (Prüfer et al., 2014). The presence of the Denisovan genetic legacy in the modern human gene pool suggests that during the early modern human dispersal in Asia, 80–50 ka BP, hybridization occurred, and that the hybrids were fertile. Denisovans and early anatomically modern migrants from Africa, then, were rather closely related, and reproductive barriers between them, if any, were relatively weak.

Therefore, all available data suggest that Denisovans might be a population within the species *H. sapiens*, and that hominins associated with the Denisovan Upper Paleolithic tradition, which emerged some 50 ka BP, can be termed *H. sapiens altaiensis**.

The subspecific status of Upper Paleolithic Denisovans, reflected by the trinomen *H.s. altaiensis*, is supported by several considerations relating to modern human origins. Having migrated from Africa to Asia, early *H. sapiens* came in contact with the native populations such as Denisovans, whose immune systems were better adapted to resist local pathogenic microorganisms. Through admixture with natives the immigrants received genes enhancing adaptation to local ecological conditions, protecting them from diseases, and reinforcing their immune systems.

The part played by Denisovans in the adaptive introgression is evidenced by human leukocyte antigens (HLA) present in modern humans, helping the immune system to recognize and combat pathogenic organisms. Judging by the genome of the *Denisova 3* individual, represented by a phalanx, one of the highly important components of the immune system (the *HLA-B*73* allele) was inherited by modern humans from the Denisovans (Abi-Rached et al., 2011).

An illustrative example of adaptive introgression is the adaptation of Tibetans to hypoxia, caused by deprivation of oxygen supply at extreme altitudes. Whereas in plains dwellers, acclimatization to high mountain conditions is accompanied by increased hemoglobin levels, resulting in a greater risk of

*The history of the term "Denisovan" has been described by S. Pääbo, who writes that on December 3, 2009, when he was attending an international conference at the Cold Spring Harbor Laboratory, the then postgraduate student Johannes Krause called him from the Institute of Evolutionary Anthropology in Leipzig, asking if he remembered a small bone he had gotten from the Institute of Archaeology and Ethnography in Novosibirsk. The news was that the mtDNA extracted from that bone differed from the mtDNA of both Neanderthals and *H. sapiens*. In mid-January, Pääbo and his team arrived in Novosibirsk to discuss the results. Eventually, by mutual agreement after some consultations, it was decided to describe a new species under the term *Homo altaiensis*. The article outlining the findings was sent to *Nature*. One of the reviewers pointed out that labeling the individual with a formal taxonomic name would be unwise, as too little was known about the find, so it was decided to give the new taxon an informal eponymous designation—Denisovan. This was the name under which the new hominin population was introduced (Pääbo, 2014: 227–238). Today, new data on the evolutionary history, material and possibly spiritual culture of Denisovans prompt us to revert to the original name *H. altaiensis*. However, given the role of this group in the origin of modern humans, we believe that the full name should be *H. sapiens altaiensis*.

thrombosis, Tibetans show a comparatively low hemoglobin level and, accordingly, lower risk of cardiovascular diseases. Tibetan females are more fertile than those living on the plains; they do not suffer from pre-eclampsia, and the weight of their infants at birth is more stable.

One of the peculiar genetic features of Tibetans is the hypoxia pathway gene, *EPAS1*, responsible for adaptation to low oxygen supply at high altitudes. The sequencing of the region around this gene in Tibetan and Han individuals, in 26 other genetically diverse populations from the Human Genome Diversity Panel, and in fossil hominins demonstrated that *EPAS1* gene variation is found only in Denisovans and Tibetans. Its frequency is Han Chinese is quite low, and in the other modern peoples it is absent. Furthemore, comparison of DNA of Denisovans and Tibetans showed that the latter are genetically much closer to Denisovans than other modern humans, and that archaic, specifically Denisovan introgression helped them to adapt to high altitudes (Huerta-Sánchez et al., 2014).

Evidence of adaptive introgression from Denisovans into humans was also found in other populations of South, East, and Southeast Asia (Skoglund, Jakobsson, 2011; Reich et al., 2011; Lalueza-Fox, Gilbert, 2011; Prüfer et al., 2014; Qin, Stoneking, 2015; Sankararaman et al., 2016; Jacobs G.S. et al., 2019).

Archaeological materials

The Paleolithic cultural sequence established in Denisova Cave is the longest among those identified in North and Central Asia. Studies inside the cave were performed in four areas: the Main, East and South Chambers, and the entrance zone (see Fig. 2). The most complete picture of the development of the Paleolithic traditions is given in the deposits of the Middle and Upper Pleistocene in the Main and East Chambers (see Fig. 3). On the basis of the chronostratigraphic data and the techno-typological features of the lithic industries, the archaeological artifacts recovered from layers 22–20 in the Main Chamber and layers 15 and 14 in the East Chamber belong to the Early Middle Paleolithic; from layers 19–12 in the Main Chamber and layers 13–11.3 in the East Chamber to the Middle Paleolithic; from layer 11.2 in the East Chamber to the Initial Upper Paleolithic; from layer 11 in the Main Chamber, layer 11.1 in the East Chamber, and layer 11 in the South Chamber to the Early Upper Paleolithic; and from layer 9 in the Main, East, and South Chambers probably to the Middle Upper Paleolithic.

The earliest artifacts were recovered from layer 22 in the Main Chamber; the upper border of the corresponding deposits was OSL-dated to 287 ± ± 41 ka BP (Jacobs Z. et al., 2019). The overlying culture-bearing horizons 21 and 20 are dated to 250 ± ± 44 to 170 ± 19 ka BP. The East Chamber deposits corresponding to the above were determined as layers 15 and 14 with the age of 203 ± 14 to 187 ± 14 ka BP.

The geochronology of the basal cave deposits makes it possible to attribute the archaeological materials from these layers to the Early Middle Paleolithic. These industries are characterized by unifacial or bifacial radial and Levallois flake cores (Fig. 5, *1*, *6*, *8*); and parallel single-platform cores (Fig. 5, *2–5*, *7*), prepared mainly on large flakes, massive in a cross-section, and small boulders. The category of blanks is dominated by the shortened flakes with plain or natural platforms and longitudinal unidirectional or orthogonal dorsal scar patterns. Rare blades show planar striking-platforms and longitudinal dorsal scar patterns.

The predominant tools are the typologically distinct series of artifacts made on standard blanks: single straight (Fig. 6, *13*), diagonal (Fig. 6, *12*), transverse (Fig. 6, *3*, *5*), convergent (Fig. 6, *1*, *7*, *8*), and angle side-scrapers, including those fashioned by stepped retouch of Quina type; as well as spur-like (Fig. 6, *2*), denticulate and notched tools. Numerous artifacts with ventral thinning are noteworthy; these tools were mostly fashioned on thick flakes with extensive preparation of the distal edge, and one or two lateral edges, by large ventral removals (Fig. 6, *11*). Other typical implements are flakes with truncated basal parts, and truncated faceted flakes, most often truncated from the ventral face, more rarely from the dorsal face. The tools include naturally-backed knives, burins (a transverse one on a blade, and an angle one on a large flake (Fig. 6, *4*)), an elongated Levallois point with a faceted chapeau de gendarme platform (Fig. 6, *10*), and blade-like flakes with discontinuous retouch (Fig. 6, *6*, *9*).

The next stage in the Middle Paleolithic development in Denisova Cave is associated with the deposits of the Final Middle and the first half of the Upper Pleistocene. This period is illustrated by the lithic industries from layers 19–12 in the Main Chamber and layers 13–11.3 in the East Chamber, dated to the period from 156 ± 15 to 58 ± 6 ka BP.

In the Middle Paleolithic industries, primary lithic reduction was carried out by radial (Fig. 7, *6*) and parallel (Fig. 7, *2*, *4*, *8*) flaking, including flaking from narrow-faced (Fig. 7, *1*, *5*) and volumetric sub-

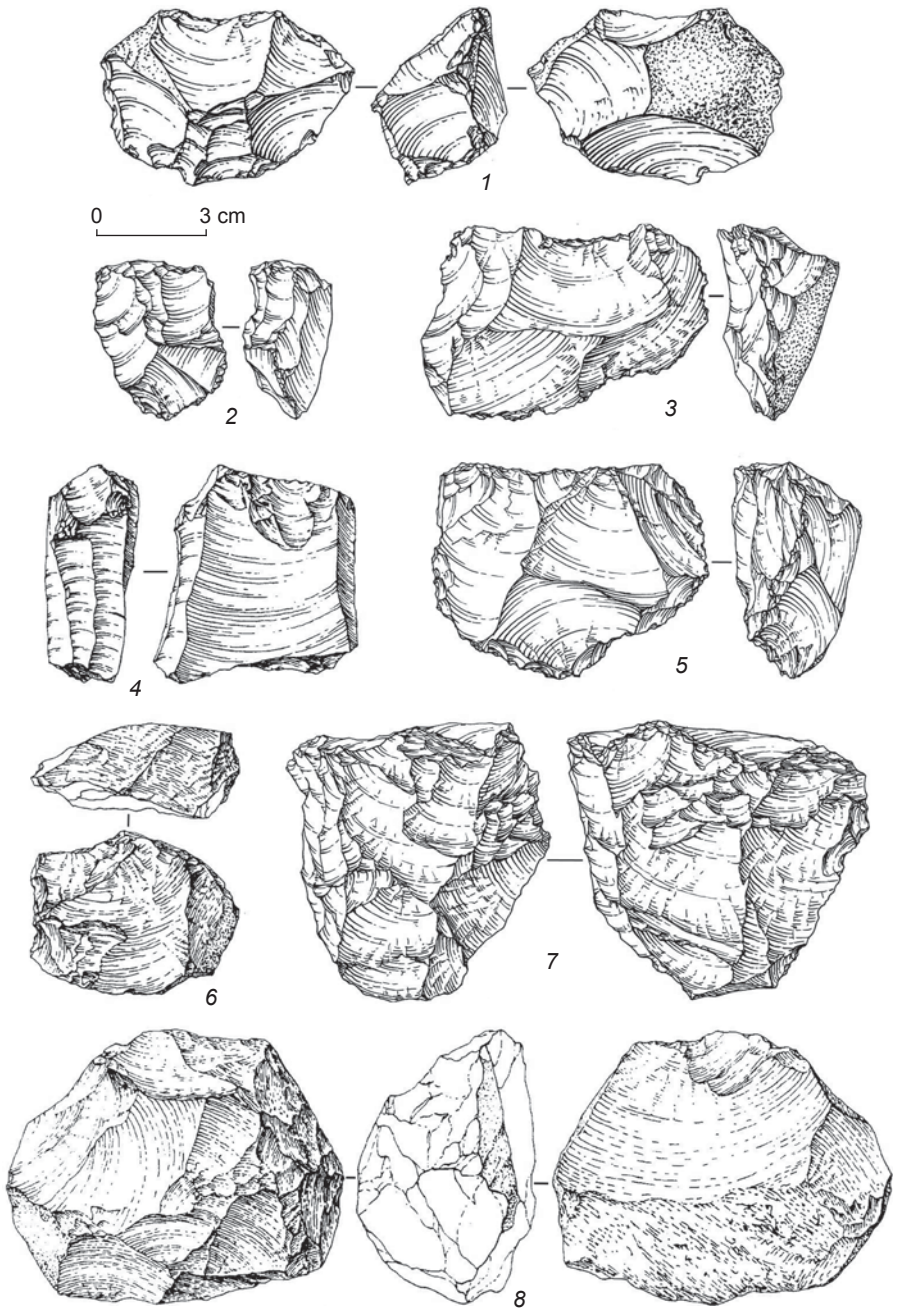

Fig. 5. Cores of the Early Middle Paleolithic from Denisova Cave.

prismatic (Fig. 7, *7*) cores, prepared on large pebbles and boulders, more rarely on massive spalls. The Levallois reduction technique is well represented in cores intended for producing flakes (Fig. 7, *3*) and blades, although it had no noticeable influence on the appearance of the industries. Tools were fashioned mainly on large and short flakes with a smooth or cortex residual striking-platform and longitudinal unidirectional dorsal scar pattern. The blade-like flakes are mostly medium-sized and small, more rarely large; the proportion of blades among the blanks increases upwards in the profile. Their residual striking-platforms are mostly smooth; although there are some blades with dihedral and faceted platforms. All the Denisova Middle Paleolithic industries contain a small number of Levallois spalls: flakes, blades, and points with thoroughly faceted chapeau de gendarme platforms (Fig. 8, *16–25*). The Levallois spalls were used mostly without any secondary working, although some blades show signs of regular retouch.

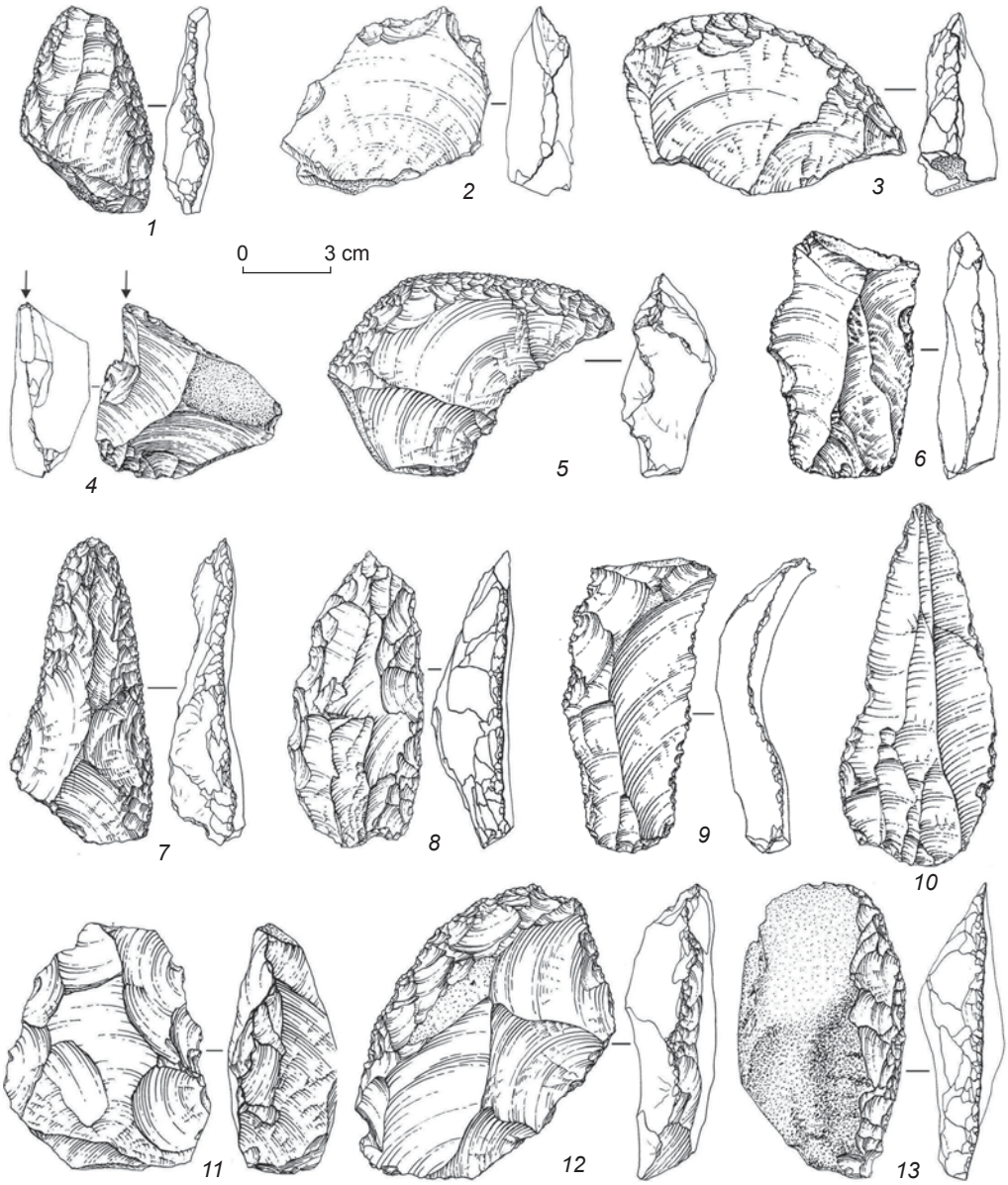

Fig. 6. Stone tools of the Early Middle Paleolithic from Denisova Cave.
1, 3, 5, 7, 8, 12, 13 – side-scrapers; *2* – spur-like tool; *4* – burin; *6, 9* – blade-like flakes with retouch; *10* – Levallois point; *11* – ventrally-thinned flake.

Side-scrapers are the most typical tools; these are dominated by single or double straight (Fig. 8, *6*, *7*), transverse (Fig. 8, *1*), diagonal (Fig. 8, *5*, *8*), convergent (Fig. 8, *15*), and angle forms. Denticulate, notched, and beak-shaped tools, fashioned mostly by retouch, more rarely by Clactonian encoches, are also numerous. There are comparatively small but typologically distinct series of the Mousterian pointed tools (Fig. 8, *10–14*), Levallois points (Fig. 8, *18*, *19*, *21*, *22*), and Levallois blades (Fig. 8, *16*, *20*, *23–25*), flakes with ventral thinning, and the Upper Paleolithic tools: end- and angle-scrapers, angle burins (Fig. 8, *2–4*), borers and truncated spalls (Fig. 8, *9*, *17*), as well as bifacial tools.

The Initial Upper Paleolithic at Denisova Cave is represented by the materials from lithological layer 11.2 in the East Chamber. The OSL-age of these deposits is 63 ± 6 to 55 ± 6 ka BP; a series of AMS-dates has also been generated, among which the oldest are over 50 ka BP, the majority of the dates falling within the interval of 50–40 ka BP.

The archaeological materials from this layer clearly show the continuous development of technological traditions from the Middle Paleolithic to the Early

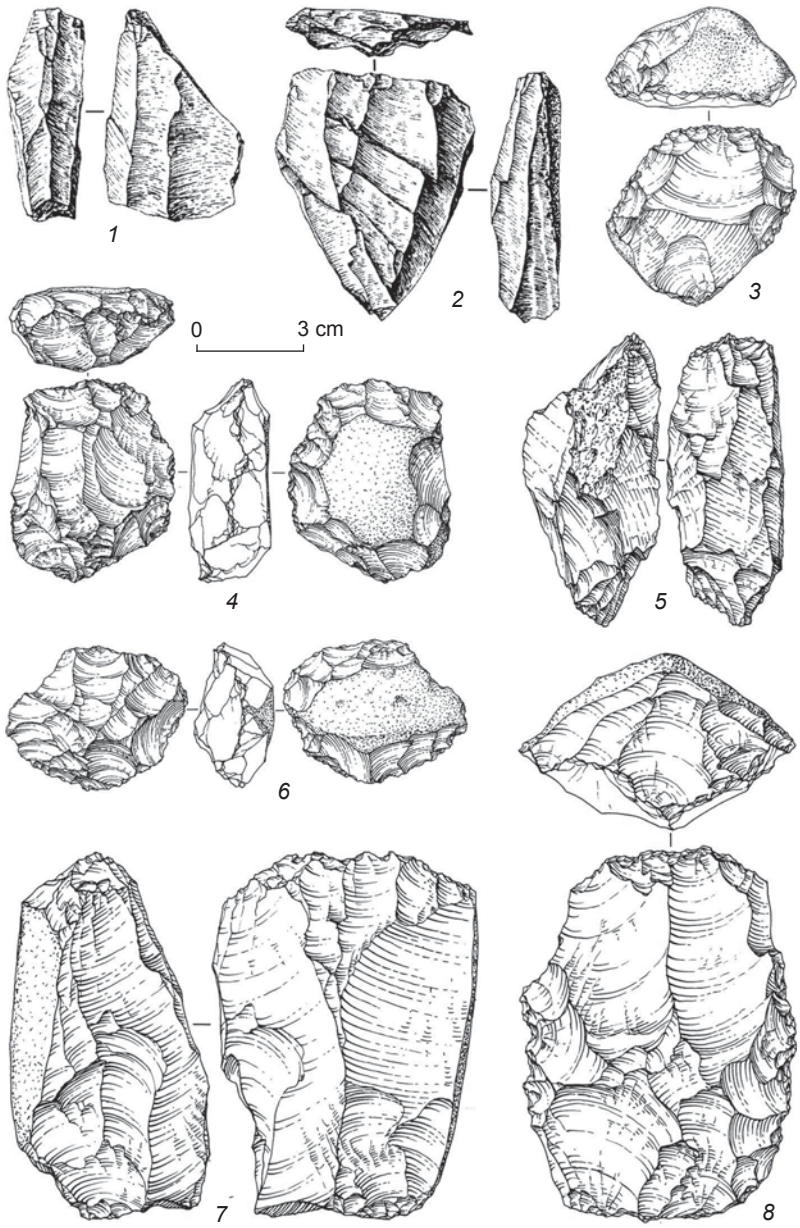

Fig. 7. Cores of the Middle Paleolithic from Denisova Cave.

Upper Paleolithic techniques of stone reduction. The major technique of stone working was parallel flaking, including from sub-prismatic (Fig. 9, *18–20*) and narrow-faced (Fig. 9, *15*) cores, often intended for producing large blades. The radial and Levallois reduction strategies were less common. The debitage category is dominated by the flakes with the parallel dorsal scar pattern and smooth residual striking-platform; although there are also series of elongated spalls removed by direct percussion with a hammer-stone.

In the toolkit, Middle Paleolithic side-scrapers are most numerous; these are mainly straight (Fig. 9, *14*), diagonal (Fig. 9, *13*), and transverse (Fig. 9, *16*). The tool collection also contains a comparatively small series of typologically distinct elongated Levallois spalls, mostly pointed (Fig. 9, *11*). The proportion of the denticulate, notched, and beak-shaped tools is also considerable. Another noteworthy category includes the Upper Paleolithic tool types: elongated points (Fig. 9, *10*), end-scrapers (Fig. 9, *1*, *2*, *17*), and angle burins (Fig. 9, *8*), some of which are fashioned on elongated spalls (Fig. 9, *7*); borers, chisel-like tools (Fig. 9, *12*), large truncated and truncated-faceted spalls (Fig. 9, *9*), and prismatic blades with retouched long edges (Fig. 9, *3–6*).

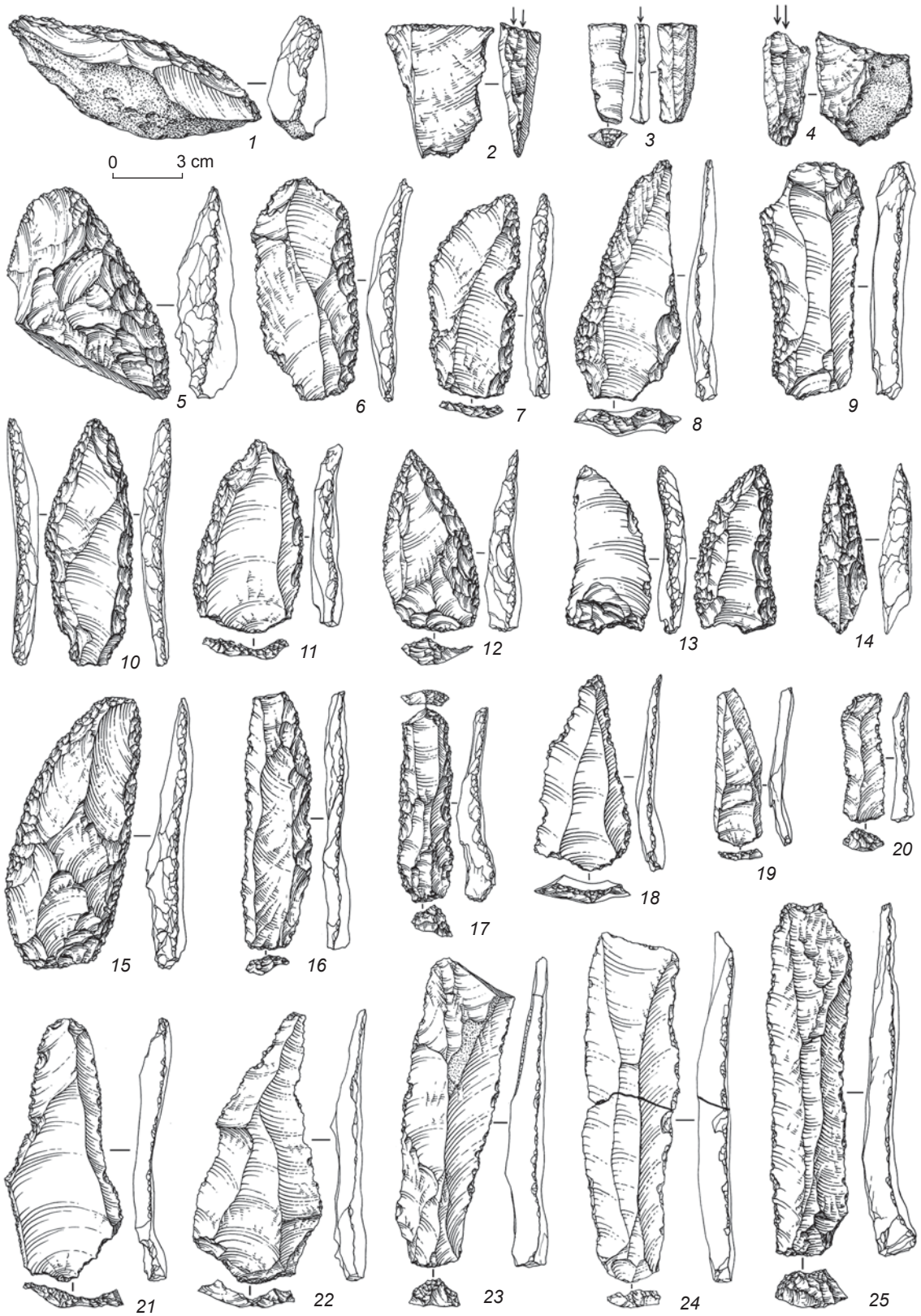

Fig. 8. Stone tools of the Middle Paleolithic from Denisova Cave.
1, 5–8, 15 – side-scrapers; *2–4* – burins; *9, 17* – truncated blades with retouch; *10–14* – Mousterian points; *16, 20, 23–25* – blades; *18, 19, 21, 22* – Levallois points.

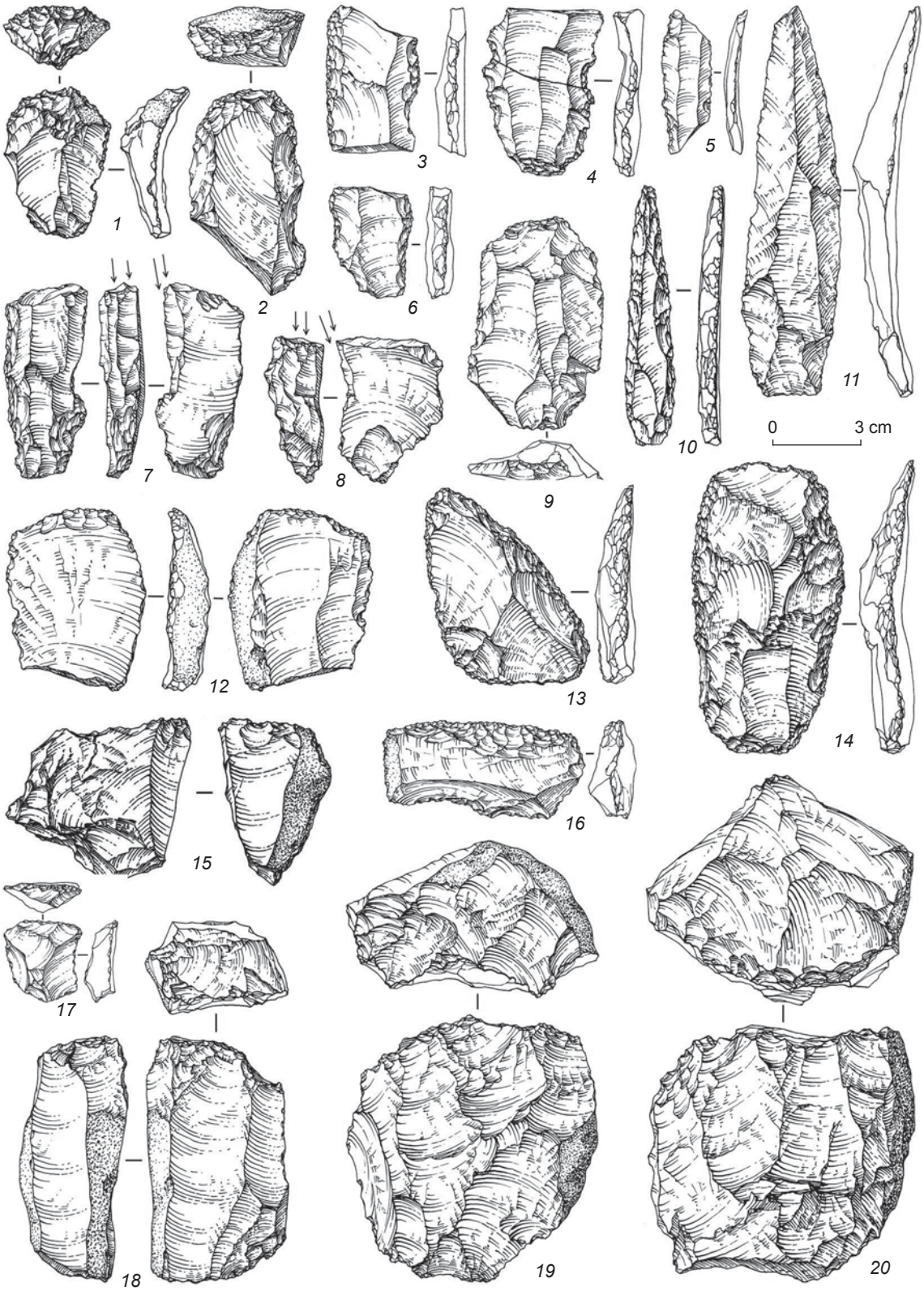

Fig. 9. Stone tools of the Initial Upper Paleolithic from the East Chamber of Denisova Cave.
1, 2, 17 – end-srapers; *3–6* – retouched blades; *7, 8* – burins; *9* – truncated-faceted spall; *10* – retouched point; *11* – pointed blade; *12* – chisel-like tool; *13, 14, 16* – side-scrapers; *15, 18–20* – cores.

Layer 11.2 also yielded bone tools and personal ornaments made of mammoth tusk, animal teeth and bones, as well as of semi-precious stone and eggshell. The bone toolkit includes retouchers, unshaped chisel-like tools, and a fragment of a thickened needle with a broken eye (Fig. 10, *16*). The ornaments include long beads or stems with engravings made of hollow tubular bones bearing symmetrical rows of deep circular grooves (Fig. 10, *9*, *10*); pendants of maral fangs (Fig. 10, *12–14*) and elk incisors (Fig. 10, *17*) with biconical drilled holes; mammoth tusk blades consisting of two crescent fragments with biconical holes (Fig. 10, *15*); a mammoth tusk ring (Fig. 10, *11*); beads of bone (Fig. 10, *4*) and ivory (Fig. 10, *5–8*) ovoid and sub-rectangular in shape, with one or three holes; a ring of white marble (Fig. 10, *21*); serpentine pendants, each with a hole drilled out at one of the transverse sides (Fig. 10, *19*, *20*); and flat ring-shaped beads made of fossilized ostrich eggshell—a unique material for the Altai Paleolithic (Fig. 10, *1–3*). Among the ornaments, an elk-tooth pendant is noteworthy (Fig. 10, *18*); its direct date is cal 42,450–49,710 years (OxA-30963), suggesting that this find is the oldest artifact of such a type in Northern Eurasia.

The Early Upper Paleolithic in Denisova Cave is represented by the materials from lithological layer 11.1 in the East Chamber, layer 11 (stratigraphic horizons 11.5–11.1) in the Main Chamber, and layer 11 in the South Chamber. The age of these deposits falls within the chronological range of 50–30 ka BP, according to the set of OSL- and AMS-dates.

The main reduction technique of that period was parallel flaking. Radial and Levallois flaking techniques were also used. Among cores, noteworthy are single- and double-platform prismatic forms with well-prepared overhangs, from which elongated spalls were detached (Fig. 11, *22*); this category also includes small cone-shaped cores, intended for the detachment of small blades (Fig. 11, *25*, *26*). The debitage set shows elongated spalls (Fig. 11, *12*, *13*, *18*), including large long blades with punctiform or linear residual striking-platforms (Fig. 11, *19*, *23*, *24*), produced using soft hammer; blades with the Levallois morphology (Fig. 11, *20*, *21*); and also bladelets (Fig. 11, *1–4*, *6*) and micro-blades (Fig. 11, *5*).

The toolkit includes series of side-scrapers, mostly of straight varieties (Fig. 11, *27*, *28*), and notched-denticulate tools. The Upper Paleolithic tool forms are represented by various end-scrapers (Fig. 11, *7–11*), angle burins (Fig. 11, *16*, *17*); miniature borers on blades (Fig. 11, *1*), large prismatic blades with

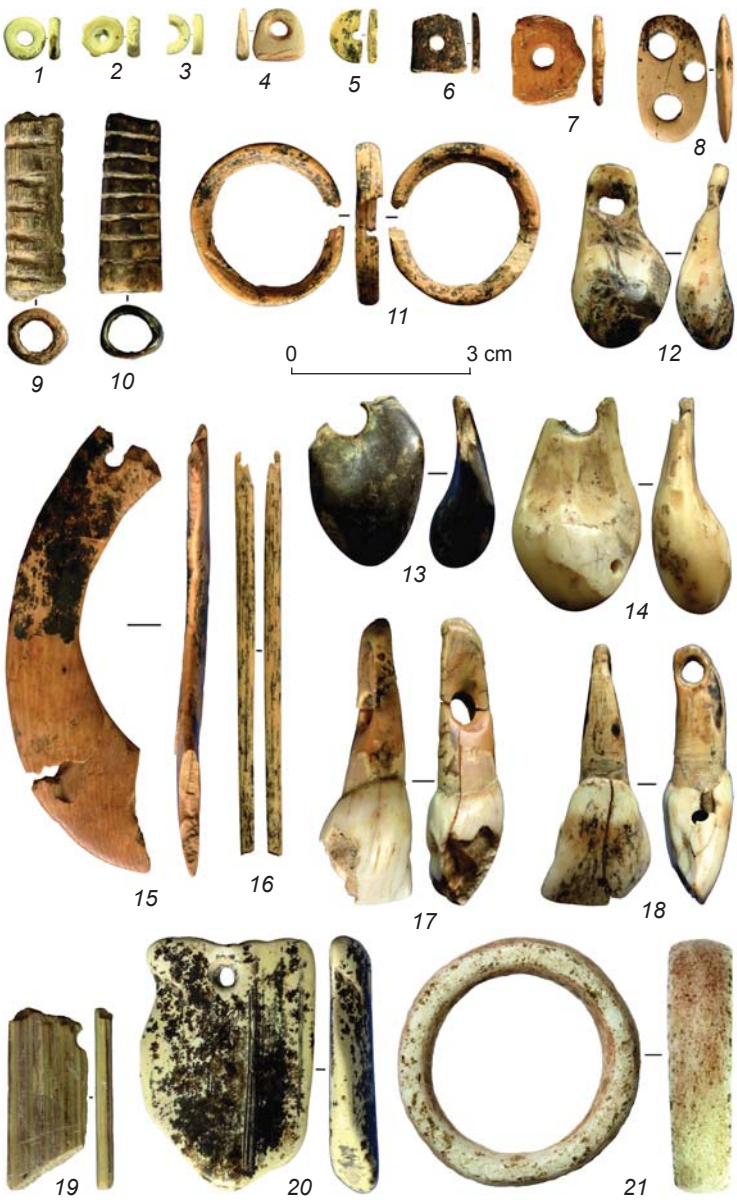

Fig. 10. Bone needle (*16*), and ornaments of the Initial Upper Paleolithic, made of egg shell (*1–3*), bone (*4, 9, 10*), mammoth tusk (*5–8, 11, 15*), animal teeth (*12–14, 17, 18*) and stone (*19–21*) from the East Chamber of Denisova Cave.

1–8 – beads; *9, 10* – long beads; *11, 21* – rings; *12–14, 17–20* – pendants; *15* – blade with hole; *16* – eyed needle.

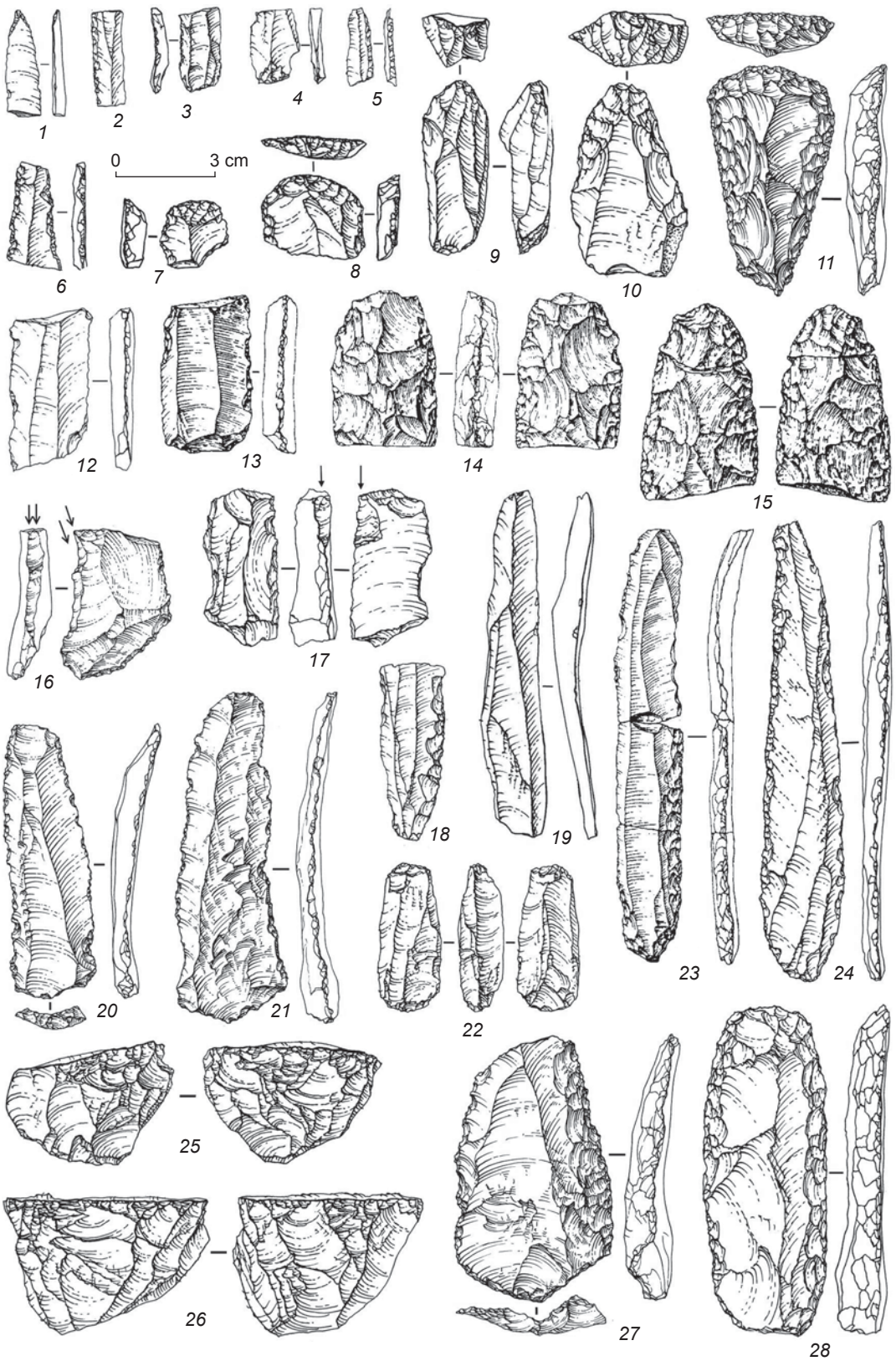

Fig. 11. Stone tools of the Early Upper Paleolithic from Denisova Cave.
1 – borer; *2, 3, 6* – retouched bladelets; *4* – bladelet; *5* – backed micro-blade; *7–11* – end-scrapers; *12, 19–21* – blades; *13, 18, 23, 24* – retouched blades; *14, 15* – bifaces; *16, 17* – burins; *22, 25, 26* – cores; *27, 28* – side-scrapers.

abrupt modifying retouch on the long margins (Fig. 11, *23*, *24*), retouched blades (Fig. 11, *13*, *18*) and bladelets (Fig. 11, *2*, *3*, *6*), and backed micro-blades (Fig. 11, *5*). The toolkit also includes comparatively small series of the Levallois blades with use-wear signs (Fig. 11, *20*, *21*), and foliate bifaces (Fig. 11, *14*, *15*).

The Early Upper Paleolithic collection from Denisova Cave contains bone tools and personal ornaments of bone, mammoth tusk, and animal teeth. The tool group comprises bone eyed needles (Fig. 12, *2*, *3*, *5*), including an intact one 75 mm long (Fig. 12, *1*) and a flattened ivory one with a broken tip, bearing lines of incised dots on both surfaces (Fig. 12, *4*); points made of mammoth tusk (Fig. 12, *7*) and of fractured long bones of large mammals (Fig. 12, *8*, *9*), and a bone pointed tool (Fig. 12, *6*) from lithological layer 11.4 in the Main Chamber, whose direct AMS-date is cal 42,660–48,100 ka BP (OxA-30271) and which is the oldest such tool known in Northern Eurasia.

The ornaments include pendants with biconical drilled holes or deep concentric fixing incisions encircling the root, made from the fangs of fox

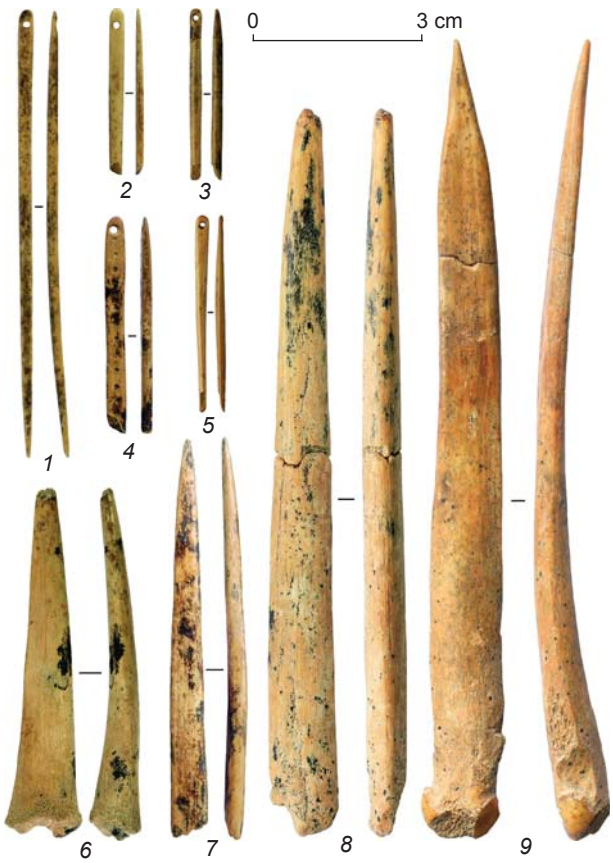

Fig. 12. Tools made from bone (*1–3, 5, 6, 8, 9*) and mammoth tusk (*4, 7*) of the Early Upper Paleolithic from Denisova Cave. *1–5* – eyed needles; *6–9* – awls-borers.

(Fig. 13, *11–13*), weasel (Fig. 13, *10*), or maral (Fig. 13, *16, 17*), from the incisors of elk (Fig. 13, *14*), bison (Fig. 13, *18*), hyena, or bear (Fig. 13, *15*), Siberian ibex (Fig. 13, *19*), or the sesamoid bone of horse (Fig. 13, *20*); hollow cylinder beads or stems made from tubular bones of mammals (Fig. 13, *2*, *8*) or large birds (Fig. 13, *3 –7*), ornamented with deep circular incisions; a part of a bone thin-walled cylindrical implement, consisting of two fragments, ornamented with deep parallel rows of transverse incisions (Fig. 13, *1*); three fragments of a long bone blade with short incisions grouped into local rows along the edges (Fig. 13, *21*); small flat beads made of broken tubular bones (Fig. 13, *9*); a thin-walled ring representing a transversely cut piece of a tubular bone belonging to a large bird; and fragmented artifacts with parallel or fan-shaped incisions, made from ribs of ungulates.

The ivory collection contains diadems or pectoral plates, each represented by a medial part of a rectangular straight plate bearing lengthwise lines of triangular dimples on both surfaces (Fig. 14, *15*) and a marginal part of a wide plate, convex in profile, with biconical hole at the end (Fig. 14, *13*); a bracelet consisting of two flattened convex fragments (Fig. 14, *12*); a large and massive rectangular pendant (Fig. 14, *11*); rings (Fig. 14, *7*) and beads of rounded, ovoid, or sub-rectangular shape, with one (Fig. 14, *1–4*) or two (Fig. 14, *5*, *6*, *8*) biconical holes; and a blade consisting of three fragments, with six biconical holes cut along the long axis, which blade was probably a blank for manufacturing large beads (Fig. 14, *14*). The unique piece is a zoomorphic figurine, probably depicting a feline predator, whose head and forelegs are missing (Fig. 14, *10*). The figurine is ornamented on all sides with rows of four short incisions bearing residues of a red mineral pigment.

Other noteworthy components of this collection are ornaments of semi-precious stone, eggshell and mollusk shell. This set includes a bracelet of dark green chloritolite (Fig. 15, *16*); various pendants of green kaolinite agalmatolite (Fig. 15, *12*), yellowish-brown laminated chrysotile (Fig. 15, *13*), white marble (Fig. 15, *8*), gray and light green serpentine (Fig. 15, *10*, *11*, *14*), or light brown talc-steatite (Fig. 15, *9*), each with a biconical drilled hole at one of the transverse edges; beads made of marble (Fig. 15, *3*), talc (Fig. 15, *4–6*), serpentine, or clay slate (Fig. 15, *7*); bead-rings of ostrich eggshells (Fig. 15, *1*, *2*); and ornaments made of freshwater mollusk *Corbicula tibetensis* shells, with sawed holes at the bases (Fig. 15, *15*).

The category of items showing the use of coloring-agents includes the sub-triangular fragment of a

hard deep-red mineral pigment, and a pear-shaped pebble of milky white marble bearing residues of red ocher. Microscopic analysis of the ornaments showed traces of use of ocher pigments in the holes and microrelief unevenness of the pendants made of chrysotile and animal teeth, and eggshell beads.

Use-wear analysis and technological data on the bone and stone ornaments have shown that these were manufactured using such operations as planing, cutting, biconical drilling, boring, grinding, and polishing.

The latest stage in the cultural sequence of the Denisova Pleistocene deposits is illustrated by the Upper Paleolithic materials from lithological layer 9 in the Main, East,

Fig. 13. Ornaments made from bone (*1–9, 20, 21*) and animals' teeth (*10–19*) of the Early Upper Paleolithic from Denisova Cave.
1 – fragment of an implement with engraving; *2–8* – long beads; *9* – a bead; *10–20* – pendants; *21* – ornamented blade.

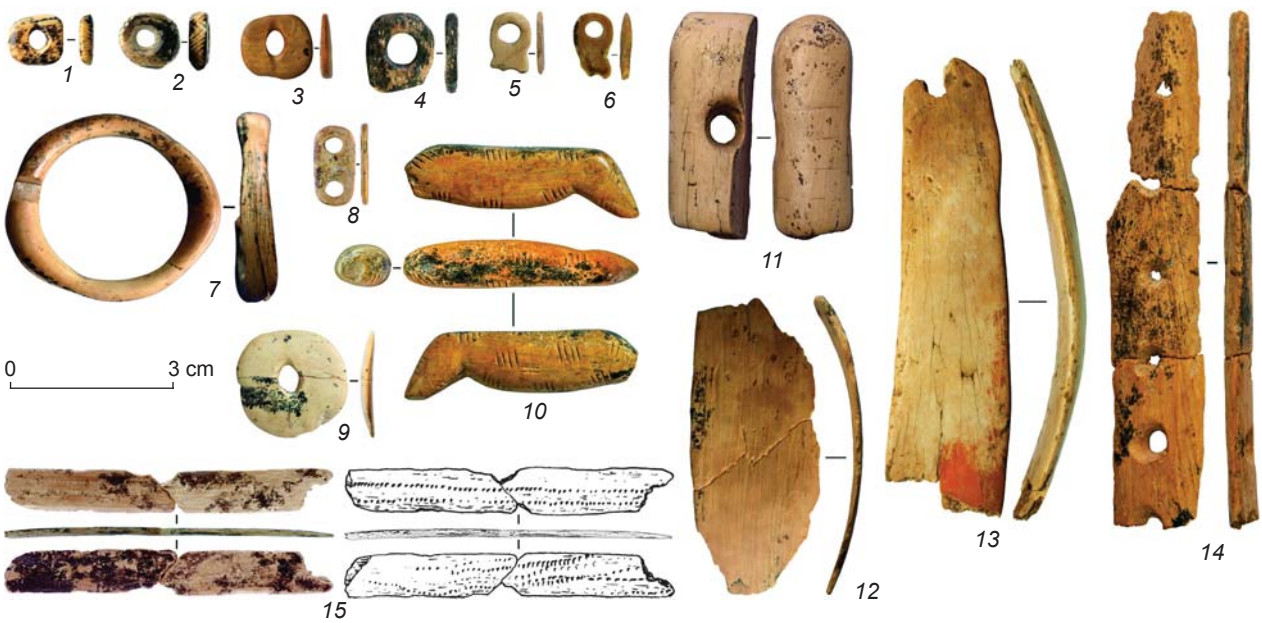

Fig. 14. Ornaments made from mammoth tusk of the Early Upper Paleolithic from Denisova Cave.
1–6, 8, 9 – beads; *7* – ring; *10* – zoomorphic figurine; *11* – pendant; *12* – bracelet; *13, 15* – diadems; *14* – blade with holes.

Fig. 15. Ornaments made of eggshell (*1, 2*), semi-precious stone (*3–14, 16*), and mollusk shell (*15*) of the Early Upper Paleolithic from Denisova Cave. *1–7* – beads; *8–15* – pendants; *16* – bracelet.

and South Chambers. According to the OSL-dates, the age of these deposits in the Main Chamber is in the range of 36 ± 4 to 21 ± 8 ka BP, which corresponds to the Middle Upper Paleolithic.

The comparatively small collection of artifacts recovered from this layer attests to the further development of blade flaking techniques based on parallel flaking of the sub-prismatic and narrow-faced cores. As compared to the previous developmental stage, the proportion of elongated blanks among the spalls increased considerably (Fig. 16, *5–7*, *11–14*, *17–19*); the proportion of micro-blades also grew (Fig. 16, *8–10*). The majority of blade-like flakes have residual striking-platforms with the signs of direct reduction of overhang. This lithic industry is characterized by a broad use of blades in the manufacture of tools, mostly as blanks for straight side-scrapers (Fig. 16, *13*, *18*). In the toolkit, of special interest are retouched blades (Fig. 16, *14*, *17*), backed bladelets (Fig. 16, *5–7*, *11*, *12*) and micro-blades (Fig. 16, *9*, *10*), carinated end-scrapers (Fig. 16, *15*), and a fragment of foliate biface (Fig. 16, *16*). Such tool types as end- and side-scrapers, angle and transverse burins, borers, chisel-like tools, atypical Levallois points, and notched and beak-shaped tools are comparatively few.

The Upper Paleolithic collection comprises a small series of tools and ornaments of bone and mammoth tusk: eyed needles (Fig. 16, *1*), awl-borers, ivory pendants with biconical hole (Fig. 16, *3*), and fragments of blades with artificial holes (Fig. 16, *4*) and rows of symmetrical transverse incisions (Fig. 16, *2*).

Despite the incompleteness in the lithologo-stratigraphic sequence, resulting from the long sedimentation gaps during the Pleistocene, the materials of the stratified Denisova complex generally illustrate the development of ancient technologies throughout the second half of the Middle and almost the whole Upper Pleistocene, spanning the period from the Early Middle Paleolithic to the Middle Upper Paleolithic, and attest to the continuity of the technological traditions of the Middle and Upper Paleolithic. The lithic industry of the Initial Upper Paleolithic was formed on the basis of the local Middle Paleolithic tradition. The similarity between the Middle and Upper Paleolithic industries was reflected by the use of one and the same raw material—pebbles of sedimentary and volcanic rocks from the alluvium of the Anui River, and by the permanent application of the parallel reduction strategy. Parallel reduction of the flat cores was widely used throughout the Middle Paleolithic alongside Levallois and radial reduction. During the Initial Upper Paleolithic, parallel flaking of prismatic and narrow-faced cores came into regular use, aimed at producing series of small and large blades. Typologically, the lithic industries of the Final Middle Paleolithic are observed to be associated with the Initial Upper Paleolithic. The Middle Paleolithic industries contain artifacts with the distinct Upper Paleolithic typology: end- and angle-scrapers, angle burins, angle borers, large retouched blades, and truncated spalls. Few, but diagnostic, Levallois implements can also be regarded as an interlink between the Early Upper Paleolithic collections and the previous industries.

Emergence of signs of micro-flaking, backed micro-blades, eyed bone needles, sets of personal ornaments and other traces of symbolic behavior in the Denisovan cultural sequence as early as about 50 ka BP indicates the formation in the Altai of one of the earliest Upper Paleolithic industries in Eurasia, which was created, according to the available

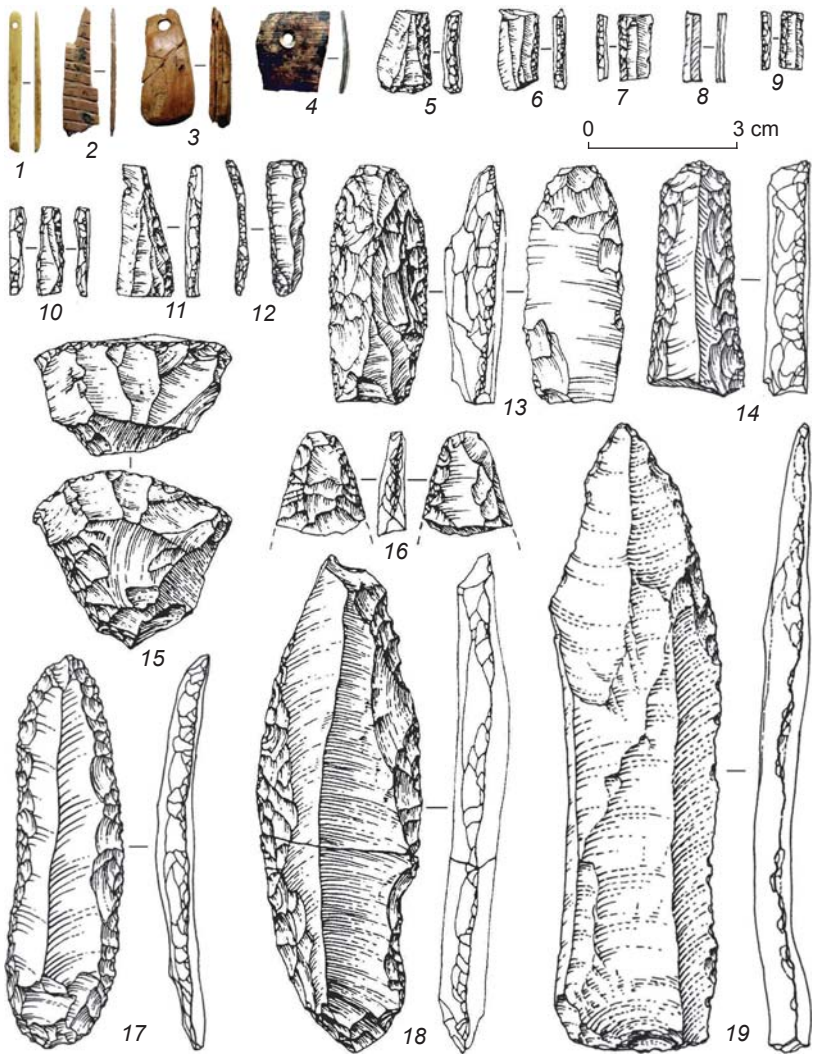

Fig. 16. Bone needle (*1*), ornaments made of bone (*2*) and ivory (*3*, *4*), stone tools (*5–19*) of the Middle Upper Paleolithic from Denisova Cave.
1 – eyed needle; *2* – blade with engraving; *3* – pendant; *4* – blade with a hole; *5–7, 9–12* – backed bladelets and micro-blades; *8* – micro-blade; *13, 18* – side-scrapers; *14, 17* – retouched blades; *15* – end-scraper; *16* – biface; *19* – blade.

anthropological and paleogenetic data, by Denisovans. In terms of behavior, Denisovans were close to those of anatomically modern humans, who arrived in Western Siberia not later than 45 ka BP (Fu et al., 2014). However, no fossils of the anatomically modern humans were found in Denisova Cave nor elsewhere in the Altai Paleolithic sites. This fact makes us believe that the Upper Paleolithic development in the Altai was associated with the Denisovan culture.

According to the anthropological and paleogenetic evidence from layer 22.1 in the Main Chamber and layer 15 in the East Chamber (Sawyer et al., 2015; Slon et al., 2017b), Denisovans populated the cave at the very beginning of its habitation, in the Early Middle Paleolithic. The evidence of Denisovan presence has been recorded in the stratigraphic sequence up the profile: in the East Chamber, at the border of the Middle Paleolithic layers 12.1 and 11.4, and in layer 11.2, bearing the Initial Upper Paleolithic industry; in the South Chamber, in layer 11, containing the artifacts of the Early Upper Paleolithic (Reich et al., 2010; Sawyer et al., 2015). The anthropological evidence for the long-term habitation of Denisovans in the cave agrees with the cultural continuity in the development of lithic industries, and suggests that Denisovans were the autochthonous population developing the Middle and Early Upper Paleolithic cultural traditions. At the same time, the Middle Paleolithic layers in Denisova Cave yielded remains of Neanderthals (Mednikova, 2011a, 2013; Prüfer et al., 2014; Slon et al., 2017a) and a bone from the hybrid girl with a Neanderthal mother and a Denisovan father (Slon et al., 2018). These materials, together with the absence of any drastic changes in the composition of the lithic industries, make it possible to hypothesize on some forms of cohabitation, rather than alternate habitation, of the cave by Denisovans and Neanderthals; the role of the latter in the development of the Middle Paleolithic technocomplex still remains unclear.

About 60 ka BP, a new Neanderthal population, genetically different from that in Denisova Cave, arrived in the Altai (Slon et al., 2018; Mafessoni et al., 2020). Numerous remains of this people were found in the Okladnikov and Chagyrskaya Caves, located 100 and 120 km from Denisova Cave, respectively (Krause et al., 2007; Mednikova, 2011b; Buzhilova, 2013). The late Neanderthal Paleolithic traditions with Mousterian-like industries, characterized by the radial reduction technique, and the Micoquien tools of déjeté and bifacial forms, sharply differ from the traditions recorded in Denisova Cave (Derevianko, Markin, Shunkov, 2013; Kolobova et al., 2020). According to the chronostratigraphic data of the

cave deposits, the upper chronological boundary of the Neanderthal habitation in Chagyrskaya Cave corresponds to 49 ka BP, and in Okladnikov Cave to at least 44 ka BP (Kolobova et al., 2020). Hence, in the range of 50–45 ka BP, the northwestern Altai was simultaneously inhabited by the creators of Mousterian and Early Upper Paleolithic traditions—Neanderthals and Denisovans. Gradually, the ecdemic Neanderthal population was likely assimilated by the indigenous Upper Paleolithic people.

Discussion

Denisovan origins and their role in the origin of modern humans

Available facts demonstrate that in the Late Middle to Early Upper Pleistocene, the long evolution of the genus *Homo* in Africa and Eurasia resulted in the emergence of three taxa—early modern humans in Africa, Neanderthals in Europe, and Denisovans in Asia. These taxa were open genetic systems, and reproductive isolation between them was incomplete, as evidenced by hybridization (Krause et al., 2010; Reich et al., 2011; Skoglund, Jakobsson, 2011; Meyer et al., 2012; Prüfer et al., 2014; Fu et al., 2015). Therefore, S. Pääbo merged the three taxa into a single metapopulation (Pääbo, 2015). One example of admixture is the *Denisova 11* girl, hybrid of a Neanderthal mother and a Denisovan father (Slon et al., 2018). On their journey from Africa 80–40 ka BP, early anatomically modern humans encountered Neanderthals and Denisovans, and mixed with them, receiving genes strengthening the immune system and enhancing the adaptation to new environments.

Archaic introgression demonstrates that *H. erectus*, having originated in Africa, migrated outside it 1.8 Ma BP or so. It was a polymorphic species, which accounts for its ability to colonize large parts of Eurasia (Fig. 17). Most hominin species living in Africa, Europe, and Asia between 1.8–0.2 Ma BP were descendants of a single biological species, who intermixed and whose hybrid progeny were fertile (Derevianko, 2019).

The evolutionary history of *H. erectus* includes three stages. The first stage, dating to 800–900 thousand years, was the time when *H. erectus* gave rise to a new species, variously termed *H. heidelbergensis, H. rhodesiensis*, or archaic *H. sapiens* (Rightmire, 1996, 1998; Hublin, 2001,

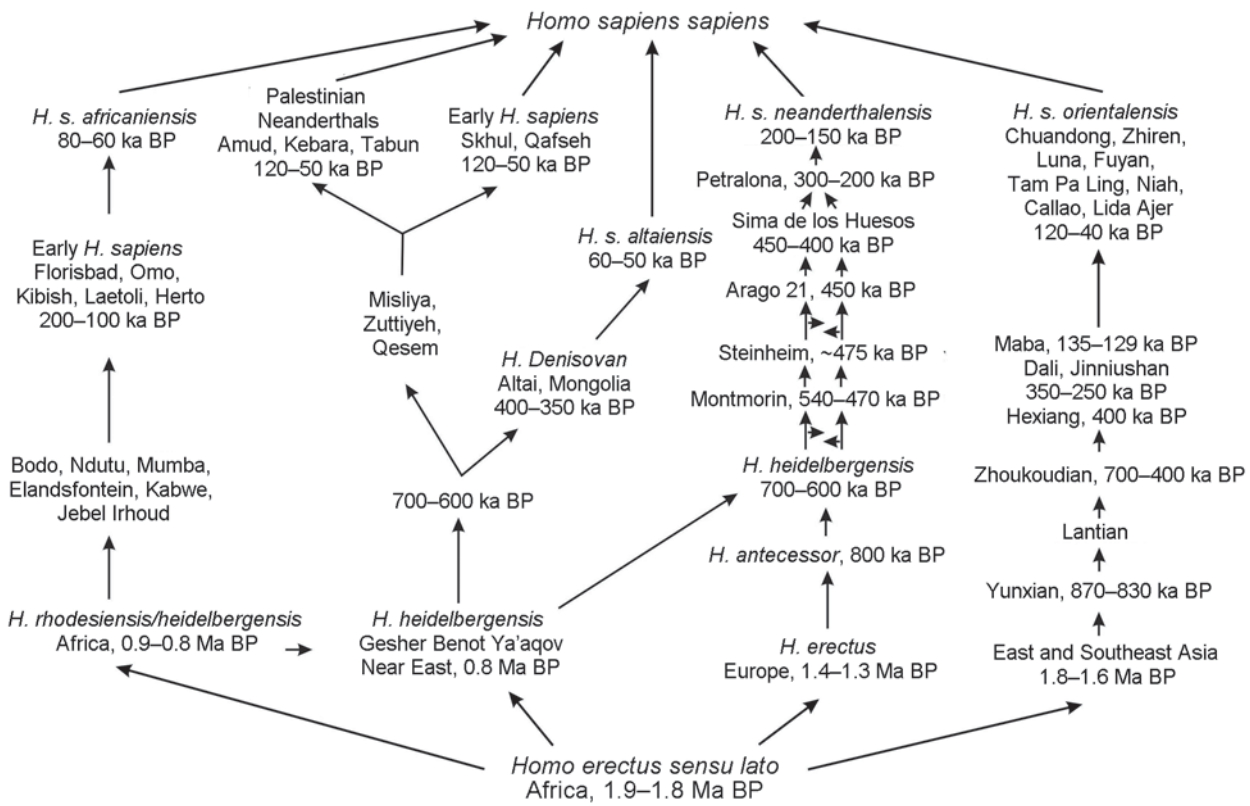

Fig. 17. Phylogenetic tree of the genus *Homo* (after (Derevianko, 2019: Fig. 254)).

