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

ARCHAEOLOGY, ETHNOLOGY & ANTHROPOLOGY OF EURASIA

Volume 46, No. 1, 2018

DOI: 10.17746/1563-0110.2018.46.1 *Published in Russian and English*

CONTENTS

ARCHAEOLOGY, ETHNOLOGY & ANTHROPOLOGY OF EURASIA

Volume 46, No. 1, 2018

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

Editors of the original Russian texts
N.M. Andjievskaya
T.V. Romanenko
Issuing Editor
Y.A. Zhuravleva
Designer
I.P. Gemueva
Russian texts translated by
V.A. Baranov
E.V. Doronicheva
A.A. Evteev
E.Y. Pankeyeva
V.S. Peysakhovich
English texts revised by
L. Baranova
P. Magnussen

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

Passed for printing March 28, 2018
Appearance April 6, 2018
Format 60×84/8. Conv. print. sh. 18.83. Publ. sh. 20.5
Order No. 436. Circulation 150 copies
Open price

IAET SB RAS Printing House
Pr. Akademika Lavrentieva 17,
Novosibirsk, 630090, Russia

DOI: 10.17746/1563-0110.2018.46.1.003-015

A.Y. Fedorchenko[1], S.V. Shnaider[1], M.T. Krajcarz[2], M.E. Romanenko[3], A.K. Abdykanova[4], K.A. Kolobova[1, 5], S. Alisher kyzy[3], W. Taylor[6], and A.I. Krivoshapkin[1, 3]

[1]Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: winteralex2008@gmail.com; sveta.shnayder@gmail.com; kolobovak@yandex.ru; shapkin@archaeology.nsc.ru
[2]Institute of Geological Sciences, Polish Academy of Sciences, Twarda 51/55, Warsaw, 00-818, Poland
E-mail: mkrajcarz@twarda.pan.pl
[3]Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia
E-mail: maxsim.romanenko194@mail.ru; saltanat.alisher.kyzy@gmail.com
[4]American University of Central Asia, Aaly Tokombaev 7/6, Bishkek, 720060, Kyrgyz Republic
E-mail: abdykanova@gmail.com
[5]Altai State University, Lenina 61, Barnaul, 656049, Russia
[6]Max Planck Institute for the Science of Human History, Kahlaische St. 10, Jena, 07745, Germany
E-mail: taylor@shh.mpg.de

Personal Ornament Production Technology in the Early Holocene Complexes of Western Central Asia: Insights from Obishir-5

The stratified site of Obishir-5 is one of the most important Final Pleistocene to Early Holocene sites in western Central Asia. In the Early Holocene component (10,700–8200 cal BP) of this site (layers 2 and 3), we discovered one of the oldest and largest assemblages of soft stone ornaments known from the region. It includes 5 items: three oval, sub-triangular, and sub-rectangular pendants, one "labret"-like ornament, and one ornament blank. All specimens come from stratified and well-dated contexts. As a result of the petrographic, experimental, use-wear, and technological analysis, we reconstructed the chaîne opératoire of these artifacts. To produce them, local raw materials (talcite and serpentinite) were from a source located 4.5 km away from the site. Small pebbles, shatters, and spalls split from nodules were used as blanks. The surface of the blank was first prepared using grinders and burins, then biconical drilling and polishing were used to finish the artifact. Our results point to an established tradition of personal ornament production from soft stone in western Central Asia during the Early Holocene. Comparison of these nonutilitarian artifacts with those from other Final Pleistocene to Early Holocene archaeological complexes across Central Asia, the Middle East, and the Near East suggests that personal ornament manufacture may be an important hallmark of social developments across a broad geographic region.

Keywords: *Central Asia, Mesolithic, experimental use-wear analysis, technological analysis, symbolic behavior, personal ornaments, pendants.*

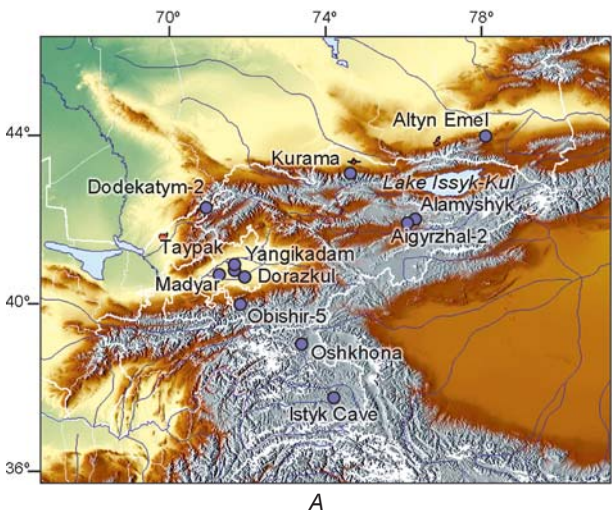
Archaeology, Ethnology & Anthropology of Eurasia 46/1 (2018) 3–15 E-mail: Eurasia@archaeology.nsc.ru

Introduction

Ornaments made from stone, bones, teeth, tusks, mollusk and egg shells are an important manifestation of symbolic behavior in prehistoric humans, and have been reflected in Central and Northern Asia since 50,000 cal BP (Derevianko, Rybin, 2003; Derevianko, Shunkov, Volkov, 2008; Lbova, 2011; Rybin, 2014; Shunkov et al., 2016; Slavinsky et al., 2017). Symbolic activities like ornament production imply creativity, as well as the everyday use of systems of symbolic communication by early humans (Vasiliev et al., 2007: 250). The development of symbolic behavior may have been closely related to processes such as storage and communication of cultural information and group identity (Barton, Clark, Cohen, 1994; Sher, Vishnyatsky, Blednova, 2004; Bar-Yosef, 2005; Lbova, 2011; Rigaud, D'Errico, Vanhaeren, 2015; Rigaud, Gutierrez-Zugasti, 2016).

Despite their important role in human cultural development, questions of cultural and chronological attribution, reconstruction of the chaîne opératoire, and the uses of ornaments from the Stone Age archaeological complexes in western Central Asia have only recently begun to attract significant scholarly interest. In previous years, many publications reported only the presence of ornaments and their material type at Early Holocene sites of this area (see, e.g., (Markov, 1966; Korobkova, 1989)). As a result, traditions of manufacture, selection of raw materials, and use of these items, as well as their complex social, cultural, and aesthetic functions, have gone unnoticed.

This article considers the production technology of stone ornaments from the Early Holocene archaeological assemblage of Obishir-5, located on the southern edge of the large Ferghana valley near Aidarkyen in modern Kyrgyzstan (Fig. 1, *A*). The lithic materials from the site, which dates to



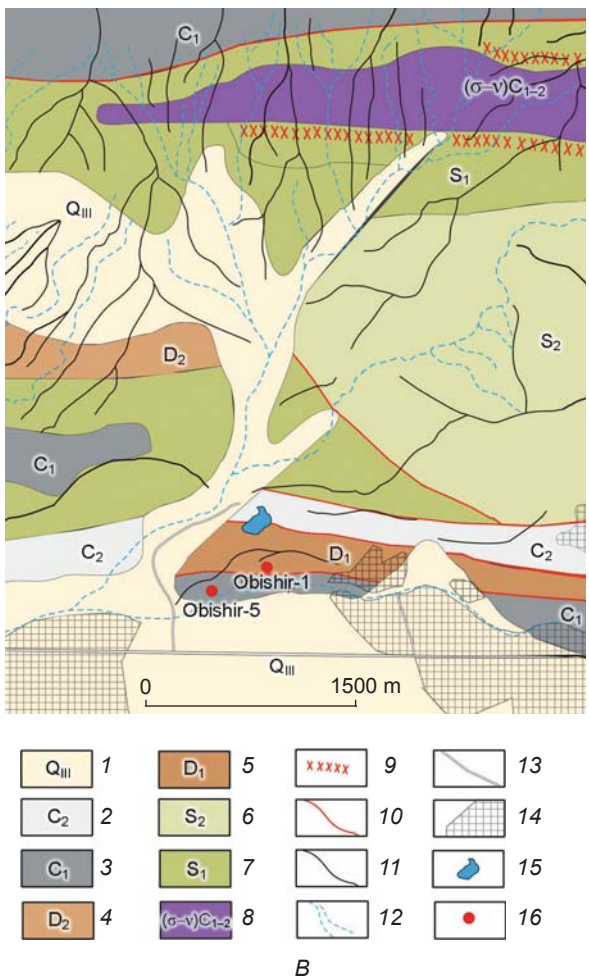


Fig. 1. Distribution of the Late Paleolithic to Epipaleolithic sites in western Central Asia (*A*) and possible sources of stone raw materials for the ornaments of Early Holocene assemblage from Obishir-5 (*B*).

1 – Upper Pleistocene deposits: loams, pebble stones, sands; *2*—Middle Carboniferous deposits: gritstones, shales, sandstones, limestones; *3* – Lower Carboniferous deposits: limestones, clay shales, siliceous concretions; *4* – Upper Devonian deposits: limestones; *5* – Lower Devonian deposits: shales, sandstones, limestones; *6* – Upper Silurian deposits: shales, limestones; *7* – Lower Silurian deposits: shales, sandstones, effusives, conglomerates, limestones; *8* – Lower and Middle Carboniferous igneous complex: peridotites, pyroxenites, serpentinites, gabbro; *9* – skarnified rocks; *10* – tectonic contact line; *11* – ridges; *12* – valleys of temporary watercourses; *13* – roads; *14* – urban or closed zones; *15* – lakes; *16* – site locations.

10,700–8300 cal BP, contain an impressive series of nonutilitarian products, including a morphologically diverse range of ornaments made from semiprecious stones. The ornament assemblage from Obishir-5 is one of the most abundant among such Mesolithic sites in this large region, and its occurrence in a well-dated stratigraphic sequence enables determination of the chronological and cultural significance of ornaments from Final Pleistocene and Early Holocene assemblages of western Central Asia.

Archaeological assemblages of Obishir-5

The site of Obishir-5 was discovered in 1965 by the expedition of the Institute of History and Archaeology of the Academy of Sciences of Uzbek Soviet Socialist Republic, led by U.I. Islamov. During the first stage of studying the site, which covered seven field seasons (1966–1971 and 1973), the excavations explored a land plot with the total area of 141 m^2. Islamov distinguished four stratigraphic layers in the northern wall of the 1973 trench, seven layers in the southern wall of the 1970 excavation, six layers in the western wall of the 1968–1971 and 1973 excavations, and five layers in the eastern wall of the 1968–1969 excavation. The uppermost layer consists of humic gray sandy loam, underlain by a gray sandy loam containing remains of an early-medieval settlement. The Early Holocene materials occurred in the lower part the deposit (layers 3–6). In the first stage of field studies of the site, about 7500 lithic artifacts were discovered.

The archaeological collection of materials from Early Mesolithic cultural horizons of Obishir-5 was analyzed by Islamov as a single assemblage. Debitage associated with primary reduction is represented by numerous products related to microblade removal. Tools recovered from Obishir included retouched bladelets and microblades, end-scrapers, segments, side-scrapers, choppers, and chopping-tools. Stone ornaments and bone items comprise a small portion of the total assemblage. On the basis of comparison with the assemblages from Tutkaul (horizon 2a) and Oshkhona (Tajikistan), the Early Holocene industry of Obishir-5 was ascribed to the 9th–8th millennium BC (Islamov, 1980).

Excavations at the Obishir-5 site were resumed in 2015 to be conducted by a joint Russian-Kyrgyzstan archaeological expedition. The purpose of field work was to clarify the stratigraphy, obtain samples for absolute dating, verify and clarify the paleoecological context of the site's use, and apply new archaeological and science-based methods (Shnaider et al., 2017). In 2015–2016, researchers working at the site excavated an area of 8 m^2 adjoining the 1968–1969 excavation area (Fig. 2, *A*).

The excavations clarified the site's stratigraphy, revealing six stratigraphic layers (Fig. 2, *B*).

Layer 0 contains vegetation and topsoil.

Layer 1 is composed of loams ranging from light-gray to gray-brown color and contains archaeological materials pertaining to the Early Middle Ages.

Layers 2 and 3 consists of loams ranging from light-brown to dark-brown, of colluvial origin. The layers contain lithic artifacts.

Layer 4 is composed of loess-like loams ranging from cream to yellowish-brown, with limestone debris.

Layer 5 can be considered as typical loess, which was formed during the last glacial maximum. These deposits contained lithic artifacts.

Taking into account the stratigraphic scheme of excavation section by Islamov and according to his stratigraphic description of the western wall of the 1968–1969 excavation area, correlations can be drawn between new and previous stratigraphic designations: layer 0 of the new excavation and layer 1 of 1968–1969 excavation, layer 1 and layer 2, layer 2 and layers 3, 4, layer 3 and layer 5, layers 4, 5 and layer 6.

Based on Accelerator Mass Spectrometry (AMS) radiocarbon dates on charcoal, Layer 1 dates to 1650 ± 20 BP (PLD-31751) (1607–1524 BP), Layer 2.3 to 7405 ± 25 BP (PLD- 31752) (8316–8178 BP), and Layer 2.4 to 9410 ± 30 BP (PLD-31753) (10,719–10,569 BP)*.

Collections of artifacts from layers 2 and 3 (about 2200 pieces in all) show considerable techno-

*Radiocarbon dates have been obtained during the study under the Project "Formation of Nomadic Societies in Ancient Eurasia" (led by K. Onuma (Kokushikan University, Tokyo, Japan)). The dates were calibrated by means of the OxCal v.4.3 software, using the confidence interval of 95.4 % (Reimer et al., 2013).

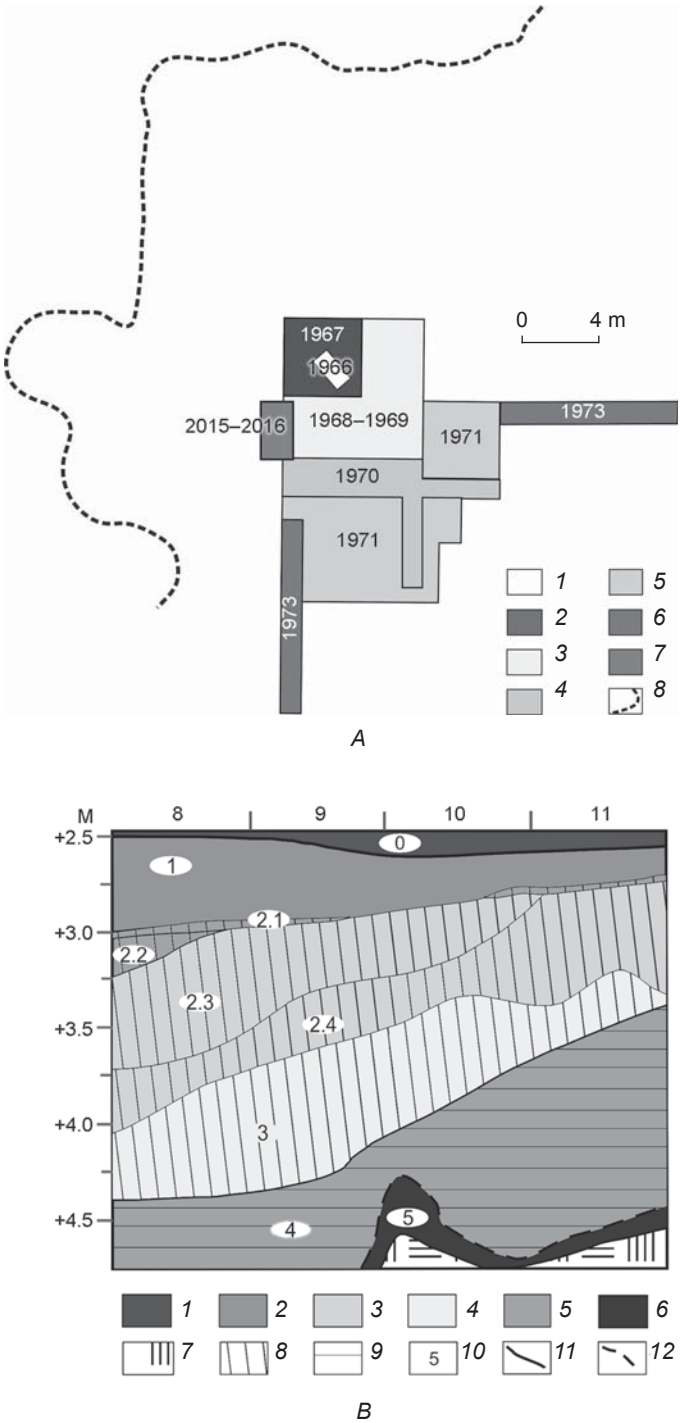


Fig. 2. Plan of excavation areas (*A*) and stratigraphy of deposits (*B*) at Obishir-5 site.

A: *1* – 1966 probe trench; *2* – 1967 excavation; *3* – 1968–1969 excavation; *4* – 1970 excavation; *5* – 1971 excavation; *6* – 1973 trench; *7* – 2015–2016 excavation; *8* – internal boundary of the grotto; *B*: *1* – vegetation and topsoil layer (lithological layer 0); *2* – gray loams (lithological layer 1); *3* – silt loams (lithological layer 2); *4* – light loams (lithological layer 3); *5* – loess-like deposits (lithological layer 4); *6* – dense loams (lithological layer 5); *7* – bedrock exposure; *8* – deposits formed as a result of colluvial activity; *9* – deposits *in situ*; *10* – numbers of layers in study; *11* – boundaries of layers (sharp, erosion); *12* – blurred boundaries.

typological similarity. Primary reduction materials from this assemblage point to the use of prismatic and narrow-faced cores to obtain bladelets and microblades by the pressure detachment technique (Fig. 3, *16*, *17–20*, *22*). The toolkit contains microblades with ventral retouch (Fig. 3, *10*, *11*), borers (Fig. 3, *2–4*), notched tools on bladelets (Fig. 3, *6*), microscrapers (Fig. 3, *13*), microchisel-like tools (Fig. 3, *12*), single burins (Fig. 3, *5*), backed bladelets (Fig. 3, *7*, *9*), and trapezoids (Fig. 3, *3*). Lithic industries of layers 4 and 5 show resemblance to each other in their basic techno-typological features. The toolkit is dominated by bladelets with a dorsal and blunting retouch (Fig. 3, *8*), and by end-scrapers (Fig. 3, *14*, *15*).

The materials from layers 2 and 3 of Obishir-5 demonstrate similarity to the Final Pleistocene and Early Holocene assemblages of Northern and Central Tian Shan (Alamyshyk, Aigyrzhal-2, Altyn Emel) and Pamirs (Oshkhona, Istyk Cave, horizon 1–2) (Abdykanova et al., 2015; Shnaider, Abdykanova, Krivoshapkin, 2015; Shnaider et al., 2016). Materials from layers 4 and 5 have parallels in the industries of the Upper Paleolithic sites of Northern and Western Tian Shan (Dodekatym-2, layers 4–2; Kurama) (Kolobova et al., 2013; Chargynov, 2015). These comparisons, in conjunction with associated radiocarbon dates, suggest that Obishir contains two non-contemporaneous and technologically different assemblages dating to the Final Pleistocene and the Early Holocene.

Study materials

There are five artifacts interpreted as stone ornaments in the archaeological collection of the Early Holocene assemblage (layers 2 and 3) of Obishir-5 (Fig. 3, *24–28*). Three nonutilitarian items were found during 1966–1973 excavations (Islamov, 1980: 71–72). According to the stratigraphic sequence proposed by Islamov, these artifacts occurred in the first cultural horizon Currently, the storage location of these items is unknown,

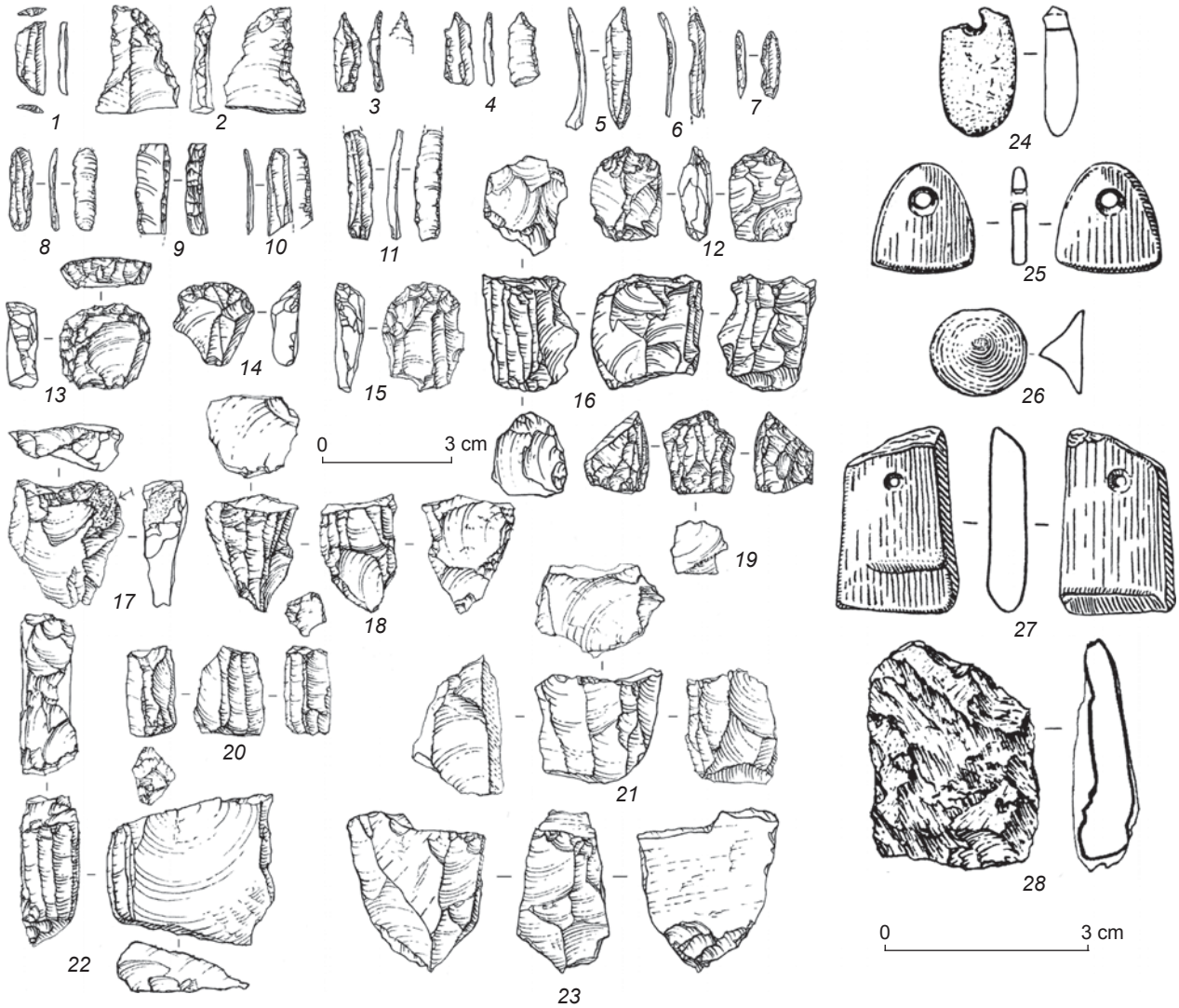


Fig. 3. Lithic industry (*1–23*) and personal ornaments (*24–28*) of the Early Holocene assemblage from Obishir-5.

but Islamov provided the following published descriptions and illustrations.

A volumetric pendant made from black marble-like rock (Fig. 3, *25*). Its dimensions are 16 × 16 × × 2 mm. It is a sub-triangular item with a biconical drilled hole in the upper portion. The item was thoroughly treated by grinding and polishing on both sides and shows signs of attrition on its surface.

A volumetric pendant made from river pebble (Fig. 3, *27*). Its dimensions are 30 × 19 × 6 mm. It is a sub-rectangular item with a biconical drilled hole in the proximal portion. The major part of the item contains preserved remains of natural cortex partially covered by abrasion marks. Signs of transverse deformation can be traced on the upper end of the pendant.

An artifact in the form of a button with a projecting point in the middle (Fig. 3, *26*). Its dimensions are 28 × 28 × 14 mm. This item, round in shape, is made from white-green siliceous rock. Its surface was thoroughly treated by grinding. Taking into account archaeological and ethnographic analogs, this item was interpreted by the excavator as a labret-like ornament (Ibid.: Pl. XII, *7*).

During new excavations at Obishir, we discovered a pendant and an ornament blank, along with another likely pendant. The artifacts were recovered from stratigraphic layer 2 (2015–2016 excavation) (Shnaider et al., 2016: 196).

A volumetric pendant made from greenish-yellow talcite (Fig. 3, *24*; 4, *1*). Its dimensions are 18.9 × × 10.9 × 4.5 mm. The item is oval shaped in plan

view, with well-rounded edges, and plano-convex in profile; a cylindrical hole (2.2 mm in diameter) is drilled near its upper edge. Traces of a transverse break can be observed near the hole, in the proximal portion of the pendant. The surface is thoroughly mirror-like smoothed on the front and back sides and along the edges.

A pendant blank made from dark-green serpentinite (Fig. 3, *28*; 4, *1*). Its dimensions are 31.8 × 24.0 × 9.0 mm. It is a sub-rectangular artifact with a unilateral convex profile. Signs of grinding can be visually identified in the central part. The edges are not treated, and the major part of back surface shows remains of pebble cortex.

Study methods

Using experimental technological and use-wear study, we reconstructed the manufacture and use of stone ornaments at Obishir-5, following a protocol developed for studying the Upper Paleolithic artwork in Northern Asia (Fedorchenko, 2014, 2015; Shunkov et al., 2016). Study of use-wear and treatment traces were conducted by means of MBS-10 stereoscopic microscope under ×7.5–100 magnification and Olympus BHM metallographic microscope under ×40–500 magnification, equipped with differential interference contrast (DIC) lenses. Photofixation of marks at macrolevel was carried out using the Canon EOS 7D digital SLR camera, EF-S 60 mm f/2.8 Macro USM lens, and a tripod mount with manual focus adjustment, and at microlevel using the Olympus BHM photo camera and optical system. High-quality photographs of the artifact surfaces were obtained using the program Helicon Focus.

To characterize and interpret traces of manufacture and use, we conducted original experiments using appropriate raw materials. The experimental research program included modeling the techniques of knapping raw nodules of soft stones, grinding blanks on coarse- and fine-grained abrasive stones, perforating blanks with the use of drills having points prepared by retouched as well as untreated working edges, and polishing blank-surfaces with leather (Fig. 5). During experiments, more than 20 pendants were manufactured from talc and talcum peach found at the Shabrovo deposit (Middle Urals). In terms of their chemical composition and basic petrophysical characteristics, talc and talcum peach are similar to the material from which the Obishir-5 ornaments were made (Geologicheskiy slovar, 1978: 295). The results of experimental works are fully consistent with the final shapes of the archaeological ornaments under study (Fig. 5, *4*).

Finally, we studied the mineral composition of stone raw materials delivered to the site, by means of visual diagnostics using the MBS-10 microscope, and investigated possible sources for the origin of this stone.

Results

The comprehensive study of stone pendants from Obishir-5 has allowed us to reconstruct the methods for their manufacture. The initial stage of ornament production included selection and delivery of stone materials to the site. Petrographic analysis has revealed that stone ornaments discovered during the 2015–2016 excavations were made from talcite and serpentinite. These materials belong to the group of so-called "soft" stones. Serpentinite, from which the pendant blank from the 2016 collection was made, is a dense dark green rock. This material has a laminar splintery fracture pattern, silky luster, dark green color, and slipping surface, typical of serpentinites. Its hardness according to the Mohs scale is 2.5–3 (Geologicheskiy slovar, 1978: 211). The pendant is manufactured from talcite, dense fine-scaly talc with the inclusion of dark-colored mineral particles, giving the otherwise white mineral a slight greenish tint. The hardness according to the Mohs scale is 1 (Ibid.: 295).

During exploratory routes along the Zarkar Gorge and the foot of the Katyrang-Bashi Ridge, 4.5 km away from the Obishir-5 site, we discovered bedrock exposures of ultramafic rocks, formed by typical ophiolite sequence of gabbros, amphibolites, and serpentinites, associated with deep water clastic sediments and cherts (see Fig. 1, *B*). In terms of petrography, serpentinite from this deposit is very close to the materials that were used by the site inhabitants in the Early Holocene. The area around the Katyrang-Bashi Ridge foot is heavily spotted with scours, formed by ephemeral streams. These channels move stone materials, including debris of serpentinite and surrounding rocks. Water transports these materials as far as the Zarkar Gorge, located

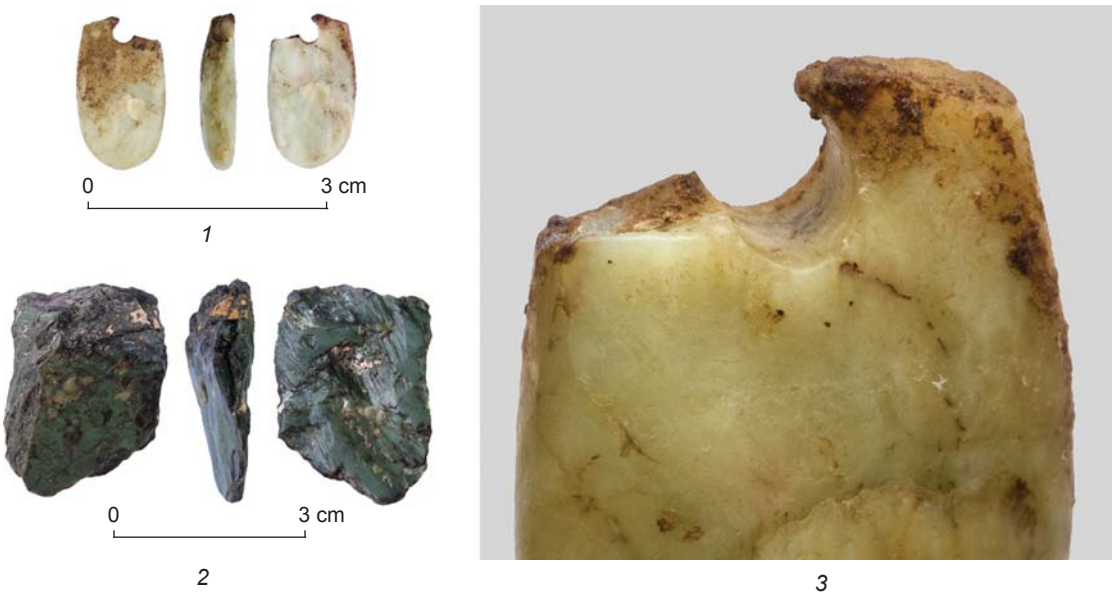


Fig. 4. Stone ornaments from Obishir-5 (2016 collection).
1 – talcite pendant; *2* – serpentinite pendant blank; *3* – fragment of talcite ornament with traces of drilling.

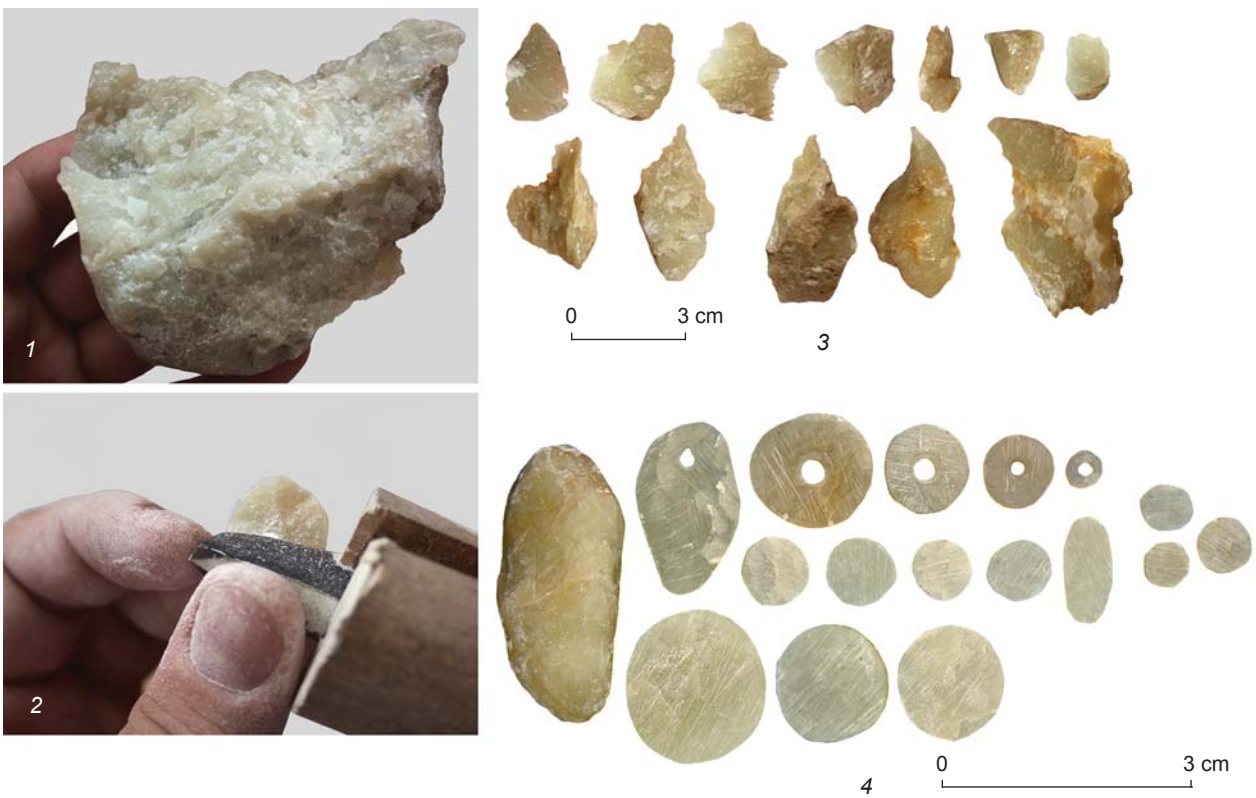


Fig. 5. The findings of experiments in manufacture of stone ornaments.
1 – talcum peach spall surface obtained by knapping; *2* – fragment of a pendant blank in the course of treatment by a flinty burin; *3* – talcum peach spalls obtained by direct percussion with a hard hammerstone; *4* – replicas of stone pendants and their blanks.

ca 2 km away from the Obishir-5 site. The rounded surfaces of the serpentinite pendant blank and of one pendant from the 1966–1973 excavation collections (see Fig. 4, *2*) point to fluvial transport of raw materials (Islamov, 1980: 71–72). Taking into account the proximity of talcite to the bedrock, we can assume that this mineral was exposed and fluvially transported near Obishir in a similar fashion.

When selecting raw materials for crafts, the site inhabitants appear to have paid special attention to the color, smoothness, and luster of talcite and serpentinite surfaces. These qualities explain the extraordinary demand for soft stones used for the production of personal ornaments (Kulik, Shunkov, 2011; Fedorchenko, 2015).The physical properties of said minerals made it possible to treat them using a wide range of potential production methods, including different techniques for knapping of stone materials (by direct or indirect percussion with stone/organic hammer) and techniques of manufacture from organic materials such as bone, horn or wood (planing, scraping, sawing, drilling, grinding, and polishing).

We produced pendants from small pebbles or rounded shatter fragments of soft stone, as well as from flakes/splinters obtained by knapping of larger raw nodules with a hard hammerstone. Use of pebble flakes as blanks for stone ornaments is evidenced by morphological features of the serpentinite pendant blank: a plano-convex profile and a remnant cortical pebble surface on the back side of the item (see Fig. 4, *2*). Our experimental blanks are characterized by the absence of pronounced bulbs of percussion and radial fissures, with preservation of the splintery fracture (see Fig. 5, *1*, *3*).

The experiments have allowed us to identify special features of ornamental stone knapping. The viscosity of talcite prevented us from application of pressure flaking or direct percussion with soft mineral or horn hammers. During the experiments, it was possible to obtain spalls, similar to the pendant blanks of the studied assemblage in terms of their dimensions, by means of a hard hammerstone (the use of a soft hammer and pressure flaking techniques proved to be inefficient). Flakiness and high cleavage of serpentinite determined the specifics of its knapping. Judging by morphology of the serpentinite pendant blank, this artifact could have been produced by flaking along the natural cleavage planes. Such peculiarities of raw materials directly influenced the morphology of experimentally-obtained products, the majority of which resembled splinters rather than flakes in the conventional sense of this term.

At present, it is difficult to identify evidence of ornamental stone production in the lithic assemblage from Obishir-5. The absence of talcite and serpentinite production waste in the 2015–2016 archaeological collection indirectly suggests the idea of primary reduction of these rocks in a site area uncovered by excavations, or beyond its limits.

The initial stage of pendant manufacture is the creation of a preform. The main technological features of this stage can be inferred based on analysis of the serpentinite blank. Marks of shaping treatment by a stone abrader have been detected in the protruding areas of convex (dorsal) surface of the artifact (Fig. 6, *1*, *2*). At ×40–100 magnification, it can be seen that the marks of grinding have the appearance of parallel rows of long, thin scratches located diagonal and perpendicular to the longitudinal axis of the item. On the talcite pendant, signs of grinding are observed only occasionally, since they are typically removed by later finishing and wear stages (Fig. 6, *5*, *6*). The use of grinding enabled the artifact surface to be treated by simultaneous removal of very small and equal layers of material over a large area. Thus, it was possible to eliminate surface roughness, to level and smooth edges and surfaces of blank, and to ensure the regular geometric shape of an item (Fig. 6, *3*, *4*) (Semenov, 1968: 75).

Abrasive tools that may have been used for such grinding were not distinguished in the collection of the Early Holocene assemblage from Obishir-5 formed in the course of field studies in the recent years. The publication devoted to materials of the 1966–1973 excavations contains a description of a grinding-tile fragment with three longitudinal flutes and heavy polish marks, which was identified as a tool for straightening arrows and darts (Islamov, 1980: 71).

A burin was used as an auxiliary tool at the stage of creating preforms for ornaments. Marks of planing using a burin (prolonged irregular twisting grooves) are evident on one face on the distal portion of the talcite pendant. Experimental results show that burin spalls are highly efficient at removing the pebble cortex remnants and leveling the side edges of blanks (Fedorchenko, 2016). Among the materials

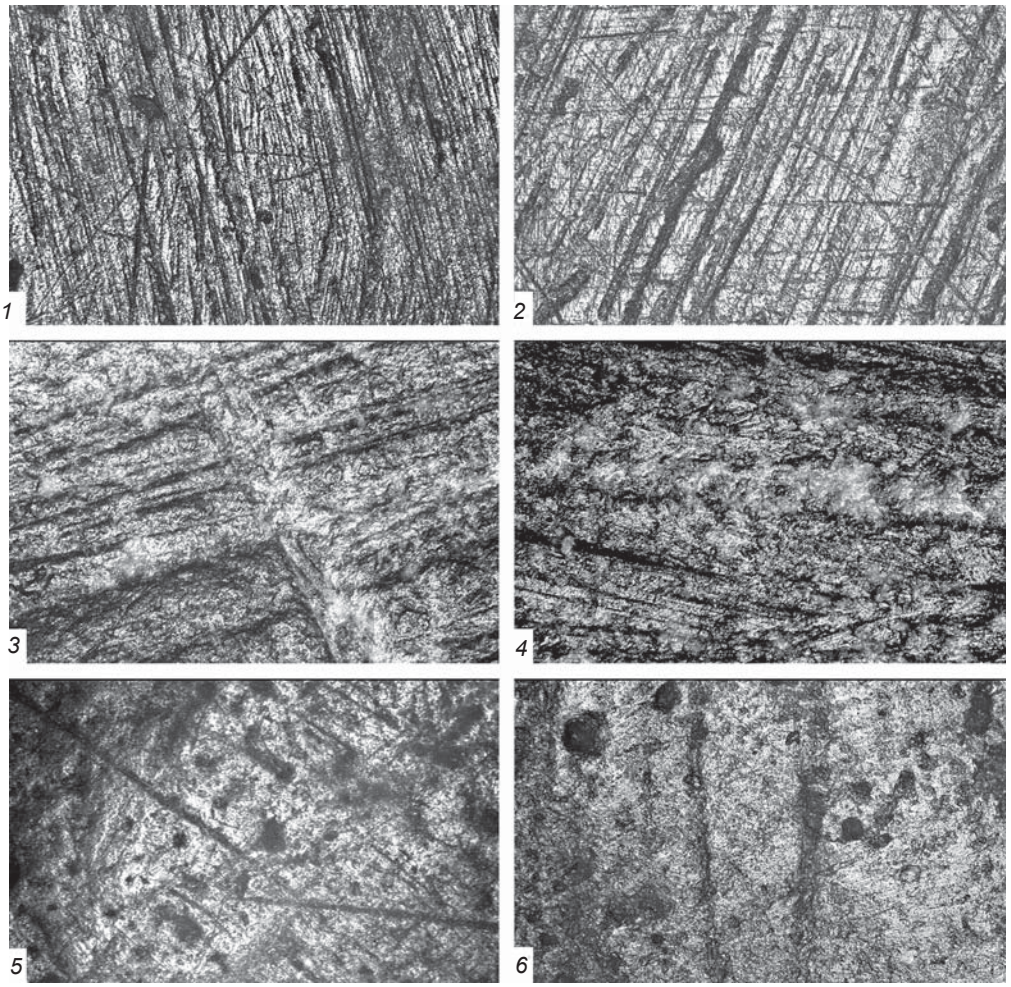


Fig. 6. Marks of wear and treatment on the surfaces of stone ornaments from Obishir-5 (Olympus BHM, DIC. Processing in Helicon Focus).
1 – grinding marks on the serpentinite pendant, ×40; *2* – grinding marks on the blank of serpentinite pendant, ×100; *3*, *4* – grinding marks on the replica of talcum peach pendant, ×100; *5* – grinding, polishing, and wear marks on the talcite pendant, ×40; *6* – grinding, polishing, and wear marks on the talcite pendant, ×100.

of the Early Holocene assemblage from the site under study, a series of "typologically unimpressive" items with burin spalls (side-burins) was described earlier (Islamov, 1980: 66–67). The collection of the 2015–2016 excavations includes one dihedral asymmetric burin (see Fig. 3, *5*) (Shnaider et al., 2016: 196–197).

The next stage of ornament production is drilling a hole in prepared preforms. The talcite pendant under study has a hole, cylindrical in profile. Concentric grooves caused by drilling inside the pendant are visible though poorly preserved (see Fig. 4, *3*). Special features of morphology and sizes of perforation marks allow a conclusion to be drawn about the use of a drill with a rather long and narrow working portion, about 5–7 mm long and 2 mm in diameter. At the initial stage of drilling, a tool with similar morphometric features was used to produce a through a hole in the form of a truncated cone on one side of the item. Then, the produced hole was drilled out from the opposite side to give the channel a regular cylindrical shape.

So far, no tools that were reliably used to perforate soft stones have been identified among the artifacts at Obishir-5. Analysis of archaeological and experimental data (Semenov, 1953; Francis, 1982; Semenov, Korobkova, 1983: 33–36; Altinbilek et al., 2001; Gurova et al., 2013) makes it possible to predict the morphology of such stone-drilling tools among the borers and points: bladelets with ends marked by one-side or double-side retouch (Islamov, 1980: 68, 74). Preliminary use-wear analysis has not

identified any traces of drilling in stone on the Early Holocene industry borers found at the site.