2009; Bräuer, 2008, 2010, 2012). *Homo heidelbergensis* and *Homo rhodesiensis* were chronospecies with open genetic systems, in which several evolutionary lines emerged in the Middle Pleistocene. Those taxa were associated with the spread of the Acheulean industry in Eurasia. *H. heidelbergensis* was the ancestor of *H. sapiens*, Neanderthals, and Denisovans alike (Stringer, 2012), as demonstrated by its entire further evolution (Derevianko, 2019). The migration of *H. heidelbergensis* to Eurasia ~800 ka BP, documented by the Gesher Benot Ya'aqov site in Israel, triggered the split of a single metapopulation into evolutionary lines leading to modern humans on the one hand, and Neanderthals and Denisovans on the other (Meyer et al., 2014).

Homo rhodesiensis remained in Africa, becoming ancestral to anatomically modern humans, who emerged 200–150 ka BP, as evidenced by their remains found in eastern, northern, and southern Africa. The transition from *H. rhodesiensis* to *H. sapiens* was a prolonged and gradual anagenetic evolution, spanning the period of 800–200 ka BP (Bräuer, 2008, 2012; Mbua, Bräuer, 2012).

The origin of anatomically modern humans is a contentious matter. G. Bräuer attributes fossils from the 300–200 ka BP interval to the late transitional archaic group of *H. sapiens*. This group includes remains from Ileret (the KNM-ER 3884 cranium, 270 ka BP), Laetoli 18 (250 ka BP), Florisbad (260 ka BP), Jebel-Irhoud 1 and 2 (190–170 ka BP)*, and Eliye-Springs (the age of this site is uncertain). As Bräuer believes, continuity between early and late archaic humans is evidenced by the Rabat fossil (250 ka BP), whereas the transition from archaic to early *H. sapiens* is documented by Omo 1 and 2, Herto, Singa, etc. (Bräuer, 2008, 2012; Mbua, Bräuer, 2012). G.P. Rightmire claims that after the emergence of the species *H. heidelbergensis* some 800 ka BP, its evolution followed two trajectories—toward Neanderthals and toward modern humans. At the end of the Middle Pleistocene, *H. heidelbergensis* gave rise to *H. neanderthalensis* and *H. sapiens*. In Rightmire's view, the idea that the first anatomically modern humans originated in Africa is supported by fossils such as Florisbad, Laetoli, and Jebel Irhoud. In the beginning of the Upper Pleistocene, modern humans appeared in southern Africa (Klasies River Mouth) and in the Near East (Skhul and Qafzeh) (Rightmire, 2001, 2009).

Certain variation in both the cranial morphology and the lithic industries of early modern African humans suggests that they evolved from *H. rhodesiensis* across large areas of northern, eastern, and southern Africa, rather than in a single center.

Finds from the Gesher Benot Ya'aqov site in Israel attest to a migration of *H. heidelbergensis* associated with the Acheulean industry from Africa to the Near East ca 800 ka BP. In the Near East, those humans probably encountered native hominins—descendants of late *H. erectus*, likewise associated with the Acheulean industry, who were the first migrants from Africa (this migration is documented by the Ubeidiya site in Israel).

All Middle Pleistocene fossils found in the Levant demonstrate a mosaic combination of morphological traits typical of modern humans and Neanderthals and possibly testifying to hybridization between *H. heidelbergensis* and late *H. erectus*. As a result of these procceses, 800–200 ka BP, there emerged anatomically modern humans such as Skhul and Qafzeh, and Palestinian Neanderthals such as Tabun, Amud, and Kebara (Derevianko, 2016, 2019). Various ideas were expressed about the evolution and relationships of anatomically modern humans and Palestinian Neanderthals. B. Arensburg and A. Belfer-Cohen, based on the studies of Middle Paleolithic fossils from Israel, concluded that the so-called Neanderthals lacked Neanderthal specializations, whereas those traditionally described as anatomically modern humans displayed certain Neanderthal traits. Both the former and the latter hominins exhibit high levels of morphological variation. The analysis of fossils suggests that "Neanderthals" and anatomically modern humans coexisted in the same territory and sometimes even in the same caves (Arensburg, Belfer-Cohen, 1998: 320). This makes it difficult to subscribe to the idea that both Levantine groups were mutually antagonistic and could completely replace one another (Shea, 2001, 2007, 2008). Numerous archaeological finds from Paleolithic sites of the Late Middle to Early Upper Pleistocene in Levant demonstrate homogeneity and continuity; stone tools show similar technological and typological characteristics, which disagrees with the idea that Neanderthals had migrated to the Near East with a different lithic industry.

In the Levant, the remains of anatomically modern humans span the period between ~130–75 ka BP, whereas the earliest remains of Neanderthals date to ~130/125 ka BP, suggesting that in the beginning of the Upper Pleistocene, two human taxa coexisted in the region, showing high variation and mosaic combinations of cranial traits. Both these taxa, however, are morphologically rather similar. The

*At present, the date of Jebel-Irhoud is estimated as ~315 ka BP (Hublin et al., 2017; Richter et al., 2017).

same applies to their lithic industries and to their burial rites. While no remains of anatomically modern humans dating to the 55–75 thousand years interval have been found in the Levant so far, archaeological finds relating to Paleolithic sites indicate the presence of these humans in that territory in the first half of the Upper Pleistocene. The homogeneity of Middle Paleolithic industries in the Levant attests that neither gene flow nor any appreciable cultural influence from Africa or Europe was present. The Upper Paleolithic industry in that territory appears to have been mostly autochthonous, with a possible contribution from anatomically modern humans, creators of the late variant of the Nubian industry (Derevianko, 2011, 2019), or *H. sapiens* represented by the fossils from the Manot Cave (Hershkovitz et al., 2015).

About 450–350 ka BP, certain *H. heidelbergensis* from the Levant began to migrate to the Iranian Plateau and further to Central and North Asia, up to southern Siberia (Denisova Cave). This was the second stage in the formation of anatomically modern humans, when the ancestral metapopulation of late *H. heidelbergensis* split into Neanderthals and Denisovans. As the sequencing of the Denisovan genomes demonstrates, this occurred 430–380 ka BP (Prüfer et al., 2014; Meyer et al., 2014). Having dispersed over North and Central Asia, late *H. heidelbergensis* gave rise to Denisovans, who were identified in the Altai, specifically in Denisova Cave. Exactly late *H. heidelbergensis* became ancestral to Neanderthals and Denisovans, who emerged in the chronological interval from 400 to 200 ka BP. The lithic industry of Denisovans in the lower cultural horizons of Denisova Cave shows technical and typological parallels with the Acheulo-Yabrudian complex of the Levant (Derevianko, 2001, 2018).

Also, the eastward migration of late *H. heidelbergensis* during the 450–350 ka BP interval is documented by the Acheulean appearance of certain industries in Turkmenia, Kazakhstan, and Mongolia (Derevianko, 2019). Their route lay likely north of the Himalayas and Tibet. A hominin's mandible from Baishiya Cave, in the northeastern Tibetan Plateau, dating to at least 160 ka BP, was diagnosed as Denisovan on the basis of the paleoproteomic analysis of the dentine sample (Chen et al., 2019). While no Paleolithic finds from Baishiya are available, 300–400 km northwest of it, at several sites in Xingjian, superficially deposited Middle and Upper Paleolithic artifacts—showing elements of Levallois and blade flaking and similar to those from Denisova—were found (Derevianko et al., 2012). These have no parallels among the Late Middle to Early Upper Pleistocene industries of China. Yet another fact demonstrating that Denisovans were present in that region is the adaptation of Tibetans to high altitudes through introgression, apparently received from those hominins (see above) (Huerta-Sánchez et al., 2014).

Having taken an eastward migration-path from the Levant, late *H. heidelbergensis* hybridized with late Asian *H. erectus* and inherited a small share of archaic ancestry from them by adaptive introgression (Prüfer et al., 2014). This might account for the erectus-like features seen in the archaic skullcap from the Late Pleistocene site of Salkhit in northeastern Mongolia (Devièse et al., 2019). The archaeological context of that find is uncertain, as it was found during gold-mining operations, but the closest parallels to the Paleolithic industries of that region are in the Denisovan complex (Rybin, 2014).

Some 50 ka BP, an Upper Paleolithic blade industry that originated in the Altai on a local basis was apparently associated with Denisovans. Combined with skeletal and paleogenetic evidence, it suggests that this taxon, at the late stage of its evolution, was a subspecies of *H. sapiens*: *H. s. altaiensis*. Indeed, paleogenetic facts make it possible that Denisovans and anatomically modern humans were immediate descendants of one and the same biological species, and did not have enough time to develop full hybrid sterility (Derevianko, 2019).

Apart from Denisova, the autochthonous emergence of the Upper Paleolithic in the Altai is documented by several other sites with a distinct stratigraphy—Ust-Karakol, Anui-3, and Kara-Bom (Derevianko, Shunkov, 2004). These sequences clearly demonstrate the continuous development of technological traditions from the Middle to the Upper Paleolithic. This continuity suggests that no external influences were involved in the formation of the Early Upper Paleolithic traditions in that region.

An evolution of the lithic industry similar to that of Denisova is evidenced by finds from the Obi-Rakhmat grotto in western Tian Shan (Grot Obi-Rakhmat, 2004). The thick Upper Pleistocene deposits of this grotto reveal a cultural sequence reflecting autochthonous evolution from the Middle to the Upper Paleolithic in the 90–45 ka BP time span. The Obi-Rakhmat industry is characterized by features of Levallois and parallel flaking technique, predominance of tools (including points) on blades, and an early appearance of small- and micro-blade flaking in the Early Upper Paleolithic. One of the habitation layers, dating to ~60 ka BP, yielded six upper teeth and about 150 small cranial fragments from an adolescent aged 9–12. The large

dimensions and archaic features of the teeth, and the morphology of the preserved cranial bones, combining modern and Neanderthal traits, do not warrant an unequivocal taxonomic attribution. However, the largest of the teeth, M^3, is comparable in size only with three Upper Pleistocene third molars, namely those of the early anatomically modern human *Oase 2* and of two Denisovans (*Denisova 8* and *Denisova 4*) (Glantz et al., 2008; Bailey et al., 2008; Sawyer et al., 2015). The characteristics of the lithic industry (see above), as well as the dental and cranial features of the Obi-Rakhmat individual, favor the idea that Denisovans had taken part in the evolution of the Middle and Early Upper Paleolithic traditions in western Central Asia.

Early Upper Paleolithic industries broadly similar to that of Denisova are known at Ushbulak in eastern Kazakhstan (Anoikin et al., 2019), Moiltyn Am, Orkhon-7, Tolbor-4, and Tolbor-21 in northern Mongolia (Okladnikov, 1981, 1986; Derevianko et al., 2007; Derevianko, Kandyba, Petrin, 2010; Rybin, 2014), as well as in southern Siberia, northern China, and Korea (Derevianko, 2001, 2005, 2006), indicating an expansion of the Denisovan traditions to vast territories of North, Central, and East Asia.

About 700–600 thousand years ago, the *H. heidelbergensis* population with Acheulean industry left the Levant and migrated to Europe. Here, the Heidelbergians encountered late members of the *H. erectus* species. In the Middle Pleistocene, that territory was associated with various industries (Acheulean, pebble-flake, Clactonian, Buda, small-tool (Tayacian?)) and with various morphologies of hominins. The most informative human fossils, dating to the Final Early Pleistocene, were found at Atapuerca, Spain, specifically at Sima del Elefante Cave (level TE 9, 1.3–1.2 Ma BP) (Carbonell et al., 2008) and at Gran Dolina (level TD 6, 0.9–0.7 Ma BP) (Bermúdez de Castro, Nicolás, 1997). On the basis of hominin remains from the TD 6 level, a separate species (*H. antecessor*) was described. It is believed to be ancestral to *H. heidelbergensis* (Martinón-Torres et al., 2006, 2007; Carbonell et al., 2008; Dennell, 2009) and might thereby be a common ancestor of Neanderthals and *H. sapiens* (Bermúdez de Castro, Rosas, Nicolás, 1999). The morphological characteristics of *H. antecessor* make it possible to attribute this taxon to the late *H. erectus* descending from the Sima del Elefante hominins and likewise associated with the pebble-flake industry. The common ancestor of the late *H. erectus* and *H. heidelbergensis* was *H. erectus* and, accordingly, hybridization was still possible. Members of the *H. antecessor* species may have been the first hominins to have hybridized with the migrant Heidelbergians; and cultural exchange occurred as well.

For the interval between 600–200 ka BP in Europe, about ten hominin populations were identified. They were named after eponymous sites—Caune de l'Arago, Ceprano, Steinheim, Sima de los Huesos, Fontéchevade, Petralona, Bilzingsleben, Lazaret, etc. They display both similarities and differences, and their lithic industries were likewise variable—Acheulean, Clactonian, pebble-flake, etc. Despite biological and cultural variation, possibly caused by diverse environmental conditions and different subsistence strategies, all Middle Pleistocene hominin populations of Europe were open genetic systems capable of hybridization. The ultimate outcome of their gene exchange and acculturation was the emergence of European Neanderthals in the 200–150 ka BP time window. In taxonomic terms, this population, associated with the Mousterian tradition, should be termed *H. s. neanderthalensis* (Derevianko, 2019). In short, this was a subspecies of modern humans, hybridizing with other early members of the *H. sapiens* species. For instance, the proportion of the Neanderthal component in the genome of an anatomically modern human from Oase, Romania, dating to 37–42 thousand years, is about 7 % (Fu et al., 2015), whereas the corresponding proportion in the genomes of modern non-Africans is about 2 % (Prüfer et al., 2014).

Paleolithic traditions in East and Southeast Asia followed different courses from those in Africa and western Eurasia. In the former areas, modern humans evolved from the Asian *H. erectus*, whose ancestors were representatives of the first wave of migration. They developed their own lithic technologies, which were adapted to local ecological conditions and differed from those practiced in the more westerly parts of Eurasia.

Several physical anthropologists, noting the morphological similarity between the late *H. erectus* populations of Africa, Europe, and East Asia, attribute hominins from Jinniushan and Dali in China to *H. heidelbergensis* (Groves, 1994; Rightmire, 1996, 1998). In the last 20–30 years, more than a dozen fossils representing modern humans and dating to the 40–120 thousand years interval have been discovered in East and Southeast Asia, indicating the formation of one more subspecies, *H. s. orientalensis*, in those regions (Derevianko, 2011, 2019).

The third stage in the evolution of modern humans dates to 60–30 ka BP. It starts from the migration of *H. s. africaniensis* from Africa to Eurasia. In the

Near East, those people mixed with early modern humans and Palestinian Neanderthals; in Europe they hybridized with *H. s. neanderthalensis*; in North and Central Asia, with *H. s. altaiensis*; and in East and Southeast Asia, with *H. s. orientalensis* (Fig. 17).

Conclusions

The entire body of available archaeological, paleoanthropological, and paleogenetic facts suggests that anatomically modern populations in Africa and Eurasia evolved from the same ancestral species—*H. erectus*. This polytypical species apparently gave rise to all later human groups. *H. rhodesiensis*, *H. heidelbergensis*, *H. antecessor*, and other taxa that existed in Africa and Europe, and late *H. erectus* in East and Southeast Asia, were ancestral to four human subspecies: *H. s. africaniensis* in Africa, *H. s. neanderthalensis* in western Eurasia, *H. s. altaiensis* in North and Central Asia, and *H. s. orientalensis* in Southeast and East Asia. All taxa filial with regard to *H. erectus*, and showing both similarities and differences, retained the ability to hybridize. This conclusion is based on the hypothesis that after almost 2 mln years of evolutioin of *H. erectus*, three taxa were formed to the beginning of the Upper Pleistocene in Africa and Eurasia: *H. s. africaniensis*, *H. s. neanderthalensis*, *and H. s. altaiensis*, who were able to intermix and whose hybrid progeny was fertile. Thus, these were not different species, but subspecies, and interbreeding took place inside one species.

Obviously, the contributions of those taxa to the modern gene pool were unequal. According to paleogenetic data, modern humans first emerged in Africa by way of the evolutionary continuity *H. erectus* – *H. rhodesiensis* – *H. s. africaniensis*. The last-named taxon displayed the highest genetic diversity, and its contribution to the gene pool of modern humankind was maximal.

In the Near East, early modern humans of the Skhul-Qafzeh type and Palestinian Neanderthals were formed evidently by way of hybridization between *H. heidelbergensis* and late *H. erectus* populations of the first wave of migration.

In western Eurasia, about a dozen taxa of Middle Pleistocene hominins have been described, displaying various proportions of archaic and modern features, apparently due to gene exchange between late *H. erectus* populations associated with the pebble-flake tradition, and those of *H. heidelbergensis* associated with the Acheulean industry. About 200–150 thousand years ago, this intricate evolutionary process resulted in the emergence of European *H. s. neanderthalensis,* associated with the Mousterian-type industries. At the final stage of the Middle Paleolithic, Neanderthals showed highly efficient technological complexes and certain elements of modern human behavior. The results of recent archaeological, skeletal, and paleogenetic studies make it possible to associate late Neanderthals with transitional industries such as the Châtelperronian, Uluzzo, and Bacho-Kiro, which had apparently taken part in the emergence of the Upper Paleolithic in Western and Central Europe. Biological facts, in addition, suggest that *H. s. neanderthalensis* contributed to the evolution of *H. sapiens sapiens*, and that this contribution, estimated at ~2 %, can be traced in the gene pool of modern non-Africans (because the distribution area of Neanderthals did not extend to Africa, virtually no such trace is observed in modern African genomes).

The population of late Heidelbergians, having migrated eastwards from the Levant in the second half of the Middle Pleistocene, made contact with *H. erectus* descendants in South and Central Asia, resulting in the emergence of the Denisovan population, which appeared in the Altai about 300 ka BP. Since the Early Middle Paleolithic, the peculiar lithic industry of the Denisovans had been evolving under occasional influences from the Altaian Neanderthals, culminating in the emergence of the autochthonous variety of the Upper Paleolithic ca 50 ka BP. Notably, the level of the Early Paleolithic culture (material and apparently spiritual) associated with Denisovans was no lower than that shown by the culture of early *H. sapiens* in Africa. These facts *in toto* enable us to speak of a separate human subspecies, *H. s. altaiensis*. This label is all the more warranted because Denisovans, like Neanderthals, participated in the origin of the modern human species, having transmitted about 6 % of their genetic ancestry to modern populations in Australia, Oceania, and insular Southeast Asia.

Given the absence of external influences on the lithic industries of the Middle and Early Upper Pleistocene in East and Southeast Asia, it can be suggested that the migration waves of late *H. heidelbergensis* had not reached those regions. This implies the preservation and a continuous evolution of local Asian populations of *H. erectus*, and the autochthonous origin of one of the subspecies of modern man—*H. s. orientalensis*, as well as an independent model of the evolution of Paleolithic industries in the eastern part of Asia. Hominins of that territory hybridized with populations of adjacent regions, as evidenced by a small genetic

introgression from Denisovans and Neanderthals in the modern gene pool of East and Southeast Asia, and by a small genetic component, which the Denisovans had evidently received from the Asian *H. erectus*.

The presence of Neanderthal and Denisovan ancestry in modern human genomes, then, attests to the emergence of autochthonous cultural traditions in Africa and Eurasia, underlying the independent models of transition to the Upper Paleolithic. Those processes were accompanied by the emergence of early modern populations, which, in one way or other, had taken part in the evolution of modern humankind.

Acknowledgments

We are deeply thankful to all our colleagues, whose contribution to the multidisciplinary studies at Denisova Cave was invaluable: S. Pääbo, R. Roberts, Z. Jacobs, T. Higham, K. Douka, V. Slon, S. Brown, B. Viola, A.K. Agadzhanyan, N.S. Bolikhovskaya, A.P. Buzhilova, M.B. Mednikova, V.A. Ulianov, and to all the numerous participants of projects focusing on the Paleolithic sites in the Altai.

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Received May 27, 2020.

DOI: 10.17746/1563-0110.2020.48.3.033-042

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Ocher in Late Paleolithic Contexts at the Kovrizhka IV Site, the Baikal-Patom Highlands (Eastern Siberia, Russia)

This paper deals with numerous ocher remains found in cultural layers 6, 2G, and 2B of the Paleolithic site Kovrizhka IV on the Vitim River, in the Baikal-Patom Highlands (Eastern Siberia). These layers are dated by radiocarbon to the interval of ~19.2–18.3 ka cal BP. In cultural layers 2B and 2G, ocher colored the living floors and combustion areas. Stratigraphic observations indicate that this was done at the very beginning of the occupation. In layer 6, traces of ocher were present on an anthropomorphic figurine made of mammoth ivory, and pieces of ocher were found near the head of another such figurine. In layer 2B, a large piece of ocher was unearthed at the edge of the hearth. Ocher residues were also detected by use-wear analysis on certain artifacts. This variety of patterns suggests different functions of ocher, possibly both symbolic and utilitarian. The mineral composition of ocher was assessed by X-ray diffraction analysis. In all three layers, hematite is associated with quartz. In layer 2G, an additional type of ocher was identified, containing impurities, such as calcite and chlorite. Known sources of ocher are located in the distribution areas of magnetite and hematite ores, over 500 km southwest and southeast of Kovrizhka IV. The importance of ocher in the life of these societies is discussed in light of the archaeological evidence and the long-distance raw material acquisition patterns of ocher.

Keywords: *Late Paleolithic, Eastern Siberia, Kovrizhka IV, dwelling, ocher, hematite.*

Introduction

The use of pigments by prehistoric societies is one of the key themes of Paleolithic studies in Eastern Europe and Northern Asia. This subject traditionally attracts attention because it is usually related to the symbolic behavior of anatomically modern humans. The use of different types of pigments, traditionally referred to in the literature as "ocher", has been reported from various Late Paleolithic sites in Siberia, within different sedimentary contexts. More specifically, the use of ocher for coloring various items, such as personal ornaments, was reported at the sites of Kara-Bom and Maloyalomanskaya in the Altai Mountains; and at Podzvonkaya, Kamenka A, Khotyk, and Varvarina Gora in Transbaikalia (Derevianko, Rybin, 2003: 44–46). A pendant pigmented with ocher, dated around 43 ka BP, was found at Kara-Bom, layer 5 (Ibid.: 38–41). In northern Siberia, the oldest artifacts pigmented with ocher (ca 32 ka BP) were found at the Yana site, where locally made beads were pigmented with ocher mixed with fat (Pitulko et al., 2012). The researchers hypothesized that this mixture was also used as a repellent for blood-sucking insects (Ibid.: 82). Ocher remains were also found at Shestakovo (layer 6, which yielded an anthropomorphic figurine) in Western Siberia (Derevianko et al., 2003: Fig. 46); Listvenka (as isolated ocher residues in layer 16) and Uy II (layer 7) in the Yenisey Region; and Malaya Syya, Khakassia (Paleolit…, 2005: 114–115; Vasiliev, 1996: 187; Lbova, Kulik, Gubar, 2018). Coloring substances in the form of isolated lumps and pigment residues on figurines were reported at Malta (Gerasimov, 1931, 1958; Lbova, 2018). Ocher was also recorded in layer III (ca 17.8 ka BP) of Malta-Most-1, Cis-Baikal (Berdnikova, Vorobieva, 1995: 92). The authors reported that pigments were spread over the living floor right before the occupants left the site. Lumps and isolated spots of ocher were noted on stones at the settlements of Ust-Kyakhta-17 (layers 3 and 5), Ust-Menza-3 (layer 4), and Studenoye-1 (layers 11 and 19/4) (Tashak, 2005: 32, 35–37; Konstantinov, 1994: 75, 79, 91). Evidences of the use of ocher were noted at the sites of Ushki I–V in Kamchatka: the excavations yielded a fish geoglyph made of ocher, and dwelling floors, graves, and human burials powdered with ocher (Dikov, 1993: 10–11, 24, 25, 32). In Eastern Beringia, ocher was also found in a burial dated ca 11.5 ka BP (Upward Sun River) in Alaska (Potter et al., 2014).

Occurrences of ocher and other coloring agents are mostly interpreted as being related with ritual or symbolic behaviors; however, some scholars associate them with utilitarian purposes (Delibes de Castro, 2000; Domingo, Garcia-Borja, Roldan, 2012; Pradeau et al., 2014; Usacheva et al., 2018). Of course, interpretations largely depend on the archaeological context of the discoveries. Here, we present the various contexts that yielded ocher within the Late Paleolithic layers of Kovrizhka IV, on the lower part of the Vitim River. Judging by the quantity of ocher remains at the site, it likely played an important role in the life of people in this area about 19–18 ka BP (hereafter, all radiocarbon dates are given in ka cal BP).

Kovrizhka IV is located in the central part of the Baikal-Patom Highlands, in the North-Baikal region, at the northeastern tip of the Irkutsk Region (Fig. 1) (Tetenkin, Henry, Klementiev, 2017). It is located on an 11-m-high terrace, on the right bank of the Vitim River. To date, 16 layers have been identified at the site. 14 of them are embedded in flood-plain alluvium fascia. Layers 6, 2G, and 2B are the most studied to date. The first analysis of the pigments of these layers (2012–2018) showed a broad use of ocher. In an earlier publication, we presented the results of the X-ray diffraction analysis of the ocher pieces, indicating that the coloring agent was hematite. Reinforcing available regional data, our results suggest that the use of ocher was a wide-spread Paleolithic tradition (Tetenkin et al., 2018). This paper focuses more specifically on the socio-economical aspect of ocher use. For layers 6, 2G and 2B, we present in detail the contexts in which ocher was found, as well as the results of new analyses of the mineral composition of the substances used. Furthermore, analyses of minerals associated with the ocher remains from different layers at Kovrizhka IV allowed evidencing potential raw material sources (i.e., iron ores located in the Northern Transbaikalia).

Complex of layer 6

This complex includes remains of a dwelling about 4.5 m in diameter, structured by two hearths and delimited by a semi-circular line of 12 boulders and slabs in the western margin of the residential area; one hearth is located at the radial center, the other one at its end, which may correspond to the dwelling entrance (Fig. 2, *a*). Several AMS-dates were obtained: 15,558 ± 103 BP (Ua-50437) on bone, and 15,740 ± 100 (LTL-16562A) and 15,750 ± 60 BP (Beta-453119) on charcoal. Calibration, based on the two last-mentioned dates, provides the interval of 19.2–18.8 ka BP (after (Bronk Ramsey, 2017; Reimer et al., 2013)). Two artifacts made from mammoth ivory, interpreted as anthropomorphic figurines, were unearthed within this complex and restored (Tetenkin, Henry, Klementiev, 2017; Tetenkin et al., 2018).

The ocher pieces and pale pink coloration are associated with artifact concentrations within the dwelling limits and at the entrance of the household zone (Fig. 2, *a*). Ocher is one of the four main categories of cultural remains, along with knapped lithic industry, charcoal and bone fragments. Use-wear analysis made using microscopes MFU MBS-10 (×4.8–×98), Olympus

Fig. 1. Location of the Kovrizhka IV site, Turuka cemetery, and iron-ore deposits in the region.
1 – Rudnogorsk; *2* – Korshunovsky; *3* – Tyya group; *4* – Toldun; *5* – Taloy; *6* – Irokinda; *7* – Nizhny Ingamakit; *8* – Katugin; *9* – Chiney; *10* – Chara-Tokko group; *11* – Abchada group.

BH2-UMA (×100–×200), and Dino-Lite Digital Microscope Premier (×30–×250) showed occurrences of ocher on the surfaces of some artifacts. One of two retouched tools, typologically identified as a side-scraper and used as a knife, bears microscopic traces of ocher on the proximal part of its face, in a retouched and thinned area (Fig. 3, *e*). One of the anthropomorphic figurines, found in the southeastern part of the dwelling, showed vivid traces of ocher on its head (Fig. 3, *a*). In the course of restoration, ocher was also noted on the figurine on its lower surface (Fig. 3, *b*). Some pieces of ocher were also found close to the head of the second anthropomorphic figurine unearthed in the entrance area (Fig. 3, *c*) (Tetenkin et al. 2018).

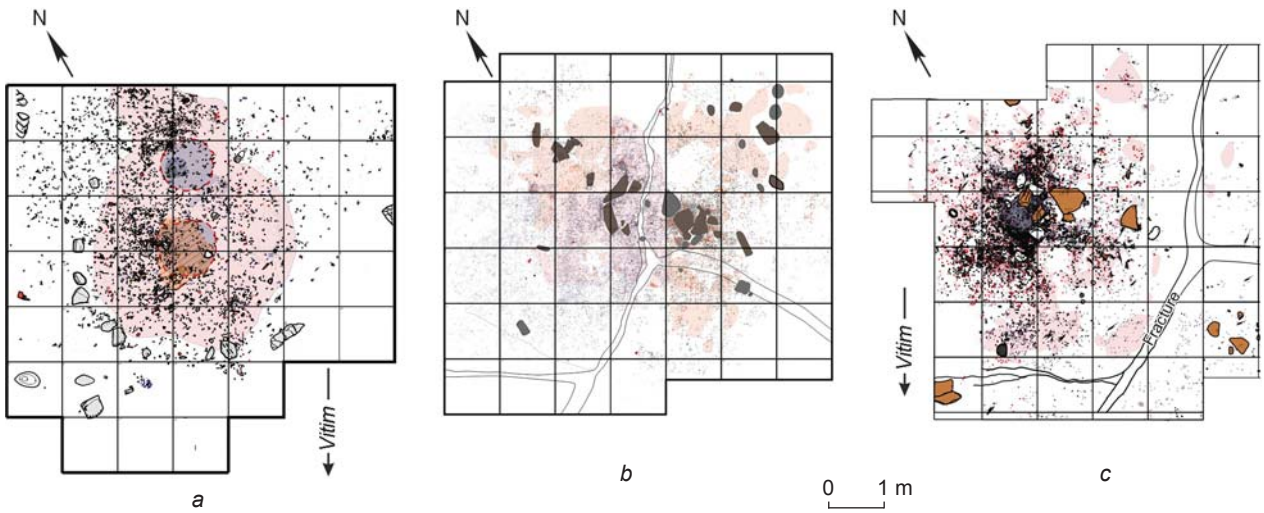

Fig. 2. Planigraphy of the complexes of layers 6 (*a*), 2G (*b*), and 2B (*c*).

Fig. 3. Ocher among other cultural artifacts from layers 6 (*a–d*), 2G (*f–i*), and 2B (*j–l*).
a – the first anthropomorphic mammoth ivory figurine in layer 6 in the course of discovery; ocher traces on the "head"; *b* – same figurine during restoration: ocher traces on the lower surface (photo by O.V. Zhmur); *c* – the second anthropomorphic mammoth ivory figurine in layer 6 in the course of discovery: ocher pieces close to the "head"; *d* – decomposed ocher piece; *e* – ocher traces on the ventral surface of a knife; *f* – hematite piece with rounded edges; *g* – ocher at the bottom of the cultural layer; *h* – ocher below the hearth construction; *i*, *k*, *l* – ocher coloration of layer; *j* – ocher piece next to a split tubular bone at the western margin of hearth.

Complex of layer 2G

Several AMS-dates on charcoal are available for layer 2G: 15,320 ± 80 BP (Poz-111356), 15,360 ± 110 BP (Poz-111232); the underlying layer 2D was dated to 15,350 ± 150 BP (Poz-106968). The calibrated interval of layer 2G is ca 18.8–18.4 ka BP. The complex includes: 1) the base of the living floor, colored with ocher; 2) hearth with charcoal fragments disseminated over an area of ca 5 m^2; 3) four stone slabs, forming a half circle

at the center of the combustion area, and a thick flat slab outlined with a large boulder and fragments of gneiss at the opposite ends; 4) alignment of four stones, as well as two isolated rock fragments, in the northern and northwestern sectors; 5) two pits 20 cm in diameter (one up to 7 cm deep, the other up to 2 cm deep) at the northern and southern edges of the complex; 6) slabs and boulders forming a contour of an arch-shaped pattern of 11 stones at the eastern periphery of the area, and isolated stones in the northern and western sectors (see Fig. 2, *b*). Most of the debitage and all the tools are located in the center and in the northwestern part of the hearth, whereas the faunal remains are scattered towards the southeast. A significant feature is the reddish coloration of the whole area at the very base of the occupation layer (see Fig. 3, *g*). Traces of ocher are also noted below the combustion area (see Fig. 3, *h*). The largest piece of hematite bears signs of abrasion at its edges (see Fig. 3, *f*). The complex is interpreted as the remains of a dwelling.

Hearth complex of layer 2B

The hearth complex with adjacent cultural remains occupies an area of about 4.5 × 4.5 m (see Fig. 2, *c*) (Tetenkin, 2019). Several AMS-dates are available for layer 2B: 15,320 ± 100 BP (LTL-16563A) and 15,460 ± ± 80 BP (Poz-106962) on charcoal, and 14,940 ± 80 BP (Poz-106023) on bone. The interval of ca 18.8–18.3 ka BP was generated from the first-mentioned date, which is well-correlated with the datings from layers 2G and 2D. Unlike layers 6 and 2G, where no cultural remains are noted outside the described complexes, layer 2B proves to be a rather large cultural layer, in which the hearth complex is only one of the structural components.

Six boulders and slabs are located over the charcoal concentrations in the eastern half of the combustion area, which measures 0.90 × 0.65 m. The stone artifacts are located mostly in the northeastern, northern, and northwestern margins of the hearth. Almost all the large bones were found south of the hearth, including two mandibles of bighorn sheep. A very intriguing find consisted of a disc of black, packed, consolidated, terrigenous, fine-grained sediment-like aleurite (silt), 12 cm in diameter and 2 cm thick, located 0.35 m north of the hearth. The X-ray fluorescence analysis shows that the chemical composition of this feature is identical to the black aleurite (silt) from the piled material over the hearth at the center of the dwelling in layer 6 (Tetenkin et al., 2018: 10).

The area surrounding the hearth is strongly colored with ocher. The majority of the finds are located on top of the cultural layer, again colored with ocher (see Fig. 2, *c*; 3, *k*, *l*). This is the reason why most of the lower surfaces of the artifacts bear traces of ocher. In some cases, traces of ocher result from the dissolution of ocher fragments over time. There are areas with continuous strong red coloration, where ocher lumps are quite rare, and artifacts show ocher residues on their surface. Areas completely free of ocher coloration and cultural remains are located at the northern edge of the combustion structure and at the southern edge of the dwelling behind the hearth (see Fig. 2, *c*). These areas probably correspond to previous positions of the gneiss slab (63 × 45 cm) and of the boulder (30 × 40 cm), northeast of the fireplace.

Ocher is absent from the center of the hearth. At its northwestern edge, free of stone pavement, there is a 15-cm-long tubular bone split lengthwise and a bright-colored stain 6 cm in diameter—a disintegrated ocher lump (see Fig. 3, *j*).

Ocher composition

The first results of the analysis of ocher from Kovrizhka show that the pigmenting mineral is hematite (α-Fe_2O_3) (Tetenkin et al., 2018). The analysis of 19 new samples from layers described above (Table 1) shows that their mineral composition is not homogenous. The powder X-ray diffraction method shows that the proportions of hematite in the ocher found at Kovrizhka IV vary from 21 % to 96 % and those of quartz from 4 % to 64 % (Fig. 4). Accessory minerals are scarce and include mica (muscovite), feldspar, goethite, chlorite, and more rarely calcite, fluorapatite, and cordierite. All three layers yield pieces of ocher composed of the quartz-hematite association. They often show spherical grains of hematite in the form of oolites and rounded quartz particles (see Fig. 3, *f*). This type is more typical of layers 2B and 6. Unlike the latter, layer 2G yields pieces of ocher with higher shares of accessory minerals, such as calcite and chlorite, up to 12 %.

Discussion

In layer 6, unlike layers 2B and 2G, the inner dwelling area and the entrance zone do not show strong coloration with ocher. A pale pink coloration was however noted in the course of the excavation of the cultural layer (1 cm thick on average). With this very residual evidence, we can thus only assume the presence of a colored living floor, on the basis of the evidence from layers 2B and 2G. Additional evidence for the spread of powdered ocher over the living floor is provided by the microscopic traces observed on the lower sides of the artifacts surfaces. On the other hand, traces of ocher on the ventral surface of a knife (see Fig. 3, *e*) may represent the remains of a compound that fastened the handle. Alternatively, the

Table 1. **Mineral composition of ocher from Kovrizhka IV, %**

Sampling point	Hematite	Quartz	Mica	Feldspar	Goethite	Chlorite	Fluorapatite	Calcite
Horizon 2B								
Unit 44, sq. 12*	72	28	–	–	–	–	–	–
Same, sq. 6*	89	11	–	–	–	–	–	–
Same, sq. 18, qtr. 3*	21	32		47	–	–	–	–
Same, sq. 13, qtr. 1*	42	–	–	–	58	–	–	–
Test pit 14*	45	44	–	–	11	–	–	–
Unit 44, sq. 12	92	8	–	–	–	–	–	–
Horizon 2G								
Same, sq. 17	36	28	23	–	–	13	–	–
Same, sq. 21	36	28	22	–	–	14	–	–
Same, sq. 23, qtr. 2	64	20	–	–	–	–	16	–
Same, sq. 24	75	25	–	–	–	–	–	–
"	29	64	–	–	–	7	–	–
Unit 48, sq. 23, qtr. 1	51	49	–	–	–	–	–	–
Same, sq. 2, qtr. 1	17	51	4	10	–	6	–	12
Same, sq. 1	60	40	–	–	–	–	–	–
"	65	35	–	–	–	–	–	–
Horizon 6								
Unit 40, sq. 4*	96	4	–	–	–	–	–	–
Unit 36, sq. 23*	58	42	–	–	–	–	–	–
Same, sq. 19, qtr. 4*	97	29	4	–	–	–	–	–
Same, sq. 12	85	15	–	–	–	–	–	–

Notes: The mineral composition of ocher was assessed by powder X-ray diffraction analysis in diffractometer D8 ADVANCE Bruker, with Göbel mirror and VÅNTEC-1 PSD detector. The obtained data were processed with DIFFRACplus program package. Mineral phases in the samples were identified using the powder diffraction file database PDF-2 (https: //www.icdol.com/index.php/pdf-2) and EVA program (https: //www.bruker.com/products/x-ray-diffraction-and-elemental-analysis-x-ray-diffraction/xrd-software/eva.html).

*The data are after (Tetenkin et al., 2018).

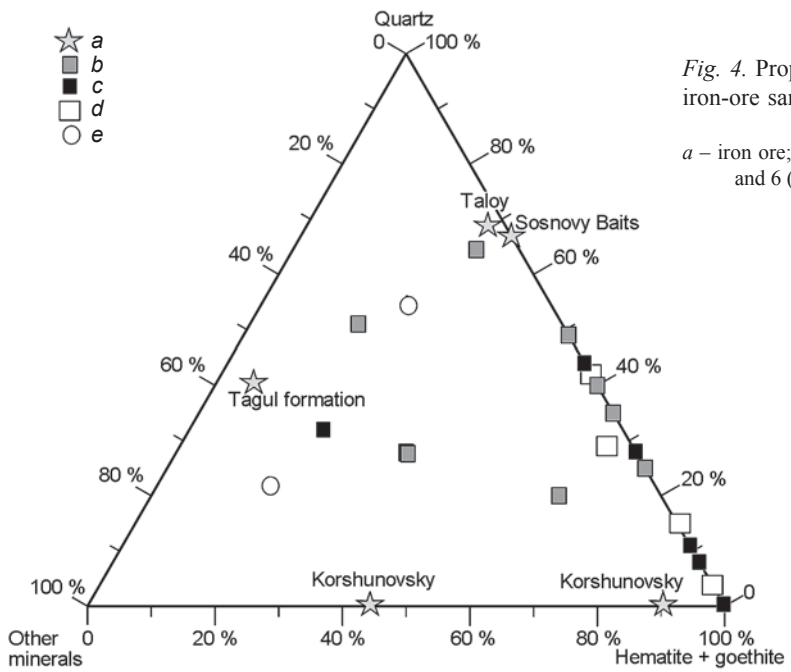

Fig. 4. Proportion of minerals in ocher and the iron-ore samples (diagram is based on the data from Tables 1 and 2).
a – iron ore; *b*–*e* – ocher from layers 2G (*b*), 2B (*c*), and 6 (*d*) at Kovrizhka IV and Turuka (*e*).

randomly dispersed microstains on this and other artifacts could be accidental.

The ocher traces on the lower surface of the figurine (i.e. on the body) found in the dwelling of layer 6 may be the natural result of its burial in a colored soil (see Fig. 3, *b*). However, the upper part of its "head" shows clear traces of ocher (Fig. 3, *a*), and a few lumps were found near the head of the second figurine (see Fig. 3, *c*). Neither case seems accidental.

In addition to a specific behavior linked to ocher, the case of the black aleurite (silt) supports the hypothesis of a cultural continuity between layers 6 and 2B. This matter was found in the hearth of layer 6 and close to the combustion structure of layer 2B. The extremely regular shape of the deposit, a 12 cm-large and 2 cm thick disc, suggests it was initially placed in some container. Its composition turned out to be identical to the black aleurite (silt) sediment overlying the central hearth of layer 6. Thus, it appears that recurrent gestures may have consisted of spreading red ocher powder over the living floor upon the arrival of humans, and of filling the hearth with black sediment before the abandonment of the dwelling. It is unclear to what extent this succession of events is connected within a technological or ritual context. The excavation area of layer 2G is entirely covered with ocher. It is clearly visible at the bottom of the cultural layer and below all the main structural elements—combustion and living floor areas (see Fig. 3, *g*, *h*). The ocher traces at the northeastern edge of the northern hearth pavement are particularly bright-colored (see Fig. 2, *b*). At the opposite side of the hearth, there is an area 0.60 m wide almost devoid of ocher. A possible explanation could be that this area was covered while the powder was scattered, maybe by a mat of some sort. The ocher spot at the southeastern part extends beyond the slabs and boulders; hematite seems to have been scattered before the dwelling was built (i.e., before the stones were placed) on the already colored ground.

The situation in layer 2B is partially similar; the only difference is that the hearth area is not colored; only small pieces of ocher were recorded, in addition to a large decomposed lump of ocher found next to the fractured bone at the western edge of the hearth (see Fig. 3, *j*). It can be proposed that these two items were intentionally left next to the hearth at the end of the occupation period.

The piece of ocher (1.5 cm long) found in layer 2G, shows rounded edges in cross-section (see Fig. 3, *f*). This may be the result of either transport or abrasion. No signs of destruction or dissolution of the pigment were noted in the layer, near the place where this item was found. Moreover, given the relatively calm conditions of the formation of the layer, i.e., fine alluvial deposits, we exclude the hypothesis of a natural abrasion of the item in the course of the formation of the cultural horizon in favor of a modification of anthropogenic origin.

Archaeological studies of ocher and ethnographic data report very different possible uses of this material, among which as a dye for certain categories of items, as an antiseptic or protective agent against decay, or as an element used in hide-processing (Pomies, Menu, Vignaud, 1999; Domingo, Garcia-Borja, Roldan, 2012; Pradeau et al., 2014; Delibes de Castro, 2000). However, hide-processing tools were not identified among the lithic artifacts from layer 2B studied by the use-wear analyst J. Jacquier. Some tools of this layer were used on mineral materials, yet ocher particles are not recorded on the used areas of these tools. Several tools from layer 6 were used for hide-scraping, but ocher residues are also absent from the used areas. In the absence of further evidence, it is difficult to support the hypothesis of the use of ocher for hide-processing at Kovrizhka.

Zooarchaeological analyses tend to show that all three complexes were occupied in winter. Considering that the dwellings may have consisted of wooden structures and other perishable materials, ocher could also have been used for "protecting wooden constructions from decay and keeping a dry atmosphere inside the dwelling"; such explanation is proposed in the interpretation of the Mesolithic-Chalcolithic dwellings in Trans-Urals and northwestern Siberia (Usacheva et al., 2018: 257); see also (Delibes de Castro, 2000). However, only charred wood is preserved, and no traces of special treatment with ocher were found in the pits probably left from posts supporting dwelling constructions (layers 6 and 2B).

Layers 2B and 2G are chronologically, stratigraphically, and spatially close to one another, with the combustion feature of 2B located exactly above the hearth of 2G. These two structures are separated by a layer of sterile sand and by layer 2V, which contained few finds, the total thickness of both being about 8 cm. One of the boulders from layer 2B lays almost on top of a hearth slab of layer 2G; three other cases of contacts between the slabs from these layers are noted. The calendar ages determined on charcoal are ca 18,576 cal BP for 2B, and ca 18,574–18,583 cal BP for 2G, which are well-correlated with the date of ca 18,600 cal BP for the cultural layer 2D. The available dates suggest that the gap between these occupation episodes did not exceed the life-span of one human generation. Apparently, the occupants of layer 2B, who treated the area with ocher, were aware that they had arrived in a previously inhabited place. The same inference is true for layer 2G, directly overlying layer 2D. Was the spreading of ocher powder at the beginning of each occupation a tradition (of utilitarian or symbolical nature) that was performed in order to "clean" the living area? Was this related to the fact that people settled previously inhabited places? In the current state of our knowledge, it seems difficult to explain these gestures further. However, they had to be of extreme relevance considering the remote provenience of the ocher used at the site.

Hematite, the coloring mineral composing the ocher used at Kovrizhka IV, is very common in iron-ore deposits. There are dozens of iron-ore deposits in Eastern Siberia (Zhelezorudniye mestorozhdeniya…, 1981: 14–21). These ores are of various ages and mineral associations, which can be used to trace the origin of the ore. Thus, the analysis of the ocher's mineral composition makes it possible to establish its provenance. There are no iron-ore deposits in the lower part of the Vitim Basin (see Fig. 1). The X-ray phase analysis of the ferruginous gneiss sampled from the outcrops in the vicinity of the site does not show the presence of hematite. Yet, the sources of Kovrizhka IV ocher are magnetite and hematite ores (Table 2). The more frequent occurrences of iron ores are associated with Precambrian sedimentary rocks, i.e. ferruginous quartzites occurring in the Siberian Craton (see Fig. 1). Such deposits of various genesis formed in the upper tributaries of the Vitim River, in the northern part of Lake Baikal, in the Upper Chara River, and its right-side tributary Tokko.

On the basis of the mineral association, at least two distinct types of ocher can be identified. The first one is the quartz-hematite association with minor admixtures of mica and feldspar, of the oolitic texture. This type of ocher (see Fig. 3, *f*) was recorded in all layers discussed here. The oolitic texture of hematite, characterized by spherical grains, was observed at the Taloy ore field (the Upper Vitim River, Taloy and Usoy interfluve), and also at the fields of the Angara-Ilimsky District (the Irkutsk Region) and of the Chara-Tokko group. The latter contain oolitic ores devoid of quartz, occurring in association with chlorite and calcite (Zhelezorudniye mestorozhdeniya…, 1953: 16–20, 70; Rudniye mestorozhdeniya…, 1978: 71; Charo-Tokkinskaya… formatsiya, 1984: 8, 86). Thus, the ores from the Taloy and Chara-Tokko ore fields can be regarded as the probable sources for the first type of ocher.

The second type of ocher is recorded only in layer 2G. This type has a wider mineral composition: besides quartz and hematite, it contains chlorite, various micas, feldspar and calcite. This mineral association is typical of skarn deposits, known in the Angara-Ilimsky and Severo-Baikalsky districts (see Fig. 1). Two ocher samples from the Neolithic cemetery of Turuka (near the town of Ust-Kut, on the Lena River; see Fig. 1) were taken for comparative analysis. These samples show the presence of hematite (17 % and 23 %), quartz (22 % and 54 %), mica (5 % in each), feldspar (40 % and 6 %), chlorite (3 % and 4 %), calcite (5 % in each); sample 1 also contains cordierite (5 %). A similar mineral association is observed in several samples of ocher type 2 from layer 2G. Given the age of this layer (18 ka), it should be taken into account that during MIS 2, mountains and valleys in the southern part of the Baikal-Patom Highlands were covered with glaciers. As the Lena–Angara-Ilim region is connected with Kovrizhka by a single river-system, it seems the most probable origin for the ocher found at the site.

Judging by the abovementioned facts, we can assume that hematite was transported to the site from various regions of the eastern (southeastern) or western (southwestern) direction, located at a distance of no more than 500 km.

Currently, the phenomenon of processing living floors with ocher in the Vitim valley is known only for the period of 19.3–18.2 ka BP. So far, Kovrizhka IV layers 6, 2G, and 2B are the oldest occupation layers containing ocher in the region. The excavated hearth complexes from layers 9, 8, 7, 6, 5, 4V, 4B, 4A, 4, 3V, 3B at Bolshoy Yakor I (15.0–13.6 ka BP); 8a, 8, 7 at Ust-Karenga (15.4–12.7 ka BP), and layer 2 of Kovrizhka III (13.0–12.2 ka BP) do not yield anything of the kind. Layer 4A at Bolshoy Yakor I contained a piece of rock bearing traces of ocher grinding; layer 2 at Kovrizhka IV (13.5–13.1 ka BP) yielded a pebble with similar signs and vague ocher spots within the sedimentary matrix. Layer 4A at Kovrizhka II (9.2 ka BP) yielded small solitary traces of ocher. Considerably large amounts of ocher were only recorded at the cemetery of Stary Vitim II and at the site of Ust-Karenga XVI at the bottom of graves and ritual pits, respectively (Vetrov, 2008). These sites were dated to 8–7 ka BP; i.e., over 9000 years younger than layers 6, 2B, and 2G of Kovrizhka IV. In the Cis-Baikal region, in that time, i.e. Final Mesolithic to Early Neolithic transition, ocher was recorded in the burials of Shchukino and Ershi cemeteries, as well as in the Kitoy culture burials (Bazaliysky, 2012).

Table 2. **Mineral composition of iron ores**

Sampling point	Hematite	Quartz	Mica	Feldspar	Chlorite	Calcite	Magnetite
Taloy	28	69	–	3	–	–	–
Sosnovy Baits	33	67	–	–	–	–	–
Korshunovsky, sample 1	18	–	–	–	22	34	26
Same, sample 2	–	–	–	–	–	10	90
Tagul formation	6	40	9	30	15	–	–

Conclusion

We evidenced the earliest use of ocher known so far in the lower part of the Vitim Basin (19.3–18.2 ka BP), within three chronologically close complexes from layers 6, 2G, and 2B at Kovrizhka IV. Analysis of ocher and its mineral sources was carried out along with studies of other cultural aspects. The general context of the site was the decisive factor in the perception and interpretation of the coloration of the cultural layer and artifacts by ocher.

Indeed, far from representing isolated spots or fragments, ocher is found dispersed over the entire occupational areas, i.e. living floors, and combustion features, black aleurite (silt) being found associated to the latter in some instances. Ocher was also found on artifacts, such as anthropomorphic ivory figurines and stone tools. The purpose of these procedures may have been ritual, utilitarian, or both. In some cases, the coloring of the items may have been due to the random contacts with ocher on the layer or during the transportation.

The main mineral composing the ocher was hematite, which was prepared by crushing and grinding rocks with high hematite content (up to 94 %). Hematite was transported over long distances from deposits located at a minimum of 500 km. Ocher from layer 2G was transported from other deposits, possibly from the west and/or east (i.e. the Lena Basin).

Acknowledgements

Archaeological studies were supported by the Russian Foundation for Basic Research (Project No. 18-59-22003\18). Analytical works were supported by the Russian Science Foundation (Project No. 19-78-10084) in the Center for Collective Use “Geodynamics and Geochronology” of the Institute of Geochemistry SB RAS. Colleagues from France were supported by Maison Fondation Sciences de l’Homme, in the frame of the project “LicHENS” Late Pleistocene Hunter-Gatherer Adaptations to Tundra Environments in North-Baikal Siberia”.

The authors thank V.I. Bazaliysky (Irkutsk State University) for submitting the ocher samples from the burial of Turuka; and O.V. Zhmur (Peter the Great Museum of Anthropology and Ethnography (Kunstkamera) RAS) for the assistance in the study of the ivory figurines. Special thanks go to V.I. Levitsky (Sosnovy Baits iron ore deposit), S.I. Shkolnik (Taloy, Tagul formation), and T.A. Radomskaya (Korshunovsky iron ore deposit) for submitting the ore samples from the deposits.

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Received November 18, 2019.
Received in revised form February 14, 2020.

DOI: 10.17746/1563-0110.2020.48.3.043-049

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Cave Sites of the Jomon Period in Taishaku Gorge, Western Japan

We describe the largest group of cave sites in Japan known to date. It includes some 50 sites, located in a gorge within the area of the modern Taishaku National Natural Park. Their characteristics are provided and their relevance to the study of the early stages of the Jomon Period is assessed. The study is based on publications, field reports, and samples of artifacts owned by the museums in the Hiroshima Prefecture. The focus is on cave sites in the Chugoku region, their location, structure, inner space, and utility zones in the adjoining territory. Special attention is paid to the reconstruction of sequence in which parts of the cave space were exploited at different stages of the Jomon Period. Archaeological finds are described in detail—stone and bone tools, potsherds, and mollusk shells. Their analysis suggests that the Jomon people who lived in those caves subsisted mostly by hunting and freshwater mollusk collecting. Shells of marine mollusks and tools made of sanukite, which is unavailable in the area, indicate trade relations between cave dwellers and people of the adjoining regions, including the sea coast. A conclusion is made that population growth and greater reliance on hunting and fishing territories rich in vegetation led to the change in lifestyle and subsistence strategies of the Jomon people.

Keywords: *Jomon, Japanese islands, cave sites, cave, rock shelter, pottery.*

Introduction

Taishaku Gorge is one of the most famous canyons in Japan. It is located near the town of Shobara, in the Hiroshima Prefecture, on Honshu Island, and it is a part of the Taishaku National Park. The gorge is a rocky crevice located on a plateau, with a depth of 200–300 m and a length of 18 km, which stretches along the Taishaku River (tributary of the Takahashi River). The canyon is known not only for natural features, but also for archaeological sites dating back to the Paleolithic–the Kofun period. The group of cave sites in the Taishaku Gorge of the Jomon Period is the most numerous in Japan, and its materials provide a wealth of information about the various stages of the existence of human society in this area.

This research is based on published sources, field materials of the study of sites stored in the museums of the Hiroshima Prefecture, as well as the observations of the authors, who took part in the excavations.

The aim of this study is to characterize the sites in the Taishaku Gorge as a special type of archaeological sites,

Archaeology, Ethnology & Anthropology of Eurasia 48/3 (2020) 43–49 E-mail: Eurasia@archaeology.nsc.ru

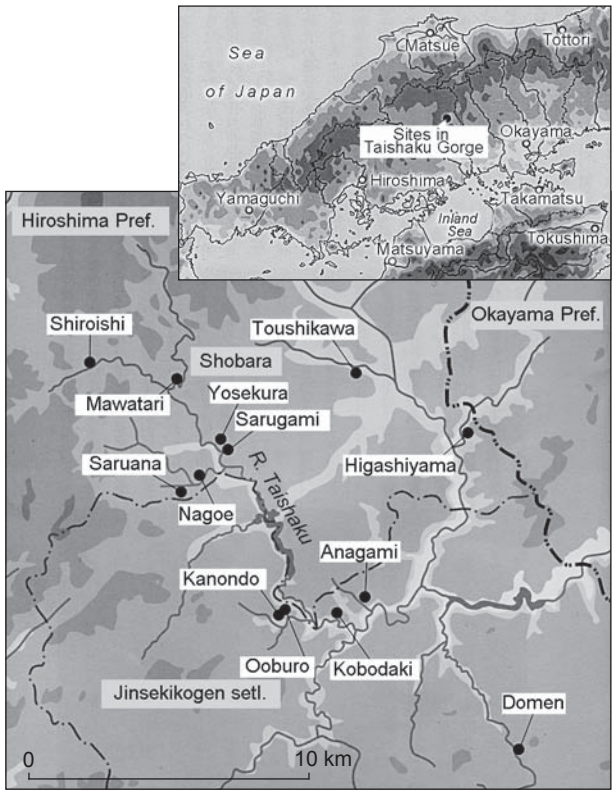

Fig. 1. Cave sites in the Taishaku Gorge (after (Kawase, 2007: Fig. 6)).

and to determine the significance of their materials for studying the early stages of the Jomon Period.

Sites in the Taishaku Gorge were discovered in 1961 during the road construction. In 1977, the University of Hiroshima began to study them. During the archaeological survey of the area, 42 objects were discovered—caves and rocky shelters. The following sites stand out among the archaeological materials: Mawatari, Yosekura, Nagoe, Saruana, Sarugami, Shiroishi, Toushikawa, Higashiyama, Kanondo, Domen, Anagami, Kobodaki, Ooburo (Fig. 1). During the excavation of these sites, fragments of ceramics, stone tools, bone tools, and well-preserved human bones were found. Mawatari and Kanondo are the sites of the Pre-Pottery Period.

Beginning of the Jomon Period* coincided with a warming of climate that caused changes in flora and fauna: large animals became extinct, smaller and faster moving ones appeared, such as wild boar and raccoon dog (see (Kawamura, 1992)). Humans, who were forced to adapt to new climatic conditions, developed new tools. Changes in the toolkit have been recorded starting from layer 4 in the Mawatari rock shelter. At the sites in the Taishaku Gorge, a large number of stone tools with grooves were found: these were sinkers for river nets, which testify to the harvest of fish and shellfish by humans during the Jomon Period. Materials from cave sites allow us to study the transition of the population of the Japanese islands to new forms of adaptation and a change in foraging strategies at the initial and early stages of the Jomon Period.

*The period, corresponding approximately to the Neolithic, ranges from 13,000 BC to the early 4th century BC (An Illustrated Companion…, 2016: 21).

Special features of the Jomon Period cave sites of the Taishaku Gorge

The formation of caves is associated with the processes of erosion of rocks. River erosion is a phenomenon in which water cuts through rocks, and stones carried by the current break down at the bottom and along the banks of the river, forming rock shelters and caves. Taishaku Gorge is located in a kind of limestone belt in the Chugoku region. Limestone rocks are found in different parts of Japan, in the central part of Kyushu—in the territory from the Kumamoto Prefecture to the Oita Prefecture, on Shikoku Island—from the Ehime Prefecture to the Kochi and Tokushima prefectures. Territory from the Wakayama Prefecture to Nara, Mie, Aichi, and Shizuoka prefectures belongs to the limestone belt. Limestone is also sometimes found in the area from the Fukuoka Prefecture to Yamaguchi Prefecture (Akiyoshido Cave), from Kyoto Prefecture to Shiga and Gifu (Kyugo Cave), Nagano (Natori Cave) and Toyama prefectures. Large cave sites along the Pacific coast in Saitama (Tateya Cave), Tochigi (Oyadera Cave), and Iwate prefectures in Tohoku Region (Ryusendo Cave), Aomori Prefecture (Siriroambe cave) (Watanabe, 2012, 2015). On Hokkaido Island, limestone rocks are concentrated in the area of Hakodate and Abashiri cities (Kawase, 2007: 12).

The archaeological cave sites include the actual caves and rock shelters. The caves are mostly horizontal, with archaeological material found inside the cavity and on the outer terrace. Several walls form a vault; the space along the far wall is usually darkened. The drip line is outside and separates the inside of the cave from the terrace, which is usually larger in area than the interior space. The terrace is usually located sloping towards the valley (Serizawa, 1979).

Rock shelters most often do not have a vault; the rock in the upper part forms an eave. The space under such a canopy looks like this: the inner wall slopes up to 65°, the inner space is small, and the terrace adjoins. The entrance can be of different sizes. For example, in the rock shelters of Yosekura and Mawatari (Taishaku Gorge), the entrances are wide—up to 10 meters. In 50 cave sites of the Incipient Jomon, the entrance is oriented mostly to the south, sometimes to the east, and N-E (Shiraishi, 2015: 4).

The caves change their shapes owing to the natural destruction. Rocks are destroyed by the sun, rain, wind, snow, and falling trees. If cracks form in the soil from the roots of trees, rainwater gets into them and accumulates, which can be one of the destructive factors. Collapses also occur due to earthquakes, landslides, and fires. In some cases, the caves are destroyed, leaving a rocky surface.

The ancient inhabitants of the Japanese islands were settling in caves, because these were cool in summer and warm in winter. Notably, the average annual temperature in the limestone cave is 15–16 °C; it is stable as compared to the annual temperature outside the cave. The humidity is 80–100 % (Shiomi, 1999: 32). The large entrance provided illumination of the front of the cavity. The space in front of the cave was probably multifunctional: it was used for stone processing, making pottery and hunting tools, sorting nuts, etc. The specialization of the small areas of such sites was formed, most likely, in the course of human adaptation to the environment, and not through active change. In the Nagoe rock shelter, traces of a partition were found, which looks like a double fence of a terrace with pillars (Shiraishi, 2015: 6).

In the sediments of the caves, fragments of rock, sand, traces of human activity, including hearths, are found. The filling of the hearths contains coal, ash, and food remnants. The location of objects could change as a result of the influx of large volumes of water, weathering, and temperature changes. In places of temporary use, archaeological finds are scarce. In the cave sites, the stratigraphy of the deposits is clearly visible. Cultural strata are different in thickness; some are very thin, without archaeological remains. Finds are spread through the layers, but may shift. The mixing of materials from the upper and lower cultural layers is possible. This requires a particularly careful approach to the study of the finds.

The drip line, as noted above, divided the cave space into inner and outer zones. In the Initial Jomon, the deceased were buried in the unlit inner space of the caves (Ibid.: 7). It is absolutely certain that the caves were used as burial places in the Late Jomon: in layers 3 and 4 of the Yosekura site, two common graves of adults and children were found. In Fun Cave, Oita prefecture, 66 human skeletons were found; nine of them belong to the Initial Jomon, 40 to the Early Jomon, and 17 to the Late Jomon (Ibid.: 11). Rock cavities were often used for burial. For example, in Tobayama Cave, Nagano Prefecture, a lot of scattered human bones of the Kofun Period* were found; in Oderayama Cave, Chiba Prefecture, there were several wooden coffins. Further research may help to establish whether the caves were used for burial in the Incipient Jomon (Vorobiev, 1958).

It is difficult to determine whether the people of the Incipient Jomon, who began to make pottery, aspired to settled life, since no settlements of this time have been found. In addition to dwellings, people needed various sites for manufacturing stone tools and pottery, assembling and repairing hunting equipment, preserving food made from nuts, carving prey, burying, and conducting ceremonies. These actions, even if they were not performed simultaneously, required certain spaces in front of the cave. In other words, the presence of large terraces was an important condition determining the choice of the cave for living. Similar sites from the Incipient Jomon are found in river valleys. These include the Maeda Kochi cave site near Tokyo, whose inhabitants were most likely engaged in salmon and trout fishing (Shiraishi, 2015: 18). Since the fishing industry is seasonal in nature, it was necessary to preserve the caught fish in order to keep it for a long time. The presence of a cave terrace or open areas on the riverbank was vital (Kawamura, 1988). On the terraces, excavations have uncovered stone tools, pits, and utility sites, dating back to the Incipient Jomon. While exploring Fukui Cave in the Nagasaki Prefecture, on a gentle slope on its southern side, materials from the Paleolithic–Jomon Period were found. Artifacts associated with caves can also be found on rocky surfaces that slope towards the river. Kamikuroiwa rock shelter in the Ehime Prefecture, in Western Japan, is located on the southern slope of a cliff, and has a flat adjacent platform. If earlier research of caves was focused directly on the caves themselves, now the area around them is also actively studied.

Artifacts of the beginning of Jomon Period

The number of cave sites in the Japanese archipelago, which deposits contain a cultural layer of the Incipient Jomon, is small. At the archaeological sites in the Taishaku Gorge, Hiroshima Prefecture, layers of the Paleolithic and the Insipient Jomon have been traced in the caves of Kanondo, Kobodaki, Ooburo, and in the Mawatari rock shelter (see *Table*). They contain scarce materials of the Insipient Jomon (Ichikawa, Nagatomo, Hagihara, 1978: 173; Roberts, 1997: 821).