During the final stage of manufacture, both surfaces of the pendant edge appear to have been polished, probably, with crafted leather. Polishing produced the tactile and visually satisfying even, smooth, and shiny surfaces (Semenov, 1968: 79).

Use-wear analysis has revealed wear signs resulting from wearing of the talcite pendant (see Fig. 6, *5*, *6*). At ×40–200 magnification, we discovered traces of microdamage, including single, differently directed, shallow and twisting, thin and short scratches, on both sides of the item, in sharp contrast with the smoothly polished surface. The described signs of wear are accompanied by soft coating polish penetrating deep into the microrelief of the artifact's face. The presence of attrition marks overlying concentric grooves caused by drilling on this item may indicate prolonged and free movement of the pendant along the thread. This complex of traces is interpreted as signs of contact between the pendant and clothes or human skin during everyday wear of the ornament.

Conclusions

The results of our study suggest the existence of tradition of personal ornaments production from soft stones, in western Central Asia, ca 10,700–8200 cal BP. According to the reconstruction, the manufacturing process included several sequential steps. The Early Holocene inhabitants of the Obishir-5 site produced stone ornaments from local raw materials (talcite and serpentinite), the source of which was located 4.5 km away from the site. Small pebbles, shatters, and spalls split from nodules were used as blanks. Subsequent manufacturing stages included treating the surfaces of blanks with abrasive stones and burins, then biconical drilling and polishing. Comparison of the results of studying the ornaments discovered in 2015–2016 with the data on similar finds of 1966–1973 suggests the use of identical techniques and tools for the manufacture of all these items.

The ornaments from Obishir-5 are the earliest evidence of the use of grinding and drilling of stones in western Central Asia. In this regard, the problem of identifying the tools that were employed for grinding, planing, and drilling in soft stones by the site inhabitants seems to be an important question, which must be answered by functional analysis of burins and borers on microblades known in the Early Holocene layers of this site. Establishing technological interconnections between personal ornaments and various types of stone tools will allow more detailed reconstruction of the chaîne opératoire in manufacture of studied nonutilitarian items, assuming that the entire ornaments production cycle (or part thereof) was carried out on-site.

Experimental use-wear analysis has revealed a complex microstratigraphy of wear and treatment signs on the stone pendants. We established that abraders and burins were employed at the stage of preform manufacture to prepare the initial blank surface, while polishing resulted in the deformation of grinding and planing marks. During wearing of the pendants, traces of microwear were overlaid on wear related to production. The context of the analyzed talcite pendant, petrophysical properties of its material, and morphology of polishing and deformation marks point to a prolonged use of this item for ornamentation of clothes or as a personal amulet. Most probably, the item lost its value after partial destruction of its upper portion, which disabled its further use as an ornament.

In western Central Asia, personal ornaments made from stone, bones, and mollusk shells are recorded in the Late Mesolithic to Early Neolithic archaeological complexes dated to the period between 9000 and 7000 cal BP. The Early Holocene industry in Dam-Dam Cheshme 2 Cave (Eastern Caspian region) contains pendants made from shells and a stone sub-rectangular pendant with a biconical hole displaced to one edge (Markov, 1966: 114). A series of oval pendants from ornamental stones have been identified from Late Mesolithic to Neolithic complexes at the sites of Madyar, Dorazkul, Yangikadam, and Taypak, in the Ferghana Valley (Islamov, Timofeev, 1986; Korobkova, 1989: 161). Some similarity to the artifacts under consideration is demonstrated by the ornaments typical of the early and middle stages of the Jeitun Neolithic culture (Korobkova, 1996: 96).

Analogous stone pendants from the Early Holocene complexes in western Central Asia are also known in the Near East. A tradition of pendant production from ornamental stones and bones is found in the Late Natufian culture of the el-Wad and Rosh Horesha sites dated to 13,000–11,500 cal BP

(Weinstein-Evron et al., 2007; Bar-Yosef Mayer, Porat, 2008; Bar-Yosef Mayer, Porat, Weinstein-Evron, 2013). Personal stone ornaments gained widespread use in the pre-pottery Neolithic of the Near East, between 11,500–6500 cal BP, such as Gilgal 1 and 3, Hatula, Jericho, Nahal Hemar Cave, and Kfar HaHoresh (Bar-Yosef Mayer, Porat, 2008; Belfer-Cohen, Goring-Morris, 2010). Isolated stone polished pendants have been found on the Middle East Körtik Tepe and Shanidar sites of the pre-pottery Neolithic, dated to 11,000–8000 cal BP (Solecki, 1969; Alarashi, 2016).

Among the materials from the mentioned sites of the Middle and Near East, the most abundant artifacts include oval and sub-rectangular polished stone pendants with one biconical drilled hole each, oval pendants with two holes each, discoid flat polished beads, cylindrical pipe-shaped beads; oval bone pendants with one hole each, rectangular pendants with two holes each, and ornaments made from mollusk shells. The items of said types were made using techniques similar to those employed at Obishir-5.

Taking into account the chronological attribution of the assemblages found in these areas and comprising morphologically and technologically similar personal ornaments, given the earlier date for these stone pendants in the Near East, they may have spread to Central Asia through cultural diffusion or human movements during the Early Holocene.

According to the "braided stream" hypothesis, groups of the population of western Central Asia, the Near East, and the Middle East repeatedly came into direct or mediated contacts (Krivoshapkin, 2012; Kolobova, 2014; Shnaider, 2015). The episodes of intercultural contacts, such as migrations, exchange of ideas and technologies, at the boundaries of the settled areas can be traced from the Middle to Upper Paleolithic transition period through the Neolithic (Davis, Ranov, 1999; Brunet, 1999; Richter et al., 2010; Kolobova, 2014; Shnaider, 2015; Kolobova, Shnaider, Krivoshapkin, 2016). The presence of similar technologies for the manufacture of personal stone ornaments in the Late Pleistocene to Early Holocene industries may be a particularly striking manifestation of this process, which was earlier substantiated only by the techno-typological similarity between certain elements of lithic industries.

Acknowledgements

Archaeological studies were supported by the Russian Science Foundation (Project No. 14-50-00036), geological survey, by the Institute of Geological Sciences, Polish Academy of Sciences (2017). The authors express their gratitude to D. Bar-Yosef Mayer (Tel Aviv University, Israel), N. Gubenko (Israel Antiquities Authority, Jerusalem), and N.E. Belousova (IAET SB RAS) for advice in preparation of this study.

References

Abdykanova A.K., Tabaldiev K.T., Chargynov T.T., Rashit-uulu N., Alisher kyzy S. 2015
Rezultaty issledovaniy pamyatnika kamennogo veka Alamyshyk v 2012–2013 gg. In *Vozvrashcheniye k istokam: Sbornik pamyati vydayushchegosya arkheologa V.A. Ranova*. Novosibirsk: IAE SO RAN, pp. 207–214.

Alarashi H. 2016
PPNA stone grooved pendants from the Middle Euphrates valley: Markers of cultural identity? *Neo-Lithics: The Newsletter of Southwest Asian Neolithic*, vol. 2: 20–28.

Altinbilek C., Coşkunsu G., Dede Y., Iovino M.R., Lemorini C., Özdoğan. 2001
Drills from Çayönü. A combination of ethnographic experimental and usewear analysis. In *Beyond Tools: Redefining the PPN Lithic Assemblages of the Levant*. Berlin: Ex oriente, pp. 137–143.

Bar-Yosef D.E. 2005
The exploitation of shells as beads in the Palaeolithic and Neolithic of the Levant. *Paléorient*, vol. 31 (1): 176–185.

Bar-Yosef Mayer D.E., Porat N. 2008
Green stone beads at the dawn of agriculture. *Proceedings of the National Academy of Sciences*, vol. 105 (25): 8548–8551.

Bar-Yosef Mayer D.E., Porat N., Weinstein-Evron M. 2013
Natufian green stone pendants from el-Wad: Characteristics and cultural implications. In *Natufian Foragers in the Levant. Terminal Pleistocene Social Changes in Western Asia*. Ann Arbor: Intern. Monographs in Prehistory, pp. 139–145.

Barton C.M., Clark G.A., Cohen A.E. 1994
Art as information explaining Upper Palaeolithic art in Western Europe. *World Archaeology*, vol. 26 (2): 185–207.

Belfer-Cohen A., Goring-Morris N. 2010
The Initial Neolithic in the Near East: Why it is so difficult to deal with the PPNA. *Journal of the Israel Prehistoric Society*, vol. 40: 1–18.

Brunet F. 1999
La neolithisation en Asie Centrale: Un etat de la question. *Paléorient*, vol. 24/2: 27–48.

Chargynov T.T. 2015
Arkheologicheskiye raskopki stratifitsirovannogo pamyatnika Kurama v 2014 g. In *Materialy mezhdunar. nauch.-prakt. konf. "VII Orazbayevskiye chteniya"*. Almaty: Kazak Univ., pp. 83–87.

Davis R., Ranov V.A. 1999
Recent work on the Paleolithic of Central Asia. *Evolutionary Anthropology*, vol. 8: 186–193.

Derevianko A.P., Rybin E.P. 2003
The earliest representations of symbolic behavior by Paleolithic humans in the Altai Mountains. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 3: 27–50.

Derevianko A.P., Shunkov M.V., Volkov P.V. 2008
A Paleolithic bracelet from Denisova Cave. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 2 (34): 13–25.

Fedorchenko A.Y. 2014
Tekhnologiya izgotovleniya kamennykh ukrasheniy v paleolite Ushkovskikh stoyanok (Kamchatka). In *Trudy IV (XX) Vseros. arkheol. syezda v Kazani*, vol. I. Kazan: Otechestvo, pp. 169–171.

Fedorchenko A.Y. 2015
Kamenniye ukrasheniya VII kulturnogo sloya Ushkovskikh stoyanok (Tsentralnaya Kamchatka): Tekhnologicheskiy analiz. *Vestnik Severo-Vostochnogo nauchnogo tsentra DVO RAN*, No. 1: 100–114.

Fedorchenko A.Y. 2016
Izdeliya s reztsovimy skolami VI paleoliticheskogo sloya stoyanki Ushki-I (Kamchatka). *Stratum plus*. *Arkheologiya i kulturnaya antropologiya*, No. 1: 223–241.

Francis P. 1982
Experiments with early techniques for making whole shells into beads. *Current Anthropology*, vol. 23 (6): 713–714.

Geologicheskiy slovar. 1978
V 2 t. K.N. Paffenholz (ed.), vol. 2. Moscow: Nedra.

Gurova M., Bonsall C., Bradley B., Anastassova E. 2013
Approaching prehistoric skills: Experimental drilling in the context of bead manufacturing. *Bulgarian e-Journal of Archaeology*, vol. 3: 201–221.

Islamov U.I. 1980
Obishirskaya kultura. Tashkent: Fan.

Islamov U.I., Timofeev V.I. 1986
Kultura kamennogo veka Tsentralnoy Fergany. Tashkent: Fan.

Kolobova K.A. 2014
Verkhniy paleolit Zapadnogo Pamiro-Tyan-Shanya. Dr. Sc. (History) Dissertation. Novosibirsk.

Kolobova K.A., Flas D., Derevianko A.P., Pavlenok K.K., Islamov U.I., Krivoshapkin A.I. 2013
The Kulbulak bladelet tradition in the Upper Paleolithic of Central Asia. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 41 (2): 2–25.

Kolobova K.A., Shnaider S.V., Krivoshapkin A.I. 2016
Preyemstvennost razvitiya verkhnepaleoliticheskikh i mezoliticheskikh industriy v zapadnoy chasti Tsentralnoy Azii. *Stratum plus*. *Arkheologiya i kulturnaya antropologiya*, No. 1: 51–63.

Korobkova G.F. 1989
Mezolit sredney Azii i Kazakhstana. In *Mezolit SSSR*. Moscow: Nauka, pp. 149–174.

Korobkova G.F. 1996
Srednyaya Aziya i Kazakhstan. In *Neolit SSSR*. Moscow: Nauka, pp. 87–133.

Krivoshapkin A.I. 2012
Obirakhmatskiy variant perekhoda ot srednego k verkhnemu paleolitu. Dr. Sc. (History) Dissertation. Novosibirsk.

Kulik N.A., Shunkov M.V. 2011
Istochniki kamennogo syrya paleoliticheskikh ukrasheniy iz Gornogo Altaya. In *Problemy arkheologii, etnograii, antropologii Sibiri i sopredelnykh territoriy*, vol. XVII. Novosibirsk: Izd. IAE SO RAN, pp. 62–66.

Lbova L.V. 2011
Formy znakovogo povedeniya v kulturakh rannego verkhnego paleolita. *Gumanitarniye nauki v Sibiri*, No. 3: 11–14.

Markov G.E. 1966
Grot Dam-Dam Cheshme 2 v Vostochnom Prikaspii. *Sovetskaya arkheologiya*, No. 2: 104–125.

Reimer P.J., Bard E., Bayliss A., Beck J.W., Blackwell P.G., Bronk Ramsey C., Buck C.E., Cheng H., Edwards R.L., Friedrich M., Grootes P.M., Guilder T.P., son, Haflidason H., Hajdas I., Hatté C., Heaton T.J., Hoffmann D.L., Hogg A.G., Hughen K.A., Kaiser K.F., Kromer B., Manning S.W., Niu M., Reimer R.W., Richards D.A., Scott E.M., Southon J.R., Staff R.A., Turney C.S.M., van der Plicht J. 2013
IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years Cal BP. *Radiocarbon*, vol. 55: 1869–1887.

Richter T., Garrard A.N., Allock S., Maher L.A. 2010
Interaction before agriculture: Exchanging material and sharing knowledge in the Final Pleistocene Levant. *Cambridge Archaeological Journal*, vol. 21/1: 95–114.

Rigaud S., D'Errico F., Vanhaeren M. 2015
Ornaments reveal resistance of North European cultures to the spread of farming. *PLoS ONE*, vol. 10 (4). URL: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0121166

Rigaud S., Gutierrez-Zugasti I. 2016
Symbolism among the last hunter-fisher-gatherers in northern Iberia: Personal ornaments from El Mazo and El Toral III Mesolithic shell midden sites. *Quaternary International*, vol. 407: 131–144.

Rybin E.P. 2014
Tools, beads, and migrations: Specific cultural traits in the Initial Upper Paleolithic of southern Siberia and Central Asia. *Quaternary International,* vol. 347: 39–52.

Semenov S.A. 1953
O kamennykh sverlakh. *Materialy i issledovaniya po arkheologii SSSR*, No. 39: 455–462.

Semenov S.A. 1968
Razvitiye tekhniki v kamennom veke. Leningrad: Nauka.

Semenov S.A., Korobkova G.F. 1983
Tekhnologiya drevneishikh proizvodstv. Mezolit–eneolit. Leningrad: Nauka.

Sher Y.A., Vishnyatsky L.B., Blednova N.S. 2004
Proiskhozhdeniye znakovogo povedeniya. Moscow: Nauchnyi mir.

Shnaider S.V. 2015
Tutkaulskaya liniya razvitiya v mezolite zapadnoy chasti Tsentralnoy Azii: Cand. Sc. (History) Dissertation. Novosibirsk.

Shnaider S.V., Abdykanova A., Kraitsarzh M., Krivoshapkin A.I., Kolobova K.A., Romanenko M.E., Alisher kyzy S. 2016
Rezultaty arkheologicheskikh raskopok pamyatnika Obishir-5 v 2016 godu. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XXII. Novosibirsk: Izd. IAE SO RAN, pp. 194–198.

Shnaider S.V., Abdykanova A., Krivoshapkin A.I. 2015
Rezultaty arkheologicheskikh raskopok pamyatnika Obishir-5 v 2015 g. In *Problemy arkheologii, etnografii,*

aontropologii Sibiri i sopredelnykh territoriy, vol. XXI. Novosibirsk: Izd. IAE SO RAN, pp. 174–178.

Shnaider S.V., Krajcarz M.T., Viola T.B., Abdykanova A., Kolobova K.A., Fedorchenko A.Yu., Alisher-kyzy S., Krivoshapkin A.I. 2017

New investigations of Epipalaeolithic in Western Central Asia: Obishir-5. *Antiquity*, vol. 91, iss. 360 (e3): 1–7.

Shunkov M.V., Fedorchenko A.Y., Kozlikin M.B., Belousova N.E., Pavlenok G.D. 2016

Kostyaniye orudiya i ukrasheniya rannego verkhnego paleolita iz Tsentralnogo zala Denisovoy peshchery: Kollektsiya 2016 goda. In *Problemy arkheologii, etnografii i antropologii Sibiri i sopredelnykh territoriy*, vol. XXII. Novosibirsk: Izd. IAE SO RAN, pp. 221–224.

Slavinsky V.S., Rybin E.P., Belousova N.E., Fedorchenko A.Y., Khatsenovich A.M., Anoykin A.A. 2017

Spetsificheckiy sposob podgotovki zony rasshchepleniya nukleusov v nachalnom verhknem paleolite Yuzhnoy Sibiri i Tsentralnoy Azii. *Stratum plus*. *Arkheologiya i kulturnaya antropologiya*, No. 1: 221–244.

Solecki R.A. 1969

Copper Mineral Pendant from Northern Iraq. *Antiquity*, vol. 43 (172): 311–314.

Vasiliev S.A., Bozinski G., Bradley B.A., Vishnyatsky L.B., Girya E.Y., Gribchenko Y.N., Zheltova M.N., Tikhonov A.N. 2007

Chetyrekhyazychniy (russko-anglo-franko-nemetskiy) slovar-spravochnik po arkheologii paleolita. St. Petersburg: Peterburg. vostokovedeniye.

Weinstein-Evron M., Kaufman D., Bachrach N., Bar-Oz G., Bar-Yosef Mayer D.E., Chaim S., Druck D., Groman-Yaroslavski I., Hershkovitz I., Liber N., Rosenberg D., Tsatskin A., Weissbrod L. 2007

After 70 years: New excavations at the el-Wad terrace, Mount Carmel, Israel. *Journal of the Israel Prehistoric Society*, vol. 37: 37–134.

Received May 22, 2017.

DOI: 10.17746/1563-0110.2018.46.1.016-026

E.V. Doronicheva[1], A.G. Nedomolkin[2], A.A. Muriy[3], M.A. Kulkova[4], T.V. Sapelko[5], and E.S. Nosevich[6]

[1]ANO "Laboratory of Prehistory", 14-ya liniya 3, St. Petersburg, 199034, Russia
E-mail: edoronicheva@hotmail.ru
[2]National Museum of the Republic of Adygea, Sovetskaya 229, Maykop, 385000, Russia
E-mail: nedomolkinandrei@mail.ru
[3]Sergeev Institute of Environmental Geoscience, Russian Academy of Sciences, Ulansky per. 13, bldg. 2, P.O. Box 145, Moscow, 101000, Russia
E-mail: amuriy@gmail.com
[4]Herzen State Pedagogical University of Russia, Nab. r. Moyki 48, St. Petersburg, 191186, Russia
E-mail: kulkova@mail.ru
[5]Institute of Limnology, Russian Academy of Sciences, Sevastyanova 9, St. Petersburg, 196105, Russia
E-mail: tsapelko@mail.ru
[6]Saint Petersburg State University, Universitetskaya nab. 5, St. Petersburg, 199034, Russia
E-mail: katenosevich@mail.ru

Hadjoh-2: A Middle Paleolithic Workshop-Camp in Northwestern Caucasus

This article outlines the results of a multidisciplinary study of stratified Middle Paleolithic site Hadjoh-2, northwestern Caucasus, situated at the outcrop of high-quality Shahan flint. During five field seasons, more than 6-meter deep deposits were excavated over an area of ca 33 sq. m. Ten lithological strata and four habitation-horizons were identified. Excavations focused on bottom layers 6 and 7. During their accumulation, the site occupied a floodplain terrace on the right bank of the Sredniy Hadjoh River, a right tributary of the Belaya. Because the terrace dates to the Middle/Late Pleistocene boundary, the site is no earlier than the beginning of Late Pleistocene, 130–120 ka BP. Results of pollen-analysis suggest that the climate was cold and dry, and subalpine and alpine meadows prevailed around the site at that time. The study of lithic assemblages shows that the bottom layers accumulated when the site was a workshop near the flint outcrops. In both layers, knapping debris such as cores, chips, and small fragments predominate. Most tools are unfinished bifacial forms. These assemblages are paralleled by the Eastern Micoquian industries of Mezmaiskaya, Barakaevskaya, Monasheskaya, and Ilskaya.

Keywords: *Paleolithic, workshop site, stone industries, Caucasus.*

Introduction

The sites situated on sources of stone raw materials allow us to obtain a lot of new data, not only concerning use and transportation of the raw materials, but also about organization by humans of various site types, human mobility, and subsistence strategies (Shchelinsky, 2005; Nekhoroshev, 1999: 29–32; Kovalenko, Ketraru,

Archaeology, Ethnology & Anthropology of Eurasia 46/1 (2018) 16–26 E-mail: Eurasia@archaeology.nsc.ru

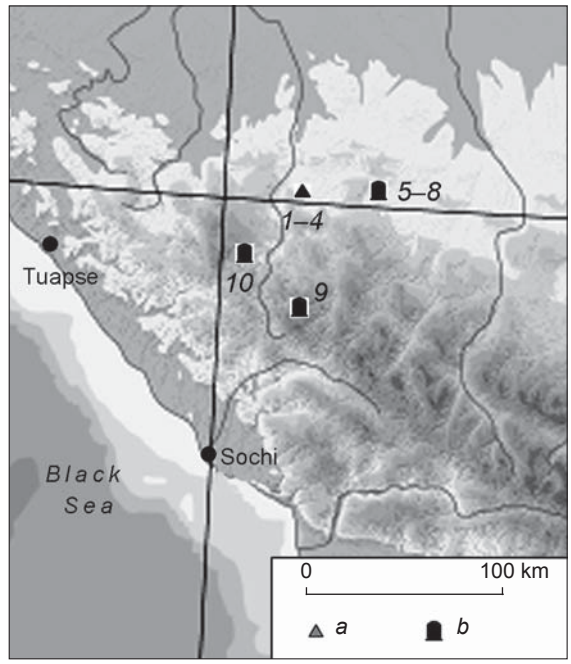


Fig. 1. Location of sites mentioned in the paper in the northwestern Caucasus.
a – open-air sites; *b* – cave sites.
1–4 – Sredniy Hadjoh, Shahan, Hadjoh-2, -3; *5–8* – Barakaevskaya, Monasheskaya, Autlevskaya, Gubs Rockshelter 1; *9* – Mezmaiskaya, *10* – Matuzka.

2010; Matyukhin, 2010; Fedyunin, 2011; Neruda, Nerudová, 2010; Gopher, Barkai, 2011; Dawson et al., 2012). Until recently, ten multi-layered stratified Middle Paleolithic sites were known in the northwestern Caucasus: Ilskaya I, II, Monasheskaya, Barakaevskaya, Autlevskaya, Mezmaiskaya, Matuzka, Dakhovskaya caves, Gubs Rockshelter 1, and Baranakha-4 (Fig. 1). According to most researchers, these belong to a special cultural tradition—the Eastern Micoquian, and have analogies in the sites of Central and Eastern Europe (Golovanova, 1993; Golovanova et al., 1998; Lioubine, 1998; Golovanova, 2015). According to modern data, this tradition appeared in the northwestern Caucasus ca 70 ka BP, and existed until the end of Middle Paleolithic in this region (ca 40 ka BP). But during surveys in 2007–2014, there were discovered the new open-air sites of Besleneyevskaya-1, Hadjoh-2, and Hadjoh-3, located on sources of raw materials.

This article presents results of complex research in the multi-layered site of Hadjoh-2. It is located in the Kuban River area (Fig. 1), on the right bank of Sredniy Hadjoh River (Belaya River valley), at about 60 m above the river, and 503–507 m above the sea level; 44°18′46.9″ N, 40°14′30.2″ E. E.V. Doronicheva discovered the site in 2008. During five (2009–2010, 2013–2015) excavation campaigns, deposits with thickness more than 6 m were studied on an area of 33 m^2 (Fig. 2). The lower cultural layers 6 and 7 are the most rich in artifacts. This article focuses on describing these materials.

Results of geological and geomorphological research

Geological and geomorphological research showed that the area of Sredniy Hadjoh River valley is composed of Jurassic and Cretaceous deposits (Gosudarstvennaya geologicheskaya karta…, 2004: L–37–XXXV). According to the scheme by S.A. Nesmeyanov (1999: 177) and field observations by A.A. Muriy (in 2014), the terrace, on which the Hadjoh-2 site is located, is preliminarily correlated with the Late Hadjoh geomorphological level (Fig. 3). Because of a fuzzy morphological manifestation of terrace formations in the area, we can assume that the site may belong to either the Late Hadjoh, or to the very beginning of the subsequent Early Vyushat erosion-accumulation cycle. The Hadjoh geomorphological level is dated to the Late Middle Pleistocene period. The formation time of the terrace where the site is located can be estimated as the boundary between the Middle and Late Pleistocene: about 130 ka BP according to modern data (Paleoklimaty…, 2009: 4).

Stratigraphy

At the site, ten lithological layers were identified (see Fig. 2, *2*).

Layer 1. Humus sandy loam, black in color, without inclusions. The contact with the underlying layer is fuzzy, 15–20 cm.

Layer 2. Beige loam with numerous inclusions of small corroded sandstone pebbles, 50–80 cm.

Layer 3. Light brown loam with a large number of highly corroded limestone pieces, 40–60 cm.

Layer 4A. Dark brown, dense loam with numerous inclusions of decomposed limestone. The contact with the underlying layer is fuzzy, 20–30 cm.

Layer 4B. Light beige, dense loam with a large number of decomposed limestone pieces and rare corroded sandstone pebbles, 30–50 cm.

Layer 4C. Gray-brown, dense loam with rare inclusions of corroded limestone. The contact with the underlying layer is fuzzy, 60–80 cm. Bones of steppe bison (*Bison priscus*, definition by Y.N. Spasovsky) are found.

Layers 1–4C lie with a slight slope towards the edge of the terrace.

Layer 5. Red-gray, sandy loam with few small and medium-sized corroded fragments of sandstone and limestone. The surface and bottom of the layer lie

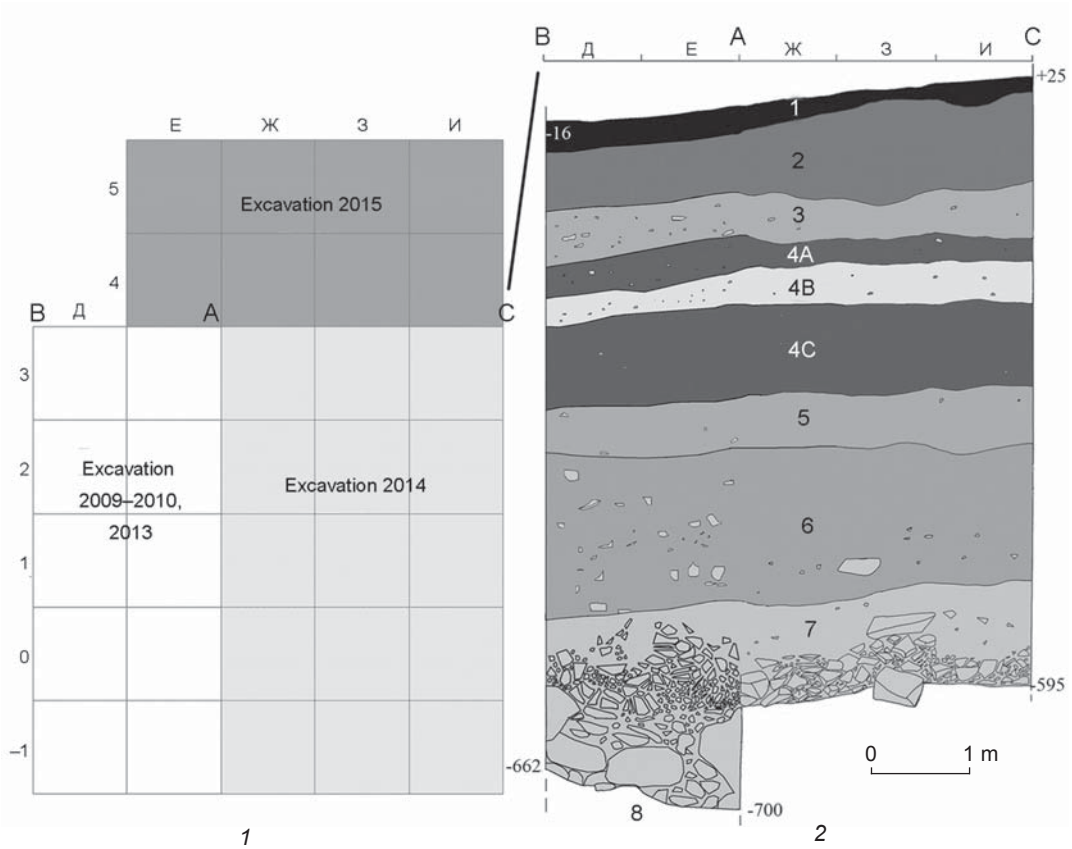


Fig. 2. Excavation plan (*1*) and section (*2*; see description in the text) of the Hadjoh-2 site.

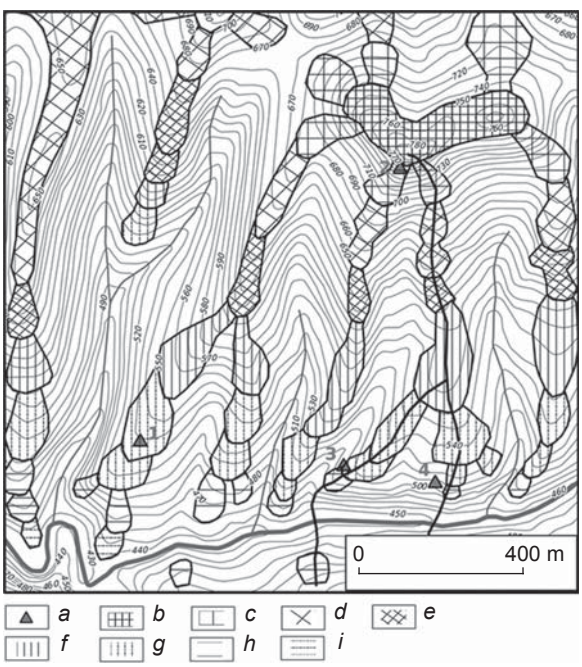


Fig. 3. Structure-geomorphological scheme of the Hadjoh-2 site area.
a – sites; *b*–*i* – geomorphology levels: *b* – Shahan, *c* – Makhoshevsk, *d* – Early Kurdzhips, *e* – Late Kurdzhips, *f* – Early Hadjoh, *g* – Late Hadjoh, *h* – Vyushat, *i* – Maikop.

relatively horizontally towards the terrace backside, 40–60 cm.

Layer 6. Light brown loam with numerous small, medium-sized, and rare large fragments of sandstone and limestone, 160–190 cm. Several unidentified bones were found.

Layer 7. Reddish loam with medium and large limestone debris and blocks, the number of which increases sharply in the lower part. The layer slopes to the edge of the terrace, up to 200 cm.

Layer 8. Brown loam with numerous small and large blocks of limestone, visible thickness 200 cm. The layer apparently lies on the terrace pedestal.

Artifacts are not found in layers 2, 5, and 8. Rare reworked small flint artifacts are found in layers 1, 3, and 4B. Layers 4A, 4C, 6, and 7 are sufficiently rich in stone tools, which are dated to the Middle Paleolithic. A slight planar erosion of artifacts within the terrace is not excluded for these layers.

Palynological data

15 samples were analyzed from layers 7 and 6. Technical processing was carried out according to the improved standard method (Grichuk, 1940; Berglund, Ralska-

Jasiewiczowa, 1986; Sapelko, 2014). All the samples were found to be strongly carbonate.

In samples from layer 7, pollen of grasses (*Asteraceae, Chenopodiaceae, Cichoreaceae, Polygonaceae, Rosaceae, Linaceae, Rubiaceae, Cyperaceae*, and others) prevails. Pollen of *Polygonum* and *Geranium* occurs. The tree species are represented mainly by birch; a few pollen grains of pine are mostly torn and crumpled. There is a significant content of phytoliths and coals. In the lower part, decrease in the number of phytoliths and appearance of faunal remains were noted.

In layer 6, pollen of tree species quite disappears. Pollen of herbs (*Asteraceae* and *Rosaceae*) is found. Pollen grains of *Geranium* and spores of fern are found. The saturation with phytoliths is less than in layer 7. In the lower part, their number decreases, and faunal remains are present.

According to the results of the analysis, it is incorrect to draw conclusions about the character of the vegetation because of the low pollen-content. The unfavorable conditions for fossilization of pollen grains were likely associated with the cold and dry climate in layer 6. The environment was better during the accumulation of layer 7. Apparently, at the time of layer 7, there was woody vegetation, which disappeared during formation of layer 6. The spread of the flax family, which also disappeared in layer 6, may testify to a warmer, but dry climate during accumulation of layer 7. Flax is usually found in the mountain steppes, subalpine and alpine meadows (Zernov, 2006: 365–366).

Lithic raw materials

Five flint sources (called Shahan-1–5) have been detected in the Sredniy Hadjoh River valley. They are not indigenous, but represent flint in the secondary occurrence in clays. Flint nodules originate from a destroyed stratum of the Oxford-Kimmeridgian (Upper Jurassic) limestones. One of the important characteristics of this raw material is the size of the nodules, whose length can reach 90 cm (rare cases), but is mostly 20–40 cm. The Hadjoh-2 site is located directly on the flint exposure—the Shahan-4 source. M.A. Kulkova conducted petrographic and geochemical analyses of flints from the natural outcrops and the site in the Fersman laboratory of environmental geochemistry (the Herzen State Pedagogical University of Russia), using the standard method (Doronicheva, Kulkova, 2016).

According to the petrographic analysis, the flint from Shahan-1 and Shahan-2 sources consists mainly of quartz with inclusion of chalcedony geodes. The composition includes a significant amount of siliceous skeletons of marine organisms (shells and spicules), and separate grains of olivine. The flint from Shahan-3 and Shahan-5 sources is somewhat more saturated with organogenic inclusions, and contains less limonite. The flint from Shahan-4 source is most enriched with siliceous skeletons of marine organisms, especially sponge spicules. The X-ray fluorescent analysis of flint samples with the "Spectroscan MAX" device showed an increased content of some trace elements, such as P_2O_5, Y, Zr, Ni, and MnO.

According to the results of research on the lithic assemblage from the Hadjoh-2 site, 99 % of artifacts are made from the flint (KR-9/10) coming from the Shahan-4 source, on which the site is directly located. The exceptions are two flakes, one from sandstone (in layer 6) and another from flint (in layer 7) derived from the Meshoko source, located at the distance of ~6–7 km from the site. Several quartzite, sandstone, and limestone pebbles were found in both layers. All these rocks are known in the modern pebble deposits of the Sredniy Hadjoh River.

Description of lithic industry

Layer 6. In total, 1639 artifacts have been found (Table 1); all have a good preservation (not battered or abraded). The most of the finds are covered with a white patina; 25 pieces are covered with limestone crust, and 7 pieces are burnt.

Core-like fragments (43 pcs) are pieces of flint (2–10 cm) with flake negatives on some portions of their surfaces. Apparently, most of these are fragments of cores.

Among 20 cores, unifacial single-platform cores (14 pcs) predominate (Fig. 4, *4–7*). Their sizes are 4–8 cm on average. The striking platforms on cores were made by one, more rarely two, large scars, and two cores have platforms prepared by a series of small removals. The flaking was carried out mainly in one direction on slightly convex surfaces. Convergent negatives are rare (Fig. 4, *6*). Angles of striking platforms are 70–80°.

Two- and three-platform (Fig. 4, *8*) cores are rare (3 pcs each), and unifacial and bifacial variants of opposite and orthogonal flaking are equally represented. The striking platforms on these cores are made mainly by large scars.

Flakes make up one third of the collection (Table 2), and most of them are fragmented. There are nine technical flakes (CTE) used for preparation of striking platforms (Fig. 4, *1*). More than half of the flakes (54 %) have cortex areas. Primary and semi-primary flakes are 20 %, and 15 % of flakes have cortical striking platforms. Flakes with negatives going in the same direction as the flake are 59 %; most of the negatives are parallel. Flakes with orthogonal (4.7 %) and opposite (10 %) dorsal patterns are few. Striking platforms are mostly flat, then punctiform (19.5 %), retouched (2.6 %), and dihedral (2.8 %) (Table 2). The collection includes only 35 (6.4 %) laminar

Table 1. **General composition of the collection from the Hadjoh-2 site**

Categories	Layer 6		Layer 7	
	N	%	N	%
Cores/core-like fragments	20/43	3.9	55/94	8.2
Broken nodules	49	3.0	73	4.0
Small fragments	664	40.5	440	24.2
Chips	301	18.4	233	12.8
Technical flakes (CTE)	9	0.5	19	1.1
Blades/laminar flakes	0/35	2.2	1/33	1.9
Flakes	502	30.6	839	46.2
Tools on chunks	2	0.1	2	0.1
Tools on flakes	10	0.6	20	1.1
Pebbles	4	0.2	8	0.4
Total	1639	100	1817	100

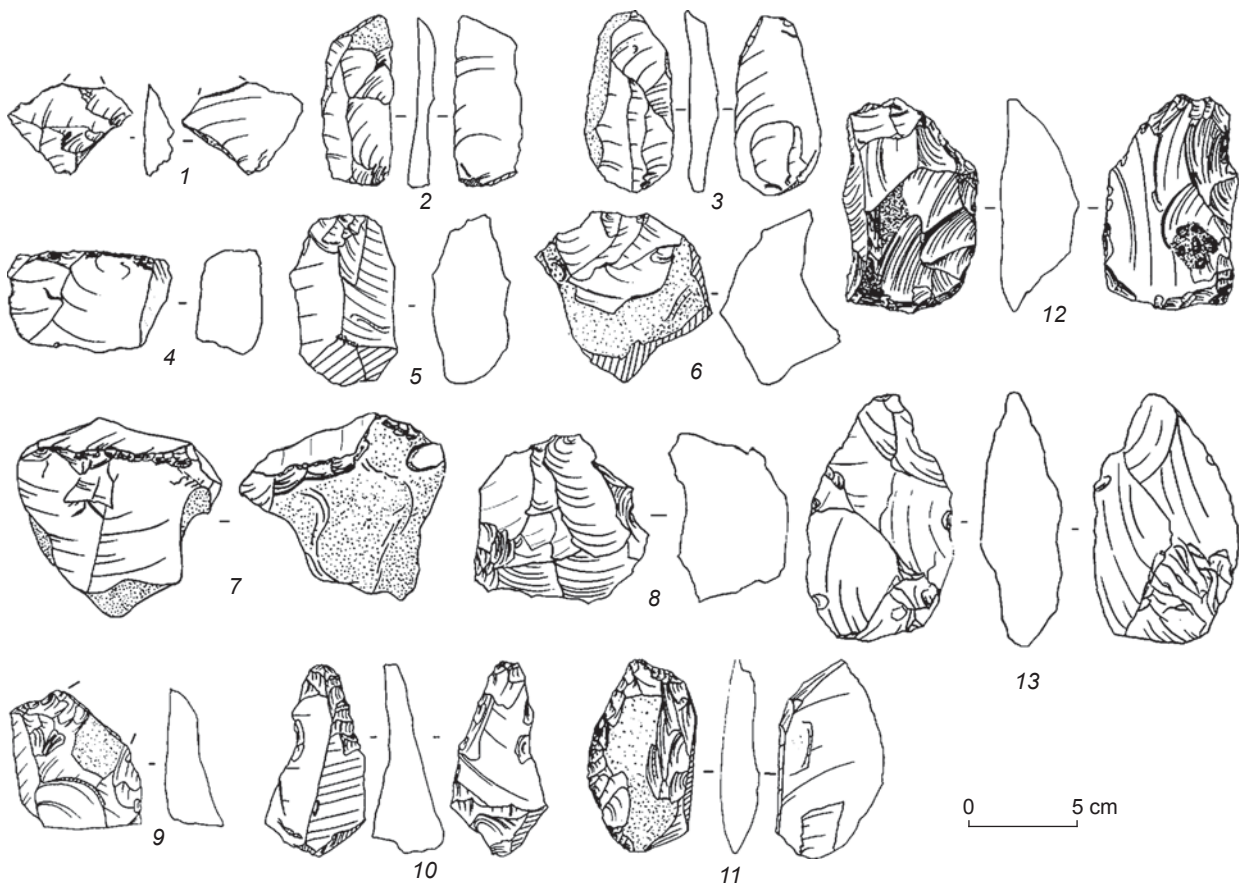


*Fig. 4.*Lithic artifacts from layer 6.
1 – technical flake (CTE); *2*, *3* – laminar flakes; *4–8* – cores; *9* – side-scraper fragment; *10–13* – tools.

Table 2. **Characteristics of striking platforms on flakes**

Flake groups	Total	Flat	Punctiform	Dihedral	Retouched	Cortical	Fragmented
Primary (100 % cortex)	54/68	15/19	7/9	–/1	–/1	15/26	17/12
Semi-primary (50–99 % cortex):							
with unidirectional removals	40/84	21/56	9/4	–	–/1	5/11	5/12
longitudinal-transverse	3/13	1/7	1/–	–	–	1/5	–/1
opposite	5/8	2/4	1/–	–	–	2/4	–
unidentifiable	8/10	4/3	1/–	–	–	1/3	2/4
Flakes with cortex (0–49 % cortex):							
with unidirectional removals	113/220	55/111	11/21	2/2	–/3	17/36	28/47
longitudinal-transverse	16/15	10/9	4/2	–/1	–	–/2	2/1
opposite	36/20	20/7	5/3	1/–	–	7/8	2/2
unidentifiable	18/45	7/11	3/3	1/–	–	4/2	3/29
Flakes:							
with unidirectional removals	162/261	72/133	29/20	6/18	8/7	3/4	54/79
longitudinal-transverse	7/6	6/4	–	–	–	–	1/2
transverse	–/3	–/2	–/1	–	–	–	–
opposite	14/18	10/8	2/6	–	–	–/3	2/1
unidentifiable	26/66	3/14	1/1	–	–	1/2	21/49
Levallois flakes with unidirectional removals	–/2	–	–	–	–/2	–	–
Blades with unidirectional removals	–/1	–/1	–	–	–	–	–
Laminar flakes with unidirectional removals	35/33	16/18	3/2	1/1	2/2	4/–	9/10
Technical flakes (CTE)	9/19	6/9	3/3	–	–	–/3	1/4
Total	546/892	248/416	80/75	11/23	10/16	60/109	147/253

Note. Before the slash the data for layer 6, after the slash the data for layer 7.

flakes (Fig. 4, *2*, *3*), with unidirectional dorsal patterns. Real blades are absent.