It is difficult to determine exactly how the ancient people used the caves because of the specifics of the sites and the relatively small number of finds. Archaeologists have fully explored only few of them. Analysis of finds from Senpukuji and Fukui caves, in the Nagasaki Prefecture, showed that the amount of pottery there was more than the life of the family requires. In addition, layer 9 at Senpukuji Cave contained 2153 microlithic tools and 162 blanks. Since this cave was used seasonally, it can be assumed that it was a workshop for the manufacture of microlithic tools (Shiraishi, 2015: 13). In the Nagoe rock shelter, in the Taishaku Gorge, the number of utility pits and the area of cave terraces correspond to one or

*The period of Japanese history, 3rd to 7th centuries.

Chronological attribution of sites in Taishaku Gorge

Site	Paleolithic	Jomon Period						Yayoi Period
		Incipient Jomon	Initial Jomon	Early Jomon	Middle Jomon	Late Jomon	Final Jomon	
Mawatari	+	+	+	–	–	–	–	+
Kanondo	+	+	+	+	+	+	+	+
Kobodaki	–	+	+	+	+	+	+	+
Domen	–	–	+	+	–	+	+	+
Ooburo	–	+	+	–	+	+	–	–
Yosekura	–	–	+	+	+	+	+	–
Nagoe	–	–	+	+	+	+	+	+
Shiroishi	–	–	+	+	–	+	–	+
Saruana	–	–	+	–	–	+	+	–
Anagami	–	–	+	+	–	+	–	–
Sarugami	–	–	–	–	–	+	+	–
Toushikawa	–	–	+	+	–	+	–	–
Higashiyama	–	–	+	+	–	+	+	+

two families. Most likely, one family lived in the shelter (Shiomi, 1999: 130).

On the banks of the Mawatari River (a tributary of the Taishaku River), there is a rock shelter of the same name. In an excavation site 4 m deep, five layers with artifacts and three thin layers without archaeological material were identified. In layers 1–3, stone arrowheads, fragments of ceramic vessels, bones of raccoon dogs, and shells of freshwater mollusks were found. Layer 4 yielded stone points, a spearhead, fragments of ceramic vessels, bones of a wild boar, and mollusk shells. Layer 5, which the researchers attribute to the Paleolithic era, contained a large number of small stone tools and the jaws of a large-horned deer. Layers 1–4 correspond to the Jomon Period. Layer 4 contains not only Paleolithic stone points, but also stone arrowheads and pottery fragments. The presence of a stone tip indicates the use of a bow and arrow. Studies have shown that ceramic finds are the remains of dishes used to cook food over a fire (Kawase, 2007: 25). The big-horned deer belongs to large animals that became extinct at the end of the Ice Age. Excavation materials from Mawatari Cave indicate that during the Jomon Period, the big-horned deer inhabited the territory of the Hiroshima Prefecture and was a hunted game. Around the beginning of the Jomon Period, the cold Ice Age climate changed to a warmer climate, closer to the present. Plants appeared, the fruits of which could be eaten, large animals disappeared, but the number of smaller animals, such as wild boars and raccoon dogs, increased. Changes in the toolkit, the appearance of ceramics should be associated with the adaptation of people of the Jomon Period to changes in nature.

Kanondo Cave is one of the main archaeological sites at the bottom of the Taishaku Gorge (Fig. 2). Since 1964, more than 30 studies have been carried out here (excavations have currently been suspended). The cave is located on a limestone rock, at an altitude of 500 m above sea level, its height is 8 m, width 14 m, depth 9 m, the width of the entrance is 12 m; the entrance is oriented to the south. Archaeological materials from the Jomon Period occur mainly in layers 3–22; probably, people have lived in this cave since the beginning of this period (The Cambridge History…, 1993: 55). Rich cultural layers of the Late and Early Jomon yielded numerous pottery fragments. Various items made of horn, bone, and shells, such as bone needles and rings, were found in the deposits. The presence of shells of freshwater and marine mollusks probably indicates to the trade relations of the local population with the inhabitants of coastal areas. This assumption is supported by the pieces of sanukite found in the layers, which is not mined in this area. The cave also displays stone tools: arrowheads, *takikishi* tools, used to cut plants, and sinkers for fishing nets (Kawase, 2007: 22). Traces of burials were recorded, indicating the presence of a long-term settlement in the cave.

The Ooburo Cave, located at an altitude of 460 m above sea level, is small in size: its height is 3.0–3.5 m, width 5.7 m, depth 4 m, entrance width 11 m; the entrance is oriented to the south. The area of the terrace is approximately 40 m^2. The cave was discovered in 1984 and is constantly being explored. In layers 1–2, artifacts from the Nara and Muromachi periods (Middle Ages) were found. Pottery and shells of the eastern mollusks *Meretrix lusoria*, dating to the Late Jomon, were discovered in layer 3; artifacts from the Incipient and Initial Jomon occur in the upper part of layer 5 (Iwase et al., 2012: 120; Hakuhiro, Hirao, 2016: 99). Individual

Fig. 2. Kanondo Cave. Modern view. *Photo by the authors.*

bones of Pleistocene animals were found between layers 5 and 6. The remains of burnt soil were recorded in layers 2, 3 in the far part of the cave. Many fireplaces have been found, especially in sector D (dating to Late Jomon). According to the researchers, this was the main living space. Pottery and stone tools are accumulated in the western part of the cave. The bones of small animals (snakes, mice, bats) show no signs of heating. It is known that the meat of large animals, such as deer and wild boar, was used as food (Shiomi, 1999: 124).

Kobodaki Cave, like Kanondo Cave, is one of the main archaeological sites at the bottom of the Taishaku Gorge. It is located at the base of a limestone cliff; owing to the similarity of the latter with a waterfall, the cave was named "Kobo Falls". Excavations of the site have been carried out since 1985 to the present. When exploring the cave, 16 layers were identified. According to the excavations, the cave was used mainly during the Jomon Period, as well as during the Kofun Period and in the Middle Ages. Materials from layer 4 date to the Middle Jomon; the lower half of the cultural layer of the Jomon Period is rich in pottery. The finds allow us to trace the formation of the archaeological site back to the beginning of the Jomon Period or the Paleolithic era. The inner space of the cave was apparently vast.

Yosekura rock shelter is located on the left bank of the Taishaku River, in the eastern part of Taishaku district. Its height is 20 m, width 14 m, depth 15 m, entrance width

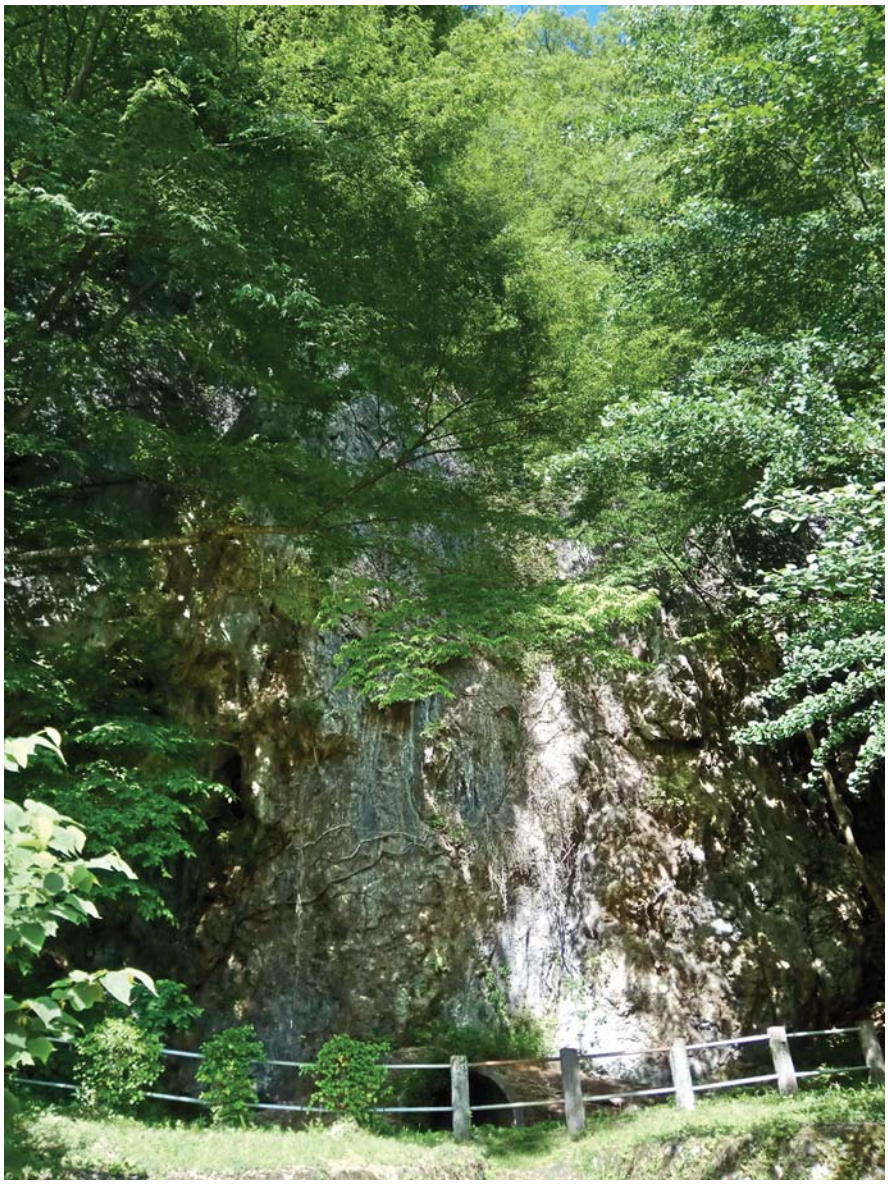

Fig. 3. Yosekura rock shelter. Modern view. *Photo by the authors.*

50 m; the entrance is oriented to the SW (Fig. 3). The age of the finds ranges from the Initial Jomon to the Middle Ages. Among the finds, artifacts of the Jomon Period predominate. The Yosekura rock shelter is a site with clear stratigraphy. Its layers yielded numerous ceramic finds, serving as a reference point for the identification of ceramics of the Jomon Period in the Chugoku and Shikoku regions. Rich material was also found in common graves of the Late and Final Jomon.

Conclusions

On the Japanese islands, approximately 700 cave archaeological sites were discovered. Among them, there are 50 sites with finds from the Incipient and Initial Jomon. Most of the materials from the caves date back to 9000 BC, the Initial Jomon. This can be explained, first, by the population growth, the transition to a sedentary lifestyle; second, by the emergence of fishing and hunting areas, the development of territories suitable for collecting plant food, the creation of open areas for industrial and economic purposes, with the result that caves began to be used for burials. Thus, the materials of the studied cave sites testify to a transition to new forms of adaptation and a change in foraging strategies in the Initial Jomon.

The huge number of unexplored caves of the Japanese archipelago is a potential source of new information for studying the issues of inhabiting and use of caves. The group of sites in the Taishaku Gorge continues to be

studied, in particular, using the latest technologies, for more than 50 years. The materials of the described sites allow us to trace in detail the stages of development of the Chugoku region territory since the Paleolithic, and to shed light on the formation and development of the Jomon culture.

Acknowledgements

This study was supported by the Russian Science Foundation (Project No. 19-18-00003).

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Received March 2, 2020.
Received in revised form March 12, 2020.

DOI: 10.17746/1563-0110.2020.48.3.050-058

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An Unusual Fabric from Jety-Asar-2, Eastern Aral Sea Region, in the Context of the Central Asian Textile Tradition

We present the results of an interdisciplinary study of an unusual sample of wool fabric, found at the Jety-Asar-2 fortified site, representing the Jety-Asar culture of the late 4th century BC to early 1st century AD, in the central Turan Plain. We outline the results of the analysis of the dyes and technological characteristics of the fabric. The woven pattern is described in detail. The specimen is compared with the tapestry from Shanpula (Sampul) cemetery in the Hotan oasis, Xinjiang, China. We examine the idea that the Jety-Asar fabric had been manufactured in Shanpula and transported to the Aral basin along the Great Silk Road. Previously, this type of tapestry was believed to have been used only in the Hotan oasis, because no direct parallels with other areas were known. A direct parallel with such a remote westerly region is all the more intriguing. Apparently, colorful strips of woolen tapestry depicting animals, birds, humans, fantastic beings, mountains, and flowers were in big demand. The tradition, then, may have been distributed much more widely than previously thought. Many anthropomorphic, zoomorphic, plant, and purely decorative motifs have numerous parallels in the Early Iron Age art of the Eurasian steppes, highlands, and piedmont areas. The Shanpula people used such fabric for decorating skirts. In other cultures, it was destined for various purposes.

Keywords: *Textile, Shanpula, Xinjiang, Jety-Asar culture, Eastern Aral Sea region, interdisciplinary research.*

Introduction

Textiles are a unique archaeological source. They are very rarely discovered at archaeological sites. Only localities like Xinjiang or Egypt possess an abundance of ancient fabrics and items made of them. Ancient textiles, which as a rule have been preserved fragmentarily, are of great value as important sources of scholarly information. Such finds include textiles discovered at the sites of the Jety-Asar culture in the Eastern Aral Sea region.

In 1973, a rectangular white felt rug was found on the steps of the stairs inside the vaulted shooting gallery (cultural layer 9) during the excavations at the settlement of Jety-Asar-2 (7th–6th centuries BC to 3rd–4th centuries AD) conducted by the Khorezm Archaeological and Ethnographic Expedition of the Institute of Ethnography of the USSR Academy of Sciences (today, the Institute of Ethnology and Anthropology RAS), headed by L.M. Levina. As Levina wrote, "This was a case of the secondary use of the

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Fig. 1. Felt rug trimmed with woolen fabric. Jety-Asar-2 fortified settlement.

saddle cloth" (1996: 217). Along the perimeter, the rug was trimmed with "a strip of lint-free woolen carpet woven using two-way carpet technique".

This rare find became the object of research by A.K. Elkina, an expert on ancient textiles, who established that the woven pattern was "a weaving repeat by every 12–13 cm; the pattern consists of two motifs: an animal (horse) is in one half; the height of the animal was equal to the width of the border band; the second motif consisted of two identical images (possibly also animal) located one above the other. In the next repeat, both of these motifs were woven upside-down" (Ibid.). Substances that were used to dye the threads of woolen fabric were identified, and it was established that "red and pink colors were obtained using common madder; blue was produced from indigo; yellow – possibly from some local plant, and green resulted from dyeing yellow over blue" (Ibid.). Unfortunately, the method used for establishing the content of the dyes was not indicated.

The reason for new research into the fabric was information derived from the discovery of numerous remains of woolen textiles in graves in Xinjiang in recent years. The availability of this evidence opens up the prospects for placing the textiles found at a site of the Jety-Asar culture in a historical context.

In 2002, we had an opportunity to comprehensively re-examine the fabric described and take color photos of it* (Fig. 1). Unfortunately, the book on the ethnic and cultural history of the Eastern Aral Sea region, where the fabric was described, contains only a black and white drawing (Levina, 1996: 315, fig. 120), which does not reflect rich and bright colors, while the small image size does not make it possible to see all the pattern details.

This study intends to use advanced methods and devices to establish the substances used to dye woolen threads, as well as to identify the technological features of the object, and to describe and interpret the woven images. The analysis was carried out at the Chemical Research Center for Collective Use of the SB of the RAS.

Description of fabric from the Jety-Asar-2 site

Research methods and results. Tissue fibers were analyzed using scanning electron microscopy with a Hitachi TM-1000 microscope. Dyestuffs were extracted from the threads by boiling the samples in a

*The item is kept in the State Museum of Oriental Art in Moscow. We thank L.M. Levina for the permission to use the evidence from the excavations done by the expedition she leads. Many thanks to E.I. Zheltov for photographing the fabric.

Fig. 2. Photo of samples of the fabric threads.

37 % HCl/H_2O/methanol solution (2/1/1, v/v/v) for ten minutes. The resulting solution was cooled, separated from the residue by centrifugation, and evaporated. The residue was dissolved in methanol/formic acid (9/1, v/v) and centrifuged again. The solution was used without dilution, for a high performance liquid chromatography. The analysis was carried out using an Agilent 1200 system from Agilent Technologies with a diode array detector. Separation was performed on a Zorbax XDB-C8 column (2.1 × 150 mm, 3.5 μm) by Agilent Technologies. Detection was conducted at wavelengths of 255 nm (bandwidth 16 nm), 370 nm (60 nm), 440 nm (80 nm), 540 nm (60 nm), and 600 nm (80 nm) with the reference wavelength of 850 nm (100 nm); separation was carried out by gradient elution with a mixture of 2 % water solution of formic acid and 20–90 % acetonitrile (5–15') at a flow rate of 0.3 ml/min.

The threads of red, blue, yellow, pink, and gray colors were analyzed (Fig. 2, 3). All the threads contained fibers of different thicknesses. For example, the diameter of the fine fibers of red threads was from 11 to 17 μm; the diameter of threads of medium thickness ranged from 26 to 40 μm, and the diameter of the coarse wool was from 50 to 68 μm. All the fibers were thoroughly dyed. In blue threads, the fibers were mainly of medium thickness (from 17 to 23 μm). Rough fibers ~50 μm and wool ~91 μm thick occurred. Coarse fibers were not dyed all the way through. Fibers of yellow threads had small (from 12 to 19 μm) and medium (from 28 to 38 μm) diameters. Coarse fibers ~46 μm sporadically occurred. All the fibers were thoroughly dyed. Fibers of pink threads were mixed and included fine fibers with a diameter from 18 to 23 μm and coarse fibers (from 41 to 44 μm). Occasional wool (62–67 μm) was observed. Coarse fibers were not dyed all the way through. Fibers of gray threads were thin (from 15 to 24 μm). Individual coarse fibers had diameters from 39 to 43 μm. Comparison of macrophotographs of fibers with models makes it possible to conclude that the fabric analyzed was woven of unsorted sheep wool (Fig. 3). This is also indicated by the presence of lanolin on the fibers of the threads, which is a typical feature of sheep's wool.

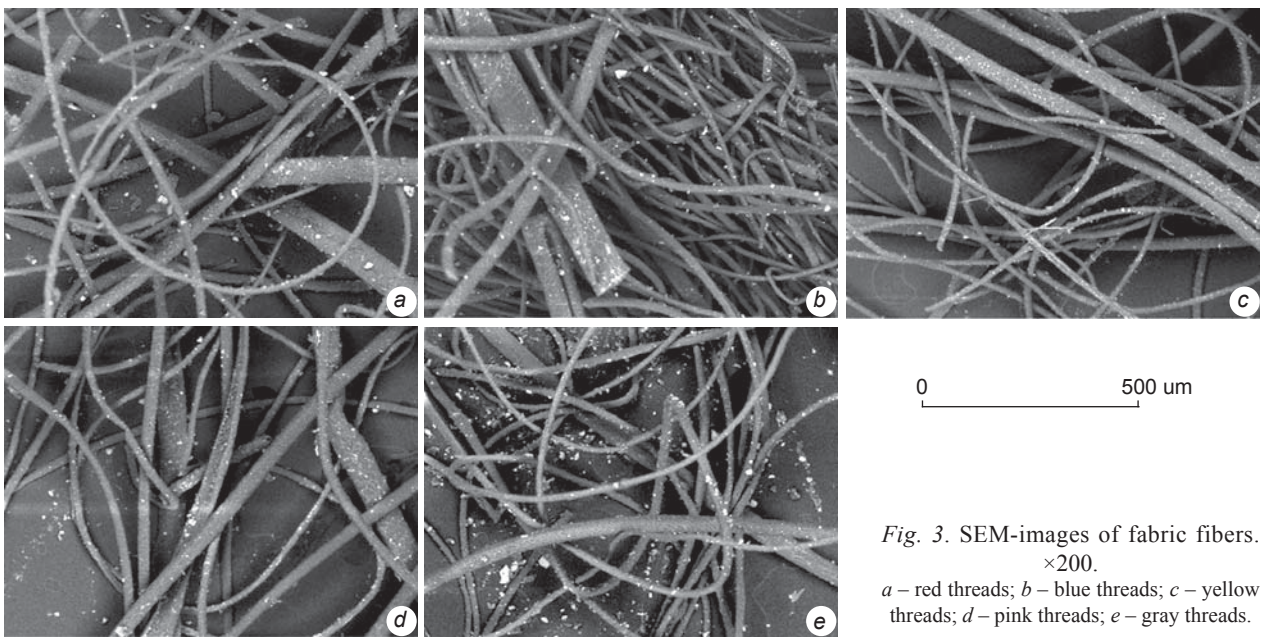

Fig. 3. SEM-images of fabric fibers. ×200.
a – red threads; *b* – blue threads; *c* – yellow threads; *d* – pink threads; *e* – gray threads.

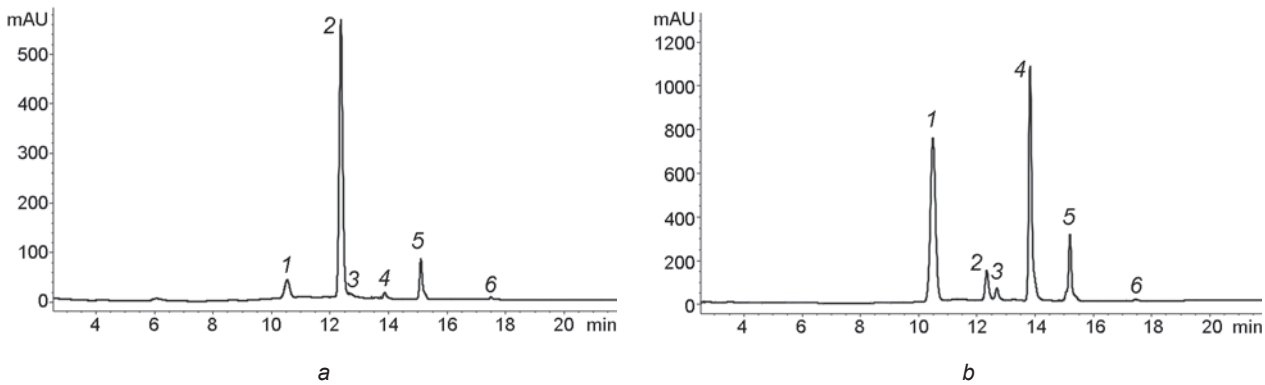

Fig. 4. Chromatographic profile of dyestuff extracts with green buckthorn berries without mordant (*a*) and with potassium alum (*b*).
1 – quercetine; *2* – kaempferol; *3* – isorhamnetin; *4* – rhamnetin; *5* – rhamnazin; *6* – emodin.

During the study, the substances used for dyeing woolen threads have been identified. The red threads were dyed with madder (*Rubia sp.*). The main dyestuff is alizarin. A rather high content of purpurin has been detected. Traces of alizarin, purpurin, and xanthopurpurin have been discovered in the threads of other colors. Except for trace amounts of alizarin and purpurin, which probably passed from red threads, dyestuffs have not been detected in gray threads. Most likely, these threads were natural. Indigotine, indirubin, and trace amounts of alizarin and xanthopurpurin have been identified in the blue thread. Purpurin has a retention time close to indigotine; therefore, it was not visible against the background of indigotine peak. Kaempferol, as well as traces of alizarin and purpurin, have been identified in the chromatogram of the yellow thread. Kaempferol was found in the standard dyed with green buckthorn berries (*Rhamnus frangula* L.)*. It was the main dyestuff for the yellow color in dyes made without mordanting (Karpova et al., 2017: 444). In the chromatograms of wool standard dyed with Rhamnus sp. using potassium alum as a mordant, the main component was rhamnetin (Fig. 4, *b*). Rhamnetin has not been found in the yellow threads of the fabric; it is likely that they were dyed with buckthorn (Persian berries) without mordanting (Balakina et al., 2006).

Thus, it has been established that the threads of woolen tapestry from the Jety-Asar-2 fortified settlement were dyed with madder, Indigofera (or other indigoid plant), and probably buckthorn berries. These data are consistent with the results of analysis of woolen fabrics from the Shanpula site (Xinjiang) obtained at the Netherlands Institute for Cultural Heritage (Graaff de, van Bommel, 2001).

*Buckthorn grows in North Africa and Europe; in Asia it occurs in Siberia (except for the Far North), Altai, and Northern China.

The item was also studied by an expert in ancient textile technology, Dr. T.N. Glushkova, according to whose conclusion the woven band 80 mm wide, which has come down to us in two fragments, was made using a two-way carpet technique (weft cord weaving), with a weft density of about 18 threads per 1 cm, and with average warp and 6 threads per 1 cm, with loose warp. The weft density was not uniform, because the tapestry weave pattern was created by several wefts. The colored weft moved only within the colored ornamental pattern. The pattern repeats every 12–13 cm; it is composed of two motifs—the image of an animal, and representations of mountains and trees. The edges were made of thick or double threads. Judging by the technological features, the fabric under study was made on a very simple (primitive) loom using the same techniques that were used for creating the Shanpula tapestries (Schorta, 2001: 85).

A complete coincidence of technological features of fabrics and main types of dyestuffs found in textile threads from these sites cannot be a sufficient basis for drawing a conclusion about manufacturing fabrics from the Jety-Asar-2 site in the Hotan oasis. Notably, organic dyestuffs of plant origin (madder and Indigofera, or other indigoid plants), which were used by the craftsmen who created the fabric in question, have been used since ancient times on a vast territory from China to India, and the devices on which such fabric could have been made were very primitive. An important proof that this fabric could have been produced in Xinjiang is the ornamental pattern woven into it.

Ornamental composition of the fabric from Jety-Asar-2

The image of an animal, which the authors of the excavations at the Jety-Asar-2 fortified settlement

Fig. 5. Fragment of ornamentation representing an animal on the fabric. Jety-Asar-2.

Fig. 6. Fragment of ornamentation representing an animal on the fabric. Jety-Asar-2.

called a horse, is repeated on the woolen band of the tapestry fabric. Although the image is stylized, which is inevitable with such a weaving technique, it is clearly visible that this is a wild animal, since there are no traces of a harness on it (Fig. 5). The animal is depicted with a short body bent downward, with its head similar to that of a horse, pointed ears, and an unusual lifted up thin tail, at the end of which there is a brush in the form of a ball with a cross inside (Fig. 6)*. The stylized and decorative nature of the image makes it possible to suggest that this could have been the tail of a wild ass, kiang, or Przewalski's horse, whose tails have a pronounced brush, since they are covered with hair only in the lower part. All these animals have much in common in appearance; for example, they lack bangs and have a very short mane. We should also pay attention to the colors used for showing the repetitive image of the animal. The muzzle and undertail are white, while the neck and trunk are made up of alternating pale stripes of pink and yellow (see Fig. 5, 6). It is known, for example, that the kiang's upper part of the body is usually light brown with a reddish tint, and the lower part is white. In kulans, the upper part of the body is reddish-brown, and the legs and abdomen are white. Describing wild horses he saw in Dzungaria, N.M. Przewalski observed that their bodies were roan (gray with an admixture of a different color); the lower parts of the body were almost white; in one herd he saw two piebald (with large spots) horses (2008: 240, 241). This means that by the color of their wool, the woven mysterious animals are similar to the wild animals described above. Their habitation area was great in ancient times. For example, Przewalski's horses could be seen in the territory from the Volga in the west to the Daurian steppes in the east. They preferred dry steppes and high foothill valleys up to 2000 m above sea level. Kulan inhabited deserts, semi-deserts, foothills, and plains from Turkmenistan and Kazakhstan to Iran, Mongolia, and China. The habitation area of the kiang includes the territories of Tibet, Chinese Qinghai and Sichuan, India, and Nepal. These animals occur there at a height of 5000 m above sea level. They also live in Xinjiang, where local residents could observe them.

Animals both real (horses, camels, ibex, and rams) and fantastic (winged deer and goats, animals with human faces) were woven on the Shanpula textiles. Even though the image of the animal created on the tapestry that was found in the Eastern Aral Sea region does not find direct parallels in the rich and varied Shanpula bestiary, it fits it well both in the manner and style of its representation. The animal is shown among the mountains overgrown with trees (Fig. 7). Mountains and vegetation are depicted in the same way as on Shanpula textiles and using the

*The petroglyphs of the Bronze Age in Central Asia show bulls having tails with a brush. This method of representation is an important dating feature, since fantastic animals with thin tails decorated with a mask-like sphere appeared for the first time on the Okunev stelae (see, e.g., (Savinov, 2006: 174, fig. 3)). In the image described here, the spherical shape at the end of the tail is a decorative element.

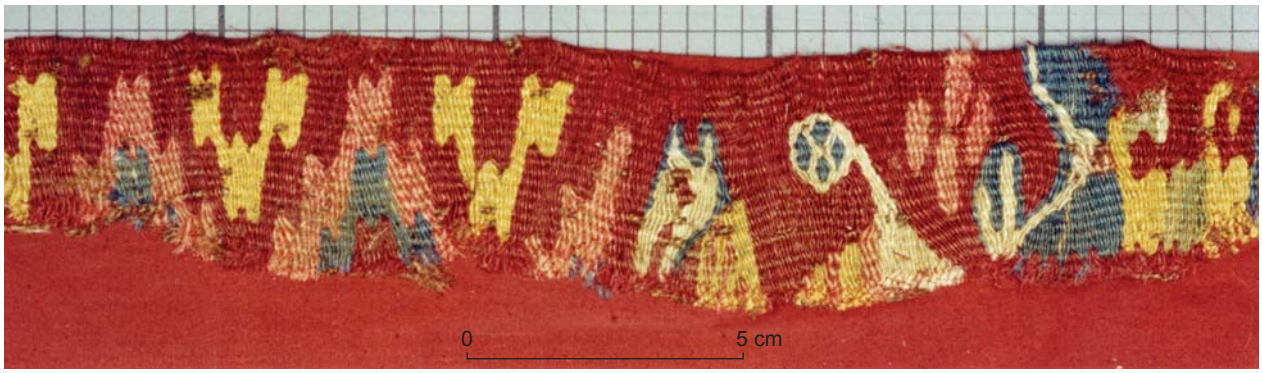

Fig. 7. Fragment of fabric representing an animal among the mountains overgrown with trees. Jety-Asar-2.

same manner (Bunker, 2001: 26–27): mountains are shown in the form of stepped pyramids, and trees and plants in the form of ornamental pattern (Fig. 8, 9).

Comprehensive analysis of the find from the site of the Jety-Asar culture makes it possible to conclude that the tapestry fabric was made by the Xinjiang weavers. The conducted research has revealed many similarities between the textiles from the Eastern Aral Sea region and fabrics found at the Shanpula cemetery. In the local culture in Xinjiang, bands of tapestry fabrics were a part of women's composite skirts and their decoration. As E. Bunker noted, "Tapestries with similar images have not yet been found either in Xinjiang, or further west of it in Central Asia, or anywhere else" (Ibid.: 16). In light of this statement, the tapestry found far to the west of the Hotan oasis constitutes an important piece of evidence that in fact tapestries with original images were much more widespread than it had been previously thought. The discovery of such fabrics in Central Asia is only the matter of time*.

Fig. 8. Fragment of fabric representing mountains. Jety-Asar-2.

Fig. 9. Drawing of fabric representing mountains. Shanpula, Xinjiang.

Studying the modest evidence of the burial inventory from the Shanpula site, Bunker suggested that weaving and trade constituted the basis for the economy of the population inhabiting the oasis (Ibid.: 42). They could have made colorful fabrics not only for their own needs, but also for sale (exchange). The find at the site of the Jety-Asar culture supports this assumption.

*It is quite possible that in the future we will find skirts with patterned stripes of fabric borrowed from the Shanpula in the burials of the Pazyryk culture. So far, one intact women's skirt and three fragmented skirts have been found in the Pazyryk cemeteries. A band of imported tapestry fabric similar in the structure to kilim weave to the tapestry fabrics from Shanpula was used for sewing one of the skirts of a woman buried in the Second Pazyryk mound (Tsareva, 2006: 244–247).

Language of the images on the fabric (In lieu of conclusions)

The results of the interdisciplinary analysis of fabric from the Eastern Aral Sea region make it possible to include this find into the circle of rare sources on ancient textiles of Central Asia. In the course of this study, it has been established that the woolen fabric from the Jety-

Asar-2 fortified settlement was similar to the fabrics discovered in the burials at the Shanpula cemetery. The similarity manifested in the use of one type of raw material (unsorted sheep's wool), the set of dyestuffs of plant origin, the method of weaving, the arrangement of the ornamental pattern, and the style of the images all suggest that the bands of ornamented fabric from the two sites were made according to the same weaving tradition.

The Shanpula tapestry fabrics, which were decorations and parts of women's skirts, have always raised many questions regarding the origin of this textile tradition and especially of woven ornamental patterns among the scholars. These fabrics were found only in the Shanpula cemetery. However, the images of animals, people, and fantastic creatures represented on them appear among the evidence found in Kazakhstan, Altai, in the steppes of the Southern Urals, and even in Iran (Bunker, 2001: 39–42). Notably, the similarity is manifested by a single system of imagery—those signs of a culture that replaced writing in the Scythian-Sarmatian period and were a language understandable throughout the Eurasian steppes and vast expanses of Central Asia.

L.M. Levina, the head of the excavations at the Jety-Asar-2 site, believed that "similar multilayer saddlecloths made of white felt trimmed with woolen threads and a woolen patterned band have often occurred in burial mounds of the Altai Mountains", such as the Fifth Pazyryk mound (1996: 217). The trimmed felt rug is not a complete parallel to the Pazyryk saddlecloths from the "royal" Fifth Pazyryk mound: the latter were much larger in size and only two of the five were covered with cloth (one with woolen fabric; the other with silk). This is precisely the cover, and not the trimming along the edge, as it is the case with the Jety-Asar find. The fabrics are of the highest quality: the wool fabric was identified as weft rib and the silk fabric as taffeta. It has been established that the woolen fabric was made in the Achaemenid workshops: one part of the sewn cloth, which became the saddle cloth, was produced in the Eastern Mediterranean, the other part in Egypt (Gavrilenko, Grigorieva, 2005), while the silk fabric was produced by South Chinese artisans (Polosmak, Barkova, 2005: 131–137; Lubo-Lesnichenko, 1994: 22). Nevertheless, there is certainly something in common between the Pazyryk finds and the Jety-Asar item: we should only compare not the saddlecloths from the "royal" mound, but the saddle cover from the ordinary Pazyryk burial of a woman with accompanying horses, found in mound 1 at the Ak-Alakha-5 cemetery on the Ukok plateau (Polosmak, 2001: 87–93). A felt saddle cover with the same applied images of fantastic predators and pendants of ram's head were found on one of the buried horses. Along the edge, the item was trimmed with a woolen ribbon with woven stylized bird heads. The fabric has survived in small fragments; its colors have faded and its ornamental decoration is almost invisible to the naked eye (Fig. 10, 11). However, upon careful study it was possible to establish that this band of fabric of tapestry weave was made of threads of green, yellow, and red colors on a primitive loom. In its manufacturing technique, this band is fully consistent with the items discussed above. In addition, many of the characters depicted on the Shanpula tapestries show similarities

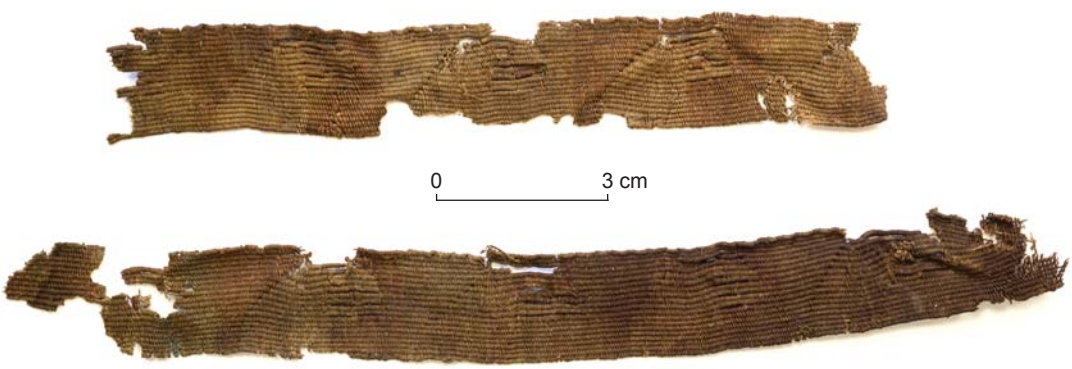

Fig. 10. Fragments of woolen band trimming the saddle cover. Mound 1 at the Ak-Alakha-5 cemetery.

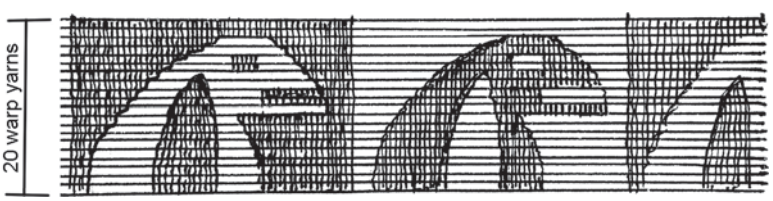

Fig. 11. Drawing of woven ornamentation on the band. Mound 1 at the Ak-Alakha-5 cemetery.

Fig. 12. Head of a fantastic animal, woven on a woolen cloth from Shanpula (*a*) and wooden pendant representing the head of an anthropomorphic being—decoration of horse harness from the Kuturguntas mound (*b*).

to the images on the items from the burial mounds of the Pazyryk culture. For instance, the so-called animal muzzles woven on one of the fragments of the Shanpula fabric very much resemble fantastic anthropomorphic heads with horns, which are wooden pendants on a horse harness found in the Kuturguntas mound on the Ukok plateau (Polosmak, 1994: 66–90) (Fig. 12). Bunker also pointed to the similarity between the images of the so-called monsters on the Shanpula textiles and images on a felt carpet from the Fifth Pazyryk mound (2001: 28–29), although she did not find any connections between the carriers of the Pazyryk culture and the inhabitants of the southern oases of Xinjiang (Ibid.: 39).

A band of woolen textiles, similar in all its features to the fabric from Shanpula, was found far from the Hotan oasis. This suggests a wider distribution of fabrics of this type, which simply might not have been preserved in other locations. It is possible that this fabric reached the Eastern Aral Sea region together with other goods; for example, with numerous silk fabrics and other items found in the Jety-Asar burials (Levina, 1996: 218), which were delivered to the region along the northern section of the Silk Road from China.

Such fabrics in the form of rather narrow (5–25 cm) bands could have been used in various ways. The journey of the band of fabric that we studied could have been long, and its use could have been varied. It is quite possible that initially this fabric was a part of a skirt, then a decoration of a saddle-cloth, which after a while became a simple rug on the step of some stairs. In ancient times and in traditional cultures, textiles were treated with great care; they were never thrown away. It is known that in ancient times and in the Middle Ages, the use of beautiful or unusual imported fabrics (their fragments and scraps) passed from one thing to another. They were stripped from worn-out garments, sewn onto other items, and were used until the fabric became completely unusable.

Without denying the uniqueness of the Shanpula tapestries, we are inclined to assume the tradition of making narrow woolen fabrics with images of animals, birds, people, mountains, and plants on primitive looms in the tapestry technique became spread far beyond the Hotan oasis.

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Received April 30, 2020.

DOI: 10.17746/1563-0110.2020.48.3.059-069

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Petroglyphs of Mount Dyalbak, Eastern Altai

This study focuses on a petroglyph site of Mount Dyalbak in the northeastern part of Balyktuyul village, in the Ulagansky District, Altai Republic. Images are engraved mostly on horizontal planes of the Devonian limestone of which the mountain slope is composed. We give a detailed description of the documentation methods. Photography was carried out under the oblique natural light, though certain areas of the planes were photographed using flash. Engravings were copied mostly on a tablet computer. On the basis of visual observations, the condition of planes with petroglyphs is described, conclusions regarding the principal threats are given, and measures aimed at the preservation of the site are proposed. Rocks and planes with engravings are described in detail. Most images date to the Early Middle Ages. Their motifs and characters have numerous parallels in Central Asian art. There are scenes of hunting, armed fighting, and separate pictures of bows and quivers, relating to the cult of weapons and militarism. Two depicted warriors are holding spears with banners. Images of animals include those of mountain goats, reindeer, and boars. Some motifs are unusual: yurts and a pair of Siberian stags, male and female, related to the fertility cult. Some images, such as that of a chariot, date to the Late Bronze Age, while others, like those engraved on a separate small stone, are recent.

Keywords: *Petroglyphs, Altai, Turkic period, Early Middle Ages, Dyalbak, hunting scene, chariot.*

Introduction

Petroglyph sites are considered the most abundant archaeological records in Altai; however, owing to certain natural and anthropogenic factors, petroglyphs are among the most sensitive objects. Documentation of petroglyphs is impeded by their broad distribution over the region, and by the difficulties involved in recording many images, especially those executed by thin incised or engraved lines. Thanks to achievements in the research process, certain methods of more complete documentation of rock images have been developed nowadays.

Engraved images represent important visual sources of information, because they show the finest details. Among rock images in Altai, the engravings attributed to the Early Middle Ages are firmly identified (Cheremisin, 2004: 39). The petroglyph site at Mount Dyalbak in the Ulagansky District, Altai Republic, studied in 2017–2018, also pertains to the early medieval period.

Archaeological sites in the Bolshoi Ulagan River valley (Eastern Altai) have been attracting the attention of researchers at least since the last third of the 19th century. The first excavations in this region were carried out by N.S. Gulyaev in 1890; he apparently excavated one of the medieval burials here (Otchet…, 1901: 84). However, archaeological sites in this valley became widely known because of the works

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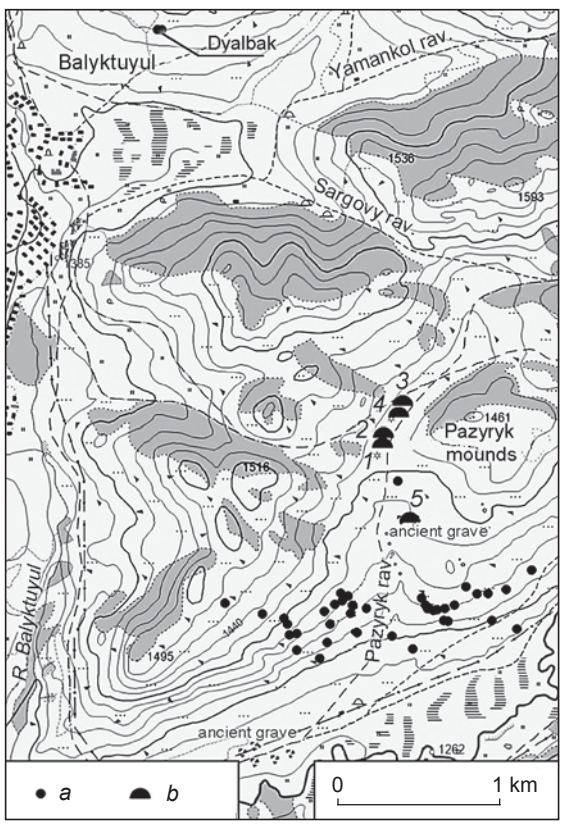
at the Pazyryk cemetery carried out by S.I. Rudenko (1953) and M.P. Gryaznov (1950) in 1929 and 1947–1949. Later, along with the numerous burial and ritual complexes, scholars reported rock art sites here (Sorokin, Chumakaev, 1971; Marsadolov, 1981: 196; Surazakov, 1983: 165; Kubarev V.D., Matochkin, 1992: 17, 21). In 2017–2018, the present authors made a survey of separate areas in the valley aimed at searching for and documenting petroglyphs; especially detailed study of rock engravings was performed at the Dyalbak site. This paper focuses on the results of the studies at this site.

A



B

The site is located on the slope of Mount Dyalbak (Alt. *jalbak* 'wide, flat; plateau' (Molchanova, 1979: 175)), in the northeastern outskirts of the village of Balyktuyul in the Ulagansky District (Fig. 1, 2). The images are engraved on the horizontal planes of the Devonian limestone, slightly projecting over the modern surface (Fig. 3, *A*). The planes with images are overgrown with lichens and show fissures. The petroglyphs were found in 1979 by V. Butvilovsky, a member of the Kurai Geological Team. Two years later, archaeologist A.S. Vasyutin studied this site. Information on the site is provided in his field report currently kept in the archive of the Institute of Archaeology RAS (R-1, No. 8571). In the scientific literature, there are only several short notes concerning this site (Vasyutin, 1983; Kubarev V.D., Matochkin, 1992: 58).

We have partially cleaned the planes of lichens, and documented the petroglyphs. The recorded subjects and images were added to the repertoire of the visual sources dating to the early medieval period. Furthermore, visual observations allowed us to assess the state of the planes with rock images and to propose measures aimed at the preservation of the site.

Materials and methods

Methods of documenting

The site was examined in 2017: engravings on the planes were photo-recorded, GPS-coordinates of two planes with images were identified, and a plan of the site was made. In October 2018, the site was re-examined, certain previously unknown planes with images were found, and images were recorded. Because of the lichens, some compositions could not be distinguished; therefore, some areas of the plane surfaces were cleaned with the aid of pointed wooden sticks.

Photography was carried out under oblique lighting, according to the method successfully used at many petroglyph sites (Miklashevich, Bove, 2014: 75). The works were carried out under natural light in the mornings and evenings, i.e. with different directions of light. Some details of the engravings were photographed using external flash. Photography was carried out with the reflex camera Nikon D3200 with high-aperture lens Nikon AF-S DX NIKKOR 35mm f/1.8G, with fixed

Fig. 1. Location of Dyalbak petroglyphs (*A*) and petroglyphs near Balyktuyul in 2017–2018 (*B*).
a – petroglyphs; *b* – Pazyryk mounds.

Fig. 2. Dyalbak Mount (arrows point to petroglyph location on the slope). View from the south.

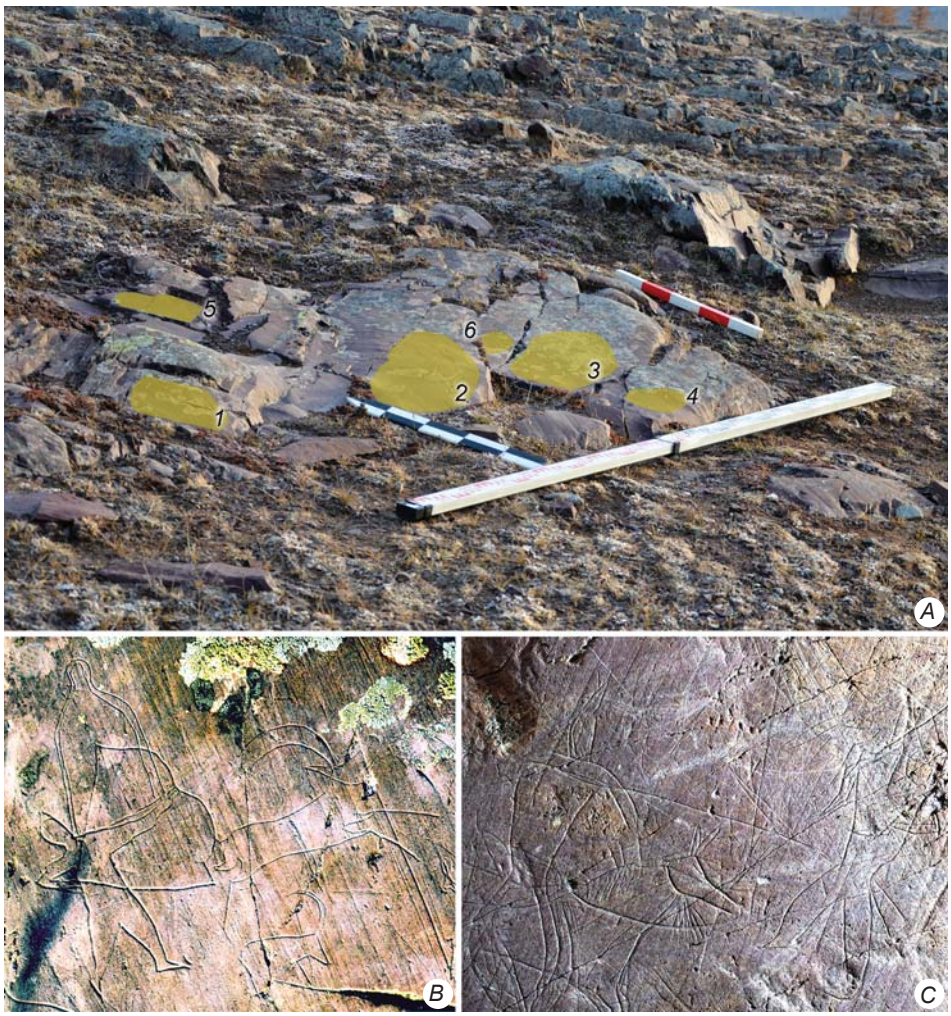


Fig. 3. General view on stone 1 (*A*) and details of compositions (*B*, *C*).
A – rock exposure (planes with engravings are designated with filling and numerals); *B* – hunting scene on plane 1; *C* – detail of fighting scene between a horseman and a unmounted warrior on plane 3.

focal length, and an ordinary zoom lens Nikon AF-S DX Nikkor 18-105mm f/3.5-5.6G. Photography was executed in the orthogonal plane for subsequent tracing in graphical computer programs.

After splicing the individual images in the graphical computer programs, trace-drawing was performed on an Apple iPad 2018 tablet computer. This tablet has a pressure-sensitive screen, so that the thickness of the line when drawing is set by the pressure of a stylus. In this case, there is no need to interrupt drawing to switch the thickness of the line when the thickness of the engraved line changes, which speeds up the copying process. The rendering on the tablet was performed in the Procreate program, and additional computer processing was also done.

State of the planes

The petroglyphs of Mount Dyalbak are located on the planes of four rock outcrops and a separate comparatively small rounded stone of Devonian fine-grained polymict, partially schistose, red sandstone (Fig. 3). The planes with engravings are located almost at the level of the daylight surface and parallel to the mountain's slope. The rocks with petroglyphs are vegetated by various lithophytes, growing in fissures; some areas of the stone surface are covered with soil and crustaceous lichens; some areas show split-off edges, caverns, and modern images in the form of vague lines and sketches. The planes are covered with numerous gravitational fractures, with their widths from less than 1 millimeter to several centimeters. Large, curved, ragged fissures filled with soil run across the planes. There are areas with exfoliated cortex and scaly peelings, which processes cause rapid degradation of the rock. The homogenous reddish-brown patina on the rock's surface is ca 1 mm thick. The patina's color is lighter on the areas covered with lichens; this was noted when the vegetation was removed.

The rock art site is situated *in situ*, in the historical and natural context affected by hydrological, geochemical, and biological processes producing their destructive impacts on the rock art. Atmospheric precipitates penetrate the porous rock structure. Under the sharp temperature drops, especially in spring and fall, the water in stone gets frozen and expands, causing deformations and destruction of the rocks. Dust and biological contaminants are imported into the fissures with precipitates, and this also leads to the rock destruction. The rock art site is located on the south-facing slope, and is subjected to intense insolation leading to temperature difference in the rock structure. Large lichen colonies produce organic acids and other rock damaging agents (Devlet E.G., 2002: 115–116). The last two factors also produce damaging effects on the rock's surface.

The observed problems and the ongoing destructive trend, caused primarily by the frost and the biogenic weathering of the rock surfaces with petroglyphs, raise the question of the use of preventive measures for the conservation and preservation of the site. For example, it is necessary to ensure drainage of rainwater from the slope above the site to avoid accumulation of soil particles in the rock structure. For that, it is necessary to analyze the physical and chemical features of the rock through petrographic methods, carry out X-ray analysis, non-destructive ultrasound scanning of the rock surface, and Karsten's analysis. The moisture accumulated on the rock outcrops triggers the growth of biological agents and physical cracking of rock surfaces, which are the main damaging factors. In order to prevent further destruction, direct conservation should be carried out, the fissures and caverns should be filled with siliceous-organic matter, and the exfoliating cortex should be flanged to avoid dust and biological contamination of the rock's structure.

Importantly, the rock art site is located in the immediate vicinity of the village and is subjected to permanent anthropogenic impact. Goats and sheep moving along the slope raise dust that accumulates on the planes, trigger stone-falls, and produce scratches and waste products in the form of excrement and urine. The chemical composition of the urine might affect the mineral composition of the rock surface and cause salt formation (Ibid.: 113–115).

Description of the planes

Stone 1. It is located in the western part of the site. The rock exposure is 2.4 × 1.7 m in size. The images are engraved on the flat areas between the fissured and uneven parts of the stone surface.

Plane 1. It is located in the western part of the rock outcrop (Fig. 3, *A*). The plane is slightly inclined down to the slope and faces south. The upper part of the plane shows an unmounted archer hunting a mountain goat (Fig. 3, *B*; Fig. 4, *1*). Over the archer's stretched out arm, a yurt (?) is depicted. The engravings include images of a wild boar and other ungulates. A vague zoomorphic image engraved with thin lines can be noted in the lower part of the plane.

Plane 2. It is located in the southeastern part of the rock outcrop (see Fig. 3, *A*). In the central part, there is a two-level combat composition (Fig. 5; 6, *1*). The upper level shows a combat between a mounted lance-bearer and a unmounted warrior. The lance-bearer wears a helmet with a high plume and an aventail (?) (see Fig. 3, *C*). The lance has a pointed tip and a long triangular banner. The engraved image shows some details of the horse's bridle, and the horse's mane

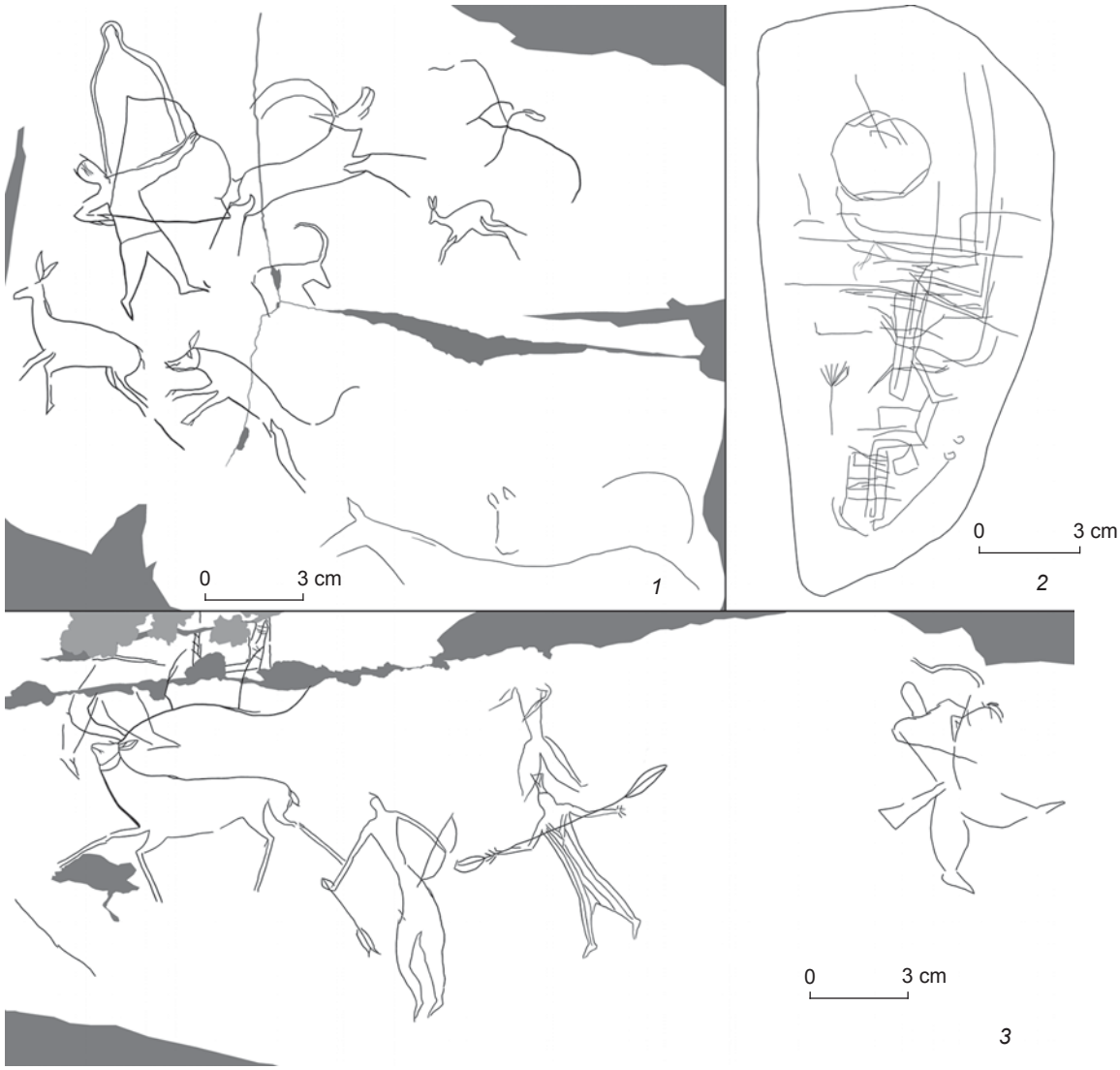


Fig. 4. Petroglyphs on stones 1, plane 1 (*1*), 5 (*2*), and 2 (*3*).

with three prominent spikes. Below, three unmounted warriors are shown, with two of them equipped with lances. The lance of the central warrior is depicted with a banner of triangular cut. This character is overlapped by the unfinished image of an animal. The upper and lower parts of the plane show images of various animals, among which mountain-goat images are the most vivid. In the lower portion, images of an archer and a yurt (?) are engraved (Fig. 7, *2*).

Plane 3. The plane is in the southern part of the rock exposure (see Fig. 3, *A*). A fighting (?) scene with unmounted warriors is rendered in the center of the plane (Fig. 8). Three archers, a lance-bearer (?), and one more character with a long object (bladed weapon?) are also visible. The plane has several animal images. Two isolated bow images are shown on the right and left (below) edges of the plane.

Plane 4. It is located in the southern portion of the rock outcrop. The plane bears engravings; it is separated from plane 3 by a deep fissure (see Fig. 3, *A*). In the portion free of lichens, images of ungulates are visible (see Fig. 7, *1*). The greater part of the images is hidden under the lichens.

Plane 5. The plane is in the northern part of the rock exposure (see Fig. 3, *A*). The plane is dissected by fissures, two of which are deep; three parts of the plane are of varying heights. The plane shows two animal images, possibly a reindeer and a wild boar (Fig. 9). The reindeer image overlaps one more unfinished image of an animal.

Plane 6. It is separated from planes 2 and 3 by deep fissures (see Fig. 3, *A*). Two images of ungulates are shown on the plane (see Fig. 7, *3)*. The head of the larger animal is hidden under the lichens.

Stone 2. A narrow horizontal plane on the rock outcrop located northeast of stone 1. The size of the plane with

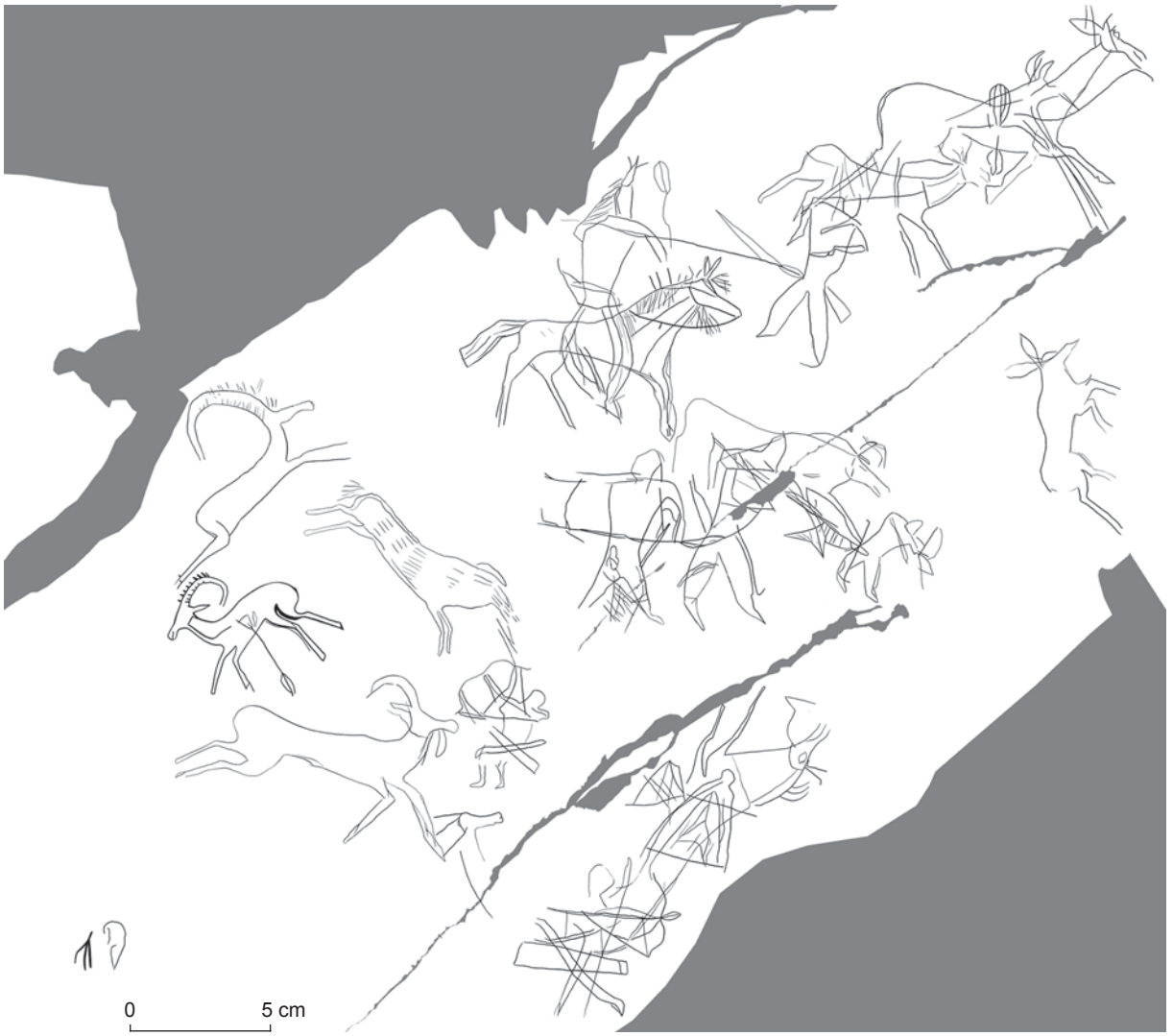


Fig. 5. Petroglyphs on stone 1, plane 2.

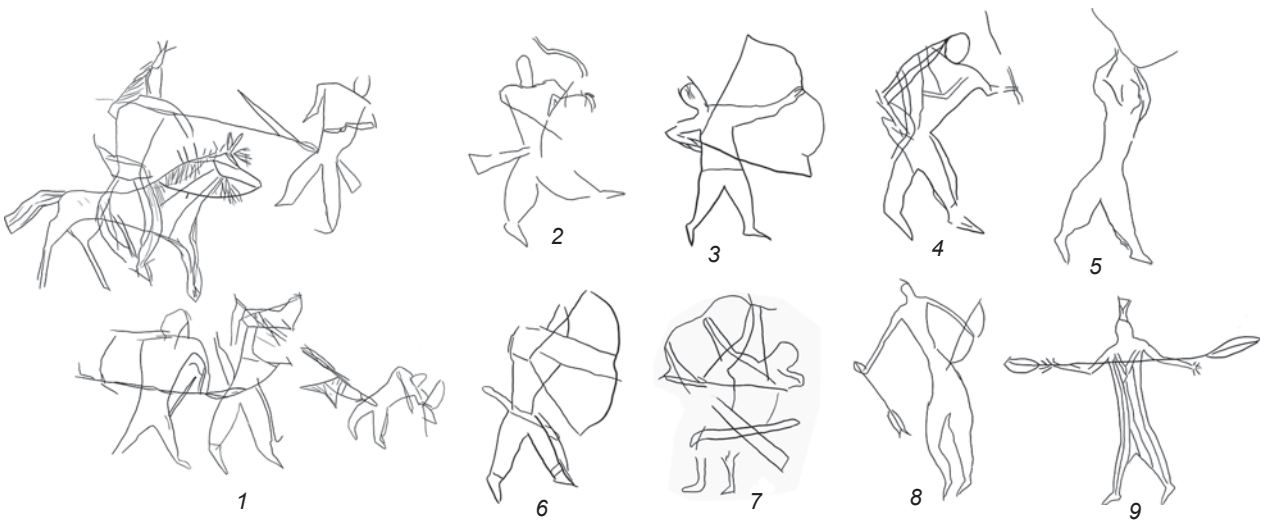


Fig. 6. Anthropomorphic images and a fighting scene on stones 1 (*1–8*) and 2 (*9*).

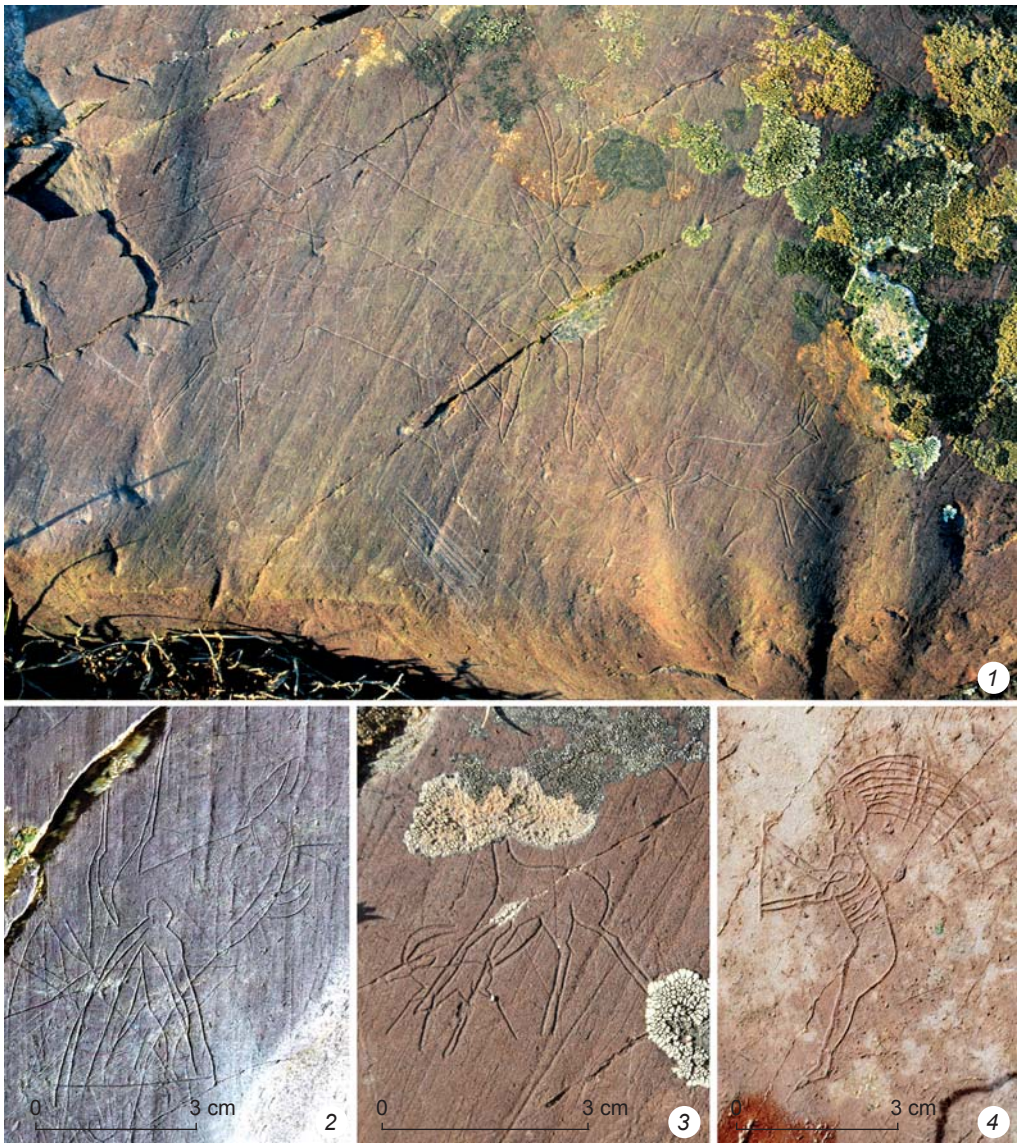


Fig. 7. Petroglyphs on stones 1, plane 4 (*1*), 2 (*2*), 6 (*3*), and 3 (*4*).

petroglyphs is ca 0.5 × 0.2 m. The plane bears several anthropomorphic images and a reindeer image (see Fig. 4, *3*). Noteworthy is a human figure with vertical strips engraved on the body (see Fig. 6, *9*). The strips likely represent clothing; they are limited by the "V-cut of the neck". Some engraved images on the upper edge of the plane are covered by lichens.

Stone 3. A small horizontal plane of subtriangular form is located in the eastern part of the site, to the northwest of stone 4. The plane's size is 0.3 × 0.4 m. It shows an engraved side-view anthropomorphic (?) image (see Fig. 7, *4*). The character is shown with long hair, which is crossed by three lines. One short line represents some object in the hands of the character.

Stone 4. It is located in the eastern portion of the site. There are quite few isolated horizontal rock planes here. The size of this plane is 4.3 × 1.6 m, its long axis runs along the W-E line.

Plane 1. The northern edge of the central part of the plane shows a pair of Siberian stags, male and female, facing each other (Fig. 10, *1*).

Plane 2. The western part of the plane shows an engraved image of a two-wheeled chariot. The axle and pull-tongue are depicted by several incised lines. At the end of the pull-tongue, a device for fastening draught animals is shown by a curved line (Fig. 10, *2*).

Plane 3. In the eastern part of this stone, there is the image of an archer. At some distance from the archer, images of some object (a quiver?), covered with incised lines, and arrows are represented (Fig. 10, *3*).

Stone 5. A separate, comparatively small rounded stone is located 0.5 m to the southeast of stone 4.

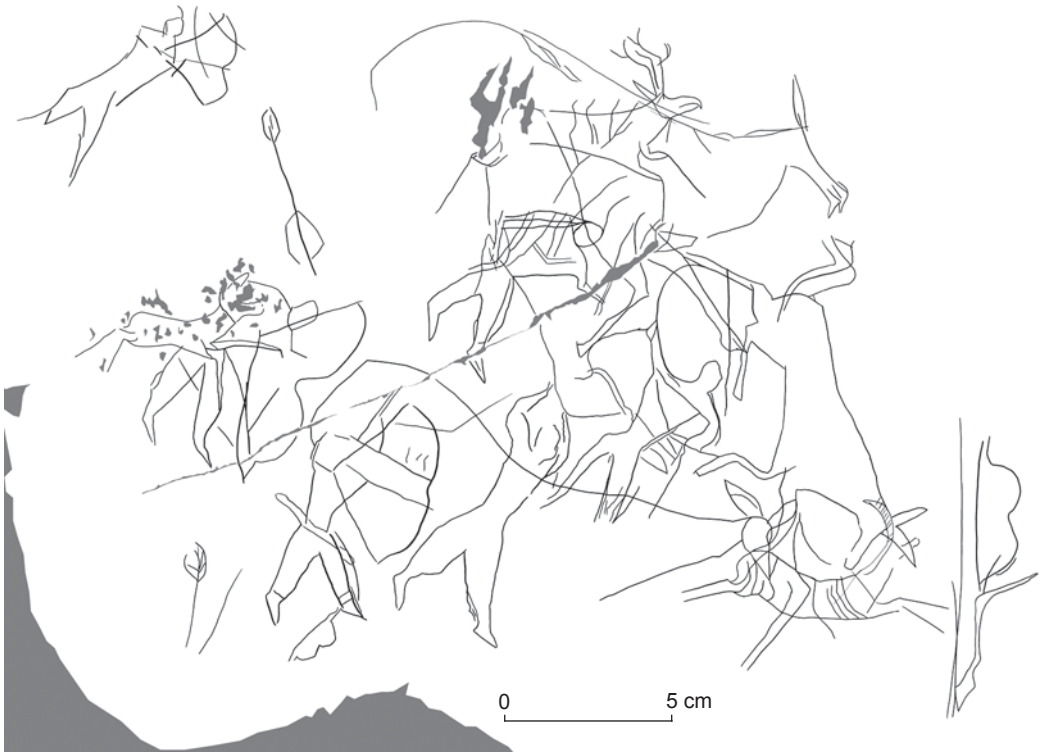


Fig. 8. Petroglyphs on stone 1, plane 3.

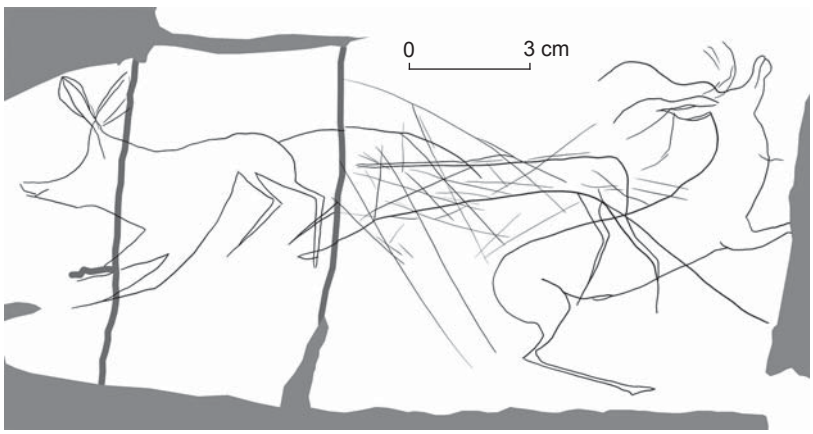


Fig. 9. Petroglyphs on stone 1, plane 5.

Lines are engraved on the flat surface of this pebble (see Fig. 4, *2*). Regrettably, the image of the whole figure can hardly be detected.

Dating and parallels to the Dyalbak petroglyphs

All the images were executed with the engraving technique (Miklashevich, 2012: 158). The majority of the images belong to the early medieval period; several petroglyphs have been attributed to other periods. However, the images of different periods do not differ in color of incised lines or extent of patination. This is explained by the fact that the lines incised on the Devonian sandstone surface without refreshing soon become vague as a result of weathering and patina-formation (Mukhareva, 2017: 127). In addition, the patina color of some engravings vanished under the lichens. The chronological attribution of the images was based on their style, typical motifs, and images.

The chariot image on stone 4 (see Fig. 10, *2*) should be considered the earliest one. Similar images were widely distributed in Eurasia (Novozhenov, 2012). The

representations found in Central Asia are attributed mainly to the Late Bronze Age (Kubarev V.D., 2004: 16); though some of them are associated with the beginning of the Early Scythian time (Chugunov, 2008: 65). Rock images were mainly made using pecking technique; engraving was often used in depiction of chariots and their elements (Cheremisin, 2006: 94, fig. 1–8).

The youngest images among the Dyalbak petroglyphs are the engravings on the small rounded stone 5 (see Fig. 4, *2*), located close to stone 4. These images have been preliminarily dated to the recent historical past (Grichan, 1987; Devlet M.A., 1988).

The majority of the images have been attributed to the Early Middle Ages. In general, this is a petroglyph site of the Turkic period. Nearly 20 rock images are anthropomorphic. Some of them are involved in fighting and hunting scenes. For example, the engraved anthropomorphic images are clearly visible in the two hunting scenes with pedestrian archers and mountain goats on stone 1 (planes 1 and 2) (see Fig. 4, *1*; 5). Two battle compositions were noted on stone 1 (planes 2 and 3). The heroes of these scenes are a horseman and unmounted warriors. The image of the horseman and his horse shows many details. The two warriors in the scene on stone 2 bear lances with banners of various shapes (see Fig. 6, *1*). The mounted knight with a lance bears a long triangular banner; the pedestrian one has a standard of a complicated form with a V-notch. The banner-bearer images are also typical of Central Asian rock art. A wide variety of banner shapes known from petroglyphs (Sovetova, Mukhareva, 2005: 95) makes it difficult to determine which particular shapes were used by population groups of Central Asia and southern Siberia in the Turkic period.

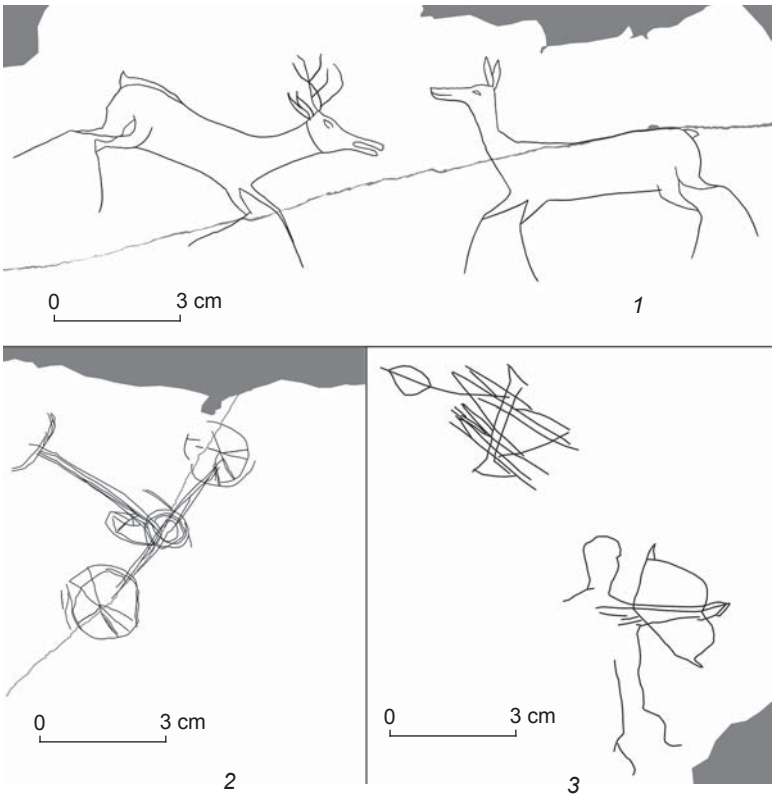


Fig. 10. Petroglyphs on stone 4, planes 1 (*1*), 2 (*2*), and 3 (*3*).

The battle scene on plane 3 shows archers, a lance-bearer, and a warrior equipped with an allegedly bladed weapon (see Fig. 6, *4*). All the archers engraved at Dyalbak are equipped with M-shaped bows (see Fig. 6). In most cases, the bow-ends and a drawn bow-string are vividly depicted. Some images show bow-cases and quivers attached to the belts of the anthropomorphic characters (see Fig. 6, *2*, *6*, *7*).

Noteworthy also are two isolated bow images on plane 3 (see Fig. 8) and a quiver on stone 4 (see Fig. 10, *3*); these can be considered a demonstration of the weapon cult (Kubarev V.D., 2003: 26). Separate images of quivers and bow-cases are known from the early medieval petroglyphs, but there they are usually associated with the humans involved in the compositions (Kubarev G.V., 1998: 191, fig. 3).

Among the anthropomorphic images, two figures are of special interest. One of these is located in the center of the plane on stone 2 (see Fig. 6, *9*). The body of this character is covered with longitudinal lines, and a V-neck is shown on the breast; the character bears a long headgear with a straight top and a triangular "cut" inside; the arms are stretched out with the fingers apart. The hands hold an elongated item reminiscent of an arrow with head and fletching. The other anthropomorphic figure is shown in side view on stone 3 (see Fig. 7, *4*). Its body is covered with hatching; the long hair is "bound" with three cross-lines. In the upper part of the body, there are several cross-lines. The character holds a small elongated item in its hands. The attribution of the first figure to the Early Middle Ages is undoubted, but the chronological attribution of the second is not so obvious. On the basis of the some special features, this second image can be dated to the Turkic period.

Noteworthy are two images on stone 1: possibly these are yurts. The first image is located on plane 1 (see Fig. 3, *B*). The image is depicted above the hunter's shoulder and arm (on the background?). The walls and roof of the yurt are shown with a double line, the bottom with a single line. In the upper part, there is a protrusion representing a chimney. Plane 2 also contains a yurt image (see Fig. 7, *2*).

The triangular image is shaded with several slanting lines. A rounded protrusion in the upper part possibly represents a chimney. The yurt images are comparatively rare; these are known from the visual sources of the Early Middle Ages (Hudiakov, Tabaldiev, Soltonbaev, 1997: Fig. 2, *2*; Kubarev G.V., 2003; Mukhareva, Sovetova, 2012: 73–74, fig. 7, 8).

Among the abundant images of ungulates, the images of mountain goats, and of reindeer with antlers, are noteworthy. Images of hornless hoofed animals (reindeer?) are more numerous. Two images on planes 1 and 5 apparently represent wild boars. A pair of Siberian stags, male and female, facing each other is of special interest. This scene is possibly related to the fertility cult.

Conclusions

The Dyalbak site in Eastern Altai contains wonderful rock art images of the Early Middle Ages. The majority of the engravings date to this time; however, there are also separate images related to other periods. The earliest image is that of a chariot dating to the Late Bronze Age. Apparently, the rock outcrops on the mountain slope attracted the attention of the ancient artists exactly at this period.

There are popular motifs of Turkic art here: scenes of fighting, hunting, and "meeting" between male and female Siberian stags. Certain images and motifs can be related to the cult of weapons (isolated bow images) and fertility (a paired image of Siberian stags). Some engravings, owing to their detailed representation, can be used for the reconstruction of outfit, weapon kit, riding horse equipment, etc.

The significant areas of the planes with petroglyphs were covered with lichens; we managed to clean some parts. However, several images remained hidden. Subsequent cleaning of the remaining areas with lichens will provide additional information on the motifs and images. In future, it is planned to monitor changes of the cleaned areas and state of the planes' preservation.

The study of the Dyalbak petroglyphs adds to our knowledge of the rock art repertory in the Altai. Visual observations of the state of planes' preservation made it possible to determine the main threats and to propose measures aimed at their prevention.

Acknowledgement

This study was supported by the RF President grant for the state support of young Russian scholars, MK-1413.2019.6.

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Received February 11, 2020.
Received in revised form March 19, 2020.

DOI: 10.17746/1563-0110.2020.48.3.070-079

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Rich Burials of Children at Zeleny Yar, Northwestern Siberia

This article introduces high-ranking burials of children excavated in 2015 and 2018 at a medieval cemetery Zeleny Yar on the lower Ob. A detailed description of the burial rite is provided, with special reference to the shape and construction of the burials and the position of the bodies. Burial goods include a hatchet, a scabbard, bracelets, and temple rings. The high social status of the children is discussed. The finds are compared with those relating to medieval children's burials in adjacent territories—the Surgut, Novosibirsk, and Tomsk regions of the Ob. Also, ethnographic evidence concerning the social status of 6–7-year-old boys among the indigenous northern minorities are discussed. Archaeological and ethnographic sources suggest that high-ranking burials of children (boys) appear in northwestern Siberia no later than the Middle Ages.

Keywords: *Burial rite, Zeleny Yar cemetery, mummified remains, indigenous peoples, North, Siberia, Middle Ages.*

Introduction

Among the archaeological sites discovered in northwestern Siberia, Yamal-Nenets Autonomous Okrug (YaNAO), the Zeleny Yar medieval cemetery has a special status. Owing to the excellent state of preservation of its mummified human remains, as well as burial goods and clothing, it can rightfully be considered unique to the region.

The complex of archaeological monuments at Zeleny Yar is located near the village of the same name in the Priuralsky District of YaNAO (Fig. 1), on a floodplain island formed on one side of the Poluy River, and on the other by the Gorny Poluy channel. The complex includes the remains of a metalworking foundry (a furnace for melting metal), two buildings (6th to 7th centuries), and two cemeteries of the 8th–9th and 12th–13th centuries (Zeleny Yar…, 2005: 7). Over the course of ten field seasons (1999–2002 excavations by N.V. Fedorova, 2013–2018 excavations by Al.V. Gusev), 88 burials in varying degrees of preservation were investigated. Most of them are burials of men (61) and children (26). There are only two female burials: in burial No. 15 were the remains of a girl, and in burial No. 78, woman. This article presents materials from two children's burials (No. 53 and 84) of the late Zeleny Yar cemetery, which stand out among the others for their rich accompanying inventory.

Materials and research methods

Burial No. 53

This burial, discovered in 2015, is oriented north-south, with a slight deviation to the west (head to the south). Taking into account its excellent preservation, the author of the excavations decided to extract the complex in the form of a monolith with continental soil for a preliminary study by computed tomography and a subsequent opening in laboratory conditions*.

*The burial structure was opened in the laboratory of the Shemanovsky Museum and Exhibition Complex (Salekhard).

Fig. 1. Location of the Zeleny Yar archaeological complex.

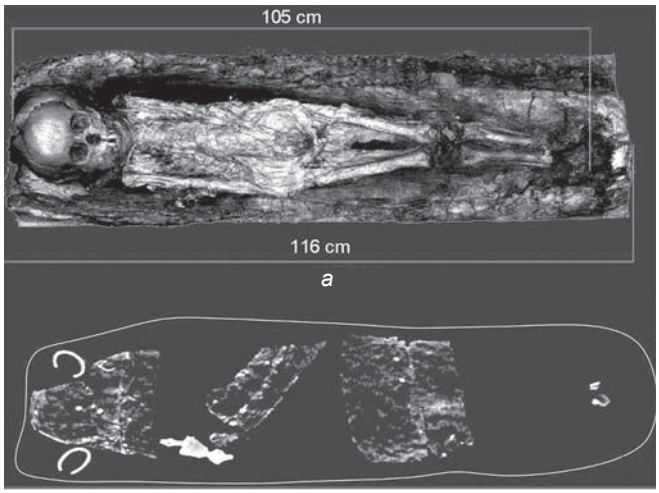

Fig. 2. Tomographic images of mummified human remains (*a*) and burial goods (*b*).

Tomographic examination* showed that the complex contains human remains, covered in the head, chest-abdomen, and thighs with metal plates (Fig. 2). Metal objects were found under the right shoulder, parietal bones, and feet.

According to the degree of epiphyseal fusion of the tubular bones, as well as the formation of the dentition, the age of the interred was determined: at the time of death he was approximately 7–8 years old. Geneticanalysis was used to determine his male sex**.

The tomographic study revealed the Harris lines on the long bones of the legs (transversely oriented bone plates in the area of the growth zone of the long bones), which are formed during periods of delay in the growth processes of the body. In paleopathology, this symptom is considered an indicator of episodic food stress (due to severe illness or prolonged fasting).

The boy was buried in a relatively shallow pit: its maximum depth in the central part was 54 cm from the ancient surface (Gusev, Svyatova, Slepchenko, 2016: 219). It contained a kind of oval-shaped cocoon 151 × 36 cm in size from a birch-bark canvas, under which there was a linen of bast, according to the assumption of the author and restorers of the Shemanovsky Museum and Exhibition Complex aspens, laid on an oblong wooden dish (?) (Fig. 3, 4). Birch-bark and bast linen, apparently, were elements of a single design: they had longitudinal folds shaped by human teeth*, which were stiffeners.

The child was buried in a supine position, with its legs straightened and brought together in the area of the knee and ankle joints (Fig. 5, 6). One part of its remains was skeletonized, the other was mummified. The facial region of the skull, the area of the upper limbs, chestm and abdomen, as well as thighs, were mummified. The left hand was turned inward, with the back of the hand facing the central part of the pelvis. The right arm was straightened and brought under the pelvic bones. The legs and feet were skeletonized.

The skull of the deceased rested on the occipital bone, while the chin region was pressed against the chest. The teeth of the upper and lower jaw were closed. On the parietal bones, there were fragments of hair: straight or slightly wavy, soft, dark brown.

Under the right shoulder, a bronze battle hatchet was found (Fig. 7, *1*). A large ax of a similar shape, forged from iron, was found in burial No. 27 of the late Zeleny Yar cemetery. Near the blade of the hatchet were a bronze zoomorphic pipe-shaped bead (Fig. 7, *2*) and a destroyed iron item, most likely a knife. Close analogs of the pendant from burial No. 53 are unknown. In the area of the head, silver temporal rings were recorded, covered with a fragment of tanned skin (it was not possible to determine which animal it belonged to). Such temporal

*Computed tomography was carried out in the Salekhard District Clinical Hospital.

**Description of anthropological material was carried out by E.O. Svyatova, a Leading Specialist of the Archaeology Department of the Scientific and Production Center for the Protection and Use of Historical and Cultural Monuments of the Sverdlovsk Region (Yekaterinburg).

*This was one of the traditional ways of processing birch-bark and leather among the population of the region. About the images created with the help of teeth by the population of a small camp on the Vyzhaya River, a tributary of the Lozva River, see the article by V.N. Chernetsov "Disappeared Art (Patterns, Squeezed by Teeth on Birch-bark by Mansi)" (1964).

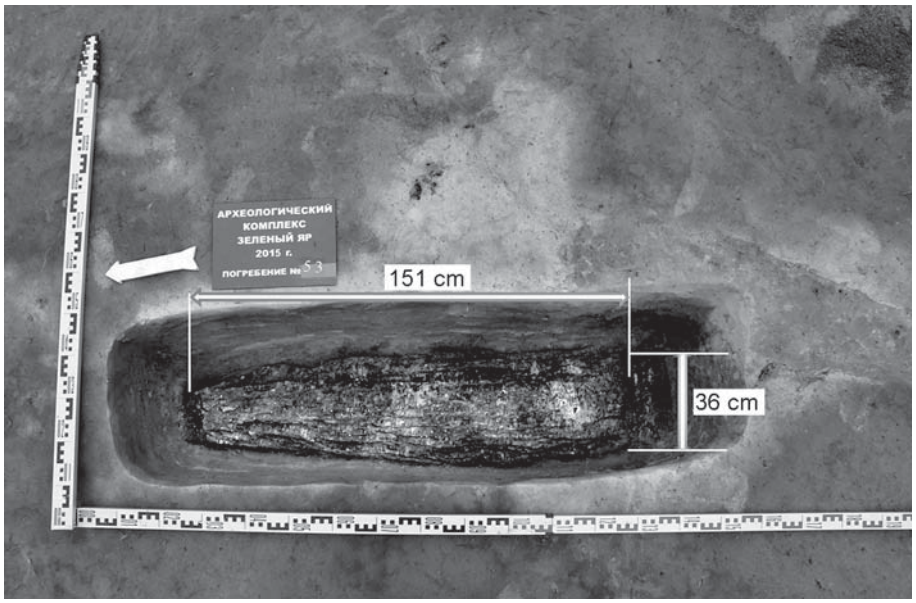

Fig. 3. Burial No. 53 (field fixation).

Fig. 4. Linen of bast (aspen?). Burial No. 53.

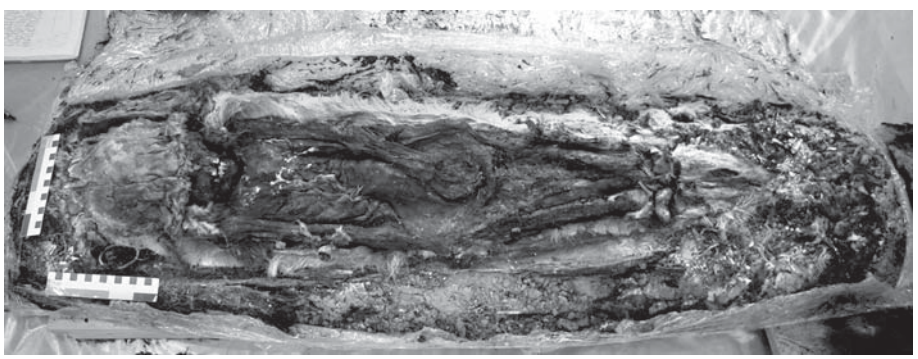

Fig. 5. Mummified remains of a child. Burial No. 53.

rings are characteristic of jewelry sets of the population of the northwestern Siberia at the beginning of the 2nd millennium AD. The rings were most likely made in the Perm Cis-Urals (Belavin, Krylasova, 2008: 446, fig. 181, *10*, *11*). Under the feet, there were small copper plates. During the examination of the remains of the deceased, no items of clothing were found. However, taking into account the coincidence of the outlines of the left foot and the bronze plate located under it (Fig. 8), it can be assumed that the child was wearing shoes or fur stockings.

The child's body was placed in a fur cocoon made (according to the author of the article) from the skin of a fox or an arctic fox (Fig. 9). On top of the fur cocoon, large copper plates of the cauldron were placed (Fig. 10). Two plates were located in the area from the parietal bones to the lower jaw (Fig. 11, *a*). A rounded plate, lying on top of

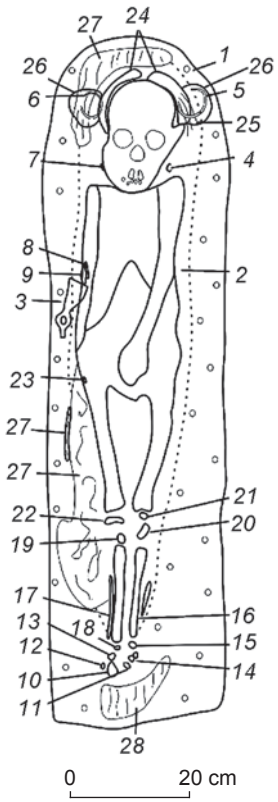

Fig. 6. Plan of burial No. 53.
1 – yellow continental sand; *2* – a fur item with a long hard pile; *3* – a bronze hatchet; *4* – a bronze ring from a plate; *5*, *6* – silver temporal rings; *7* – a bronze plate; *8* – a fragment of an iron object (knife?); *9* – a pendant in the form of a tube with a bear figurine; *10*, *11* – bronze plates; *12* – metapodium (?); *13* – bones of the right foot, with organic matter; *14* – bones of the left foot, with organic matter; *15* – left talus; *16* – bones of the left tibia (fibula and shinbone); *17* – bones of the right tibia (fibula and shinbone); *18* – distal epiphysis of the right shinbone; *19* – proximal epiphysis of the right shinbone; *20* – distal epiphysis of the left femur; *21* – patella; *22* – distal epiphysis of the right femur; *23* – nail plate; *24* – parietal bones; *25* – human hair; *26* – fragments of tanned leather; *27* – a fragment of a wooden structure, element 1; *28* – a fragment of a wooden structure, element 2.

Fig. 8. Skeletonized feet of the deceased with a bronze plate. Burial No. 53.

Fig. 7. Bronze hatchet (*1*) and zoomorphic pipe-shaped bead (*2*). Burial No. 53.

the bones of the brain region, partially overlapped a rectangular plate located in the area of the facial region. Its dimensions are 19 × 14 cm. The plate, which was located above the jaw, is rectangular in shape, measuring 25 × 15 cm. Leather belts were found on the plates: one lay parallel to the longitudinal axis, two others were located perpendicular to the one indicated and were connected with it by a knot in the central part of both plates. To the right of the

Fig. 9. Fur cocoon made from the skin of a fox or an arctic fox. Burial No. 53.

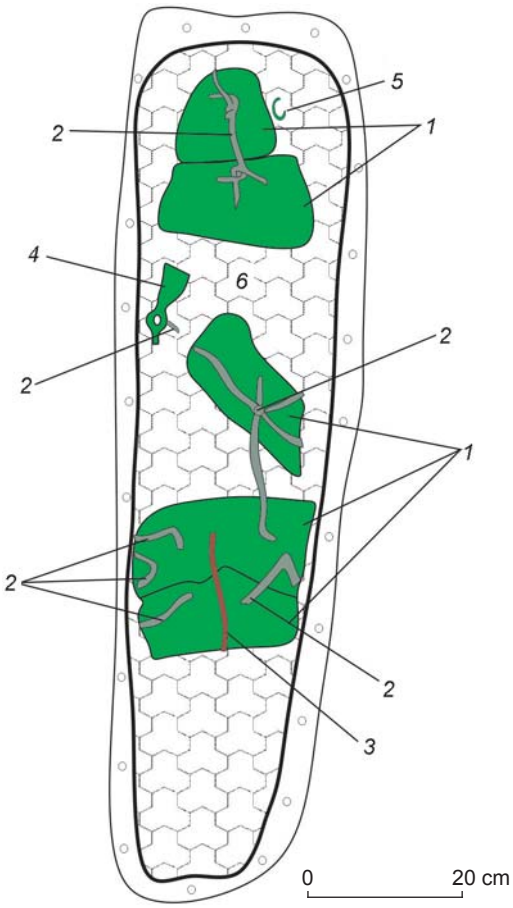

Fig. 10. Location plan of goods in burial No. 53.
1 – copper plates of the cauldron; *2* – fragments of leather belts; *3* – a twisted cord; *4* – a bronze hatchet; *5* – a bronze ring made of a plate; *6* – a fur cocoon.

skull, there was a plate of a bronze cauldron, to the left was an open ring made of a narrow bronze plate. The third rectangular plate was located diagonally in the thoracic region and the abdominal cavity (Fig. 11, *b*). Its dimensions are 41 × 15 cm. In the central part of the copper cauldron plate, there was a knot that tied five leather belts. The ends of the two belts lay parallel to the longitudinal axis of the body of the deceased. The end of the belt, which stretched towards the feet, reached the plates overlapping the area of the deceased's thighs. The ends of two more belts were parallel to the longitudinal axis of the copper plate.

The presence of leather belts in the burial should be associated, most likely, with a protective ritual. This assumption is supported by the fact that the belts were cut or untied prior to burial. This ritual is based on the ideas of the indigenous inhabitants of the northwestern Siberia about the "mirroring of the worlds": a spoiled thing in "our world" acquires integrity in the "other world". In the burial tradition of the indigenous peoples of the northwestern Siberia, the ritual has existed since the Middle Ages and is preserved in our days in the form of the deliberately breaking through the bottom of copper cauldrons during burial.

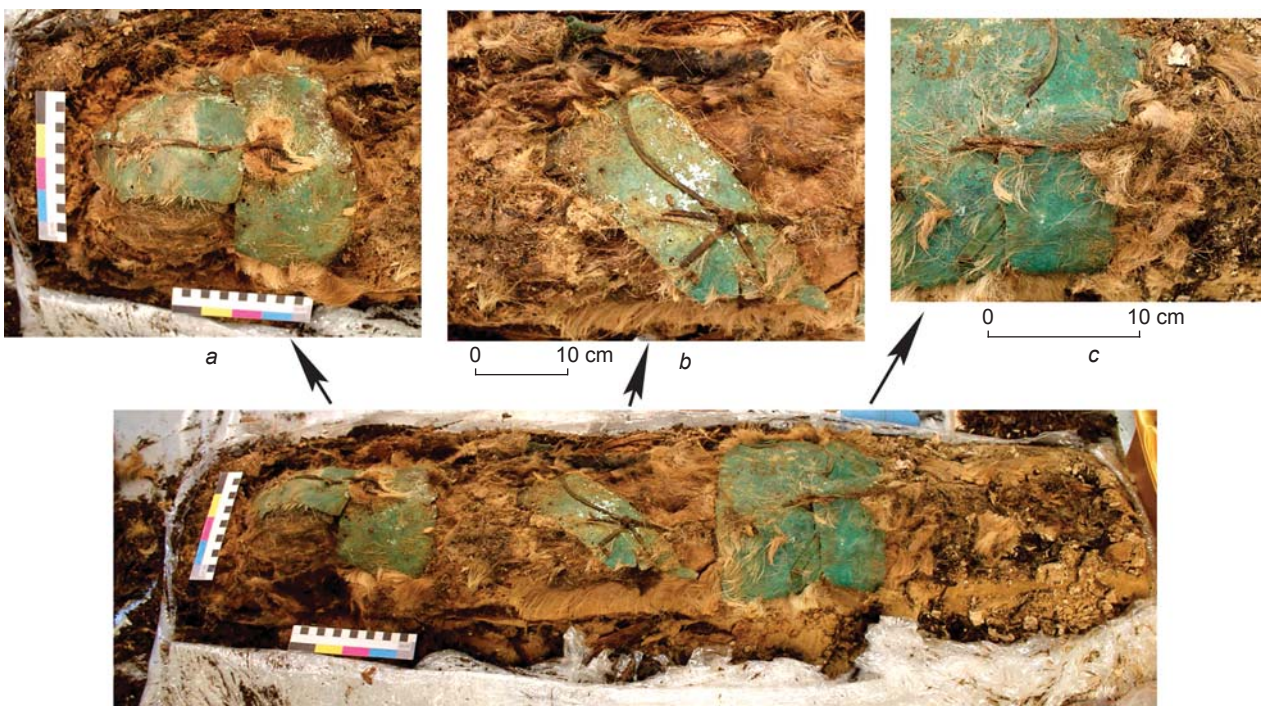

Fig. 11. A fur cocoon with copper plates of the cauldron. Burial No. 53.
a – plates and leather belts in the area from the parietal bones to the lower jaw; *b* – a plate and a knot connecting five leather belts in the area of thoracic section-abdominal cavity; *c* – plates, braided strap, and fragments of leather belts in the thigh area.

The thigh area was covered by two rectangular copper plates, the longitudinal axis of which was perpendicular to that of the deceased (Fig. 11, *c*). The plates were overlapping and had practically the same dimensions: 15 × 32 and 14 × 30 cm. On them, parallel to the longitudinal axis of the deceased, there was a braided strap (its material has not yet been determined). Fragments of leather belts were found along the edges of both plates. Notably, the ends of the leather belts that lay on top of the described plates were not tied. Perhaps they were untied or cut before burial.

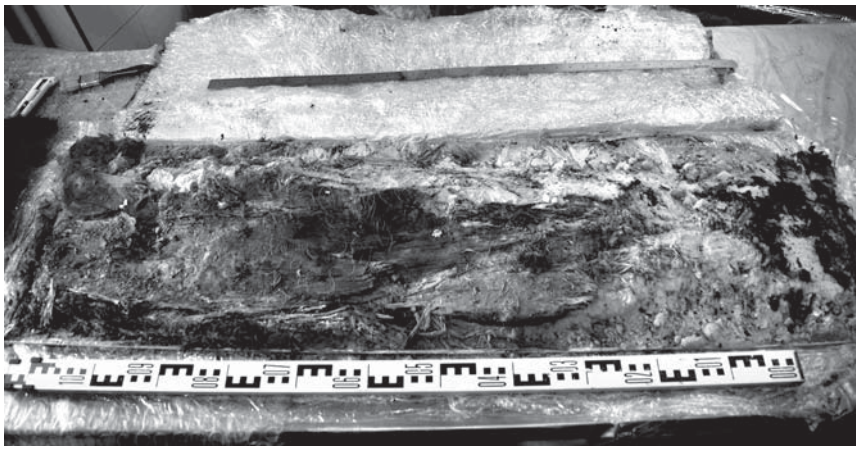

Fig. 12. Wooden dish (?), on which there was a birch-bark cocoon with the buried person. Burial No. 53.

A birch-bark cocoon with the child's body was laid on an elongated wooden dish (?), probably with raised edges (Fig. 12). Unfortunately, owing to the poor preservation of the item, it is not possible to accurately determine its shape and size. According to the restorers of the Shemanovsky Museum and Exhibition Complex, the dish is made of coniferous wood.

The burial pit was filled up to the top. Remains of above-the-grave structures were not found.

Burial No. 84

Another burial with a rich inventory was discovered during the 2018 field season. Like burial No. 53, this one was structurally different from the rest. The remains found in it belonged to a 6–7 year old boy. The pit is relatively shallow; its maximum depth is 39 cm. A boat-shaped funerary structure with a straight stern was placed in it. Judging by the thickness of the fragments found in the northern part of the burial, it was made of wood. Most likely, the structure was hollowed out from a solid larch trunk. Folded birch-bark canvases, folded under the walls of the burial chamber in the northern part of the complex, served as a cover.

The child was stretched out in the boat on his back, with his feet toward the river, and with his legs straightened and brought together in the area of the ankle joints (Fig. 13, 14). The arms of the deceased were straightened and placed along the body; their back surfaces were pressed to the sides. Hair is preserved on the bones of the skull; on the left side of the chest, lay a lock

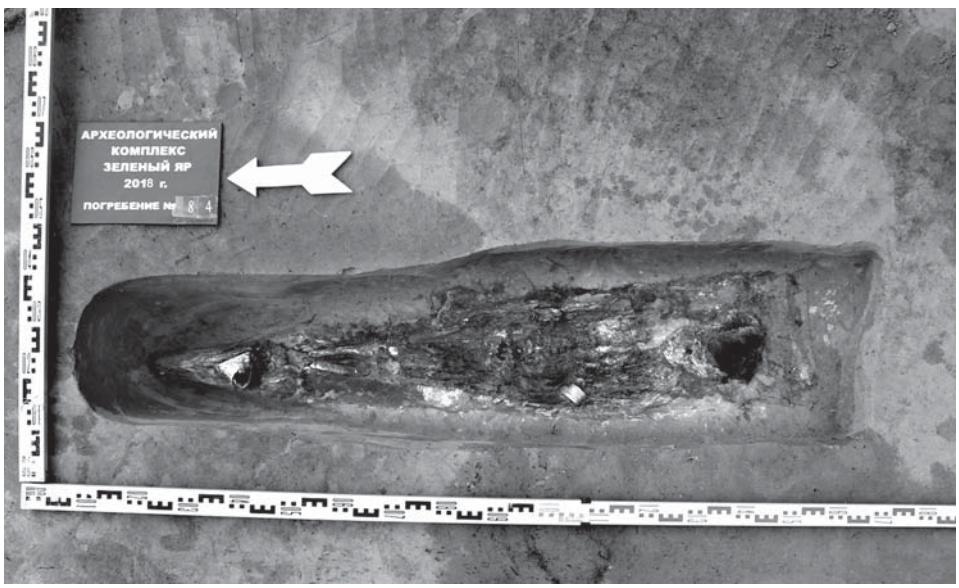

Fig. 13. Burial No. 84 (field fixation).

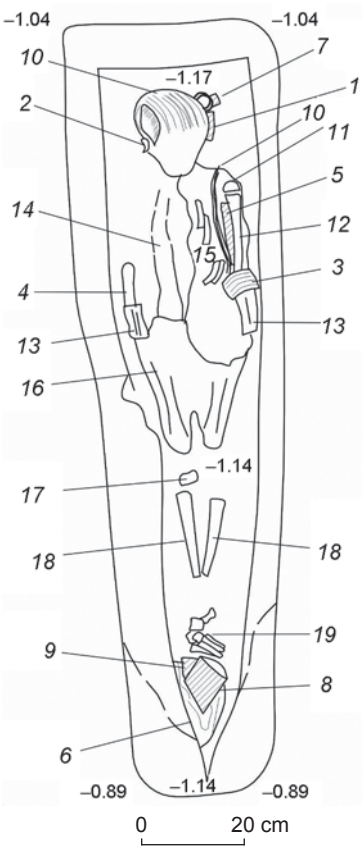

Fig. 14. Plan of burial No. 84.

1 – fragment of a bracelet; *2* – fragment of a temporal ring (?); *3* – a bronze bracelet; *4* – handle of a bronze knife; *5* – a bronze scabbard; *6* – fragment of a wooden object; *7* – temporal rings; *8* – cone-shaped item from the cauldron wall; *9* – cauldron wall; *10* – human hair; *11* – head of the humerus; *12* – diaphysis of the humerus; *13* – mummified forearm; *14* – spinal column; *15* – fragments of ribs; *16* – mummified part of the body (pelvis, hips); *17* – unidentifiable bone fragment; *18* – shinbone; *19* – bones of the right foot.

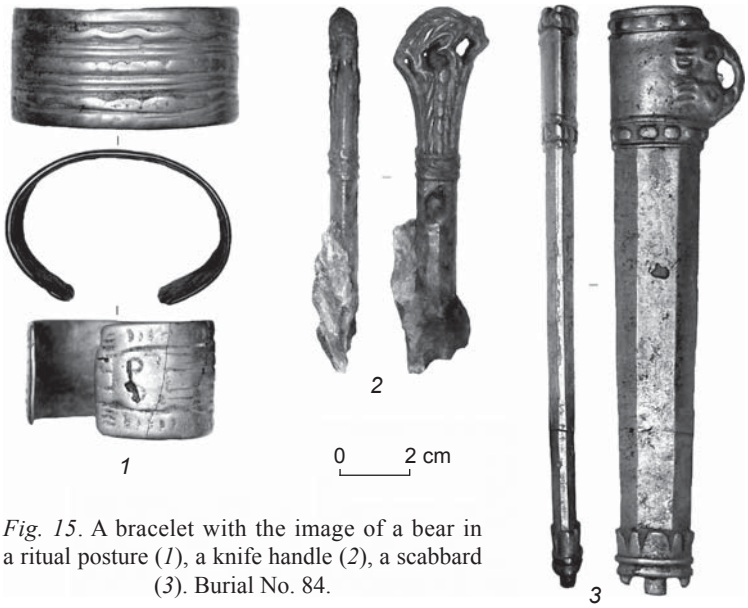

Fig. 15. A bracelet with the image of a bear in a ritual posture (*1*), a knife handle (*2*), a scabbard (*3*). Burial No. 84.

of long hair (up to the level of the elbow joint). The hair is slightly wavy and black. The teeth were closed, which indicates the fixation of the jaws. The child may have been dressed. The articulation of bones of the postcranial skeleton, as well as the "closed" position of the chest and pelvic girdle, indicate that the decomposition of the body took place in a limited space. Thick clothing could have acted as a limiter. The co-directionality of the metatarsal bones of the right foot indicates a limited isolated space in which its decomposition took place. Only tight shoes could have been the limiter. On the boy's left hand, in the area of the elbow joint, there was a fragment of a bronze bracelet, depicting a bear in a ritual pose (Fig. 15, *1*). The other two parts of this bracelet were located near the left temple. Bracelets depicting a bear in a ritual pose belong to the status ornaments of the late 1st to early 2nd millennium AD. They were used in the northwestern Siberia from the Surgut region of the Ob to the Yamal Peninsula. Sometimes, they are even called Ob-type bracelets. Such bracelets are found, for example, in the complexes of the Saygatinsky I (Surgutsky District, Khanty-Mansi Autonomous Okrug (KhMAO–Yugra)) and Kintusovsky (Nefteyugansky District, KhMAO–Yugra) cemeteries (Ugorskoye naslediye…, 1994: 87–88), the Barsov Gorodok cemetery (Surgutsky District, KhMAO–Yugra) (Arne, 2005: 81), and they are also found among accidental finds (Baulo, 2011: 214).

Knives were laid under the arms near the child's shoulders: on the right, there was an iron knife with a bronze handle; on the left, a knife with a wooden blade in a bronze scabbard, with a wooden handle (Fig. 15, *2*, *3*). A bronze scabbard with a wooden blade inside was discovered at the cemetery for the first time. The fully preserved scabbard was made of white bronze by casting in a bipartite cored mold; the surface was polished. Bronze scabbards with a zoomorphic decor are rare in the northwestern Siberia. Apart from those found in burial No. 84 at Zeleny Yar, two scabbards are known from the Yamal Peninsula: one from the Pechora River, and others from the Koksharovsky Kholm complex (Verkhne-Saldinsky District, Sverdlovsk Region) (Chernetsov, 1957: 196).

The head of the deceased was probably decorated with two pairs of bronze temple rings. One pair was sewn to a fur garment (a headdress or a fur blanket), in the place that corresponds to the right side of the parietal region (Fig. 16). Another pair of rings and a fragment of a bronze bracelet were found in the lower left part of the skull (Fig. 17). All rings are completely preserved, covered with a green patina. The rings are open, made of forged bronze wire round in cross section.

The boy's body was wrapped in a blanket, which in the burial is evinced by the remains of decayed flesh. When studying the find, it was possible to establish that the fur layer consisted of two canvases. The upper fabric was a skin

Fig. 16. A pair of temporal rings located in the parietal region of the deceased. Burial No. 84.

Fig. 17. A pair of temporal rings and a fragment of a bronze bracelet, located in the lower left part of the skull of the deceased. Burial No. 84.

Fig. 18. Copper plates fixed with leather straps on a fur blanket. Burial No. 84.

Fig. 19. A copper cone. Burial No. 84 (field fixation).

turned with the pile down. The fur was long, with brown axial hair and light underfilling. The lower fabric was a skin turned with the pile up. The fur was light. To which animal the fur belonged is difficult to determine.

On the fur cover, copper plates were fixed with leather straps. They were laid across the abdomen, pelvis, and crosswise on the thighs (Fig. 18). At the northern edge, at the bottom of the burial structure, an object in the form of a cone (Fig. 19) rolled from a copper sheet was uncovered. Cones or similar figures, made from the walls of copper cauldrons, are characteristic of burials of the Zeleny Yar cemetery of the 12th–13th centuries. They were usually placed at the feet of the interred (Gusev, 2019: 227). At other burial sites discovered in the northwestern Siberia, no cones from the walls of cauldrons were found. They are extremely rare in the cemeteries of the Kama region. K.A. Rudenko calls them symbolic vessels, and dates them to the 11th–12th centuries (2000: 41, 103).

The burial pit, after the burial boat was placed in it, was filled up to the top. The remains of the above-the-grave structures were not found.

Thus, the above-described children's burials at Zeleny Yar are characterized by unusual burial structures (in burial No. 53, a birch-bark cocoon made with teeth; in burial No. 84, a boat), as well as a wealth of grave goods. At this cemetery, in the burials of children under the age of 5–6 years, at best, small fragments of a copper cauldron were found; in the burials of adult men (apart from burial No. 27), there were fragments of a copper cauldron and of knife handles.

Discussion

The cemetery of Zeleny Yar of the 12th–13th centuries includes 18 children's burials. The age of death of the children ranges from six months to eight years old. According to the rite, children's burials at the late cemetery generally do not differ from those of adults. The bodies were placed in wooden log-sarcophagi in the form of boats, which were tied with plant fibers. One exception to this is seen in the children's burial No. 53: a birch-bark cocoon with the body of a child was laid on an oblong wooden dish (?).

Children were buried wrapped in fur blankets or dressed in fur clothes. Both children and adults were buried in bonnet-type hats and shoes made of reindeer hide, which resemble modern *kisy* (fur boots of the indigenous peoples of the North). Some remains show traces of fur stockings. Children's clothing and blankets are made of beaver, sable, marten, wolverine, or polar fox fur. At the bottom and side walls of three burials, the remains of a deerskin litter were found (Gusev, 2015: 292).

Mummified remains of varying degrees of preservation were found in seven children's burials of the late cemetery. Mummification was provided by a large amount of copper (these were plates of a copper cauldron, which presence can be considered a feature of the late Zeleny Yar cemetery), which has antiseptic properties, as well as by high soil acidity and permafrost.

The children's burials under study stand out in terms of the richness of the inventory, which includes artifacts that are rarely found in this territory: a bronze hatchet and a scabbard.

Analogs of the examined children's burials with rich burial goods are known in the Surgut region of the Ob, at the Barsov III cemetery dating to the 1st to early 3rd centuries. Two burials were made in the ditch of the Beloyarsk period settlements of Barsov Gorodok I/20 (Early Iron Age) and Barsov Gorodok I/3 (Surgutsky District, KhMAO–Yugra). The people were buried in the supine extended position, apparently in wooden coffins. In both burials, a vessel was installed at the feet of the deceased. In burial No. 1 at Barsov Gorodok I/20, which had a rich inventory, a boy with Mongoloid features of about six years of age was buried. The inventory includes numerous glass and other types of beads, zoomorphic pendants, plaques, onlaid pipe-shaped beads, bronze and silver plates, a bracelet, a whole mirror, and fragments, including those with engravings; cult castings, weapons (bronze arrowheads of the Kulai type, iron daggers, and celts). Next to the buried was a vessel of the Late Sarov type (Chemyakin, 2008: 82).

The preservation of items made of organic materials (leather, fur, and wood) in other burial sites of the Middle Ob region, including those synchronous to those under study, were much lower than in the Zeleny Yar burial grounds. This makes it difficult to find archaeological parallels. In addition, most of the materials from the Barsov and Saygatinsky cemeteries, which are geographically closest to the Surgut region of the Ob, have not yet been described (except for the materials of the above-mentioned Barsov Gorodok III, of the Early Iron Age).

At the cemeteries of the 10th–14th centuries in the Novosibirsk region of the Ob, in particular at the Berezovy Ostrov I burial mound, children were buried in pits of various depths. In one child's burial, there may have been a coffin (Ocherki…, 1994: 225). At the burial mound of Yurt-Akbalyk-3 (the basin of the Ueni River, the left tributary of the Ob, in the north of the Novosibirsk region of the Ob), there is a mound dating to the 7th to early 8th centuries, containing two rich burials of children under 3 years of age. The associated burial inventory included various ornaments, belt sets of the Early Turkic time, Chinese coins of the 50s and 580s, and bronze plaques with the heads of three bears (Ibid: 217).

Most of the cemeteries of the 11th–14th centuries in the Tomsk region of the Ob, unfortunately, were plundered. Judging by individual details, it can be concluded that the burial goods consisted of things that a person would use during his lifetime. Each age category has a specific composition of inventory. The least plundered, but also the poorest, is the Astrakhantsevo cemetery. Four of 11 children's burials there did not contain any goods. In the rest of the burials, there were beads and earrings (a small amount), an iron arrowhead, a knife, and an accumulation of ceramics (Ibid: 256–257).

Unfortunately, in the search for parallels, ethnographic materials are of no help. K.F. Karjalainen when describing the burial rite, or rather, the rites of preparation "for the last journey" and rituals after burial (1994: 76–133), focuses on actions and ceremonies. He gives only general information about what is put in the burial, without indicating the differences in the inventory, determined by the sex and age of the deceased. He does not even mention children's burials.

O.A. Murashko and N.A. Krenke, who described materials from cemeteries of the 19th century in the lower reaches of the Ob (Priuralsky District, YaNAO), which were studied by D.T. Yanovich, report that all cemeteries contain the deceased in a supine extended position (2001: 30), and "children's burials are distinguished by the presence of toys" (Ibid.: 34).

The data of modern ethnography of the Ob-Ugric and Samoyed peoples are significant for our research. They say that boys by the age of 6–7 not only have an idea of purely male occupations, but also have certain work skills. They are not considered children, and actively help their parents, and they are especially trained and educated as future breadwinners of the family (Krasilnikov, 2009: 57).

Conclusions

When describing the burial rites of the Ob-Ugric peoples, researchers usually focus on certain aspects of the rituals and do not touch upon the burial ceremony of children who died at 6–7 years of age. Information is provided mainly on the burials of infants and adults. Therefore, it is not possible to trace the preservation or transformation of the burial rite of children of the age of interest. Nevertheless, we can confidently assert that for a boy, a representative of the indigenous peoples of the Far North, the age of 6–7 years was the transitional period from childhood, when he imitated his parents, to an independent adult life. It was from these years that the boy took an active ("adult") part in the life of the family, and became the main assistant to his father in the trades and reindeer herding.

This period of transition from childhood to adulthood was reflected in the burial rite at the medieval cemetery Zeleny Yar. That is why the boy, who died at the age of 6–7, when he became an independent family member, was sent to another world with a lot of expensive jewelry and furs.

The tradition of a rich funeral accompaniment of boys was developed at least in the Middle Ages, and has survived to our days.

Acknowledgements

This study was supported by the Russian Foundation for Basic Research (Project No. 18-09-40011). The author is grateful to E.O. Svyatova for her work with anthropological material from the Zeleny Yar cemetery.

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Received November 18, 2019.
Received in revised form December 2, 2019.

DOI: 10.17746/1563-0110.2020.48.3.080-089

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Methodological Aspects of Determining Type, Age, and Origin of Archaeological Wood: The Case of Fort Nadym

Archaeological studies in the forest-tundra zone of Western Siberia are highly relevant to studying the material culture, social structure, and ethnic history. The presence of permafrost ensures the unique preservation of organics in cultural layers, including timber, which makes it possible to conduct dendrochronological studies (calendar dating of samples, determination of species composition, typological analysis, and the source of the timber origin). In 2011–2012, during the excavations at Fort Nadym, 347 samples of wood were selected for the assessment of the age of wooden structures. The results showed that most samples belonged to three species of trees: Siberian larch (Larix sibirica Ledeb.), Siberian spruce (Picea obovata Ledeb.), and Siberian pine (Pinus sibirica Du Tour). The typological analysis revealed that walls were mostly built from spruce, pine logs, and half-logs, whereas the floors were made from larch and pine. To assess the origin of wood, a new methodological approach was proposed. As a result, it was demonstrated that the main building material was driftwood. This has allowed us to make more accurate interpretations and to specify the years of construction. The analysis indicates three periods of construction / reconstruction: the 1450s–1460s, 1470s–1480s, and 1520s–1570s. The new approach can be applied to other wooden monuments located on the banks of major water arteries of the Siberian forest-tundra zone.

Keywords: *Driftwood, dendrochronology, archaeology, calendar dating.*

Introduction

Nowadays, the dendrochronological studies are carried out in many archaeological sites from the Yamal-Nenets Autonomous Okrug to the lower reaches of the rivers Ob, Nadym, and Taz: Mangazeya, Polui, Ust-Voikar, Nadym, Yarte VI (Shiyatov et al., 2005), Staroturukhansk (Zharnikov et al., 2014), Bukhta Nakhodka (Sidorova et al., 2017), and other fortified settlements. The studies of archaeological sites with frozen cultural layers, which preserved items from organic materials, expand our knowledge about material culture, social structure, and ethnic composition of the population (Fenomen…, 2000; Molodin, Parzinger, Tseveendorj, 2012).

The continuous written history of the region under study began at the turn of the 16th and 17th centuries. In this regard, archaeological sites are almost the only source of information about the settlements in the North of Siberia in antecedent epochs (Myglan, Vaganov, 2005; Kardash, 2009). One such site is Fort Nadym, which remained practically unmentioned until the early 17th century. It is reliably known that prior to its functioning from the late 16th to the first third of the 18th century, this place served as an administrative center and winter residence for the chiefs of Bolshaya Karacheya—the military and political association of the Northern Ostyaks and Samoyedic people (Kardash, 2009). Its ethnic and cultural history, as well as social composition of the population in the 13th–16th centuries, are in the process of study. The historical and architectural analysis of the evidence from Fort Nadym made it possible to identify three main construction horizons with significant differences in the planning structure of the defensive and residential complex and in the architecture of its constituent structures. The earliest, "Novgorod" horizon (13th to mid-15th centuries) was associated with the period of the inclusion of the Lower Ob territories under the name "Yugra Volost" into the lands of Novgorod the Great. The next horizon belonged to the period of jurisdiction of the Moscow State over the population of the Lower Ob region (mid-15th to early 18th centuries). This period can be divided into two sub-periods: from early/mid-15th century to the late 16th century, and from the late/end of the 16th century to the first third of the 18th century.

Taking into consideration the good preservation of archaeological samples, the dendrochronological method can be used for the calendar dating, which allows us to determine the history of functioning of the settlement (Chernykh, 1996; Shiyatov et al., 2005; Zharnikov et al., 2014). The first dendrochronological studies of Fort Nadym were carried out by V.M. Goryachev. In 1999–2003, an upper cultural layer with a thickness of 1.5 m was removed and 1600 samples of wood were selected. On the basis of calendar dating of "around 550 samples", it was established that Fort Nadym existed "from the second half of the 10th century until the early 18th century" (Shiyatov et al., 2005: 49). In 2011–2012, during further excavations, V.S. Myglan and G.T. Omurova selected 347 samples of archaeological wood. When analyzing the evidence, the authors initially assumed the Goryachev's hypothesis that the settlers were harvesting building materials in the nearest areas of the floodplain forest. As the forestless areas spread, more distant areas had to be explored (Goryachev, 2003: 31). The results of the calendar dating of buildings 2 and 12 raised some questions about the accuracy of the identified sources of the building material (Omurova et al., 2013). For example, the analysis of dendrochronological dates showed a significant variation in time for the formation of outermost rings of samples. During the route surveys, no coniferous forest or traces of its existence in the past were found in the vicinity of Fort Nadym. The nearest trees grew 12 km to the west, on the left river bank, or 20 km upstream on the Nadym River. This circumstance allowed us to assume that the driftwood (tree trunks brought by the river during strong seasonal floods) could have been widely used as building material. In this regard, the question about the origin of wood for Fort Nadym is open. The answer for it has a high importance for interpreting the dendrochronological dates, since in one case they indicate the years of logging, and in the other case, periods of driftwood accumulating on the river bank as a result of erosion processes, severe floods, and other natural occurrences.

Materials and methods

Fort Nadym is located within the delta of the Nadym River, on an island elongated from northwest to southeast (Fig. 1; a detailed geographical description is given by O.V. Kardash (2009: 5, 6)). Location of the settlement is inconvenient: the river channels are not abundant in fish and animals for hunting; lichen pastures are absent from the immediate vicinity of the settlement; floods occur in the summer season, and there are more convenient sites for settling in the area. It is

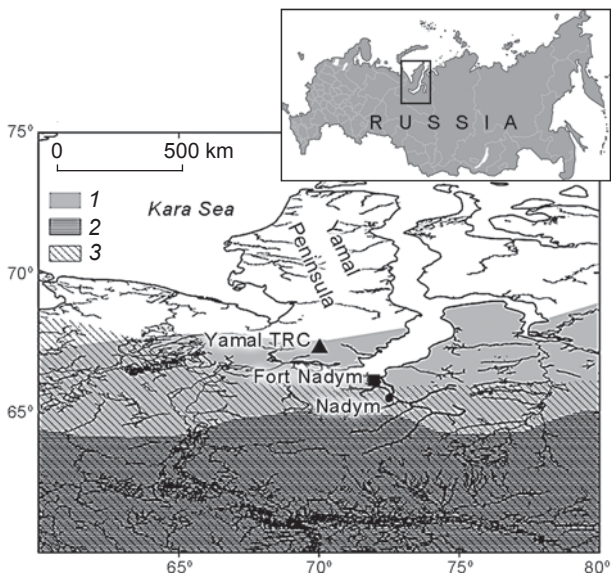

Fig. 1. The map of the study area.
1 – area of larch, *2* – pine, *3* – spruce.

usually pointed out that one of the reasons for founding Fort Nadym was its proximity to the crossroads of trade routes, as evidenced by the presence of imported goods, including weaponry, tools, utensils (copper cauldrons), fabrics (woolen cloth, silk), etc. (Ibid.: 6, 283–284).

In total, 347 samples of wood were selected in 2011–2012 from 11 buildings and from the walls of the external fence. A maximum number of samples with the largest number of peripheral rings were selected from each architectural element. The wooden structures of Fort Nadym at the time of sampling had different states of preservation. Some parts were *in situ*; other parts were disassembled and stored. In the latter case, the sample marking made it possible to correlate the samples with elements of each particular (floor, wall, etc.) structure, but it was not possible to reconstruct the original arrangement of log layers (e.g., building 10).

The procedure of sample preparation, measurement, and cross-dating was carried out according to standard methodology (described in detail on the website https://sibdendro.com). For establishing the composition of tree species of the dated samples, the book of V.I. Benkova and F. Schweingruber (2004) was used. Tree growth series for each tree species—larch (*Larix sibirica* Ldb.), spruce (*Picea obovata* Ldb.), and Siberian pine (*Pinus sibirica* Du Tour)—were created as generalized tree-ring chronologies (TRC), which were cross-dated with each other and then correlated with the Yamal TRC (Hantemirov, Shiyatov, 2002). Samples of larch trees growing 20 km upstream of the Nadym River were used for calculating and analyzing the regional growth curve. The regional age curve was calculated by displaying individual series of growth for the first year (which for all trees was taken as 0), with subsequent averaging.

The peripheral rings of archaeological samples showed various states of preservation. According to this feature, they were divided into three groups. The first group included samples with the outermost ring; the second group (less than 10 rings lost) included samples wherein one ring could be observed along the circumference of sapwood, but there were no remains of bark or bast. Therefore, it could be assumed that some of the outer rings were not preserved. The third group (more than 10 rings lost) included samples with traces of hewing and poor preservation of wood along the outer circumference of the sample.

We formulated the following criteria to identify the cases of harvested wood from the forest for the construction: 1) the time frame of a significant part of the samples (including with outermost rings) should be dated in a short period of several years; 2) the wall logs should have comparable diameters, to simplify the subsequent task for fitting them into the wall. In the case of correspondence of the samples with these criteria, the timber was considered harvested in the forest, and the year of construction / reconstruction was identified by the formation of the outermost ring. If the samples did not meet any of these criteria, we assumed the use of driftwood. In this case, the dates of peripheral rings (including the outermost rings) were distributed randomly, i.e. the year of tree felling was not associated with the human impact. Therefore, the year of the building was identified by the latest dendrochronological date (samples with outermost ring were excluded). The obvious disadvantage of this approach is that in the case of rebuilding, it was only possible to determine the date of the last reconstruction and not the time of the initial construction (the wording in this case was "the building was built not earlier than…").