Only 12 tools were found in layer 6. Side-scrapers on flakes (3 pcs) are represented by fragments (Fig. 4, *9*). Bifacial tools are made on flakes (3 pcs) and chunks (2 pcs). Among these, there are two partly bifacial tools: a convergent tool (Fig. 4, *10*), and a scraper with thinned back and proximal part of the flake (Fig. 4, *11*). The bifacial backed scraper, similar to the Bockstein type (Fig. 4, *12*), indicates that the layer 6 assemblage belongs to the circle of Micoquian industries in Central and Eastern Europe. Unfinished bifacial convergent tools (2 pcs) are close to small sub-triangular bifaces, which are also typical of the Eastern Micoquian (Fig. 4, *13*). Besides these forms, an end-scraper on flake, two flakes with scale retouch, and a tool fragment were identified.

Some conclusions about the flaking technique can be reached on the basis of the analysis of cores (20 pcs) and flakes (546 pcs). The collection is also characterized by the presence of core-like fragments (43 pcs), fragments of flint nodules (49 pcs), and a large number of small indefinable fragments (664 pcs). The great number of waste products of flaking indicates that the stone-knapping was carried out directly at the site. Most flakes (54 %) have cortex areas, and 15 % of the flakes have cortical striking platforms.

The preparation of cores involved mainly the preparation of striking platforms by large removals. Flat platforms on flakes are 60.1 %. The flaking was carried out mainly in one direction, on slightly convex surfaces. Unifacial single-platform cores and flakes with negatives of removals struck in the same direction as the original

flake predominate. This flaking technique was not aimed at the production of blades. Real blades are absent, and laminar flakes are infrequent.

The multi-platform cores appear to reflect various stages of core-reduction. The renewal of cores was produced with opposite and orthogonal flaking. The number of cores and flakes with longitudinal-transverse (orthogonal) and opposite flaking patterns is small. A large proportion of flakes with cortex, predominance of single-platform cores, and the small number of multi-platform cores indicate that core reduction cycles were short: usually only a few flakes were struck from one striking platform, and the core reduction was mainly completed at the stage of single-platform flaking, after which the core was discarded. In Middle Paleolithic archaeological contexts, this feature is usually a reflection of the abundance of stone raw materials. The Hadjoh-2 site is located on flint outcrops. The marked characteristics of the materials, as well as the small number of tools, some of which are unfinished bifacial forms, allow us to conclude that layer 6 preserves the remains of a flint-knapping workshop, located on flint outcrops, where ancient people repeatedly came throughout the formation-period of the layer.

Layer 7. The collection comprises 1817 artifacts (see Table 1); all are well preserved (not battered or abraded). A part of the finds (15 %) is not patinated. Most artifacts (75 %) are covered with a white patina, many only on one surface. Five pieces are covered with limestone crust, and 13 pieces are burnt.

Among 55 cores, unifacial single-platform cores (34 pcs) predominate (Fig. 5, *6*, *7*, *11*). The striking platforms on cores are made by one, or rarely two, large removals. Eight cores have platforms prepared by a series of small removals (Fig. 5, *10*). The flaking was carried out mainly in one direction, on slightly convex surfaces. Angles of striking platforms are 70–80°. Especially interesting is the refitting of a unifacial single-platform core (Fig. 5, *9*) and a Levallois flake (Fig. 5, *8*), which were found in adjacent squares. The striking platform of the core is prepared by small removals, the platform angle is 78°. Negatives of two parallel scars are preserved on the production surface. The flake has a retouched convex platform.

Also, two-, three-, and four-platform unifacial cores (8, 3 pieces, and one piece, respectively) are represented. Less frequently, cores were reduced from two (5 pcs) or more (3 pcs) surfaces. The reduction from opposite and orthogonal platforms is present. The striking platforms are mostly flat. One highly reduced core (45 × 48 × 14 mm) can be defined formally as a disk-shaped core (Fig. 5, *5*); however, in this technological context, the core can be defined as a bifacial multi-platform residual core.

Flakes make up one third of the collection (Table 2), and most of them are fragmented. Core platform preparation technical flakes (CTE; 19 pcs) are identified. More than half (54 %) of the flakes have cortex areas, semi-primary (12.9 %) and primary (7.6 %) flakes are numerous, and 17 % of the flakes have cortical striking platforms. Flakes with negatives of removals struck in the same direction as the flake predominate (64 %), and the negatives are usually parallel (Fig. 5, *2*). Flakes with opposite (5.2 %) and longitudinal-transverse (3.5 %) dorsal patterns are rare, and flakes with the irregular dorsal pattern (Fig. 5, *1*) are represented by individual pieces. Two flakes can be defined as Levallois (Fig. 5, *8*), with unidirectional negatives and faceted striking platforms. Flat striking platforms prevail (65 %), and there are also punctiform (11.8 %), dihedral (3.6 %), and retouched (2.6 %) platforms. Only one blade (Fig. 5, *3*) and 33 (3.8 %) laminar flakes (Fig. 5, *4*) with unidirectional negatives were identified.

In layer 7, 22 tools were found. Unfinished bifacial forms prevail (12 pcs). These include the tool that can be defined as an oval biface or bifacial scraper (Fig. 5, *16*), and the tool similar to small triangular bifaces characteristic to the Micoquian industries (Fig. 5, *15*). The presence of leaf-shaped biface fragments (3 pcs; Fig. 5, *14*) is also indicative. Among 7 side-scrapers, 3 simple, 2 angled, a transversal (Fig. 5, *12*), a diagonal, and a thick scraper are identified. Also, there are three end-scrapers on flakes (Fig. 5, *13*).

All the characteristics of the materials indicate that the flint-knapping was carried out directly on the site. There are numerous waste products, including small unidentifiable fragments (24.2 %), core-like fragments (5.2 %), and fragments of broken nodules (4.0 %). A large part of the finds has cortex areas, and many flakes have cortical striking platforms. The large number of core-like fragments is explained by the fact that with the abundance of flint raw material the cores were exploited to the limit and, if defect, were discarded in the initial stages of reduction.

The technique of core preparation was primarily the preparation of striking platforms by large flakes. Most flakes have flat platforms, while carefully prepared platforms are rare (6.2 %). The flaking was carried out in one direction, from slightly convex surfaces. Unifacial single-platform cores (61.2 %) and flakes with negatives of removals, struck in the same direction as the original flake, prevail. The renewal of cores was produced using opposite and orthogonal flaking. Flakes with longitudinal-transverse and opposite dorsal patterns are rare.

In general, the flaking technology is similar to the technology described for layer 6. Some differences (for example, the presence of two Levallois flakes and one true blade in layer 7) are apparently explained by only the slightly larger representativeness of the collection from layer 7. The characteristics of the materials from this layer, as well as the presence of unfinished bifacial

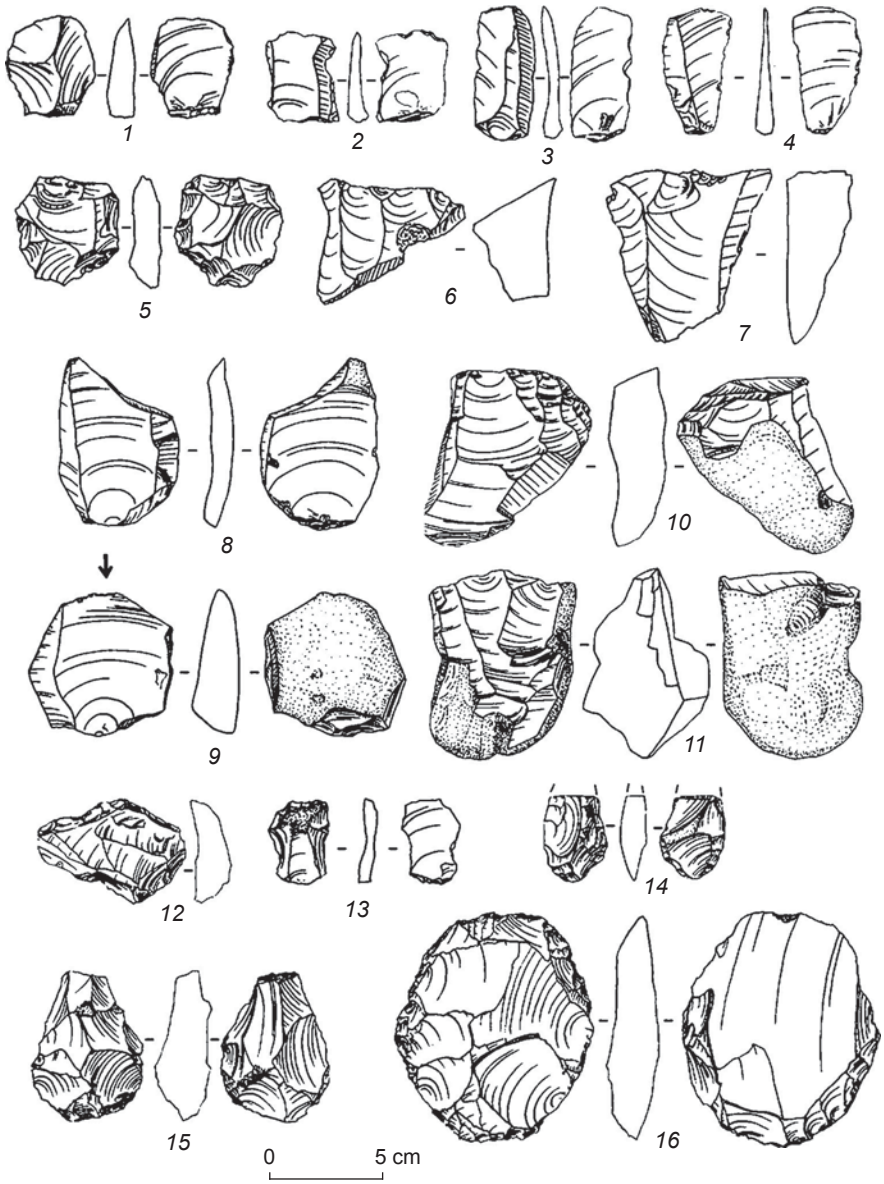


Fig. 5. Lithic artifacts from layer 7.
1, *2*, *4* – flakes; *3* – blade; *5–7*, *9–11* – cores; *8* – Levallois flake refitting with the core (*9*); *12–16* – tools.

tools, allow the conclusion to be made that during formation of layer 7 the site was used as a workshop located on raw material outcrops.

Conclusions

The results of a multidisciplinary research of the Hadjoh-2 site allow us to propose a preliminary reconstruction of paleorelief and paleoclimate. During the formation of layers 7 and 6, the site was located on the floodplain terrace on the right bank of the Sredniy Hadjoh River. The terrace's formation is dated to the boundary of the Middle and Late Pleistocene; consequently, the Hadjoh-2 site is not older than the beginning of the Late Pleistocene, 130–120 ka BP. According to the results of pollen analysis, cold and dry climate dominated at that time in the site area, and the environmental conditions were similar to subalpine and alpine meadows. Such a climate was reconstructed in the lower layer 3 at Mezmaiskaya Cave (Golovanova et al., 1998), whose age is ca 70 ka (Golovanova, 2015). Apparently, layers 6 and 7 in the Hadjoh-2 site can also be correlated with one of cooling periods at the end of MIS 5 or the onset of MIS 4.

The analysis of stone inventory indicates that layers 6 and 7 in the Hadjoh-2 site represent remains of workshops located directly on outcrops of high-quality flint. In both collections, products related to primary stone-knapping

predominate, including cores (3.9 and 8.2 %), flakes (33.3 and 49.2 %), and small fragments (40.5 and 24.2 %). Most of the finds have cortex areas. The technique of core preparation was based on preparation of the striking platform by large flakes; carefully prepared platforms are rare. The flaking was carried out in one direction, from slightly convex surfaces. Unifacial single-platform cores prevail (70 and 61.2 %). The renewal of cores was made using predominantly opposite and orthogonal flaking. The parallel dorsal pattern prevails on flakes. There is a series of laminar flakes. According to F. Bordes's method (1953), 33 laminar flakes, a blade, and two Levallois flakes can be assigned to the Levallois products (IL = 4.0) in layer 7. The flaking technique can be defined as non-laminar and non-Levallois. In layer 6, 35 laminar flakes can be assigned to the Levallois products (IL = 6.4). This, according to Bordes's method, indicates some presence of Levallois technique, but, nevertheless, does not allow us to define the industry as a Levallois one (IL > 20 is required for this definition).

In general, the flaking technique in the site of Hadjoh-2 is similar to that in Mezmaiskaya Cave (lower layers 3 and 2B-4). Primarily, this is reflected in the cores. In Mezmaiskaya Cave, flaking in one direction from slightly convex surfaces also predominates. The percentage of laminar flakes is not high, and the Levallois indexes are low (3.6 in layer 3, and 3.0 in layer 2B-4). However, the index of prepared platforms is higher in Mezmaiskaya Cave; Hadjoh-2 is similar to Barakaevskaya Cave on this index (Table 3).

The tools in layers 6 and 7 are represented predominantly by unfinished bifacial forms. On the basis of the technical and typological parameters of the collection (including the bifacial scraper similar to the Bockstein type, fragments of unfinished leaf-shaped forms, and sub-triangular bifaces), we conclude that the materials of the lower layers in the Hadjoh-2 workshop-camp are most similar to the Eastern Micoquian industries in the Mezmaiskaya (Golovanova et al., 1998; Golovanova, 2015), Barakaevskaya (Lyubin, Autlev, 1994), Monasheskaya (Lyubin, 1977: 144–173; 1989; Belyaeva, 1999: 71–143), and Ilskaya (Shchelinskii, 1998) sites.

The Shahan flint outcrops, on one of which the Hadjoh-2 site is located, were a kind of "silicon province", whence the flint was transported to other sites in the

Table 3. **Percentage of main categories of lithic artifacts and technical indexes***

Site	Cores and core-like fragments	Broken nodules and chunks	Small fragments	Chips	Flakes	Flakes**			Tools	IL	IF large
						with cortex	technical	laminar flakes and blades			
Hadjoh-2:											
layer 6	3.9	3.0	40.5	18.4	33.3	54.0	1.6	6.4	0.7	6.4	5.4
layer 7	8.2	4.0	24.2	12.8	49.2	54.0	2.1	3.8	1.2	4.0	6.2
Mezmaiskaya Cave***:											
layer 3	1.8	0.1	25.4	40.6	13.0	26.0	4.0	3.6	18.6	3.6	19.0
layer 2B-4	3.4	0	24.7	25.9	26.0	17.0	9.0	3.0	20.0	3.0	22.2
Barakaevskaya Cave:											
layer 2	0.3	…	…	…	…	…	…	…	3.7	1.8–6.2	24.4
Monasheskaya Cave:											
layer 4	1.2	7.1	…	13.1	73.7	…	…	4.6	4.2	…	53.0
layer 3A, hor. 3	0.9	4.3	…	16.7	75.8	…	…	7.8	2.3	…	48.5
" hor. 2	0.5	3.3	…	22.5	71.4	…	…	6.1	2.3	…	43.9
" hor. 1	0.5	1.9	…	9.2	84.7	…	…	3.7	3.7	…	37.5
layer 2	1.4	1.1	…	6.4	87.5	…	…	5.0	3.6	…	49.3

*The data collected by E.V. Doronicheva and according to: (Belyaeva, 1999: 71, tab. 2.; Lyubin, 1989: pp. 84–87).
**The percentage relative to the total number of flakes.
***Collections from 1987–2001 excavations.

northwestern Caucasus. The analyses of stone raw materials show that the flint from Shahan outcrops was transported in the Middle Paleolithic to Mezmaiskaya (30–40 km to the south-west) and Matuzka (about 30–40 km to the west) caves. Moreover, the data from Mezmaiskaya, where this flint was recorded in all Middle Paleolithic layers (dating to 70–40 ka BP), indicate that the Shahan outcrops were exploited throughout the entire period of the Neanderthal occupation of this region (Doronicheva, Kulkova, 2016; Doronicheva, Kulkova, Shackley, 2016).

A comparison between the materials from the lower layers of the Hadjoh-2 site and Mezmaiskaya Cave (Table 3) shows a number of differences. In the cave, the proportions of cores and flakes are less, and the percentage of technical flakes is higher. This, apparently, is related to a limited amount of raw materials and their maximum use, which is reflected in the renewal and maximum reduction of cores. At the same time, there are significantly more tools and chips in Mezmaiskaya Cave, which may indicate the production and rejuvenation of tools directly on the site. This ratio of major categories of inventory allows us to define Mezmaiskaya Cave as the camp-site of active habitation, where various tools were used and stone knapping was restricted; and the Hadjoh-2 site as the workshop-camp used for stone knapping and manufacturing of preforms for bifacial tools.

Comparing the Hadjoh-2 collections with materials from the active habitation workshop-camps in the Gubs Gorge (Lyubin, Autlev, 1994; Belyaeva, 1999), which are also located on a flint source, one can note that the percentage of cores in Monasheskaya and Barakaevskaya caves is lower, and the percentage of tools is higher than in the Hadjoh-2 site (Table 3). The technological indicators are higher in Monasheskaya Cave than at Hadjoh-2, and the cave-site has a later age than the Hadjoh-2 site (Golovanova, 2015). The significant feature of active habitation workshop-camps is the multi-raw-materials resource base of their lithic industries. The transported lithic raw materials are represented mostly by tools (Belyaeva, 1999: 72). In the Hadjoh-2 site, 99 % of artifacts are made of flint, on sources of which the site is located.

The Hadjoh-2 site functioned for quite a long time. Our studies indicate that the materials from layers 7, 6, and 4A represent workshops. Layer 4C is a camp where humans not only made tools, but also butchered game (details for layers 4A and 4C see in: (Doronicheva et al., 2016)). Further research will allow us to compare in more details the stages of human habitation at Hadjoh-2 and other sites, as well as to study economic variability among the sites, human life support strategies and mobility, cultural relations and exchange in the Middle Paleolithic of northwestern Caucasus.

Acknowledgement

This study was supported by the Russian Foundation for the Humanities, Project No. 14-31-01209a2.

References

Belyaeva E.V. 1999
Mustyerskiy mir Gubskogo ushchelya (Severniy Kavkaz). St. Petersburg: Peterburg. Vostokovedeniye.

Berglund B.E., Ralska-Jasiewiczowa M. 1986
Pollen analysis and pollen diagrams. In *Handbook of Holocene Palaeoecology and Palaeohydrology*. Chichester: Wiley-Interscience, pp. 455–484.

Bordes F. 1953
Essai de classification des industries “mousteriennes”. *Bulletin de la Société préhistorique française*, vol. 50, fasc. 7/8: 457–466.

Dawson M.-C., Bernard-Guelle S., Rué M., Fernandes P. 2012
New data on the exploitation of flint outcrops during the Middle Paleolithic: the Mousterian workshop of Chêne Vert at Dirac (Charente, France). *Paleo*, No. 23: 55–84.

Doronicheva E.V., Kulkova M.A. 2016
Izucheniye kamennogo syrya v paleolite: Metody i rezultaty. *Rossiyskaya arkheologiya*, iss. 2: 5–18.

Doronicheva E.V., Kulkova M.A., Shackley M.S. 2016
Raw material exploitation, transport, and mobility in the Northern Caucasus Eastern Micoquian. *PaleoAnthropology*: 1–45. URL: http://www.paleoanthro.org/media/journal/content/PA20160001.pdf

Doronicheva E.V., Nedomolkin A.G., Ivanov V.V., Muriy A.A. 2016
Predvaritelniye rezultaty issledovaniya pozdnikh kulturnykh sloyev srednego paleolita na stoyanke Khadzhokh-2 (Severo-Zapadniy Kavkaz). *Materialy polevykh issledovaniy MAE RAN*, iss. 16: 269–294.

Fedyunin I.V. 2011
Masterskaya epokhi paleolita na severe Kalachskoy vozvyshennosti. *Rossiyskaya arkheologiya*, No. 2: 94–103.

Golovanova L.V. 1993
Ob istorii odnoy mustyerskoy kultury na Severnom Kavkaze. In *Vtoraya Kubanskaya arkheologicheskaya konferentsiya: Tezisy dokl*. Krasnodar: pp. 24–27.

Golovanova L.V. 2015
Les hommes de Néanderthal du Caucase du Nord: Entre l’Ouest et l’Est. *L’Anthropologie*, No. 119: 254–301.

Golovanova L., Hoffecker J., Nesmeyanov S., Levkovskaya G., Kharitonov V., Romanova G., Svejenceve I. 1998
Site du Micoque Esteuropeen du Caucase de Nord (Resultats presentifs des etudes de la grotte Mezmaiskaya, les fouilles des annes 1987–1993). *L’Anthropologie*, No. 1: 45–66.

Gopher A., Barkai R. 2011
Sitting on the tailing piles: Creating extraction landscapes in Middle Pleistocene quarry complexes in the Levant. *World Archaeology*, vol. 43 (2): 211–229.

Gosudarstvennaya geologicheskaya karta Rossiyskoy Federatsii masshtaba 1 : 200 000. 2004
Seriya Kavkazskaya, sheet L–37–XXXV (Maikop): Obyasnitelnaya zapiska. S.G. Korsakov, I.N. Semenukha, E.V. Beluzhenko, V.I. Chernykh, G.R. Tuzikov, I.I. Grekov, V.N. Tokarev, M.G. Dergacheva, V.V. Sokolov (comp.). 2nd edition. St. Petersburg: VSEGEI.

Grichuk V.P. 1940
Metodika obrabotki osadochnykh porod, bednykh organicheskimi ostatkami, dlya tseley pyltsevogo analiza. *Problemy fizicheskoy geografii*, iss. 8: 53–58.

Kovalenko S.I., Ketraru N.A. 2010
Stoyanki-masterskiye verkhnego paleolita srednego techeniya r. Reut. *Stratum Plus*, No. 1: 269–275.

Lioubine V.P. 1998
La grotte mousterienne Barakaevskaia (Nord Caucase). *L'Anthropologie*, No. 1: 67–90.

Lyubin V.P. 1977
Mustyerskiye kultury Kavkaza. Leningrad: Nauka.

Lyubin V.P. 1989
Paleolit Kavkaza. In *Paleolit Kavkaza i Severnoy Azii*. Leningrad: Nauka, pp. 9–142. (Paleolit mira).

Lyubin V.P., Autlev P.U. 1994
Kamenniy inventar mustyerskogo sloya. In *Neandertaltsy Gupsskogo ushchelya na Severnom Kavkaze*. Maikop: Meoty, pp. 99–141.

Matyukhin A.E. 2010
O kharaktere svyazi syrya, tipologii i tekhnologii domustyerskikh i mustyerskikh pamyatnikov Russkoy ravniny. *Stratum Plus*, No. 1: 201–225.

Nekhoroshev P.E. 1999
Tekhnologicheskiy metod izucheniya pervichnogo rasshchepleniya kamnya srednego paleolita. St. Petersburg: Yevropeiskiy Dom.

Neruda P., Nerudová Z. 2010
Moravský Krumlov IV – a new multilayer Paleolithic site in Moravia. *Archäologisches Korrespondenzblatt*, H. 2: 155–174.

Nesmeyanov S.A. 1999
Geomorfologicheskiye aspekty paleoekologii gornogo paleolita. Moscow: Nauch. mir.

Paleoklimaty i paleolandshafty vnetropicheskogo prostranstva Severnogo polushariya: Pozdniy pleistotsen–golotsen: Atlas-monografiya. 2009
A.A. Velichko (ed.). Moscow: GEOS.

Sapelko T.V. 2014
Palinologiya pozdnepaleoliticheskikh pamyatnikov Desny. In *Epigravettiyskoye vremya na territorii Srednego Podneprovya*. Kiev: Vidavets Oleg Filyuk, pp. 115–130.

Shchelinskii V.E. 1998
Der Mittelpaläolithische Fundplatz Ilskaya II im Westlichen Kubangebiet. In *Jahrbuch des Römisch-Germanischen Zentralmuseums*. Mainz: pp. 131–165.

Shchelinsky V.E. 2005
O stratigrafii i kulturnoy prinadlezhnosti Ilskoy stoyanki. In *Chetvertaya kubanskaya arkheologicheskaya konferentsiya: Tezisy i dokl*. Krasnodar: pp. 309–316.

Zernov A.S. 2006
Flora Severo-Zapadnogo Kavkaza. Moscow: Tovarishchestvo nauchnykh izdaniy KMK.

Received October 18, 2016.
Received in revised form February 1, 2017.

DOI: 10.17746/1563-0110.2018.46.1.027-033

A.A. Shalapinin
Samara State University of Social Sciences and Education,
Maksima Gorkogo 65/67, Samara, 443099, Russia
E-mail: anton-shalapinin@ro.ru

The Late Chalcolithic Ceramics of the Volga Forest-Steppe

Chalcolithic pottery from the eastern Volga area was subjected to a technological and typological analysis. Three types are described: Chekalino, Gundorovka, and vessels "with an inner rib". Chekalino vessels have gently curved profiles, are tempered with crushed shells, and are decorated with short and moderately long comb imprints and pits. Gundorovka vessels are either pot-like or have gently curved profiles, are tempered with crushed shells and feathers, and are decorated with moderately long comb imprints and those of a cord. Vessels "with an inner rib" are pots and jars tempered with crushed shells and feathers, and decorated with imprints of a fine-tooth comb or a plain stamp, hatching, and pits. The Chekalino-type ceramics are paralleled by the Chalcolithic pottery of the forest and forest-steppe Volga and Kama. The Gundorovka vessels reveal similarities to the collared Chalcolithic vessels of the forest-steppe, and to the Volosovo ceramics of the Middle Volga forests. Vessels "with an inner rib" show some resemblance to those of the Sredni Stog, Altata, and Turganik forest-steppe. The Late Chalcolithic ceramics date to 4250–3500 BC. Chekalino is related to Late Neolithic combed ceramics of the Middle Volga. Gundorovka originates from the collared Chalcolithic pottery of the Lebyazhinka III type. Ceramics "with an inner rib" derive from those of the forest-steppe Middle Chalcolithic.

Keywords: *Late Chalcolithic, chronology, ceramics, forest-steppe, Volga basin, radiocarbon date, ornamentation.*

Introduction

It became possible to speak of the Chalcolithic of the Volga forest-steppe region after studying the Syezzheye and Khvalynsk burial grounds, and also the Alekseyevka and Staro-Elshanskaya sites in the 1970s. On the basis of these complexes, two stages, Mariupol (the earlier) and Ancient Pit Grave (the later), have been distinguished (Vasiliev, 1978). The later stage is represented by the finds from sites with mixed cultural layers. These are paralleled by artifacts belonging to the forest cultures of the Volga and Kama regions. Somewhat later, on the basis of collections from the sites in the Tok River basin, N.L. Morgunova identified the Tok and Turganik types (1995). Some Late Chalcolithic materials discovered in the Sok River basin were associated with the Volosovo and Novoilyinskoye cultures of the forest Volga and Kama regions. Also, ceramics of Repin and Alekseyevka steppe cultural types were recorded at these forest-steppe sites. Notably, many characteristics of the Tok and Turganik types were similar. Descriptions of specific complexes were inconsistent with characteristics of the pottery of the main culture area. Owing to the lack of radiocarbon dates, the chronological attribution of the majority of complexes was determined by comparison with materials from adjacent territories. The Late Chalcolithic of the Middle Volga forest-steppe zone was considered a period of rather prolonged co-existence between cultures of various origin (Vasiliev, 1990; Vasiliev, Ovchinnikova, 2000; Ovchinnikova, 2006). In recent years, a special type of Late Chalcolithic ware, ceramics "with an inner rib", was distinguished (Korolev, Ovchinnikova, 2009).

Archaeology, Ethnology & Anthropology of Eurasia 46/1 (2018) 27–33 E-mail: Eurasia@archaeology.nsc.ru

Characteristics of complexes

There are 14 sites that contain Late Chalcolithic materials in the Volga forest-steppe region. These are located in the basins of the Sok and Samara rivers, and also near the Tok River, the Samara's tributary (Fig. 1). All the sites contain not only Late Chalcolithic artifacts, but also materials belonging to other epochs. This makes it difficult to identify stone tools pertaining to the Late Chalcolithic, and forces us to place particular emphasis on the ceramic inventories. Most representative series of the Late Chalcolithic pottery are available in the collections from the Gundorovka, Ivanovo, Bolshaya Rakovka II, and Chekalino IV sites. The Ivanovo Late Chalcolithic complexes of the Tok and Turganik types have been addressed comprehensively in a number of studies by N.L. Morgunova (1989, 1995, 2011). Therefore, it is reasonable to focus on the materials from the Gundorovka, Chekalino IV, and Bolshaya Rakovka II sites, which fall into three groups in terms of their technological and typological characteristics.

The first pottery complex is represented by materials from Chekalino IV and Bolshaya Rakovka II. Small amounts of this pottery have also been found at Chesnokovka II, Popovo Ozero, and Lebyazhinka IV. The ware has a gray-brown color. The paste was tempered with crushed shells. The inner surfaces often show traces of comb imprints. The vessels have closed, straight, or cauldron-like profiles. The rims are thickened on their inner and outer sides, straight, or weakly- or moderately-folded outward. There is a single T-shaped rim. The bottoms are rounded or flattened. The patterns are formed by comb, honeycomb, crescentic, or plain imprints, or pits of various shapes. Ornamental motifs include the following types: horizontal zigzag and oblique and straight rows of stamp imprints; combination of horizontal rows of oblique short, moderately long, or long comb imprints; rows of pits and horizontal rows of oblique stamp imprints; horizontal bands and horizontal rows of oblique or straight stamp imprints, etc. (Fig. 2). The most abundant, second pottery complex is related to the Gundorovka settlement. Certain vessels of this type are available in the collections of Bolshaya Rakovka II and Lebyazhinka IV. The pottery is of brown, gray or dark gray color. It is tempered with crushed shells and feathers. The vessels have ovoid, cauldron-like, and pot-like shapes. The last-named predominates. The rims are straight, thickened on the outer side, open, variously folded outwards, and L- or T-shaped. Weakly everted rims are most abundant. The bottoms are rounded or flattened. Ornamentation is dominated by comb imprints. Grid stamp design, cord imprints, and pits are also encountered. Horizontal rows of oblique and straight stamp imprints, horizontal rows of pits, non-contoured rhomboids, and stepping comb are the most popular designs (Fig. 3).

The third pottery complex (vessels "with an inner rim") is richly represented in the collections of Chekalino IV and Gundorovka. Certain vessels of this type occur in collections from Lebyazhinka IV, Chesnokovka II, Bolshaya Rakovka II, and Vilovatoye. The ceramics are gray or brown. Paste contains crushed shells and feathers. Traces of combing are observed on the outer and inner sides. The vessels have pot-like or jar-like shapes. The rims are straight, or folded outward. At the place of folding, there is often an inner rib. The ceramics are decorated with imprints of fine-tooth comb, plain stamp, hatching, or small pits of various shapes. There are also unornamented vessels. Designs include horizontal rows of oblique and straight comb imprints, oblique and straight rows of stamp imprints, horizontal zigzags formed by comb stamp imprints, horizontal lines of plain stamp imprints, horizontal bandlets of comb imprints, "lattice", cross-hatched triangles, etc. These combinations of motifs are often present on the same vessel (Fig. 4).

Cultural and chronological attribution

Vessels of the first complex from the sites of Chekalino IV and Bolshaya Rakovka II show the greatest resemblance in their shape, texture, paste admixtures, elements, and ornamental motifs to the pottery from Elshanka XI on the Sviyaga River (Viskalin, 2008), Barskiye Kuzhery III on the Ilet River (Nikitin, 1991), Dubovaya Griva II and Igimskaya in the Ik-Belaya interfluve (Shipilov, 2012), Mullino (Matyushin, 1982: 196–215),

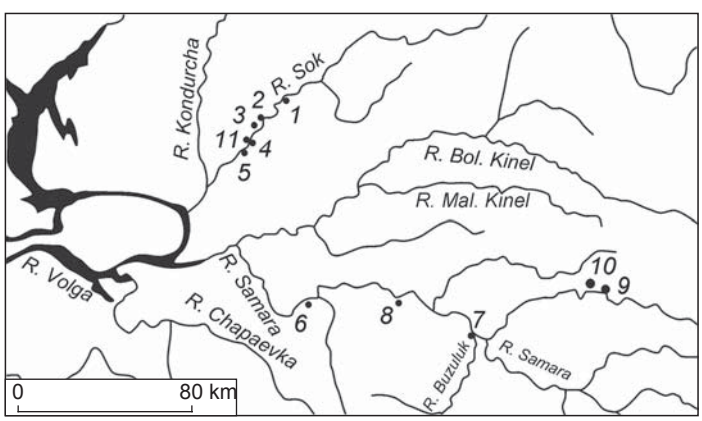


Fig. 1. Late Chalcolithic sites of the Volga forest-steppe.
1 – Chekalino IV; *2* – Chesnokovka II; *3* – Popovo Ozero; *4* – Lebyazhinka IV, VI; *5* – Bolshaya Rakovka II; *6* – Maksimovka site; *7* – Staro-Elshanskaya II site, Staro-Elshanskaya coastal site; *8* – Vilovatoye; *9* – Ivanovo settlement; *10* – Turganik site; *11* – Gundorovka.

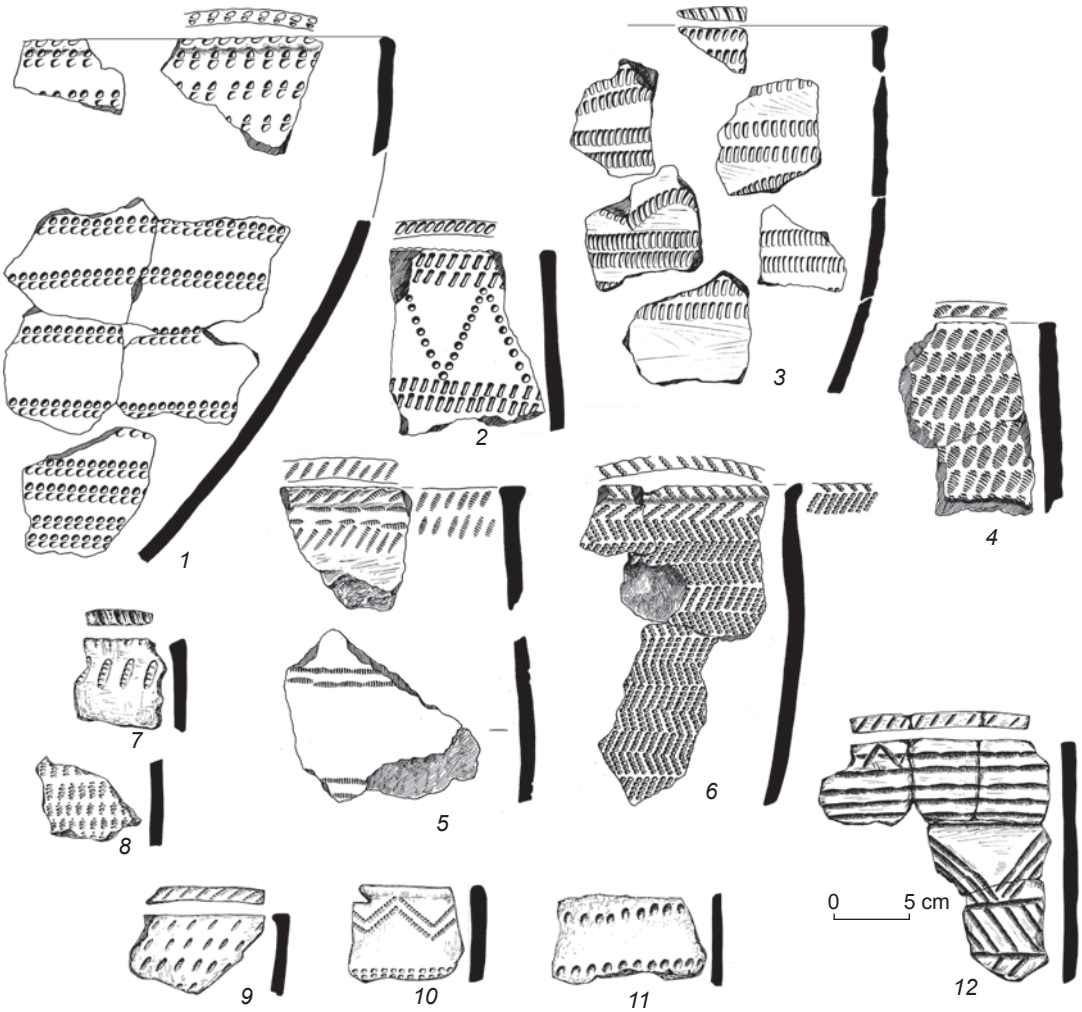


Fig. 2. Late Chalcolithic ceramics of the Volga forest-steppe.
1–6 – Chekalino IV (Korolev, 2011: Fig. 3–5); *7–11* – Bolshaya Rakovka II; *12* – Chesnokovka II.

Srednyaya Oka (Morozov, 1982) in Cis-Urals, and Ivanovo on the Tok River. This puts materials from Chekalino on a par with those from the said sites.

The vessels of the second (Gundorovka) complex have common features with the Middle Chalcolithic forest-steppe Volga pottery from the Lebyazhinka III site (Ovchinnikova, 1995), but also with the Volosovo materials of the Middle Volga forest zone (Tokareva (Khalikov, 1960: 50), Rutka, and Akhmylovo settlements (Nikitin, 1991)). The Gundorovka vessels reveal similarities to the Lebyazhinka III collared pottery in admixture of feathers and shells in paste, the shapes of items, dominance of comb ornamentation, stepping-comb design, horizontal rows of stamp imprints, etc. Such features as paste admixture, T- and L-shaped rims, ornamentation in the form of grid stamp, crosses, and non-contoured rhomboids are common to both Volosovo and Gundorovka ceramics.

Ceramics of the third complex (vessels "with an inner rim") are similar to the Sredni Stog pottery from Moksha region (Korolev, Stavitsky, 2006: 9–25), and partly to the Pshenichnoye ceramics collection attributed to the Altata culture (Yudin, 1989: 152–154), in the following traits: pot-like shapes of vessels, neck type, traces of combing on surface, use of short or moderately long narrow comb ornamenting tools, plain stamp, and decoration with small pits. Ceramics "with an inner rib" are close to the Turganik vessels in their shapes and ornamentation including horizontal lines, zigzags, rows of oblique and straight imprints, cross-hatched triangles, and rows of oval and rounded pits. However, vessels "with an inner rib" do not entirely resemble either of the said pottery complexes in their traits. Thus, ceramics "with an inner rib" represent a unique cultural phenomenon of the Chalcolithic forest-steppe Volga region.

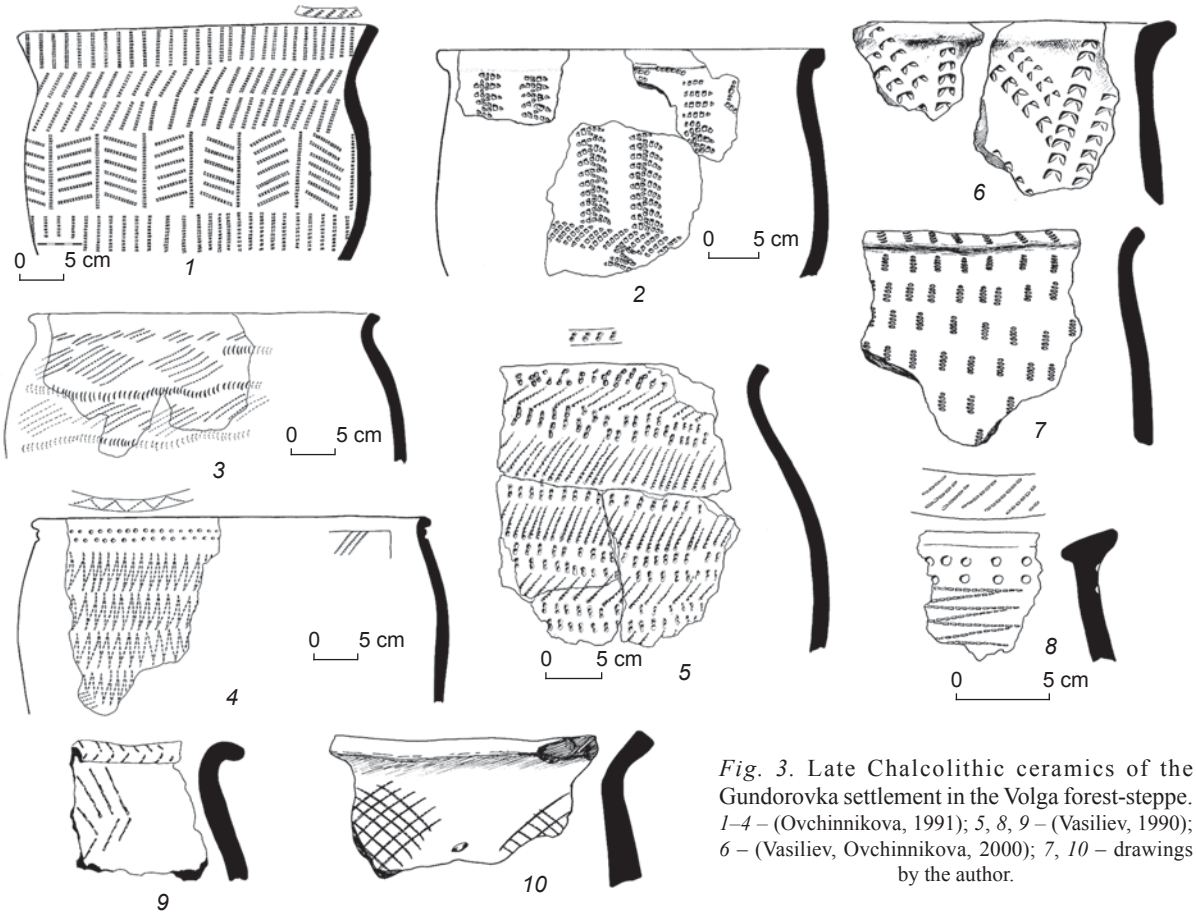


Fig. 3. Late Chalcolithic ceramics of the Gundorovka settlement in the Volga forest-steppe. *1–4* – (Ovchinnikova, 1991); *5*, *8*, *9* – (Vasiliev, 1990); *6* – (Vasiliev, Ovchinnikova, 2000); *7*, *10* – drawings by the author.

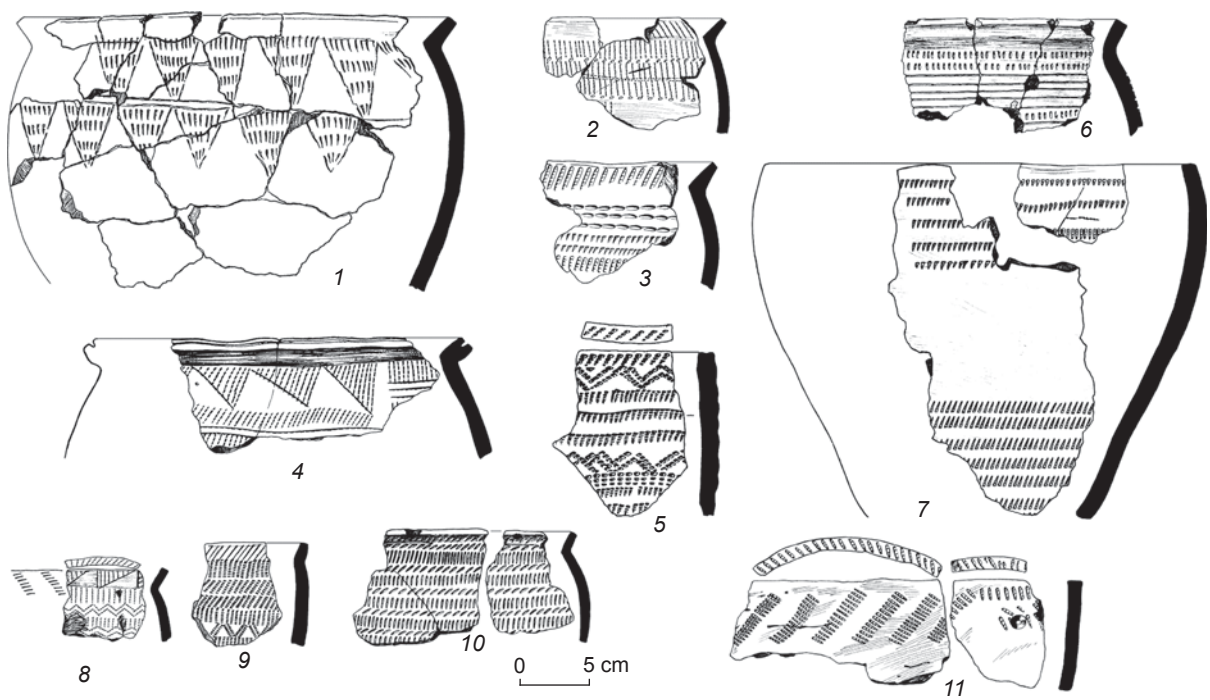


Fig. 4. Late Chalcolithic ceramics of the Volga forest-steppe.
1–7 – the Gundorovka settlement (Vasiliev, Ovchinnikova, 2000; Korolev, Ovchinnikova, 2009); *8–11* – Chekalino IV (Korolev, 2009).

Radiocarbon dates of the pottery complexes from the Late Chalcolithic sites of the Volga Forest-Steppe

Site	Laboratory code	^{14}C-date, years BP	Pottery type	Source
Chekalino IV	Ki-14572	5270 ± 80	"With an inner rib"	(Korolev, Shalapinin, 2014)
	Ki-14573	5320 ± 80		
Gundorovka	Ki-16280	5290 ± 70	Gundorovka	
	Ki-16278	5270 ± 80		
	Ki-16279	5380 ± 70		
	SPb-772	5412 ± 100		
	SPb-767	5035 ± 100		
	SPb-768	5230 ± 100		
	SPb-769	5488 ± 200		
	SPb-766	5300 ± 100		
Chekalino IV	Ki-15775	6620 ± 80	Chekalino	
	Ki-14571	5840 ± 80		
	Ki-16440	5050 ± 80		
	Ki-16439	5065 ± 70		
	Ki-14574	5240 ± 80		
	Ki-15774	5470 ± 140		
Chesnokovka II	SPb-1056	5024 ± 120		
Ivanovo settlement	Ki-15069	4860 ± 80	Turganik	(Morgunova et al., 2010)
	Ki-15088	4790 ± 80		
	Ki-14515	5920 ± 80		
	Ki-15068	4930 ± 80	Tok	
	Ki-15089	4940 ± 80		
	Ki-15070	5070 ± 80		
Turganik settlement	Ki-14517	5830 ± 70		

At present, there are 24 radiocarbon dates obtained for the Late Chalcolithic of the Volga forest-steppe. The results of dating were repeatedly analyzed (Morgunova et al., 2010; Morgunova, 2011; Korolev, Shalapinin, 2014; Mosin et al., 2014) (see *Table*). The late stage of the Chalcolithic of the Volga forest-steppe can be assigned to 4300–3700 BC with a probability of 68.2 %, or to 4450–3500 BC with a probability of 95.4 %.

Origin of the Late Chalcolithic in the Volga Forest-Steppe

Radiocarbon dates obtained for the Volga forest-steppe finds precede the earliest ^{14}C-determinations for the Middle Volga forest region materials (Korolev, Shalapinin, 2010). Therefore, the appearance of Chekalino and Gundorovka artifacts in this area cannot be associated with the Volosovo or Gari population that migrated from north. According to I.B. Vasiliev, the Tok pottery tradition was developed in the local forest-steppe (1990: 67). Thus, the origin of Chekalino ceramics can also be considered in this way. For example, the late radiocarbon dates of the combed complexes from Lebyazhinka IV (5420 ± 80 (Ki-14082), 5360 ± 90 (Ki-14121)) (Vybornov et al., 2008: 104) are almost coincident with the ^{14}C-determinations of the Chekalino ceramics. Certain traits of Chekalino pottery (straight profile; bandlets of pits under the rims; dense ornamentation by a comb stamp; design combining imprints of short and moderately long comb stamps, etc.) also occur on the artifacts belonging to the comb complexes of the Middle Volga.

Finds from Lebyazhinka III are of primary importance for addressing the issue of the Gundorovka complex's origin, since both collections have common features. Notably, the Gundorovka collection includes a series of collared ceramics identical to the Lebyazhinka pottery (Korolev, Shalapinin, 2008). The latter, in turn, is close to the main Late Chalcolithic complex of this settlement (admixture, shape of vessels, ornamentation). The Gundorovka ceramics have certain features that differentiate them from the classic Volosovo specimens,

namely: pot-like shape, bandlet of pits under the rim, stepping-comb decoration. The origin of these features is related to forest-steppe complexes. Among the Middle Volga Volosovo materials, especially clear distinctions from the Gundorovka ceramics are demonstrated by early vessels from the Maidan group of sites: these have exclusively straight profiles, and are ornamented with short oval and moderately long comb imprints, etc. (Nikitin, 1991). Thus, formation of the Gundorovka assemblage pertains to the Chalcolithic of the Volga forest-steppe region.

The issue of the origin of the vessels "with an inner rib" is the most complicated. According to A.I. Korolev, these appeared with the arrival of Sredni Stog population from the Don (2009). However, sites containing the ceramics "with an inner rib" are located far away from the Sredni Stog cultural area. No Sredni Stog sites have been found eastward of the Moksha basin, in the Sura region. The typological similarity between the Turganik-type ceramics and vessels "with an inner rib" cannot be explained by the presence of the Sredni Stog component in both of them. Therefore, the hypothesis as to the influence of migrants from the western Middle Volga on local population requires further elaboration. An idea about the local origin of the Turganik ceramics has been raised in the literature (Morgunova, 1995: 77). A.I. Korolev and N.V. Ovchinnikova conceded that the "inner rib" ceramics could have been developed under the influence of Ivanovo and Khvalynsk traditions (2009: 303). Some Khvalynsk and Ivanovo vessels have each an inner rib and dense horizontal-zonal ornamentation, which is often located only in the upper portion of vessel. Also, there are some similar ornamental motifs, such as horizontal incised lines, bandlets of shallow pits, oblique rows of imprints, horizontal zigzags, cross-hatched triangles, etc. Some rims of the "inner rib" ceramics show collars.

Conclusions

The Late Chalcolithic of the Volga forest-steppe is represented by several pottery complexes. The first one comprises Chekalino materials recorded near the Sok River, and Tok materials from the Samara River basin. The origin of these complexes is associated with the late Middle Volga combed ceramics. The second complex (Gundorovka ceramics) is localized in the lower Sok River, and originates from the collared Chalcolithic materials of the Lebyazhinka III type. The third complex is represented by Turganik materials from the Samara River, and vessels "with an inner rib" from the Sok River. These trace their origin to the Chalcolithic forest-steppe cultures. The Late Chalcolithic of the Volga forest-steppe region is dated to 4250–3500 BC.

Acknowledgement

This study was performed under the Public Contract of the Ministry of Education and Science of the Russian Federation (Project No. 33.1907. 2017/ПЧ).

References

Khalikov A.K. 1960
Materialy k izucheniyu istorii naseleniya Srednego Povolzhya i Nizhnego Prikamya v epokhu neolita i bronzy. In *Trudy Mar. arkheol. ekspeditsii*. Yoshkar-Ola: Mar. kn. izd.

Korolev A.I. 2009
Aktualniye voprosy izucheniya keramiki "s vnutrennim rebrom". In *Problemy izucheniya kultur rannego bronzovogo veka stepnoy zony Vostochnoy Yevropy*. Orenburg: Izd. Orenburg. Gos. Ped. Univ., pp. 190–196.

Korolev A.I. 2011
Materialy lesnogo kruga so stoyanki Chekalino IV lesostepnogo Zavolzhya (po rezultatam raskopok 2007 g.). In *Tverskoy arkheologicheskiy sbornik*, iss. 8. Tver: Triada, pp. 219–228.

Korolev A.I., Ovchinnikova N.V. 2009
K voprosu o kulturnoy prinadlezhnosti keramiki "s vnutrennim rebrom" s poseleniy Samarskogo Povolzhya. In *Tverskoy arkheologicheskiy sbornik*, iss. 7. Tver: Triada, pp. 296–304.

Korolev A.I., Shalapinin A.A. 2008
Ob odnoy gruppe gundorovskoy keramiki: Noviy vzglyad na volosovskuyu kollektsiyu. In *Arkheologiya vostochnoyevropeiskoy lesostepi*, vol. I (2). Penza: pp. 148–151.

Korolev A.I., Shalapinin A.A. 2010
Radiouglerodnoye datirovaniye rannikh materialov volosovskoy kultury Srednego Povolzhya. *Izvestiya Samarskogo nauchnogo tsentra RAN*, vol. 12 (2): 256–259.

Korolev A.I., Shalapinin A.A. 2014
K voprosu o khronologii i periodizatsii eneolita stepnogo i lesostepnogo Povolzhya. *Izvestiya Samarskogo nauchnogo tsentra RAN*, vol. 16 (3): 266–275.

Korolev A.I., Stavitsky V.V. 2006
Primokshanye v epokhu rannego metalla. Penza: Izd. Penz. Gos. Ped. Univ.

Matyushin G.N. 1982
Eneolit Yuzhnogo Urala. Moscow: Nauka.

Morgunova N.L. 1989
Eneoliticheskiye kompleksy Ivanovskoy stoyanki. In *Neolit i eneolit Severnogo Prikaspiya*. Kuibyshev: Izd. Kuib. Gos. Ped. Inst., pp. 118–135.

Morgunova N.L. 1995
Neolit i eneolit yuga lesostepi Volgo-Uralskogo mezhdurechya. Orenburg: Izd. Orenburg. Gos. Ped. Univ.

Morgunova N.L. 2011
Eneolit Volzhsko-Uralskogo mezhdurechya. Orenburg: Izd. Orenburg. Gos. Ped. Univ.

Morgunova N.L., Vybornov A.A., Kovalyukh N.N., Skripkin V.V. 2010
Khronologicheskoye sootnosheniye eneoliticheskikh kultur Volgo-Uralskogo regiona v svete radiouglerodnogo datirovaniya. *Rossiyskaya arkheologiya*, No. 4: 18–27.

Morozov Y.A. 1982
Eneoliticheskiye pamyatniki Priuralya. In *Volgo-Uralskaya step i lesostep v epokhu rannego metalla*. Kuibyshev: Izd. Kuibysh. Gos. Ped. Inst., pp. 71–82.

Mosin V.S., Epimakhov A.V., Vybornov A.A., Korolev A.I. 2014
Chronology of the Chalcolithic and the Early Bronze Age in the Urals. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 42 (4): 41–53.

Nikitin V.V. 1991
Medno-kamenniy vek Mariyskogo kraya (seredina III–nachalo II tysyacheletiya do n.e.). Yoshkar-Ola: Mar. kn. izd.

Ovchinnikova N.V. 1991
Keramika volosovskogo tipa s Gundorovskogo poseleniya. In *Arkheologiya i etnografiya Mariyskogo kraya*, iss. 19. Yoshkar-Ola: MarNII, pp. 89–98.

Ovchinnikova N.V. 1995
Lebyazhinka III — poseleniye epokhi eneolita v lesostepnom Zavolzhye. In *Drevniye kultury lesostepnogo Povolzhya*. Samara: Izd. Samar. Gos. Ped. Inst., pp. 164–190.

Ovchinnikova N.V. 2006
Itogi izucheniya eneoliticheskikh poseleniy lesostepnogo Povolzhya. *Izvestiya Samarskogo nauchnogo tsentra RAN*. Special issue: "Aktualniye problemy istorii, arkheologii, etnografii": 294–301.

Shipilov A.V. 2012
Eneolit Iksko-Belskogo mezhdurechya (po materialam poselencheskikh pamyatnikov): Cand. Sc. (History) Dissertation. Kazan.

Vasiliev I.B. 1978
Yuzhniye rayony lesostepnogo Povolzhya v volosovskoye vremya. In *Arkheologiya i etnografiya Mariyskogo kraya*, iss. 3. Yoshkar-Ola: Mar. Nauch.-Issled. Inst., pp. 169–184.

Vasiliev I.B. 1990
Pozdniy eneolit lesostepnogo Povolzhya. In *Eneolit lesnogo Urala i Povolzhya*. Izhevsk: Udmurt. inst. ist., yaz. i lit UrO RAN, pp. 52–69.

Vasiliev I.B., Ovchinnikova N.V. 2000
Eneolit. In *Istoriya Samarskogo Povolzhya s drevneishikh vremen do nashikh dney*. Kamenniy vek. Samara: Izd. Samar. nauch. tsentra RAN, pp. 216–277.

Viskalin A.V. 2008
Kompleks lesnogo eneolita v lesostepnykh rayonakh Volgo-Uralskogo mezhdurechya. In *Arkheologiya vostochnoyevropeiskoy lesostepi*, vol. II (2). Penza: pp. 39–49.

Vybornov A.A., Kovalyukh N.N., Lastovsky A.A., Mamonov A.E., Morgunova N.L., Skripkin V.V. 2008
Noviye radiouglerodniye daty dlya neolita lesostepnogo Zavolzhya. In *Arkheologiya vostochnoyevropeiskoy lesostepi*, vol. I (2). Penza: pp. 96–105.

Yudin A.I. 1989
Eneoliticheskoye poseleniye Pshenichnoye na r. Torgun. In *Neolit i eneolit Severnogo Prikaspiya*. Kuibyshev: Izd. Kuib. Gos. Ped. Inst., pp. 146–167.

Received June 16, 2015.
Received in revised form October 2, 2016.

DOI: 10.17746/1563-0110.2018.46.1.034-040

V.A. Deryugin[1], S.V. Sukhoverkhov[2], Yoshihiro Ujiie[3], and A.D. Pavlov[2]

[1]Far Eastern Federal University,
Sukhanova 8, Vladivostok, 690091, Russia
E-mail: tsukuba01@mail.ru
[2]Institute of Chemistry, Far Eastern Branch, Russian Academy of Sciences,
Pr. 100-letiya Vladivostoka 159, Vladivostok, 690022, Russia
E-mail: svs28@ich.dvo.ru; yalyonya@gmail.com
[3]Hirosaki University,
Bunkyo-cho 3, Hirosaki, Aomori, 036-8561, Japan
E-mail: ujiie@hirosaki-u.ac.jp

On the Origin of Natural Bitumen at Yasnoye-8 (Sakhalin Island)

In this study, we analyze samples of a black substance that was used for restoring a Tym-type vessel at Yasnoye-8, Central Sakhalin. On the basis of similar finds from the Japanese archipelago, this was initially assumed to be natural bitumen. However, scientific methods have not previously been used to test this assumption. In addition to identifying natural bitumen, we sought to identify its source. The studies were carried out independently at two laboratories, using geochemical and petrographic methods, so the results may be considered reliable. For the first time in Russia, the method of pyrolysis gas chromatography-mass spectrometry was used, along with elemental and petrographic analysis, to identify hydrocarbon from an archaeological site. The results confirm the use of natural bitumen during the Early Iron Age. This can be procured in sufficient amounts on Sakhalin Island. Identification of specific sources is complicated by the virtually complete lack of geological data (bitumen is not mined for industrial purposes). Available materials suggest that the bitumen found at Yasnoye-8 originates from the northern Sakhalin petroleum zone, or from adjacent areas. No relationship to bitumen deposits in northeastern Honshu was found. Nor is it likely that the sample is related to surface hydrocarbons of Hokkaido.

Keywords: *Sakhalin, natural bitumen, Early Iron Age, Tym-type ceramics, pyrolysis gas chromatography-mass spectrometry, elemental analysis, petrography.*

Introduction

Natural bitumen represents a type of fossil hydrocarbon that humans began to use along with the development of technologies, primarily for the manufacture of hunting and fishing tools. These were employed to fasten stone tools to wooden bases as early as the Paleolithic and Neolithic Ages. The adhesive and water-proof properties of natural bitumen were highly appreciated in the various areas of human activities, from waterproofing containers to building complex engineering structures. Owing to the availability of oil deposits and active tectonic processes, Sakhalin Island, along with the Japanese archipelago, is one of the peculiar places in Northern Eurasia where humans could have been using crude hydrocarbons in their subsistence activities since extreme antiquity (Deryugin, 2014).

Object of the study

Our study is concerned with natural bitumen on a fragmented vessel from the Yasnoye-8 site, located approximately 5 km northwest of its eponym, the village of Yasnoye on the upper Tym River, Central Sakhalin (Deryugin, 2007a, b, 2010, 2015). The fragmented vessel was discovered in 2006 during excavation of a single rectangular-plan ditch with rounded corners, 22 × 19 m in size and 20–50 cm deep below the ancient surface. The structure without any distinct pillar-type constructions had a hearth at its center, near the eastern wall. The intended use of this object is unclear. However, the arrangement of goods argues for the economic use of the unearthed structure. The number of lithic artifacts (heavy-duty tools, end-scrapers, arrowheads, a borer, etc.) is negligible, and no typological variability is observed among these items. A large proportion of the flakes have been found in accumulations in the production zones along the southeastern wall of the ditch. The vast majority of ceramics have been discovered along the southwestern and northeastern walls of the ditch.

The site is single-layered, and the ceramic assemblage is morphologically consistent, which has made it possible to distinguish a separate Tym type of ceramics on Sakhalin Island. On the basis of 11 radiocarbon dates, the date of the ancient structure was determined to be within the 7th to 4th centuries BC (Deryugin, 2007b, 2015).

Test samples were taken from the vessel found as crushed vessel No. 9 in compact accumulations No. 29 and 32. The first accumulation was in pit No. 5, the second approximately 2 m from it, in a corner of the ditch. Among the 22 fragmented vessels that it was possible to reconstruct, either fully or partially, only one vessel showed traces of a restoration in ancient times that used coils of natural bitumen (Fig. 1). This is an unornamented flat-bottomed neckless vessel of open type, with a straight rim, which is not delimited from the body. The outer edge of the mouth is slightly folded outward, owing to thickening of the upper coil. There is a flange along the bottom edge. The vessel's height is 30.8 cm; its diameter is 30.5 cm at the upper edge of the rim, and 12.2 cm at the bottom. The vessel was manufactured using the coil-ring technique, and the coils were fastened together butt-to-butt. The paste contains a considerable proportion of temper in the form of rather well-graded fine sand. The vessel was exposed to bonfire baking at a rather low temperature.

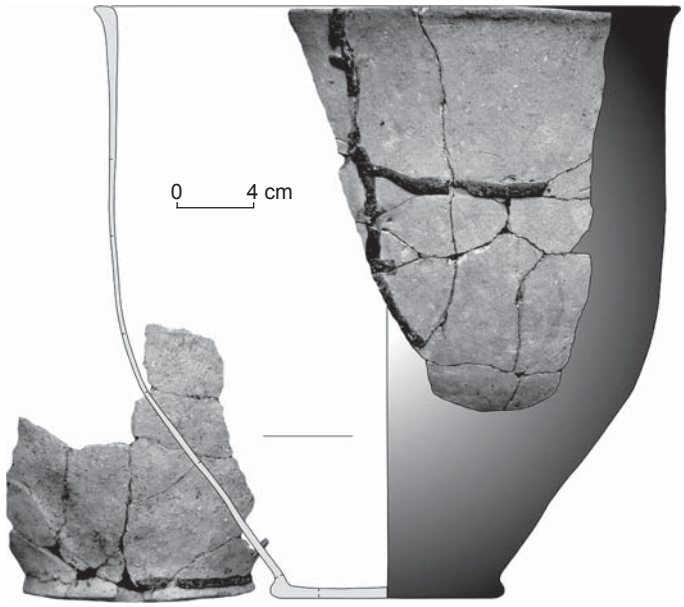


Fig. 1. The fragmented Tym-type ceramic vessel, with the remains of gluing coils of natural bitumen. Yasnoye-8.

Bands of a black substance are observed mainly on the outer side of the vessel, on the vertical crack formed as a result of the vessel's baking, and on the inner side near the mouth portion. Horizontal bands were located at the joints of clay coils, which were deformed to a near breakout condition during baking, probably because of the thinness of the vessel's walls. The majority of found coils were scaled off from the vessel's walls, and exactly these fragments were subjected to geochemical and petrological analyses.

Problem statement

In this study, we planned to address two tasks. The first was to confirm the assumption about the bitumen-component of the substance that was used for the restoration of cracked vessels in ancient times. The second, stemming from a positive result to the first, was to identify a specific source of natural bitumen from the Yasnoye-8 site. No scientific research on the ancient use of natural bitumen on Sakhalin Island has so far been conducted. More than 20 years ago, the use of coils exactly of "asphalt-bitumen paste of natural origin" for restoration of vessels in ancient times was mentioned visually (Shubina, 1992: 126). However, it has also been suggested that the black adhesive substance from Sakhalin sites had an artificial origin (Vasilevsky, Grishchenko, 2012: 37).

The second task is no less essential. While the majority of archaeological sites where natural bitumen

was found on Sakhalin Island are localized within the established oil- and gas-accumulation zone of the Northern Sakhalin oil-and-gas bearing area (Belonin, Margulis, 2006), Yasnoye-8 is situated at a considerable distance from the known deposits or manifestations of this mineral product (Fig. 2).

There are various examples of the distance of natural bitumen sources from the places of use of this raw material at various epochs in other regions. At the Middle Paleolithic site of Umm el Tlel in Syria, where stone tools were found showing traces of fastening with bitumen and dating back to ca 70 ka BP, the used fossil adhesive material originated from the source at the Djebel Bichri deposit, located 40 km from the archaeological site (Boëda et al., 2008), i.e. within one day's walk. In Azerbaijan, where various forms of natural hydrocarbons had been used since extreme antiquity, bitumens were delivered to the Menteshtepe settlement dating to ca 3500 BC from the Byandovan bitumen deposit located 460 km away (Abbasova, 2012). The origin of natural bitumen from the Tell el-Oueili site of the Ubaid period (4500–3700 BC), in Southern Mesopotamia, is related to the deposits of Northern Iraq (the area of modern Kirkuk) (Connan, 1999: 40–41), and their distance exceeded 500 km.

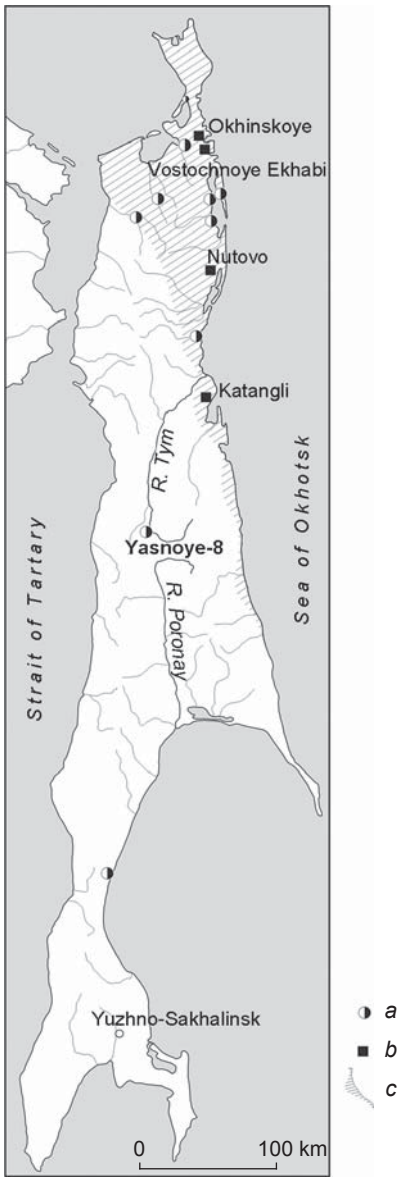


Fig. 2. Distribution of archaeological sites where natural bitumens were found (*a*) and the main manifestations of the latter (*b*) in the established oil and gas accumulation zone of the Northern Sakhalin oil-and-gas bearing area (*c*) (the data were derived from the following papers: (Belonin, Margulis, 2006; Vasilevsky, Grishchenko, 2012)).

On the neighboring Japanese archipelago, where the use of bitumens has been observed since the second half of the Initial Jōmon, while its peak is dated to the late and final periods of this epoch, three groups are distinguished according to the remoteness of the sources of raw materials from the places of consumption (Fukui Jun'ichi, 2010: 487). In the first group, the sources of fossil adhesive material were located no more than 50 km from the consumer settlement. In this case, the share of arrowheads with traces of fastening with bitumen could have reached more than 50 % of all those found at the site, such as, for example, in the territory of the Niigata Prefecture, where abundant bitumen manifestations are recorded. The sources of the second group were located at a distance of 50–100 km from the settlements; in the third group, at a distance of 100–150 km. The consumption of this material is inversely related to its remoteness.

The nearest known surface occurrences of natural bitumens south of the Yasnoye-8 site are in northern Hokkaido, in the areas adjacent to the Soya Strait. These are recorded on oil deposits of Wakkanai, Menashi, and Kita Toyotomi (Ibid.: 490). Unfortunately, we are not familiar with their identifying characteristics, owing to insufficient knowledge of both Hokkaido and Sakhalin bitumens. However, the assumption is noteworthy on the basis of the chromatography-mass spectrometry results (Kato et al., 2008: 1027), according to which, natural bitumens at a number of Hokkaido sites originate from the Nutovo deposit in the north of Sakhalin.

Study method

The nature of the organic compounds in a sample of substance from Yasnoye-8 was identified using the pyrolysis gas chromatography-mass spectrometry

method (standard conditions) (F-Search…, 2010; Sukhoverkhov et al., 2014). A Shimadzu GCMS QP-2010 gas chromatograph-mass spectrometer was employed, along with a Double-Shot PY-2020iD pyrolyzer. The temperature of the pyrolyzer furnace was 600 °C, that of the PY/GC interface was 320 °C. Separation of pyrolysis products was performed using the Ultra ALLOY-5 column with helium as carrier gas. The column's temperature was programmed from 40 to 320 °C, with a rate of 20 °C /min. The comparison of pyrograms was carried out using F-Search "All-In-One" software, Ver. 3.10.

In order to correlate the Yasnoye-8 sample with some specific surface manifestation of natural bitumens, additional studies were conducted for identification of the elemental composition of bitumens and the composition and properties (reflective power) of macerals. A Yanagimoto MT-5 gas chromatograph was used for the CHNO analysis. The method was implemented under the standard conditions: helium as carrier gas, and a flow rate of 180 ml/min. During determination of the carbon, hydrogen, and nitrogen contents, the temperature in the combustion chamber was 950 °C, that in the oxidation chamber was 850 °C, in the reduction chamber 550 °C; for the oxygen, 1050, 1000, and 300 °C, respectively. Immediately before the analysis, the sample was dried in a vacuum desiccator for more than 24 hours.

The percentage material composition of macerals (organic microcomponents) of bitumen and the reflectivity coefficient of one of these were used as a supplemental marker for comparison with materials from the Japanese archipelago (Stach et al., 1982; Xiao Xianming et al., 1998). The material's composition was studied using an Axio Imager A2m microscope made by Carl Zeiss MicroImaging, at 500x magnification in reflected light. The quantitative relationship between macerals was determined on the basis of 400 reference points per 100 μm, using IBM SPSS Statistics software, Ver. 21.0. Determination of macerals based on the reflection coefficient and morphological characteristics was performed using the International Classification (The New Vitrinite Classification…, 1998; The New Inertinite Classification…, 2001).

Results

It has been established that the substance used at Yasnoye-8 pertains to natural bitumens that are well represented in northeastern Sakhalin as surface manifestations in the form of asphalt lakes and deposits of bituminous sand (Yaroshevich, Kravchenko, 1984). Analysis of the sample by the pyrolysis gas chromatography-mass spectrometry method showed no more than 30 per cent of coincidences with the majority of known natural and synthetic polymers in the standard library of the F-Search "All-In-One" software, Ver. 3.10. The search for matches in the library of oils and waxes from the Western Siberian and Sakhalin deposits* has established that the substance under study contains oil hydrocarbons, and is most similar to waxes (coincidence 71 %) and oil (coincidence 53 %) from the Sakhalin deposits (Fig. 3). The coincidence of 30 % to 45 % with oil and wax samples from other areas also unambiguously points to the petroleum nature of this substance.

The CHNO-analysis has demonstrated the following elemental composition of bitumen sample from Yasnoye-8 site:

H	6.02
C	66.39
N	1.14
O	19.78
Ashes	2.97
H/C	1.09
O/C	0.22

Most conspicuous is a low carbon-content. Judging by the relationship between the main elements, some similarity of this sample to Nutovo bitumen manifestations can be observed (Osnovniye puti…, 1961: 152–153). However, there is no overall database on small bitumen-manifestations and deposits of bituminous sand, which does not allow an exact determination of the source of bitumen used at Yasnoye-8.

In terms of the composition of macerals, the studied sample differs from natural bitumens found on some sites in northeastern Honshu (see *Table*). Though amorfinit predominates in all cases, its content is considerably higher in the bitumens originating from the deposits on Honshu Island. As for macerals of the vitrinite and inertinite groups, their amount is greater in the studied sample.

The reflection coefficient of amorfinit contained in bitumen from Yasnoye-8 is 5.68 %. This suggests a higher reflective power as compared to samples from the earlier studied deposits and archaeological sites in northeastern Honshu (Ujiie Yoshihiro, 2013). The data on reflective power of amorfinit of natural bitumens from Sakhalin and Hokkaido deposits are currently absent or understudied.

*The library was created by the authors on the basis of all available samples, and does not cover all deposits.

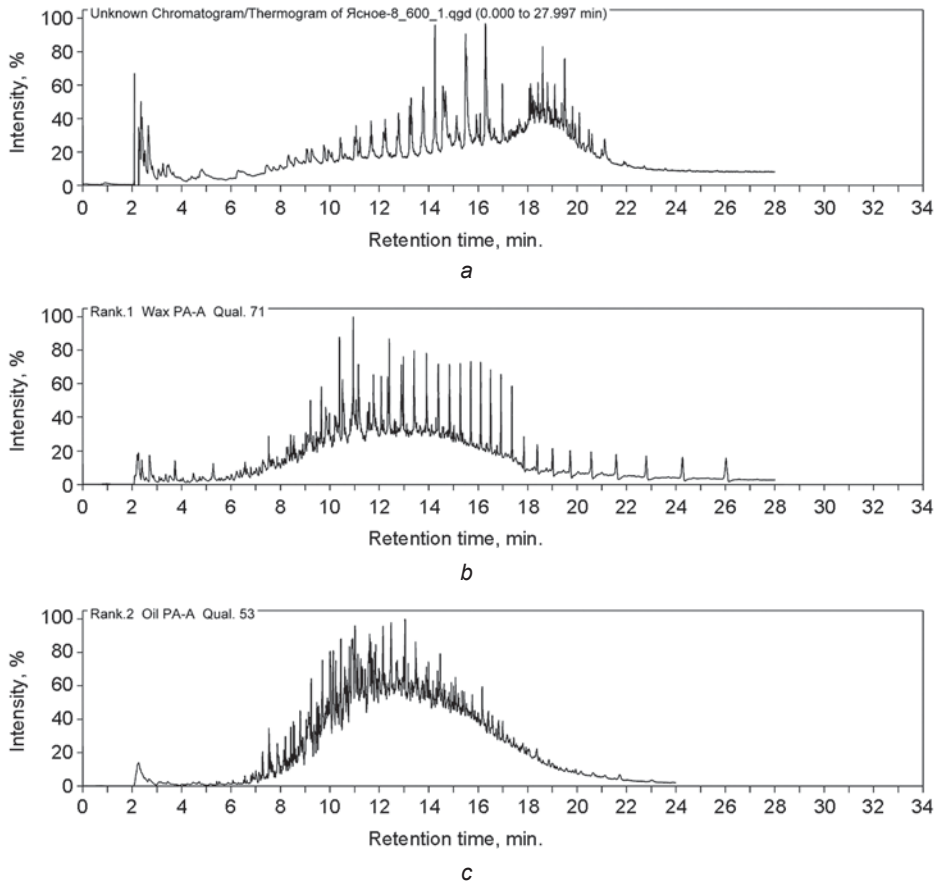


Fig. 3. Pyrograms of natural bitumen samples from Yasnoye-8 site (*a*), wax (*b*), and oil (*c*) from Sakhalin deposits.

Content of macerals in bitumen samples from the Yasnoye-8 site and a group of sites in northeastern Honshu, %

Group of macerals	Maceral	Yasnoye-8, the Yasnoye village	Shinmichi, the Kikonai village	Tangoyachi, the Hachinohe city	Tangoyachi (dump site), the Hachinohe city	Kazahari, the Hachinohe city	Matsugasaki, the Hachinohe city
Liptinites	Amorfinit	87.50	98.00	98.25	98.50	98.75	92.75
	Total	87.50	98.00	98.25	98.50	98.75	92.75
Vitrinites	Telinit	1.50	0.25	0.50	0.25	0.25	1.00
	Vitrodetrinit	4.25	0.75	0.75	0.50	0.50	1.75
	Korpokolinit	0.75	0.00	0.00	0.00	0.00	0.00
	Gelinit	2.50	0.00	0.00	0.00	0.00	0.75
	Total	9.00	1.00	1.25	0.75	0.75	3.50
Inertinites	Fyuzinit	0.25	0.25	0.00	0.00	0.25	0.25
	Semifyuzenit	0.75	0.25	0.25	0.50	0.25	0.50
	Funginit	0.00	0.50	0.00	0.00	0.00	0.75
	Inertodetrinit	2.50	0.00	0.25	0.25	0.00	2.25
	Total	3.50	1.00	0.50	0.75	0.50	3.75

Conclusions

As a result of undertaken geochemical and petrographic studies of adhesive black substance on the vessel from Yasnoye-8 site, it has been fully confirmed that this is a natural bitumen, whose surface manifestations are well represented in northeastern Sakhalin. At present, it is impossible to determine the specific source of the raw materials because of the complete absence of data on the abundant small surface manifestations of hydrocarbons, and the insufficient exploration of the large manifestations that were partly studied for industrial purposes. Judging by the presence of certain mechanical admixtures, it cannot be ruled out that natural bitumen from Yasnoye-8 originates from some unknown small manifestation of bituminous sand in the site's neighborhood. This bitumen is obviously unrelated to the deposits in northeastern Honshu. Any relation to surface manifestations of Hokkaido hydrocarbons remains to be determined; however, it is hardly likely.

Acknowledgements

The authors would like to express their great appreciation for help with this study, and also with the preparation of this publication, to S.V. Gorbunov, Kakiuchi Ato, A.S. Kolossovsky, Nakamura Kazuyuki, Sekine Tatsuhito, and O.A. Shubina. This study was performed using the equipment of the Far Eastern Center for Structural Studies of the Institute of Chemistry FEB RAS.

References

Abbasova D.R. 2012

Opredeleniye istochnika proiskhozhdeniya bituma, nanesennogo na keramicheskuyu posudu, naidennuyu v Menteshtepe — drevnem poselenii Azerbaidzhana. *Vestnik Moskovskogo Universiteta*. Ser. 2: Khimiya, vol. 53 (6): 401–404.

Belonin M.D., Margulis L.M. 2006

Neftegazoviy potentsial i perspektivy osvoyeniya uglevodorodnykh resursov Vostoka Rossii. *Neftegazovaya geologiya: Teoriya i praktika*, vol. 1: 1–18. URL: http://www.ngtp.ru/rub/6/13.pdf (Accessed January 01, 2016).

Boëda E., Bonilauri S., Connan J., Jarvie D., Mercier N., Tobey M., Valladas H., Al Sakhel H. 2008

New evidence for significant use of bitumen in Middle Palaeolithic technical systems at Umm el Tlel (Syria) around 70,000 BP. *Paleorient*, vol. 34 (2): 67–83.

Connan J. 1999

Use and trade of bitumen in antiquity and prehistory: Molecular archaeology reveals secrets of past civilizations. *Philosophical Transactions of the Royal Society B: Biological Sciences*, vol. 354: 33–50.

Deryugin V.A. 2007a

Predvaritelniye rezultaty issledovaniya na pamyatnike Yasnoye-8 v ramkakh proyekta Sakhalin-2. In *Arkheologicheskiye issledovaniya perekhodnogo perioda ot neolita k zheleznomu veku na Dalnem Vostoke Rossii*, Kumaki Toshiaki, Fukuda Masahiro (eds.). Tokyo: Tokyo Univ., pp. 39–47.

Deryugin V.A. 2007b

Raskopki na pamyatnike Yasnoye-8 v ramkakh proyekta Sakhalin-2 v 2006 godu: Nauchniy otchet. *Arkhiv IA RAN*. R-1, No. 47315, 47316.

Deryugin V.A. 2010

Keramika tymskogo tipa i voprosy klassifikatsii, periodizatsii keramicheskikh kompleksov epokhi paleometalla Sakhalina. In *Priotkryvaya zavesu tysyacheletiy: K 80-letiyu Z.V. Andreevoy*. Vladivostok: Reya, pp. 246–258.

Deryugin V.A. 2014

Prirodniye bitumy na dalnevostochnykh ostrovakh v drevnosti. *Yevraziya v kainozoye: Stratigrafiya, paleoekologiya, kultury*, iss. 3: 56–63.

Deryugin V.A. 2015

Yasnoye-8 — pamyatnik epokhi paleometalla Tsentralnogo Sakhalina. In *Pervobytnaya arkheologiya Dalnego Vostoka Rossii i smezhnykh territoriy Vostochnoy Azii: Sovremennoye sostoyaniye i perspektivy razvitiya: Materialy region. nauch. konf*. Vladivostok: Dalnauka, pp. 149–157.

F-Search "All-In-One". Ver. 3.10. Mass Spectral Libraries for Polymers and Additives, and Search Software. 2010

Koriyama: Frontier Laboratories Ltd.

Fukui Jun'ichi. 2010

Hokkaido: ni okeru jo:mon bunka kara zokujo:mon bunka no asufaruto riyo:. In *Fu:yo:ho no ko:kogaku. Ikegami Satoru sensei kanreki kinnen ronbunshu:*. To:kyo: Rokuichi shobo, pp. 485–494. (In Japanese).

Kato K., Miyao A., Ito J., Soga N., Ogasawara M. 2008

The search for the origin of bitumen excavated from archaeological sites in the northernmost island in Japan by means of statistical analysis of FI-MS Date. *Archaeometry*, vol. 50 (6): 1018–1033.

Osnovniye puti preobrazovaniya bitumov v prirode i voprosy ikh klassifikatsii. 1961

V.A. Uspensky, O.A. Radchenko, E.A. Glebovskaya, A.P. Shishkova, T.N. Meltsanskaya, F.B. Indenbom. Leningrad: Gostoptekhizdat.

Shubina O.A. 1992

Arkheologicheskiye raskopki poseleniya Severo-Sakhalinsk I v Okhinskom rayone v 1989 godu. In *Krayevedcheskiy byulleten*, No. 2. Yuzhno-Sakhalinsk: pp. 125–126.

Stach E., Mackowsky M.-Th., Teichmüller M., Taylor G.H., Chandra D., Teichmüller R. 1982

Stach's Textbook of Coal Petrology. Third Revised and Enlarged Ed. Berlin: Gebrüder Borntraeger.

Sukhoverkhov S.V., Prokuda N.A., Pavlov A.D., Sergienko V.I. 2014

Ispolzovaniye piroliticheskoy gazovoy khromatomass-spektrometrii i gazovoy khromatomass-spektrometrii dlya analiza organicheskikh soyedineniy v donnykh osadkakh. *Vestnik DVO RAN*, No. 6: 151–159.

The New Inertinite Classification (ICCP System 1994). 2001

International Committee for Coal and Organic Petrology. *Fuel*, vol. 80 (4): pp. 459–471.

The New Vitrinite Classification (ICCP System 1994). 1998

International Committee for Coal and Organic Petrology. *Fuel*, vol. 77 (5): pp. 349–358.

Ujiie Yoshihiro. 2013

Hakodate shinai no jo:mon iseki kara shutsudo suru asufaruto no gensanchi suitei. In *Hakodateshi itaku kenkyu: "Hakodateshi jo:mon bunka tokubetsu kenkyu:" ho:kokusho*. Hirosaki: Hirosaki daigaku, pp. 6–17. URL: http://www.hjcc.jp/files/H24hjcc_report.pdf (Accessed January 1, 2016). (In Japanese).

Vasilevsky A.A., Grishchenko V.A. 2012

Sakhalin i Kurilskiye ostrova v epokhu paleometalla (I tys. do n.e.–pervaya polovina I tys. n.e.). *Ucheniye zapiski Sakhalinskogo Gosudarstvennogo Universiteta*, iss. IX: 29–41.

Xiao Xianming, Wilkins R.W.T., Liu Zufa, Fu Jiamo. 1998

A preliminary investigation of the optical properties of asphaltene and their application to source rock evaluation. *Organic Geochemistry*, vol. 28 (11): 669–676.

Yaroshevich M.S., Kravchenko T.N. 1984

Prirodniye bitumproyavleniya na Severnom Sakhaline. In *Prirodniye bitumy — dopolnitelniy istochnik uglevodorodnogo syrya*. Moscow: Inst. geologii i razrabotki goryuchikh iskopayemykh, pp. 52–54.

Received February 19, 2016.
Received in revised form February 19, 2017.

DOI: 10.17746/1563-0110.2018.46.1.041-050

P.K. Dashkovsky[1] and N.F. Stepanova[2]
[1]Altai State University,
Pr. Lenina 61, Barnaul, 656049, Russia
E-mail: dashkovskiy@fpn.asu.ru
[2]Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: nstepanova10@mail.ru

Inskoy Dol: A New Early Bronze Age Site in Western Altai

This article describes Early Bronze Age burial mounds at Inskoy Dol, in the lowland zone of the western Altai. The cemetery includes two groups of mounds differing in funerary rite and burial goods. One of them reveals features typical of the Afanasievo culture (rounded cairns made of 2–3 layers of small and medium-sized stones, a stone enclosure, supine flexed position of the buried, heads directed toward the west, ocher coloring, and egg-shaped vessels with pointed bottoms). The other group corresponds to the Kurota type (rounded cairns made of stones placed flat in a single layer, supine flexed position of the bodies, eastern orientation, ocher coloring, jar-shaped vessels). The Afanasievo and Kurota cemeteries, then, are separate but close to one another. The radiocarbon date of the Afanasievo mounds is the 29th to 27th centuries BC. Excavations at Inskoy Dol make it possible to specify the boundaries of the Afanasievo culture, suggesting that it was distributed not only over the highland, central Altai but over more westerly, lowland areas as well.