The flooring and walls were analyzed separately in typological and species analysis, as well as in determining date of the last reconstruction of the building, because floor items could be replaced at any time. In this study, the term "log" includes "lafet", while the term "plank" means a wooden plate with a thickness of ~10 cm. Architectural terms are given according to the dictionary by V.I. Pluzhnikov (1995). Detailed information about the collection of wood samples from Fort Nadym (photos, tables) are stored as archived data at https://sibdendro.com.

Results

Description of the collection of samples, species composition, and type of timber. Based on species composition of dated samples from Fort Nadym, timber of larch, spruce, and pine was used (see *Table*). 39 % of samples consist of larch (prevailing in building 7), 33 % of spruce (prevailing in buildings 10 and 17), and 28 % of pine (prevailing in buildings 12 and 14).

In further work, samples were analyzed according to typological and species-related criteria (separately for walls and floors; buildings represented by one sample only were not considered). The results showed that the walls of the buildings were mainly from logs (buildings 3, 6, 10, 11, 12, and 17), and less often from planks (buildings 2 and 7) and half-logs (building 14) (see *Table*, Fig. 2, *a*). The plank and half-logs were erected by frame-and-post structures using the *zaplot* technique (building 7), the log *pryaslo* technique (building 14), or with multilayer walls, when the log construction was lined with vertically arranged wooden plates from the outside (building 2).

The spruce and larch wood was used mainly for the walls (Fig. 2, *b*). The main building materials were

Main features of buildings and walls of external fence

Structure	Number of samples		Distribution by timber type composition, %			Distribution by the elements of structure, %					Time of building/rebuilding		
						Wall			Floor				
	Dated, pcs.	Undated, %	Larch	Spruce	Pine	Log	Half-log	Plank	Half-log	Plank	I (1450s–1460s)	II (1470s–1480s)	III (1525–1575)
Buildings:													
2	47	18	32	32	36	9	28	63	7	93	–	–	Not earlier than 1519
3	13	28	31	38	31	100	–	–	–	100	–	Not earlier than 1479	–
6	37	20	43	22	35	100	–	–	–	100	–	Not earlier than 1486	–
7	37	23	73	11	16	–	47	53	5	95	–	–	Not earlier than 1523
10	35	19	14	77	9	80	14	6	–	–	Second half of the 1460s	Second half of the 1470s	Not earlier than 1531
11	12	40	42	25	33	67	–	33	67	33	Not earlier than 1466	–	–
12	21	13	38	19	43	83	–	17		100	Not earlier than 1449	–	–
14	17	29	24	29	47	40	40	20	10	90	–	Not earlier than 1472	–
17	6	14	–	100	–	67	33	–	–	–	Second half of the 1460s	–	–
18	1	0	–	–	100	1	–	–	–	–	Not earlier than 1429	–	–
19	1	0	100	–	–	1	–	–	–	–	–	–	Not earlier than 1511
Walls:													
FWWF	5	67	20	20	60	20	60	20	–	–	–	–	Not earlier than 1559
NWW DRC	8	27	12	38	50	63	25	12	–	–	–	Not earlier than 1482	–
NWE	15	0	73	7	20	87	–	13	–	–	–	–	Not earlier than 1541
WOB6&7	16	6	31	56	13	6	13	81	–	–	Not earlier than 1456	–	–

Note. FWWF – frame of western wall in the external fence, NWW DRC – northwestern wall of defense and residential complex, NWE – northwestern entrance, WOB6&7 – wall opposite to buildings 6 and 7. I–III – building horizons.

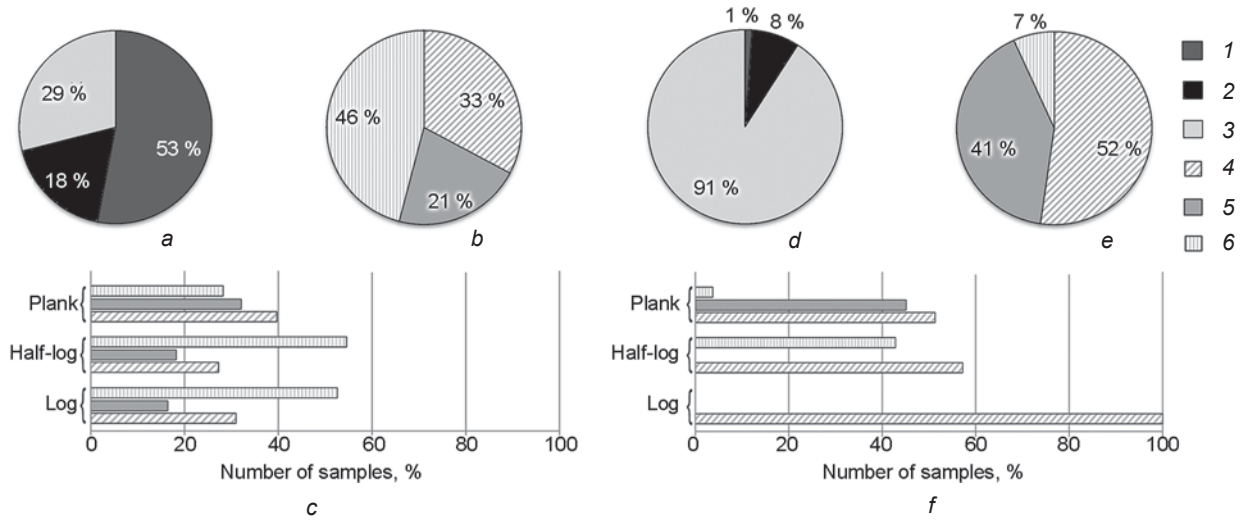

Fig. 2. Distribution of wall (*a*, *b*, *c*) and floor (*d*, *e*, *f*) samples according to typological features (*a*, *d*), timber type composition (*b*, *e*), typological features and timber composition (*c*, *f*).
1 – log; *2* – half-log; *3* – plank; *4* – larch; *5* – pine; *6* – spruce.

spruce logs, half-logs, and larch planks (Fig. 2, *c*). For the wall connecting elements, timbers of different species could be used. Analysis of floor samples from buildings has revealed a different picture (Fig. 2, *d*, *e*). In most cases, the larch and pine planks were used (Fig. 2, *e*, *f*). The fact of re-using ship parts for flooring has been established (building 14).

The presence of timber samples of larch from archaeological sites and living trees has made it possible to compare the age curves and averaged radius values. The results have shown that larch trees growing south of Fort Nadym have lower average growth rates as compared to archaeological wood, and stabilization of average growth on the age curve occurs earlier. According to the archaeological evidence, the average value of the radius was 7.6 cm, while for the living trees it was 4.8 cm. Analysis of the frequency of anomalies in the structure of tree rings has manifested similar results: this frequency was lower in archaeological wood than in living trees (Omurova et al., 2018). All of these data indicate that the trees used in the construction of Fort Nadym grew in more favorable climatic conditions (much further to the south), even as compared to the larch, which currently grows 20 km south of the settlement.

Dating of buildings and walls of the external fence. From 347 archaeological samples, 271 samples were dated (Fig. 3, *a*). The number of undated samples from each building varied. The rate of undated samples is above 40 % for building 11 and the frame of the western wall of the external fence (see *Table*). There is a significant variation in the dates of the formation of peripheral rings in the samples from almost all the buildings. Only in two cases (buildings 10 and 17), is the formation of the peripheral and outermost rings in a significant part of the samples dated in a short chronological interval (Fig. 3, *a*). The analysis of total distribution of samples shows a sharp increase in the number of samples with a preserved outermost ring dating to 1463–1466 and 1474–1476 (Fig. 3, *b*). The samples with less than 10 lost rings show a different distribution according to the dates when the peripheral rings were formed. The maximum number of samples is dated to 1463–1466, 1468, 1470, 1474–1475, and 1482–1484 (Fig. 3, *c*). The next step was the identification of buildings that were constructed by harvested wood from forest.

Building 10 was not preserved *in situ*. Forty three samples were taken from the walls of the building; 35 samples were dated (Fig. 3, a). The building material were spruce logs of similar diameter.

Two periods can be distinguished: 1465–1466 and 1474–1476. The first period includes five samples with a preserved outermost layer (ng088a, ng091, ng093, ng102, ng106) and seven samples with less than 10 lost rings (ng086b, ng087b, ng092, ng095, ng097, ng104, ng181). The second period includes four samples (ng096, ng103, ng108, ng112) and two (ng084b and ng089), respectively. The sampling also included larch wood (ng089), which indicates a repairing of the walls after 1531. Thus, building 10 was built after 1466 and rebuilt after 1476 and 1531.

Building 17 was preserved *in situ*. Seven log samples were taken from the remains; six samples were dated (Fig. 3, *a*). The building material were spruce logs of similar diameter. All samples (including outermost rings) were dated to 1464–1465. Thus, the building 17 was built after 1465.

Further, we analyzed the year distribution of samples from buildings and walls of external fence of Fort Nadym, where driftwood was used as main construction material.

Building 2 was not preserved *in situ*. Fifty eight samples were taken from three levels; 47 samples were dated (see *Table*). The dates of the logs samples from the wall are alternated randomly and cover a wide chronological period from 1362 (ng125) to 1616 (ng64). Sample ng64 must have been mistakenly assigned to building 2. With our proposed methodology, building 2 was erected not earlier than 1519.

Building 3 was preserved *in situ*. Eighteen samples were taken; thirteen samples were dated (see *Table*). The dates of log walls of the construction correspond to a wide chronological period from 1281 (ng463) to 1479 (ng455). Thus, building 3 was erected not earlier than 1479.

Building 6 was preserved *in situ*. Forty five samples were taken; 37 samples were dated (see *Table*). The dates of log walls of the construction correspond to a wide chronological period from 1284 (ng425) to 1486 (ng419). Building 6 was erected not earlier than 1486.

Building 7 was preserved *in situ*. Forty eight samples were taken; 37 samples were dated (see *Table*). The dates of the samples from the walls belonged to the period from 1419 (ng239) to 1523 (ng079). Thus, building 7 was erected not earlier than 1523.

Building 11 was not preserved *in situ*. Twenty samples were taken; twelve samples were dated (see *Table*). The dates of the samples from the walls correspond to the chronological period from 1349 (ng473) to 1466 (ng294). Thus, building 11 was erected not earlier than 1466.

Building 12 was partially destroyed by the erosion of the river bank. Traces of fire were found in the northwestern part of the log construction. A total of 24 samples was taken; 21 samples were dated (see *Table*).

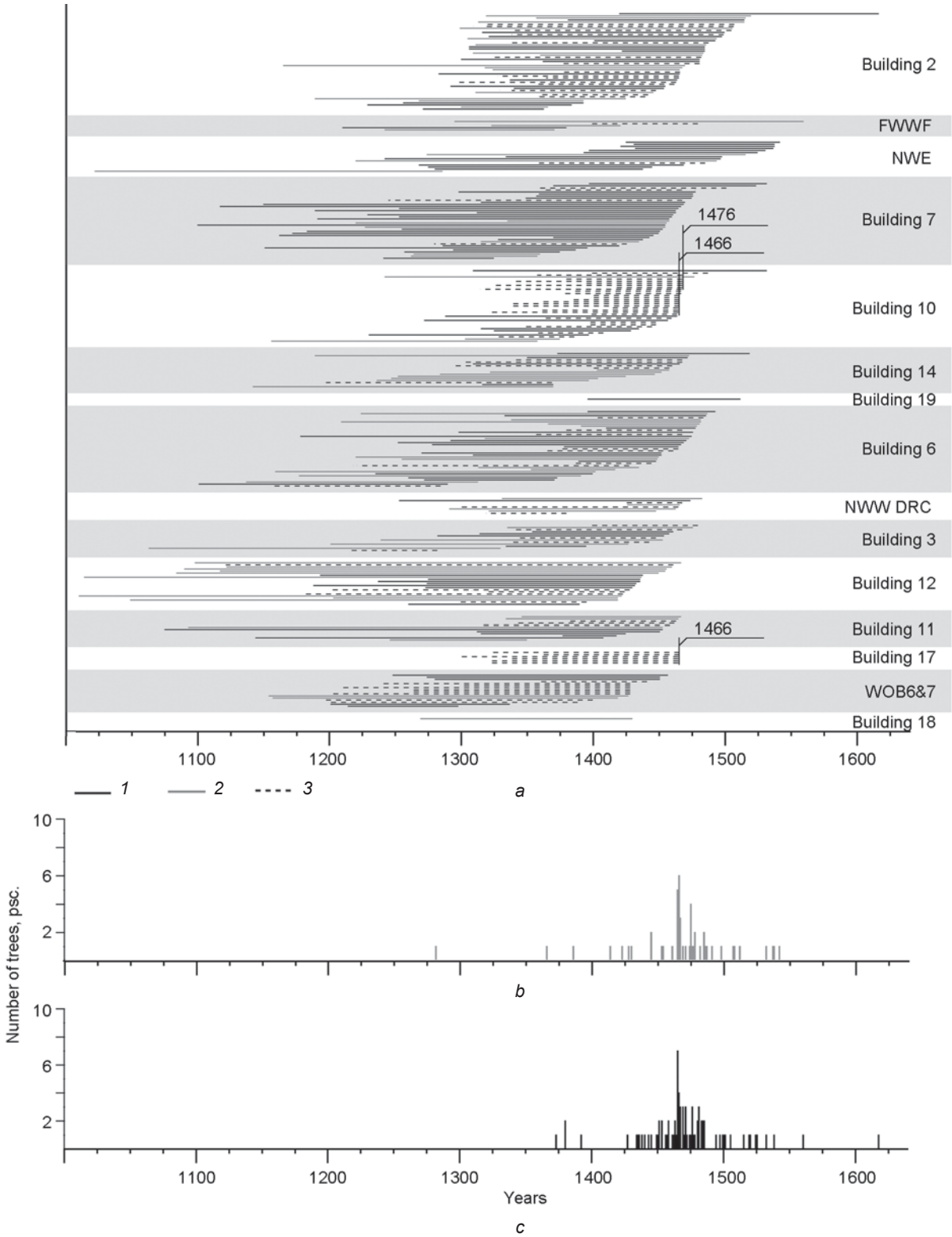

Fig. 3. The results of cross-dating (*a*), distribution of samples with the outermost ring (*b*), and samples that lost less than 10 rings (*c*).

1 – samples of larch, *2* – samples of pine, *3* – samples of spruce. FWWF – frame of western wall in the external fence, NWE – northwestern entrance, NWW DRC – northwestern wall of defense and residential complex, WOB6&7 – wall opposite to buildings 6 and 7.

The dates of the samples are from 1418 (ng332) to 1449 (ng331). Thus, building 12 was erected not earlier than 1449.

Building 14 was not preserved *in situ*. Twenty four samples were taken; 17 samples were dated (see *Table*). The dates of the samples from the walls are from 1377 (ng470a, b) to 1472 (ng278). A specific feature of this building was the use of ship parts in the flooring (ng284, ng285, ng286). High values of the multiple correlation coefficient between individual series of growth obtained by measuring samples from ship parts and buildings indicate that the timber used for the construction of ships and buildings had a common origin. With our proposed methodology, building 14 was erected not earlier than 1472.

Buildings 18 and *19* are represented by only two samples: ng186 (building 18) and ng503 (building 19). The building 18 was erected not earlier than 1429, and 19 not earlier than 1511.

The frame of the western wall of the external fence. Fifteen samples were taken from the structure; five samples were dated (see *Table*). The dates correspond to a wide chronological period from 1370 (ng296a, b) to 1559 (ng194). Thus, the frame was built not earlier than 1559.

The northwestern wall of the defense residential complex. Eleven samples were taken; eight samples were dated (see *Table*). The dates belong to the period from 1379 (ng256) to 1482 (ng261). Thus, the wall must have been built not earlier than 1482.

The northwestern entrance. Fifteen saw cuts were selected from the structure; all were dated (see *Table*). The dates correspond to a wide chronological period from 1285 (ng465) to 1541 (ng175). This structure was built not earlier than 1541.

The wall opposite to buildings 6 and 7 was not preserved *in situ*. Seventeen samples were taken; sixteen samples were dated (see *Table*). The dates cover the period from 1297 (ng143f) to 1456 (ng135). Thus, the wall was built not earlier than 1456.

The analysis of the dates obtained has made it possible to conventionally distinguish three building periods (see *Table*). The first period was the 1450s–1460s (buildings 10–12, 17, and 18, and walls opposite to buildings 6 and 7). The second period was the late 1470s–1480s, when buildings 3, 6, and 14, and the northwestern wall of the defensive and residential complex were built, and building 10 was rebuilt. The third period (1520s–1570s) was associated with construction of buildings 2, 7, and 19, the northwestern entrance and the frame of the western wall of the external fence. In the same period, building 10 was rebuilt. Thus, the analysis of the collection of archaeological samples from 2011–2012 has shown that almost all structures were built from the second half of the 15th to the first half of the 16th centuries.

Discussion

According to the data obtained from samples selected from the upper layers, Fort Nadym functioned "from the second half of the 10th century to the early 18th century" (Shiyatov et al., 2005: 49). The results of dendrochronological analysis from the lower cultural layers revealed a narrower chronological frame. The analysis of samples from 2011–2012 has shown that the buildings were erected in the second half of the 15th and first half of the 16th centuries. The dates from buildings 13.4, 21, and 22 correspond to the period from the first half of the 14th to the first half of the 15th century (Kardash et al., 2018). We will try to explain the causes of the discrepancies of dendrochronological dating results.

Considering the point of view proposed by Goryachev, timber was harvested in the nearest forest areas, later also in distant areas due to lack of wood (2003: 31). Based on this assumption, the time of the buildings was established by the preserved outermost ring of the samples. Presence of samples from different chronological periods in each particular building was explained by repeated secondary use of wood during construction. Buildings were often repaired, but existed "for a long time" (Ibid.), continuously functioning for several hundred years (according to Fig. 10 in the article by S.G. Shiyatov et al. (2005: 50)). However, this point of view has a number of weaknesses.

In our opinion, specific features of dendroarchaeological evidence from Fort Nadym can be easily explained, since the main source as a building material was driftwood. In the following, the arguments that support this assumption will be explained.

Within a radius of over 10 km from Fort Nadym, conifers are not growing. The survey of the vicinity of the site has shown the absence of undergrowth and stumps of old trees. The boundary of the location of larch trees has not significantly changed over the past millennium (Hantemirov, 2009: 28). Currently, driftwood from different species can be found on the river banks. It is possible that a similar situation existed during the functioning of Fort Nadym. The assumption that driftwood was the main construction source explains the fact that walls (67 %) are mainly composed of spruce and pine and that the floor mostly consists of pine plank. Larch grows near the fort, while spruce and pine grow much further south (Fig. 1).

Larch wood samples from the archaeological site and living larch trees were compared by parameters like age curve and circumferences. As a result, the frequency of anomalous structures of the annual rings has shown that the archaeological wood samples come from more favorable climatic conditions (probably further south) than today. Consequently, timber of pine, spruce, and larch has a southern origin and is driftwood. The fact that driftwood was used can be explained bya significant percentage of undated samples, the randomly distributed dates within a single structure, as well as by a wide range of dated samples. According to the historical data, the before-mentioned example is not typical for the objects of architectural and archaeological heritage of (Far North) Siberia during 16th–19th century (Myglan, Vedmid, Mainicheva, 2010; Zharnikov et al., 2014). The assumption about large-scale and multiple re-using of the building elements could not be confirmed with photos. Only in some cases (e.g. the floor of building 14, walls of building 2) can we confirm a secondary use. Notably, presence of permafrost imposes restrictions on re-using elements from the lower layers of buildings (e.g. the preserved door sills in building 7).

These arguments confirm the widespread use of driftwood for building structures at Fort Nadym. At the same time, the question of deliberate logging for harvesting timber is open. Driftwood could not fulfill all needs in building material in the settlement. During the active periods of construction, the need for building material was in high priority for the settlement. Then, obviously timber was harvested in the forest. This is evidenced by a sharp increase in the number of samples with an outermost ring in 1463–1466 and 1474–1476. They correlate with the periods of (re-)constructing in buildings 10 and 17 (Fig. 3). Apparently, during the periods of active construction, the residents of Fort Nadym used all available sources of wood. It can be assumed that some of the buildings (e.g. building 7) with samples from 1465–1466, 1476, and 1531 could have been built earlier than we indicated according to our results.

The presence of wood harvested in the forest raises the question about the method of its transportation. Since Fort Nadym is located along the large river, the population used boats for transporting timber during the summer season. The transportation of logged wood by reindeer or dog sledges for delivering building materials seems unlikely. Reindeer sledges as a transport option was not invented in that region during 15th century. Sledges were widespread (Istoricheskaya ekologiya…, 2013: 298); however, we are not sure about the advantage of this method in comparison to drifting timber on the river.

Thus, the results confirm that driftwood was used as a building material at Fort Nadym, which calls for revising the dendrochronological dating made by Goryachev (2003) and Omurova with their colleagues (2013). The chronological period for the functioning of Fort Nadym needs to be adjusted. The dates of buildings 2 and 12 must be corrected with the data provided in our *Table*. Widespread use of driftwood during construction suggests that one of the reasons of the location of Fort Nadym was the presence of a river, which made it possible not only to transport building materials by water, but also to use driftwood during seasonal floods.

In focus are the three periods when timber was intensively harvested (1463–1466, 1474–1476, and 1482–1484). These periods are correlated with the historical events taking place in the Russian centralized state. In 1462, immediately after his coronation, the Grand Prince of Moscow Ivan III organized a military campaign under the leadership of the *voevodas* Boris Kozhanov and Boris Slepoy Tyutchev, the end point of which was Great Perm. Preparations for the next military campaign further east, "to conquer the Yugra lands", began in September 1464. The campaign took place in 1465 under the leadership of the *voevoda* Vasily Skryaba (Polnoye sobraniye…, 1982: 46). It ended successfully, and communal chiefs ("the Yugra princes") were brought to Moscow to the Grand Prince Ivan III, who imposed a tribute on them and let them return to Yugra. This was the first military campaign to incorporate the territory of the Lower Ob region into the lands of the Moscow State. As a matter of fact, it contradicted the terms of the Treaty signed with the Novgorod Republic by Grand Prince Vasily Vasilyevich in 1456: according to this document, Yugra was considered a Novgorod Volost. Possibly, in that time, Novgorod the Great was unable to control its remote territories.

The Moscow-Novgorod war of 1471 ended with signing a peace treaty between Ivan III and Novgorod the Great, after which the Novgorod Republic completely lost its independence and control over the northern volosts, including Yugra. In the winter of that year, the campaign to Great Perm, led by the *voevodas* Prince Fedor Pestryi Starodubsky and Gavrila Nelidov took place. As a result, the Volga-Kama trade route, connecting the Lower Ob region with the Islamic states of Western Asia for centuries, starting from 1472 was under control of the Moscow State. For more than ten years, there were no military campaigns to Great Perm and Yugra.

The Grand Prince Ivan III Vasilievich organized the next campaign to the territory of the Lower Ob region in 1483 for subjugating the Voguls and the Yugra dwellers, and establishing the power of the Moscow State. The army was led by Prince Fedor Semenovich

Kurbsky (Chernyi) and Ivan Ivanovich Saltyk-Travin (Ibid.). In its scale and results, this military operation surpassed the previous campaign. In spring of 1484, "princes of the Voguls and of the Yugra dwellers, and Siberian princes" of all territories where military activities were carried out, personally came to Ivan III in Moscow (Ibid.: 49). According to the regulations of that time, they swore allegiance to the Grand Prince, pledged to pay tribute, received the corresponding authority, and left back to their lands.

Conclusions

The analysis of samples from Fort Nadym, selected in 2011–2012, has made it possible to establish the time of construction of eleven buildings and four elements of the external fence (walls, entrance). It has been established that only in the case of buildings 10 and 17 can we speak about logging in the forest located upstream of the Nadym River. All the remaining buildings were mostly constructed from driftwood. The analysis of the timber types in the collection of samples has shown that mostly logs and half-logs of spruce and pine were used for the walls, while larch and pine were used for flooring. According to the results of the study, three construction periods can be distinguished: the 1450s–1460s for buildings and the wall opposite of buildings 6, 7, 10, 12, 17, and 18. In late 1470s–1480s the buildings 3, 6, and 14 were constructed, as well as the northwestern wall of defense and a residential complex. In addition, building 10 was rebuilt. The buildings 2, 7, 19, the frame of the western wall of the external fence, and the northwestern entrance were constructed in 1520s–1570s. Also, the buildings 10 and 14 were rebuilt.

We do not know how the military operations by the Russian centralized state in 1462–1465, 1471–1472, 1482–1484, which were aimed at establishing its power in Great Perm and Yugra affected Fort Nadym. However, a drastic reconstruction of the settlement and its transformation into a defensive and residential complex did occur in the second half of the 15th century. The reason for such a large-scale development is hard to explain. It could be the expectation of an attack, or, conversely, the reconstruction could have been a result of the first Moscow campaign, when Fort Nadym became an outpost of the Moscow State, or it was some form for consolidating military successes in Yugra.

The results of this study have a big theoretical importance, since they raise the principal question about the source of construction wood. Ignoring of it may lead to incorrect dating of the northern settlements in forest-tundra zone.

Acknowledgments

This study was supported by the Russian Science Foundation (Project No. 19-14-00028). Typological analysis of the elements of structures was conducted by V.V. Barinov as a part of the research project, "Reconstruction of the Natural Environment and Methods of Adapting to it by the Eurasian Population in the Quaternary Period" of the Institute of Archaeology and Ethnography of the SB RAS.

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Received April 30, 2019.
Received in revised form February 28, 2020.

DOI: 10.17746/1563-0110.2020.48.3.090-098

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Cultural and Technological Characteristics of Russian Forged Iron Tools from the Selkup Cemetery Migalka in the Middle Ob Basin

This study addresses Russian iron artifacts from the Narym Selkup cemetery Migalka, dating to the late 1600s to early 1700s. Two most important categories of tools are described—knives and axes. In terms of morphology, knives fall into two groups: straight-backed and those with convex ("humped") backs. The combination of a "humpbacked" blade, typical of native manufacture, and Russian hilt plates precludes an unambiguous ethnic attribution. Special attention is paid to knives with filigree-enamel hilt plates as markers of high socio-economic status. The garniture evidences northern Russian origin. The metallographic analysis of knives (22% of the sample) revealed two technological groups: made of solid steel and welded. Axes, made by Russian artisans, are of the shaft-hole type and fall into four types. The analysis, relating to 42% of the sample, indicates two techniques: welding of a steel blade onto an iron base or a piece of raw steel, and using irregularly carbonized metal for forging the entire axe. Ferrous metal items follow the Russian technological traditions. Three key factors accounted for the spread of Russian artifacts among the natives: "Tsar's gift" for paying the yasak (tribute); colonization of Siberia followed by the emergence of trade manufacture; and the involvement of natives, specifically the Narym Selkups, in the all-Russian market. Our findings attest to the relevance of iron artifacts from archaeological sites to the historical and cultural studies of the colonization period in western Siberia.

Keywords: *Narym (Middle Ob) Selkups, Migalka cemetery, late 17th–early 18th century, iron artifacts, technological analysis, tool types, historical-cultural context.*

Introduction

The southern (central) group of the Selkups who belong to the Samoyedic people is the indigenous population of the Middle Ob region, where they settled compactly in the Narym region of the Ob and were scattered among the Turkic population in the Tomsk region of the Ob. These lands were included into the Russian State in the late 16th–early 17th century after the defeat of the military and political union of the southern (central) Selkups of the Skewbald Horde and building the Narym and Ket forts (1596 and 1602). The Middle Ob (Narym) Selkups were obliged to pay the tribute (Selkupy…, 2011: 6–24; Pelikh, 1981: 8–11; Chindina, 2013: 91–94).

Archaeological studies of the Late Medieval sites in the Narym region of the Ob, carried out by A.P. Dulzon (1953, 1955), L.A. Chindina (1975, 2001, 2004), A.I. Bobrova (2007, 2016), L.M. Pletneva (1990), N.V. Berezovskaya (2010), and Y.I. Ozheredov (1998, 2001) yielded a wide range of iron objects, which have a great value in solving historical and cultural problems of the communities under research. Therefore, it is crucial

to study specific features of ferrous metallurgy and production of iron products in each case.

This article discusses the evidence from the Migalka cemetery located in the Narym part of the Middle Ob region, near the village of Yurty Inkiny, in the Kolpashevsky District of the Tomsk Region. L.A. Chindina investigated this site in 1989–1992. Seventy-four undisturbed burials and about thirty destroyed burials were identified. The complex of items found in the burials consisted of pottery, personal adornments, and household implements. The collection contains the objects not only of local production, but also those made by Russian and foreign artisans, including knives, axes, metal dishware, boots, personal ornaments, various fabrics, elements of horse harness, weaponry, coins from the reign of Tsars Mikhail Fedorovich, Alexei Mikhailovich, and Peter I, as well as counting tokens of the Nuremberg medalists. The site was dated to the last quarter of the 17th–first third of the 18th century (Chindina, 2004).

The Migalka cemetery is interesting for its originality and rich information. A relatively short period of its existence (60–70 years) makes it possible to order the chronology of long-term sites in the region and more reliably reveal the dynamics of historical and cultural processes. The Migalka site manifests the final stage of the Russian colonization of Siberia, which occurred under the influence of Peter I's reforms, which makes it possible to establish the features and forms of cultural adaptation and integration of the Selkup society.

Analysis of knives and axes

This article explores the category of items—knives and axes—which are indicative of the social status and are indispensable to the life support system. Their technological study was carried out using metallographic and X-ray structural analyzes, the results of which have been partially published (Zinyakov, 2002: 142–147, fig. 14).

Knives were the most common finds at the cemetery after pottery and personal ornaments, and consisted of 32 items from 74 graves. They were absent in children's burials (a ban up to 4–5 years of age). All knives were single-edged. The length of the blade varied from 9 to 15–16 cm; their width ranged from 1.5 to 2.7 cm, and thickness reached 0.4 cm. The knives were equipped with wooden, rarely burl handles, oval in cross-section. In eight cases, the wooden base had a metal frame. The handle was mounted on an iron wedge-shaped haft, sometimes with a tang. Two groups with variants can be distinguished according to their morphological features (shape of the blade and tang, specifics of their juncture). In the first group, blades have straight back and blade, converging at acute angle; sometimes, the blade bends smoothly or sharply at the end. The handle is coaxial to the blade. These knives have two ledges in the area of transition to the tang. In the second group, the back of the blade and tang form a single smooth arch. There is one ledge in the area of transition to the tang on the side of strictly straight blade.

Judging by visual morphological features, knives with the "humped" backs go back to the daggers of the Turkic period (Gryaznov, 1956: 101, pl. XXXII, *1*, *12*; Molodin, Sobolev, Soloviev, 1990: 69, fig. 52). The Relka, Odintsovo (Upper Ob), Ulan-Koba, and other warriors of the Early Middle Ages used these knives as daggers in the forest Middle Ob region, forest-steppe Altai, and the Altai Mountains (Gorbunov, 2006: 210, fig. 45, 65; Chindina, 1977: 25, fig. 5, 6). The multifunctionality of "humpbacked" knives provided the warrior with a convenient weapon for hunting in everyday life, and this type became to be used for centuries in the working life of fishermen and hunters in the Middle Ob region.

The seven best-preserved specimens were subjected to metallographic analysis. Two of them had solid wooden handles, and five were additionally equipped with lower hilt plates (bolsters) and pommels made of copper alloys. The bolster of the handle was located at its junction with the blade. The pommel fastened the end of the tang. They tightened all elements attached to the tang, strengthened the wooden parts, and generally ensured reliability of the knife's structure. In addition, the bolster and pommel also had a decorative function. They had a smooth surface, sometimes with edging grooves or braids (Fig. 1, *1*), or were decorated with engraving (Fig. 1, *2*, *3*, *7*) and filigree enamel (Fig. 1, *6*; 2). For obtaining the line of the needed width and depth, an engraving was carried out with different types of cutters. Professional carvers created complete and highly artistic images in the style of volute-like ornamental decor on each facing element of the handle.

One of two knives with frames and handles decorated using the filigree-enamel technique, which were found in the cemetery, was metallographically analyzed. That knife was discovered in burial 69 (see Fig. 1, *6*). The filigree was made by soldering very thin wire twisted in half on the surface of the bolster and pommel. The cells of the artistic composition were filled with colored enamel. Ornamentation consisted of three medallion-ovals against a blue enamel background along the entire ring of the hilt plate and pommel. The ovals are filled with white enamel; a three-petal lily is represented in the center; its side petals are blue; the central petal is yellow. The medallions are separated by a filigree vertical braids with three small circle buds filled with yellow and blue enamel. The composition is completed by two horizontal cord-edges (see Fig. 2). The lid of the pommel is decorated with a filigree pattern in the form of an oval with the eight-petal rosette in the center and two small lilies on its sides. The

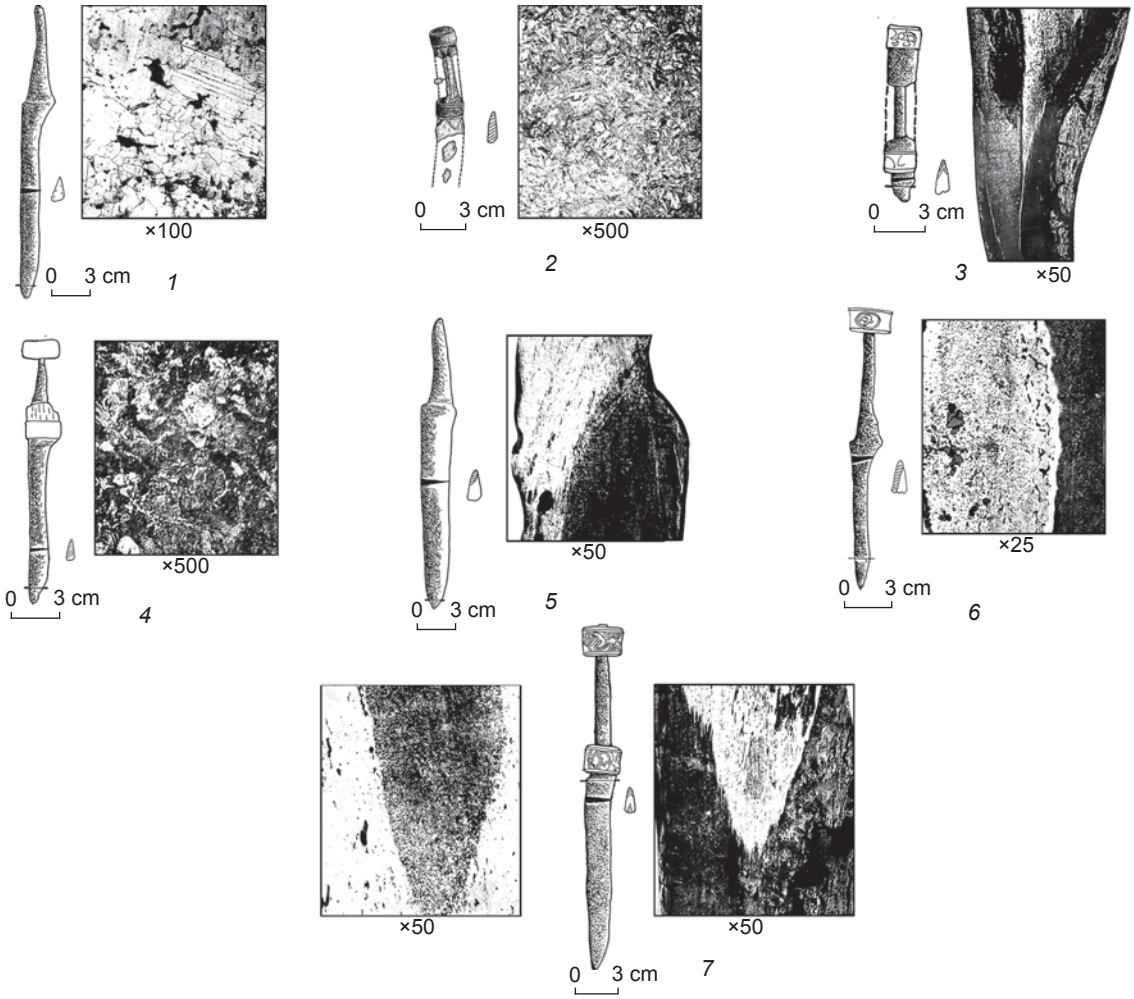

Fig. 1. Knives: technological designs and microstructures.
1 – burial 10, analysis 1368; *2* – burial 9, analysis 1371; *3* – burial 19, analysis 1372; *4* – burial 13, analysis 1378; *5* – burial 48, analysis 1370; *6* – burial 69, analysis 1367; *7* – burial 10, analysis 1369.

enamel on the pattern has been severely crumbled and only a piece of the blue background has survived.

A significant number of items with enamel decoration were found at Migalka, including rings (and seal-rings), *golubtsy* ("dove-like") earrings, as well as the above-mentioned knives. The parallels to these knives occur in the materials from other burial sites of the Middle Ob region, including Mysovskoy site (late 13th–first third of the 18th century) on the same Shudelka River (left tributary of the Ob River) (Chindina, 1986) and Kolymukhta site (17th–20th centuries) (Berezovskaya, 2010) on the anabranch of the same name (on the right bank of the Ob River), near the village of Nazino and the town of Strezhevoy. The exact same knives have been found at the Kiki-Akki cemetery in the Upper Taz area (Poshekhonova et al., 2018). They are not inferior to the Migalka knife in terms of sophistication of their décor, and most importantly, they emphasize a wide geography of prestigious and expensive items similar in manufacturing technology and artistic decoration. According to customs books, in 1668–1670, similar knives cost 2 rubles 10 kopecks (Merzon, Tikhonov, 1960: 424). Notably, parallels to the knives with engraved patterns on the frames have been found at the cemeteries of Balagachevo (Dulzon, 1953) and Bergamak II (Tataurov, Tikhonov, 1996: 74, fig. 7).

Specific aspects of manufacture technology and artistic processing of the Migalka knife indicate that it belongs to the goods imported "from Rus'" to Siberia from the late 17th to 18th centuries (Chindina, 2004). In the period under study, there were a number of urban centers with long traditions in development of the applied art of filigree and enamel in the Russian State. Their products were distinguished by artistic features expressed in a specific composition of ornamentation, typology of motifs, and set of colors. A comparison of the enamel items from Migalka with Russian enamels directly indicates their belonging to the Solvychegodsk and Ustyug schools of filigree-

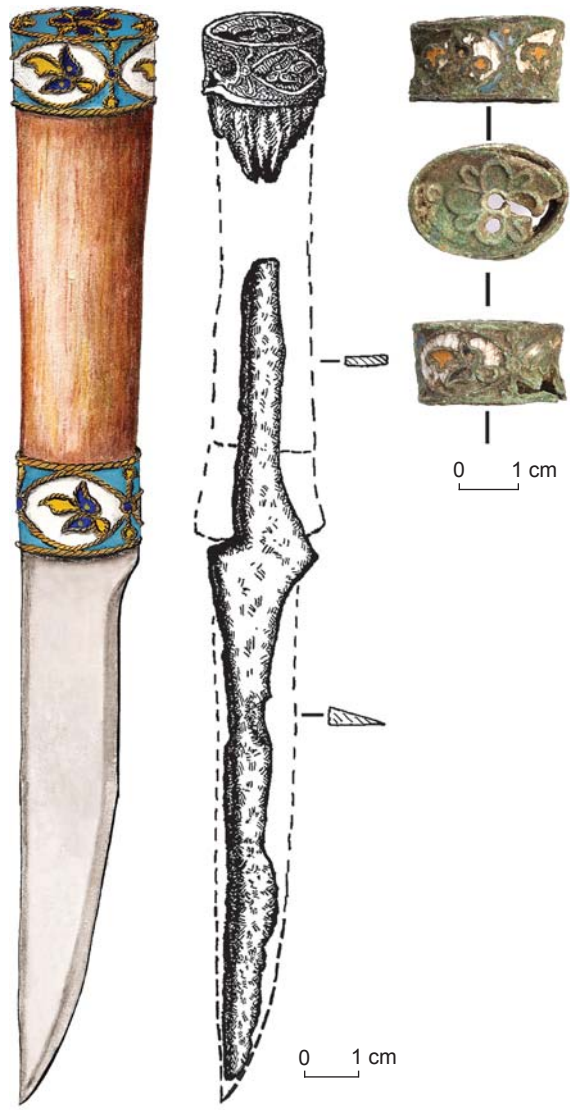

Fig. 2. Remains of a knife with enamel hilt plates from burial 69, and its reconstruction by L.A. Chindina (drawings by E.V. Ryltseva and L.V. Chernaya, photographs by E.V. Barsukov).

makers and enamelers, who typically used a special basic background color (white in Usolye, and blue or light blue is Ustyuzhye) and a variety of colors in the pattern. The palette changed over time: mainly blue, green, and light blue colors appeared in the enamels of the "Usolsk and Ustyug production" in the 16th century, while yellow and yellow-orange, borrowed from the German enamel-makers, became widespread in the 17th century (Postnikova-Loseva, 1959: 581–582; Postnikova-Loseva, Platonova, 1959: 52–54, 57, 59). The central motifs were always emphasized in the composition of the ornamental décor on the Ustyug enamels at the turn of the 17th–18th centuries, and the secondary elements were subjected to the central motif (Mukhin, 1996: 90). The superposition of tiny contrasting dots on the main pattern is also typical of the Northern Russian and Moscow centers of enamel production.

Direct parallels to the knife from burial 69 at the Migalka cemetery are knives from a set of cutlery made by Ustyug craftsmen in the late 17th to first third of the 18th century, which belonged to merchants-entrepreneurs, later barons, the Stroganovs (State Historical Museum funds: OK 730, State Historical Museum, Inv. No. 43945). They are also distinguished by a special shape of the handle and specific technique for decorating its frame, including filigree enamel, lush flower rosettes, lilies, and multicolored enamels on a snow-white background*.

Metallographic analysis of a collection of knives from the Migalka cemetery has revealed the use of two technological patterns: production entirely of steel (3 spec.) (see Fig. 1, *1*, *2*, *4*) and production of welded structures (4 spec.) (see Fig. 1, *3*, *5*–*7*). Raw steel with an uneven distribution of carbon in the metal was used as the raw material for the products of the first technological group in two cases, and high-carbon steel in one case. Quenching was used for hardening (see Fig. 1, *2*, *4*). The microstructure of the hardened metal is structureless martensite, martensite with bainite, and bainite. The microhardness of martensite was 659–713 kgf/mm^2, that of bainite was 356 kgf/mm^2. This group includes knives with the "humped" backs. Notably, such knife-daggers sometimes had expensive cladding (hilt plates) typical of the Russian-made products. This can be explained in two ways: either local craftsmen used Russian décor in manufacturing traditional knives, or Russian craftsmen adopted a new type of products, popular in the local market, continuing to make prestigious and very expensive cladding. It is also curious that the hilt plates from the knives that went out of service were kept: in burial 29 they were placed in a box, while the hilt plates of the knife from the male burial (No. 9) were apparently reused.

Several versions have been observed in the second technological group: 1) side welding of iron and steel with subsequent quenching for martensite and troostite (see Fig. 1, *6*); the microhardness of the metal was 286–509 kgf/mm^2; 2) a V-shaped welding of a steel blade on an iron base, and a similar hardening (see Fig. 1, *3*); 3) a V-shaped welding of a steel blade on a ferrite base combined with the welding of a steel wedge from the side of the blade's back (see Fig. 1, *7*); the finished product was

*The expert assessment of the reconstruction of the Migalka and Mysovskoy knives with filigree and décor, which was made by Chindina, was performed by T.I. Sizova, the Head of the Department of Precious Metals of the State Historical Museum. We are very grateful for her expert advice on enamel art.

quenched in water; the metal microstructure is martensite with troostite (blade) and troostite (back); and 4) slanting welding of a steel blade (see Fig. 1, *5*), followed by hard quenching of the metal to martensite.

Another important group of items from the Migalka cemetery, produced by Russian artisans, are shaft-hole axes. They were indispensable in woodworking (felling trees and hewing timber), and, if necessary, served as military weapons.

Five (of 12) shaft-hole axes have been metallographically examined. According to a well-known classification, they represent types III, IV, and V (Molodin, Sobolev, Soloviev, 1990: 38–43). Axe of type III (1 spec.) is distinguished by a wedge-shaped striking part with a triangular eye. The upper platform of the butt has a protrusion towards the handle. The axe beard is absent. The total length of the striking part is 12 cm; the width of the blade is 10.5 cm (Fig. 3, *4*). Axes of type IV (3 spec.) have a similar striking part. Their only distinctive feature is the presence of a small beard on the butt. The total length of the items is 11.5–13.0 cm; the width of the blades is 7.8–10.7 cm (Fig. 3, *1*, *3*, *5*). Axe of type V (1 spec.) has the shape described above and distinctive beard. The total length of the striking part is 12.5 cm; width of the blade is 10.8 cm (Fig. 3, *2*).

A metallographic study of the thin sections taken from the cross-sections of the blades and one full section of the entire striking part has revealed two technological patterns followed in the production of shaft-hole axes. The first pattern welds a steel blade onto iron base (Fig. 3, *3*, *4*) or low-carbon raw steel (Fig. 3, *2*, *5*); the second pattern forges an entire axe of unevenly carburized metal, structurally representing ferrite and ferrite-pearlite (Fig. 3, *1*). Welding technology was varied: narrow-faced, one-sided slanting lateral, and double-sided lateral (possibly V-shaped). Welded implements had better working properties. For increasing wear resistance, a solid steel blade was forged in a cold state. The heat treatment of the metal (quenching) has been observed as a hardening procedure. The microstructure of the hardened steels is martensite, troostomartensite, and troostite (Fig. 3, *2*, *3*, *5*). Laboratory studies have not revealed any relationship between the types of the axes under consideration and the technology of their production.

The general technological pattern for manufacturing the body of shaft-hole axes in Medieval Rus has been

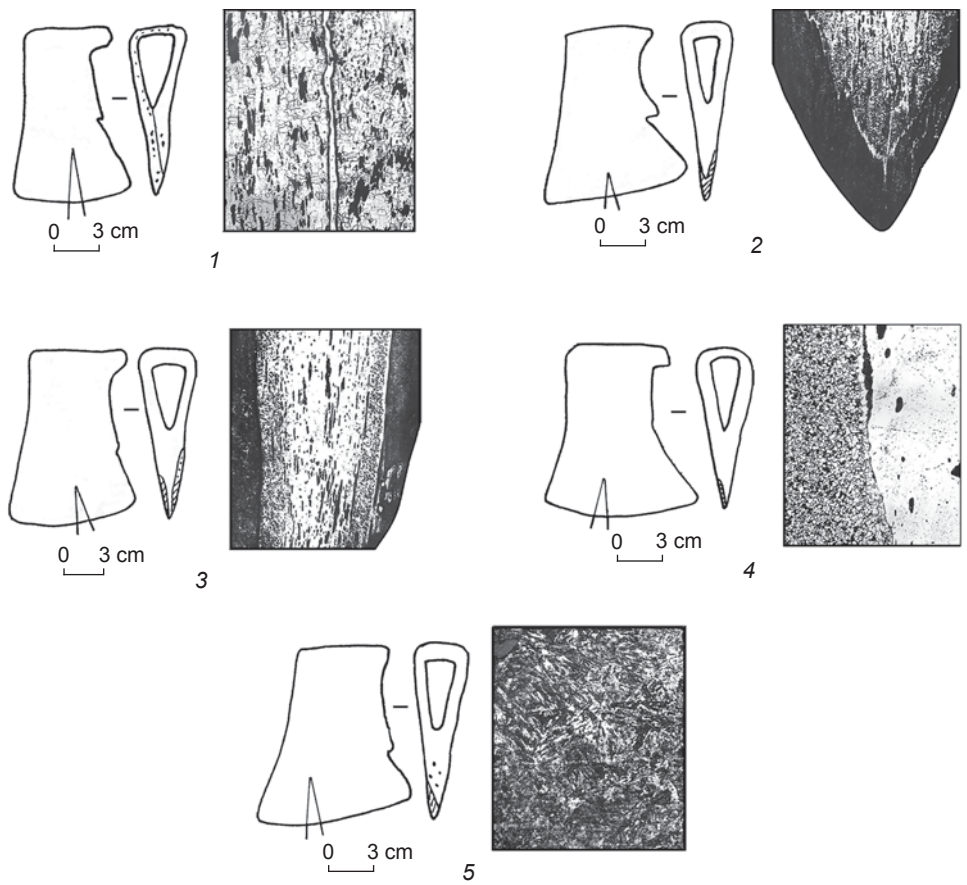

Fig. 3. Axes: technological designs and microstructures (×20).
1 – burial 20, analysis 1365; *2* – burial 9, analysis 1377; *3* – burial 43, analysis 1376; *4*, *5* – space between the burials (analyses 1375 and 1366, respectively).

studied and reconstructed by B.A. Kolchin, using extensive archaeological materials from the 10th–15th centuries (1953: 102–108). Judging from the results of structural analysis, Kolchin identified two technological methods, which are still used in the artisanal production of axes. The first pattern is as follows: a pre-forged strip was bent in the middle on a metal frame to obtain an eyelet and a butt. At the point of contact, strip halves were welded; the blade was expanded and the working edge was processed. The weld is clearly visible in the photograph of the microstructure of the axe (Fig. 3, *1*). The second method of forming the eyelet and butt was to bend one end of the blank in the form of a loop and weld it to the strip at the point of contact. At the other end of the blank, the blade was expanded and the edge was processed (Ibid.: 104). Macro- and microstructural analysis of the Migalka axes indicate that the technological methods for producing the shaft-hole axes described above were used in the 16th–17th centuries.

Metallographic study of the Migalka collection of ferrous metal products made by the Russian artisans makes it possible to conclude that modifications of two technological methods were widely used in their manufacturing. The first method was based on welding techniques, while the second method was based on solid steel processing. A certain pattern can be observed: there were not many more welded knives as compared to solid steel knives, but the vast majority of axes were welded products.

Judging by archaeological evidence, Russian axes were widespread among the Selkups. They were clearly more effective than the previously used socketed adze-axes: their massiveness increased the impact of the tool; the wide blade and the long wedge-shaped striking part improved performance. A vivid expression of the advantages of the mechanical properties shown by the Russian axes is their efficiency. In the same work, it equals 0.71 for axe-adze, and 0.94 for shaft-hole axe of the 15th–18th centuries (Levashova, 1967: 70). Notably, only one adze-axe has been found at Migalka.

Local technology for producing adze-axes and knives is quite simple. Essentially, it consists of methods of metal plastic processing in a hot state. All operations were performed with hand hammers on an anvil. For example, at the Tiskino cemetery (70 km from Migalka), two burials of blacksmiths accompanied by their professional tool-sign (hammer) were found in the same burial mound (Chindina, 1975: Pl. 11, 13). Metallographic analysis of axes from this cemetery has revealed their low quality. For improving the working properties of the tools, the Selkup blacksmiths used hard and soft quenching (Paskal, Fedorishcheva, Chindina, 1983: 114; Zinyakov, 1997: 176–177).

Comparison of the results of metallographic studies into ferrous metal products from the Migalka cemetery and forged iron tools from the European towns of the Russian State (Zavyalov, Rozanova, Terekhova, 2007: 135–147) points to their significant similarity except for the ratio of structural designs. Generally, European Russia is characterized by the predominance of solid metal knives (59%) over welded knives (41%) (Ibid.: 140–142). This discrepancy can be explained. First, the metallographic data on blacksmith production of European Russian towns are averaged, since the initial evidence for research was taken from various regions of the state, while the items from the cemetery under study are associated with towns of only one region—the Russian North. It is known that the main bulk of Russian goods imported into Siberia in the 17th century was from Veliky Ustyug, Ustyuzhna Zhelezopolskaya, Solvychegodsk, etc. (Zinyakov, 2005), where the welding technology had long traditions in its various kinds. Secondly, in exchange transactions with the Selkup population, aimed at obtaining valuable Siberian furs, the Russians used primarily high-quality industrial products.

According to the sources, the flow of Russian goods into the environment of the autochthonous Siberian population was determined by three major factors: collection of the yasak tribute, industrial development of Siberia, and development of the all-Russian market. Yasak was a tax collected from the indigenous population of Siberia from the 17th to early 20th centuries. Until 1763, it was collected exclusively in kind (furs) (L.M. Dameshek, I.L. Dameshek, 1983: 161). A kind of remuneration—the "Tsar's gift" granted for yasak payment—was the means of encouraging voluntary and timely payment of the tribute. The gifts consisted of goods that were in great demand among the Siberian population, such as small fresh-water pearls, copper rings and combs, tin in dishes and plates, copper in basins and cauldrons, iron "in bars" and iron products (axes, knives, "knife iron blanks", and needles) (Bakhrushin, 1927: 22–32). The "Tsar's gift" was an indispensable condition for receiving furs from the indigenous population, which quickly realized its benefits and tried to get it before submitting the yasak tribute. The governors complained: "They do not give the yasak without the Tsar's gift—tin and beads" (Butsinsky, 1999: 26). Therefore, the central government was concerned about supplying Siberian towns with necessary reserves and creating a special "gift treasury", which in the initial period of colonization of Siberia (17th century) was purchased in European Russia or abroad and was sent to the destination. Gifts as a prerequisite for submitting the yasak existed from the 17th to the late 19th century According to the observation of S.V. Bakhrushin, the distribution of gifts for the "yasak payment" looked more like an exchange trade than the fiscal duty (1927: 26).

The second factor that determined the flow of Russian goods into the environment of the indigenous population and their nomenclature, as well as qualitative and

quantitative composition, was the industrial development of Siberia. Research shows that in the late 16th–17th century, the Siberian region was in many respects economically dependent on European Russia with an established commodity artisanal and manufacturing production. The goods were supplied from Moscow, Kazan, and northern towns. Such trading and artisanal centers as Veliky Ustyug and Solvychegodsk played a particularly important role (Vilkov, 1967: 118–119).

Industry in Siberia and more specifically in the Middle Ob region was created in two ways. First, both written and archaeological evidence testify to a greater demand in the search for local raw material sources. One may confidently speak about specialized metallurgical sites based on siderite deposits in the interfluve of the Ob and Lower Tom Rivers (Shelomokskoye, Kizhirovskoye) (Pletneva, 1990: 102–109; Maloletko et al., 1983) and a number of sites on the Tagan River (Shaitansky, Mogilnitsky, Kireevsky). In the 17th century, this area became a part of Temerchinskaya Volost of Tomsk Uyezd, named after the ethnonym "Temertsi-yon" ("blacksmith-people"), which indicates this specific way of life of the local population (Barsukov, 2010: 13–16; 2015: 86–89; Konovalenko et al., 2010: 196–200). Archaeological evidence on the development of metallurgy and production of iron products in the Shaitansky microdistrict are not chronologically differentiated, however, scholars still distinguish the Late Medieval period (Barsukov, 2010: 13–16).

Second, the intentional training of professional personnel was carried out by relocating skilled artisans from the most developed urban centers of European Russia. In addition to blacksmiths, who possessed the sophisticated technical skills of processing iron and steel, representatives of the old-time servicemen were engaged in blacksmithing, and local craftsmen learned new technologies.

As a result, by the end of the 17th century, western Siberian towns increasingly acquired the features of trade and artisanal centers, and by the second quarter of the 18th century, some of them (Tobolsk and Tomsk) had already passed a significant path of development (Nikitin, 1983). According to archaeological and written sources, the processes of metallurgy and metalworking have been most clearly revealed using the example of Tomsk (Chernaya, 2015: 128–139). In addition to urban artisans, blacksmiths from the settlements on the vast territory of the Narym-Tomsk region of the Ob were also involved in the production of iron products using simple methods of forging and welding iron and steel (Zinyakov, 1997: 179).

The third factor that determined the turnover of Russian industrial goods in Siberia was the development of the all-Russian market, which started to emerge in the late 17th century. After Siberia had become a part of the Moscow State, trade in imported "Russian" goods in exchange for furs developed there. The demand for these goods fostered the engagement of the region into an emerging all-Russian market. Until the late 17th century, "goods from Rus'" occupied a dominant position in local trade. By the early 18th century, the supply volumes dropped sharply due to the emergence of Siberian industry (Vilkov, 1967: 86–87, pl. 10). The range of market goods consisted of several hundred items; the most important of which were the products made of ferrous and non-ferrous metals, glass, and various fabrics, which is vividly demonstrated by the evidence from archaeological sites (Chernaya, 2016: 47–48). The Migalka cemetery stands out for its large range of Russian goods.

Conclusions

The results of analysis into category of iron objects in the system of burial rites at the Migalka cemetery unambiguously indicate important social points. The presence of extremely expensive knives with enamel, including those appearing in women's burials, emphasized the high social and property status of those buried in them. The presence of axes only in male burials, in addition to the economic aspect, clearly marks gender specificity.

The study of ferrous household objects belonging to the Selkup population from the 17th–early 18th centuries shows the presence of a significant number of products made by the Russian artisans among them. Metallographic analysis of forged iron tools indicates that they were made according to the technological traditions of Russian ironworking and for the most part had high performance capacities. In general, imported Russian and foreign artisanal and manufactured goods which widely appear at the Migalka cemetery and other indigenous archaeological sites testify to the accelerated process of the engagement of the Middle Ob Selkups into commodity-money relations, their entry into all-Russian market, and the adoption of new values and standards of interaction between the two cultures.

Acknowledgments

This study was supported by the Competitiveness Improvement Program of Tomsk State University.

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Received January 24, 2020.
Received in revised form January 27, 2020.

DOI: 10.17746/1563-0110.2020.48.3.099-106

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A Yakut Composite Bow from the Toybokhoy Museum

We give the first description of an unusual composite bow of the Central Asian type, owned by the Toybokhoy Museum in the Suntarsky District of Yakutia, and provide information about its discovery. We focus on the details and structural peculiarities of the specimen, and note that this reflex composite bow differs in terms of construction and technology from those of the Northern type used by the Yakuts in the 17th to 19th centuries. It resembles bows of the Central Asian type. Its distinctive features are eight horn and bone frontal plates, four end-plates, and four long edging-plates made of bone. According to folkloric sources and 17th century archival documents, before the Russians migrated to the Lena Territory, the Yakuts had used bone combat bows of the Central Asian type. We cite an archaeological fact demonstrating the use of such bows in Yakutia—a central plate from a composite bow with widening paddle-shaped ends from the mid-15th to early 16th century burial at Sergelyakh. We publish the results of the radiocarbon analysis of the horn plate from the Toybokhoy bow, carried out at the Center for Isotope Research at the University of Groningen. They support the legendary version: the Toybokhoy bow belonged to the brother of the Yakut ruler Tygyn Darkhan, Ala Kyrsyn, who lived in the early 17th century and became the founder of one of the Vilyuy Yakut clans. We conclude that alongside the Northern type bows, the late medieval Yakuts used reflex bows of the Central Asian type.

Keywords: *Yakuts, bows, Central Asian type, composite bows, bone, horn, bow plates, birch-bark, Toybokhoy.*

Introduction

The bow was most likely invented not later than the terminal Paleolithic. This hypothesis is supported by the wooden arrow-shafts and arrowheads found in Germany and dated to the early 9th millennium BC (McEwen, Miller, Bergman, 1991). This type of weapon was used in hunting and battles. In the Late Neolithic, composite bows appeared, with their elements made of various materials. For almost ten thousand years, before the wide distribution of firearms, bows were the main weapons of many peoples of the world for long-range combat. During the medieval period, the bow became a real piece of engineering art. Its manufacture required knowledge of arrow-flight patterns, which today are explained by the laws of physics, mathematics, and ballistics, as well as of the properties of various materials, their combination and resistance, and also certain skills. The bow manufacturing techniques were developed on the basis of personal experience and also the borrowing of various innovations from populations of other regions.

In the 17th to 19th centuries, the Yakuts widely used composite bows of the northern type. The construction of these bows and their manufacturing technique are described in the works by E.D. Strelov (1927), I.V. Konstantinov (1971), Y.B. Simchenko (1976), and F.F. Vasiliev (1995). A.P. Okladnikov argued that the Yakut composite bow "belongs not to the steppe group of bows, but to another group, which should be named the hyperborean or northern group, according to the area of

Archaeology, Ethnology & Anthropology of Eurasia 48/3 (2020) 99–106 E-mail: Eurasia@archaeology.nsc.ru

its distribution" (1955: 285). The folklore and epic stories, as well as ethnographic materials, provide evidence on the use by the Yakuts of composite bows of the Central Asian type (bows made of bone (*muos okh saa*, *kuraakh saa*)), alongside the northern bows. These bows differed from the Tungus ones by their construction (which was similar to the bows of Xiongnu and Mongol types) and the presence of the end horn-inserts and the middle bone-plate (Tokarev, 1945: 82; Ivanov, 1966: 70; Gogolev, 1990: 101–102; Vasiliev, 1995: 64–65). In this article, we present a description of a bow of this type owned by one of the museums in Yakutia.

The history of the bow's discovery, its description, and the research method

In 2014, among the exhibits of the Bessonov Republic History and Local Lore Museum in Toybokhoy, the authors discovered a unique composite bow of the Central Asian type, with central frontal and several limb horn-plates; central and end-plates; and also edging-plates made of bone (Fig. 1). In the museum, this item is recorded as "an ancient Yakut bow (horn)", its size is 120.5 × 3.5 cm; materials: wood, bone, and birch-bark. According to the museum's records, the bow was donated by the pupils of the Kutana School in the Suntarsky District of the Yakut ASSR on January 25, 1937.

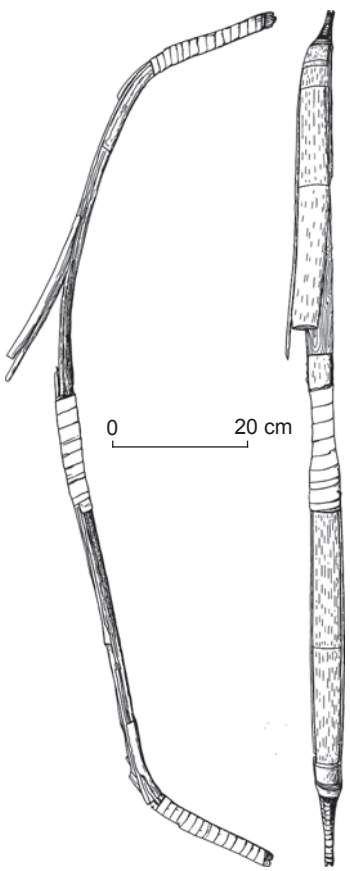

Fig. 1. Toybokhoy composite bow.

Some information about the bow's discovery was provided by N.N. Martynov, the local lore expert. He visited the Toybokhoy Museum in 1967 and became acquainted with its Director, G.E. Bessonov, who told him that the bow belonged to Ala Kyrsyn, an ancestor of the Khochinsky Yakut clan. The bow was passed to blood relatives, until one of them decided to take it to the afterworld upon his death. The ritual construction over Ala Kyrsyn's grave "was until recently situated on the shore of the island in Lake Toybokhoy. This was a hexagonal cribwork, with walls each 3 m long, and as high as a two-storey building. The six-slope roof was topped with a small bulbous dome that was coated with copper plates cut of the old cauldrons. Such constructions over the tombs were widespread among the Yakuts in the 19th to early 20th centuries. The old residents narrated that the bow-owner wanted to divide the bow into two parts, and began to take the upper layer of birch-bark away. Under the birch-bark, there was a horn plate, and he did not dare to break it. Therefore, instead of being placed into the grave, the bow was put in the cellar, where [it] was found by the pupils…"*.

Ala Kyrsyn was a real historical person, a hero of oral legends and stories of the Vilyuy Yakuts. His son, Byulyusyut Kyrsynov, was mentioned among other persons in the Russian records of the 17th century, in connection with the case of Baltuga Timireev, a leader of Yakut rebellion against the tax collectors in 1675–1676 (Petrov, 2017: 99). Ala Kyrsyn was a son of a Tumat woman called Dzhaardaakh (in other versions – Dzhaarkhan), a foremother of the Vilyuy Yakuts, and a Kangalass toyon called Munnyan, a father of the Yakut "king" Tygyn (in other versions – Tygyn himself) (Ksenofontov, 1977: 206; 1992: 67–68).