Keywords: *Early Bronze Age, Afanasievo culture, Altai, funerary rite, ceramics.*

Introduction

The Early Bronze Age in the Altai Mountains and the Altai foothills still remains understudied. No sites have been identified and no excavations have been carried out in many areas of the foothill zone. Each discovery of a new site is very important for studying the ancient history of the region, which is located on the border of the mountainous and lowland zones. The burial ground of Inskoy Dol is interesting in that it includes the burials of the Afanasievo culture along with burials that currently cannot be correlated with any of the known archaeological cultures. Similar objects were investigated in the 1970s–1980s and were regarded as belonging to the Afanasievo culture, since excavations were carried out over small areas, which did not make it possible to correlate the objects with each other (Khlobystina, 1975; Tsyb, 1984). Later, these burials were identified as the Kurota type of sites (Stepanova, 2012a). On the basis of planigraphic data, the studies at Inskoy Dol have confirmed the validity of identifying the Kurota type of burials: the group of people who left them had their own separate cemeteries. The presence of burials left by the Afanasievo population at this site in the lowland zone of the Altai makes it possible to expand the boundaries of the region where the Afanasievo culture was spread, since until recently most of the Afanasievo burials were found in the Central Altai and in the valley of the Katun River.

The Inskoy Dol cemetery is located in the Chineta archaeological microregion, in Krasnoshchekovsky

Archaeology, Ethnology & Anthropology of Eurasia 46/1 (2018) 41–50 E-mail: Eurasia@archaeology.nsc.ru

District of the Altai Territory (Fig. 1). It was discovered by P.K. Dashkovsky in 2010 during a survey in the southern part of the Inya River Valley. The necropolises of Chineta II and Khankarinsky Dol were discovered earlier and partially excavated in the northern and central parts of the valley (Dashkovsky, Usova, 2011; Dashkovsky, 2014). The cemetery of Inskoy Dol is located on the second terrace above the floodplain, 2 km to the east-southeast of Chineta village, on the left bank of the Inya River in the southern part of the valley. A study of the topography, planigraphy, and specific features of the mounds has made it possible to establish that the site belongs to different periods and includes objects of the Scytho-Saka period and the Early Bronze Age (Dashkovsky, Meikshan, 2014; Dashkovsky, Goncharova, Meikshan, 2015; and others). Burial mounds of the Early Bronze Age are located in the northern and southern parts of Inskoy Dol, in a group of structures near the ravine and on a small promontory. The investigated mounds of the cemetery can be divided into two groups both on planigraphic grounds (the distance between them is 200 m) and according to the differences in the funerary rite. The southern group includes mounds No. 4, 5, and 9, and the northern group includes mounds No. 6–8 (Fig. 2).

Fig. 1. Location of the Inskoy Dol cemetery.

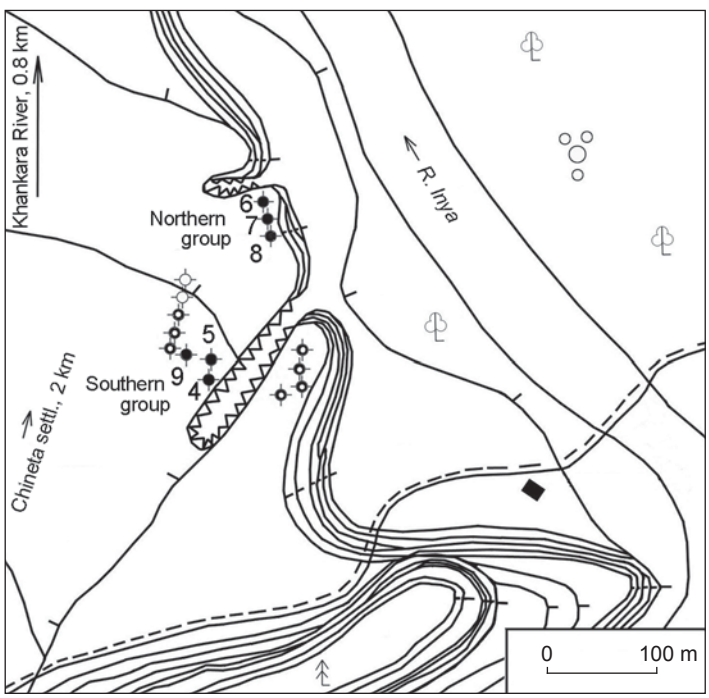


Fig. 2. Map of the Inskoy Dol cemetery.

Description of the funerary rite and pottery

Southern group

Mound No. 4. The width of the mound was 9.75 m along the N–S line, and 9.5 m along the W–E line. The mound of stones laid in one to four layers reached a height of 0.6 m. The stonework was very dense (Fig. 3). Larger stones arranged in a ring and forming a crepidoma were found under the mound. The outer diameter of the ring was 9.6 m; the width was 0.75–1.0 m. A fragment of pottery was found in the lower part of the baulk (Fig. 4). A grave measuring 1.8 × 1.23 × 0.91 m was located in the central part of the structure; the burial was destroyed. Most of the bones, including fragments of a skull, were found at the western wall of the grave; a smaller amount of bones was discovered in the central and northeastern parts of the grave. The deceased was possibly oriented with his head towards the west. Fragments of an egg-shaped vessel were scattered throughout the grave (Fig. 5).

Mound No. 5 was located 5 m to the north of mound No. 4, and constituted a single microgroup with that mound. Despite the high degree of turf formation, the mound and especially the stone enclosure around the perimeter were clearly visible at the level of the present-day surface. The mound had a stone ring

Fig. 3. Mound No. 4.

Fig. 4. Fragment of a vessel from mound No. 4.

Fig. 5. Pottery from mound No. 4.

Fig. 6. Mound No. 5.

enclosure 2.25–3.5 m wide, composed of medium-sized and large stones and slabs. The largest slabs were found in the northeastern sector of the structure. The diameter of the enclosure, which was made of two or three layers of stone, reached 15.25 m along the N–S line, and 15 m along the W–E line; its height was 0.9 m. A passage up to 2 m wide was found in the western part of the structure (Fig. 6). A sub-rectangular structure of stones laid in one layer was inside the enclosure; it was oriented according to the cardinal directions and measured 5.5 × 5.0 m. A burial pit measuring 2.3 × 1.67 × 0.72 m and oriented almost strictly according to the cardinal directions was under that structure. A skeleton of a man who was buried in the supine flexed position, with his head directed toward the west, was discovered inside the grave. A pointed bottom vessel was found 0.15 m to the north of the skull (Fig. 7).

Mound No. 9 was located 10 m to the northwest of mound No. 5. The width of the mound of stones laid in two or three layers was 7 m along the N–S line, and 8 m along the W–E line. The height of the mound was 0.4 m. A ring-shaped crepidoma 0.5–1.0 m wide was under the mound along its perimeter (Fig. 8, 9). A grave of suboval shape measuring 1.95 × 1.44 × 0.49 m oriented with its longer axis along the N–S line was found in the central part of the mound. The burial was looted. Displaced human bones with traces of red ocher were discovered in the center of the grave. Grave goods were not found.

Fig. 7. Pottery from mound No. 5.

Fig. 8. Mound No. 9.

Fig. 9. Crepidoma along the perimeter of mound No. 9.

Two vessels were found in the burials, and a large fragment of the body of a third vessel was discovered in the cairn. The egg-shaped vessel with pointed bottom from mound No. 5 was almost intact. Its total height was 19.5 cm; the height of the rim reached 2.6 cm; the diameter of the rim and the body was 12 and 15 cm, respectively. The vessel was smoothened on the inside and outside with a hard object (on the inside, possibly, with a stamp). The rim was decorated with impressions made with a denticulate tool. Horizontal rows of impressions at the top of the object were made by two tools or an object with two working edges; below, diagonal and vertical rows can be seen (see Fig. 7, 10).

The vessel from mound No. 4 was partially preserved (Fig. 5). The diameter and height of its rim were 11 and 1.8 cm, respectively; the diameter of the body reached 14 cm. It was undecorated but smoothened with a hard tool. The wall of the vessel from this mound was decorated with impressions similar to rope imprints (Fig. 4).

Technical and technological analysis of the pottery was carried out using the methodology of A.A. Bobrinsky. The analysis has shown that the vessels were made of ferruginous claylike raw material of medium plasticity

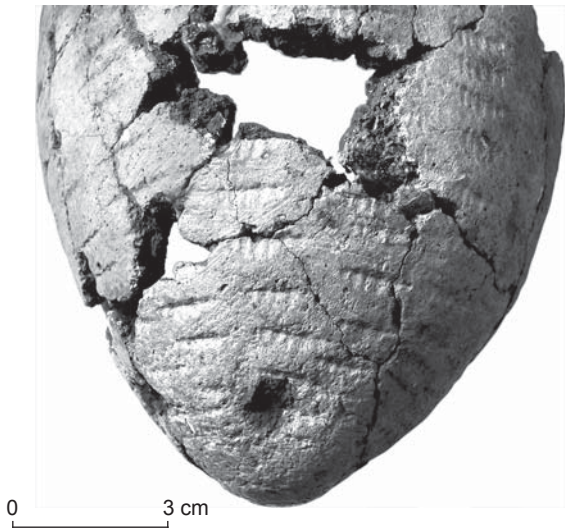


Fig. 10. Fragment of a vessel from mound No. 5.

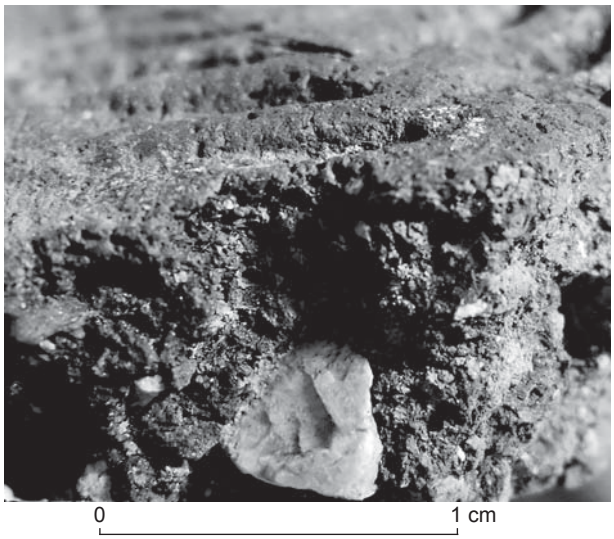


Fig. 11. Additions to the paste of a vessel from mound No. 5.

from various sources typical of mountainous areas. Grog and organic additives were added to the paste. The vessel from mound No. 5 was unusual in its composition of natural impurities (Fig. 11): its paste contained a significant amount of small limestone fragments, which is not typical for the pottery from the mountainous and lowland Altai (Stepanova, 2015a). Since limestone outcrops are present on the territory of Krasnoshchekovsky District, the use of local raw materials was quite possible. Grog was sometimes added during manufacture of the Afanasievo pottery, but this was a declining tradition (Stepanova, 2015b).

Northern group

Mounds No. 6 and 7 were located on a small hill, 200 m to the northeast of the above group of mounds, in the northeastern part of the cemetery. Prior to the excavation, these mounds were practically indistinguishable at the level of the present-day surface. For studying these objects, an excavation pit measuring 19.5 × 11.25 m was made, encompassing objects No. 6–8. The southern rim of mound No. 6 and the northern rim of mound No. 7 overlapped each other, forming virtually a single structure (Fig. 12, 13).

Mound No. 6. Its diameter reached 9 m, and its height reached 0.35 m. The object represented a ring 1.5–2.0 m wide, laid mostly in one layer of small and medium-sized stones. In the central part of the mound, there were very few stones. A grave pit measuring 2.0 × 1.2 × 0.94 m from the daytime surface was in the central part of the object; the longer axis of the grave was oriented along the NE–SW line with slight deviations. The grave contained the skeleton of a man who was placed in a supine flexed position, with knees to the left, and his head towards the east (Fig. 14), and was abundantly sprinkled with red ocher. Grave goods were not found.

Mound No. 7. The diameter of this mound, which was mostly made of one layer of small and medium-sized stones, was 7.5 m; the height was 0.35 m. As with the previous mound, this object had a ring 1.5–2.0 m wide, made of small stones along the perimeter of the structure (Fig. 12, 13). There were almost no stones in the center of the mound. The grave pit was shifted from the center of the object to the south, and was oriented with its longer axis along the NE–SW line. Its size from the level of the ancient surface was 1.54 × 0.9 × 0.79 m. A double burial with poorly preserved bones was discovered in the grave (Fig. 15). The deceased were probably buried in a supine flexed position, with their heads directed toward the east, and were sprinkled with red ocher. A jar-shaped vessel was found in the northwestern corner of the grave, at the feet of the first skeleton. The diameter of its rim was 19.2–19.6 cm; the diameter of the body was 24 cm; the diameter of the bottom was 19.7–20.5, and its height was 17.9–18.1 cm (Fig. 16). The vessel was made of ferruginous low-plasticity raw material, which included large fractions of natural impurities. Artificial additives have not been found in the paste. The surface of the item was smoothened with a denticulate tool on the inside and outside.

Mound No. 8 adjoined mound No. 7 to the south, but did not cover its rim (Fig. 12, 13). The diameter of the mound laid in one to three layers of medium-sized stones was 7.25 m along the N–S line, and 6.75 m along the W–E line. The height of the burial mound was 0.5 m. Because this object was located at the very edge of the promontory, the southern rim of its mound partially slid down. This mound differed from two previous ones. River boulders and pebbles were used for its construction, whereas

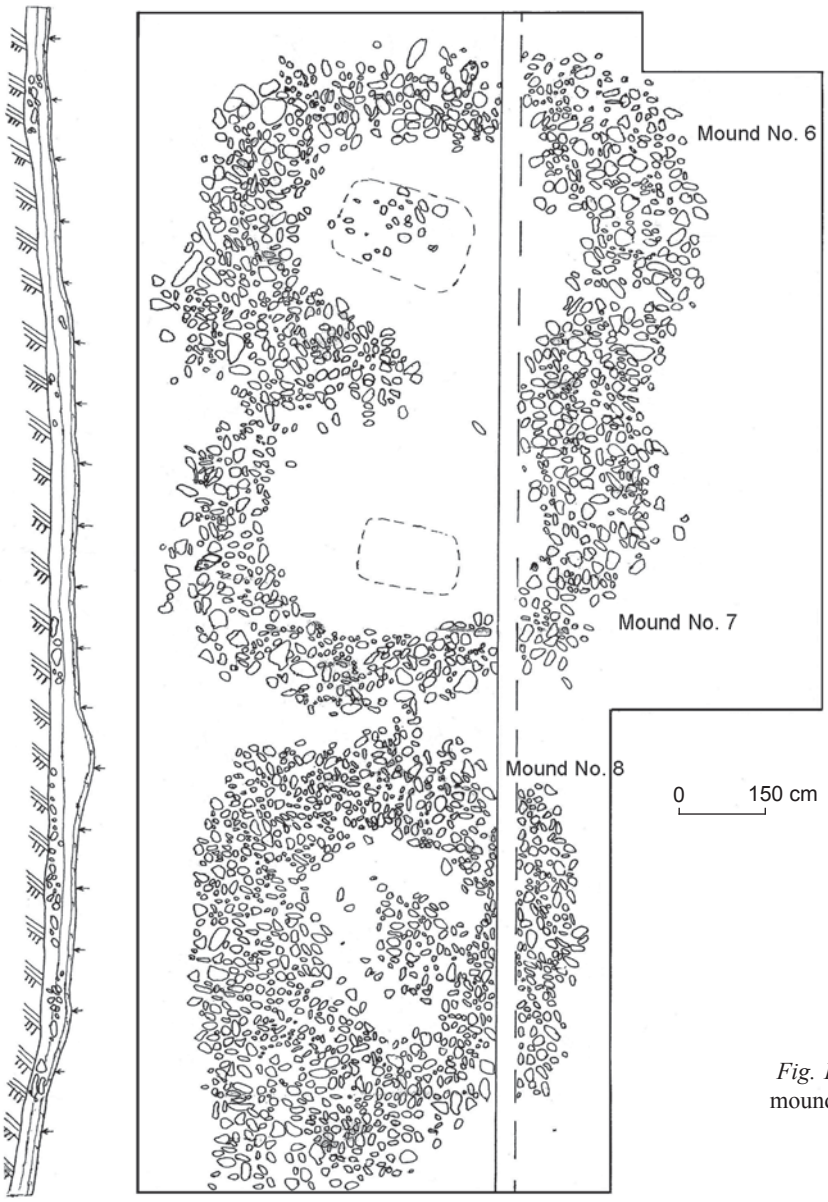


Fig. 12. Map of mounds No. 6–8.

Fig. 13. Mounds No. 7 and 8.

Fig. 14. Burial in mound No. 6.

Fig. 15. Burial in mound No. 7.

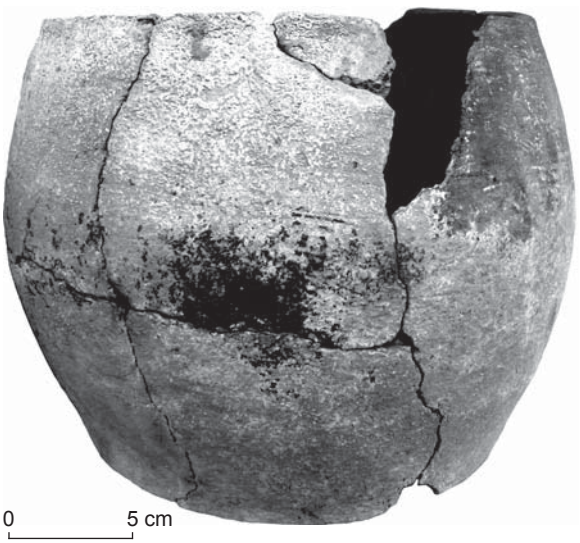


Fig. 16. Pottery from mound No. 7.

mounds No. 6 and 7 were built using crushed stone. The stones in the mound were laid evenly over the entire area of mound No. 8, which is another difference from mounds No. 6 and 7. A grave spot was not found under the mound. Mound No. 8, apparently, was made for ritual purposes.

Findings and discussion

The objects from the southern group typically have cairns of rounded shape, made of small and medium-sized stones laid in two or three layers. Ring-crepidoma, made of vertically placed slabs and large stones which were laid flat, is along the perimeter of the structure. The graves were flat. The deceased were buried in a supine flexed position (mound No. 5), with their heads to the west (mounds No. 4 and 5), and were sprinkled with red ocher. Egg-shaped vessels with pointed bottoms were found in the burials.

Two mounds (No. 6 and 7) from the northern group were made of stones placed in one layer. Large stones, which did not form a closed structure, were laid on the periphery of the objects. The deceased were placed in flat graves in a supine flexed position, with their heads to the east, and were sprinkled with red ocher. A jar-shaped vessel was found in one burial. As opposed to these two mounds, a third mound (No. 8) was built of river boulders and pebbles, which were laid in two or three layers, and did not contain a grave.

Common features of the mounds of both groups include the rounded shape of the cairn, use of stone for the construction, supine flexed position of the bodies, and the use of ocher. However, there are many more differences between the objects of both groups: the cairns in the objects from the southern group were composed of crushed stones laid in several layers; there were crepidomas made of large stones along the perimeter. The objects from the northern group were made of mostly rounded stones in one layer;

crepidomas were not found; the buried persons in the graves of the southern group were oriented to the west, while in the northern group to the east; egg-shaped vessels with pointed bottoms appear in the objects of the southern group, while a flat-bottomed jar has been found in the mounds of the northern group; in the southern group, the paste of the vessels included grog and organic materials, while in the northern group, artificial additives were not found, and the pottery was made of low-plasticity clay.

The posture, orientation, and coloring of the buried with ocher, as well as egg-shaped vessels with pointed bottoms, as is the case with mounds No. 4, 5, and 9 of the southern group, are typical for the sites of the Afanasievo culture (Vadetskaya, Polyakov, Stepanova, 2014). The cairns seem to belong to the group of enclosures made of several flat layers of small and medium-sized stones (wall-enclosures or rings), which occupy the second largest place among the Afanasievo structures in the Altai Mountains (Ibid.: 315). Crepidomas in the mounds of the southern group also have some parallels (Abdulganeev, Larin, 1994; Larin, 2005). However, the presence of an opening in the western part of the crepidoma in mound No. 5 is not typical of the Afanasievo culture. Perhaps it was made purposefully as the entrance to the sacral space. According to scholars, such a construction of the Afanasievo mound may be correlated with cosmological beliefs (Kuzmin, 1992: 127).

Vessels from mounds No. 4 and 5 also belong to the Afanasievo culture. The peculiarity of the object from mound No. 5 is that it was decorated with a tool with unusually long teeth, the imprints of which left vertical rows. For the Afanasievo culture, ornamenting tools with small teeth are typical, whose imprints form horizontal rows, while vertical and diagonal rows are very rare (Stepanova, 2010a, b, 2012b). Undecorated vessels with traces of smoothening, as the vessel from mound No. 4, are known from the funerary and settlement Afanasievo complexes (Vadetskaya, Polyakov, Stepanova, 2014, Fig. 4, *4*; 37, *1*; 52, *11*; 53, *14*; and others).

Notably, the features which were observed in the mounds (No. 6–8) of the northern group (rounded cairns in the form of rings of stones placed flat, supine flexed position of the bodies, heads directed toward the east, coloring of the deceased with ocher, burial of two persons in a single grave, and the absence of grave goods or the presence of jar-shaped vessels) are typical of the Kurota type burials (Kurota-2, Boitygem-1, Bersyukta-1, Bike-1, Elekmanar cemeteries) (Kubarev, Cheremisin, Slyusarenko, 2001; Stepanova, 2012a; Vadetskaya, Polyakov, Stepanova, 2014: 325–327, fig. 59–69, 198). It is noteworthy that vessels of jar-like form in the Altai Mountains are known from the burials of the Ulita type; in the forest-steppe Altai, from the sites of the Elunino culture; and on the territories adjacent to the Altai Mountains, from the Bronze Age burials (Kiryushin, 2002; and others). However, there is not a single burial of the Afanasievo culture containing such vessels. Mounds with cairns without burials, as burial mound No. 8, are known from the sites of the Kurota and Pokrovka types, for example, at the burial grounds of Elekmanar, Pokrovka-4, and Shchuchiy Log-1 (Vadetskaya, Polyakov, Stepanova, 2014: Fig. 69, *5*, *6*; Shulga, 2006; 2010). However, it should be noted that the Pokrovka objects contain vessels of other types, such as flat-bottomed pots and censers, but no jars.

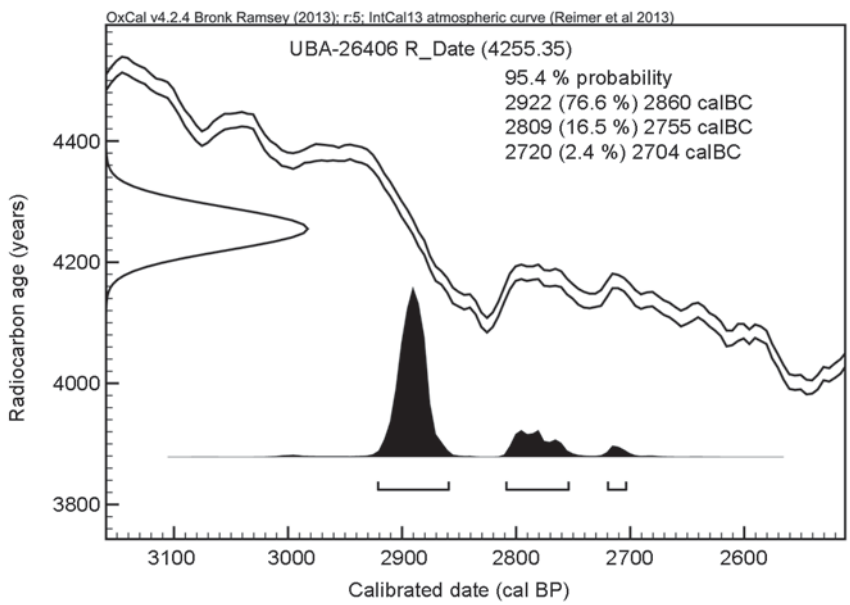


Fig. 17. Calibrated date and radiocarbon age of mound No. 9.

The time when the burials of the Kurota type appeared was determined using the relative analogies and the radiocarbon date of 4275 ± 85 BP (SOAN-7862) (Soenov, Trifanova, 2010: 176). Date calibration performed with the OxCal 4.3 software, using the Int Cal13 calibration curve, established the time of death of the person with a probability of 95.4 % as being during the period of 3265–2581 BC. Such finds as a knife from Elekmanar, vessels of a specific form with pointed bottoms from several Kurota burials, and flat-bottomed vessels with obvious signs of borrowing from the traditions of flat-bottomed Afanasievo pottery (Nizhny Tyumechin-1, Kara-Koba-1) (Vadetskaya, Polyakov, Stepanova, 2014, Fig. 69, *6*; Stepanova, 2012a: Fig. 3) make it possible to date the sites of the Kurota type to the mid 3rd millennium BC and to consider them synchronous to some sites of the Afanasievo culture. The influence of the population with other traditions on the Afanasievo culture is reflected in the funerary rite, for example, in the orientation of the deceased to the northeast and east-northeast (Kara-Koba-1, enclosure 8, Pervyi Mezhelik-1, enclosure 4, etc.) (Vadetskaya, Polyakov, Stepanova, 2014: 10–12, 17, 53, 328, fig. 19, *5*).

The time when the Afanasievo objects were created at the Inskoy Dol burial ground was established using the date that was obtained from the human bones from the burial in mound No. 9: 4255 ± 35 BP (UBA-26406)* (Fig. 17). The date was calibrated by A.V. Polyakov with the OxCal 4.2.4 software, using the Int Cal13 calibration curve. It has been found with a probability of 95.4 % that the person died within the period from 2922 to 2704 BC, which corresponds to the chronological framework of the Afanasievo culture, based on ^{14}C-dates, most of which correspond to the above interval (Polyakov, 2010).

Conclusions

Original materials of the Afanasievo and Kurota type have been obtained for the Altai foothills. The observations at the cemetery of Inskoy Dol enabled identification of the differences between the burials of the Kurota type and the burials of the Afanasievo culture. It has been proven that the group of population that left the burials of the Kurota type had separate cemeteries. Studies at Inskoy Dol have shown that differences in funerary rite and material culture of both groups of population were not accidental, but were caused by the fact that two groups of people with different cultural traditions lived there in the Early Bronze Age.

On the basis of studies of the Afanasievo burial mounds in the Altai foothills, the area where the sites of this culture occur was expanded. It was concluded that the low mountains of the Western Altai were inhabited by the Afanasievo tribes. According to the radiocarbon date, the group of the Afanasievo burials in Inskoy Dol emerged in the 29th to 27th centuries BC, which corresponds to the main series of dates of the Afanasievo culture (Polyakov, 2010). Thus, the chronological framework of this culture has been clarified, and the base of the radiocarbon dates for the Afanasievo culture in the Altai has been expanded. Further research at the Inskoy Dol cemetery is promising for studying the Early Bronze Age of the Altai.

*The authors are grateful to S. Svyatko for the assistance in obtaining the date for the samples from mound No. 9 of the Inskoy Dol burial ground in the laboratory of the Center for Climate, the Environment and Chronology (^{14}CHRONO), Queen's University Belfast.

References

Abdulganeev M.T., Larin O.V. 1994
Afanasievskiye pamyatniki Boitygema. In *Arkheologiya Gornogo Altaya*. Barnaul: Izd. Alt. Gos. Univ., pp. 24–36.

Dashkovsky P.K. 2014
Kurgans of the Yenisei Kyrgyz at the Chineta II Burial Ground in the Altai. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 42 (2): 82–89.

Dashkovsky P.K., Goncharova N.S., Meikshan I.A. 2015
Prodolzheniye issledovaniya kurganov na mogilnike Inskoy Dol. In *Poleviye issledovaniya v Priirtyshye, Verkhnem Priobye i na Altaye 2014 g.: Arkheologiya, etnografiya, ustnaya istoriya*, iss. 10. Barnaul: Alt. Gos. Ped. Univ., pp. 40–44.

Dashkovsky P.K., Meikshan I.A. 2014
Issledovaniye kurganov skifskogo vremeni na mogilnike Chineta-II i Inskoy dol. In *Sokhraneniye i izucheniye kulturnogo naslediya Altaiskogo kraya*, iss. XX. Barnaul: Izd. Alt. Gos. Univ., pp. 94–100.

Dashkovsky P.K., Usova I.A. 2011
Pazyryk Burial at Khankarinsky Dol in the Northwestern Altai. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 39 (3): 78–84.

Khlobystina M.D. 1975
Drevneishiye mogilniki Gornogo Altaya. *Sovetskaya arkheologiya*, No. 1: 17–34.

Kiryushin Y.F. 2002
Eneolit i rannyaya bronza yuga Zapadnoy Sibiri. Barnaul: Izd. Alt. Gos. Univ.

Kubarev V.D., Cheremisin D.V., Slyusarenko I.Y. 2001
Bike I, II: Pogrebalniye pamyatniki afanasievskoy kultury na Sredney Katuni. In *Drevnosti Altaya*. Gorno-Altaysk: Gorno-Alt. Gos. Univ., pp. 32–54. (Izvestiya laboratorii arkheologii; No. 6).

Kuzmin N.Y. 1992
Genezis sayano-altaiskogo shamanizma po arkheologicheskim istochnikam. In *Severnaya Yevraziya ot drevnosti do srednevekoviya: Tezisy dokl. konf. k 90-letiyu so dnya rozhdeniya M.P. Gryaznova*. St. Petersburg: IIMK RAN, pp. 125–130.

Larin O.V. 2005
Afanasievskaya kultura Gornogo Altaya: Mogilnik Saldyar-1. Barnaul: Izd. Alt. Gos. Univ.

Polyakov A.V. 2010
Radiouglerodniye daty afanasievskoy kultury. In *Afanasievskiy sbornik*. Barnaul: Azbuka, pp. 158–171.

Shulga P.I. 2006
Pogrebeniya epokhi eneolita–bronzy v doline Senteleka. In *Pogrebalniye i poselencheskiye kompleksy epokhi bronzy Gornogo Altaya*. Barnaul: Izd. Alt. Gos. Univ., pp. 47–72.

Shulga P.I. 2010
Zakhoroneniya epokhi eneolita–bronzy iz mogilnikov Shchuchiy Log-1 i Ust-Teplaya. In *Afanasievskiy sbornik*. Barnaul: Azbuka, pp. 189–194.

Soenov V.I., Trifanova S.V. 2010
Pogrebeniya perioda ranney bronzy na Nizhney Tarkhate. In *Afanasievskiy sbornik*. Barnaul: Azbuka, pp. 172–176.

Stepanova N.F. 2010a
Afanasievskaya kultura Gornogo Altaya i Yeniseya: Pogrebalniy obryad i keramika (skhodstvo i razlichiye). In *Afanasievskiy sbornik 2*. Barnaul: Azbuka, pp. 177–187.

Stepanova N.F. 2010b
Osobennosti ornamentalnykh kompozitsiy afanasievskoy keramiki iz pogrebalnykh kompleksov Gornogo Altaya. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XVI. Novosibirsk: Izd. IAE SO RAN, pp. 307–311.

Stepanova N.F. 2012a
Afanasievskaya kultura Gornogo Altaya i pogrebeniya kurotinskogo tipa. In *Afanasievskiy sbornik 2*. Barnaul: Azbuka, pp. 173–182.

Stepanova N.F. 2012b
Perviye rezultaty izucheniya instrumentov dlya naneseniya ornamenta po ikh otpechatkam na afanasievskoy keramike (po materialam pogrebalnykh kompleksov iz Gornogo Altaya). In *Igor Gennadievich Glushkov: Sbornik nauch. statey*. Khanty-Mansiysk: Pechatniy mir, pp. 43–50.

Stepanova N.F. 2015a
Kulturniye traditsii v vybore iskhodnogo syrya i mineralnykh primesei pri izgotovlenii keramiki po materialam gornykh, predgornykh, stepnykh i lesostepnykh raionov Altaya. *Samarskiy nauchiy vestnik*, No. 4 (13): 90–95.

Stepanova N.F. 2015b
Rol keramiki v izuchenii afanasievskoy kultury. In *Sovremennye podkhody k izucheniyu drevney keramiki v arkheologii*. Moscow: IA RAN, pp. 269–277.

Tsyb S.V. 1984
Afanasievskaya kultura Altaya: Cand. Sc. (History) Dissertation. Kemerovo.

Vadetskaya E.B., Polyakov A.V., Stepanova N.F. 2014
Svod pamyatnikov afanasievskoy kultury. Barnaul: Izd. Alt. Gos. Univ.

Received May 13, 2016.
Received in revised form June 7, 2016.

DOI: 10.17746/1563-0110.2018.46.1.051-058

V.Y. Mogritskaya
I.S. Shemanovsky Yamal-Nenets District Museum and Exhibition Complex,
Chubynina 38, Salekhard, 629008, Russia
E-mail: marginalkadenna@inbox.ru

Decorated Birch-Bark Artifacts from the Ust-Polui Sanctuary (100 BC to 100 AD)

Birch-bark items from the Ust-Polui sanctuary are unusually well preserved, thanks to permafrost, and are richly decorated. We list the archaeological sites with birch-bark artifacts, decorated and otherwise, in the Lower Ob basin, spanning the period from the Chalcolithic to the Late Middle Ages. At Ust-Polui, the vast majority of such artifacts were found during the latest excavations, conducted by A.V. Gusev. Most were found in a ditch dug across the site. Special reference is made to their cut and decoration technique. Some high-quality specimens are intentionally damaged, possibly by way of sacrifice. The evolution of the northwestern Siberian decorative tradition is discussed.

Keywords: *Lower Ob, Yamal, Ust-Polui, birch-bark artifacts, permafrost.*

Introduction

Birch-bark artifacts are among the rarest items in archaeological collections. In the modern Yamal-Nenets Autonomous Okrug (YNAO), they were found at some thoroughly excavated sites of various epochs, where the presence of permafrost allows items made of organic materials to persist for several thousand years. These sites include the Chalcolithic settlement of Gorny Samotnel-1 (Tupakhina, 2013: 107), the Ust-Polui site (ancient sanctuary) belonging to the Early Iron Age (Gusev, Fedorova, 2012: 22), and also the so-called aboriginal forts, such as Voykar (Fedorova, 2006: 16), Polui (Kardash, 2013: 245–253), and Nadym (Kardash, 2009: 241–248). The collections from the Sherkaly-1/2 fortified settlement (Parkhimovich, 1998) and the Saygatinsky III burial ground (Ugorskoye naslediye, 1994: 76) are the most remarkable in the Khanty-Mansi Autonomous Okrug–Yugra. Thus, birch-bark artifacts in archaeological collections can be referred to as a new, understudied phenomenon.

This paper presents the results of studying decorated birch-bark artifacts from the Ust-Polui archaeological site. This article was preceded by a number of preliminary publications regarding various issues involved in studying the decorated birch-bark (Mogritskaya, 2010, 2011, 2014; Mogritskaya, Pitukhin, 2013).

Study materials

The Ust-Polui is situated in the Yamal-Nenets Autonomous Okrug, within the Salekhard city limits, at the latitude of the Arctic Circle. The study involves collections from excavations conducted before 2014. In total, over the years of the study of the site, 15 conventionally intact (reconstructable) decorated birch-bark items in the form of small containers, and more than 50 fragments decorated using various techniques, have been discovered. Photo-recording, restoration, and drawing of the ornamented specimens were conducted during 2010–2013. Data on their attribution and number

Archaeology, Ethnology & Anthropology of Eurasia 46/1 (2018) 51–58 E-mail: Eurasia@archaeology.nsc.ru

were constantly changing, owing to the fact that an artifact could have been wrongly interpreted before restoration. It was not possible to identify the total number of decorated birch-bark artifacts until 2014.

The Ust-Polui sanctuary is dated to the period from 100 BC to 100 AD (Shiyatov et al., 2000: 55). It may be called unique, since no such large-scale ritual places pertaining to the Early Iron Age and also almost completely studied by stationary excavations have been known so far. Over the years of excavation, the cultural layer of this site has demonstrated very high saturation with various artifacts. In 2010, for the first time, finds composed of organic materials, including birch-bark items, became abundant, owing to the discovery of a deep ditch filled with frost-bound organic remains (Gusev, Fedorova, 2012: 24). Since its discovery in 1932, the site has been studied by many researchers, including V.S. Adrianov, A.F. Palashenkov, V.N. Chernetsov, V.I. Moshinskaya, S.G. Parkhimovich, V.M. Morozov, N.V. Fedorova, and A.V. Gusev (Mazurin, 2012: 13). Collections from the excavations by Parkhimovich, Fedorova, and Gusev contained ornamented birch-bark items.

The cultural layer's conditions in the central part of the site area did not contribute to the preservation of birch-bark items; however, despite this fact, remains of birch-bark coatings of timber decks and pit-linings were found here; in 2006, a small square birch-bark undecorated box, containing a bone ball, was added to these finds (Gusev, Fedorova, 2012: 24).

Almost all other artifacts were found in the ditch, a part of which was excavated as early as 1995. At that time, intact birch-bark items and their fragments were discovered. The ditch opened in 2010 had a depth of 2.5 m from the present-day surface, and 1.9 m from the ancient one. The bridge crossing the ditch was uncovered at the same time. It was here, in the immediate vicinity of the bridge, that the bulk of the birch-bark items were found. The 2011–2012 excavation areas were established with due regard to the direction of the ditch; however, the tendency to reduction in the number of objects made of organic materials is obvious (Ibid.).

Typology of birch-bark items and their decoration

The majority of decorated birch-bark items found at the site are remains of containers. The ornithomorphic image cut from a birch-bark layer is a special case (Fig. 1). The morphological typology of birch-bark artifacts from Ust-Polui has been created on the basis of the most abundant collection from the excavations of 2010 (Mogritskaya, 2011: 363). According to the cutting patterns of the birch-bark layers, four types of container have been distinguished. Decorated items are encountered among artifacts of all types.

Type 1. There is only one ornamented container. Each item was made from a rectangular birch-bark sheet, the ends of which were bent at the corners in the forms of triangles, put along the short sides of the box, and held together using a rod or a cedar root threaded through pairs of holes. Usually, such a container was made of a rough sheet of birch-bark in such a way that the outer bark-layer formed the external side of the item. Birch-bark containers of this type are most numerous. In most cases, they are not decorated (Fig. 2, 3).

Type 2. Eight ornamented artifacts of this type have been discovered. A birch-bark sheet with a complex cutting pattern was used as a blank: a rectangular base with slightly concave short sides and semi-circles adjoining the long sides. The shape was created from a

Fig. 1. Ornithomorphic image cut from a birch-bark sheet.

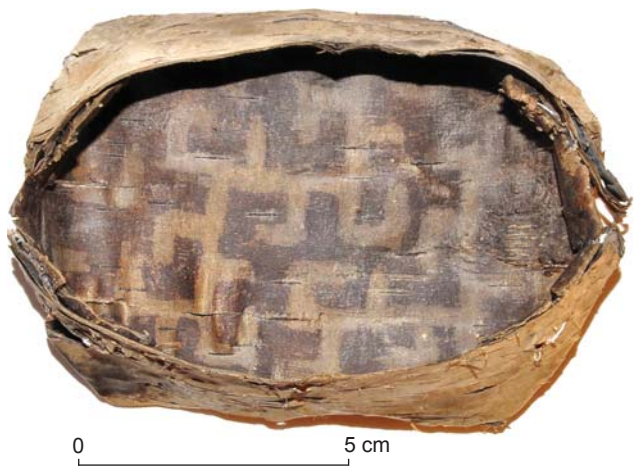


Fig. 2. Decorated birch-bark container of type 1.

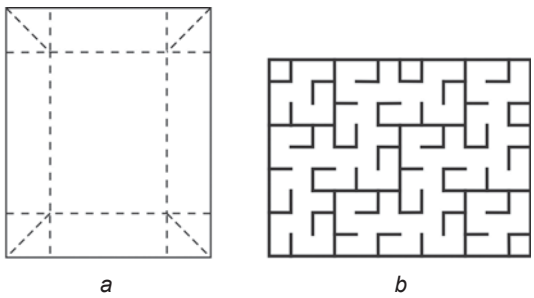


Fig. 3. Cutting pattern for containers of type 1 (*a*), and ornamental pattern of the item (*b*) represented in Fig. 2.

Fig. 4. Decorated container of type 2.

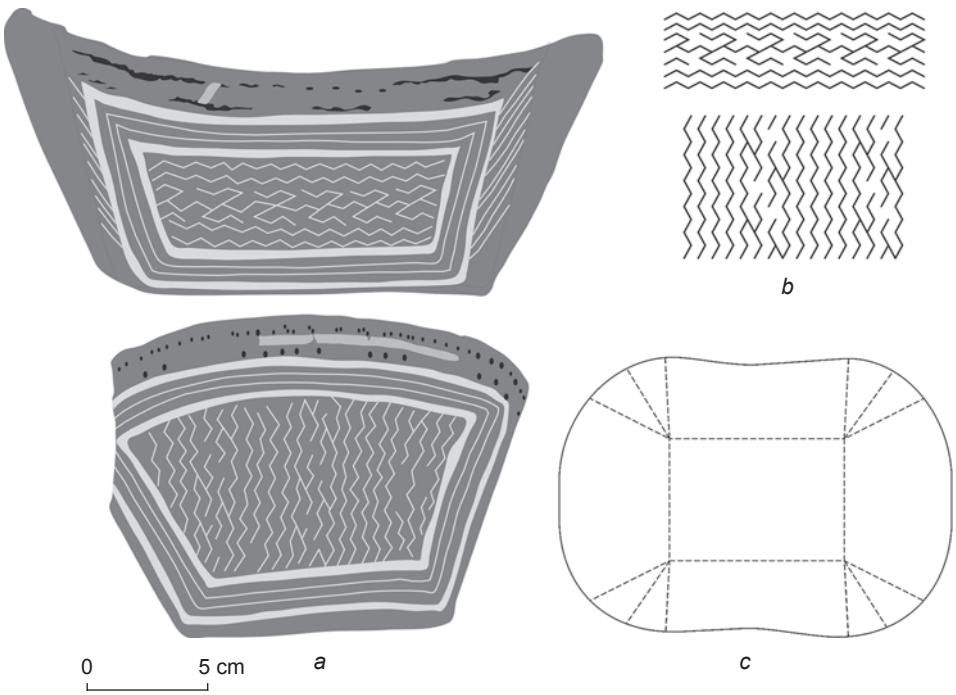


Fig. 5. Drawing of ornament (*a*) and ornamental patterns of the item (*b*) represented in Fig. 4, a cutting pattern for containers of type 2 (*c*).

double layer as follows: the ends of the inner layer, with a dark side facing out, were bent at the corners in the forms of triangles and put along the long sides; while the outer layer was slashed, and its ends were bent upwards, thus forming a container with a widened mouth and a relatively rectangular bottom. One or two rods were inserted along the top edge, and the entire construction was sewn around with a double or single seam made of cedar-roots or grass (Fig. 4, 5).

Type 3. This type is represented by a single specimen. The container is cut from several birch-bark layers. The base is a rectangular sheet with V-openings along the short sides. Additionally, parts of trapezoidal shape were cut out. The container was created by sewing together the base along the openings, and applying additional parts along the lateral sides (Fig. 6, 7).

Type 4. Four decorated artifacts of this type have been discovered. Each container is made in the form of a cylinder, and consists of three parts: a round bottom, a round cover, and a lateral side from a birch-bark band. The diameters of the items and the heights of their walls vary considerably (Fig. 8, 9).

The ornamental patterns are represented by meanders in the forms of borders or nets in various arrangements. Sometimes, the variability of ornaments is achieved by way of reducing or increasing the segments. There are some examples of complex closed compositions including images of birds and animals at their centers framed by

Fig. 6. Decorated container of type 3.

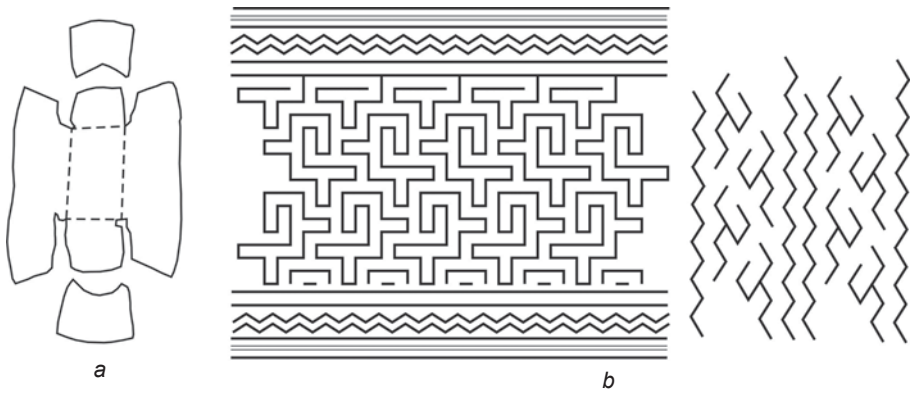


Fig. 7. Cutting pattern for containers of type 3 (*a*), and ornamental patterns of the item (*b*) represented in Fig. 6.

Fig. 8. Decorated container of type 4.

geometric patterns. In some cases, the main structural element is a swastika. The majority of ornaments are inscribed each within a strict geometric net with various angles of inclination of guide-lines. Noteworthy is a precise marking of ornamental patterns, which reveals itself in parallelism of lines and observance of angles of inclination. This suggests the use of stencils for decoration. At the time of study, there are no finds with curvilinear motifs.

In the vast majority of cases, the technique of scraping against a dark background was used (see Fig. 6), while only in two cases, drawings were made by scratching (Fig. 10, 11), and in one case the drawing was pricked (Fig. 11). Also, in 2010, for the first time, birch-bark openwork bands with profiled edges were discovered (Fig. 12), which were obviously used to decorate containers of the 2nd and 4th types.

The majority of containers were intentionally torn into several pieces, into some of which bones of animals, fur fragments, etc. were put. This suggests that the birch-bark items were purposefully made for some ceremonies and were subsequently destroyed. Such actions are described in detail in ethnographic studies (Kharyuchi, 2001: 133).

Conclusions

The majority of researchers see the origins of modern ornaments of the northwestern Siberian peoples in the ornamentation of the Bronze Age cultures.

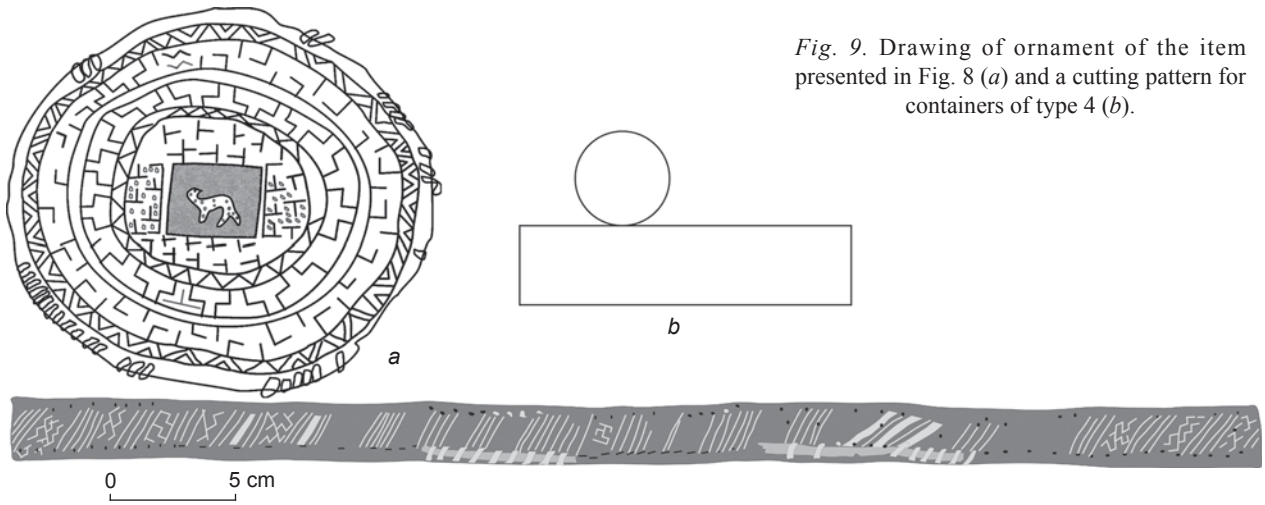


Fig. 9. Drawing of ornament of the item presented in Fig. 8 (*a*) and a cutting pattern for containers of type 4 (*b*).

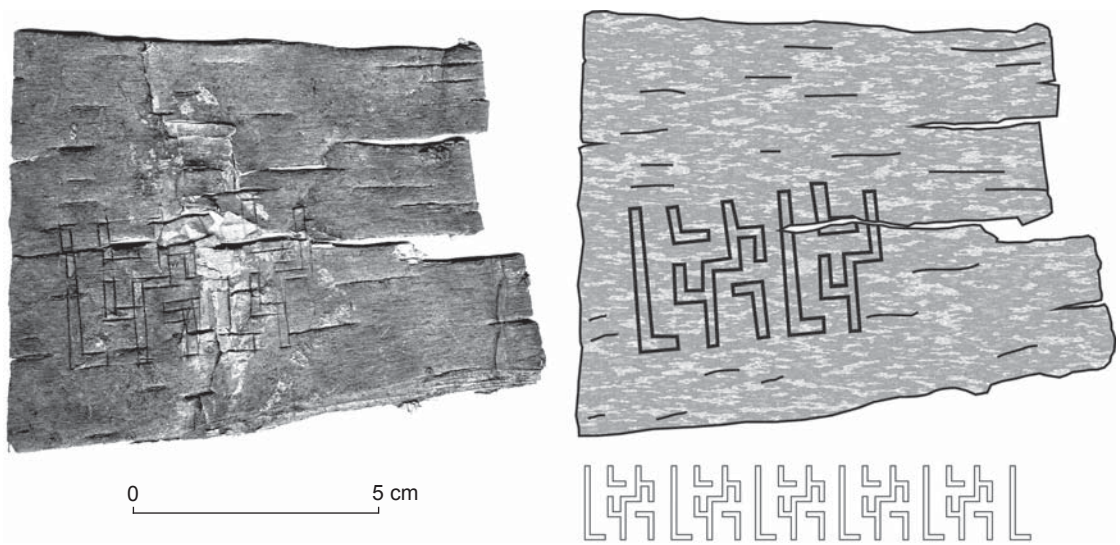


Fig. 10. A fragment of a birch-bark item with scratched-out ornament.

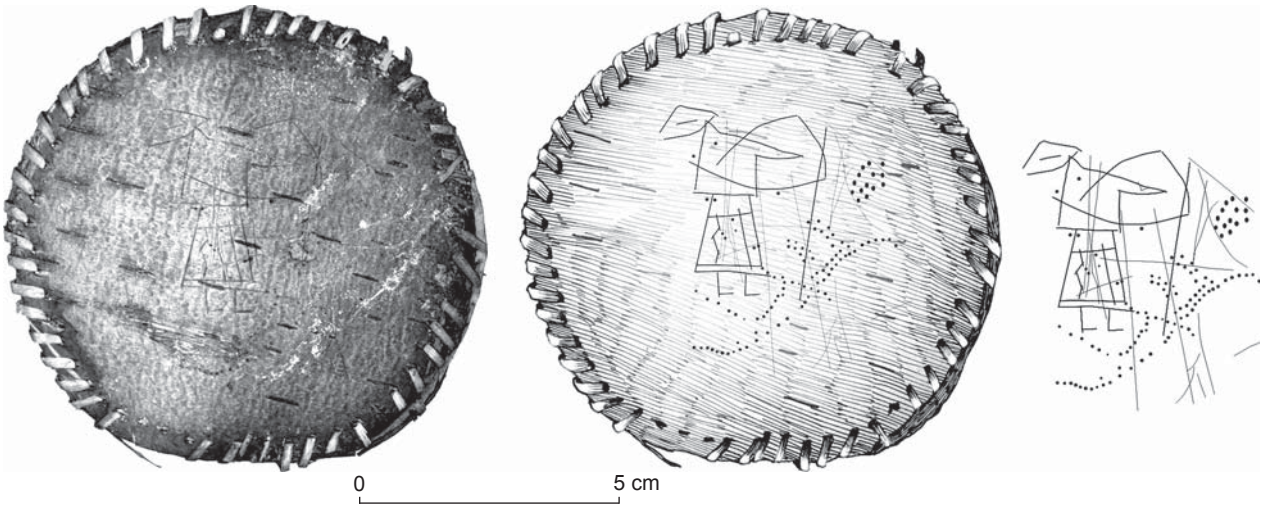


Fig. 11. A fragment of a birch-bark container of type 4 with scratched-out and pricked images.

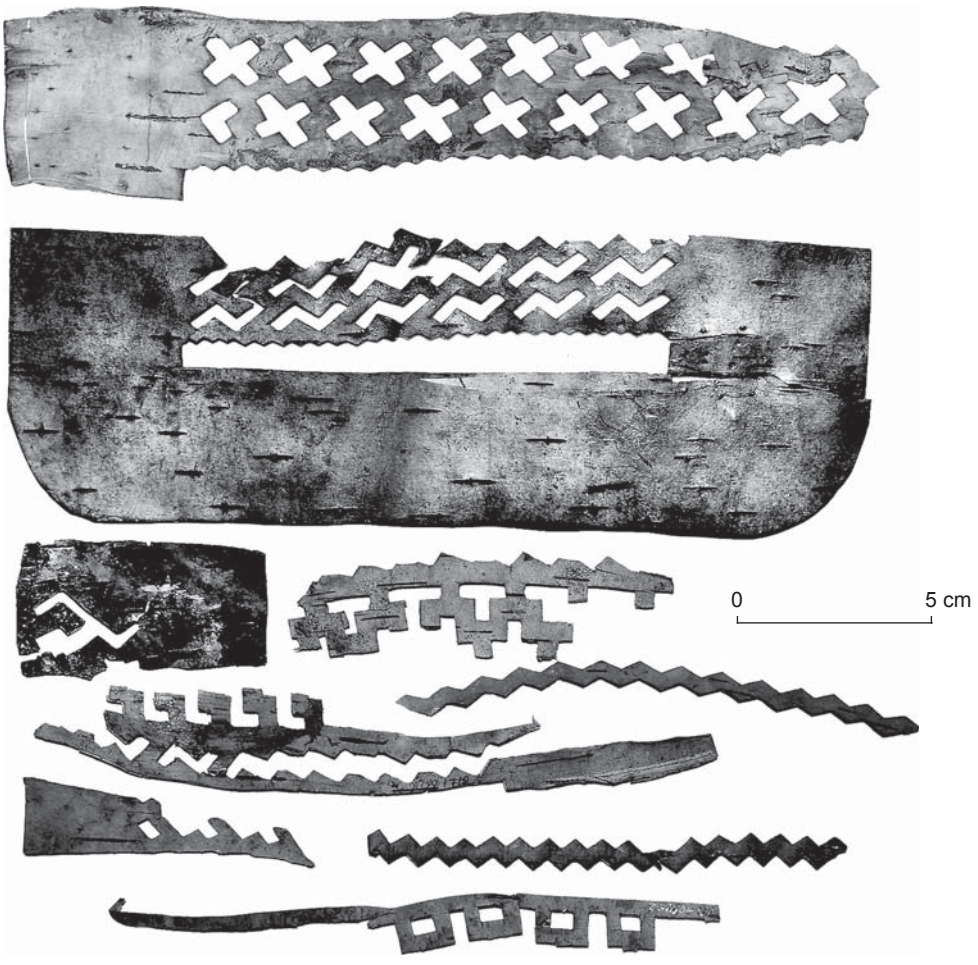


Fig. 12. Openwork and profiled birch-bark bands.

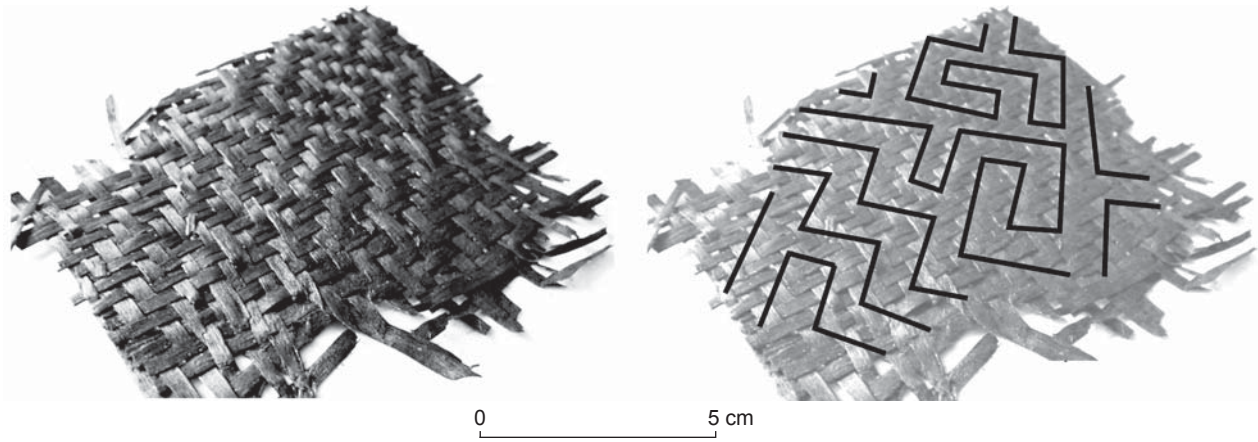


Fig. 13. Decorated grass mat.

No unambiguous opinion has been formed in this respect so far. V.N. Chernetsov came to the conclusion that the decorative tradition of steppe Andronovo-type cultures, having reached into the area of taiga tribes in the Bronze Age, formed the basis for development of the modern decorative system of the Khanty and Mansi. According to S.V. Ivanov, we may talk "not about ornamentation in general, but only about one ornamentation complex represented mainly by a series of border ornaments of special type" (see (Koksharov, Ermakova, 1992: 12)). At the same time, there is a point of view according to which the role of Andronovo-type groups of population in the formation of traditional ornamentation among the Middle and Lower Ob region peoples was very limited, while a crucial role is ascribed to the decorative traditions of the Atlym and Lozva cultures (Ibid.). Interesting also is the opinion that the meander motifs initially appeared on soft materials rather than on ceramics (Ryndina, 1995: 376). This appears to be logical, but has not found sufficient confirmation in the archaeological materials so far. This can be supported by such evidence as the grass mat found in Ust-Polui in 2010. Its complex plaiting is such that alternation of separate elements forms a meander (Fig. 13). Most probably, the pattern was also highlighted by color, since mats with elements painted red and black were found at the site. During preliminary study of this item, the colorant was not discovered; but subsequently, restorer S.V. Pitukhin managed to discern differently colored elements of the mat at a certain inclination and illumination. The colorant's composition has not yet been determined.

Many birch-bark containers had widened mouths and subrectangular shapes. This makes it possible to compare them with clay boat-shaped vessels of the Bronze Age. Apparently, similar birch-bark vessels existed during the Chalcolithic and the Bronze Age; however, these have not survived to the present day.

The question arises of the birch-bark decoration's continuity from the turn of the eras to the present day. Comparison of Ust-Polui and Late Medieval motifs shows more differences than similarities. For example, large stylized images of animals as a center of composition appeared in the first half of the 2nd millennium BC. This motif gained maximum momentum in the second half of this millennium, and is impressively represented on birch-bark artifacts discovered in the course of studying the "forts" of that period. Meanwhile, in the Ust-Polui ornamentation, images of animals are more realistic and small, and the centers of closed compositions are filled with net pattern. As for the similarities, meander band patterns that are extant even now have remained substantially unchanged (Syazi, 2005: 70). In addition, neither the shapes of items nor their manufacture and decoration techniques underwent major transformations.

Acknowledgements

The author would like to express her gratitude to the researchers of the Ust-Polui ancient sanctuary—Head of the Department of Archaeology N.V. Fedorova, and Senior Researcher A.V. Gusev (Arctic Research Center, Salekhard)—for providing the opportunity to study and publish the results of their field works, and for assistance in the preparation of this article.

References

Fedorova N.V. 2006
Voikarskiy gorodok: Itogi raskopok 2003–2005 gg. *Nauchniy vestnik YaNAO*, iss. 4 (41): 11–17.

Gusev A.V., Fedorova N.V. 2012
Drevnyeye svyatilishche Ust-Poluy: Razmyshleniya post factum. In *Arkheologiya Arktiki: Materialy Mezhdunar. nauch.-prakt. konf., posvyashch. 80-letiyu otkrytiya pamyatnika arkheologii "Drevnyeye svyatilishche Ust-Poluy"*. Salekhard: Delovaya pressa, pp. 22–29.

Kardash O.V. 2009

Nadymskiy gorodok v kontse XVI – pervoy treti XVIII v.: Istoriya i materialnaya kultura. Yekaterinburg, Nefteyugansk: Magellan.

Kardash O.V. 2013

Poluiskiy mysovoy gorodok knyazey Tayshinykh. Yekaterinburg, Salekhard: Magellan.

Kharyuchi G.P. 2001

Traditsii i innovatsii v kulture nenetskogo etnosa. Tomsk: Izd. Tom. Gos. Univ.

Koksharov S.F., Ermakova N.N. 1992

Meandroviye uzory na keramike lozvinskogo i atlymskogo tipov. In *Ornament narodov Zapadnoy Sibiri*, N.V. Lukina (ed.). Tomsk: Izd. Tom. Gos. Univ., pp. 12–21.

Mazurin A.B. 2012

Arkheologicheskiy pamyatnik Ust-Poluy: K voprosu izucheniya protsessa issledovaniy. In *Arkheologiya Arktiki: Materialy Mezhdunar. nauch.-prakt. konf., posvyashch. 80-letiyu otkrytiya pamyatnika arkheologii "Drevnyeye svyatilishche Ust-Poluy"*. Salekhard: Delovaya pressa, pp. 13–19.

Mogritskaya V.Y. 2010

Ornamentirovanniye berestyaniye izdeliya Voikarskogo gorodka. In *III Severniy arkheologicheskiy kongress: Tezisy dokl*. Yekaterinburg: IzdatNaukaServis, pp. 271–272.

Mogritskaya V.Y. 2011

Berestyanaya utvar drevnego svyatilishcha Ust-Poluy (I v. do n.e. – I n.e.) v kontekste traditsionnoy kultury naseleniya severa Zapadnoy Sibiri. In *Trudy III (XIX) Vseros. arkheol. syezda*, vol. I. St. Petersburg, Moscow, Veliky Novgorod: IIMK RAN, pp. 363–364.

Mogritskaya V.Y. 2014

Beresta v sakralnom prostranstve drevnego svyatilishcha i v traditsionnoy culture obskikh ugrov i samodiytsev. In *Trudy IV (XX) Vseros. arkheol. syezda*, vol. III. Kazan: Otechestvo, pp. 521–524.

Mogritskaya V.Y., Pitukhin S.V. 2013

Ornamentirovanniye berestyaniye izdeliya drevnego svyatilishcha Ust-Poluy: Noviye postupleniya i opyt restavratsii. In *Arkheologiya Severa Rossii: Ot epokhi zheleza do Rossiyskoy imperii: Materialy Vseros. nauch. arkheol. konf*. Yekaterinburg, Surgut: Magellan, pp. 60–65.

Parkhimovich S.G. 1998

Ornamentirovanniye berestyaniye izdeliya rannego zheleznogo veka iz Nizhnego Priobya. In *Yezhegodnik TOKM 1996 g*. Tyumen: pp. 128–146.

Ryndina O.M. 1995

Ornament. Tomsk: Izd. Tom. Gos. Univ. (Ocherki kulturogeneza narodov Zapadnoy Sibiri; vol. 3).

Shiyatov S.G., Mazepa V.S., Khantemirov R.M., Goryachikh V.M. 2000

Itogi i perspektivy ispolzovaniya dendrokhronologicheskogo metoda dlya datirovki arkheologicheskikh, istoricheskikh i etnograficheskikh pamyatnikov na territorii YaNAO. *Nauchniy vestnik YaNAO*, iss. 3: 54–55.

Syazi A.M. 2005

Uzory severnogo siyaniya. Vol. II: Samodiyskiye narody. Salekhard: Artvid, St. Petersburg: Russkaya kollektsiya.

Tupakhina O.S. 2013

Rybolovstvo v epokhu eneolita v Nizhnem Priobye. *Nauchniy vestnik YaNAO*, iss. 2 (79): 106–107.

Ugorskoye naslediye. 1994

A.P. Zykov, S.F. Kokharov, L.M. Terekhova, N.V. Fyodorova. Yekaterinburg: Vneshtorgizdat.

Received February 16, 2015.

DOI: 10.17746/1563-0110.2018.46.1.059-065

L.N. Ermolenko[1], A.I. Soloviev[2], and Zh.K. Kurmankulov[3]

[1]Kemerovo State University,
Krasnaya 6, Kemerovo, 650043, Russia
E-mail: lyubov.ermolenko@mail.ru
[2]Institute of Archaeology and Ethnography, Siberian Branch,
Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: easolovievy@mail.ru
[3]A.K. Margulan Institute of Archaeology, Committee of Science
of the Ministry of Education and Science of the Republic of Kazakhstan,
Pr. Dostyk 44, Almaty, 050010, Republic of Kazakhstan
E-mail: kurmankulov@gmail.com

An Old Turkic Statue from Borili, Ulytau Hills, Central Kazakhstan: Issues in Interpretation

We describe an unusual Old Turkic statue from Borili (Ulytau, Central Kazakhstan), distinguished by a peculiar position of the hands and holding an unusual object—a battle axe instead of a vessel. Stylistic features and possible prototypes among actual battle axes suggest that the statue dates to the 7th to early 8th centuries AD. The composition attests to the sculptor's familiarity with Sogdian/Iranian art and with that of China. Several interpretations of the statue are possible. The standard version regarding Old Turkic statues erected near stone enclosures is that they represent divine chiefs—patrons of a specific group of the population. Certain details carved on the statue indicate an early origin of the image. It is also possible that such statues are semantically similar to those of guardians placed along the "path of the spirits" near tombs of members of the Chinese royal elite.

Keywords: *Old Turks, statues, Central Kazakhstan, Sogdian art, China, "path of the spirits", bladed weapons.*

Introduction

A stone statue that was recently discovered from the location of Borili, in the Ulytau Hills, southwestern Kazakh Uplands (Saryarka), was described earlier (Ermolenko, Soloviev, Kurmankulov, 2016). This full-length statue of a man leaning on a battle axe with one hand and holding the handle of a straight-bladed weapon in a sheath attached to his belt was found broken into several parts. On the statue, there can be clearly seen lapels of clothing, bracelets, a torque, earrings, belt with onlays, a short-bladed weapon with a handle located at an angle to the blade and equipped with a ring-shaped pommel, round and rectangular handbags with pendants, and a whetstone (Fig. 1). Although this sculpture undoubtedly belongs to the Old Turkic world, a number of parallels point in the Sogdian-Iranian direction. Yet, in the search for explanation of the worldview and visual phenomenon behind this image, one should also turn to the materials of the territorially close Empire of China. This state possessed not only a powerful military and cultural capacity which in its time made a significant impact on the political events in the nomadic world and ancient civilizations of East Asia, but also had a developed

Archaeology, Ethnology & Anthropology of Eurasia 46/1 (2018) 59–65 E-mail: Eurasia@archaeology.nsc.ru

Fig. 1. Sculpture from Borili.

sculptural tradition going back to times of deep antiquity long before the appearance of the Old Turkic military and political entities.

Statue attribution

Continuing the analysis of the Borili statue, we would like to draw attention to one very curious circumstance. In fact, the posture of the represented person (standing position, both hands resting on weapons) is more likely to belong to a guardian than to a feasting hero with a cup in his hand (the main character of Old Turkic stone sculptures, who probably was perceived in this way, at least at the initial stage of the ritual use of this sculpture). However, even though the postures of Old Turkic sculptures were canonically established, there were variants, which differed in terms of the position of the left hand: on the belt, on the abdomen, on the handle of a bladed weapon, on the body of the vessel together with the right hand, or on the left knee as for example is the case with some skillfully made, almost round sculptural images discovered in Mongolia. We are deliberately focusing on the basic visual elements which had the most important meaning for the viewers, being associated with the generally understandable "language" of conventional signs and gestures. In the overwhelming majority of cases when we consider male representations, such significant elements are the vessel, belt, bladed weapon, and torque. And if the latter three elements in different combinations designated the status of the character, the vessel marked a specific subject of a sacral kind. In advance, we should note that depending on the urgency of the moment and the general scenario of the sacral ceremony (funeral feast, commemoration ritual, appeal to the spirit of the sacralized ancestor-patron, personal appeal, etc.), the meaning of the hand gesture with the cup would change. It can, for example, be interpreted as a sign of good will, the act of reception or, conversely, handing over the vessel, symbolic exchange of its contents between the person represented in stone and his relatives and descendants, etc. In fact, precisely the absence of the "feasting bowl" and its replacement with the battle axe—a dangerous weapon of close combat, which the medieval warriors of Eurasia used on the territory expanding from the banks of the Amur River to the valleys of the Rhine and the narrow fjords of Northern Europe, significantly changed the sacral meaning of the statue under consideration. The axe as a weapon of military struggle was also certainly known to the representatives of the ancient Chinese civilization which, as recent discoveries show, was the initiator, if not the trendsetter, of many popular forms of weaponry for the "northern barbarians" (various groups of cattle breeders whose herds grazed at the Chinese borders). The local elite was especially affected by the "charm" of the material and spiritual culture of the Great Empire. It is not difficult to find examples. Even in the Xiongnu period, the highest nobility of the Xiongnu Empire buried its representatives according to the Han norms of funerary rite with the corresponding architecture of funerary structures and a large number of high-quality objects manufactured by artisans from imperial workshops (Polosmak, Bogdanov, 2015: 53–109, 119–132). The situation did not change much in the Middle Ages, in the Tang period, which can be confirmed by the "mausoleums" of Tonyukuk, Bilge Khagan, and Kul Tigin. The latter "mausoleum" was actually constructed by Chinese builders who were sent there with signs of "respect", appropriate for the steppe mentality. These structures included the so-called path of the spirits (*Shendao*, *Guidao*, *Shenlu*) (Komissarov, Kudinova, Soloviev, 2012) with the standard set of stone

sculptures including statues of people and animals, set in pairs and included into the single architectural ensemble of the necropolis. According to the surviving beliefs, the souls of the deceased would walk along this path, and the creatures embodied in stone would defend them. The earliest "valley of the spirits" can be found in the burial of the Commander Huo Qubing mu (140–117 BC), and the first of the known monumental sculptures were set up in 120 BC (Kravtsova, 2007: 495, 496; 2010). We should emphasize that the main features of the "path of the spirits" that had been established during the Han period, remained the mandatory elements of elite, and mainly of imperial, burials in China until the Ming (1386–1644) and Qing (1644–1911) dynasties inclusively. A.V. Adrianov observed and photographed a complex of dignitaries and creatures from the mythological bestiary, created according to the standard norms of the medieval Chinese sculptural tradition, on the left bank of the Ulug Khem in 1916 (Belikova, 2014: 116–120, fig. 43–50). Judging by the pictorial canon and mutual arrangement of the statues, they represented the remains of such a "path of the spirits", once associated with the funerary complex of the highest nobility, which has now disappeared. Adrianov rightly correlated the find in Tuva with the eastern tradition and believed that it was left "by the Chinese during their stay here" (Ibid.: 117). The fact that stone was processed by Chinese artisans does not raise doubts, as opposed to a further attribution of the sculptures to a visiting imperial official. Given the eternal and even in the recent past unshakable Chinese tradition of returning the deceased (even from the most remote regions) for burying them in the historical homeland, it is highly probable that the burial complex at the Ulug Khem was built for a local noble man. Relatively recently, a burial mound of the mid-7th century was studied at the site of Shoroon Dov in Mongolia, where one of the major local officials from among the tribal nobility appointed by the Chinese administration was buried (see (Danilov, 2010)). A stone slab with an epitaph in Chinese, and a series of terracotta figures of people and animals were found there. The tradition of placing them in funeral complexes existed in China already in the era of the Qin and Han dynasties (from the last quarter of the 3rd century BC to the first quarter of the 3rd century AD). Epitaphs, carved on massive stone slabs in Chinese and dedicated to local officials, were also found on the territory of present-day Kyrgyzstan (Tabaldiev, Belek, 2008: 165, 167, 168). An important semantic element of elite burials belonging to the highest imperial nobility of Ancient China were voluminous, at times huge, dragon-like stone turtles, symbolizing eternity. High (over 3 m) stelae with extensive epitaphs were set up on their backs. A huge marble turtle and similar stele with runic and Chinese inscriptions belong to such structurally important components of the famous funeral complex of Kul Tigin. Judging by the abundance of such various-sized dragon-like armored reptiles that have been found in Mongolia (Mengguguo gudai youmu…, 2008: 206, 230, 282, 283, 288), and pieces of stelae, the Chinese funerary tradition with the statue series of visualized sacral characters was quite popular among the aristocratic environment of the Old Turkic society. Notably, Tonyukuk, the famous military and political figure of the Second Turkic Khaganate, and the adviser to Kul Tigin and Bilge Khagan, was educated in the capital of the Tang Empire in the spirit of the Chinese culture. And military clashes and "devastating" campaigns that are mentioned in the epistolary sources of the steppe warriors, as well as confrontation with the Tang dynasty of China, turned out not to be so important. The centuries-old technological dominance of the Empire, its wealth, luxury, vastness of territory, rigid centralization of power, and rapidly restorable military capacity could not but affect the imagination of the steppe aristocrats, who felt like they stood on the same level as the rulers of the Empire by copying the dominant elements of the neighboring high and sophisticated culture. Accordingly, the local elites of lower rank also began imitating their leaders and reproduce (in accordance with their understanding and capabilities) the prestigious attributes together with forms of their demonstration, adapting them to the traditional norms of life. However, the greater the distance, the more the processes of such "acculturation" lost their bright ethnic flavor. Stone turtles and stelae with epitaphs are not known on the territory of the Altai Mountains, and stone sculpture there for the most part looks much more primitive, which however does not exclude a series of expressive statues executed at a high level, most likely by professional artisans. As far as the southern part of Altai and Xinjiang as a whole are concerned, at least 200 sculptures of various types were known there already in the 1990s, and their number is constantly growing (Wang Bo, 1995; Wang Bo, Qi Xiaoshan, 1996; Xu Yufang, Wang Bo, 2002; and others)*.

At the present time, we can establish the presence of remarkable high-quality sculptures of Old Turkic forms in Xinjiang, manufactured most likely by Sogdian artisans. In addition to the manufacturing technique, this is confirmed by the elements of the equipment, the parallels to which can be observed in fresco painting, as well as in stylistic methods of representing hands

*Unfortunately, the objects of the Old Turkic circle are still under the cover of unspoken silence, and only recently the veil on this phenomenon has begun to be lifted.

with the "elegant" position of the slender fingers*. There is nothing surprising about this, since the routes of the Great Silk Road, which passed across this territory, transmitted powerful cultural impulses clearly visible from archaeological materials. An example is the famous Tang funerary piece of portable art, which retained the distinctive appearance of bearded foreigners on foot, riding horses, and leading camels, wearing high headgear and long caftans with lapels**. Stylistic links with the traditions of Iranian-Sogdian art can be noted already on the carved walls of marble sarcophagi belonging to important officials of the Northern Chinese states of the 6th–7th centuries. For example, the carved images on sarcophagus from the tomb of Yu Hong*** represent both scenes from his own biography, and episodes of the Iranian epic legends and Zoroastrian beliefs (Komissarov, Soloviev, Trushkin, 2014). It is curious that stone sculptures of Xinjiang include a representation of a man holding a staff in one hand and vessel in another hand, having a thick beard in the style typical of the Tang clay portable art that reproduced foreign Sogdian characters (Fig. 2)****. Notably, it is easy to recognize the characters of various ethnic origin, including those of Turkic appearance, among similar clay figurines depicting heavily armed riders (Komissarov, Soloviev, 2015: Fig. 3–7). Thus, we may speak about a certain favorable multicultural situation in Northern China and the surrounding areas in the third quarter of the first millennium AD, which is reflected in both the material and spiritual culture*. We should point out that the Turks in Central Asia also practiced the arrangement of settlements of the Sogdian colonists. This affected the economy and culture of the Khaganates, which were characterized by the merging of the traditions of the settled agricultural population, "consisting of a small part of Turks who settled on the land, but mostly originating from the agricultural areas of the predominantly Sogdian population which occupied the main positions in agriculture, crafts, trade, and cultural life of the states, and the nomadic Turkic population which dominated politically and was economically based on nomadic cattle breeding" (Mogilnikov, 1981: 30). The consequences of this situation are reflected in the materials from the territory of present-day Kazakhstan. Old Turkic portable art pieces discovered in that region show explicit parallels to the Sogdian pictorial canons, for example, manifested by "elegant" rendering of hands and gestures, design of braids of the hairdo, etc.

Turning to the Chinese pictorial materials, it is easy to see that the "equipment" of the reproduced images with various kinds of weaponry has a long-standing tradition going back to the Qin period when, for example, the famous Terracotta Army of the first Emperor was supplied with real weapons. We must note the steady tradition of creating figures that seem to lean on the handles of bladed weapons or the striking parts of axes standing in front of them. This feature took final shape in the subsequent period, but can be clearly observed in full-size statues of the officer corps of the Terracotta Army. We should also point out the fact that the pole striking weapon for both cutting and stabbing belonging to the statue was very popular in the military formations of the Celestial Empire, ranging from various bronze flat-bladed spike hammers to pole-axes. Moreover, by the Song period (960–1279), combined axes (double-edged or with an opposing striker), attached to a long haft, became an important attribute of images of the highest military hierarchy or sacred warlike characters, including female spirits (Liu Yonghua, 2003: 133, k-20.2; 121, k-4). Another attribute of our statue from Borili, which finds parallels both in the pictorial tradition and in the arsenal of the military equipment of ancient China, is the bladed cutting and stabbing weapon with a ring-shaped pommel, which was already known during the Eastern Han Dynasty (25–220) (Yang Hong, 1980: 124). Once again, we should emphasize that the figure with weapons in both hands does not correspond to the pictorial standard of Old Turkic societies, associated with the required depiction of a vessel in the sculptural composition. Weapons in

*We had a chance to examine one such sculpture with traces of external damage (its head was broken off) in the Museum of Cultural Monuments of the Altay Prefecture (the city of Altay, Xinjiang, China).

**In fact, the representations of the Sogdians can also be recognized in funerary portable art of the already mentioned burial mound in Shoroon Dov in Mongolia, but it is premature to make any definitive conclusions before a complete and detailed publication of the materials.

***He lived in the state of Yu; his grandfather was among the leaders of the Northern Wei, and his father was an official of the Rouran Khaganate. Yu Hong served since the age of 13. He received the title of "Mohefu" in the Rouran State and was sent with embassies to Persia, Tuyuhun, and Northern Qi. In Northern Zhou, he headed the administration for control of foreigners, received the title of "Count" (*bo*); during the Sui Dynasty, he became one of the "yitong sansi", that is, a dignitary of the highest rank. Yu Hong died in 592, and his wife, whose body was also placed in a marble sarcophagus, died in 598, which marks the exact date of the entire complex.

****Rounded cheekbones, a straight nose, and rich facial hair, as well as wide eyebrows, a mustache twisted upwards, and thick beard trimmed in a special way recreate the typical ethnographic appearance of a representative of this culture.

*Subsequently, it was severely suppressed and did not develop further for reasons which need additional comprehension.

Fig. 2. Representation of Sogdians in the clay portable art of the Tang Dynasty (*1–3*) and stone sculpture of the Old Turks (*4*).
1 – Museum of the city of Altay in the Xinjiang Uyghur Autonomous Region; *2–4* – Shaanxi History Museum.

both hands, even if they were not drawn, in a state of combat readiness, radically change the perception of the sculpture by both contemporary viewers, who only vaguely know about the ideas behind that object, and medieval viewers, for whom they were simple and understandable. With all possible interpretations, the inevitable and probably the main emotional impulse emanating from the armed character was connected, if one may say this, with a threat message. It can have both an apotropaic function, carrying out a sacred defense and demonstrating the heroic past of the character (good for his own people and dangerous for strangers), and a broadcasting function, manifesting the strength and firmness of the potestary power, whose might guarantees the stability of the hierarchy of social structures in society. Be it as it may, the very perception of the direction of the "vector of power" is associated with the position occupied by the participant in the ritual or visitor to the memorial complex in the system of his own worldview as well as cultural and historical coordinates regarding the reproduced fragment of the event scenario. In this case, two images (of the ruler and of the already mentioned guardian) most closely match the emotional message embodied in the Borili statue. Let us turn to one, in our opinion, important circumstance. Required characters of the "path of the spirits" near the funerary complexes included the statues of guard-soldiers with bladed and pole weaponry. They could hold the weapons in their hands, lean on them, or demonstrate their presence in some other way. We should note that in this case we are speaking only about the typological similarity of the compositional idea, while the sculptures show considerable differences in terms of manufacturing technique and style. The sculpture from Borili undoubtedly represents a Turk, and is executed following the canons of the Turkic sculptural tradition or under its influence. It is quite possible that this object of portable art once served as one of the guardians of the "path of the spirits" accompanying the immaterial essence of the deceased to the place of his afterlife stay, and by its presence marked some kind of extraordinary status of the buried. An indirect argument in favor of such a hypothesis can be the presence of a barrow structure in the immediate vicinity of the place where the statue was discovered. However, before the archaeological research of this funeral complex and, accordingly, before its chronological and cultural-historical interpretation, such an association has no reliable scholarly significance. We should only repeat that the burial practices of the powerful southeastern neighbor might have influenced the development of the tradition of marking the sacred space around the burials of socially important persons belonging to the "barbarian" population of the adjacent territories. The seeds of such ideas fell on fertile soil and sprouted at the right moment, which manifested itself in the desire of the local aristocracy to reproduce a number of visual characteristics belonging to the funeral ensembles of the "civilized" neighbors in the very same period of the Early Middle Ages, when the processes of cultural interaction were particularly strong.

At the same time, one should not abandon the usual approach to interpreting Old Turkic sculptures as the

attributes of so-called enclosures, found in the mountain and foothill areas where the monuments of the Old Turkic complex occurred, and associated by the scholars with the cycle of commemoration rituals. However, in our case, considering the non-standard appearance of the sculpture, we will have to recognize certain changes in the beliefs of the group of the population that left the statue. These changes are manifested by departing from the "universal" norms which dictate the need for representing the vessel. Accordingly, it is also possible to assume certain changes in ritual actions associated with funerary practices and the subsequent use of the sculpture in the sacral life of the community. In this case, we may also assume the existence of a series of similar sculptures and to expect their discovery at least on the nearest territory. After all, being sufficiently conservative, the traditional worldview would require the repetition of the entire cycle of ritual actions and associated attributes for ensuring the welfare of the immaterial essence of the deceased, and consequently, of the community, after it had accepted that canon in such an important area for the community as the demise of its member.

And finally, we should propose one more hypothesis, although the least probable of all, based on the existence of a large number of early parallels from the territory of the most ancient states of East Asia to the iron blade with the ring pommel represented on the statue. Most likely, this weapon along with other elements of spiritual and material culture, spread over the nomadic Ecumene from that region. This circumstance makes it possible to suggest that the example of the sculpture from Borili reveals the initial stages in the formation of the Old Turkic statuary tradition.

Conclusions

It is important that the sculptor who created the statue at Borili ignored the tradition by replacing the vessel with a "non-canonical" attribute. Such deviations are very rare; one such example is a rather realistic sculpture from the Karagash locality (Central Kazakhstan), which represents a male wearing a lapelled robe and holding a long staff with both hands (Margulan, 2003: Ill. 89). The closest parallel in terms of territory is the representation of a Turk (figure 19) in the painting on the western wall of room 1 in Afrasiab (Albaum, 1975: Fig. 7; Ermolenko, Kurmankulov, Bayar, 2005). However, the canon of that statue can be correlated with the image of the guardian—an indispensable element of the funerary rite of the Chinese elite, which could have been incorporated into the rituals of the nomadic aristocracy, influenced by the achievements of the culture of the powerful neighboring state. Consequently, there are reasons to believe that the stonecutters who produced such unusual sculptures, were familiar with the examples (and were aware of the significance of the images) of Sogdian and Chinese art, which also represented the Turks. Apparently, the sculptors turned to using the artistic means of highly developed art following the extraordinary demands of high-ranking customers. It is no coincidence that the structure near to which the sculpture from Borili was found, does not look like an ordinary enclosure, but only excavations will make it possible to get a better idea of its design, as well as to confirm the connection between these objects.

Acknowledgment

This study was supported by the Ministry of Education and Science of the Russian Federation (Public Contract No. 33.2597.2017/ПЧ).

References

Albaum L.I. 1975
Zhivopis Afrasiaba. Tashkent: Fan.

Belikova O.B. 2014
Poslednyaya ekspeditsiya A.V. Adrianova: Tuva, 1915–1916 gg.: Arkheologicheskiye issledovaniya (istoriograficheskiy aspekt). Tomsk: Izd. Tom. Gos. Univ.

Danilov S.V. 2010
Shoroon Dov – "zemlyanoy bugor". *Nauka iz pervykh ruk*, No. 6: 288–299.

Ermolenko L.N., Kurmankulov Z.K., Bayar D. 2005
Izobrazheniya drevnikh tyurkov s posokhom. *Arkheologiya Yuzhnoy Sibiri*, iss. 23: 76–81.

Ermolenko L.N., Soloviev A.I., Kurmankulov Z.K. 2016
An Old Turkic statue at Borili, Ulytau Hills, Central Kazakhstan: Cultural realia. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 44 (4): 102–113.

Komissarov S.A., Kudinova M.A., Soloviev A.I. 2012
O znachenii "alley dukhov" v ritualnoy praktike Kitaya i sopredelnykh territoriy v epokhu Drevnosti i Srednevekovya. *Vestnik Novosibirskogo Gosudarstvennogo Universiteta.* Ser.: Istoriya, filologiya, vol. 11 (10): 29–40.