How did the bow emerge in the school of Kutana? In 1936, a museum of local lore was established in the village of Kutana. It was founded by the teacher and local lore expert N.I. Ivanov. With a group of pupils, he carried out many trips all over the region in search of exhibits for the museum. Ivanov was a friend of G.I. Bessonov's; and quite likely, at the opening ceremony of Toybokhoy museum, he presented the discovered bow to him as a gift.

The Toybokhoy reflex composite bow is similar in its shape to Central Asian bows. Its distinctive features are four long bone plates at the edges, eight horn and bone frontal plates, and four bone end-plates with bow-string notches (Fig. 2). The bow's tips and the area near the grip are wrapped with birch-bark, and the outward surface of the core limbs is glued over with birch-bark.

*R.I. Bravina's personal archive.

In order to specify the shapes and lengths of the plates, as well as to identify any damage and other peculiarities of the elements*, X-ray and tomographic images of the bow in various positions were made. Special studies were aimed at identifying the bow's materials and its time of manufacture (radiocarbon dating).

The bow was found unstrung, with the bowstring missing; the bow-ends were directed forwards (away from the archer), similarly to other reflex bows of this type with the reverse curvature of the core in the unstrung position (Ermolov, 1987: 151). Such bows are also designated as recurve (Apresov, 2008). The "bone" coat on one of the bow's limbs was damaged, possibly intentionally; in the damaged area, part of the edging was missing, horn and bone plates and edging had become partially unglued from the wooden base, and the bow's limbs had become asymmetrical. On the other limb, close to the bow's end, there was more damage, resulting in an unstuck bone plate and broken bone edging.

The distance between the bow's ends is 121 cm; however, with the unstuck elements fixed to each other and to the base, this distance is about 126 cm. The bow's core is 151 cm long along the outside and 146 cm along the inside (facing the archer). The exact length of the bow when strung is unknown. The width of the bow's limbs (in the operating position) is 3.5–3.6 cm, thickness (in the position "the bow lying on its side") 1.6–1.7 cm; the grip is 1.9–2.0 cm wide and 2.9 cm thick; the base of the bow-ends is 2.9 cm wide and 1.9–2.1 cm thick, the narrow ends of the bow tips are 1.0–1.2 cm wide and 1.9–2.0 cm thick. Narrow wooden planks, elongated-triangular in shape, are stuck to the bow-ends from the inside; they are 9.2 and 7.2 cm long and 1.0 and 0.8 cm wide, respectively. These planks form steps of a sort, which probably served as supports for the string knots. In this area, the bow-ends are 2.6 cm thick each.

The bow's core was made of two sorts of wood, most likely larch and birch. Both wooden layers near the central plate, where both layers are visible, are 0.8–0.9 cm thick. The tomographic image clearly shows the two layers: one is dark, and the other is light, which indicates their different density (Fig. 3). The birch plank is shorter than the larch one; it is thin at the bow's ends. In the upper part of the bow, the birch plank is spaced 8.3 cm from the end tips, in the lower part 10 cm. Judging by the CT image, the birch and larch planks are solid; they are glued together and fixed to one another with a wooden dowel fastened in the larch plank.

The bow's ends are rigid and straight, each is covered with two bone end-plates with string notches at the narrow faces; the plates are stuck to the larch base of the bow; the ends of the larch base are perpendicular to the plane of the limb, as in a propeller. The plates on the lower end of the bow are 14.9 and 15.2 cm long and 0.6–1.6 cm wide; the plates on the upper end of the bow are of the same length of 15.3 cm and 0.8–1.7 cm wide. It is visible on the image that the left upper plate is broken in the middle into two fragments 6.9 and 8.5 cm long; in the middle of its outer edge, there is a notch about 3 cm long and up to 0.4 cm deep (Fig. 4). The plates on the narrow faces, close to the string notches, are about 0.3 cm thick. The plates are identical to the end-inserts of the Yakut bows of the Northern type reported from the sites of the Kulun-Atakh culture of the 14th–16th centuries and the Yakut culture of the 17th–19th centuries (Gogolev, 1990: 135, 141, 142, pl. X, *10*; XVI, *7*; XX, *10*). On the Toybokhoy bow, the bone end-plates were wrapped over with sinews, and then carefully in a spiral with the birch-bark band. The birch-bark winding on the upper bow end is 20.5 cm long; that on the lower one is 17.5 cm long. There is birch-bark binding on the bow's grip too; this served to cover the joints between the medial

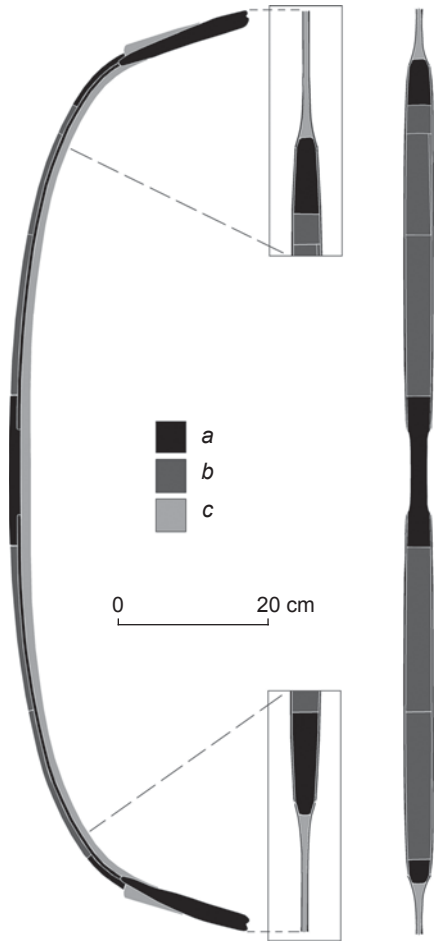

Fig. 2. Diagram of bow construction.
a – bone; *b* – horn; *c* – wood.

*Analyses were carried out in the Suntar Central Regional Hospital and in the X-ray Computer Tomography Department of the Republic Hospital No. 2. Scanning was executed with the CT Toshiba Aquilion 64.

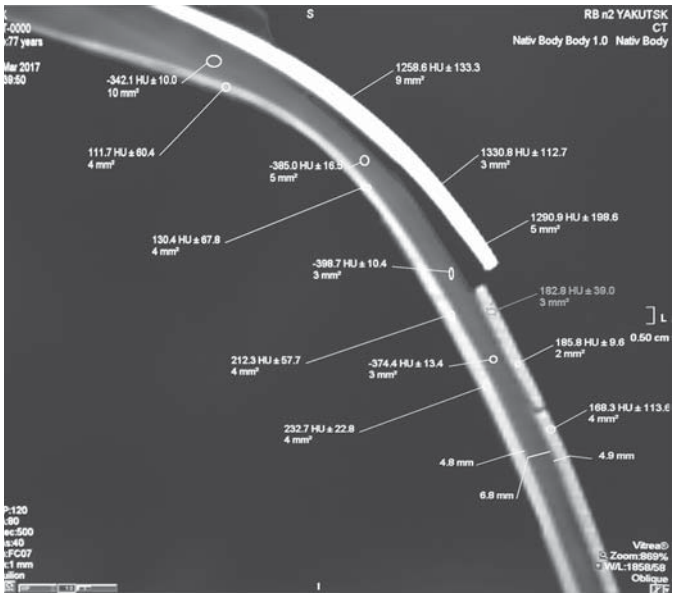

Fig. 3. CT image of the bow-fragment.

Fig. 4. X-ray images of the bow-ends.

and limb-plates. Because one of the limbs is split, the birch binding is probably preserved only partially. The preserved part is 16.3 cm long.

The inward surface of the bow was tightly glued over with horn and bone frontal plates of various shapes and sizes. In total, there are eight frontal plates, one of which is composed of two parts (see Fig. 2). The rigid bone plates are fixed on the grip and bow-ends, the flexible horn plates are on the limbs.

Subrectangular bone plates with curved profiles are glued over both the curved ends, close to the main core of the bow. The upper plate is longer than the lower one; it is narrowed wedge-like in front and side views. The plate is 17.5 cm long on the straight, and 18.5 cm long in an arc. The plate's width is 2.3 cm at the base; 2.1 cm in the middle, at the place where narrowing starts; 0.4 cm at the narrow end; and its thickness varies in the range of 0.1–0.5 cm. The lower plate is shorter and does not show wedge-like narrowing in the side view. It is 9.6 cm long on the straight, 9.8 cm long in an arc; its width is 1.8–2.5 cm; thickness is 0.4–0.6 cm.

The medial frontal plate, semi-oval in cross-section, has widening paddle-shaped ends (Fig. 5). It is made of bone. The plate is 17.3 cm long, 1.7 cm wide in the middle, and 2.3 cm wide at the ends. Narrowing in its medial part starts 3.3 cm from both plate-ends. The plate is 1 cm thick in the medial part, and 0.7 cm thick at the ends.

All the limb-plates were made of cow horn (Fig. 6). In bows of this type, such plates secured elasticity of compression. Three plates (one of which is composite) are glued over one of the limbs; two long plates are on the other. The shortest plate, fixed close to the bow end, is 4.1 cm long and 2.6–2.8 cm wide. The plate in the middle of the limb is 16.1 cm long and 2.8–2.9 cm wide. This plate consists of two parts closely fitted to one another. One of these parts is narrow, 0.05–0.4 cm wide; it is attached to the main plate of 2.4–2.85 cm wide. The third limb-plate, fixed close to the bow's grip, is 20.8 cm long and 2.2–2.9 cm wide. A sample 1.2 cm long was cut off this plate for the radiocarbon analysis.

The plate fixed close to the grip on the opposite limb is 21.5 cm long and 2.5–2.9 cm wide; the second plate located close to the bow end is 18.5 cm long and 1.6 (2.4)–2.9 cm wide. One edge of this plate is damaged, and one of the corners is missing. The tomographic images show that the limb-plates were 0.3–0.7 cm thick and had D-shaped cross-sections.

The plates are fixed to the wooden base with thick fibrous glue; glue remains are visible in the area where the curved plate partially unglued from the bow core (Fig. 7). The glue's fibers are dark gray, almost black. According to the available literary sources, the glue was made of the air-bladders of sturgeon or other fish (see, e.g., (Vasiliev, 1995: 69)), but its manufacturing technology is not known for certain.

The outer surface of the bow core is covered with sheets of birch-bark with a double-line motif carved lengthwise (Fig. 8). In the area close to the grip, the motif also shows four slanting dashes connecting the long lines; 15 such slanting dashes are visible on both sides of the bow core. The other bow-limb shows two more lines (the birch-bark is damaged here). In the top part of the core, near the bow end, a piece of reddish birch-bark 10.9 cm long is glued over; further, closer to the grip, there is a piece of yellowish-white birch-bark 35 cm long; in the area from the grip to the lower

Fig. 5. X-ray image of the middle frontal plate.

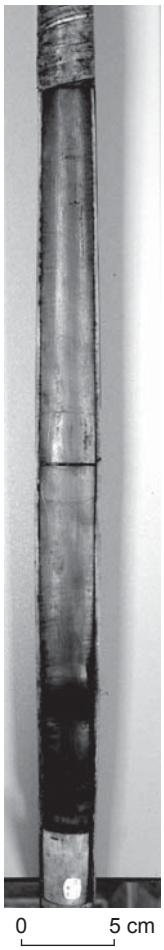

Fig. 6. Horn limb-plates.

Fig. 7. Traces of gluing agent in the area of the bone-plate exfoliation from the wooden core.

Fig. 8. Birch-bark cover on the bow.

bow-end, a piece of yellowish birch-bark 31.1 cm long; and immediately near the bow-end, a piece of birch-bark of ocher-reddish color 11.6 cm long.

The well-polished edgings made of long bones ca 0.4–0.7 cm wide were attached to the lateral bow-surface, in the area from the narrowing part of the medial paddle-shaped plate to the bow-ends, directly against the end side-plates. These plates were apparently decorative. The joining areas of horn edging-plates show fractures and breakages; one fragment is missing. The edging-plates of the lower limb are 51.2 and 51.4 cm long; the intact edging-plate of the upper limb is 53.7 cm long. The complete parallels of such bows with bone edging-plates are not known to the present authors.

Discussion of results

Available museum exhibits and archaeological materials indicate that the Yakut composite bows of the Northern type were most often made of wood. Bone and horn were sometimes used in manufacturing end-inserts, with the string notch on the cut end of the plate rather than on the side. Such inserts were put into the splits on the bow-ends, and tightly wrapped around with sinews and birch-bark (Okladnikov, 1955: 285; Konstantinov, 1971: 112; Gogolev, 1990: 101, 135, 141, 142, 155, pl. X, *10*; XVI, *7*; XVII, *10*; XXX, *3*; Vasiliev, 1995: 63, 67, pl. 2, *6*). The details were glued together with isinglass, additionally wrapped around with sinews, and then with birch-bark to protect the bow from moisture and other external impacts. The distinct feature of the Yakut composite bows is that the inward (facing the archer) bow-plank is normally made of larch; while the outward plank is made of birch. It is believed that larch has the highest compressive strength, while birch has the highest tensile and tearing strength coefficient. The inward (larch) part was composed of several plates. In some cases, the outward (birch) detail was also made composite, to increase the elastic limit of the bow (Strelov, 1927: 66–67). The larch planks were cut

only of heartwood of proper age, growing in the proper place (Vasiliev, 1995: 63).

The folklore sources hold that prior to the arrival of Russians in Yakutia in the 17th century, Yakuts used combat bows of the Yakut type, with reinforcing bone plates. The Yakut epic poem Olonkho describes a "rattling bone bow" (Ibid.: 64–65). The Yakut bone bows are also mentioned in various written sources of the 17th century (see, e.g., (Ivanov, 1966: 70)). The records dating to 1672–1673 report the "Yakut bow for shooting", which was distinct from the Tungus bow (see (Tokarev, 1945: 82)).

According to information from Northern Yakuts, in older times, there were various techniques of shooting with the composite bows. With the Russian intrusion, weapons, including bone bows, were no longer produced; over time, the technology of bow-manufacture was lost (Yakut Scientific Center SB RAS. F. 4, Inv. 12, Item 41, fol. 226).

Probably, it was the harsh climate that forced the Yakuts to abandon the manufacture of Central Asian-type bows. At temperatures of –50 to –40 °C, the elasticity of sinews and horn decreased, and the bow was getting too tight (possibly because of that, the Yakuts waged war only in the fall). The Yakut ancestors that had arrived in the Lena Territory borrowed their bow construction from the local tribes. There is information that bows of both types were used in the late medieval period by a single population group in the Middle Yenisey (Skobelev, Mitko, 2001).

In 1939, the ethnographer A.A. Savvin recorded interviews with the Verkhoyansk residents; they narrated that in former times, additional horn plate was stuck to the bow's back (Yakut Scientific Center SB RAS. F. 4, Inv. 12, Item 3, fol. 36). His field records from 1940 contain sketches of bows resembling the Central Asian ones in the curvature of the bow's core. One of the bows belonged to a forefather of I.N. Nikulin, a resident of the Abyisky District. His ancestor Khobolookh arrived in the Upper Yana River from Central Yakutia during the Kyrgys period (the legendary time of military conflicts between the Yakut tribes in the 14th to 16th centuries). According to the legend, this person was a warrior and wore an armor *kuyakh*, which he sank in the forest lake. Savvin described the bow as follows: on the bow's limbs, in the area of contact of the string and the wood, patches of one-finger thick and two-finger wide cow skin (*dapsy*) were glued, in order to soften the strong impact of the string over the bow's core upon shooting. The string was made from a horse skin, which was not soaked, but coated with warm blood, twisted, and dried. From outside, the bow was wrapped around with the horse's spinal tendons, because it was believed that they did not harden at low temperatures. Then, to protect the bow from moisture, a layer of birch-bark was glued over the bow. The isinglass was boiled from a sturgeon's air-bladder. A bow of this type had a great striking force. I.N. Nikulin's elder brother broke an elk femur with an arrow shot from this bow (Ibid.: Item 41, fol. 223–224).

The evidence of the use of such bows in Yakutia was obtained in 2013, when the Sergelyakh burial of a warrior, dating to the mid-15th to early 16th century, was discovered, yielding horse harness items, a *palma* spear-head, and iron arrowheads, as well as four bone plates from a composite bow of the Central Asian type (Bravina et al., 2016). The middle plate with widening paddle-shaped ends of such bows is composite. The reverse sides of the plates show lengthwise grooves securing strong gluing on the wooden core. The obverse side is ground with a rather hard abrader leaving slanting scratches. The total length of both plates is 23.2 cm, the longer plate is 17.2 cm, the shorter is 6 cm long. The width in the middle is 2 cm, and at the ends 3.5 cm. The middle part of the plate is 0.7 cm thick.

One of the bone limb-plates is subrectangular, slightly widening to the ends, with a slightly convex cross-section. Its obverse side shows slanting scratches. The reverse side bears numerous lengthwise grooves, securing strong gluing on the wooden core. The plate is 7.8 cm long and 3.4–3.7 cm wide (Ibid.). The other bone limb-plate (?) is made of the rib of a large mammal. In fact, it is a rib-fragment fractured at two points. The edges are uneven and unworked. The plate is 7.8 cm long and 3.4 cm wide (Ibid.). This artifact is probably not a part of the bow, but it was located close to the two other plates, and its size was the same as that of the limb-plate described above.

The finds from the Sergelyakh burial are the first archaeological items attesting to the existence in Yakutia of composite bows of the Central Asian type along with the Northern type bows. The composite bows with plates similar to those of Sergelyakh were widespread among the nomads of Central Asia and Siberia from the late antiquity to early medieval period (Hudiakov, 1991: 25–27, 51, 99–104; 1997: 28–29, 60–64, 79–80, 121–123; Klyashtorny, Savinov, 2005: 187; and others). Such bows were used by the Ust-Talkino culture people in the Southern Angara region and the Upper Lena region in the 12th to 14th centuries; this population is considered to be ancestral to the Yakuts (Nikolaev, 2004: 82, 160).

It is difficult to assess the effectiveness and fighting qualities of the Toybokhoy bows; but there is information concerning the Mongolian bows of the same origin and similar construction. The draw weight of Mongolian bows ranged from 46 to 75 kg, which was higher than that of the English, Hungarian, or Chinese bows with a draw of 32–46 kg. The Mongolian one had great power, which could be increased by means of additional bone plates on the bow's limbs. Furthermore, the Mongolian bow was distinguished by its greater flexibility; its string could be drawn further, and produced a greater impulse on the arrow (Nefedov, 2010: 141–142). Reflex bows had

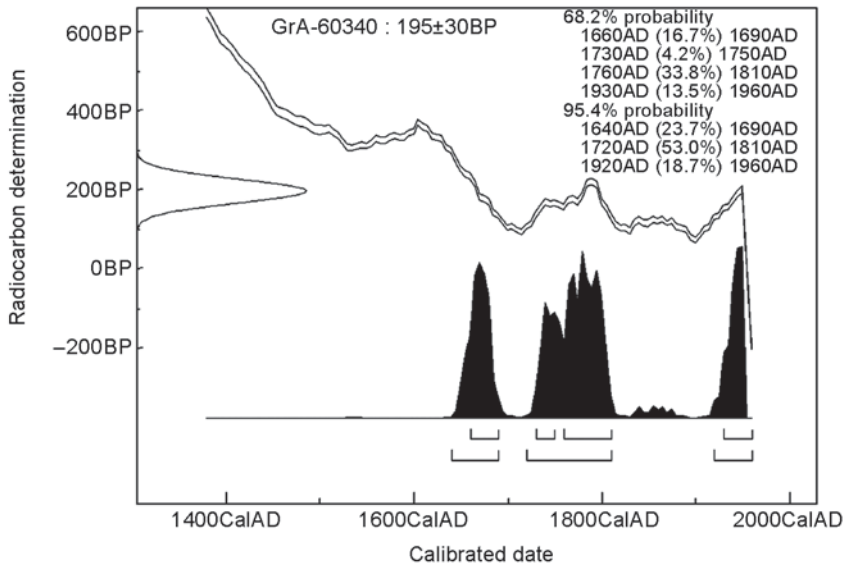

Fig. 9. Results of radiocarbon dating.

pre-tension even unstrung; therefore, these bows resisted tension from the very first millimeters, forming a high and relatively flat (with even force) dynamic curve. This quality, along with elasticity of the horn plates, ensured high accuracy and long range (Apresov, 2008).

The AMS radiocarbon date of 195 ± 30 years BP (GrA-60340) was obtained from a sample of the horn plate of the Toybokhoy bow at the Center for Isotope Research of the University of Groningen (Netherlands). The calibrated date (±2σ, probability 95.4 %)* falls in the range of 1640–1960; the diagram (Fig. 9) shows three peaks within this interval: 1640–1690 (23.7 %); 1720–1810 (53 %); and 1920–1960 (18.7 %). Given that the bow was passed from the first owner to his heirs (from generation to generation), the most likely time the bow was manufactured can be considered the period of 1640–1690. The two other peaks possibly indicate later contaminations of the sample with extraneous organics. Thus, the calibration of the radiocarbon date shows that the bow was manufactured most likely in the mid-17th century. This agrees with the legend that it belonged to Ala Kyrsyn, a brother of the Yakut ruler Tygyn Darkhan.

Conclusions

The Yakut traditional material and spiritual culture was formed in the late medieval period along with the formation of the Yakut ethnic group in Central Yakutia on the basis of intermixture with the cultures of local and foreign ethnic groups. The ethnocultural relations between the ancestors of the Yakuts and the Turko-Mongolic tribes from the Great Steppe are confirmed by both folklore data and the results of archaeological, anthropological, ethnological, and linguistic studies. In the process of adaptation to the harsh climatic conditions of the Lena Territory, the newcomers continued the practice of their pastoral culture and extended the Turkic culture of their southern ancestors far to the north. The Yakuts borrowed many components of the material culture from indigenous tribes. These included hunting tools and weaponry, such as bows of the Northern type, which proved their effectiveness in the Arctic and Sub-Arctic zones, and were used by the local tribes throughout the centuries (Simchenko, 1976). However, the late medieval Yakuts also used other types of weapons, inherited from their steppe ancestors. The composite bows from the Toybokhoy Museum and Sergelyakh burial attest to the fact that the Yakuts used reflex composite bows of the Central Asian type alongside the widespread northern type bows.

*Calibration was carried out using the OxCal 3.10 program, developed at Oxford University (Great Britain).

Acknowledgements

The authors are grateful to the staff of the Bessonov Republic History and Local Lore Museum in Toybokhoy, Suntarsky District, and personally to A.E. Evseev for the opportunity to carry out the comprehensive studies of the bow; to the members of the X-ray Laboratory at the Suntar Central Regional Hospital and the X-ray CT Department at the Republic Hospital No. 2 for executing the relevant analyses; and to F.I. Markov, the bone-carving artist, the Honored Artist of Russia, and the Peoples Artist of Republic of Sakha (Yakutia), for identification of the material of the Toybokhoy bow.

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Received March 11, 2020.
Received in revised form March 30, 2020.

DOI: 10.17746/1563-0110.2020.48.3.107-116

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An Eastern Tibetan Tool for Managing Draught Cattle

This study, based on a trip to the Yushu Tibetan Autonomous Region of Qinghai Province, China in August 2018, focuses on the tradition of using wooden nose-rings for managing draught yaks and yak-cow hybrids, still practiced in Tibet. The materials and technology for manufacturing this tool are described, and measurements are provided. I describe variants of the traditional yoke and plow (ard) system used in conjunction with a nose-ring and identify several variants of nose-ring, distinguished by the style of terminus. I investigate seasonality of use, method of piercing, age of animals at piercing, techniques for managing single animals and draught teams, as well as nose-ring durability and advantages of wooden vs. rope forms. Based on a comprehensive comparative historical analysis of materials from Yushu, I suggest that Tibetan ancestors, who had moved there from the northeast in the second half of the 1st millennium BC, introduced wooden nose-ring technology.

Keywords: *Wooden nose-rings, yoke, ard, yak, ox, Tibet, Kham.*

Introduction

According to the archaeological record of southern Siberia, the oldest type of tool for managing cattle in the east of the Eurasian steppe belt was a wooden loop or nose-ring, with a rope inserted into the animal's nose. This technology was first recorded in the rock art of the Okunev culture of the middle 3rd to early 2nd millennium BC in the Minusinsk Basin, and subsequently spread further east and south. At present, the use of this technology continues only on the periphery of its former distribution, including areas of the Korean Peninsula and the Tibetan Plateau (Esin, 2018). This tradition is most widespread and best preserved in Tibet, where it is still part of a traditional culture. Ethnographic study of this tradition makes it possible to find out a number of aspects of the manufacture and use of this tool that are not available for research through archaeological materials. In Tibet, a wooden nose-ring is used to manage both domestic yak (*Bos grunniens*), as well as a yak-cow hybrid (*Bos taurus taurus*), known as *dzo* in the local language. The normal function of the loop is to control the animal while riding, transporting goods in packs, and cultivating fields. Owing to the peculiarities of the topography, wheeled transport in Tibet never become widespread, although there is ethnographic evidence of the use of two-wheeled carts (Tsybikov, 1918: 173). Unfortunately, there is very little available information about the use of nose-rings for managing cattle, which played a crucial role in the history of harnessed transport in Eurasia. Only isolated references to the use of such wooden loops can be found in the ethnographic literature (Przhevalsky, 1883: 256; Kaznakov, 1907: 65; Furer-Haimendorf, 1983: 78; Himalayan Buddhist Villages…, 1994: 108).

The purpose of this research is to perform a detailed study of the fabrication and use of wooden nose-loops in the east of the Tibetan Plateau. Results presented here are derived from an expedition to the Yushu-Tibetan Autonomous Region, located in the south of the

Archaeology, Ethnology & Anthropology of Eurasia 48/3 (2020) 107–116 E-mail: Eurasia@archaeology.nsc.ru

Qinghai province of China, in August 2018. Data were collected in two areas in the northeast and southwest of this region: in the valleys of the Drichu River འབྲི་ཆུ (Chinese 'Tongtian River' 通天河, headwaters of the Yangtze River; Chindu County 称多), and the valley of Dzachu River རྫ་ཆུ (Chinese 'Lancang River' 澜沧江, headwaters of the Mekong River; Zadoi County 杂多). In the traditional geography of Tibet, these areas belong to the Kham region of the eastern Tibetan Plateau. Their indigenous population speaks the Kham Tibetan language. A comprehensive description of this part of Tibet was carried out by an expedition of the Russian Geographical Society, under the leadership of P.K. Kozlov (1906), which took place in the second half of 1900 and early 1901 (Fig. 1).

Ethnographic study of tools for managing draught cattle and harnesses was accompanied by a detailed study of rock art in the region. This included meetings with individual informants and families in Tibetan villages, as well as short interviews with participants in the yak festival near Chindu and the horse festival in the Saikang Monastery area, which expanded territorial coverage and scope of the study. In addition to collecting oral accounts about the use of nose-rings and traditional methods of harnessing of cattle, I conducted photography, did sketches, took measurements of relevant objects, and collected descriptions in Tibetan language.

Analysis of the collected material included the study of the use of wooden nose-rings; the method and seasonality of their manufacture; the advantages and disadvantages of a wooden loop as compared to a rope loop; the process of nose-ring implementation and the duration of its use; the design of a yoke for a draught team and *ard* (traditional plow)—both used in conjunction with a nose-loop; methods for managing animals with a nose-loop, and other uses. Finally, I consider explanations for the origins of this tradition in Tibet.

Manufacture and efficiency of nose-rings

The main tool for managing cattle among the Tibetans of the Yushu region consists of two elements: a wooden loop – Kham, *níkhi*; a rope – Kham, *nadó* (Fig. 2). Comparative analysis of all nose-loops seen during the expedition (about 30 pcs.) allows us to note the shape of their ends as an essential feature and, depending on the latter, divide them into three variants: 1) both

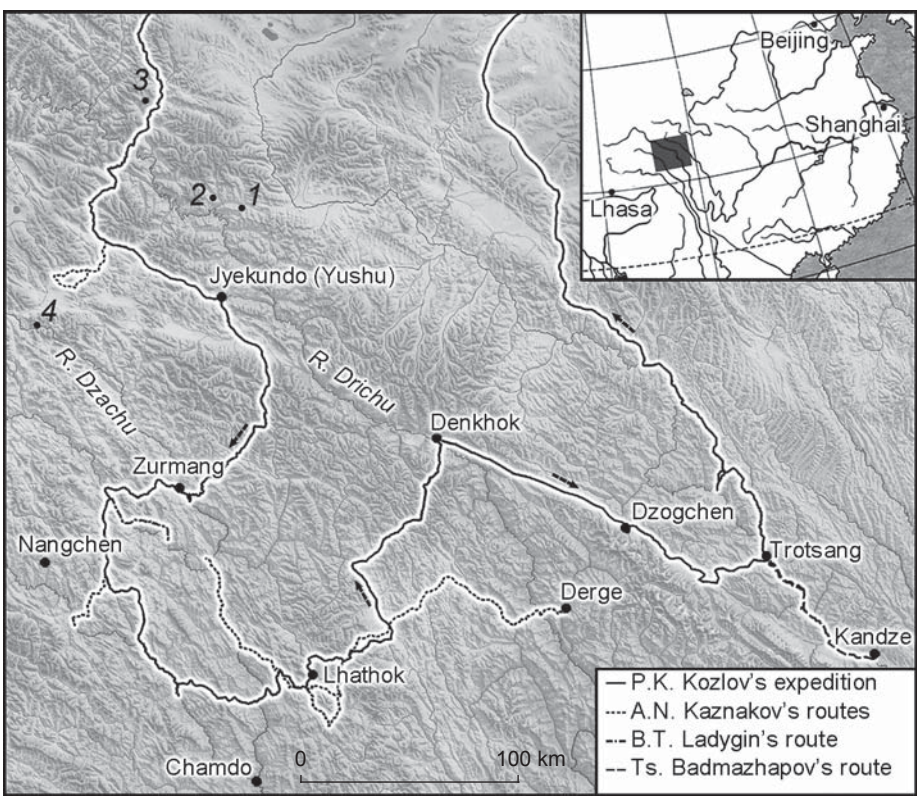

Fig. 1. Places of collection of materials in Eastern Tibet in 2018 concerning the route of the expedition of P.K. Kozlov in 1900–1901 (the map of the study area was prepared on the basis of cartographic materials http://kham.cnrs.fr).

1 – Chindu town 称多; *2* – Bailong village 白龙; *3* – surroundings of the Saikang monastery 赛康寺; *4* – neighborhoods of Angsai 昂赛乡.

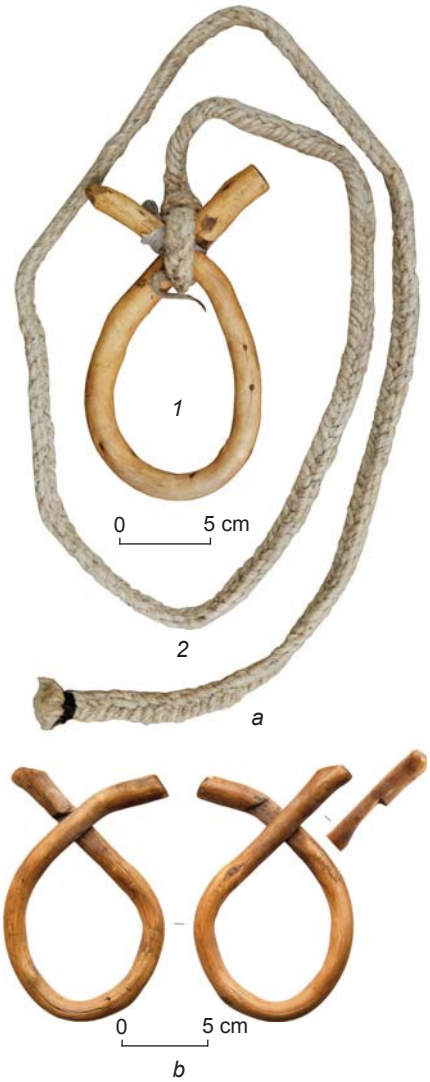

Fig. 2. Wooden nose-ring for managing draught animals, with (*a*) and without (*b*) equipment.
1 – wooden loop (Kham, *níkhi*), *2* – rope (Kham, *nadó*). Property of the Konge (*a*) and Lati (*b*) families, Bailong.

Fig. 3. Variants of tools for controlling yaks/hybrids by nose at the yak festival near Chindu, August 2018.

ends are blunt (Fig. 2, *b*); 2) one is pointed (Fig. 2, *a*); 3) both are pointed (Fig. 3, *1*). The pointed end makes it easier to insert the loop into the animal's nose. The variant with two pointed ends is rare, while the other two in the Drichu River valley are distributed more or less equally and are noted simultaneously in the same families. In the south of the Yushu region, according to Matei from the Dzachu River valley, it is generally not customary to sharpen the ends of the loop. For a more reliable connection of the ends (regardless of their shape), the vast majority of loops have grooves (see Fig. 2, *b*), although their presence is not mandatory and does not affect the functionality of the tool. The size of the loop depends on the size of the yak. On average, it is 9–10 cm wide and 15–20 cm high.

According to all the informants, a wooden loop for managing the animal by nose is made only from the branches of a locally grown cypress tree. Its wood is flexible, dense, and resinous, which prevents cracking, as well as shows certain antibacterial properties. It is usually the men who manufacture these loops. Several pieces are made at a time. In particular, in two or three days, approximately twenty loops can be made. The traditional time for this activity is from February to April. At the preparatory stage, a flat branch with a thickness of about 1.5 cm, or slightly more, and about 1 m long, with a minimal number of side shoots, which are removed, is used. The middle part of the semimanufactured piece is heated over a fire for about five minutes (the fire is traditionally made on dry yak manure, which yields

a higher temperature than wood) and is then usually bent around a stone or post. Matei from the Dzachu River valley, demonstrating this process, used another technique: he bent the item by the ends with his hands and repeatedly stepped on the middle part with his foot, stretching it to the right and left as he pressed it to the ground. After an even curve is obtained, the loop is tied with a string or a narrow strip of fabric at the intersection of the ends (often, such a rope continues to be tied at the end of a completely finished loop during use). At the same stage or later, grooves can be cut with a knife, providing a tighter and more reliable connection. Then the ends of the piece are cut off, and the bark is removed. One or both ends may be sharpened. The loop is left for a day or more to cool and fix its shape. Then its surface is finally leveled (cutting off any cones or knots) and fashioned into the required shape. As an important feature of making the loop, Matei noted the need to bend the right part of the item on top of the left, explaining this by the fact that if you do the opposite, the animal will get sick. At the same time, many loops examined in the Drichu River valley do not comply with this rule.

The rope that is tied to a wooden loop is made of yak wool for durability and flexibility in all weather conditions. It is ordinarily woven either from white and dark strands, or from only white ones. Some informants mentioned that the dark color was unacceptable. The rope is fastened as follows: one end of it, on which a small loop is made, is pulled through a wooden loop, and the second is passed through a rope loop, and tightened at the intersection of the ends of the wooden loop, which provides their additional connection. The rope is usually long enough to be tied around the horns when the loop is in the animal's nose (see Fig. 2, *a*).

The Tibetans themselves consider the manufacture of the nose-loop to be very simple, which opinion is reflected in their folklore. In particular, in one Tibetan legend, a wife constantly reproaches her lazy husband for not even being able to make a yak's nose-loop (Haiwang Yuan, Awang Kunga, Bo Li, 2014: 99).

At the Yak Festival in August 2018 near the city of Chindu, along with a wooden loop, the use of an all-rope tool was recorded to control an animal while riding. It can consist of a separate rope loop inserted into the nose, and a long rope tied to it (see Fig. 3, *2*), or just a rope. In the latter case, there are two options for use: 1) one end of the rope is pulled through the nose and tied in a loop (see Fig. 3, *3*); 2) the rope is pulled through the nose to the middle of its length, and is held in the rider's hand by both ends (see Fig. 3, *4*).

Wooden and rope implements have their own advantages and disadvantages. The Tibetans themselves explain the advantage of the first by the fact that it does not cause irritation and inflammation of the nose, even with prolonged use. However, as compared to a wooden loop, the rope is more painful for the animal, so it is easier to control it with the latter. This is probably the reason for the large number of rope nose-loops on the yaks that participated in the races at the 2018 festival. In addition, when explaining the reason for using a rope without a wooden loop, some informants spoke of the difficulty of obtaining cypress branches for making loops, since in the Drichu River valley, this tree does not currently grow everywhere (during the years of the Cultural Revolution and the struggle against religion, cypresses, which are sacred to Buddhists, were cut down in some places). However, for fieldwork, requiring prolonged use of the implement in the nose, a wooden loop is preferable.

Implementation and use

According to available literature, a wooden loop is traditionally inserted into the animal's nasal septum at the age of about one year (The Yak, 2006: 217). However, our informants reported later dates for this process as well. For example, the owner of a yak who won the race at a yak festival in August 2018, near Chindu, said that the nasal septum of this animal was pierced at the age of 4 years. According to residents of Bailong village, they usually perform this operation at the age of 5–6 years. After the piercing, a wooden loop is immediately inserted into the hole and left for a period of two months to one year, so that the animal can get acclimated to it. After piercing, the nose-ring can then be removed and inserted as needed.

All informants interviewed in the Drichu River valley reported that the nasal cartilage was traditionally pierced with the horn of a Tibetan gazelle (*Procapra picticaudata*). In one published photograph (Fig. 4), this instrument has a leather strap at its base for hanging on the wall during storage. However, in most cases, the horn was not specially curated. According to some informants, when the need for such a tool arises, they will acquire the material through hunting.

In the Dzachu River valley, where the natural environment is somewhat different, in order to pierce the nasal cartilage of cattle or yak, a pointed rod made of sea buckthorn (Kham, *téva*) is used, a very hard material. According to my informant, animals are pierced in this region at the age of 4–5. They do this in April or May (the timing depends on the climate/weather of a particular area—if the weather is cold, the piercing will be done later). After piercing, fabric tape is inserted into the hole for six to seven days, and then the wooden loop is inserted for a period of three months to a year.

Draught animals are castrated as a means of making them more docile. Informants from the Drichu River valley said that this measure was taken before nose piercing was done. For example, the yak that won the race at the festival in August 2018 had been castrated at the

age of three, and his nasal septum had been punctured at four. However, according to the informant from Dzachu, the local residents of his area castrate an animal seven to eight days *after* piercing the nose.

Notably, animals with nose-loops are always kept near the village, and when they are released into the pastures, their rings must be removed (to dissuade easy theft). A similar precaution also mentioned by the members of the expedition of P.K. Kozlov (Kaznakov, 1907: 65).

All informants reported that a wooden nose-loop for horned draught cattle serves approximately for 30–40 years. If a loop is cracked and unusable, it is to be discarded. No prohibitions or instructions regarding the further use of these objects were mentioned by informants interviewed for this study.

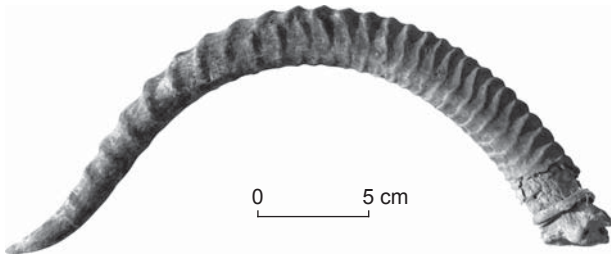

Fig. 4. A tool for piercing the nasal septum of an animal from Chindu County.

The yoke and the ard for a pair harness

In many parts of Tibet, the population has a mixed economy, which combines animal husbandry with agriculture. The main grain crop grown in the region is barley. Small fields are terraced on mountain slopes near the villages. To cultivate the land, an *ard* (plow) and a pair of yaks are harnessed to a yoke. The style of harness used, which is designed for nose-ring control, may be archaic and therefore particularly deserving of scholarly attention. This harness configuration (which includes reins and a yoke) is a relatively autonomous module that can be used to pull various objects. Currently, in Tibet, these uses include the ard and the harrow (a toothed implement used to break up plowed earth). However, a harness configuration of this type in ancient times could have also been used to move carts.

Four yokes of the same type were examined in the Drichu River valley. Measurements show that the yoke (Kham, *nyákhi*) has a length of ca 1.63–1.68 m, and a diameter of ca 8 cm (Fig. 5). A wooden plate (given no unique name) 33–54 cm long is securely tied the middle of the yoke with leather straps (Kham, *dzhomb*). The function of the plate is to reduce the load and protect this part of the yoke from wear, as it also boasts a hole for fastening the ard.

All the holes on the yoke are known as *káku*. These are rectangular in shape. The central hole is the largest, about 5.5 × 2.0 to 2.5 cm, while the dimensions of the others are 4.0 to 4.5 × 2.0 cm. The ard is attached to the yoke with a strap using a loop and a wooden pin (Kham, *nyokhó*) about 15 cm long (in one case, bone was used for this purpose). This pin is often secured to a yoke near the center hole, so that it does not get lost between uses.

The yoke is attached to the necks of the animals with two ropes. Each rope has a loop at one end (Kham, *chadó*), and a stick (Kham, *char*) tied near its base. The ropes are pulled from top to bottom through the holes nearest to the center of the yoke bar. Each rope runs around the neck of one animal from below. The rope is passed up through another hole near the end of the yoke, pulled through a loop at its other end, and pulled, pressing the yoke to the neck of the animal. The ends of both ropes are tied together. To reduce the pressure on the animal's neck, each rope is supplemented with a wide ribbon made of felt and fabric (Kham, *nyató*) (the width of the ribbon in Fig. 5, *d* is 8 cm, length 52 cm), as well as special covers made of the same material (Kham, *nyáti*). These are affixed to the yoke (the width of the cover in Fig. 5, *a* is 52 cm, the length corresponds to the circumference of the yoke). The covers have two holes in the middle, which are aligned with the holes at the bottom of the bar. The corners of each cover are sewn on top of the bar. During storage, the cover is additionally secured via a rope. The length of one such rope was measured at 2.3 m. Before harnessing, this rope is removed and serves as a long rein that connects to a wooden loop in the nose. For storage, this rope is pulled through the same holes as that which fastens the yoke to the animal's neck (Fig. 5, *b*, *c*). Here, it should be noted that when harnessing, an animal's individual collar (see Fig. 3, *2*), which serves for tying up at night, it is not removed.

An ard, used in tandem with the aforementioned yoke, uses a straight draught pole (Kham, *khya*) 2.63–2.84 m long (Fig. 6). Its width at the rear is about 8 cm. On the front portion of the ard, 8 cm from the edge, there is a hole 1.0 to 1.5 × 4.0 to 6.0 cm in size, used for attaching a belt with a loop at the end (Kham, *khyoró*; the total length of this belt is 58 cm, and the loops are 30 cm). With the help of these features, the draught pole is attached to the yoke. The length of the ard's body (Kham, *tongó*) shown in Fig. 6, is roughly 0.9 m. An iron tip (Kham, *tcho*) is placed on the ard's lower end. A little higher, on the sides of the block, small planks (Kham, *dzhonbó*) 20.5 cm long are fixed, making the ard wider; the total width of the implement at this point is 27.5 cm. A handle (Kham, *chunzú*) 11 cm long is inserted at the top. The draught pole is fixed in the ard's body via wedges (Kham, *yunzý*), as well as a spacer (Kham, *kunzú*).

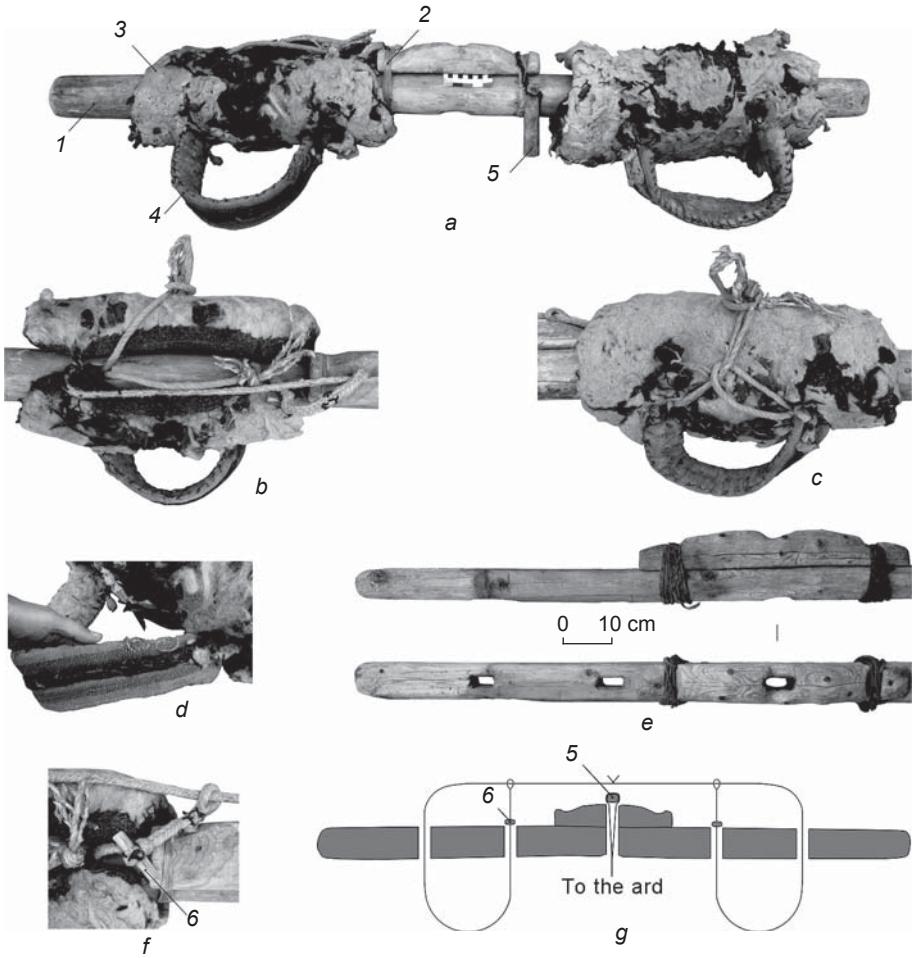

Fig. 5. Construction of a yoke for a team harness.
a – general view of an equipped yoke; *b–d*, *f* – its components; *e* – yoke without equipment; *g* – diagram showing method of affixing the yoke onto the necks of draught animals. Property of the Konge (*a*) and Lati (*e*) families, Bailong.
1 – nyákhi; *2 – dzhomb*; *3 – nyáti*; *4 – nyató*; *5 – nyokhó*; *6 – char*.

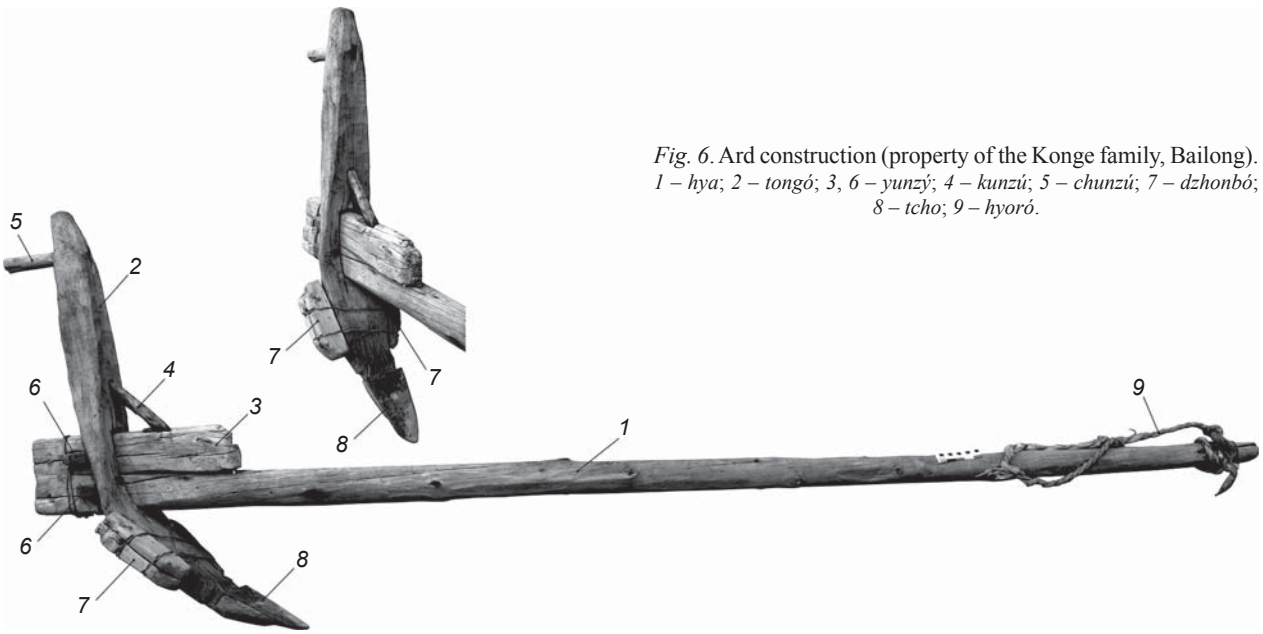

Fig. 6. Ard construction (property of the Konge family, Bailong).
1 – hya; *2 – tongó*; *3*, *6 – yunzý*; *4 – kunzú*; *5 – chunzú*; *7 – dzhonbó*; *8 – tcho*; *9 – hyoró*.

Managing animals with a nose-ring

A nose-ring/loop with a lead rein is used to control both single and team-harnessed animals. When alone, animals are usually used for riding and for transporting packs on their backs. When riding, the rope is passed between the horns and is held in the hand of the rider, who controls the movement of the animal, pulling it in one direction or another. To manage a load-bearing animal, the driver walks ahead with leading rope in hand. When the animal is not being used for work, this rope is usually simply tied around the horns or tied to a pole or stake.

There are several methods used for managing a draught team, which can be divided into two categories based on where the driver is situated relative to the animals: in front, or behind. With the in-front system, two people are required to control the team: one manages the ard (usually a man), while the other controls the animals (often a woman). The animal-manager walks in front of the team and guides it in the desired direction via the rope tied to the loops in the animals' noses. We recorded this approach in the vicinity of the Saikang monastery, on the Drichu River, and it appears to be quite widespread in Tibet.

With the second method, common among residents of Bailong village, one man simultaneously controls both the ard and the animals (The Yak, 2006: Fig. 8, *10*). To achieve this end, an additional long rope is tied to each nose-ring. Each rope has a length of approximately 2.3 m, as described above. These are pulled by the driver, and the ends are tied behind the ard, near the handle. By pulling this rein to the right or left, the driver turns the moving team. Additionally, a leather lash with a wooden handle (Kham, *chyattsé*), or a rod is used to drive the animals.

The rear-driving apporach can also be subdivided into a number of different strategies, depending on how the reins are passed, how they are connected to the rings, and what role the nose-ring itself plays. In the Yushu region, it is typical to pass the reins between the ear and the horns of the animal under the collar, on the outer side of the team for each animal. However, in Tibet, there are also cases in which the reins is passed along the inside or between the horns. Another difference has to do with how the long rein is secured to the animal—to the side of the nose-ring itself, or to a secondary rope attached to the ring. If attached directly to the nose-ring, which is most typical, a short loop-rope is also tied around the horns, which keeps the nose-ring taut. For better control of the team, as well as for synchronization of the movement of both animals on turns, their wooden nose-rings can also be tied together or passed through a single rope.

In Matei's family in Zadoi County, the wooden nose-ring was not inserted at all into the noses of the animals of the team, but was instead used as a pulley for tightening a simple rope halter on the muzzle. Using the resulting halter with long reins, a man walking near the ard managed the team. According to Matei, this alternative is possible when the animals are obedient. The halter approach is more accessible for wealthy families (on the Dzachu River, families with 300–400 yaks are considered such), who have a large selection of animals (and are thus able to select the most obedient). These families are also able to choose hornless individuals for harnessing, which are potentially less dangerous to humans. Poor families have less of a choice, so they must use horned and less docile animals (where nose-ring control is essential). In restless and less tame animals, the nose-ring must always be kept in taut position to ensure control.

Beyond the original and basic function of the wooden nose-ring (controlling an animal), it has developed other functions in traditional Tibetan culture. In particular, during the expedition, the use of a loop as a pulley for stretching the ropes of a Tibetan tent (made of yak wool) was recorded (Fig. 7, *1*, *2*). According to the owner of the tents examined near the Saikang monastery, the same wooden loops used for yak-driving can be used for this purpose. However, more often, tent loops are specially-made. In terms of manufacturing approach and terminology, these are no different from animal loops, although thicker cypress branches (around 2 cm in diameter) are chosen for this purpose. A standard tent requires twelve such loops: two at each corner (pulled with two ropes), and one for each rope in the middle of each side of the tent. In recent years, wooden loops for tents have been increasingly replaced with iron loops or rings (Fig. 7, *3*).

According to information received from the Dzachu valley, sometimes a wooden ring with a rope is used to tie up cattle at night in the stall. In this scenario, the rope end is attached to the animal's collar, while the wooden loop is attached to the fence. Finally, the same style of loop is sometimes used for tying the Tibetan Mastiff. At the end of the dog's rein, a wooden ring is attached, which is looped over a wooden post.

Classification and origin of the Tibetan harness system

Owing to the considerable size of the Tibetan Plateau, the difficulty of travel and communication between different parts of the country, and the ethnolinguistic variety of the population, the harness configurations used across Tibet are understandably heterogeneous. The most significant differences identified across the region concern the yoke. The yoke we studied in the Yushu region is secured to the animal's neck. However, during the expedition of P.K. Kozlov (1906: 282), in the Kham area (probably in

1

2

3

Fig. 7. Loops on the ropes of a traditional Tibetan tent in the vicinity of the Saikang monastery.

the southern portion of the expedition's route), a different type was documented, which is also widespread in the Tibetan Autonomous Region (Esin, 2018: Fig. 5, *3*). This is a head yoke, affixed to the back of the horns of draught animals. Historically, this type of yoke is the most ancient in Eurasia.

Along with these two "pure" types of harness in Tibet, there are also more complex ones, which combine certain elements of each. For example, in one such version, a yoke is tied to the horns of animals from behind, as when harnessing a head yoke. However, the bar of the yoke in this system is thinner in diameter, and the agricultural implement is attached not it, but instead to a second neck yoke. In this case, the head "yoke" retains only a part of its former functioning: it serves to align the animals in team, and provides greater control. In another version of the Tibetan harness system, a yoke is simultaneously attached to both the necks and the horns. Vertical wooden rods are also sometimes used to secure the neck yoke.

As for the wooden nose-ring/loop, there are no major differences among the regions of Tibet. However, the rope tied around the horns used to hold the nose-ring in a taut position is replaced in some areas by a ribbon of dense material with images of sacred symbols.

The origin of the nose-loop tradition in Tibet can only be understood in the larger context of the history of Eurasian draught animals and harness technology. To the south, beyond the Himalayas, people use a rope pulled through the nose, the ends of which are pulled along the sides of the muzzle and tied behind the head of the animal. In the southern system, a control rein is attached to this rope. Figurative materials from India clearly record the use of this device from the late 1st millennium BC (Deloche, 2014: Fig. IX, *g*). This harness system appears closely connected to management of the cattle breeds indigenous to South and Southeast Asia: the zebu and the buffalo, and its emergence and spread may trace back to the domestication of these animal taxa.

Judging by the geography of the available archaeological and ethnographic evidence of the use of a wooden nose-ring across Eurasia (Esin, 2018), this technology must have entered Tibet from the area of cattle-breeding cultures of more northern territories. The use of cypress for nose-loop production, in contrast, should be seen as an adaptation of this tradition to local conditions. The arrangement of the yoke in the Tibetan system also speaks in favor of a northern orientation for cultural ties. Particular noteworthy is the similarity between the way the ard draught pole is attached, and the ancient north Eurasian method of attaching the draught pole to the neck yoke of an ox-cart. This system was first recorded in the Pazyryk culture in the Russian Altai (6th–3rd centuries BC), and combines a vertical hole in the middle of the yoke with a leather strap, and a wooden pin (Gryaznov, 1950: 58, 59). According to the classification of the Eurasian ards, developed by Y.A. Krasnov, the Tibetan system belongs to the straight-draught pole, single-arm type. Distribution area of this type of ard (Krasnov, 1975: Fig. 27) does not contradict the conclusion about the northern origin of the harness configuration in Tibet.

Characterizing the timing of the appearance on the Tibetan Plateau of the nose-ring system for managing

yaks, and understanding the way in which this tradition arose, is a more problematic task. Rock art in the Drichu valley provides some clues, showing clear cultural influence from the northern pastoral territories with specific animal style in the 1st millennium BC. Judging by these images, the people who produced them appear to have been new groups in the region. The stylistic features of these Early Iron Age petroglyphs correlate well with information from Chinese written sources, which attest that several groups of ancestors of modern Tibetans relocated into the region from the northeast, in the 4th century BC, and later (Zhuravlev, 1961: 87, 88).

Consequently, from a historical perspective, the appearance of a wooden nose-loop for managing draught animals in the Tibetan Plateau is likely connected to the arrival of new groups from more northerly regions in the second half of the 1st millennium BC. It can be assumed that the ancestors of the Tibetans mastered the nose-ring draught system, as well as other aspects of the harness system and some techniques of the steppe animal style, through contact with pastoralists of the eastern part of the Eurasian steppe belt.

Conclusions

Studying the use of the nose-ring draught system is important for understanding both Tibetan culture and the development of the harness configuration in Eurasia. Among the various features of loops, the shape of their ends is the most significant feature for the purposes of classification. On the basis of end shape, three variations of this tool can be distinguished. Here, I have described the techniques and timing of nose-ring manufacture and insertion, and identified two types of tools for piercing the nasal septum (a hardwood rod and a sharp horn of a wild ungulate). Geographic patterning in the use of these tools reflects the adaptation of the economy to the environment and resources of different parts of Eastern Tibet. This research suggests that a wooden nose-ring may have an extraordinary service life, of up to 40 years. In comparison to a wooden loop, a rope ring is easier to manufacture, but wears out more quickly. Interviews suggest that ropes are more painful for the animal, and provide better control, though they can cause inflammation of the nose. Therefore, in terms of the duration of continuous use and safety, rope is inferior to wood. The methods of control chosen depend on the type of activity, whether a single animal or a team will be harnessed, and the docility of the animal(s) to be used. For maximum control over the animal, the loop or ring should always be in a taut position in the nose, which is usually achieved by tying a halter rope around the horns. Other uses of the wooden rings, unrelated to the management of draught animals, were also discovered—pulling tent ropes, and tethering animals. A comprehensive comparative historical analysis of materials from Yushu suggests that the emergence of a tradition of using this tool to manage draught cattle on the Tibetan Plateau may be a result of the resettlement of the ancestors of the Tibetans here from the northeast in the 1st millennium BC.

At present, in the Yushu region, the traditional method for field cultivation is going out of practice, as motorized ploughs and tractors replace animal draught teams. Most informants have reported that, while they retain equipment for harnessing animals to ards, in recent years they have preferred to hire machines for working their fields, as this approach is faster and easier. This fact requires the urgent intensification of research on the traditional Tibetan harness and characterization of its use and significance for Eurasian prehistory.

Acknowledgments

The author is grateful to all of the residents of Yushu County who shared their experience of using tools to manage draught animals, and especially those whose knowledge played a key role in the preparation of this article: the Lati and Konge families from the village Bailong in Chindu County; an experienced cattle breeder, Matei (48 years old), from the area of Angsai in Zadoi County. Special gratitude for help in conducting this research goes to Nima Tseren, Secretary of the Party Committee of the Communist Party of China in Chindu County, Renchin Nima, Head of the Association of Literary and Art Workers of the same County, and Dikyi Bamao, graduate student of the Russian State University for the Humanities. I also thank Dr. William Taylor, University of Colorado Museum of Natural History, for his important editorial assistance.

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Received February 17, 2020.

DOI: 10.17746/1563-0110.2020.48.3.117-123

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On Sacred Girdles and Matrilineal Descent in Ainu Society

This study examines a mysterious item of the Ainu women's undergarment—the upsor kut, or chakhchanki, which, in ethnographic collections and scholarly texts, is described as a "belt of modesty". A comparative and historical analysis of Ainu women's girdles from Hokkaido and Sakhalin was carried out. They are displayed in very small numbers at museums of Russia, Japan, and the UK. These artifacts are rare, as women had to preserve their upsor kut (chakhchanki) from being seen by strangers, especially males. They became a part of late 19th to early 20th century ethnographic collections, because scholars, such as B.O. Piłsudski and N.G. Munro, became trusted by the natives. In the past, Japan's hard-line policy of assimilation for indigenous peoples, the banning of the Ainu language and traditional culture, and the introduction of schooling and public health service resulted in an even greater secrecy of Ainu women and the gradual decline of the tradition of wearing secret girdles, precluding the carrying out of field studies. The analysis of Ainu linguistic and folkloric materials analyzed by Japanese and European researchers sheds light on the function and meaning of these items of the women's undergarment. In essence, they had two important functions: determining the maternal lineage and protecting the family and the clan. This suggests that remnants of matrilineal exogamy existed in Ainu patriarchal society, which eventually disappeared at the turn of the 20th century.

Keywords: Ainu, Hokkaido, Sakhalin, belt of modesty, sacred girdle, matrilineal exogamy, upsor kut, chakhchanki.

Introduction

The interdisciplinary approach to studying the material culture of the Ainu people, which is used in this work, makes it also possible to understand other aspects of the traditional life of this people. In studies and catalogs of museums in Russia, Japan, and Great Britain, girdles of the Ainu women worn on the body (*upsor kut* in Hokkaido or *chakhchanki* in Karafuto) are designated as "modesty girdles" or "chastity belts" (Ainu Collections…, 1998: 20–21, 62, 96). However, in the Sakhalin catalog, B.O. Piłsudski described such a girdle as "a girdle for menstruation. МПК 904-18" (Katalog…, 1991: 21). Kindaichi Kyosuke also called them "menstrual belts", which were inherited through the female line (Tate, 2005: 231). Perhaps, this designation was associated with the fact that in Hokkaido, Ainu mothers tied the *upsor kut* on the belly of their daughters after the start of their menstruation (Ainu seikatsu shi…, 1984: 210).

Girdles from the collection of B.O. Piłsudski, which are kept in the Kunstkamera in St. Petersburg and which Japanese scholars call undergarments (*shita himo* or *chakhchanki*), differ in appearance from the *upsor kut* of Hokkaido. The latter are rope belts of various types of plaiting, with pieces of fabric at the ends. The undergarments of the Sakhalin Ainu females (*chakhchanki*) are distinguished by a more sophisticated shape: a triangular or trapezoidal colorfully embroidered piece of fabric was sewn on their front part. L.Y. Sternberg drew attention to the fact that the Ainu borrowed "some elements of ornamental decoration" from the Gilyaks (Nivkhs) (1933: 559). Replicas of beautiful Sakhalin

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girdles appeared for sale in Hokkaido souvenir shops in the 1970s (Haginaka Mie, 1992: 128–129).

In our study, we have chosen the definition of "sacred girdles" for the *upsor kut* and *chakhchanki*, given by N.G. Munro in 1934, since these items were not only a secret sign of maternal kinship of the Ainu women, but also a protective amulet for the whole family, which was received, according to their legends, directly from the goddess of fire Kamuy-fuchi (Fuji). In the ancient tradition, they are called *e-esimukep*, which means 'the most hidden thing'. Another name used by old people is *ishirimau-riri*, which means 'preserving great (bodily) strength'. *Raun kut* or *ram kut* ('lower girdle' or 'girdle of the spirit') are also used (Munro, Seligman, Watanabe, 1996: 141–143). For example, there are three *raun kut* female girdles in the collection of the Foundation for Research and Promotion of Ainu Culture (Collections…, 2001: 110).

Ainu women of Hokkaido and Sakhalin wore sacred girdles under their clothes, hiding them from view. In the dictionary of J. Batchelor, the term *chakhchanki* is interpreted as a female apron made of bast threads (1926: 64). Haginaka Mie calls the modesty girdles of the Sakhalin Ainu females *shita himo*, the Japanese for 'undergarment belts' (1992: 128). Their appearance in Hokkaido is associated with the tragic upheavals in the fate of the Ainu of Sakhalin, who were forced to repeatedly leave their place of residence. In the late 1940s, most of them were repatriated to Hokkaido. It can be assumed that the sale of souvenir *chakhchanki* indicates a high degree of assimilation of the Sakhalin residents, who lost not only their native land and their roots, but also the secrets of their culture, and who survived material difficulties in post-World War II Japan.