Komissarov S.A., Soloviev A.I. 2015
Vsadniki Astany. *Vestnik Novosibirskogo Gosudarstvennogo Universiteta*. Ser.: Istoriya, filologiya, vol. 14 (10): 62–75.

Komissarov S.A., Soloviev A.I., Trushkin A.G. 2014
Izucheniye mogily Yui Khuna (Taiyuan, Kitai) v kontekste polietnichnosti kulturnykh svyazey perekhodnogo perioda. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. XX. Novosibirsk: Izd. IAE SO RAN, pp. 194–197.

Kravtsova M.E. 2007
Lingqin. In *Dukhovnaya kultura Kitaya: Entsiklopediya: V 5 t.* Vol. 2: Mifologiya. Religiya. Moscow: Vost. lit., pp. 493–496.

Kravtsova M.E. 2010
Kho Tsyui-bin mu. In *Dukhovnaya kultura Kitaya: Entsiklopediya*. Vol. 6: Iskusstvo. Moscow: Vost. lit., pp. 746–747.

Liu Yonghua. 2003

Zhongguo gudai junrong fushi [Armour and its furniture in old China]. Shanghai: Shanghai guji chubanshe. (In Chinese).

Margulan A.K. 2003

Kamenniye izvayaniya Ulytau. In *Sochineniya*: *V 14 t.*, vol. 3/4. Almaty: Daik-Press, pp. 20–46.

Mengguguo gudai youmu minzu wenhua yicun kaogu diaocha baogao (2005–2006 nian). 2008

[Report on archaeological study of cultural heritage of the ancient nomadic peoples of Mongolia (2005–2006)]. Beijing: Wenwu chubanshe. (In Chinese).

Mogilnikov V.A. 1981

Tyurki. In *Stepi Evrazii v epokhu srednevekovya*. Moscow: Nauka, pp. 29–43.

Polosmak N.V., Bogdanov E.S. 2015

Kurgany Sutszukte (Noin-Ula, Mongoliya), pt. 1. Novosibirsk: INFOLIO.

Tabaldiev K.S., Belek K. 2008

Pamyatniki pismennosti na kamne Kyrgyzstana: (Svod pamyatnikov pismennosti na kamne). Bishkek: Uchkuk.

Wang Bo. 1995

Xinjiang lushi zongshu [Overview of deer stones of Xinjiang]. *Kaoguxue jikan*. No. 9: 239–260. (In Chinese).

Wang Bo, Qi Xiaoshan. 1996

Sichouzhilu caoyuan shiren yanjiu [Study of steppe stone statues on the Silk Road]. Wulumuqi: Xinjiang renmin chubanshe. (In Chinese).

Xu Yufang, Wang Bo. 2002

Buerjinxian shiren lushide diaocha [Study of stone statues and deer stones in Buerjinxian]. *Xinjiang wenwu*, No. 1/2: 38–51. (In Chinese).

Yang Hong. 1980

Zhongguo binqi lunqun [Study on the history of Old Chinese weapons]. Beijing: Wenwu chubanshe. (In Chinese).

Received January 11, 2016.

DOI: 10.17746/1563-0110.2018.46.1.066-075

T.N. Prudnikova
Ubsunur International Center for Biosphere Research, Internatsionalnaya 117a, Kyzyl, 667007, Russia
E-mail: tprudnikova@inbox.ru

On Ancient Agriculture in Arid Regions of Central Asia: The Case of the Uvs Nuur Basin

The Uvs Nuur Basin is one of the largest arid basins in southern Siberia and Central Asia. The local economy is based on pastoralism. Small-scale irrigation farming is practiced in river valleys. Satellite images of the basin reveal traces of ancient farming, which was much more extensive than that practiced at present. In the central part of the basin, in the Tes-Khem valley, dense irrigation networks are observed, along with numerous associated and hitherto unknown ancient settlements. Presumable remains of an ancient city, surrounded by a network of irrigation canals, were discovered on the west coast of Lake Uvs Nuur. Field studies confirmed the results of image analysis. Parts of ancient irrigation systems, and the ruins of the city and separate settlements, were documented on the ground. For the first time, paleobotanical studies of buried soils and peatlands on ancient fields in the central Uvs Nuur Basin revealed seeds of Triticum sp. Remains of trees and grasses found in the same associations suggest that parts of the basin that are now deserted were covered by forest-steppe landscapes, and the climate was milder at the time when agriculture was practiced. Tentative results of radiocarbon dating suggest that the city existed during the High Middle Ages. Our results point to a greater role of agriculture at that time as compared to the present.

Keywords: *Tuva, Uvs Nuur Basin, satellite images, ancient agriculture, irrigation, paleobotany, Triticum sp., wheat.*

Introduction

The Uvs Nuur Basin, assigned to the Great Lakes Basin of Western Mongolia, is a vast closed drainage area, with the Uvs Nuur salt lake located in its central part. The main elements of the territory are plains lying at hypsometric levels of 750–1000 m a.s.l. The forms of relief, the type of rock weathering, the character of the soil formation, and the flora and fauna reflect the effect of the proximity of the Central Asian deserts. The landscapes are dominated by dry steppes including sandy, stony, desertified ones, as well as vast massifs of wind-blown sands (Prirodniye usloviya…, 1957: 246–250).

The main waterway of the basin is the Tes-Khem River, originating from the spurs of the Khangai ridge and running into Lake Uvs Nuur in its eastern part. Low-water rivers, which lose themselves in deposits of subaerial deltas after exiting the mountain valleys, flow down mainly from the Tannu-Ola ridge, which frames the north of the basin. The rivers of the southern frame, the Khan-Khukhii ridge, are also low-water. The rivers nourished by glaciers of Turgen and Tsagaan Shuvuut Uul high-mountain ridges in the western part of the basin are sufficiently full-flowing and deep. They fall into numerous streams and creeks in the downstream reach of the lacustrine basin. Large areas of this basin are swamped, and certain portions

Archaeology, Ethnology & Anthropology of Eurasia 46/1 (2018) 66–75 E-mail: Eurasia@archaeology.nsc.ru

of mountain slopes are also flooded, which is caused by discharge of groundwaters along the permeable zones of tectonic faults.

The basic activity of the population is nomadic cattle-breeding. Small-scale agriculture (mainly, irrigation farming) is practiced in river valleys. Researchers of Central Asia (according to Y.I. Drobyshev, Central Asia comprises Mongolia, Buryatia, and Tuva, plus the Inner Mongolia and Ningxia Hui autonomous regions and Qinghai and Gansu provinces included in the PRC, as well as the northwestern part of the Tibet Autonomous Region (2014: 54)) noted the presence of fields and also remnants of irrigation canals and ancient fallow lands in this territory, including the Tuvan and Uvs Nuur basins (Semenov, Potanin, 1877: 667; Radlov, 1894: 12; Kazimirsky, 1942; Bichurin, 1950: 40, 223; Kiselev, 1951: 255, 513, 570; Kon, 1952; Dulov, 1952; Kyuner, 1961: 57–58; Weinstein, 1969: 9; Kyzlasov, 1984: 12–13, 23, 45, 102–103; Mannai-ool, Dostay, 1996: 129; Ashak-ool, 1984; Prudnikova, 1999; and others). The overall characteristics of ancient irrigation systems in Tuva were obtained by remote sensing methods, such as aerial photography and interpretation of images from space (Prudnikova, 2005; Antropogenniye preobrazovaniya…, 2011: 207–247). The first data on the age of the irrigation systems in the Khemchik Basin were derived, which suggest the existence of irrigation farming in this territory in the Bronze Age (Prudnikova, Prudnikov, Spivakov, 2008). In general, analysis of the paleogeographic conditions and history of development of ancient Tuva has demonstrated that agriculture was practiced here during all significant historical epochs of the Middle and Late Holocene (Prudnikova, 2005). By analogy, the existence of irrigation farming in the territory of neighboring Mongolia was also presumed. It has been proven that the Wall of Genghis Khan in the Khovd River valley is the principal canal of a gigantic irrigation system (Prudnikova, Prudnikov, 2009).

Nevertheless, ancient agriculture of Central Asia is understudied, and its study remains a very pertinent issue, since the majority of modern authors project the present arid conditions of the region onto past epochs, and assign a minor role to farming in their economic set-up (Carruthers, 1914: 13; Drobyshev, 2014: 7), or characterize the population as nomadic cattle herders at all times (Carruthers, 1914: 7–8; Serdobov, 1971: 92, 215–216; Grach, 1980: 39–44). This does not always correspond with reality. Continued study of little-known chapters in the history of the region, and paleogeographical reconstructions, will enable us to trace the environmental changes in this territory and to determine the causes thereof. Moreover, studies of ancient irrigation are of the utmost practical interest, since they allow the possibility of using the ancient irrigation lands at the present time.

Interpretation of aerial and space images of the territory of Northern Mongolia helped to discover signs suggesting that traces of ancient agriculture were, possibly, distributed across the whole mountain frame of the Uvs Nuur Basin. A distinctive pattern of irrigation systems revealed the large areas of ancient irrigation. In addition, probable remains of an ancient city were discovered on the west coast of Lake Uvs Nuur, in the Khundelen-Gol River valley; and numerous traces of presumable settlements associated with ancient irrigation systems were found in the Tes-Khem River valley. No ruins of the city or settlements are marked on the old maps plotted by researchers of the Uriankhai Territory. These objects and remnants of irrigation systems in the Tes-Khem valley were not presented in the archaeological description of the Uvs Nuur Basin (Hudiakov, 1986). There are no references thereto in the monograph by Drobyshev either (2014). Thus, finding the solution to this issue is very topical from the viewpoint of several scientific disciplines.

Research objective, methods of study

Interpretation of surface, identification of ancient farming objects on satellite images with subsequent in-situ clarification is one of the basic methods for studying ancient agro-irrigation landscapes. The purpose of this paper is to verify in-situ the results of the interpretation of satellite images of the Uvs Nuur Basin territory, which could be used as evidence of the existence of widely developed irrigation farming in the past in the Tes-Khem valley, and of settlements, including the object identified as a fortified settlement. It was proposed to determine the age of these settlements, and to reconstruct the conditions of their locations.

To achieve this purpose, a Russian-Mongolian scientific research expedition was undertaken to the Uvs Nuur Basin in summer 2013, supported by the Russian Geographical Society (Project No. 31/2013-H4), aimed at landscape observations and complex scientific field studies. Paleobotanical studies were conducted by the paleocarpologist V.L. Koshkarova (V.N. Sukachev Institute of Forest,

SB RAS, Krasnoyarsk). Radiocarbon dating of the objects was conducted in laboratories of research institutes at Novosibirsk (Laboratory of Cenozoic Geology and Paleoclimatology of the V.S. Sobolev Institute of Geology and Mineralogy, SB RAS) and St. Petersburg (Radiocarbon Group of the Archaeological Technology Laboratory of the Institute for the History of Material Culture, RAS). Archaeological study of the discovered objects was also planned; but, since the Mongolian team failed to provide their archaeologist, only visual examination of the present-day outer surface of the monuments was performed.

In-situ confirmation of the existence of ancient agriculture

In the course of our expedition throughout the basin we observed traces of ancient irrigation systems, land allotments, and irrigation fields, in various places: on the proluvial-colluvial plumes of the mountain slopes of the Tannu-Ola ridges, on the spurs of the Sangilen mountains, in the northwest part of the basin, on vast desertified plains, in the valleys of rivers, and in small oases among hummock-ridged eolian landscapes. The valley of the Tes-Khem River (the main stream of the basin) is covered by irrigation canals along almost its whole length (Fig. 1). The scope of irrigation works is very considerable. At present, principal canals many kilometers long look like blind creeks up to several meters wide; however the raised clay slopes allow irrigation systems to be recognized in them. Their irrigating grooves are confined by elongated chains of woody vegetation. In the steppe part, water for irrigation systems was taken directly from the river: the canal sections adjacent to the river's course are often positioned at a right angle to it. This hampers the outflow of the water due to gravity, and suggests either its high level, frequent precipitation that facilitated the rise of the water, or the existence of specially equipped elevators to supply water to the canals. The irrigated areas were from hundreds of square meters to tens or even hundreds of hectares. The irrigation systems had cellular, weblike, fan-shaped, or other structures. At present, ancient irrigation canals are covered by fluvial sediments.

With the permission of the administration of the Uvs Nuur Reserve, several sections of soil, including those on ancient agro-irrigation landscapes of the Tes-Khem valley, were established for scientific studies. These revealed highly humus and sufficiently thick horizons of ancient soils under recent fluvial sediments. Certainly, water (in our case, the inexhaustible source of the Tes-Khem River) is the primary requirement for the development of farming, but the presence of fertile soil is of no less importance. In one of the soil sections, an example of the physical removal of a fertile horizon (a drastic reduction of fertile layer without any traces of erosion) can be observed. Extraction of soils for

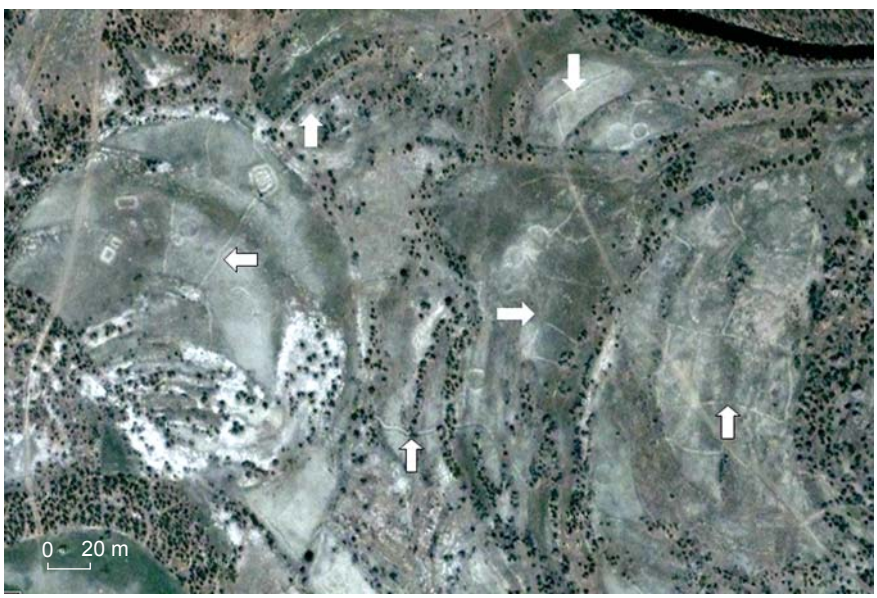


Fig. 1. Remains of irrigation systems in the lacustrine basin of the Tes-Khem valley (the arrows point to the beds of ancient irrigation canals).

relocation to new fields was noted by P.K. Kozlov during his travel across Western China (1947: 286).

Special features of the basin's relief are favorable for the development of sai agriculture, the traces of which are preserved along its entire mountain frame. Irrigation of land allotments in the lower reaches of small mountain rivers and intermittent streams (sais) decaying on the valley plain is one of the earlier (Neolithic) stages in the development of irrigated farming (Shishkin, 1981: 8–24). Therefore, the presence of traces of this in the Uvs Nuur Basin may point to a considerable age for the agriculture in this territory. Possibly its appearance is related to migrants from ancient farming regions: for example, the Aral Sea region. Meanwhile, the absolute age of buried soils under the bed of a canal of an ancient fan-shaped system in the Tarlashkyn-Khem valley (the northern framing of the Uvs Nuur Basin), which is 2110 ± 50 years, gives evidence that advanced irrigation farming already existed in the Uvs Nuur Basin at the turn of the Christian era (Prudnikova, 2015).

The conducted paleobotanical studies have allowed the character of the vegetation cover in the central part of the basin to be determined. The vegetation species' composition is evidenced by the results of analysis of individual samples selected in 2013.

Sample No. 13. The upper reach of the Nariin Gol River, the right slope. Peat-bog. The depth of sampling is 1 m. The content of fossil plant macroremains in the residual fraction is: *Picea obovata* Ledeb. (16 acerous leaf fragments and 8 bark fragments); *Pinus sylvestris* L. (five bits of cone scales, 13 small charcoals); *Larix sibirica* Ledeb. (two acerous leaf fragments); *Betula alba* L. (a fragment of female ament scale); *Carex pediformis* C.A. Mey. (2)*; *Carex* sp. (3); *Arabis pendula* L. (2); *Campanula rotundifolia* L. (1); *Artemisia commutate* Bess. (3); *Bromopsis inermis* (Leyss.) Holub (3).

Sample No. 7. The upper reach of the Nariin Gol River, the right slope. Gray fine-grained sand. The depth of sampling is 23–33 cm. The content of plant macroremains is: *Pinus sylvestris* L. (four small charcoals), *Padus avium* Mill. (4), *Fragaria viridis* Duch. (2), *Salsola* sp. (3), *Suaeda* sp. (1), *Eleocharis* sp. (2), *Carex enervis* C.A. Mey. (2), *Draba nemoresa* L. (2), *Triticum* sp. (2), *Atriplex* sp. (1), *Chenopodium album* L. (39), *Ch. rubrum* L. (2).

These data mean that local vegetation was represented by spruce-deciduous sedge-grass community, and its surroundings by steppe pine forests. The presence of forest in the central part of the Uvs Nuur Basin during the Late Quaternary* points to a milder and more humid climate in this region of Central Asia. At present, the common pine (*Pinus sylvestris* L.) is absent in most of the basin, including its center (Mongolskaya Narodnaya Respublika, 1990: 74).

In the buried soil horizons of land-plots in the upper Nariin Gol, remains of *Triticum* sp. (wheat) seeds were found for the first time. In the sections of ancient agro-irrigation landscapes of the Tes-Khem, seeds of *Panicum* sp. (panicum) and *Avena* sp. (oats) have been discovered. Apart from cultivated plants, *Setaria viridis* L. (green bristle grass), *Cerastium arvense* L. (starry grasswort), *Agrostemma githago* L. (common corn cockle), *Chenopodium glaucum* L. (pigweed), *Linum perenne* L. (perennial flax), and others are represented. Generally, the presence of such weeds is typical of old-arable soils that were long used for sowing of cultivated grain varieties.

The simultaneous presence of the common pine, the Siberian larch, the Siberian spruce, and wheat points to the fact that forest communities and forest-steppe landscapes existed here rather recently, at least at the time of medieval agriculture, when the Uvs Nuur Basin was not represented by desertified landscapes with massifs of wind-blown sands, as it is today.

In-situ confirmation of settlements

As noted above, the presence of numerous and varied traces of settlements associated with ancient canals was presumed in the Tes-Khem valley (Fig. 2). Indeed, these were recorded on the ground. The preservation of buildings varies. Some are fully destroyed, and are represented by accumulations of clay masses with gravel and rubble. However, certain buildings still have the remains of walls. Judging by the outlines, the settlements were represented by accumulations (often chaotic) of small adobe houses rectangular in plan view (Fig. 2, *1–3*), sometimes with the presence of large manors (Fig. 2, *4–6*). In the vicinity of several "crescent-shaped" structures, there were elongated buildings with inner cellular structure (Fig. 2, *7*, *8*), which resembled constructions located along the inside perimeter of the Uyghur fortress of Por-Bazhyn,

*Hereinafter, the digits in brackets designate the number of discovered macroremains.

*This is also confirmed by recent (2016) data of carpological analyses of samples taken on the left slope of the Nariin Gol River.

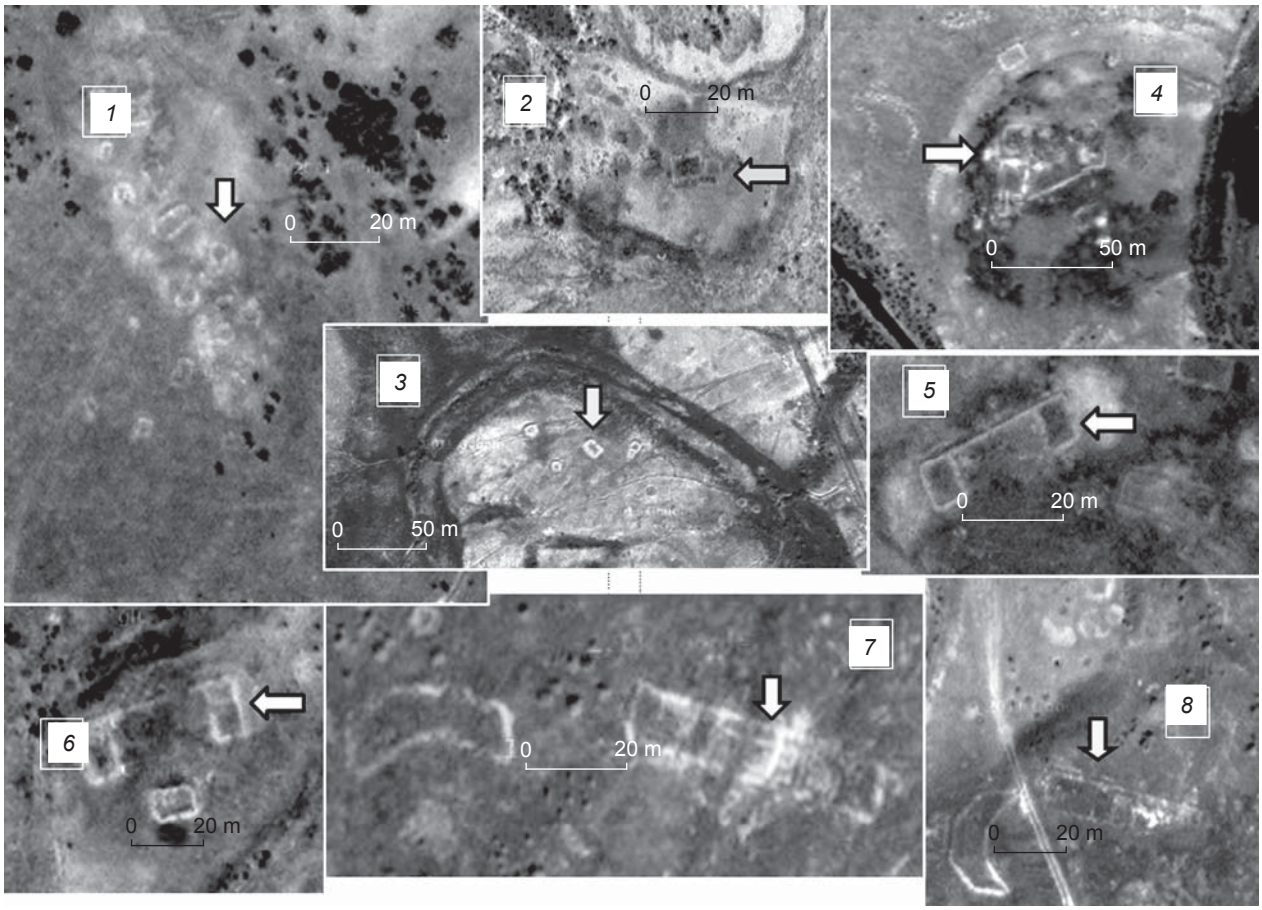


Fig. 2. Remains of settlements in the Tes-Khem valley.
1–3 – traces of settlements; *4–6* – various forms of manors; *7*, *8* – traces of "crescent-shaped" structures and adjacent elongated buildings.

in the east of Tuva (Arzhantseva et al., 2008). The canals and buildings are presumably of various ages, and may pertain to several historical periods.

The object revealed at the west coast of Lake Uvs Nuur, and preliminarily identified as a city, indeed proved to be a fortified settlement. It is located at a large distance from modern highways, and has no access roads. The fortified settlement is situated on a dry terrace on the right slope of one of the Khoit-Khendlen-Gol River creeks, some 10 km from the present-day west coast of Lake Uvs Nuur. It is oriented with its long sides along a NNE–SSW axis (Fig. 3).

A system of irrigation canals approaches the walls of the fortified settlement from the west and south sides (Fig. 3, *1*). It seems as if the settlement was built on the fields with the already existing canals, i.e. it is younger than they. After construction of the town walls, the initial branched canals within the city were corrected, and their directions were changed. One of them, in the southwestern part, sharply changes its direction at an angle of 90° and approaches the internal structure, behind which it branches off and leaves the settlement in the northeastern sector. The northeastern corner of the settlement stops at the Khoit-Khendlen-Gol River channel, where a lake-shaped expansion is observed (Fig. 3, *2*).

The city was enclosed with light adobe walls (Fig. 3, *3*), which clay material comprised a large share of sand, gravel, and rubble. The thickness of the town walls is about 3 m, their current height does not exceed 1 m. The town gate is not well-defined. In the southern part of the settlement, rather well-preserved remains of square and rectangular structures are located (Fig. 3, *4*). Their walls are made of light sun-dried bricks (of average size 30 × 20 cm) laid flat and on edge (Fig. 4, *1*). Small additional premises adjoin the walls of the main structures. Remains of adobe walls have also been discovered. Canes and tree-branches were used to reinforce structures, or for some other purposes. Brickworks often contain grass and straw interlayers; clay and sun-dried plaster elements are preserved at

Fig. 3. Fortified settlement in the Khoit-Khendlen Gol valley and its vicinities.
1 – beds of canals; *2* – lake-shaped expansion of the river, a possible location of a mill; *3* – the town wall of the fortified settlement; *4* – remains of internal structures; *5* – clay masses outside of the city, possible ruins of ancient buildings; *6* – traces of a city dump; *7* – locations of millstones; *8* – location of a cast iron boiler fragment; *9* – location of a plate with lettering; *10* – location of a soil section outside the town wall, established in June 2013.

certain places. Burnt tree-trunks that were used as supports for some constructions, as well as rectangular holes (30 × 40 cm) from burned-out or destroyed supports, are encountered. At several locations, among ruins, remains of multi-story buildings are present (Fig. 4, *2*).

The structures in the northern part of the settlement are fully destroyed, and represent solid clay masses with rare sun-dried brickbats (possibly, these are more ancient structures). There were fires in the city, obvious traces of which are observed in several areas: the clay and bricks have acquired a reddish hue, grassy interlayers have burned out, and abundant ash deposits are noticed.

Outside the town walls, in the adjacent territory, large and small objects were revealed in the satellite images. These were considered settlements, and indeed, they turned out to be so. In general, regular outlines of these destroyed structures are preserved (see Fig. 3, *5*). A large dump, the traces of which are recorded in the form of a humic spot, was located southward of the city (see Fig. 3, *6*).

In the southern part of the settlement, an intact millstone and a fragment (ca 35 × 25 cm) of another millstone with hewed-out grooves (see Fig. 3, *7*; 4, *3*, *5*), and also, presumably, the remains of a stone structure of rotary mill were discovered (see Fig. 4, *4*). The diameter of the intact millstone is about 2 m. There is a circular hole at the center, and a small rectangular recess at the edge. The millstone has fully "grown into the ground" and is covered by recent fluvial sediments, therefore its thickness was not determined. It is not clear, either, whether it is the upper millstone (the runner) or the lower millstone. It can be tentatively assigned to the second group, according to the classification by R.S. Minasyan (see (Sarapulov, 2013)). The millstones are hewed out of medium-grained granite (red and white). Their presence suggests that either a water-mill (probably at the place of the lake-shaped expansion of the river) or an animal-powered mill was available in the city.

In the southern part of the settlement, a small fragment of a cast-iron boiler was found on the surface of one of the premises (see Fig. 3, *8*). It is adorned with relief decoration: a meander ornament engirds the upper part; below, an image of tree (with a bird?) and, possibly, a fallow deer are discernible. Rare potsherds are encountered on the present-day surface of the settlement. These are glazed ceramics with predominantly light turquoise green, or various blue-and-white, glazes. More rare are unglazed easel ceramics. In the dump area, fragments of ware are more varied; certain samples are decorated with overglaze drawings. Taking into account the large population of this territory in the past, the presence of the Altyn Khans' headquarters in the basin, and

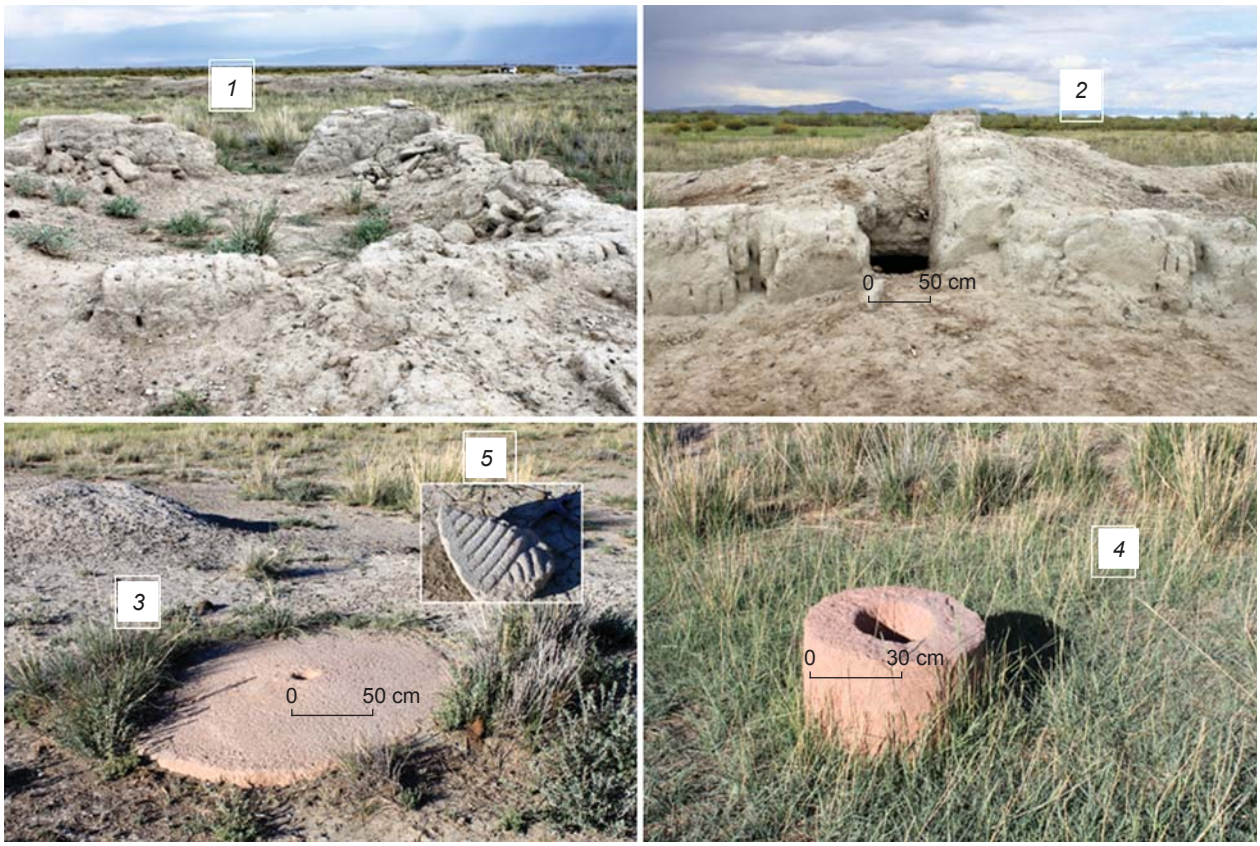


Fig. 4. Elements of the fortified settlement in the Khoit-Khendlen Gol valley. Photograph by T.N. Prudnikova, 2013.
1 – walls of structures composed of sun-dried bricks; *2* – preserved remains of the second floor of the building; *3–5* – millstones and a part of the stone structure of a mill.

numerous "Chinese guards" along the southern slope of the Tannu-Ola Ridge (Ritter, 2007), ceramics may be of various ages.

Among the ruins of one of the inner rooms (see Fig. 3, *9*), a small plate (ca 12 × 5 cm) with poorly preserved lettering written in black ink was discovered. In the opinion of V.P. Zaytsev, Researcher of the Department of Far Eastern Studies at the Institute of Oriental Manuscripts RAS (St. Petersburg), these are hieroglyphics (Chinese, Jurchen, or Khitan large script).

A soil section outside the town wall (see Fig. 3, *10*) has allowed clarification of certain points in the history of the city, which existed for a long time and survived epochs of desolation. At some point in time, the town wall was actually leveled to the ground. A topsoil of thickness ca 10 cm, rich in humus, had enough time to form on the rampart's remains. Then, the wall was heightened; a clay addition ca 60 cm thick is preserved on top of the buried soil layer. This may be indicative of revival of the city at a new historical stage. According to the results of radiocarbon analysis (conducted by L.A. Orlova in the Institute of Geology and Mineralogy, SB RAS), the age of the soil horizon (recorded in a probe trench) buried on the town wall is 1010 ± 40 years (SOAN-9196). At this stage of studies, this suggests that destruction of the town wall and the formation of a soil layer on its debris took place at the end of the 1st millennium AD.

In terms of its shape and size (ca 215 × 155 m), the fortified settlement resembles similar medieval sites of neighboring Tuva, of which there are about 20 (Kyzlasov, 1959). The nearest Uyghur fortified settlements are located just 100–150 km away. The Uyghur period (the Early Middle Ages) is associated with the flourishing of agriculture in the ancient Tuva (Prudnikova, 2005). Therefore, it can be assumed that the city discovered in the Uvs Nuur Basin was established in the Early Middle Ages: "even Arabian geographers mentioned the vast scale of building of towns, fortresses, and settlements in the Central Asian Uyghur state in the 8th century AD" (Kyzlasov, 1998: 11–12). The city could also have been founded at a later time—for example, by the Yenisei Kyrgyzs

who destroyed the Uyghur state in 840. The ancient farming culture of the Yenisei Kyrgyz people is widely known. After the victory over the Uyghurs, the military settlers in the new territories facilitated development of irrigation farming, which was widely developed during that period in the Minusinsk Basin (Istoriya Khakasii…, 1993: 73; Sunchugashev, 1989: 9–10, 15; Serdobov, 1971: 108).

The discovered additional structure of town walls suggests a prolonged existence for the settlement, i.e. it could have been restored after the departure of the Kyrgyzs from the Uvs Nuur Basin—for example, under the onslaught of the Khitans, who started occupying a dominant position in Central Asia in the 10th century. The Khitans built their cities, which extended in a chain-like manner from east to west, and resettled Chinese and Bohai farmers there (Drobyshev, 2010; Istoriya Dalnego Vostoka…, 1989: 196). According to Drobyshev, at the turn of the 10th–11th centuries garrison fields were created along the borders of the Khitan Empire; the border guards were obliged to till these fields and store grain to supply the army (2010). The Khitans had their own writing systems ("large" and "small") (Bembeev, 2003). A sample of hieroglyphics found at the fortified settlement argues for the presence of the Khitans in this region, as does also its age.

At the end of the 11th century, in the area of the Talas and Chu rivers, a small state of the Qara Khitais (the Kara Khitans), Western Liao (Si Liao, 1124–1211), was established (Vasiliev, 1998: 62). In the opinion of L.R. Kyzlasov (1959), in the 12th–13th centuries the center of its northern province was located in the territory of Tuva. The Qara Khitais sowed almost all varieties of grain (wheat, barley, millet, etc.) known in China at that time, and manufactured large millstones for mills. Later, the Mongols who squeezed out the Qara Khitais also built cities and created military-agricultural settlements in the captured territories. The earliest data on such settlements in Tuva pertain to 1220 (Kyzlasov, 1969: 138–143). Thus, the city discovered in the Uvs Nuur Basin could have existed at least till the 14th century.

Conclusions

Analysis of satellite images of the Uvs Nuur Basin, and subsequent in-situ verification of their interpretation results, using science-based methods, allow us to confirm the presence of extensive evidence of ancient irrigation in this area; to see the overall picture of irrigation systems; to identify their lengths, types, and special features; to calculate the areas of land allotments and the degree of disturbance and drying out of landscapes; and to record the remains of farming settlements associated with irrigation systems. The large scale of irrigation works points to a considerable size for the population that inhabited this territory earlier. A branched pattern of irrigation systems suggests a sufficiently high level of irrigation development. Humus-rich buried soils, which present a favorable condition for farming, as well as kernels of *Triticum* sp., *Panicum* sp., and *Avena* sp. cultivated grains, have been discovered on the ancient agro-irrigation landscapes. The results of paleobotanical studies showed that arid regions in the central part of the Uvs Nuur Basin were, in the past, forest-steppe landscapes. The simultaneous presence of forest-steppe plants and grain crops suggests the existence of farming here.

The existence of an ancient fortified settlement earlier unknown to science and preliminarily dated back to the Early Middle Ages has also been confirmed. The presence of irrigation systems surrounding the settlement and the occurrence of millstones in its territory make it possible to attribute this site to the farming settlements. The discovered example of hieroglyphics (Chinese, Jurchen, or Khitan large script) may argue for the medieval age of the fortified settlement.

The obtained data shed new light on the region's history. At the beginning of the 2nd millennium AD, the natural environment was as yet relatively undisturbed, and therefore favorable for farming, of which extensive evidence has survived to the present day. In view of this, it is wrong to label the currently arid areas of the Uvs Nuur Basin and Central Asia as infertile and "actually unsuitable for farming" in past historical epochs (Drobyshev, 2014: 370). The main reason for desertification of the basin is deforestation, which caused the reduction of the groundwater level. In this regard, we may refer to the opinion of Kozlov, who pointed to an unlimited forest loss on the Alashan Ridge, leading to drying-up of brooks and wells, and predicted the coming impoverishment of the region (1947: 122–123). The role of overgrazing by cattle should not be downplayed either. The discovered ancient agro-irrigation landscapes of the Uvs Nuur Basin are a potential source of food resources, since many areas that were irrigated in ancient times are quite suitable for farming today.

Acknowledgments

This study was supported by the Russian Geographical Society (Project No. 31/2013-H4). The author expresses her gratitude to Director of the Ubsunur International Centre for Biosphere Research S.S. Kurbatskaya (Kyzyl, Russia), Director of the Uvs Nuur Reserve M. Ankhbayar (Ulaangom, Mongolia), Director of the Uvs Nuur Basin Reserve V.I. Kanzai (Kyzyl, Russia), all participants in the Russian-Mongolian expedition; Researcher of the Institute of Oriental Manuscripts of the RAS V.P. Zaytsev (St. Petersburg, Russia), Senior Researcher of the V.N. Sukachev Institute of Forest V.L. Koshkarova, researchers of the Tuvinian Institute for Exploration of Natural Resources of the SB RAS S.G. Prudnikov, O.D. Ayunova, V.I. Lebedev, and O.I. Kalnaya (Kyzyl, Russia), participants in the Central Asian archaeological expedition M.E. Kilunovskaya, V.A. Semenov, V.A. Kisel, S.A. Khavrin, K.V. Chugunov, and Y.I. Ilikhina (Institute for the History of Material Culture of the RAS, Peter the Great Museum of Anthropology and Ethnography of the RAS, the State Hermitage Museum, St. Petersburg, Russia), and others who rendered assistance in the research.

References

Antropogenniye preobrazovaniya aridnykh regionov. 2011
V.P. Chichagov, O.A. Chichagova, A.A. Golieva, T.N. Prudnikova. Moscow: Inst. Geogr. RAN.

Arzhantseva I.A., Mkrtychev T.K., Zavyalov V.A., Inevatkina O.N., Vafeev R.A., Modin I.N., Panin A.N. 2008
Por-Bazhyn – pamyatnik drevney Tuvy. In *Uryankhay: Tyva Depter: v 7 t.,* S.K. Shoigu (comp.). Vol. 7: Drevnosti Tuvy: Arkheologicheskiye pamyatniki: Bronzoviy vek – konets XIX veka. Moscow: Slovo, pp. 886–898.

Ashak-ool A.C. 1984
K voprosu ob izuchenii tuvinskogo zemledeliya. In *Problemy istorii Tuvy*. Kyzyl: Tuvinskiy NII yaz., lit. i ist., pp. 124–139.

Bembeev V.S. 2003
Imperiya Lyao. URL: kalmyki.narod.ru/history/bembeev/bembeev-2.html (Accessed May 5, 2014).

Bichurin N.Y. 1950
Sobraniye svedeniy o narodakh, obitavshikh v Sredney Azii v drevniye vremena, vol. I. Moscow, Leningrad: Izd. AN SSSR.

Carruthers D. 1914
Nevedomaya Mongoliya, N.V. Turchaninov (trans.). Petrograd: Pereselen. upr. Gl. upr. zemleustroistva i zemledeliya. Vol. 1: Uryankhaiskiy kray.

Drobyshev Y.I. 2010
Politika kidaney v Tsentralnoy Azii. In *Obshchestvo i gosudarstvo v Kitaye: XL nauch. konf*. Moscow: Inst. Vostoka RAN, pp. 108–122. (Ucheniye zap. otd. Kitaya Inst. Vostoka RAN; iss. 2).

Drobyshev Y.I. 2014
Chelovek i priroda v kochevykh obshchestvakh Tsentralnoy Azii (III v. do n.e. – XVI v. n.e.). Moscow: Inst. Vostoka RAN.

Dulov V.I. 1952
Zemledeliye u tuvintsev v XIX – nachale XX v. In *Materialy po istorii zemledeliya SSSR*. Moscow: Izd. AN SSSR, pp. 304–321.

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

Hudiakov Y.S. 1986
Dinamika eikumenizatsii severo-vostoka Ubsunurskoy kotloviny. In *Informatsionniye problemy izucheniya biosfery*. Pushchino: ONTI NTsBI AN ASSR, pp. 230–247.

Istoriya Dalnego Vostoka SSSR s drevneishikh vremen do XVII veka. 1989
Moscow: Nauka.

Istoriya Khakasii s drevneishikh vremen do 1917 goda. 1993
Moscow: Nauka.

Kazimirsky S. 1942
Irrigatsiya posevnykh ploshchadey v TNR. *Pod znamenem Lenina-Stalina (polit-ekonom. zhurn. TK Tuv. nar.-rev. partii)*, No. 3: 71–88.

Kiselev S.V. 1951
Drevnyaya istoriya Yuzhnoy Sibiri. Moscow: Akademizdat.

Kon R.Y. 1952
Predvaritelniy otchet. In *Materialy po istorii zemledeliya SSSR*. Moscow: Izd. AN SSSR, pp. 106–108.

Kozlov P.K. 1947
Mongoliya i Amdo i mertviy gorod Khara-Khoto. Moscow: OGIZ.

Kyuner N.V. 1961
Kitaiskiye izvestiya o narodakh Yuzhnoy Sibiri, Tsentralnoy Azii i Dalnego Vostoka. Moscow: Izd. vost. lit.

Kyzlasov L.R. 1959
Srednevekoviye goroda Tuvy. *Sovetskaya arkheologiya*, No. 3: 66–80.

Kyzlasov L.R. 1969
Istoriya Tuvy v sredniye veka. Moscow: Izd. Mos. Gos. Univ.

Kyzlasov L.R. 1984
Istoriya Yuzhnoy Sibiri v sredniye veka. Moscow: Vysshaya shkola.

Kyzlasov L.R. 1998
Severnoye manikheistvo i ego rol v kulturnom razvitii narodov Sibiri i Tsentralnoy Azii. *Vestnik Moskovskogo gosudarstvennogo universiteta*. Ser.: Istoriya, No. 3: 8–35.

Mannai-ool M.K., Dostay I.A. 1996
Istoriya Tuvy. Kyzyl: Tuv. kn. izd.