Very few scholars were able to see and even more so to procure the sacred girdles of the Ainu women for their collections. Only those people whom Ainu women especially trusted had an opportunity to study that secret item, hidden even from the eyes of their husbands. Such scholars included J. Batchelor, B. Piłsudski, and N. Munro. Suzuki Hiromi discovered a drawing of the *upsor kut* in the dictionary of the first Ainu professor Chiri Masiho (1996: 47). The Sakhalin doctor N. Kirillov wrote about the girdles of the Ainu females, who could not "uncover their private parts, except for a shirt or gown, which tightly fitted the belly, additionally covered with a triangular cloth that goes down to the knees and was tied with a rope over the naked body. This apron plays an important role: the woman receives it from her mother, so she will lift it only for her husband. A woman raped without this apron should not persecute the offender; a woman who dies without the apron will not meet her parents in the afterlife" (1898: 71).

In the dictionary of Batchelor, the *upso'unkut* is translated as a 'woman's loincloth' (1926: 512). In the fall of 1903, at the request of Professor F. Starr from Chicago, J. Bachelor organized a group of Hokkaido Ainu to participate in the World Exhibition in St. Louis (USA, 1904), where they stayed for almost two years. One of the returning women turned to Bachelor with a request to help her save the money earned at the exhibition by making Ainu bags and embroidered cushions. When he agreed, the woman moved into a corner and then handed him a bag with money, which was warm and had a strong smell. When Batchelor asked where she hid the money so safely, she replied that the money was hidden in her *upsor kut* (2000: 144–145).

Indeed, a curious piece of Ainu clothing is the loincloth, which was used instead of pants. This kind of clothing was typical for the inhabitants of the tropics, but not for the peoples of North Asia (Sokolov, 2014: 686). "This can be primarily explained by the distinctive nature of the Ainu culture, whose many features can be described as southern, as well as by the sharp difference in the anthropological type of the Ainu people as compared to the surrounding ethnic communities" (Spevakovsky, 1986: 46). Torii Ryuzo also mentioned that since ancient times the Ainu wore loincloths, and in his work he presented an image of a Neolithic statuette of a female wearing a loincloth, which was found in Mitsu Prefecture (1919: 159).

However, the Sakhalin and Kuril Ainu, displaced from the islands of the Japanese archipelago, also wore pants (Ainu Collections…, 1998: 62), which was caused by the harsh climate and influence of neighboring peoples—the Nivkhs, Orochs, and Kamchadals, who did not have loincloths. Torii Ryuzo wrote that the Kuril Ainu borrowed pants (*ouoi*) from the Kamchadals, but they also wore loincloths (as he called the modesty aprons – *chakhchanke* in the Ainu language, or *mokko* in the Kamchadal language) (1919: 158–159). Among the elements of clothing of the Sakhalin Ainu, M. Dobrotvorsky indicated "pants (*oio*, the Gilyak word), which are worn very rarely" (1875: 34) or "*choske* – leggings: the word in the Ainu dialect of Sakhalin" (Ibid: 426). However, his dictionary also indicates the word *tepa*, meaning the loincloth of the Ainu men or "*chokhke* (*chokhki*) – the Ainu apron for enveloping the scrotum". "The Ainu males often prefer, if the temperature allows, to sit in front of their hearth without clothing, with only an apron (*tepa*) tightly covering their private parts" (Ibid: 37). In his collection of the myths of his people, Chiri Masiho cited three versions of the legend about the male loincloth *fundoshi* (in Japanese), left by a man in the river for washing, but carried away by the river flow to the goddess of pure water (Chiri Mashiho-cho sakushu, 1987: 164–169). According to the Sakhalin Ainu woman Kanaya Fusa, girls also had *chihchika umpe* loincloths (covering the genitals *chin*, *chit* – 'secret female member'), which varied in size depending on one's age, but they were not

concealed and constantly worn as the *upsor kut* (Haginaka Mie, 1992: 130; Dobrotvorsky, 1875: 424).

The most detailed descriptions of the *upsor kut* were made by N. Munro, who worked as a doctor among the Ainu of Hokkaido for twelve years since 1893. Thanks to his great tactfulness and patience, he was able not only to see the sacred girdle and learn its role in the life of the Ainu females, but also to receive five *upsor kut* specially made for him (kept in the British Museum) (Munro, Seligman, Watanabe, 1996: 141–142).

The secrecy of the Ainu females regarding their sacred girdles led to the fact that modern scholars in this field are mostly women. In the mid 20th century, an article by Segawa Kiyoko about the *upsor kut* of the Ainu women living in the Saru River valley (Hokkaido) was published. The article mentioned that this item was known as early as the Edo period (17th–19th centuries). In the 1940–1950s, Ainu women reluctantly talked about it, avoiding questions in all ways possible. At that time, the *upsor kut* was worn by many Ainu women, especially by those who were over fifty years of age. They said that girdles worn on the body were a secret and the spirits would punish them if it were revealed. From time immemorial in the Ainu society there was a taboo related to the *upsor kut*: "Do not look, do not tell, and do not listen" (Segawa Kiyoko, 1952: 246–248). However, later in the 1980s, Haginaka Mie had personal meetings with old Ainu women of Hokkaido and Sakhalin, and her interlocutors willingly talked about the *upsor kut* and showed them. Yet, few of these women remain (Haginaka Mie, 1992). Although the tradition of wearing the *upsor kut* had disappeared and few people had seen them, they all knew about the taboo on mentioning this item. Suzuki Hiromi was able to obtain detailed information on sacred girdles from only two Ainu women. She believes that the *upsor kut* performed four main functions: it served as a symbol of an adult woman, played the role of a protective talisman, symbolized modesty, and were the mark of maternal kinship (Suzuki Hiromi, 1996: 47–48).

We will consider sacred girdles as a sign of matrilineal kinship, as a protective talisman, and as a symbol of connection with a deity. Unfortunately, there is very little information about various functions of the Sakhalin girdles (*chakhchanki*), so we will primarily discuss the *upsor kut* of Ainu females of Hokkaido.

Sacred girdles as a sign of matrilineal kinship

Sacred girdles (*upsor kut*) are a mark of matrilineal kinship, which has survived in the patriarchal Ainu society. Women who wore the same *upsor kut* were called *shine-upsor* 'one pocket', as belonging to the same family in matrilineal descent (Haginaka Mie, 1992: 129). Sternberg wrote that the Gilyaks had "a typical paternal system, while the Ainu had a maternal system" (1933: 559). A.B. Spevakovsky, who studied the terminology of kinship, observed that the Ainu people "typically showed a clear distinction between paternal and maternal relatives" (1986: 52–53).

According to N. Munro, wearing sacred girdles was a condition for observing matrilineal exogamy. A man could not marry two sisters, who had the same girdles. Two brothers were forbidden to marry two sisters. A widow's marriage to her late husband's younger brother was permitted, but it was forbidden to marry an older brother (Munro, Seligman, Watanabe, 1996: 147). At the same time, Munro pointed out that the matrilineal descent was recognized only by women, but not by men among the Ainu people of Hokkaido. In addition, his informant listed representatives of the male line of kinship back to the fifteenth generation, while women could determine the female line no further than their grandmother. This seems unexpected, but suggests a gradual disintegration of the matrilineal system. Munro cited the terms used by the Hokkaido Ainu people for the relations of kinship: *fuchi-ikir* or *shine-ikir* – matrilineal group; *ekashi-ikir* – patrilineal group; *kemrit* translated as 'blood vein' – matrilineal relationship; *shinrit* – ancestors, patrilineal group; *iriwak* – family relations (Ibid.: 145).

Piłsudski wrote that the Sakhalin Ainu people had "a mixed system of kinship, but family ties on the female side are stronger than on the male side. The mother's brother is still the head of the family today. A sister in her own family enjoys greater privileges than her brother's wife" (1994: No. 1, p. 61). When choosing a groom for a girl, the decisive voice was that of the maternal uncle. For the birth of the first child, the woman in labor had to return to her mother's house (Munro, Seligman, Watanabe, 1996: 146).

Sugiura Ken'ichi observed that the society of the Ainu from the Saru River valley was based on patrilocal families in a village, where men constituted one or more localized patrilineal related groups *ekashi-ikir* (the great-grandfather's clan); those people who had the same clan sign (*itokpa*) called themselves *shine-itokpa*. Women belonged to a non-localized matrilineal group *fuchi-ikir* (clan of the great-grandmother), and those who had the same sacred girdles formed a kindred matrilineal unity *shine-upsor*. If a married woman moved to her husband's house in another village, she tried to find women of her clan there. The clan sign of the family (*itokpa*) with which the ceremonial headdress is adorned, was passed from father to son, while the secret female *upsor kut* was passed from mother to daughter. If a girl did not have a mother, one of the women of her maternal clan tied her *upsor kut*. Thus, fathers had priority in the Ainu community, but women were not completely powerless. When divorced, sons left with their father, while daughters stayed with their mother. After the death of the father, the eldest son

inherited the house, and after the death of the mother, women's things were passed on to the eldest daughter (Sugiura Ken'ichi, 1952: 187, 192, 205; Ainu seikatsu shi…, 1984: 210).

J. Batchelor pointed out the important role of Ainu women, especially of advanced age, in the families and community. He observed great respect for them on the part of men. Wherever there was less outside influence, women had a say, in all family matters. Nevertheless, Batchelor mentioned that in the villages directly influenced by the Japanese, the role of women significantly decreased (1930: 14–15). Most likely, this was caused by intensified assimilation policies pursued by the Japanese state since the late 19th century.

According to Segawa Kiyoko, the sacred girdle, hidden from the eyes of men and testifying to the connection between the *shine-upsor* women, was very important for women (1952: 246). The Ainu women claimed that if they would not constantly wear the *upsor kut*, after death they would not be able to meet their mothers and grandmothers. In addition, only *shine-upsor* women could help each other during childbirth, at weddings, or funerals. For example, if a man's mother died, his wife (the daughter-in-law of the deceased) had no right to participate in the preparations for the funeral. Marriage within the *shine-upsor* was prohibited; therefore, before the decision of marriage was made, the mothers of the young couple asked each other whether they were the owners of the same *upsor kut*. Thus, the opinion of the mother could have been decisive. Gradual destruction of matrilineal exogamy in the Ainu society is evidenced by the existence of certain conditions making it possible to bypass this taboo. For instance, if a man insisted on marrying a girl from his mother's *shine-upsor*, they simply changed the bride's *upsor kut* and made up a new, fictitious, genealogy (Haginaka Mie, 1992: 128). Another example: childless spouses could adopt a girl, making a sacrifice to the ancestors, provided that she was from the *shine-upsor* of the foster mother, but even if the matrilineal kinship did not coincide, this did not become an obstacle, since it was possible to change the *upsor kut*. Munro described the case of the adoption of a Japanese girl by an Ainu family. The girl was given the girdle of the foster mother (Munro, Seligman, Watanabe, 1996: 145).

Upsor kut was removed during childbirth, as well as after the death of the husband. For the entire mourning period, the widow could only be in the corner of the dwelling, with a headdress put on, and she was forbidden to approach the fire. After a week of mourning, she was allowed to put on a renewed girdle. If the widow did not remove the *upsor kut*, she changed its position by moving it from the belly to the back. And only after that could she get married again. If another relative died, the girdle was not removed (Segawa Kiyoko, 1952: 246, 248).

The Ainu people had a special attitude towards the dead; they tried not to mention their names. Munro observed this secrecy among the Ainu old people, even among those who were well-disposed towards him. They did not mention the names even during special prayers to the spirits of their ancestors. Such a strict and long-standing prohibition led to the absence of identical names; at least Munro did not come across them. The special attitude of the Ainu people to the names of their departed ancestors made the Japanese, who pursued the policy of assimilating the indigenous population of Hokkaido in the late 19th century, to compose Ainu surnames from names of the area (Munro, Seligman, Watanabe, 1996: 159). It can be assumed that the secret of the names of the deceased to some extent hindered the ability to trace the relationship of kinship between future spouses, but this was somewhat compensated by the existence of the sacred girdles of the Ainu mothers. It would seem that such a small ethnic community in the modern world should know the kinship of its fellow tribesmen. However, the entire history of the Ainu people suggests that this used to be a numerous and powerful people, who lived on the vast territory of the Japanese archipelago up to the Island of Kyushu. In the course of constant clashes with the Japanese, the surviving Ainu were gradually pushed north—to Hokkaido, Sakhalin, and the Kuril Islands.

Since the late 19th century, given the Japanese policy of forced assimilation of the Ainu population, especially through schooling, more and more young Ainu women stopped wearing the *upsor kut*. In the second half of the 20th century, elderly women, although they did not wear the *upsor kut*, kept the sacred girdles in special boxes and asked to have them put into the grave after death. Of course, there were also those who continued to wear the *upsor kut*, but it became difficult to keep it a secret, because more and more often it was necessary to undress and remove undergarment belts before visiting a bathhouse, during medical examinations, etc. (Suzuki Hiromi, 1996: 68–69).

Sacred girdles as protective amulets and their connection with the Ainu deities

The *upsor kut* received the definition of 'sacred girdles' because they were also considered an amulet, or protective talisman. According to the Sakhalin Ainu females, their *chakhchanki* were not equivalent in their meaning to the Hokkaido *upsor kut* (or *raun kut*), since they were protective amulets, like the Hokkaido *ishima* (*isma*) (Haginaka Mie, 1992: 131). There were also *ikema* rope amulets with some sign on one end, also made by women. Three *ikema* have been preserved in the collection of the Foundation for Research and Promotion of Ainu Culture. One of them in the form of a black and white twisted

cord 36.5 cm long and 1.5 cm thick was like a girl's *inau**, which was hung around the neck or over the cradle (Collections…, 2001: 111).

According to the beliefs of Ainu women, the *upsor kut* have magical power (Munro, Seligman, Watanabe, 1996: 142–143). This may explain many Ainu names for the girdles, indicated by different informants. In "Ainu Ethnography", under the illustration of the *upsor kut*, it is written that this is the protective amulet (*ishima*) of the Ainu women, passed on by matrilineal descent. Men could not say anything specific about the girdles, although they knew about their existence (Ainu minzoku, 1969: 125–126). The Ainu females believed that the *upsor kut* could calm a raging storm, return a tidal wave, stop a fire, and repel the smallpox deity. A woman without a sacred girdle had no right to come close to the hearth in the house or approach the cage with a sacred bear, as during menstruation. She could be punished for not observing the prohibitions, since it was believed that this could bring trouble to the family and clan (Munro, Seligman, Watanabe, 1996: 142–144).

The Sakhalin Ainu men knew about the magical property of a girl's loin girdle. Piłsudski mentioned the Ainu legend when a man asked for the *chakhchanki* from his wife, made a blindfold out of it, and was able to obtain "metal likenesses of luminaries", sent by the gods and becoming the talisman in the village of Kotankes in the house of Shiritorikainu (1994: No. 85). Khaginaki Mie believed that on Sakhalin, *chakhchanki* were often confused with triangular bands used for protecting eyes from the sun (1992: 131–132). Indeed, the collection of Piłsudski contains such a band shaped like a *chakhchanki* (Katalog…, 1991: 21).

During her field research among the Ainu people from the valley of the Saru River, conducted in 1951, Segawa Kiyoko received confirmation that the *upsor kut* passed over from one's grandmother lost its power if it was shown to anyone. Women were obliged to constantly wear the *upsor kut*; otherwise they could not light the fire, prepare food, and make their husband and children happy (Segawa Kiyoko, 1952: 246). It is known that in the late 19th century, during the colonization of Hokkaido by Japanese settlers, who encountered considerable difficulties in this harsh land, some Japanese women adopted the Ainu tradition of wearing girdles as protective amulets against illness or misfortunes (Suzuki Hiromi, 1996: 68–69).

Aware of the taboo on disclosing the secret of the *upsor kut*, Suzuki Hiromi decided to investigate whether there was any mention of them in Ainu folklore. The Ainu people did not have a written language, so their entire history and life were reproduced in orally transmitted myths and legends. It turned out that there were quite a few legends about the sacred girdles of Ainu women, especially about the role of deities in the emergence of this secret female attribute. Notably, according to a myth told by an Ainu woman from Shizunai (Hokkaido), once, an older brother handed the girdle from the daughter of a deity to his sister, although in Ainu society it was passed on only by the mother or grandmother. In another legend, a girl raised by her older brother did not know how to sew, and once, during a thunderstorm, the daughter of the thunder deity descended to earth, taught the girl the art of sewing and embroidery, as well as the art of making the sacred girdle, and explained that women with the *upsor kut* should make offerings to the goddess of fire and other spirits of the house. Before leaving the world of people, she gave the girl a metal *upsor kut* and told her to remember, when she would lay down next to her husband, that this was a gift from the daughter of a deity. There is no evidence on the existence of metal girdles; most likely, this symbolizes a connection with the deity of thunder. Thus, the legends show a direct connection between the *upsor kut* and Ainu deities, who not only handed over or taught how to make girdles, but also gave them magical properties (Ibid.: 58, 68–69). The prevailing belief was the role of the goddess of fire Kamuy-fuchi in manufacturing the *upsor kut*, with all prohibitions established by her.

Main types of sacred girdles

Two main types of Ainu female sacred girdles in Sakhalin and Hokkaido can be distinguished: the Sakhalin type (*chakhchanki*) and Hokkaido type (*upsor kut*, *raun kut*, *pon kut*, *ishima*). The former type differs significantly in manufacturing technique, as well as shape and patterns embroidered on the fabric with colored cotton threads, from the simpler Hokkaido *upsor kut*, similar to braided cords. Yet, Haginaka Mie also came across Sakhalin girdles similar to the Hokkaido ones, which consisted of two cords, sometimes sheathed with fabric (1992: 129). Cotton fabric was used more in *chakhchanki*. For example, Piłsudski describes one of the girdles in the following way: it is "…made of dense dark blue fabric, lined, with three fabric ties. It is trapezoidal; the upper half is decorated with embroidery with colored (yellow, light green, and white) threads" (Katalog…, 1991: 21). It is known that Sakhalin craftswomen also weaved using nettle fibers (Roshia ga…, 2013: 57). Sakhalin *chakhchanki* with black and red rectangles were embroidered with colored threads and beads (Ainu Collections…, 1998: 20).

The Hokkaido *upsor kut* looked much simpler. They were twisted or braided of two, three or five cords made

*Inau are sticks with curled shavings at one end, vaguely resembling a human figure. They were perceived as intermediaries between people and deities, and served as amulets.

of plant fibers (nettle, bast of the elm, linden, or spindle tree) with black triangles or rhombs at both ends. In some Hokkaido settlements, white, red or black colors were avoided when decorating girdles (Suzuki Hiromi, 1996: 51, 57, 66).

Munro first discovered three types of Hokkaido girdles, denoting three lines of the maternal clan: from the deity of fresh water (Wakka-ush-Kamui), from the deity of the bear (Kim-un Kamui), and from the deity of the sea or killer whale (Rap-un Kamui). Each of these types was woven in a special way and differed in pattern and number of strands; all were made of wild hemp fibers. The length of the cord was individually determined by the distance between the fingers of the woman's outstretched arms. Later, Munro managed to study five more types of sacred girdles with special marks of the origin of the family clan (the wolf, fox, eagle, badger, and hare). People of the hare clan occupied the lowest position. According to the Ainu legend, once a hunter saw a beautiful girl who was weaving a cord in the forest. She was ashamed that the man saw her secret occupation. To hide her shame, the girl had to become his wife. She originated the clan of the hare. All women worshipped the goddess of fire Kamuy-fuchi (Fuji), the ancestor of the Ainu people, who taught them how to make the *upsor kut* at the order of the main goddess of the Ainu Aeoina Kamui. At the same time, as Munro writes, female informants gave him different explanations for the origin of the sacred girdles: some said that their great-grandmothers received the *upsor kut* directly from Kamuy-fuchi, while others said that it was received from divine animals (Munro, Seligman, Watanabe, 1996: 141–144).

With great care and tactfulness, Munro was able to order five girdles of various types. They were woven of softened bast fibers, although most of them were woven of nettle fibers. Thus, Ainu women tried to circumvent the ban on making them by the order of a male, and even more so a foreigner. The women warned Munro about the need to keep their secret; otherwise, as they said, he might develop a toothache or even die (Ibid.: 141–144).

From an early age, girls were taught that the *upsor kut* had to be hidden from the eyes of other people. Among themselves, the women talked about the sacred girdles very carefully and showed them to each other furtively. Young women were not allowed to participate in their manufacturing; mostly old women could make them. In addition, the *upsor kut* had to be regularly renewed so it would not inadvertently fall in the presence of the husband (Ibid.).

One of the legends about the rainbow speaks of strict observance of specific ways of making girdles in accordance with the clan of the mother. A girl named Rayochi received a girdle made by her mother before the wedding according to the ancient custom. Rayochi, disobeying her mother, adorned it with multicolored silk. The deity who learned about this became angry and turned the bride into the rainbow (in Ainu, *rayochi*). And if it suddenly rains on a clear day, they say that this is Rayochi who is grieving and crying (Suzuki Hiromi, 1996: 59).

The collection of the Foundation for Research and Promotion of Ainu Culture contains girdles made by old Ainu women in the second half of the 20th century, which were already out of use. The female amulet girdle of rope, *raun kut* (397.3 cm long, 0.9 cm wide), was made by Sugimura Kyoko under the guidance of Kinarabukku, who admitted that she never wore them herself (Collections…, 2001: 110–111). Suzuki Hiromi presented various types of Hokkaido girdles in her work: from simple cords without additions to more sophisticated items (with black triangles or quadrangles at the ends or with straps), as well as Karafuto *chakhchanki* with triangles in the lower belly (1996: 54).

Conclusions

Thus, we agree with N. Munro that the girdles of the Ainu women, secretly worn on the body and designated in the scholarly literature and catalogs of museums as belts of modesty or chastity, are sacred family clan girdles passed on by matrilineal descent. The main argument in favor of this definition is the fact that they performed the most important function of preserving matrilineal exogamy in the already patriarchal society of the Ainu people (by the late 19th century). The secrecy of the sacred girdles, which, according to the Ainu myths, were received from the deity of fire, and which were carefully hidden not only from the male eye, but also from the eyes of strangers in general, was dictated by the sense of women's responsibility for the destiny of the family and clan. The presence of two lines of kinship (matrilineal and patrilineal) in the Ainu society indicates the preservation of the important role of mothers in the life of the Ainu people, as well as close connection and mutual assistance of women belonging to the same maternal lineage.

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Received January 9, 2020.
Received in revised form March 2, 2020.

DOI: 10.17746/1563-0110.2020.48.3.124-133

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Karakalpak Family Ritualism: The *Bes Kiyim* Custom in the Transformation of Traditional Culture

This study describes the bridal and funerary rite of exchanging clothes (Bes Kiyim – 'Five Costumes') in the context of the traditions and innovations in the Karakalpak culture. On the basis of field data collected in 2014–2019 and earlier in places with a continuous or patchy distribution of the Karakalpak population (Chimbaysky, Karauzyaksky, Kegeyliysky, Nukussky, Khodzheyliysky, and the Takhiatashsky districts of the Republic of Karakalpakstan, Republic of Uzbekistan) and of earlier sources, changes in ritualism are analyzed. Bridal rites include exchanges of gifts, such as items of clothing. The comparison of sources shows that the Bes Kiyim rite originated in the mid-20th century in the context of socio-cultural changes. It has remained rather stable up to the present time, being an integral part of Karakalpak bridal ritualism. This indicates its importance in the normative culture of that ethnic group. In one district of Karakalpakstan, the term Bes Kiyim was transferred from the bridal to the funerary rituals. The origin of the rite relates to the transformation of the Iyis custom—the distribution of the deceased person's clothing among those participating in the ablution of the body. In the late 20th century, specially purchased items of clothing began to be used for that purpose. Apparently, the five items distributed among those participating in the rite symbolize the deceased person's transition to the ancestors' world. By the same token, the bride's five outfits allude to her passage to the category of married women and the beginning of her marital life. Therefore, the ritual innovations of the Karakalpaks, caused by socio-cultural and economic changes, mirror the logic and content of traditional family festivals whose complex symbolism relates to status change.

Keywords: *Karakalpaks, tradition, transformation, innovation, family rites, ritual exchange, Bes Kiyim custom.*

Introduction

The Karakalpaks are a Turkic-speaking people, Sunni Muslims, the titular ethnic group of Karakalpakstan—the sovereign republic in the Republic of Uzbekistan. Over 1.8 million people live in Karakalpakstan, including Karakalpaks, Uzbeks, Kazakhs, Turkmens, and representatives of other peoples (Russians, Tatars, Koreans, etc.).

Since ancient times until the present day, interethnic contacts have largely determined the distinctiveness of the culture of the Karakalpaks. The most important ties were with the Kazakh, Nogai, Turkmen, and Uzbek communities; they had a great influence on the emergence of the normative ritual culture of the Karakalpaks. Family rituals—wedding and funeral-commemorative ceremonies—remained the most stable.

The first studies on the traditional family ritualism of the Karakalpaks were undertaken in the first half of the 20th century. Ethnographers U. Kusekeev (1934), K. Esbergenov, T. Atamuratov (Esbergenov, Atamuratov, 1975), A. Bekmuratova (1969), and R. Kamalova

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(1996) continued the research. Their works describe specific features of marriage relationships among the Karakalpaks and most distinctive rituals performed during matchmaking and wedding. Systematization of evidence on the Karakalpak family and marriage was carried out by N. Kislyakov. Many aspects of traditional ritual culture were analyzed in his summarizing study "Essays on the History of Family and Marriage Among the Peoples of Central Asia and Kazakhstan", yet when describing the wedding ceremony of the Karakalpaks, the scarcity of information on this topic was noted (Kislyakov, 1969).

The funeral-commemorative rituals of the Karakalpaks were studied in the works by K. Esbergenov (1963a; 1964) and T. Atamuratov (Esbergenov, Atamuratov, 1975), where the genesis of religious beliefs associated with this area was analyzed. Certain aspects of the Karakalpak funerary ritualism, more precisely magical beliefs, were analyzed in the study by K. Turekeev (2020). However, a systematic study of family rituals among the Karakalpaks has not yet been carried out. In recent decades, these rituals have undergone transformations, which are very important to study.

This work is based on original field materials collected in 2014–2019 in the places of compact settlement of the Karakalpaks (Chimbaisky, Karauzyaksky, and Kegeyliysky districts), and in the areas with mixed population (Nukussky, Khodzheyliysky, and Takhiatashsky districts). The evidence from the expeditions of 1960–1980 carried out by the Department of Ethnography at the Davkaraev Institute of History, Language, and Literature of the Karakalpak Branch of the Academy of Sciences of Uzbekistan was also widely employed.

This study intends to analyze the Karakalpak family (bridal and funeral-commemorative) ritualism in terms of traditions and innovations. The research focuses on the practice of ritual exchange of clothes—the *Bes Kiyim* custom.

Clothing in the rituals of the wedding and funeral-commemorative cycle among the Karakalpaks

Family rituals of the Karakalpaks have shown the stability of structures, scenarios, and practices of social communication throughout the 20th century. Traditionally, wedding celebration was timed to summer or autumn. People also tried to ensure that wedding did not coincide with the month of Sapar—the second month of the Muslim lunar calendar, which was considered unfavorable for such celebrations, and the holy month of Ramadan—the month of fasting, obligatory for the Muslims. This requirement is strictly observed even now.

Traditionally, the Karakalpaks had several types of marriage arrangement: *aqlay quda* – agreement about the marriage of yet unborn children, *zhaslai quda* – agreement since childhood, when the boy's parents asked the consent of the girl's parents concerning the future marriage of their son with their daughter, and agreement concerning the marriage of full-aged children. In addition, there was a custom of bride stealing – *alyp qashuw*. According to field evidence, this form of marriage-arrangement had not been formerly typical of the Karakalpaks. Most of the respondents showed a negative attitude to this tradition: *"I got married in 1958. Previously, matchmakers were sent to girl's parents. We did not have a tradition of stealing the girl*;" "*When I was in the sixth or seventh grade, we did not have a tradition of stealing the girl. Such an action was condemned by the population. This tradition appeared later and was associated with the desire of the girl to marry her beloved one, and not the one whom her parents have chosen"* (FMA*, 2018).

The choice of the marriage partner among the Karakalpaks was determined by the parents. It often did not coincide with the choice of the young people. In such cases, they might decide to arrange a kidnapping. The practice of abduction still exists today, but as a rule, it is formal in nature: the guy steals the girl by agreement with her.

Traditional Karakalpak wedding included several stages. At the initial stage, the groom's parents chose the bride, often taking into account his opinion. The family clan attribution of those entering into marriage was of great importance. The exogamous norms of the Karakalpaks forbade persons belonging to the same clan to marry, even if they were the members of different divisions of this clan – *tiyre*. After the choice of the bride and the approval of numerous relatives of the young man, matchmakers *zhawshy* (from *zhaw* – 'foe') were chosen, who had to obtain consent to the marriage on the part of the girl's parents. If the answer was positive, the day of official matchmaking – *quda tusiw* (literally, 'arrival of matchmakers') – was appointed.

The next stage of the Karakalpak wedding was *esik ashar* (literally, 'opening of the door') – the first visit of the groom to bride's house after his paying a half of the bride price *qalyn*. In the evening of the same day, a cycle of ceremonies related to the first meeting of the bride and groom began; the Muslim wedding ceremony *neke* was performed.

After full payment of the bride price, the groom's side asked for permission to perform the wedding. On the day of the girl's departure, the ritual of seeing off the bride – *qyz uzatuw toi* – was performed in her parents' home; after

*Field materials of the author.

Fig. 1. Bride and groom wearing traditional Karakalpak outfits (Nukus, 2019).

that, the wedding train went to the groom's aul, where the traditional wedding *uly toi* (literally, 'big wedding') took place (Fig. 1).

Traditions were steadily preserved in the Karakalpak funeral-commemorative ritualism. Even nowadays, there remain the Karakalpaks' beliefs on the immortality of the soul, afterlife, and the associated rituals, the purpose of which is to "provide services" to the deceased in this and the other world. The custom of loud mourning of the deceased by his family (*dawys shigaryw*) should be understood in this context. Hearing loud mourning, the neighbors learn about the death of the person and begin to gather in his house. While a specially appointed person *aitywshy* (literally, 'bringer of the news') was notifying the relatives, friends, and acquaintances of the deceased about the day of the funeral, the household began to prepare for this. The Karakalpaks, like other Muslim peoples of Central Asia, performed ritual ablution of the deceased – *suwga endiriw* (literally, 'immersing into water'), associated with many magical procedures. After that, the deceased was dressed in a shroud – *kepin*. The funeral was conducted on the second or third day; people sacrificed an animal, prepared pilaf, flatbreads, and *bawyrsaq* – pieces of dough fried in oil. The female relatives of the deceased, having gathered in one room, received condolences from the women whom one of the sons or close relatives led to the doorstep with loud crying. Men did not enter the house; they expressed their condolences in front of the house. Guests (men and women) were seated separately in different rooms, where the *dastarkhan* commemoration tables had already been prepared. After commemorating the deceased, everyone gathered again in front of his house to see him off on his last journey.

The body was carried out on a wooden stretcher – *tabyt* or *agash at* (literally, 'wooden horse'), but before that, *phidiya* (absolution of sins) was performed. This was followed by funeral prayer – *zhanaza*. After that, the stretcher was lifted, and the deceased was as quickly as possible carried to the cemetery where he or she was buried. Commemoration prayer began for the participants in the ceremony. This was the end of the ceremony associated with the farewell to the deceased.

The funerary rites of the Karakalpaks, like those of other Turkic Muslim peoples, included fivefold commemoration: 1) *qara asy* (literally, 'black meal') was performed before the funeral; 2) *zhetisi* – 'week commemoration' was conducted after seven days;

3) *qyrqy* – 'fortieth day obit' was carried out on the 37th and 40th days after the funeral; 4) *zhuzi* – 'one hundred days' was celebrated on the 97th and 100th day; 5) *zhyly* – 'yearly commemoration' was celebrated a few days before the anniversary of the funeral.

One of the obligatory elements of the wedding and funerary rites was various offerings. Wedding ceremonies included payment of a bride price by the groom to bride's parents. It consisted of various kinds of livestock, food, and household items; their cost was translated into *tuwar* – the cost of one head of cattle (Bekmuratova, 1969: 66). In addition, on the eve of the wedding, the groom's parents sent to the bride's house *sogym* bull meat, which was distributed among the inhabitants of the aul. The groom usually also gave dresses to the bride's closest relatives (Ibid.: 71).

The bride's dowry included a yurt with all the necessary furnishings, and clothes. The bride was supposed to prepare *sarpai* gifts for the parents and relatives of the groom. She presented an *aq kiymeshek* headdress to the groom's mother, which, according to tradition, the bride had to embroider herself; a *shapan* robe to groom's father and to the person who gave away the bride (*muryndyq ata*); a shirt to groom's brother; a *bogzhama* carpet bag for storing clothes to the brother's wife; *tubeteika* skullcaps to the patriarchs of the aul; and headscarves to the elderly women of the aul (Fig. 2).

The funerary rites of the Karakalpaks were also accompanied by ritual gifting. An obligatory one was the *zhyrtys* ritual (from *zhyrtyw* – 'to tear'), during which men were given the clothes of the deceased, bundles of money, and pieces of fabric; women were given flatbreads, sugar, oil, meat, etc. (Esbergenov, 1963b: 35). Traditionally, the clothes of the deceased were presented to those who performed the washing of the body, as well as to his or her close relatives.

Among the practices of the Karakalpaks ritual exchange of clothes, noteworthy is the custom of *Bes Kiyim* (literally, 'five costumes'). On the eve of the wedding, the groom presented five items of clothing to the bride, and this was no less important than the bride price.

In the normative culture of the Karakalpaks, *bes kiyim* is a set of clothes consisting of five compulsory items without which it was not customary to appear in public. This included a headdress, shirt, pants, outerwear, and shoes, i.e. things that completely cover the person's body and mark his or her sex, age, and social status. The number of items—five (*bes*)—had not only a functional but also a symbolic nature. In the opinion of the majority of scholars, the number five in the symbolism of the popular Islam of the Karakalpaks was associated with the anthropomorphization of the cosmos: according to the earthly order of things, the limbs, body, and head of a person relate to each other as four cardinal directions

Fig. 2. Passing the gifts brought by groom's relatives (Nukus, 2013).

and center (Leffler, 1913: 8; Kerlot, 1994: 577; Zhuraev, Rasulova, 2014: 104).

There are many metaphorical expressions where the number five appears: *bes sawsaq* (literally, 'five fingers') – hand, *bes qonaq* (literally, 'five guests') – five cold days of autumn, *bes togys* (literally, 'five oppositions') – five frosty days of winter, *bes namaz* (literally, 'five prayers') – five daily obligatory prayers, *bes paryz* (literally, 'five requirements') – five pillars of Islam mandatory for all Muslim believers. Such expressions suggest a five-fold structure as a designation of obligatory (inherent in nature and confirmed by the religious canon) wholeness and completeness.

Information about *Bes Kiyim* in the culture of the Karakalpaks is very contradictory. It is absent from the ethnographic manuscript of U. Kusekeev written in 1934. Some scholars from the 1950s–1960s considered this custom to be old and common (see, e.g., (Kamalov, 1959: 123)), other scholars emphasize that *Bes Kiyim* was established only in the first half of the 20th century (Karakalpaki, 1962: 499). T.A. Zhdanko wrote: "According to the new custom, the groom must definitely prepare a present for his bride, the so-called *bes keyim* – 'five costumes'. This set of clothing includes: 1) footwear – 'ayak keyimi', good shoes, usually of urban style; 2) a large elegant (festive) scarf; 3) 'shoiy koilek' – a dress made of Bukhara silk; 4) camisole (usually made of plush) or 'suit' – a jacket of European style; 5) 'palton' – a coat of urban style, most often also made of plush or velvet. Things are bought according to the girl's liking" (1952: 519). When describing the rituals of the Karakalpaks associated with matchmaking, A.T. Bekmuratova referred to the tradition according to which the girl, before leaving her home, changed her girl's clothes for a new outfit prepared by her family; these clothes were a part of bride's dowry (1969: 74). However, the author does not mention donation of *bes kiyim* by the groom.

Field evidence collected from the Karakalpaks by the author of the present article on the issue of gift exchange give cause for reflection. One part of the informants claimed that the *Bes Kiyim* custom had existed for a long time and was passed down from generation to generation, while the other part (the majority) indicated that it appeared relatively recently. According to the data from the 1980s, *Bes Kiyim* became a part of the Karakalpak bridal ritualism in the late 1920s: *"Bes Kiyim emerged in 1929–1930, when collectivization was carried out. These are the items of clothing that the groom was supposed to bring as a gift to the bride"* (Field materials of the Department of Ethnography in the Karakalpak Research Institute of Humanities of the Karakalpak Branch of the Academy of Sciences of the Republic of Uzbekistan (hereafter, KKRIH KKB AS RUz), 1988). Field evidence gathered by the author of this article confirms that date: *"In the 1920s, it happened sometimes that the bride did not have an elegant dress for the wedding celebration. In this case, people resorted to the help of relatives or neighbors—they borrowed festive clothes from them. It is not for nothing that a saying appeared among the people in those years: 'El zhiberse barady' ('If the people let her go, she will marry')"* (FMA, 2014).

Bes Kiyim of the early 20th century included *turme* (a silk scarf that women tied on their heads in the form of a turban) or *aidylly* (fabric depicting a crescent moon, which women also used as a headdress), *pashshaiy koylek* (a silk dress), *qara kamzol* (a black camisole), and *beshpent* (a sleeveless shirt); *shyqyldama qara etik* (literally, 'squeaky black boots') were put on their feet (FMA, 2014).

Informants mentioned that the bride could only lay claim to *bes kiyim* if the marriage was concluded through matchmaking. The composition of the clothing items was usually reported by one of the bride's parents. A female resident of Takhiatash gave the following information: *"Bes kiyim is given only when the girl is agreed to be given to marriage. It is brought by the groom's side. In the past, people assessed the wealth of matchmakers from the richness of the costumes in bes kiyim. Expensive things in the bes kiyim made it possible to conclude that they were wealthy people, and their status in the eyes of bride's relatives markedly increased. Bes kiyim was evaluated primarily by winter clothing [coat or fur coat], dress [both winter and summer], scarf, and shoes. The gift was considered to be rich if it included qizil etik [red boots], since these boots were expensive and only wealthy people could afford them. There were cases when more modest boots, made of goat skin, were put into bes kiyim. As my grandmother told me, a bride's outfit was very expensive; one had to sell several heads of cattle to buy it"* (FMA, 2019).

The fidelity of observing this tradition and the completeness of the set were repeatedly emphasized by the informants. If even one out of the five compulsory items was missing, the groom was not allowed to take the bride, even despite his full payment of the bride price (Kamalov, 1959: 123).

According to the survey data and evidence from expeditions, the value of clothing began to be sensed by the Karakalpaks in the early 20th century, when important social and economic transformations were taking place. As a result of dispossession and collectivization, a significant part of the population of Soviet Karakalpakia, after losing their lands and livestock, ended up in extreme poverty (Qaraqalpaqstan…, 2003: 225). In search of a better life, rural population began to move to towns. By 1939, the population of the autonomy was about 475,700 people, including 57,800 of the urban population. The level of well-being both in towns and in villages was very low.

The severity of life in those years was reflected in people's memoirs. In his recollections, U. Tilewmuratov

wrote: "From the early morning, people went to қazu [works on cleaning the main canals], plowed the land with oxen and donkeys harnessed to the yoke, and dug earth by hand. They would sow cotton, sorghum, rice, alfalfa, and barley. After harvesting, the next stage of work began. There was not enough bread, food, good shoes, or clothes. Sherim etik boots got soaked in wet weather and fell off the feet; in order to keep them on the feet somehow, people used to tie them with ropes made of kendyr [fibers extracted from the stems of the plant *Apocynum venetum*]. Many even went to work barefoot" (2009: 9).

During the Second World War and in the post-War years, the inhabitants of Karakalpakstan, like all peoples of the Soviet Union, experienced great difficulties. Old people still remember these years with bitterness: *"The 1940s were hard. There was not enough footwear, although local shoemakers made it. It was manufactured from home-processed animal skins; it was called sherim. The clothes were worn until they completely disintegrated"* (FMA, 2015). According to the recollections of old people, there were not enough fabrics and clothes. Local industrial enterprises were unable to meet the needs of the population, most of people did not even have a change of clothes.

For many families, purchase of clothes was a mark of wealth. This period is well preserved in the memory of the older generation: *"Life on the collective farm was difficult. In December, people finished picking cotton and immediately began to clear the fields and fertilize them. With the onset of spring, people began to prepare embankments for retaining water on the field, and so on. Eighty percent of the work was done manually; there were no tractors yet. There were not enough clothes; it was extremely rare to see a person in whole clothes, without patches. Only after the 1960s did people begin to live better"* (FMA, 2018).

In the post-War period, the population of Karakalpakstan (mostly rural) continued to wear traditional clothes. The female outfit of that time consisted of dress and pants, several types of outerwear (*shapan*, *zhegde*, *kamzol*, *ton*), headdress (*kiymeshek*, *turme*), and boots (*etik*) or shoes. These types of clothing made up a set of mandatory items required for going out.

The provision of this set determined the meaning of the *Bes Kiyim* custom. A resident of the Nukussky District, E. Kurbanbaev explained its appearance as follows: *"During wartime, it was difficult to find clothes, especially in rural areas. During celebrations, for example a wedding, the clothes in which the bride was dressed were borrowed from relatives and friends. Usually, they were asked to give the most beautiful outfits. It happened sometimes that after the wedding, the relatives took back their clothes, and the bride was left without any costumes. To avoid this, people came up with Bes Kiyim – five types of clothes, which should belong to the bride. Even if the groom could not pay the bride price, he was obliged to buy bes kiyim for the bride"* (Field materials of the Department of Ethnography of KKRIH KKB AS RUz, 1987).

Even in difficult economic times, the brides of the Karakalpaks had to look elegant and different from their peers. As a resident of the Khodzheyliysky District recalled, *"I was married at the age of 20. Before arriving at the groom's house, I was dressed up in beautiful clothes. After the wedding, a couple of days later, the neighbors began to come and take back their things. It turned out that all the clothes were borrowed from them"* (FMA, 2018). The Karakalpaks believed: *"Bes kiyim should be assembled completely. It was considered unacceptable to bring an incomplete set. Therefore, if the groom could not buy something, he asked the neighbors to lend the missing clothes for a while"* (FMA, 2018).

The *bes kiyim* set allowed the bride to look beautiful on the most important day of her life, and to make a favorable impression on her future relatives: *"When the groom came to take the girl who it was agreed should be taken in marriage, he was accompanied by numerous relatives. They evaluated the bride—how she walked, her appearance, her manner of speaking. Special attention was paid to the outfit; beautiful clothes adorn a person"* (FMA, 2018).

Analysis of field materials makes it possible to assert that a new rite emerged in the War and post-War years. The set of *bes kiyim* of the War and post-War years included the following items of clothing: *"turme – a turban wound by the Karakalpak women around the head; kok koilek – an elegant traditional blue dress covered with embroidery and intended for young women; a camisole, most often made of blue velvet; zhipek zhegde – a robe-cape on the head; and gewish – shoes"* (Field materials of the Department of Ethnography of KKRIH KKB AS RUz, 1989).

In the mid 20th century, a new type of outfit emerged among the Karakalpaks, combining the elements of traditional and modern clothes of the European type. Girls and young women began to wear dresses with a turned-down collar, long sleeves, and a wide gathered skirt. During this period, kerchiefs made of crêpe de chine, colorful woolen scarves, and shawls were in fashion.

Remembering the 1960s, A. Kunnazarov wrote, "Until the 1960s, several kilograms of flour and calico clothing could be bought on a salary, while most of the money was spent on buying mandatory state bonds, and plans for turning in butter, milk, or eggs. In the 1960s, after the plans were canceled, there was some money left from the salaries, and people began to go to the store more and more often; women began to wear dresses made of staple, crêpe de chine, and satin" (Qunnazarov, 2000: 113). Starting in the 1960s, the improvement in the living standards of the population led to transformations in *Bes Kiyim*. Moreover, the changes affected both the ceremony

and the set of clothes. The bride could now choose her own clothes. If earlier *bes kiyim* was brought by the groom and the bride had to accept this gift, now the opinion of the future wife was taken into account. In some cases, the groom's side gave the needed money, and the girl bought the clothes she liked: *"The bride shows these clothes to the guests during the send-off, then takes the clothes with her to the groom's house"* (FMA, 2016).

Gradually, traditional types of clothing were driven out by European designs. The composition of items included in *bes kiyim* varied depending on fashion trends, as well as social and economic factors. In the 1980s, the *bes kiyim* of the dwellers of the Kegeyliysky District of Karakalpakstan consisted of the following types of clothing: *shaiy koilek* (silk dress), *maqpal nagysly kamzol* (velvet decorated camisole), *etik* (boots), *madeli oramal* (shawl with the fringe of dark red color), and *aq gezhi* (scarf) (Field materials of the Department of Ethnography of KKRIH KKB AS RUz, 1987). Around the same time, in the Chimbaysky District, the mandatory set of gifts from the groom to the bride included: *shaiy koilek*, *koberkot kostyum* (cover cloth costume), *qyzyl etik* (red boots), *gezhi oraipek* (scarf), and coat (Field materials of the Department of Ethnography of KKRIH KKB AS RUz, 1988). Instead of a dress, the set of *bes kiyim* often began to include a piece of fabric for a dress. According to the informants, this tradition became widespread in the 1980s. *"At this time, bes kiyim consisted of a piece of fabric, most often panne velvet, gezha sharshi – a large woolen multi-colored scarf and a small scarf, European-style costume of modern design, and factory-made boots"* (FMA, 2015).

Over time, this practice has not disappeared; it has rooted in the wedding ceremony. By the 2000s, the *Bes Kiyim* custom was already perceived as an integral part of the tradition: *"Us, Kareken [the Karakalpaks], have had Bes Kiyim for a long time. People brought bes kiyim before the wedding. Usually, clothes are folded in one of the compartments of a qorzhyn [saddle bag]. The bride's family accepts the gifts and dresses up the girl in them on her wedding day. When my marriage was being agreed upon, my father told the groom's family to bring bes kiyim of the following things: coat, boots, scarf, suit, and dress*" (FMA, 2016); "*Until the groom prepares the bes kiyim, he cannot take the bride away"* (FMA, 2018).

Informants (regardless of where in the Republic they live) report that the *Bes Kiyim* tradition has begun to be observed even in the case of bride kidnapping. Today, *bes kiyim* for the bride is purchased when she is already in her husband's house. A resident of the town of Takhiatash says: *"Recently, people have begun to buy bes kiyim even when the girl is kidnapped. She chooses the clothes which she likes on her own. When I was getting married [in 2000], they brought a small red scarf, a large scarf, beshpent [sleeveless jacket], traditional dress, and shoes that were in fashion at that time"* (FMA, 2019). A small bright headscarf has become an characteristic of a married woman.

The tradition of giving clothes to the bride has survived in the present-day wedding ceremony. The former name (*Bes Kiyim* – 'Five Costumes') also remains, but the number of items included has changed: *"Now, bes kiyim has ceased to include the obligatory five types of clothing. Those who are wealthier give the bride ten types of clothing or more"* (FMA, 2015).

Clothes in the wedding ritual of the Karakalpaks marked the changes in the status of newlyweds. According to the universal logic of rites of passage, the wedding ritual implied the formation of a complete holistic image of a mature person; the set of *bes kiyim* served as its symbol.

Notably, the number five appears in the same symbolic meaning (as expression of integrity) in Karakalpak funerary ritualism. Field evidence from different years contains information about the ritual dressing of the dead. Records from 1989 mention that five items should be prepared for a woman: *"The first is a shroud, which covers her on the outside; the second is cloth that is wrapped around the body from the waist to the knees; the third is cloth for the legs below the knees. The fourth element is kiymeshek; and the fifth is a headscarf"* (Field materials of the Department of Ethnography of KKRIH KKB AS RUz, 1989). According to K. Esbergenov, "the shrouds differ somewhat in shape and consist of three parts, named by distorted Arabic terms: 1. 1. Kyryk covers men and minor children (boys under 13, girls under 9) from shoulders to knees; 2. Lpala covers the deceased from head to feet; 3. Kamis is sewn as a cylinder with extra space over the head and at the feet, no less than the width of the palm, so that it can be tied like a bag. Dead women are dressed in 2 kyryk, 2 lpala, and 1 kamis. Thus, the shroud for women consists of 5 parts" (1963a: 80–81).

The five-fold composition of the "clothing" of the deceased is a stable tradition among the Karakalpaks. According to field evidence collected by the author in the Kegeyliysky District of the Republic, the term *bes kiyim* denotes the clothes of the deceased, which are distributed after his funeral to those who took part in the ablution ritual: *"Bes kiyim exists not only during wedding. Now, when an old man dies, his children must prepare bes kiyim. Even before the funeral, shoes, outerwear, shapan, hat, and skullcap are prepared—exactly five items, which are folded into one knot"* (FMA, 2018).

Traditionally, the washing of the deceased among the Karakalpaks ended with the performance of a *zhanaza namaz* prayer over his or her body. After that, the elderly people who participated in the ritual of ablution were given items of the best clothing of the deceased (Karakalpaki, 1962: 500). *"On the day of the funeral, the participants in the ablution ceremony are given the bes kiyim clothes. About 20 years ago, these were the clothes*

that the deceased used to wear during his lifetime. Now these are five new clothes" (Field materials of Turekeev, 2016).

The Karakalpak tradition of distributing clothes of the deceased has existed for a long time. Clothes are given not only to the participants in ritual washing, but also to close relatives, as well as friends, if the person lived a long life. This practice is associated with the beliefs that the clothing of the deceased is sacred and a particle of his soul remains in it. Earlier, the clothes of the deceased in old age were called *iyis* (literally, 'scent'). The relatives received them as a *teberik* (literally, 'sacred/blessed') offering (FMA, 2019).

The Karakalpaks denoted the Muslim tradition of commemorating the dead on Thursdays with the word *iyis*. Every week on this day, Karakalpak women fried *shelpek* flatbreads on oil in the morning and distributed them to the neighbors. This was a commemoration treat which was supposed to be received with the words *"tiye bersin"* ('let him reach'). On the days of holy Muslim feasts, this tradition was strictly observed. The Karakalpaks commemorated their relatives on May 9th, the Memorial Day—public holiday in the Republic of Uzbekistan; this is an innovation in an old tradition.

Similar customs existed among other Central Asian Muslim peoples. The Nogai customs were described in detail by A.A. Yarlykapov (2008). According to their tradition, the personal property of the deceased (mainly clothes, shoes, and headdress) was donated to the people who washed the deceased, to the relatives, and to the poor. Only worn things were given away, with the words: *"Iyisin taslamai alyp yuriniz"* ('Wear the scent constantly') (Ibid: 113).

According to B.K. Karmysheva, among the Uzbeks of Fergana, the ceremony of ritual washing of the deceased was performed by professional washers *yuguvchi*, *gassol*, for whom this occupation was hereditary. Elderly people selected from the community were also invited. There was a belief that if a person washed seven dead people in his life, he did not have to fear the fire of hell. In the cases where the ceremony was performed by non-professionals, five people participated in it (Karmysheva, 1986: 142, 144).

The Karakalpaks do not have professional washers. Relatives or neighbors usually participate in the ritual. Their number must be even. According to various sources, from four to eight people participated in the ritual, depending on the age and status of the deceased. *"Eight people took part in washing of a relative, an elderly woman. Everyone tried to be included among the washers. At the end of the procedure, they were given good things: a coat to the most important person, and other types of clothing to the rest. The clothes of the deceased were taken, because she was a respected woman and lived a long life"* (Field materials of the Department of Ethnography of KKRIH KKB AS RUz, 1986) (Fig. 3).

Fig. 3. Things of an elderly woman intended for distribution as iys (Nukus, 2019).

Tradition determined the order in which the clothes are distributed among the washers. *"The most precious thing (the headdress) is given to those who washed and held the body. The best clothes are given to the one who poured water. The one who drew water from the vessel receives inner clothes, and the one who brought water gets the rest"* (Field materials of the Department of Ethnography of KKRIH KKB AS RUz, 1985). *"The coat was given to the one who washed the upper part of the body and head; a piece of fabric or scarf was given to the one who washed other parts of the body; galoshes or masi were given to the one who washed the feet"* (FMA, 2019).

According to traditional beliefs, the clothes of the deceased had to be given away, so after the transition of the person to another world, he would not turn out to be undressed. Five required types of clothing formed a holistic image projected into the other world: *"If you do not assemble bes kiyim, the head of the deceased will be cold in the next world; he will walk barefoot and without clothes. It is especially bad if he does not have a headdress"* (FMA, 2018).

The ceremony of distributing the clothes of the deceased is ubiquitous among the Karakalpaks even today. The transfer of the term *bes kiyim* from the wedding ritual to funeral ritual was observed only among the residents of the Kegeyliysky District of Karakalpakstan. While in the past washers and relatives received used clothes, now as a rule these are specially bought clothes, and the number of things has decreased. Clothes are often replaced with pieces of fabric. Old people, preparing for death, try to procure new clothes in advance for rewarding the participants of their equipment to the other world. Most of the respondents explain the replacement of used clothes with new things by the fact that people began to live well (FMA, 2019).

Dressing up into new clothes among the Karakalpaks is one of the obligatory transitional rituals of the family cycle. It is likely that the five items of clothing for the newlywed bride symbolize her transition to a new status and the beginning of a new life, while the five items that are distributed to the participants in the ritual of ablution are associated with transition to the world of the dead—the world of ancestors.

Conclusions

The analysis of field evidence has shown that the *Bes Kiyim* custom in the Karakalpak wedding ritualism appeared in the first half of the 20th century under the influence of changes in social and economic conditions, and declining living standards. At the same time, the use of clothes in the wedding ritual was deeply traditional, since it marked the change in the status of a woman during her transition to a new age and social class.

Stable preservation of the *Bes Kiyim* custom testifies to its firm place in the normative culture of the people and its perception as obligatory element of contemporary Karakalpak wedding rituals.

The transfer of the term *bes kiyim* from the wedding ritual to the funeral ritual is of a local nature. However, it relies on the widespread custom of *Iyis*—distribution of clothes to the people who took part in the ritual washing of the deceased and in his dressing. While initially these were the things which belonged to the deceased, in the late 20th twentieth century, they were replaced by specially purchased clothes. Such transformations are associated with the improved living-standards of the population. However, the tradition of distributing used clothes of the deceased persists when it is related to the person who lived a long life. In this case, the clothes of the deceased are accepted as blessed objects. The funerary traditions of distributing clothes established a symbolic completion of the life path of a person who, with the transition to the other world, lost his complete and integral earthly image. The five obligatory items of clothing (*bes kiyim*) projected it into the other world.

Innovations in the ritual practices of the Karakalpaks, which emerged in response to the social, cultural, and economic changes, corresponded to the logic and content of traditional family festive ceremonies. Changes in the attributes have not altered their meanings associated with the change of life cycles and statuses.

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Received May 15, 2020.
Received in revised form August 7, 2020.

DOI: 10.17746/1563-0110.2020.48.3.134-142

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Verbal Restrictions on the Communication of Turko-Mongols of Inner Asia

Verbal restrictions common among the Turko-Mongol peoples of Inner Asia and Siberia are analyzed on the basis of folkloric and ethnographic sources. Their principal forms are silence, circumlocution, and whisper. The socio-cultural context of these restrictions is reconstructed. They are seen in various domains of culture, in particular relating to social norms, and are believed to reflect fear of human life and the well-being of man and society in the communication with nature represented by deities and spirits. This is a natural reaction that has evolved under the harsh environmental and climatic conditions of Inner Asia. The same concerns, extending to social communication, have regulated interpersonal interactions. In a nomadic culture, verbal restrictions stem from the importance of the ritual function of language and a specific attitude toward spoken language, which, over the centuries, was the principal means of information storage and transfer, cognition and adaptation. This concept of speech affected the emergence of the principal behavioral stereotypes. The rigid norms of behavior account for the importance of the nonverbal context of the nomadic culture—the high informative potential of the entire space inhabited by the nomads, and the rich symbolism of their material culture, traditional outfit, and dwelling.

Keywords: *Inner Asia, Turko-Mongol peoples, communication, silence.*

Introduction

Verbal restriction generally understood as silence is one of the most important phenomena in universal human culture and a component of communication that has been increasingly attracting the attention of scholars. K.A. Bogdanov wrote (1997) about the versatility of this phenomenon, and the impossibility of clarifying its social and cultural semantics from the point of view of any highly specialized field of the humanities. With regard to specific societies and cultures, verbal restrictions have been analyzed by the founder of "cultural grammar" E. Hall, who authored a number of studies on the subject (Hall, 1982; Hall E.T., Hall M.R., 1990). He divided cultures into those with low and high context. In the latter type, a significant part of the information is framed by non-linguistic context (tradition, hierarchy, and status of the interlocutors), and only a small part of information is presented in words. Highly contextual cultures are characterized by high density of social ties in which status and reputation extend to all areas of life, and are inherent in many peoples of Asia, primarily those living in China and Japan.

It is also legitimate to describe the culture of the Turko-Mongol peoples of Inner Asia* as a high-context

*Selection of this region in the humanities is to a great extent justified not by geographical, but by historical and cultural boundaries: "Inner Asia is a territory primarily united by a common historical destiny in connection with natural and

culture for which non-verbal texts play a paramount role in the information space. Specific verbal culture, sparing in words, emerged among the nomads who settled in the vast territories of the region, a significant part of which is unfavorable to life. Representatives of the traditional Turko-Mongol nomadic society cannot be called emotional. This society has reproached open manifestations of joy, anger, attachment, and especially affection outside a narrow family circle. Priority of silent behavior can be seen in etiquette, which strictly regulates the rules of behavior in society for men, women, and especially children, and is duplicated by customs and rituals, prohibitions and signs.

The emotional and sensual aspect of traditional nomadic society has not been one of the problems provoking the interest of scholars. This may be possibly explained by the difficulty of including this issue into the system that divided culture into spiritual and material realms, common in the Soviet ethnography. With the emergence of new approaches to the study of culture and the expansion of the conceptual framework, behavioral features have been becoming an integral part of the studies of ethnic mentality, consciousness, and character. In the 21st century, the problems of emotions and space have become a topic of research. For example, scholars have been interested in how space affects the emergence of certain emotions, and how it limits them (Dundon, Hemer, 2016). This problem was previously indicated by Yi-Fu Tuan, who wrote about the topophilic and topophobic spaces (1974). To a certain extent, these studies have become a reference point for this work.

It is not the purpose of this article to analyze mentality and ethnic character; this study rather focuses on the factors that formed the image of the laconic secretive nomad of Inner Asia (a Mongol, Buryat, Khakas, Oirat, or Tuvinian) known to us from the works of the scholars and missionaries of the 19th–20th centuries. Such character traits irritated many people and seemed to be a manifestation of stupidity, stubbornness, and cunning, or were explained by childish naivety (Radlov, 1989: 214; Osokin, 1906: 222; Termen, 1912: 111). The rare scholars who became engaged into the culture of nomads have managed to learn more deeply their traits of behavior and character, and also to understand them more deeply (Sieroszewski, 1993; Shinkarev, 1981). Secrecy and laconic speech have survived to this day and are of interest to specialists in psychology (Semke, Bogomaz, Bokhan, 2012). How and why has the spiritual world of nomads evolved to be so "sparing" with manifestation of emotions and feelings? In our opinion, this question can be answered by the sources of various types accumulated over the centuries among the Turko-Mongol peoples of the region under study. They contain rich information about the "culture of silence" and the conditions of its emergence. The sources of this study are descriptions of the rituals of the life-cycle, as well as of hunting and fishing activities, travel notes of members of expeditions to the central regions of Asia, small genres of Turko-Mongol folklore, and evidence from the personal fund of P.P. Batorov at the Center for Oriental Manuscripts and Xylographs at the Institute of Mongolian, Buddhist, and Tibetan Studies of SB RAS. The chronological framework of this study is the 19th century to the first half of the 20th century, which is justified by the presence of historiographic research for this period. This framework is rather arbitrary, since the meaning and content of rituals and different genres of folklore reflect a set of ancient ideological concepts that are little susceptible to change.

Verbal restrictions, creating the impression of the laconicism of nomads, are expressed in various spheres of culture, and numerous prohibitions, signs, admonitions, and reprehensions. This makes it necessary to structure such a large array of evidence. The aim of this work is to reconstruct the social and cultural context in which verbal restrictions manifested themselves among the peoples of the Turko-Mongol world of Inner Asia, which will be attempted by interpreting cultural phenomena. Analyzing available evidence through contrastive and comparative methods will make it possible to identify the most common situations accompanied by verbal restrictions, and to establish the common origin of seemingly different rituals and traditions. A large array of data does not allow us to consider all situations when verbal restrictions are manifested in detail, and therefore we will focus only on the most common and relevant cases.

Verbal restrictions associated with hunting

Verbal restrictions are clearly manifested in one of the archaic economic activities of nomads: hunting. Despite the fact that cattle-breeding played an essential role in their economy, hunting was of great importance, especially in the forest-steppe and taiga natural zones. The archaic nature of this activity determined the preservation of the most ancient layer of traditional culture and accordingly, some archaic forms of ideology, associated with hunting

climatic features which created the preconditions for a single nomadic civilization. In the present-day situation, it comprises Mongolia, the Inner Mongolia Autonomous Region of China, Buryatia, Tuva, and Altai" (Mitupov, 2007: 6). N.N. Kradin includes Mongolia, Xinjiang, and Inner Mongolia of China, as well as Southern Siberia and Transbaikal region (Tuva, Khakassia, and Buryatia) into the boundaries of Inner Asia (2016: 8). The author of *The Cambridge History of Early Inner Asia* D. Sinor considers the lands of Siberia and the Urals to be the northern periphery of the region (1990).

(Zhambalova, 1991: 5). A number of verbal restrictions typical of the complex of traditional hunting may go back to the early stages of human development, when fear of the forces of nature and animals prevailed over humans. In addition, the taiga world is the most sophisticated realm according to the concept of sound landscape—a new field of research emerging in acoustic ecology (Sheikin et al., 2017: 94). Sound-orientation in limited forest visibility was extremely important for the hunter. Being in the forest required a sensitive behavior which was in harmony with the acoustic environment of the landscape.

According to traditional beliefs, some spirit-lords of the mountains—for example, the lord of the Altai—are calm, and like it when everything is quiet and calm around: "the one who gets angry in the mountains, quarrels, makes loud sounds, will bring misfortune causing the anger of the spirit of the mountain" (Zelenin, 1929: 64). The need for such behavior in the forest is understandable, because the task of the hunter is to find prey, not disclose his own location, and prevent the attack of any dangerous predator. In order to become a part of the taiga world, hunters would put on special clothing traditionally made of skins of wild animals. The Buryats sewed light, warm, and waterproof jackets and pants from the skin of roe deer or musk deer. Ancient headdress, manufactured of the entire skin, which was removed from the head of an animal along with ears and even horns, retained its importance (Zhambalova, 1991: 79–84; Galdanova, 1992: 40). Such clothes disguised human smell and appearance. When Mongolian hunters went to hunt deer and elk, they put on special *boitog* shoes sewn of deer or elk skins with fur on the outside. It was believed that the animal would not hear the approach of a human wearing such shoes (Vyatkina, 1960: 171).

Yet hunters were afraid of malevolent forest spirits even more than dangerous animals. According to popular beliefs, the spirits could lure people into remote places, kill them, or even take them to their world. In the beliefs of the Turko-Mongol peoples, such spirits include Buryat *muu shubuun* (Galdanova, 1987: 28), Khakas *albys*, *khuukhat*, and Tuvan *diiren*, *shulbus* (Butanaev, Mongush, 2005: 32–37). While hunting, it was strictly forbidden to brag, cheat, swear, or complain about poor prey (Butanaev, 1996: 27; Erdenebold, 2012: 114). Boasting, dissatisfaction with prey, excessive greed and cruelty were severely punished by forest deities (Yakutian "Baianai", Mongolian "Manuukhai", etc.), who deprived the hunter of their mercy.

Verbal restraints were associated with many hunted animals. When people were going to hunt them, it was customary to hide their intentions. Therefore, the object of the hunt was not discussed; a method of circumlocution was used in relation to it. Such rules were observed when hunting bear, wolf, wild boar, deer, and some fur animals. Mongols called red deer *turag* ('raven'), fox – *malgai* ('hat'), wild boar – *tugdger* ('humpbacked') (Vyatkina, 1960: 171), wolf – *tengeriyn amtan/nokhoi* ('creature of the sky/dog') (Lkhagvaseren, 2013: 146). They believed that a bear, wild boar, and wolf had "earth ear", that is, they were able to hear conversations at a great distance, and deer had clairvoyance, "The one who intends to kill me – let him not live to old age; the one who comes to listen to me – let him gain longevity" (Galdanova, 1987: 39). Verbal restrictions were often accompanied by secrecy of action: in order not to frighten away hunting luck, the Yakuts removed the skin from the killed fox at night, after everyone fell asleep, so no one could see this (Yakutskiye mify, 2004: 249).

Verbal restrictions associated with natural objects

In the normative culture of nomads, it was strictly forbidden to mention the names of sacred objects and true intentions and goals in certain places out loud. Compliance with these rules was especially important while traveling. The measures for protecting travelers from dangers include a prohibition on saying the "name" of a natural object aloud, be it a river or a mountain pass. According to the beliefs of the carriers of traditional culture, the lord-spirits of such places may have bad tempers and harm the travelers if they provoke their anger. One such awe-inspiring natural object is the Shurgantu Ridge in Mongolia with the "fierce" Mount Khutsa: "If anyone dares to pronounce the name of the ridge or the mountain, he has perished: either he will be struck with thunder, or thieves will steal from him, or he will get sick" (Zhamtsarano, 2001: 181). Difficulties in crossing require special measures in respect of the Kerulen River, which according to the local residents is related to the Tola River by the ties of kinship. It is considered the older brother; therefore, it is forbidden to name the Tola River before crossing the Kerulen River: "The Kerulen will be offended that they prefer its younger brother Tolu" (Ibid.: 183).

Circumlocution was also a precautionary measure. The tradition of referring to majestic natural objects in the following verbal forms is observed everywhere in the Turko-Mongol environment: "Grandmother", "Mother", "Dear one" (Buryat, Mongol *Khairkhan*; Turkic *Kairakan*). Among the Buryats, travelers who stop at the river bank will not say that they will cross the river tomorrow. There is a special expression for that: "Tomorrow we will try to ask our grandmother to get there" (Batorov, (s.a.): fol. 69).

In the Turko-Mongol world, beliefs concerning the inadmissibility of imperative, arrogant, and—even more so—insulting address to lord-spirits of all natural objects, were stable, since the anger of the spirits of even

insignificant lakes or streams could have had disastrous consequences for people. In the Yakut legend about the lady of the taiga lake Kharyialaakh, an arrogant rich man who came to the lake to fish refused to arrange the ritual meal for "grandmother" (this is what the spirit-lords of the Yakut reservoirs were usually called) and insulted the spirit of the lake with the following words: "People call it 'grandmother'. That is a pity; they started to call every little lake 'grandmother'. Cannot it really give away all the rubbish that lives in its waters?" The rich man swore, threatened to turn the lake inside out with a net, not leave a single frog in it, etc. Everyone who participated in the fishing disliked his speeches. As a punishment, the rich man did not catch a single fish, lost his seine, carts, and barely returned home alive (Yakutskiye mify, 2004: 289–302).

People treated high mountain peaks, large rivers and lakes, and deserts with special reverence, which was traditionally expressed in praise, hymn-like songs, and sacrifices. At the same time, the observance of silence was an expression of respect in sacred places. When a person was near sacred rivers, mountains, and lakes, he was not supposed to make noise, speak loudly, or shout. For example, even today people try to keep quiet on the banks of the largest Siberian river, the Lena.

The majestic Gobi Desert was an especially awe-inspiring natural object. Unusual phenomena typical of desert regions, such as mirages or sandstorms, contributed to the emergence of the image of a mysterious place hostile to man, which the Mongols called the Land of Witches. In the Gobi, often only the guides knew where the next rest-stop would be, and usually they tended to avoid sharing this information out loud with their companions. According to the beliefs of the Mongols living in the Gobi, the desert is inhabited by evil spirits who can learn from people's conversations where they are going to spend the night, and harm the travelers. This is how one of the members of N. Roerich's expedition described a similar situation: "What a misfortune—the desert heard about us. By the evening a whirlwind had arisen; it turns out that we ourselves are to blame for this: we loudly pronounced the name of the stopping-place and thus, in the opinion of the Mongol caravaners, alerted the evil forces of the desert. They can locate the whereabouts of travelers and send any misfortune. Nobody should know about the stopping-places except for the caravaners" (Ryabinin, 1996: 75). The travel notes of K.N. Ryabinin also mention the inaccuracy of the maps made by the Mongol caravaners, and the absence of important topographic points (mountains, passes, roads, etc.) therein, which was explained by the same fear of revealing oneself on the way before the spirits of the desert, "…much data on the maps is incorrect probably because the Mongols shrink from pronouncing the names of particular localities, in order to avoid (in their opinion) misfortunes for travelers after mentioning the name; since 'the desert hears' and thus learns about the location of the caravan" (Ibid: 80). There are many examples confirming the relevance of such views. In general, it probably makes sense to speak about such a phenomenon as the "language of the traveler" with a typical feature of widely using conventional names (Sagalaev, Oktyabrskaya, 1990: 155).

Pronouncing the names of the lords of the sacred places without good reason is extremely dangerous from the magical point of view, since it may bring harm to the household and to the person who bothered the spirits without good reason (Zhukovskaya, 1988: 98). In the Buryat tradition, the names of deities, spirits, and even epic heroes may be pronounced only during the ritual addressed to higher powers. Small sacrifice of food and drink should be offered to the deities and spirits: "Without a drink, forbidden names cannot be pronounced out loud" (FMA*, 2004, G.V. Baskhaev, born in 1937: Baitog Ekhirit-Bulagatsky District, Irkutsk Region).

Restrictions on noisy behavior

In the traditions of all peoples of Siberia, it was strictly forbidden to behave noisily or call someone by name loudly, especially after dark, since it was believed that any loud sounds made by a person could attract the attention of evil spirits, who would harm the person, his family, and household. This applied also to all spirits of disease: they had particularly keen hearing, and tracked down the whereabouts of people by focusing on the various sounds of human habitation. The Yakuts believed that the spirit of smallpox listened to the barking of dogs, the mooing of cows, the sound of an axe, or the creak of sleigh, and comes to people (Yakutskiye mify, 2004: 321). Fleeing from epidemics, people hid in the forest trying to keep silent—they talked in whispers, got rid of dogs, did not let cattle out to pasture, and carried hay and firewood at night (Ibid.).

According to the beliefs of the Buryats, the spirits of disease cannot stand noise. Therefore, in case of epidemic diseases, silence should have been observed. The Buryats represented the *zayans* or *ezhins* (lord-spirits) of some diseases that cause fever as very powerful spirits, who ride in black carts drawn by black horses; one half of their face is black and the other is white. They travel around the uluses and spread deadly diseases. Traditionally, during an epidemic, the Buryats performed propitiatory rituals dedicated only to the *ezhins* of these diseases (they did not perform these rituals in relation to the spirits of other diseases). The

*Field materials of the author.

Buryats spoke to the spirits through a black shaman. "During the ceremony, people spoke quietly by whispering, and they pronounced the words of prayer also in a whisper, since the spirits of these diseases do not like loud talk. The spirits were addressed in the following way:

'Shibenzhi kheleshin Those who speak in whispers
Shimkhelzhi ideshin… Those who eat with pinches' "

(Khangalov, 1958: 456).

According to popular beliefs, good deities also love silence. The Yakuts believed that goddess Aiyysyt (the protectress of women in labor and newborns) is invisibly present during childbirth, assists the woman in labor, and remains in the house where the child was born for three more days. At this time, people were supposed to speak only in whispers, to walk quietly, not to make loud knocks, and not to quarrel. Otherwise, the goddess could get angry, abandon the woman in labor, and leave the newborn without her favor (Sleptsov, 1989: 93). The Buryats shared similar views. They believed that noisy behavior and loud sounds could frighten the deity who protects children and domestic animals: "The Agi Buryats said to the children: 'Do not close the door too loudly, you will scare the zayash'. Ongon Emegelzhe Zayaashi is the protectress of children and cattle" (Gombozhapov, 2006: 52, 53).

According to legend, animals, birds and other creatures, from which individual tribes and clans originated, enjoyed special respect among the nomads. Men manifested respectful attitudes to the mythical ancestor, particularly the bird, by keeping silent, while women, in addition to special behavior, revealed this attitude in the tradition of wearing obligatory elements of clothing, in which the daughter-in-law had to show herself to her father-in-law and other relatives of her husband. This is an elegant sleeveless jacket (*uuzha*, *khubaikhi*, *deglee*, *tsegedek*, *tsegdk*) among the Mongolian peoples (Badmaeva, 1987: 64–65; Sharaeva, 2011: 124); *sigedek* among the Khakas people (Butanaev, 1996: 76), and *tangalai* fur coat among the Yakuts. "If daughters-in-law of the Engins met a hawk on the way and were not wearing a tangalai, they hid from the hawk in a ravine, and thus they observed the custom of 'kiyiittii'. Even men do not dare to frighten the hawk; they do not speak loudly, speak only in whispers, and do not pronounce its name…" (Predaniya…, 1995: 189–190).

Restrictions regarding song performance

In the culture of nomads, musical performance and song performance belong to the realm of the sacred, connecting the earthly world of humans with the other world. Rhymed speech and music acted as a kind of language through which people communicated with the inhabitants of the other world. According to the beliefs of the Buryats, diseases could manifest themselves in a song (songs of the *zayans* (Mikhailov, 1987: 55)). The song was believed to heal the disease (here it is appropriate to mention the art of Yakut singers—smallpox charmers (Gurvich, 1977: 184–185)). The supernatural power of song performance explains the logic of restrictions in that area. For example, in Tuvan culture, women are prohibited from "singing with their throats", otherwise her relatives will be harmed (FMA, 2015, C.A. Kara-ool, Ulan-Ude). The Khakas people prohibited crooning to oneself, since the devil hears a crooning person through forty hills; the crooning person has no happiness (Butanaev, 2003: 34). In many cases, these restrictions were local. Among the Buryats, the ban on performance of songs was observed in the Osinsky District of the Irkutsk Region. That is the location of the village of Ulei, where dwelled the souls of 330 girls who committed suicide or died tragically, according to the legends; all of them used to be the best singers during their lifetimes. This host of spirits, headed by the famous beauty and singer Burzhuutkhai-duukhei (Nebesnaya deva-lebed, 1992: 285–287), is interested in multiplying its community; therefore, the ban on performing songs in this area is still relevant, especially after dark.

Rules and prohibitions associated with the concept of happiness/goodness

Restraint in manifestation of emotions is justified not only by the fear evoked in people by harsh nature, but also by the fear of losing happiness. N.L. Zhukovskaya (1988: 86–100) described the category of "happiness/goodness" in the culture of the Mongols in detail. According to her research, the nomads were convinced that it was very difficult to acquire and preserve goodness, and it was easy to lose it if they did not live according to the rules. Emotional expression of joy could soon be replaced by sadness, as evidenced by one of the Mongolian sayings: "He who has excessive fun, cries afterwards". Therefore, there is a whole system of restrictions and prohibitions in the culture of the Mongols, which protects happiness from possible accidental or deliberate encroachments. Happiness/goodness resembles an elusive "bluebird", which could be scared away by anything. As Zhukovskaya aptly noted, grace is a very delicate substance.

Many social and individual rituals pursued the goal of soliciting happiness and well-being from higher powers. Large collective prayers in the tradition of the Turko-Mongols were the spring-summer *tailgans* (Buryats) (Dashieva, 2001), *ova təklhn*, *obo takhil*, *balind mörgökh*, *deer mörgökh* (Kalmyks, Oirats of

Mongolia, Khalkha Mongols, Buryats) (Bakaeva, 2003: 208; Lkhagvasuren, 2013: 141, 142; Erdenebold, 2012: 39–41), and *taiyg* (Khakas) (Butanaev, 1996: 179), which were attended by the members of the same clan, tribe, or tribal union. R.S. Merdygeev described in detail the restrictions and prohibitions that Buryat families had to observe after the *tailgan* was carried out: "After the last tailgan is completed, the household keeps a strict three-day ban *khoryul*. During this khoryul, absolutely nothing can be given to an outsider, one may not shout in the pound, beat or scold the cattle, or slam the gates hard. Otherwise, if these rules are not observed by the owners, khishyk ('happiness') that has been just received by entreating and which has not yet managed to move into the household could go to a stranger along with the object that was given away; or if dead silence is not observed and the cattle are not treated with love, 'khalyakha' may slip away (that is, separate) from the household. Therefore, khishyk is, as it were, a living and sensitive being" (Merdygeev, 1928: 146).

Verbal restrictions in the area of marriage and family relations to the greatest extent regulated the relationships between the representatives of the family and clan with their new members—daughters-in-law, sons-in-law, or children. The most common example is the custom of avoiding *kinit* (Yakut), or *seergkhe* (Buryat) in marriage and family relations, expressed by the prohibition imposed on the daughter-in-law to pronounce the names of the husband's father and his close relatives, especially of the more elderly*. The older relatives usually included those in relation to which she performed a special ritual of veneration during the marriage ceremony: father-in-law, mother-in-law, their brothers, as well as elder brothers and sisters of her husband. The daughter-in-law had to use the method of circumlocution *bai syos* (Turkic). The Turks of Southern Siberia even developed a special language (*paila*), which was used by women (Sagalaev, Oktyabrskaya, 1990: 151). It has been suggested that in social relations, the principle of circumlocution acts as a universal way of semantically marking situations of the "friend or foe" type (Ibid.: 154).

In the folklore of the Turko-Mongol peoples, there is a widespread plot about resourcefulness of the daughter-in-law, who in a difficult situation (wolves' attack of a herd of cows and coincidence of the names of the father-in-law and his sons with the names of animals and natural objects—stream and bush, where this happened) was able to quickly inform the family members about what happened using a circumlocution. Notably, the custom of avoidance in different societies of the Turko-Mongol world has its own features. For example, among the Khakas people, it was observed only in relation to those wives of the father-in-law whose official status was secured by the norms of traditional marriage, and did not apply to the third wife, "because this life-partner was not brought to worship the Sun and the Moon" (Butanaev, Mongush, 2005: 41). Violation of the custom of circumlocution was allowed only in case of complicated child delivery. In this case, the woman in labor directly addressed her husband's sisters, his mother, and father by name, asking for help. After a successful birth, the daughter-in-law gave her husband's sister a dress as a sign of gratitude (Ibid.: 140).

The fear of violating the ban on pronouncing the names of husband's relatives appears in the folklore plot of the Kalmyks in a mother's special instruction to her daughter-bride. The mother sewed a stone into her hem, instructing her to be silent until the hem wore out and the stone fell out. In this way, the mother tried to help her daughter adapt to her husband's family (Sharaeva, 2011: 130). In our opinion, this plot is associated with the ritual, widespread among the Turko-Mongol peoples of Inner Asia in the past, in which a stone played a special role. In the wedding traditions of the Mongols, it is used as a symbolic object that secures the bride in a new place of residence, in a new family. At the end of the wedding celebration in the groom's house, the bride's mother put a stone and several seeds on the hem of her daughter's dress, accompanying her actions with good wishes: "Be more beautiful than gold, be heavier than a stone" (Ochir, Galdanova, 1992: 47). During this ceremony, the bride sat down and was not supposed to get up until her parents left. Rituals with a stone are observed in the traditions of various Mongolian peoples—the Khalkha, Oirats, and Altai Uryankhai (Vyatkina, 1960: 211; Ochir, Galdanova, 1988: 117; 1992: 47; Lkhagvasuren, 2013: 128).

Verbal restrictions were accompanied by other prohibitions: at first, in a new house, and sometimes throughout her life, the daughter-in-law should not pass dishes with tea or food into the hands of her father-in-law, treat him to tobacco, touch his things, or ride his horse. Among the Urats, when starting her duties as the hostess of the yurt after the wedding, the daughter-in-law passed a cup of tea to her father-in-law through a third person (Naranbat, 1992: 70), while among the Kalmyks, at first she did not even take part in family meals (Sharaeva, 2011: 130).

Prevention of sexual relations between the father-in-law and his daughter-in-law and of her close relationships with other relatives of the husband on the ascending line explains the taboos that the daughter-in-law had to observe (Sieroszewski, 1993: 549; Petri, 1925: 30). Any deviation from the norms of behavior was regarded by the Buryats as a sin (*seer*). This concept was most fully described by B.E. Petri: "To sin (for the Buryats) means to incur the wrath of the gods and all the consequences of their anger and revenge—diseases, misfortunes, loss

*Similar prohibitions were observed by the son-in-law in relation to wife's relatives.

of livestock, crop failure, unsuccessful hunting, damage to things, etc. To sin is to violate ancient traditions and thus cause displeasure among the old people who guard them, and maybe even the ancestors; to sin is to commit an offense against society and the clan and thereby cause ridicule from those around" (1924: 24–25). Analyzing the relationship between the father-in-law and daughter-in-law in Buryat society, Petri observed that "any violation of prohibitions in relation to khadym [father-in-law] will be punished by deities, whose images [ongons] hang in his yurt" (1925: 26). As we can see, sin is not connected with morality, and the only thing that kept a person from falling into sin was fear of nature personified in numerous deities and ancestral spirits.

A number of requirements restricting freedom of expression were imposed on children. They were forbidden to speak loudly or laugh in the presence of adults, or interrupt the conversation of those who were older; adults were not supposed to be called by name, but by the name of parents (grandmothers, grandfathers) of a child they knew (Butanaev, Mongush, 2005: 157; Basaeva, 1980: 105). All these rules embedded in children respect for those who were elder and for nature.

Verbal restrictions were also present in funeral rituals. For example, the prohibition on pronouncing the name of the deceased is known (Potapov, 1969: 381). However, the occasional nature of such events in the life of society makes it possible to exclude them from the list of the most relevant normative rules in everyday life.

Verbal restrictions on persons in power

In the 19th century, the verbal restrictions observed by the newlyweds in an expanded social group spread to the representatives of the nobility among the Mongols. For example, it was not customary to pronounce the names of the Khoshun and Aimag noyons, Khan, and clergy (Vyatkina, 1960: 237). According to G.N. Potanin, the custom of not calling one's noyon by name was associated with the fear of harm inflicted on the one who uttered it: "The noyon will not be offended, but it will be bad for the person who pronounced the name of the noyon…" (1883: 131–132). All these phobias regarding those in power might have resulted from the nature of supreme power in nomadic communities, in which the ruler acted as the chosen one of the Sky and the owner of the charisma and power of the Sky, capable of ensuring the prosperity of his people and state. In the period of Genghis Khan, the ideological justification of power became much more sophisticated and was filled with new concepts, symbols, and cults (Skrynnikova, 1997). Many of these, such as the idea of charisma or the cult of Genghis Khan, retained their relevance in the Mongol society of the 19th century. With such attitudes to power, taking the names of the rulers in vain could have been tantamount to pronouncing the names of deities and sacred objects of nature, which, as mentioned above, incurred various misfortunes.

Conclusions

Verbal restrictions play an important role in social communication and communication with nature in the nomadic culture of the Turko-Mongol peoples of Inner Asia and Siberia. These restrictions are expressed most often by a method of circumlocution, quiet speech, or silence. We should emphasize a special meaning for the spoken word in the cultures with few literate people. For centuries, the spoken word remained the main means of preserving and transmitting information, and a way of learning and mastering the world. Up to the present, the importance of the ritual function of language survives in the nomadic culture, which imposes great responsibility on a person for each spoken word. Thoughtless empty chatter is reproached in nomadic society.

The study of the phenomenon of verbal restrictions in the culture of the nomads living in Inner Asia has shown that the nomadic society functioned in a strict framework of normative traditions. The slightest deviation from these traditions could lead to tragic consequences. Verbal restrictions in communicating with nature and the unreal world are justified by fear—a natural reaction, which evolved in the harsh natural environment and climate of Inner Asia. The custom of avoidance (the most common example of implementing verbal restrictions in public relations), aimed at preventing unwanted forms of communication between the members of society, was supported by the fear of causing the anger of nature in the person of deities and spirits. A sophisticated and rigid system of rules and regulations in fact resulted from the experience gained in the process of human adaptation to harsh natural conditions of the region.

The narrow framework of normative behavior could have determined the important role of non-linguistic context in nomadic culture. Information richness is inherent in the entire space occupied by the nomads (Allsen, 1996; Bawden, 1958); their object environment, traditional outfit, and dwelling are deeply symbolic (Maidar, Darsuren, 1976; Wasilewski, 1976; Zhukovskaya, 1988; Sodnompilova, 2005).

Acknowledgments

This study was supported by a grant in the form of a subsidy from the federal budget for state support of scientific research conducted under the guidance of a leading scientist of the state scientific center of the Russian Federation (Project No. 075-15-2019-1879).

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Received December 16, 2019.
Received in revised form February 19, 2020.

DOI: 10.17746/1563-0110.2020.48.3.143-153

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The Use of Computed Tomography for the Study of Chronic Maxillary Sinusitis: Based on Crania from the Pucará De Tilcara Fortress, Argentina

We discuss the methodological advantages of using X-ray computed tomography (CT) for diagnosing chronic maxillary sinusitis (CMS) of various etiologies on skeletal samples. A CT examination of 20 crania from the Pucará de Tilcara fortress, Argentina (late 8th to 16th centuries AD), was carried out. Criteria for identifying CMS included osteitic lesions in the form of focal destruction, and thickened and sclerotized walls of maxillary sinuses. To determine the etiology of the disease, a tomographic and macroscopic examination of the dentition and bones of the ostiomeatal complex were performed, the presence or absence of facial injuries was assessed, and the co-occurrence of various pathologies was statistically evaluated. Five cases of CMS were identified. Four of these may be of odontogenic origin; in two cases, a secondary infection of the maxillary sinuses is possible. In one instance, the etiology was not determined. No indications of traumatic infection were found. Statistical analysis revealed a relationship of CMS with apical periodontitis and the ante-mortem loss of upper molars and premolars. An indirect symptom of CMS may be the remodeled bone tissue and porosity of the posterior surface of the maxilla.

Keywords: *Chronic maxillary sinusitis, X-ray computed tomography, orofacial pathologies, periodontitis, osteitis, bioarchaeology.*

Introduction

Chronic maxillary sinusitis (CMS) is a long-lasting inflammation of the mucosa of the maxillary sinuses. Clinical manifestations of this disease include periodic headaches, obstruction of nasal breathing, reduction of the sense of smell, general discomfort and fatigue. In the acute phase of the disease, these can be accompanied by fever and a purulent discharge from the nose (Arefieva et al., 2014: 26; Sipkin et al., 2013: 83–84). The initial infection can have different origin. It can be rhinogenic related to respiratory infections and allergic reactions, hematogenous related to severe infectious diseases, or odontogenic (Mukovozov, 1982: 105). In some cases, chronic sinusitis can result from infection penetration after maxillofacial injuries (Bell et al., 1988). In cases of osteomyelitis or apical periodontitis, the odontogenic infection can penetrate the sinuses directly, if the floor of the sinus in the area of the upper molar and premolar roots is resorbed. But in some cases, the presence of direct communication between the sinus and the alveolus of the infected tooth is not necessary (Buskina, Gerber, 2000; Abrahams, Glassberg, 1996).

The mechanism of development of the disease is similar irrespective of its etiology. The inflammation starting as a result of a sinus infection or an allergic reaction causes swelling of the mucosa, which obstructs outflows of the sinus. This leads to a decrease of partial pressure of oxygen and to a shift of pH inside the sinus towards more acidic values. Aerobic microflora gets partially replaced by anaerobes (mainly by streptococci and bacteria of the genus *Prevotella*), and the disease becomes chronic (Arefieva et al., 2014: 20). As the mucosa of the maxillary sinus is bonded with the periosteum, long-lasting inflammations of the sinuses lead to the emergence of foci of bone-remodeling and resorption in the walls of the sinus (Sundman, Kjellström, 2013: 447). Such bone-changes can be detected in skeletal remains, which provide an opportunity to study the frequency of this pathology in ancient populations.

Chronic maxillary sinusitis has been the focus of a number of studies employing samples from Northern America, Europe, Africa, and India (Teul et al., 2013; Sundman, Kjellström, 2013; Roberts, 2007; Lewis, Roberts, Manchester, 1995; Panhuysen, Coenen, Bruintjes, 1997; Mushrif-Tripathy, 2014). The results of these studies show that the prevalence of the disease can vary broadly, ranging from 20% to 98.7%. Most of the studies consider living in crowded areas and air pollution as the main cause of a high frequency of CMS (Lewis, Roberts, Manchester, 1995: 503; Roberts, 2007: 804). But other possible factors have not been systematically analyzed.

For correct interpretations of the reasons of CMS in ancient populations, different forms of CMS should be distinguished, since the risk factors for rhinogenic, odontogenic, and hematogenous CMS are different. For the CMS of hematogenous origin, the factor is the presence of a severe disease, leading to infection spreads into sinuses through the circulatory system. Rhinogenic CMS are typically triggered by respiratory infections or air pollution with mechanical particles, which stimulate allergic swelling of the mucosa. The prevalence of odontogenic CMS depends on the state of oral health, which in modern societies is mainly related to social status and hygiene, but in ancient populations to diet (see, e.g., Machicek, Zubova, 2012; Zubova, Marchenko, Grishin, 2016; Lukacs, 1989; Rose, Condon, Goodman, 1985).

Attempts to distinguish between odontogenic and other forms of CMS have been made, to the best of our knowledge, in three studies. The first reports the results for the medieval samples from Maastricht (Panhuysen, Coenen, Bruintjes, 1997). According to this, most cases of CMS in the samples are odontogenic. But this conclusion was based only on an increased prevalence of dental pathologies in the samples, without a direct analysis of the association between dental lesions and maxillary sinus inflammations. In the second study, the prevalence of CMS was compared in samples from medieval England, Northern America, and Africa (Roberts, 2007). The results of that study have shown that while the prevalence of dental pathologies was high in all the samples, CMS was a rare condition in most (Ibid.: 798, tab. 7). According to Roberts, the frequency of CMS was mostly dependent on environmental conditions, occupation, and social status. The importance of dental pathologies for the development of CMS was underlined in the third study, which employed medieval samples from Poland (Teul et al., 2013). The prevalence of odontogenic CMS across the samples was 18.8%, while more than 80% of the cases were explained by such common factors as environment, lifestyle, and climate. The frequency of CMS in all these studies was only approximately estimated, since it was impossible to firmly distinguish inflammations of different etiology with the methods employed.

Diagnosis of CMS in virtually all studies to date has been carried out either via visual macroscopic investigation of affected sinuses (Sundman,

Kjellström, 2013) or using a medical endoscope (Lewis, Roberts, Manchester, 1995; Teul et al., 2013). Both approaches were aimed at detecting the presence of bone remodeling (porosity or bone spicules) on the internal surface of the walls of the sinus (Boocock, Roberts, Manchester, 1995; Sundman, Kjellström, 2013: Fig. 2). Using these methods, it is impossible to determine sources of infections of the sinuses except in the cases where visible fistulas are present in the alveoli (Roberts, 2007: 798, 799). Importantly, both techniques are destructive.

An alternative is the use of computed tomography (CT), which is considered the "gold standard" for diagnosis of CMS in modern medicine (Patel, Ferguson, 2012). This is a non-destructive method perfectly suited for a complex assessment of the paranasal sinuses, dentition, and ostiomeatal complex. Despite its advantages, CT has not been used for the study of CMS in ancient cranial samples before. The main aim of this study was to analyze the diagnostic potential of CT for studying pathologies of the maxillary sinuses in skeletal samples.

Materials

A cranial series dated to the late 8th to 16th centuries AD from the Pucará de Tilcara Fortress in northwestern Argentina was studied. The site is located in the Quebrada de Humahuaca valley, 1800–2800 m a.s.l., near the confluence of the Guasamayo and Río Grande rivers (Otero, 2013: 3). This area is transitory between the Junga and Pune ecological zones. The gorge is situated in the zone of a subtropical climate characterized by warm and arid summers and dry and cool winters. The summer temperature reaches 40–45 °C, while in winter it is only 2–4 °C with occasional frosts. During the late 15th to 16th centuries, the fortress was a large administrative center of the Inca Empire in Argentina, with a population ranging from 538 to 2690 people (Zaburlín, 2009). The founders of the fortress, the Omaguaca Indians, were predominantly agriculturalists cultivating maize, potatoes, quinoa, and common beans, but also practicing some gathering. The only domesticated animal was the llama (Handbook…, 1946: 620).

The cranial series from Pucará de Tilcara (MAE, No. 5148) was moved to the Museum of Anthropology and Ethnography (Kunstkamera) in 1910 via an exchange with the Ethnographic Museum of Buenos Aires (Dmitrenko, 2017; Dmitrenko, Zubova, 2020: 150). The sample includes the artificially deformed skulls of 20 individuals. Eighteen of these are adults (7 female and 11 male), one sub-adult (14–15 years) and one child (6–8 years). The age at death of the adults was determined on the basis of endocranial suture fusion (Alekseev, Debets, 1964: 29–40), taking into account the possible influence of the artificial cranial deformation on the rate and pattern of suture closure (Gerszten, 1993). Dental wear and the presence of degenerative-dystrophic changes in the temporomandibular joint were taken into account as well (Standards…, 1994: 16–21). Sex was determined on the basis of the dimorphic features of the occipital bone, brow-ridge, supraorbital area, and mastoid process (Alekseev, Debets, 1964: 29–40). The skull of the child was not included in the analysis, since his maxillary sinuses were not completely developed.

Mandibles were absent in 18 out of 19 skulls examined. Several skulls display post-mortem changes: exfoliation of the compact bone layer, widening of the cranial sutures, or tooth loss (in all but three individuals). But in general the skulls are well preserved. Maxillary bones were present in all individuals, and in most cases (84.2%) they did not exhibit any post-mortem damage.

Ante-mortem and peri-mortem traumas were detected in several skulls. These include three cases of healed nasal bone fractures, two cases of a healed fracture of the parietal bones, and two cases of peri-mortem trauma of the parietal and frontal bones. The prevalence of dental pathologies is rather high. Ante-mortem loss of one or several teeth was detected in 47.3% of the skulls. One individual had had surgery for extracting the lower third molars (Zubova et al., 2020). All the individuals older than 20 years displayed signs of chronic periodontitis, while carious lesions were observed in 69.23% of cases.

Methods

Computed tomography images of all the skulls was made using the medical scanner Philips Brilliance 64. The scanning protocol was as follows: voltage on the X-ray tube 120 kV, tube current 100 μA, without filter, slice thickness 0.9 mm. For a more detailed visualization of the internal surfaces of the sinus, the skulls from Pucará de Tilcara were additionally scanned using microfocus X-ray computed tomography device MRKT-04 constructed

at the St. Petersburg Electrotechnical University "LETI", under the following protocol: X-ray tube voltage 140 kV, amperage 50 μA, no filter, slice thickness 0.1 mm. Post-processing of the images was carried out at the Bekhterev National Medical Research Center of Psychiatry and Neurology, using the Extended Brilliance Workspace workstation; at the "LETI", using experimental software; and at the Center of X-ray Diffraction Studies of St. Petersburg State University, using CTAn and CTVox (Bruker-microCT). Multiplanar (MPR) and volume (VR) reconstructions were performed.

Several pathological conditions were being detected on the CT images. First, signs of osteitis in the maxillary sinus walls were recorded. The term "osteitis" in the medical literature is used for the inflammation of the bone walls of the sinus leading to irregular thickening and heterogeneous density on the background of focal sclerosis or focal destruction (Biedlingmaier et al., 1996; Erdogan, Fidan, Giritli, 2016; Mafee, Tran, Chapa, 2006; Georgalas et al., 2010; Momeni, Roberts, Chew, 2007; Snidvongs et al., 2014). The porosity and bone spicules, fixed in bioarchaeological studies, are manifestations of osteitis as well. Previous studies employed a visual examination with 3-scored scale for describing these lesions (Sundman, Kjellström, 2013: 450), which implies a qualitative evaluation of the severity of the pathology by a researcher. In contrast to this, using CT data makes it possible to employ quantitative criteria for the same purpose. According to the published protocols (Georgalas et al., 2010), we used the maximum thickness of one of the sinus walls of 3 mm and more as the threshold for diagnosing osteitis. The walls were measured at osteosclerotic foci of both left and right maxillary sinuses, avoiding corners of the sinuses.

Sources of odontogenic infections were detected in the CT images using a number of markers, including the presence of channels connecting the sinus with the alveoli, foci of chronic periodontitis and osteomyelitis, and other dental pathologies. In order to detect the presence of rhinogenic or hematogenous sinusitis, the conditions of bone-tissue of the osteomeatal complex elements were evaluated, and manifestations of inflammation in other paranasal sinuses and the middle ear cavity were traced. In individuals with ante-mortem trauma of the facial skeleton, the presence of inflammation of the facial bones was additionally assessed, since in such cases traumatogenic infections of the sinuses were possible.

Results

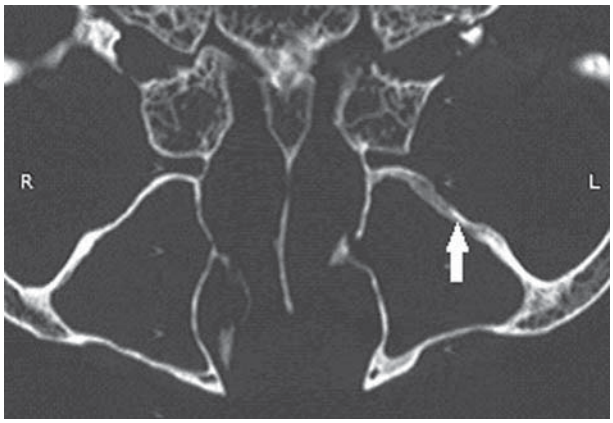
Five cases of CMS were detected in the sample, all in individuals older than 40 years. Four were observed in male skulls, and only one in a female individual. Detail description of the cases follows.

5148-1. Male, 40–50 years. Thickening of the postero-lateral wall of the left maxillary sinus, up to 4 mm in size (Fig. 1, *a*) is visible on the CT scan. The floor of the cavity is thinned. The root systems of the left first molar (lost shortly before death) and left second premolar display manifestations of apical periodontitis. The alveoli of these teeth are widened. A thin linear bone defect, connecting the alveolus of the first molar and the sinus, is present. This connection might have been the way through which the cavity was infected (Fig. 1, *b*). A widening of the periodontal space and an initial stage of apical periodontitis is observed in the right premolars as well, but no pathological changes were detected in the right sinus. The anterior wall of the left maxilla is concaved inwards and covered with bone spicules. Such spicules, as well as porosis, are also visible in the posterior wall of the cavity. The frontal sinuses of the individual displayed sclerotic changes and thickening of the wall more pronounced in the left sinus.

Chronic periodontal disease caused the ante-mortem loss of all the upper molars and upper first premolar in this individual. The alveolar process around the second molars is completely resorbed. Traumatic lesions of the facial skeleton were not detected.

5148-3. Male, 40–50 years. Sclerotic changes and thickening of the walls of the right maxillary sinus, up to 5 mm, are observed in the CT scan (Fig. 2). The alveolus of the second right molar is connected with the sinus by a network of thin channels formed as a result of apical periodontitis and the spreading of infection to bone tissue. The vestibular wall of the alveolus was destroyed by apical inflammation. The second and third right molars were lost less than three months before the death of the individual. The external relief of the posterolateral wall of the right maxilla is abnormal, demonstrating porosis and remodeling of bone tissue.

In this individual, chronic periodontal disease and carious lesions of the first and second left molars were detected. Apical periodontitis was observed in the alveoli of the second molars, and probably a granuloma formed in the alveolus of the lingual root of the left second molar. A peri-mortem comminuted



a

b

Fig. 1. CT images of the skull 5148-1 in axial *(a)* and coronal *(b)* projections.
a – the arrow points to thickening of the wall of the left maxillary sinus; *b* – the arrow points to a channel between an alveola exhibiting periodontal disease and the sinus.

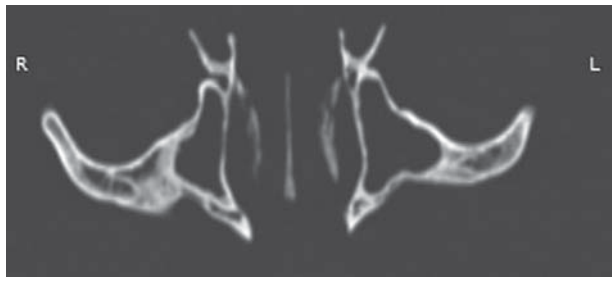
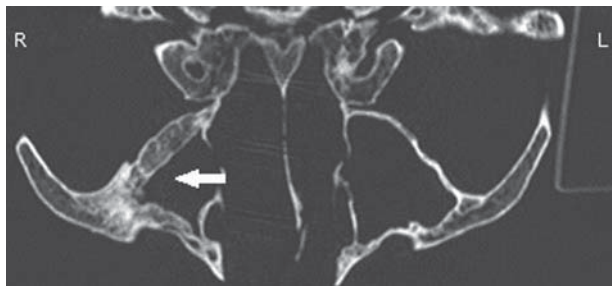
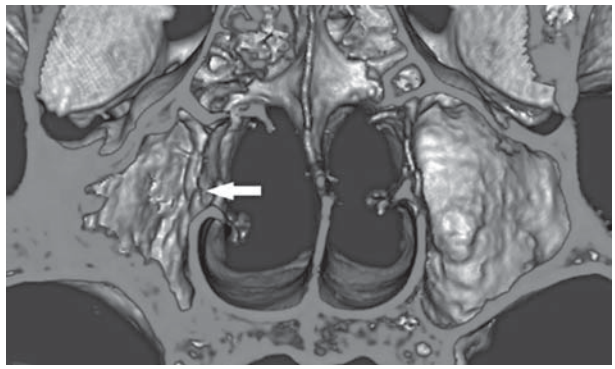


Fig. 2. CT image of the skull 5148-3 in axial projection, showing thickening and deformation of the walls of the right maxillary sinus.



a



b

Fig. 3. CT images of the skull 5148-18 in axial projection *(a)* and a 3D-reconstruction of its maxillary sinuses (*b*, the arrow points to irregularity of the posterior wall of the sinus due to bone remodeling).

blunt force frontal bone fracture was detected around *glabella* and the left superciliary arch. The strength of the blow was not very high, as the lesion did not penetrate to the inner layers of the bone. But an examination of the CT scan has shown the presence of a linear defect of the right half of the posterior wall of the frontal sinus related to the frontal bone lesion. As the trauma was caused shortly before death, it did not lead to infection of the frontal sinus. Signs of a completely healed fracture of the right nasal bone were detected. This fracture was not accompanied by an inflammatory process.

5148-18. Female, 45–50 years. Sclerotic changes and thickening of the walls of the right maxillary sinus, up to 6 mm, are observed in the CT scan. The internal surface of the sinus is irregular because of bone remodeling (Fig. 3). Signs of inflammation spread from the alveoli of the premolars are visible at the external surface of the right maxilla. The anterior surface of the maxilla is rough and irregular, deformations and porosis are present in the posterior wall of the bone. The external surface of the left maxilla has no pathological changes. The walls of the right half of the frontal sinus and both halves of the sphenoid sinus are markedly thickened, their contours display irregularity and moderate sclerotic changes.

Most of the teeth, except the I^1 and the right canine, were lost ante-mortem. Chronic periodontal disease and almost complete reduction of the alveolar margin of the maxilla were detected in this individual. Cranial trauma is absent.

5148-19. Male, about 40 years. Moderate (up to 3.2 mm) thickening of the antero-lateral walls of both maxillary sinuses is observed in the CT scan.

The second premolars and all molars were lost long before the death of the individual because of chronic periodontal disease. The right incisors were lost ante-mortem, though much later than the premolars and molars, while the left incisors and both canines were lost post-mortem. A bone exostosis is visible in the area of the lost M^2. The external surface of the anterior walls of the maxilla has no pathological changes. The posterior walls of this bone display deformations related to the resorption of bone tissue of the alveolar process around the molars. Cranial trauma is absent.

5148-20. Male, 45–50 years. Thickening of the wall of the left maxillary sinus, up to 3.5 mm, and apical periodontitis of the second left premolar are observed in the CT scan. The alveolus of this tooth is connected with the sinus by a linear defect, which does not form a visible fistula (Fig. 4). The premolar was lost shortly before the death of the individual and was accompanied by the formation of apical abscess perforating on the anterior wall of the maxilla. The internal surface of the sinus is irregular because of the remodeled bone.

Manifestations of chronic periodontal disease are observed in this skull. The right canine, first premolar, first and third molars, and the left first to third molars and the second premolar were lost ante-mortem. The right first incisor was also lost as a result of a trauma. The first left premolar and second right molar display carious cavities. The right nasal bone exhibits a posttraumatic deformation without signs of inflammation.

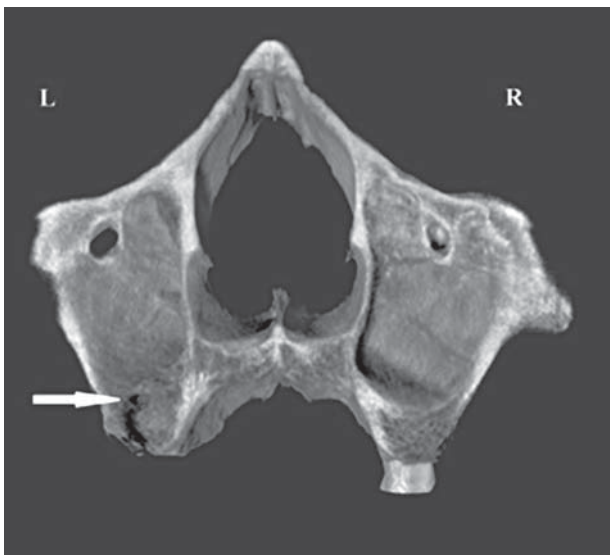


Fig. 4. CT image of the skull 5148-20 in coronal projection (the arrow points to a bone defect connecting the alveolus of the left premolar and the sinus).

Discussion

Our computed tomography study of the cranial collection from Pucará de Tilcara has shown that four of the five cases of CMS in the sample (5148-1, 3, 18, 20) could have been odontogenic. This conclusion is based on the presence of connections between infectious loci in the dentition and the maxillary sinuses. Traumatic sinusitis in these cases can be excluded because no trauma is observed in individuals 1 and 18, while the nasal bone fractures detected in individuals 3 and 20 do not display signs of inflammation. In only one case a trauma of the frontal sinus might have led to infection of the maxillary sinuses (individual 3). But this trauma was peri-mortem and could not have influenced the general pathological state of the individual.

No clear manifestations of rhinogenic inflammation were observed. The preserved fragments of the uncinate processes of the ethmoid bone in the individuals with CMS do not exhibit signs of inflammation. No manifestations of porosity or bone remodeling were detected in the nasal bones or nasal cavity. In all the four cases, inflammation is found in only one sinus, while rhinogenic sinusitis is typically bilateral. The localization of the most pronounced pathological changes of bone tissue at the antero- and postero-lateral walls of the sinuses also points towards a non-rhinogenic etiology of the sinusitis in these individuals, as rhinogenic sinusitis affects the internal wall of the sinus first (Mukovozov, 1982: 110). Nevertheless, the rhinogenic factor cannot be completely excluded in two cases (1 and 18), as in these individuals other paranasal sinuses were affected as well. Infection in these cases might have been secondary. The nature of the pathological condition observed in individual 19 cannot be ascertained from the results of our tomographic and paleopathological observations. All the molar teeth of this individual were lost long before his death. Their alveoli are completely obliterated, and complete reduction of the alveolar process is observed in this part of the dental arch. Thus, the channels connecting the alveoli with the sinuses cannot be traced. Unlike other cases, sinusitis in this individual is bilateral, but it cannot be used as direct evidence of rhinogenic infection without some additional confirmation. Traumatic sinusitis can be firmly excluded in this case because no signs of facial trauma were detected.

The odontogenic origin of all the cases of CMS in the sample was additionally confirmed by the results of a principal component analysis (PCA)

carried out using Statistica for Windows 7.0. The following variables were used (Table 1): main dental pathologies, except caries and enamel hypoplasia (these were excluded since the key teeth were lost ante- or post-mortem in more than a third of the individuals); chronic sinusitis (maximum thickness of the wall of the sinus more than 3 mm); congenital or traumatic deformations of the nasal septum, which, according to recent studies, are risk factors for CMS and frontal sinusitis (see, e.g., Piskunov S.Z., Piskunov G.Z., 2013: 53, 77). Other variables analyzed via PCA were: cribra orbitalia—the marker of anemia leading to weakening of the immune system; chronic otitis; trauma of the nasal area; manifestations of inflammation under the piriform aperture, visible in some skulls (Fig. 5); and the presence of bone remodeling on the external surfaces of the postero-lateral parts of the maxilla. These pathologies were subjected to the analysis in a binary form (presence/absence).

All the individuals displaying signs of CMS plotted in one cluster in the area of negative values of PC1 (Fig. 6). Judging by the factor loadings, these individuals display a complex of features, including CMS *per se*, apical periodontitis, ante-mortem loss of the premolars and molars, and remodeling of bone tissue of the external surface of the maxilla (Table 2). This result is yet one more confirmation of the odontogenic nature of the CMS cases. The individuals not displaying the features mentioned above exhibited positive values of PC1. Deviation of the nasal septum, nasal bone trauma, cribra orbitalia, chronic otitis, and inflammation under the piriform aperture were not related to the presence of CMS. These variables are correlated with second and lower PCs.

Table 1. **Individual distribution of orofacial pathologies and nasal bone trauma**

Number of the skull in the collection MAE No. 5148	Sex	Deviation of the nasal septum	Infalmmation below the piriform aperture	Chronic periodontitis	Apical periodontitis	Ante-mortem loss of the molars	Ante-mortem loss of the premolars	Bone remodeling at the external surfaces of the maxilla	Chronic maxillary sinusitis	Cribra orbirtalia	Nasal bone trauma	Chronic otitis
1	♂	0	0	+	+	+	+	+	+	0	0	0
2	♀	0	+	0	0	0	0	0	0	0	+	0
3	♂	0	0	+	+	+	+	+	+	0	+	0
4	♂	…	0	+	0	0	0	0	0	0	0	0
5	♀	0	0	+	+	+	0	0	0	0	0	0
6	♀	+	0	+	0	0	0	0	0	0	+	0
7	♂	+	0	+	0	0	0	0	0	0	0	0
8	♂	0	0	+	0	0	0	0	0	0	0	0
9	♂	+	+	+	0	0	0	0	0	0	0	0
10	♂	+	+	+	0	0	0	0	0	0	0	0
11	♂	0	+	+	0	+	+	0	0	0	0	0
12	♀	0	0	+	0	+	+	0	0	0	0	0
13	♀	0	0	+	+	+	0	0	0	0	0	0
14	♂	0	0	+	0	0	0	0	0	0	0	+
15	♂	+	+	+	0	0	0	0	0	0	0	0
17	♂	+	+	0	0	0	0	0	0	+	0	0
18	♀	+	0	+	+	+	+	+	+	0	0	0
19	♂	+	0	+	+	+	+	0	+	0	0	0
20	♂	+	+	+	+	+	+	0	+	0	+	0

Fig. 5. A skull displaying alteration of the structure of bone tissue below the piriform aperture.

Notably, while a statistical association between apical periodontitis (infectious and inflammatory diseases in the root area) and CMS was detected, the study of the CT images has shown that this association is not strict. As can be seen from Table 1, in two out of seven individuals with apical periodontitis, no pathological change of the maxillary sinuses was detected.

From the methodological point of view, an interesting result of the PCA is the correlation between the signs of CMS observed in CT images and the presence of remodeled bone tissue at the external surface of the maxilla (three cases). The thickness of the walls of the maxillary sinus in all the individuals displaying this feature was more than 3.5 mm. This corresponds to the maximum scores of 4 and 5 on the scale of the severity of osteitis (Georgalas et al., 2010: 456). In the absence of the possibility of applying CT examination or endoscopic observation, the presence of remodeled bone tissue can be used as an external symptom of severe osteitis and, accordingly, CMS. This hypothesis, however, is to be tested using larger samples. But, even if the hypothesis is confirmed, this feature can only be used for individual diagnosis. The use of this at the population level will lead to underestimation of the prevalence of CMS, as the absence of visible signs of bone remodeling does not imply the absence of CMS.

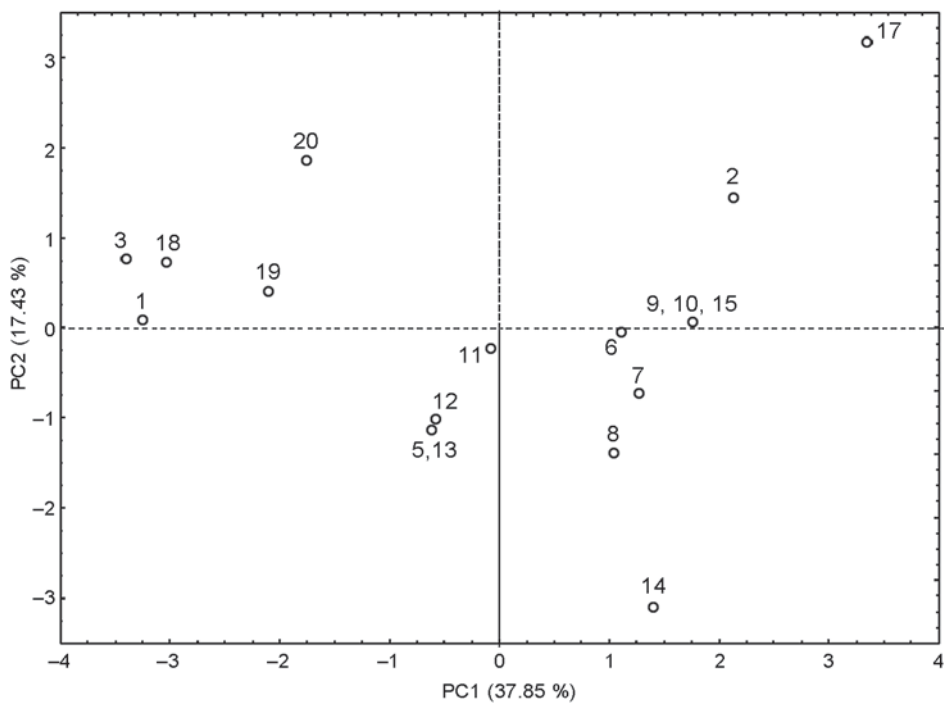


Fig. 6. Scatterplot of the first two principal components of dental and sinus pathological markers (numbers in the plot refer to the numbers of the skulls in the collection MAE No. 5148).

Table 2. **Factor loadings on the first two principal components**

Variable	PC1	PC2
Deviation of the nasal septum	0.23	0.47
Infalmmation below the piriform aperture	0.51	0.55
Chronic periodontitis	–0.49	–0.61
Apical periodontitis	–0.85	0.14
Ante-mortem loss of the molars	–0.87	0.03
Ante-mortem loss of the premolars	–0.82	0.23
Bone remodeling at the external surfaces of the maxilla	–0.73	0.18
Chronic maxillary sinusitis	–0.85	0.36
Cribra orbirtalia	0.41	0.57
Nasal bone trauma	–0.13	0.40
Chronic otitis	0.17	–0.56

The low frequency of CMS observed in the sample from Pucará de Tilcara might result from several factors. The first is the absence of agents of serious infections (such as measles, scarlet fever, and influenza) in the region, which might trigger CMS as a complication (Fedorova, 2011). Widespread in Europe, these infections were only transmitted to South America during the Age of Exploration, or later (Ramenofsky, 2003). The second factor is the absence of industrial pollution, which clearly affected the health status of some European archaeological samples (Lewis, Roberts, Manchester, 1995). The third is the architecture and location of the fortress. It was situated at the top of a hill, which facilitated natural ventilation of the settlement. The open plan of the residential buildings (Zaburlín, 2010, Tarragó et al., 2010; Otero, 2013) prevented the accumulation of smoke and allergenic particles inside the houses. Finally, the dry subtropical climate with warm summers and moderately cold winters might have prevented spread of the disease. The influence of these factors on the prevalence of CMS in various samples will be the subject of a special study.

Conclusions

Our study has demonstrated a number of advantages of the use of X-ray computed tomography (CT) for the study of chronic maxillary sinusitis (CMS) in archaeological samples. The prevalence of the disease assessed using CT data is similar to that obtained by more traditional techniques like microscopic examination or endoscopy, since all these methods rely on manifestations of osteitis. But CT is non-destructive and permits the use of an objective criterion for diagnosis of CMS: the thickness of the walls of the maxillary sinus displaying manifestations of osteitis. The severity of the disease can be thus determined according to a modern scale (Georgalas et al., 2010). One more advantage of CT is the possibility of objectively diagnosing odontogenic CMS and cases of secondary infection of the sinuses by detecting defects connecting the alveoli of the molars and premolars and the sinus. Such channels are not visible during macroscopic examination. All these capacities of the method applied to archaeological samples make it possible to distinguish more objectively between odontogenic CMS and cases of the transition of rhinogenic infections and allergic reactions in a chronic form.

Acknowledgement

This study was supported by the Russian Foundation for Basic Research, Project No. 18-00-00360 (18-00-00511, 18-00-00350).

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Received March 31, 2020.

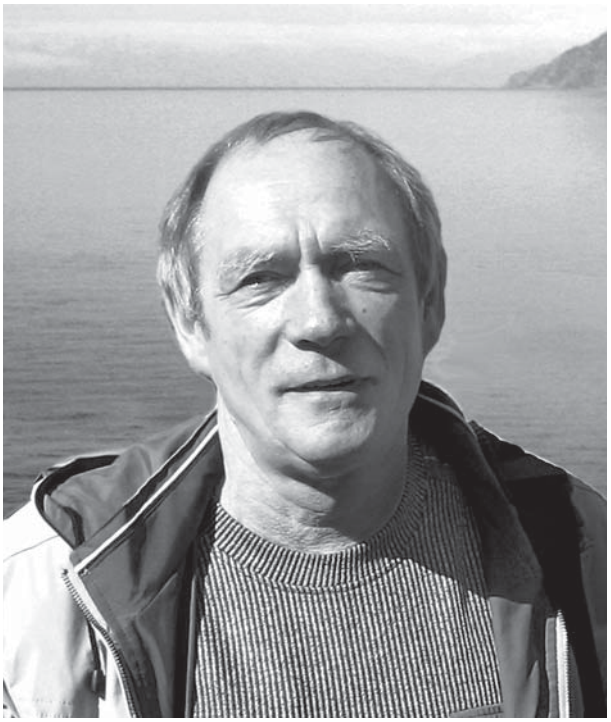
A Peer of the Victory (V.V. Bobrov is 75)

The 5th of June 2020 was the 75th birthday of Vladimir Vasilievich Bobrov, Doctor of Historical sciences, Professor, renowned Russian scholar, and a leader of the Kemerovo archaeologists. V.V. Bobrov is the trustworthy friend and colleague for the authors of this essay, and the teacher for some of us. We are connected with him by implementation of major scientific projects, such as writing the new version of "The History of Siberia", carrying out joint field works in Aidashinskaya Cave, Shestakovo, Lake Tanai, and Baraba forest-steppe. For years we have been working together and sharing the pleasures of scientific achievements, as well as the severity of loss of friends and colleagues… That is why we want to pay tribute and express our love and respect to Vladimir Bobrov.

V.V. Bobrov's anniversary contemporized with the 75th anniversary of the Victory of our people over fascism in the Great Patriotic War. This juxtaposition is quite appropriate, because his parents—Vasily Ivanovich and Nina Egorovna—were front-line soldiers. They tied their destinies to the active army, and the birth of Vladimir only one month after the end of the war was undoubtedly the best present for the happy parents. Vladimir has always been proud of his parents.

Vladimir's school-years were typical for children of the military personnel. He attended several schools at his father's duty stations in Ukraine, Germany, and later in Kemerovo. Siberia and Kuzbass became native for him. Already in high school, the young man decided to devote himself to archaeology.

In 1962, V.V. Bobrov went to the History and Philology Department of the Kemerovo State Pedagogical Institute (subsequently, Kemerovo State University), to which his creative life is still connected. Upon graduation in 1966, V.V. Bobrov was recruited as an assistant at the Department of General History of the Faculty of History. It was quite unusual, because all graduates of the pedagogical institutes were subject to distribution to schools; only really outstanding students could have been employed at institutes of higher education. During his student years, Vladimir annually worked on archaeological expeditions. Anatoly Ivanovich Martynov, subsequently a Doctor of Historical Sciences, Professor, was his first tutor. They have been and still are good friends and collaborators.



Another important milestone in V.V. Bobrov's life is his military service in the Soviet armed forces, which took place in Sakhalin and where he spent two difficult years. Our hero has always cherished warm memories about those days. It is impossible not to mention another most important event in his life. After returning from the army, Vladimir Bobrov married an amazing girl, with whom he has been walking hand in hand for 50 years! Natasha, Natalia Aleksandrovna is his faithful companion and friend. They endured both difficult Siberian expeditions and everyday joys and hardships together. This is support and maintenance, which V.V. Bobrov has always been provided with.

The first independent scientific topic of Vladimir Vasilievich was portable art of the Early Iron Age. He elaborated this topic in his candidate dissertation entitled "Reindeer in the Scytho-Siberian Animal Art Style (Tagar Culture)", which was successfully defended in 1973. It should be mentioned that the issues of the primitive art and irrational behavior of ancient humans of the Neolithic and Bronze Age are among the major fields of V.V. Bobrov's scientific interest.

In his university years, Vladimir Bobrov took part in various field archaeological studies carried out in Siberia and the Russian Far East. Vladimir Bobrov believed that participation in the archaeological expedition in the Amur region headed by A.P. Okladnikov was one of his most important experiences. Aleksey Okladnikov became his supervisor in the post-graduate studies.

Vladimir Bobrov started his independent field studies in 1973. He mainly surveyed Kuzbass; performed excavations in the Krasnoyarsk Territory, Tomsk Region, and the Baraba forest-steppe. V.V. Bobrov still actively works in the field today! The range of his scientific interests is extremely wide (from the Neolithic to the Middle Ages), but the preference is given to the Neolithic and Bronze periods. One of his most important achievements is his research of the Tanai archaeological microdistrict, located on Lake Tanai, on the borderline between the Novosibirsk and Kemerovo regions. These studies lasted for 20 years (1986–2006). The findings included not only the new data sources, but also the original scientific theories concerning particular periods of the Bronze Age in this specific region of Western Siberia. During the same period of his scientific activity, V. Bobrov worked out a concept of development of the historical-cultural processes in the Neolithic and Bronze Age in the Kuzbass-Salair mountain region, which region was practically unexplored from this point of view before. He presented this concept in his doctoral dissertation "Kuznetsk-Salair Mountain Region in the Bronze Age", which he successfully defended in the form of scientific report in 1992. This research can undoubtedly be attributed to the creative achievements of the scholar. It is still frequently referred to in the works of researchers of the Siberian Bronze Age.

In the 2000s, V.V. Bobrov investigated the Neolithic settlement sites in the Baraba forest-steppe. Large-scale excavations were carried out at the site of Autodrom-2. The accumulated materials allowed the scholar to substantiate the trends of development of the Neolithic cultures in the region, and to draw up comprehensive characteristics of the Late Neolithic Artyn culture. Vladimir Bobrov, with his colleagues and students, were the first to identify the Neolithic flat-bottomed pottery in the Baraba forest-steppe.

Having defended his doctoral dissertation, V.V. Bobrov becomes increasingly engaged in the issues of development of the Humanities in Kuzbass. In 1995, a Joint Kuzbass Laboratory for Archaeology was established on the initiative of Academician RAS A.P. Derevianko (Head of the Institute of Archaeology and Ethnography SB RAS) and Corr.-Member RAS Y.A. Zakharov (Rector of the Kemerovo State University). V.V. Bobrov was the head of this Laboratory till 2018. According to the Charter of the Siberian Branch of the Russian Academy of Sciences, the Laboratory was territorially assigned to the Kemerovo Scientific Center SB RAS, and Vladimir Bobrov became a member of its Presidium. The Laboratory was the first research institution for the Humanities in Kuzbass.

In 2004, V.V. Bobrov was admitted to the Institute of Human Ecology of the Siberian Branch of the Russian Academy of Sciences, which was founded on the initiative of the SB RAS Presidium, as a Scientific Deputy Director, and headed its Department for Humanities Research. In fact, Vladimir Bobrov took part in the organization of the Institute. In 2016, the Federal Research Center for Coal and Coal Chemistry of SB RAS was established, which included the Institute of Human Ecology. V.V. Bobrov retained the position of the Head of the Department for Humanities Research.

For 20 years, Vladimir Bobrov has been a member of the Joint Scientific Council of SB RAS, which is of paramount importance for the coordination of research across the humanities in Siberia. In Kuzbass, V.V. Bobrov for almost 10 years headed the expert council of the regional branch of the Russian Foundation for the Humanities; and since 2017, he has been a deputy chairman of the regional branch of the Russian Foundation for Basic Research. Currently, the scholar is involved in creating a department for the social sciences and humanities in the world-class scientific and educational center "Kuzbass". This decision was made at the Council for Science, Education and Technologies under the President of the Russian Federation on May 8, 2019.

Teaching has always been and remains a special and really favorite activity for V.V. Bobrov. Since 1994, he has been a professor at the Department of Archaeology at the Kemerovo State University, and since 1998, has been heading the Department. He runs a number of courses and directs field archaeological practice of students. V.V. Bobrov supervised 17 candidate dissertations and was a scientific consultant in the preparation of three doctoral dissertations.

Vladimir Bobrov is the author and co-author of 440 scientific publications, including 12 monographs. Notably, some monographs show multidisciplinary approach. The monographs addressing the issues of the Late Bronze Age (Irmen culture) and bronze casting in the Lugavskoye culture in Southern Siberia are of special interest.

The high scientific rating of V.V. Bobrov is evidenced by the constant support of the projects under his supervision by leading domestic funds: Russian Foundation for the Humanities, Russian Foundation for Basic Research, Federal Target Program "Integration", Federal Target Program of the Ministry of Education and Sciences of the Russian Federation. His scientific authority among the colleagues is evidenced by his long-term membership in the editorial council of the international

Journal *Archaeology, Ethnology and Anthropology of Eurasia*, editorial boards of the periodicals *Kemerovo State University Herald* and *Irkutsk State University News*. Vladimir Bobrov repeatedly was a member of the program organizing committee of international and all-Russian scientific conferences, and all-Russian archaeological congresses (2006 in Novosibirsk; 2008 in Suzdal; 2017 in Barnaul-Belokurikha). He is a member of several scientific councils for candidate and doctoral dissertation defense.

Professor V.V. Bobrov was awarded the title "Honored Employee of the Higher School of the Russian Federation" by the decree of the President of the Russian Federation for his significant contribution to the development of science and education. He was awarded the title of "Honorary Professor of Kuzbass" by the administration of the Kemerovo Region. Vladimit Vasilievich has won many regional and departmental awards, including "Kuzbass Development Medal", classes III and II, Certificates of Honor from the Presidium of RAS and SB RAS.

On his 75th anniversary, our Peer of Victory is full of energy and creative plans. He has the psychology of the winner! We have no doubt that V.V. Bobrov will achieve remarkable results yet more than once!

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L.N. Mylnikova, N.V. Polosmak,
A.I. Soloviev, and E.I. Derevianko

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

CVRK IMBT SO RAN – Center of Oriental Manuscripts and Xylographs of the Institute of Mongolian, Buddhist and Tibetan Studies, Siberian Branch, Russian Academy of Sciences (Ulan-Ude)

GAIMK – State Academy for the History of Material Culture (Moscow)

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)

KKO AN RUz – Karakalpak Branch, Academy of Sciences of the Republic of Uzbekistan

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

MIA – Materials and Investigations on Archaeology in the USSR

PNAS – Proceedings of the National Academy of Sciences

SAIPI – Siberian Association of Prehistoric Art Researchers

SVKNII DVO RAN – Shilo North-East Interdisciplinary Scientific Research Institute, Far East Branch, Russian Academy of Sciences (Magadan)

TyumNC SO RAN – Tyumen Scientific Centre, Siberian Branch, Russian Academy of Sciences (Tyumen)

UrO RAN – Ural Branch of the Russian Academy of Sciences

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