Mongolskaya Narodnaya Respublika: Natsionalniy atlas. 1990
Ulan-Bator: AN MNR, Moscow: AN SSSR.

Prirodniye usloviya Tuvinskoy avtonomnoy oblasti. 1957
Moscow: Izd. AN SSSR.

Prudnikova T.N. 1999
Drevniye orositelniye sistemy Tuvy. In *Kompleksniye obshchestva Tsentralnoy Yevrazii v III–I tys. do n.e*. Chelyabinsk: Chelyab. Gos. Univ., pp. 345–355.

Prudnikova T.N. 2005
Prirodniye zakonomernosti razvitiya oroshayemogo zemledeliya v drevney Tuve. Cand. Sc. (Geography) Dissertation. Barnaul.

Prudnikova T.N. 2015

Zemledeliye epokhi gunnov na territorii Tsentralnoy Azii (noviye danniye po rezultatam radiouglerodnogo datirovaniya). In *Materialy XV soveshchaniya geografov Sibiri i Dalnego Vostoka (10–13 sent. 2015 g., Ulan-Ude)*. Irkutsk: Izd. Inst. Geogr. SO RAN, pp. 139–142.

Prudnikova T.N., Prudnikov S.G. 2009

Drevniye irrigatsionniye sooruzheniya Kotloviny Bolshykh Ozer Mongolii. In *Seliverstoviye chteniya: Geografiya i geoekologiya na sovremennon etape vzaimodeistviya prirody i obshchestva: Materialy Vseros. nauch. konf. (19–20 noyab. 2009 g., Sankt-Peterburg)*. St. Petersburg: pp. 718–722.

Prudnikova T.N., Prudnikov S.G., Spivakov N.I. 2008

Drevnyaya melioratsiya na yuge Sibiri – orositelniye sistemy epokhi bronzy v Tuve. In *Meliorativnaya nauka na yuge Sibiri: Proshloye, nastoyashcheye, budushcheye: Materialy Mezhdunar. simp. (22–23 maya 2008 g., Abakan)*. Abakan: pp. 61–65.

Radlov V.V. 1894

Sibirskiye drevnosti: v 2 t., vol. 1. St. Petersburg: [Tip. Imp. Akad. nauk].

Ritter K. 2007

Zemlevedeniye Azii. In *Uryankhay: Tyva Depter: V 7 t.*, S.K. Shoigu (comp). Vol. 2: Plemena Sayano-Altaya: Uryankhaitsy (IV v. – nachalo XX v.). Moscow: Slovo, pp. 156–157.

Sarapulov A.N. 2013

Srednevekoviye orudiya dlya pererabotki zerna v permskom Preduralye. *Vestnik Chelyab. Gos. Univ.*, No. 18 (309): Istoriya, iss. 56: 5–11.

Semenov P.P., Potanin G.N. 1877

Zemlevedeniye Azii K. Rittera: v 5 t., vol. 4. St. Petersburg: [Tip. Imp. Akad. nauk].

Serdobov N.A. 1971

Istoriya formirovaniya tuvinskoy natsii. Kyzyl: Tuv. kn. izd.

Shishkin I.B. 1981

U sten velikoy Namazgi. Moscow: Nauka.

Sunchugashev Y.I. 1989

Pamyatniki oroshayemogo zemledeliya v drevney Khakasii. Krasnoyarsk: Krasnoyar. Gos. Univ.

Vasiliev L.S. 1998

Istoriya Vostoka: Uchebnik, vol. 1. Moscow: Vysshaya shkola.

Weinstein S.I. 1969

Proiskhozhdeniye i istoricheskaya etnografiya tuvinskogo naroda: D. Sc. (History) Dissertation. Moscow.

Received February 6, 2015.
Received in revised form March 16, 2017.

DOI: 10.17746/1563-0110.2018.46.1.076-085

I.V. Zhurbin[1] and M.G. Ivanova[2]

[1]Physical-Technical Institute, Ural Branch, Russian Academy of Sciences,
Kirova 132, Izhevsk, 426000, Russia
E-mail: zhurbin@udm.ru
[2]Udmurt Institute of History, Language and Literature, Ural Branch, Russian Academy of Sciences,
Lomonosova 4, Izhevsk, 426004, Russia
E-mail: margrig45@mail.ru

Geophysical Studies at the Kushmanskoye (Uchkakar) Fortified Settlement, Kama Basin

This article presents the results of interdisciplinary research at the Kushmanskoye (Uchkakar) fortified settlement, dating to the 9th–13th centuries. Using geophysical methods, such as resistivity and magnetometry surveys, ground-penetrating radar, and electrical resistivity tomography, we were able to assess the total area of the site (over 26,000 sq. m), outline its boundaries, evaluate its structure, and reconstruct the layout of all three lines of defensive constructions. Various types of feature were identified: dwellings, utility structures, a group of household- and production-related pits, and the inner fortification line. Excavations, carried out at all parts of the site but covering less than 1 % of its area, supported our preliminary conclusions based on geophysical data. The earliest fortification line, unidentifiable by visual inspection, separates the inner and the middle parts of the site. The prospection survey has revealed the housing plan of the middle and outer parts of the settlement, and the deep features outside the fortified area. The thickness of the cultural layer and its preservation were assessed throughout the site. For the first time at the site associated with the Cheptsa culture, the habitation horizon was revealed outside the fortified area.

Keywords: *Kama basin, Uchkakar, fortified settlement, magnetometry survey, resistivity survey, electrical resistivity tomography, ground-penetrating radar.*

Introduction

Current requirements regarding the preservation of cultural legacy and the need for greater efficiency in field work are among the reasons why geophysical methods in archaeology are gaining importance. The use of a combination of techniques (such as resistivity, magnetometry and ground-penetrating radar surveys, etc.) provides the possibility of a comparative analysis and of a more detailed knowledge of archaeological sites (Geophysical Survey…, 2008; Rabbel et al., 2015; Vafidis et al., 2005). The interpretation of geophysical data (correlating anomalies with archaeological features) is based on the results of excavations.

The complex approach was applied in studies of the Medieval Finno-Ugric settlement of Kushmanskoye (Uchkakar), dating to the 9th–13th centuries (Arkheologicheskaya karta…, 2004: 200–203; Ivanova, 1976; Pervukhin, 1896: 83–86; Spitsyn, 1893: 74) and located in northern Udmurtia (Fig. 1). The geophysical survey has encompassed the whole area that supposedly contains archaeological features

Fig. 1. Map showing the location of fortified settlements attributable to the Cheptsa culture.
1 – Uchkakar; *2* – Idnakar; *3* – Guriyakar; *4* – Dondykar; *5* – Sabanchikar; *6* – Vesiyakar.

(over 26,000 sq. m): the promontory of the bedrock terrace delimited by fortifications; the terrace scarp between the settlement and the Cheptsa River; and the external part of the settlement located outside the outer fortification line*. Plots of the surveys partially overlapped each other, providing a higher accuracy in interpretation of geophysical data (Fig. 2). Electrical resistivity tomography amplified preliminary interpretations**.

A similar approach to multidisciplinary studies is taken by several institutions. The best known surveys are those by the Institute of Archaeology and Ethnography SB RAS (Novosibirsk), examining the structure of settlements and cemeteries in Western Siberia and the Altai, and those by the Institute of Archaeology RAS (Moscow), focusing on sites in the Suzdal Opolye and the Kislovodsk Basin. The most frequently used technique is magnetometry survey, which is most universal and rapid. However, because archaeological features in northern Udmurtia—specifically, at Uchkakar—are magnetically hard to distinguish from the encompassing grounds, preference was given to resistivity survey.

Interdisciplinary research of the inner and middle parts of Uchkakar

According to the analysis of geophysical data (Fig. 3), two areas, differing in layout and the thickness of the cultural layer, can be distinguished and provisionally the termed inner and middle parts of the settlement. The inner part is located on the spit of the promontory. It is delimited by a bow-shaped fortification line (ditch and clay rampart), not visible in the landscape (Fig. 3, *a*). The cultural horizon is actually absent in this area. Just some features deepened into the subsoil were detected: an ellipse-shaped trench measuring 12 by 20 m, and several local pits. The trench adjoins the interior boundary of the clay rampart (Fig. 3, *b*; 7.0–19.0 m range). Two large pits up to 1.5 m deep are located in its northwestern and southeastern parts (Fig. 3, *c*; 4.0–6.5 m and 15.0–17.5 m ranges). The depth of the local pits does not exceed 0.5 m (Fig. 3, *c*; 23.5–25.0 m range). The inner fortification line included the clay rampart and ditch (Fig. 3, *b*; 19.0–27.0 m and 27.0–36.0 m ranges). Magnetometry survey confirmed their location and geometric parameters (Fig. 3, *a*).

Interdisciplinary studies at Uchkakar included excavations of key features revealed by geophysical prospection (Ivanova, Zhurbin, 2012). The results of the excavations (excavation 3; Fig. 2, 3, *a*) supported

*The resistivity survey was performed by Physical-Technical Institute, Ural Branch, Russian Academy of Sciences, and supervised by I.V. Zhurbin; magnetometry and ground-penetrating radar surveys were conducted by the Laboratory of Archaeological Geophysics and supervised by V.G. Bezdudny.

**A joint reference grid of archaeological excavations, resistivity survey, and ground-penetrating radar survey was oriented relative to the true meridian, while magnetometry survey polygons were oriented to the magnetic meridian. We follow the numbering of electrical resistivity tomography profiles within the general measuring system, the beginning of each profile being marked by a yellow dot.

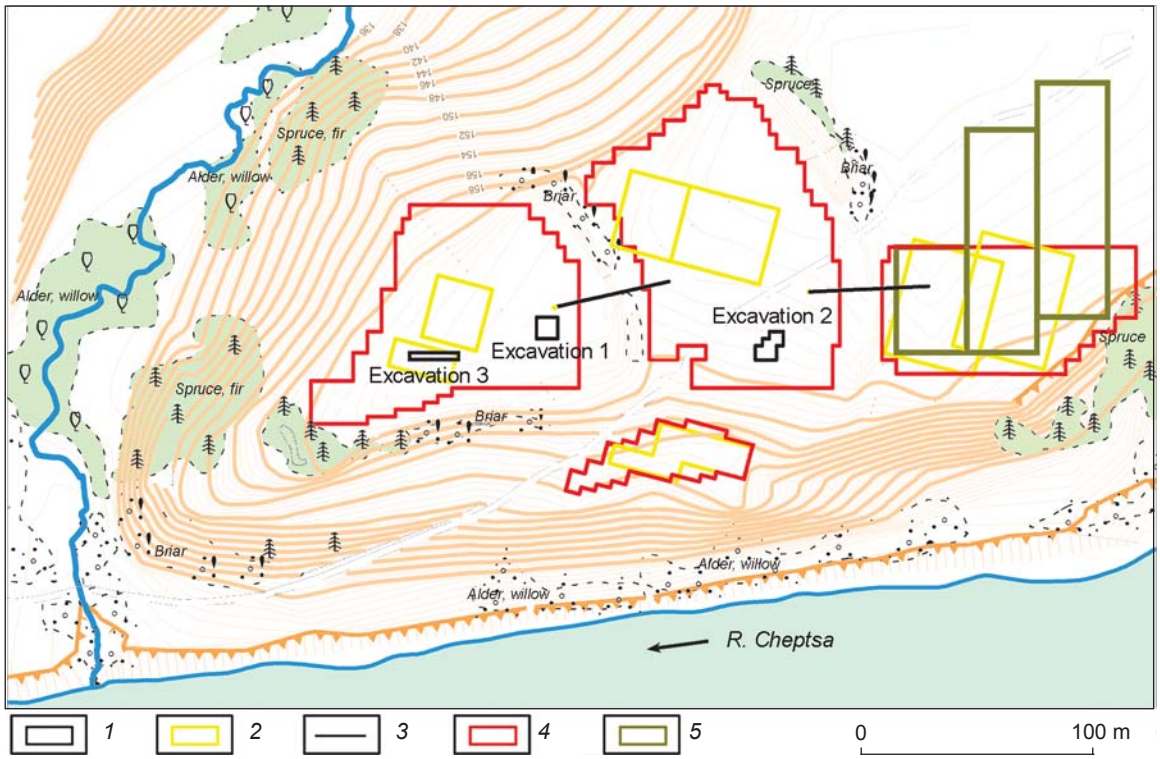


Fig. 2. Topographic plan of Uchkakar (contour interval, 0.5 m; conventional altitude scale) showing location of excavations and geophysical plots (by A.N. Kirillov, with corrections and additions by R.P. Petrov).
1 – excavation; *2* – magnetometry survey plot; *3* – electric resistivity tomography survey line; *4* – resistivity survey plot; *5* – plot of ground-penetrating radar.

the hypothesis that an inner fortification line had been present (Fig. 4), and suggested that after the ditch had been excavated (originally it was 15–16 wide and 1.5 m deep), a rampart was constructed from the subsoil clay. At least two stages in the destruction of the fortifications can be recorded. First, clay sediment from the rampart partially filled the ditch, and soil forming processes started in the upper layers of the fill (layer 2). It is possible that this area was subsequently used (layers 3 and 5). The ditch, partially filled with clay, narrowed to 9–10 m and received low humified loam with coals and organic remains. The described situation is consistent with geophysical prospection. Notably, under the preserved base of the rampart, there was a late rectangular underground structure, possibly utilitarian (Fig. 5). This feature was revealed by resistivity survey (Fig. 3, *a*), while a magnetogram did not show it clearly. The presence of this fortification line indicates that the defense system at Uchkakar consisted of inner, middle, and outer parts, the same as at other large Cheptsa settlements such as Idnakar and Guriyakar (Ivanova, 1998: 212–224; Ivanova**,** 2012: 51; Ivanova, Zhurbin, Kirillov, 2013).

In distinction from the inner part of Uchkakar, the middle part of it is characterized by a thick cultural layer reaching 1.5 m. Combined geophysical survey revealed at least 26 constructions, arranged in six rows, paralleling the fortification lines (Fig. 6). Magnetometry survey allowed us to attribute several vague resistivity anomalies associated with features of the layout. In addition, electrical resistivity tomography was applied to clarify the interpretation. Geoelectric sections "crossing" these anomalies record closed areas of low resistivity: lenses of clay in a heterogeneous humified layer (see Fig. 3, *b*, 34.0–41.0 m range; *d*, 7.0–10.5 m range). Geometric parameters and deposition depth can be assessed as well.

Excavations in the area of one of these anomalies (excavation 1; Fig. 2, 3, *a*) disclosed a large platform from a dwelling (Ivanova, Zhurbin, 2014: Fig. 4; Ivanova, Kirillov, 2013). A similar platform was discovered in the eastern portion of excavation 3 (Fig. 2, 4). Generally, in terms of composition and excavated features, the cultural layer of the Uchkakar site's middle part resembles that of other fortified settlements in the Cheptsa basin dating to the

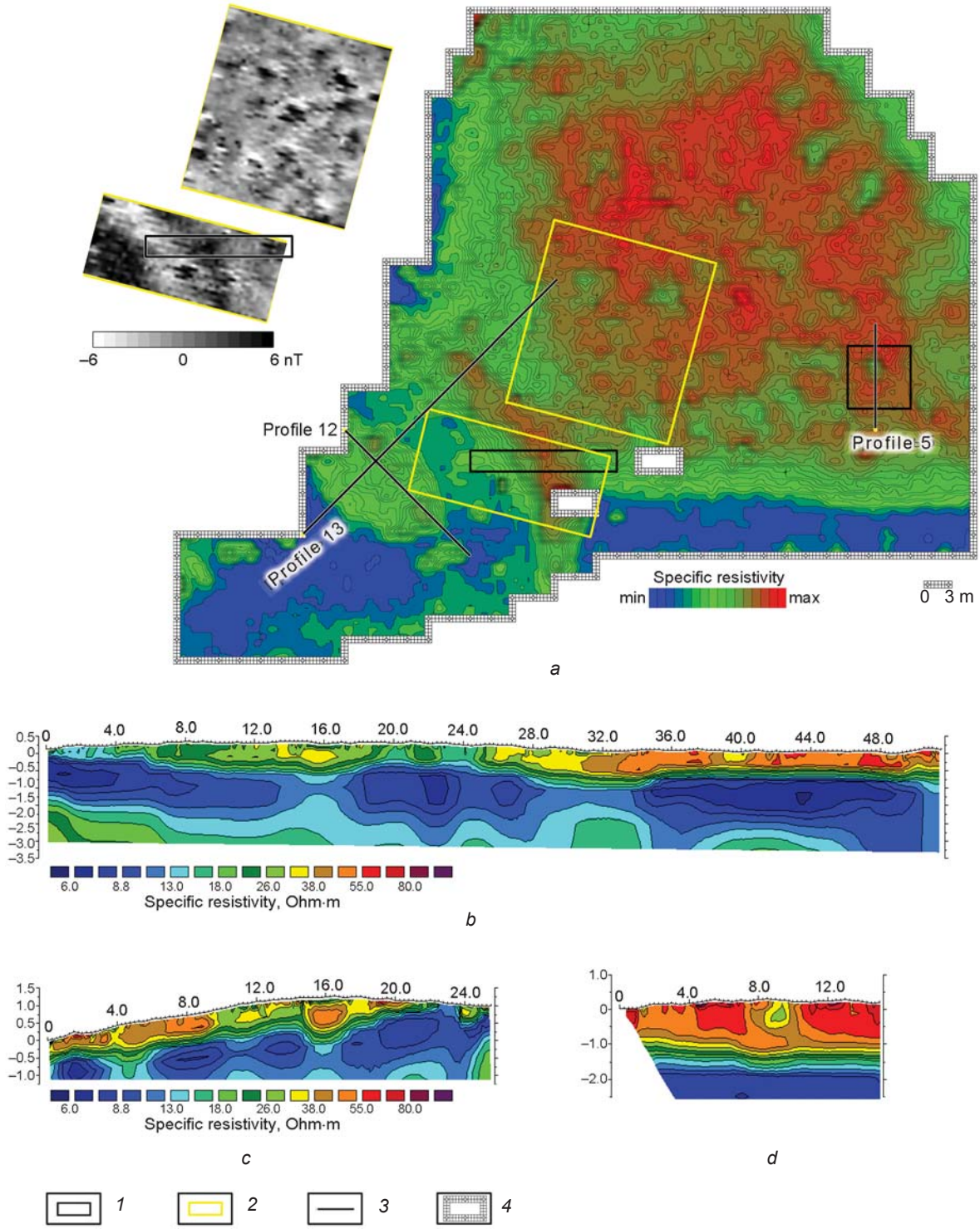


Fig. 3. Results of geophysical studies of the inner and middle parts of Uchkakar.
a – resistivity survey; *b–d* – electric resistivity sections along electric resistivity tomography line profiles 13 (*b*), 12 (*c*), and 5 (*d*).
1 – excavation; *2* – magnetometry survey plot; *3* – electric resistivity tomography survey line; *4* – looting pit unexamined by geophysical methods.

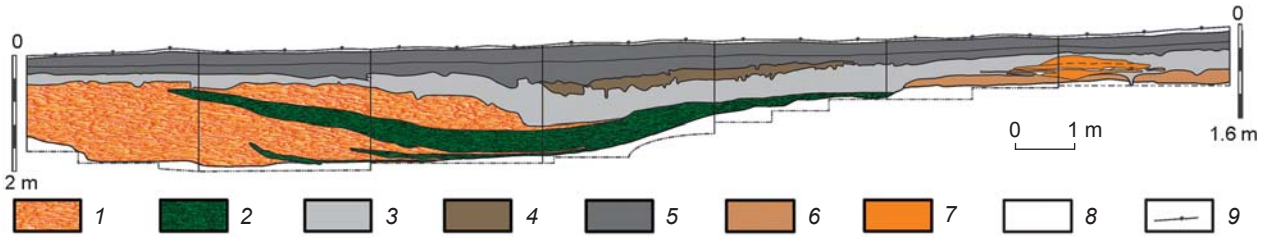


Fig. 4. Generalized scheme of the northern profile of excavation 3 (southern view).
1 – speckled light yellow and light tawny clay; *2* – clay from layer 1, affected by soil-forming processes; *3* – gray and dark gray ashy, humified loam, with coals and organic remains; early horizon of the cultural layer (after the abandonment of the inner fortification line); *4* – dark grayish-brown ashy, humified loam between the early and late horizons; *5* – dark gray humified loam (the upper portion is plowed); late horizon of the cultural layer; *6* – buried soil; *7* – dense and partially ignited clay; *8* – dense red clay of subsoil; *9* – turf.

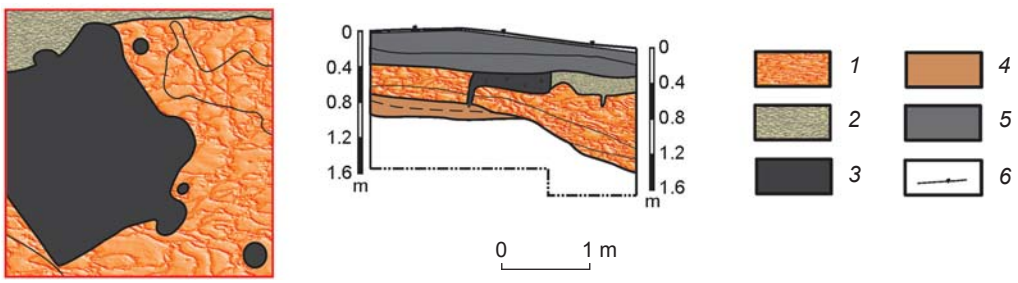


Fig. 5. Generalized scheme of spatial organization and stratigraphy (western side of the excavation) of the late construction on the clay rampart in the inner fortification line.
1 – speckled light yellow and light tawny clay; *2* – dark gray ashy, humified loam with decayed wood; *3* – dark loam with coals; *4* – buried soil; *5* – dark gray humified loam (the upper portion is plowed); late horizon of the cultural layer (after the abandonment of the inner fortification line); *6* – turf.

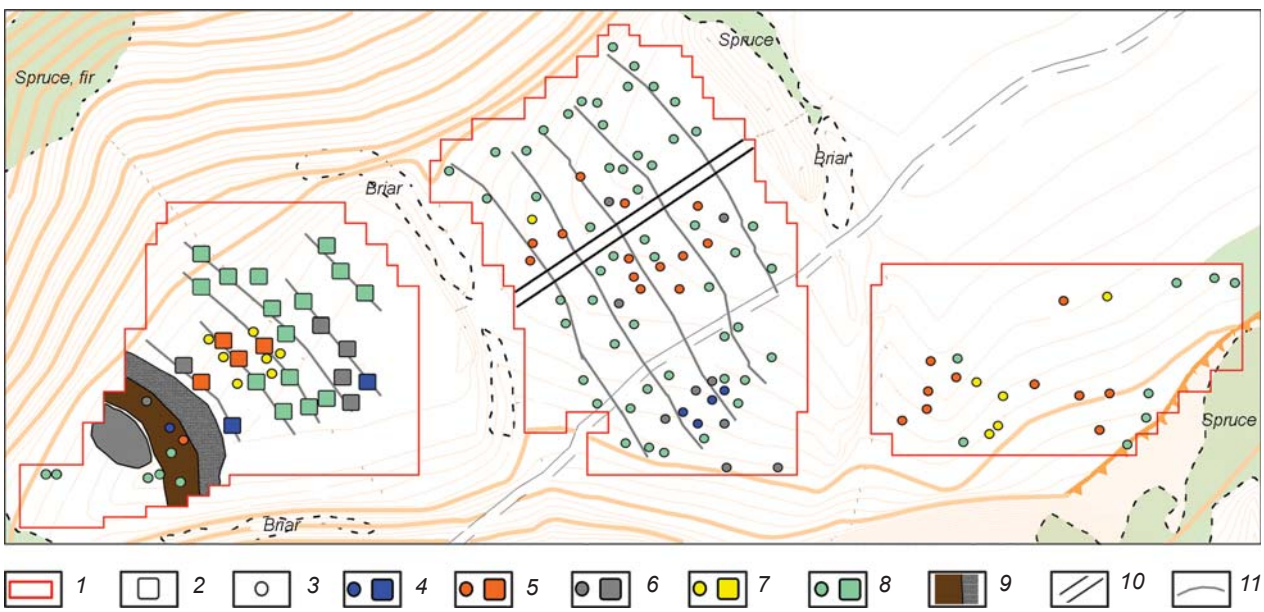


Fig. 6. Reconstructed layout of Uchkakar.
1 – resistivity survey plot; *2* – clay platform; *3* – pit; *4* – features recorded by geophysical studies and confirmed archaeologically; *5* – features recorded by resistivity and magnetometry surveys; *6* – features recorded by resistivity survey and electrical resistivity tomography; *7* – features recorded by magnetometry survey only; *8* – features recorded by resistivity survey only; *9* – clay rampart and ditch of the inner fortification line; *10* – trench of 1930 by A.P. Smirnov; *11* – probable orientation of the rows of constructions.

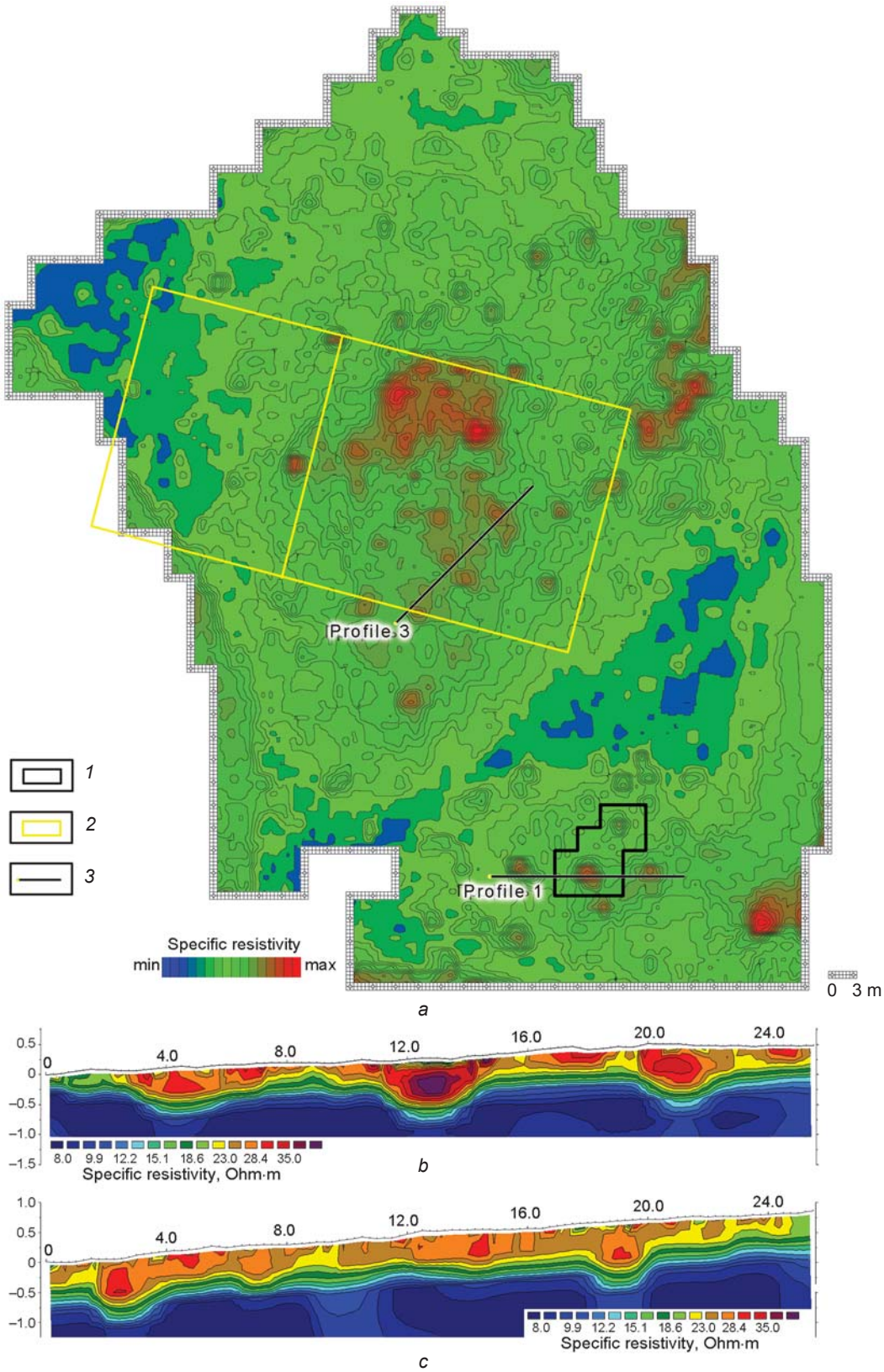


Fig. 7. Results of geophysical studies of the outer part of Uchkakar.
a – resistivity survey; *b*, *c* – electric resistivity sections along electric resistivity tomography line profiles 1 (*b*) and 3 (*c*).
1 – excavation; *2* – magnetometry survey plot; *3* – electric resistivity tomography survey line.

9th–13th centuries: Idnakar, Guriyakar, Vesiyakar, Dondykar, and Sabanchikar (Fig. 1).

A large terrace is located on the southeastern side of Uchkakar's central area. It begins from near the spit of the promontory and extends to the outer rampart (Fig. 2). Magnetometry and resistivity surveys revealed no archaeological features there.

Interdisciplinary research of the outer part of Uchkakar

The outer part of the settlement is delimited by two fortification lines identifiable by visual inspection: the middle and outer ones (Fig. 2, 7, *a*). The cultural layer had been destroyed by plowing. Thicker deposits have been registered in the central part (high resistivity zone). Only deepened features (ca 80 pits) were recorded there. Five indistinct rows of pits, rather evenly distributed over the outer part of the settlement, can be traced (Fig. 6). Resistivity survey allowed us to identify pits of two major types: 3–4 m in diameter (Fig. 7, *b*) and 1.5–2.0 m in diameter (Fig. 7, *c*). In most cases, pits of a larger size induce bipolar magnetic anomalies composed of combined negative and more intense positive parts. This suggests that these pits were associated with production premises (they were filled with slag, ceramics, ash from hearths, etc.). Smaller pits are normally recorded as areas with high magnitudes of magnetic field without distinct adjoining "negative" anomalies. Anomalies of this sort can be associated with pits deepened into the subsoil and filled with humified sediment.

Excavation 2 revealed diverse features (Fig. 2, 7). Among them, two pits of various types were studied completely (Fig. 8, *a*). Excavations showed that one of the "large" pits recorded through resistivity survey (Fig. 7, *b*, 11.0–15.0 m range) consists of two features located one above another: a later round pit and an earlier square pit framed by boards, which were fixed by poles standing in the corners (Fig. 8, *b*). The presence of slag, plaster, fragments of bronze artifacts, a foundry ladle, and a three-sided mold suggests metal casting (Ivanova, 2014; Ivanova, Modin, 2015). The geometric parameters of the pits, and the character of the archaeological remains, agree well with the geophysical data.

Comprehensive geophysical measurements at the middle part of Uchkakar have revealed the area where the trenches excavated by A.P. Smirnov in 1930 criss-crossed each other (confirmed by excavations), and subsequent studies enabled the identification of the location of the trench on the outer part (Fig. 6).

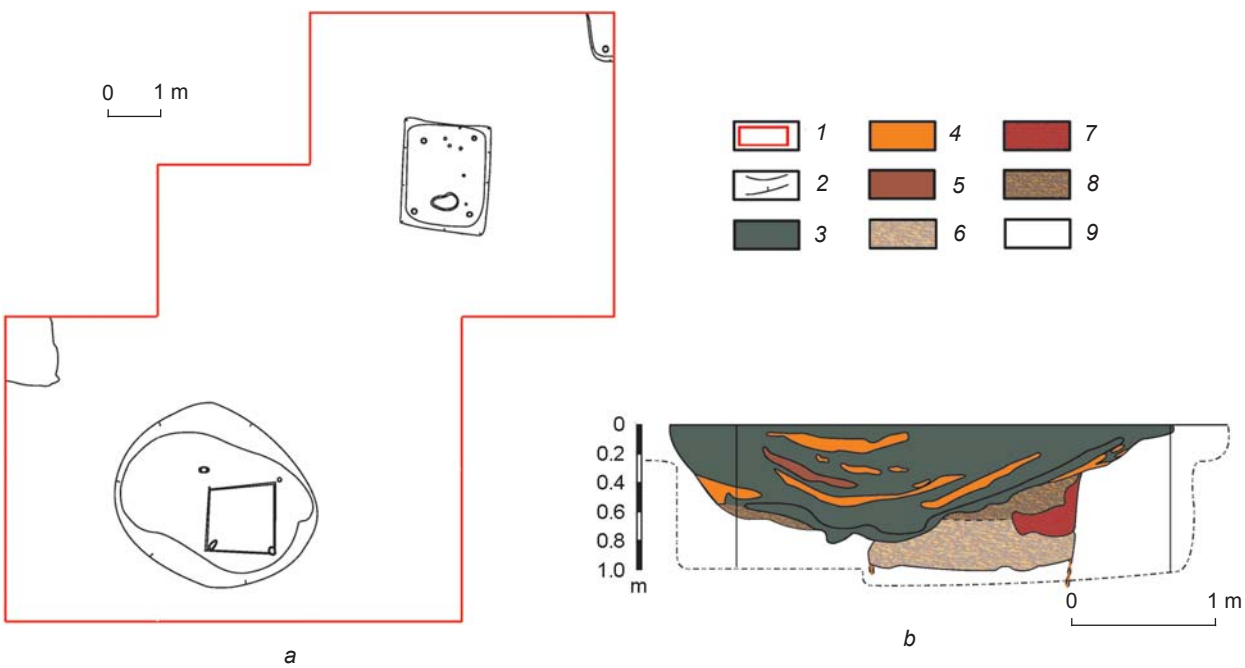


Fig. 8. Spatial organization (*a*) and stratigraphy (*b*) of the pit in excavation 2 in the outer part of Uchkakar.
1 – border of the excavation; *2* – border of features; *3* – dark gray humified loam with coals and ash; *4* – tawny and light tawny clay; *5* – dark brown and whitish-brown loam; *6* – mixed layer (light loam and tawny clay with coals and decayed wood); *7* – loose red clay with a small content of gray loam and coals; *8* –free soil infill on the bottom of a late structure; *9* – subsoil.

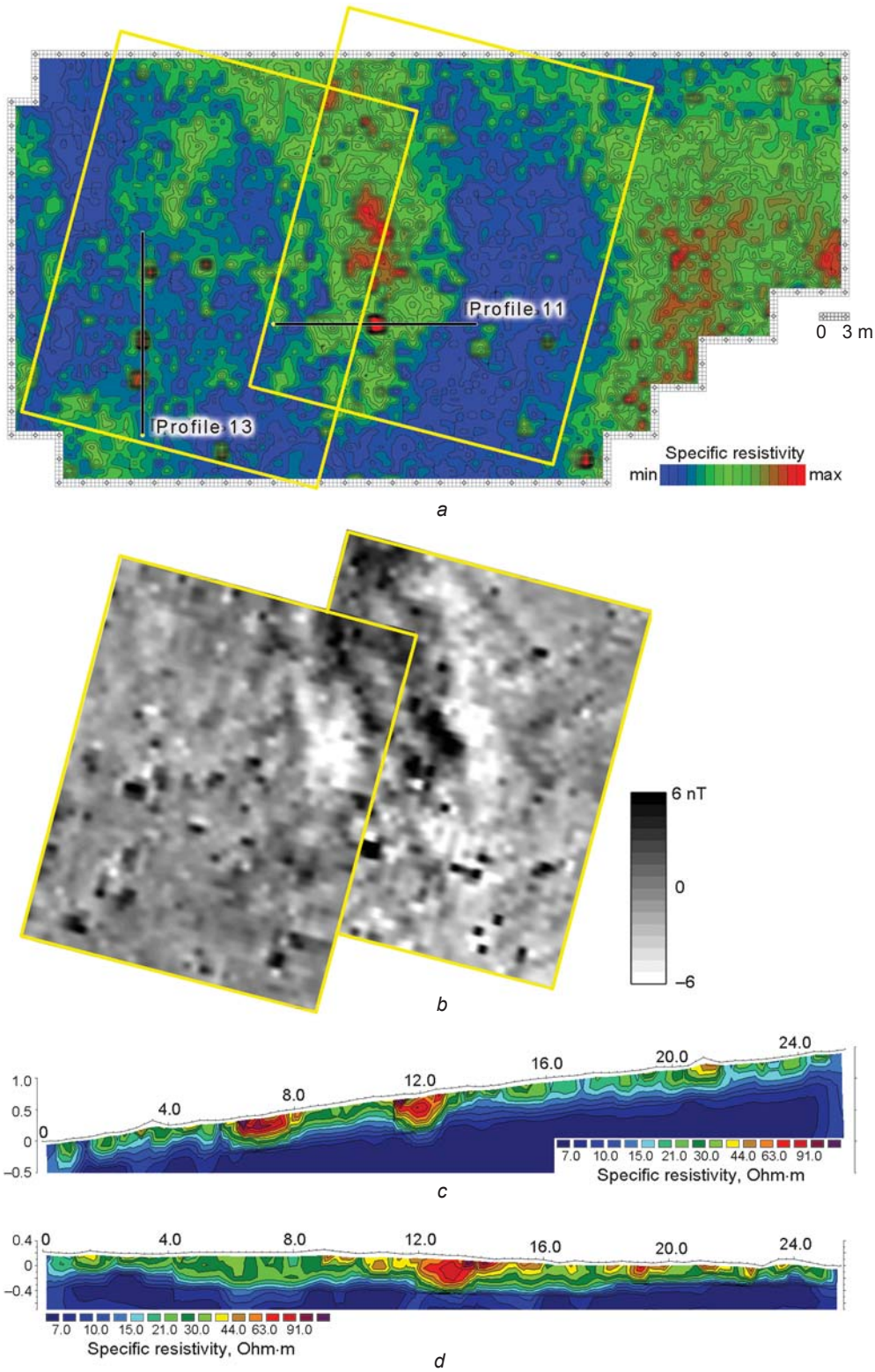


Fig. 9. Results of geophysical studies of the unfortified external part of Uchkakar.
a – resistivity survey; *b* – magnetogram; *c*, *d* – electric resistivity sections along electric resistivity tomography line profiles 13 (*c*) and 11 (*d*).

Geophysical research on the unfortified external part of Uchkakar

Outside the outer fortification line (Fig. 2), the cultural layer was also significantly disturbed (Fig. 9, *a*). Magnetometry survey (Fig. 9, *b*) and electrical resistivity tomography (Fig. 9, *c*, *d*) revealed several subrectangular pits measuring approximately 2 by 2 m and up to 1 m deep. On the magnetogram, such pits correspond mostly to bipolar anomalies. In addition, randomly spaced pits of smaller sizes were recorded. Some of these correspond to local anomalies of higher resistivity, others to areas with high magnitude of magnetic field. No regularities in the arrangement of features can be seen beyond the fortification line (Fig. 6).

Ground-penetrating radar detected no archaeological objects. However, geological features were recorded in that area. In particular, a local zone with a high content of carbonates was revealed in the center of the plot (the bedrock in the settlement's area is carbonate reddish-brown Permian clay with lime rock particles). This peculiarity is registered by magnetometry and resistivity surveys, as well as by electrical resistivity tomography (Fig. 9). The ground-penetrating radar then makes it possible to disregard natural anomalies revealed by the magnetometry and resistivity surveys.

For the first time at the site associated with the Cheptsa culture, the survey has revealed cultural deposits beyond the fortification line—a finding that is highly relevant to the archaeology of the region.

Conclusions

The geophysical studies at Uchkakar resulted in important findings. A hitherto unknown fortification line representing a structural unit of the site was revealed. The general layout was reconstructed, and each structural unit was examined in detail with regard to the thickness of the cultural layer and the shape of features. The structures and sizes of all three fortification lines were evaluated, and features outside the visible settlement border were detected.

As the interdisciplinary investigations have demonstrated, resistivity survey is the most relevant geophysical method for studying settlements of the Cheptsa culture. Magnetometry surveys and ground-penetrating radar are the most suitable methods for general reconstruction of the layout, and electrical resistivity tomography is optimal for a detailed assessment.

At Uchkakar, prospection-guided excavations focused on various structural features, accounting for less than 1 % of the site's area: the inner fortification line, constructions in the middle part, and a group of pits in the outer part. The findings were matched with the combined geophysical map, which allowed us to specify the nature of geophysical anomalies and to reconstruct the general layout of the settlement.

Acknowledgement

This study was supported by the Ural Branch of the Russian Academy of Sciences, "Traditions and Innovations in History and Culture" Program (Project No. 15-13-26-4).

References

Arkheologicheskaya karta severnykh raionov Udmurtii. 2004
A.G. Ivanov, M.G. Ivanova, T.I. Ostanina, N.I. Shutova. Izhevsk: UdIIYL UrO RAN.

Geophysical Survey in Archaeological Field Evaluation. 2008
Swindon: English Heritage.

Ivanova M.G. 1976
Kushmanskoye gorodishche. In *Voprosy arkheologii Udmurtii*. Izhevsk: Udmurt. Inst. istorii, ekonomiki, literatury i yazyka pri SM UASSR, pp. 93–106.

Ivanova M.G. 1998
Idnakar: Drevneudmurtskoye gorodishche IX–XIII vv. Izhevsk: UdIIYL UrO RAN.

Ivanova M.G. 2012
Srednevekovye gorodishcha basseina r. Cheptsy: Osobennosti topografii i planirovochnoi struktury. *Ezhegodnik finno-ugorskikh issledovanii*, iss. 2: 48–56.

Ivanova M.G. 2014
Ukreplennye poseleniya basseina r. Cheptsy: Osnovnye itogi issledovanii poslednikh let. *Trudy Kamskoi arkheol.-etnogr. ekspeditsii* (Perm. Gos. Gum.-Ped. Univ.), iss. IX: 57–64.

Ivanova M.G., Kirillov A.N. 2013
Kushmanskoye gorodishche Uchkakar v basseine r. Cheptsy: Itogi issledovanii 2011–2012 gg. In *Istoriko-kulturnoye naslediye – resurs formirovaniya sotsialno-istoricheskoi pamyati grazhdanskogo obschestva (XIV Baderovskiye chteniya): Materialy Vseros. nauch.-prakt. konferentsii*. Izhevsk: Udmurt. Gos. Univ., pp. 75–79.

Ivanova M.G., Modin R.N. 2015
Kushmanskoye gorodishche Uchkakar X–XIII vv.: Materialy vneshnei chasti v kontekste razvitiya srednevekovykh poselenii. *Trudy Kamskoi arkheol.-etnogr. ekspeditsii* (Perm. Gos. Gum.-Ped. Univ.), iss. X: 138–151.

Ivanova M.G., Zhurbin I.V. 2012
Mezhdistsiplinarnye issledovaniya arkheologicheskikh pamyatnikov Kamsko-Vyatskogo regiona: Nekotorye itogi i zadachi. *Izvestiya Komi nauch. tsentra UrO RAN*, No. 2 (10): 120–130.

Ivanova M.G., Zhurbin I.V. 2014
Arkheologicheskiye i geofizicheskiye issledovaniya srednevekovykh poselenii basseina r. Cheptsy. *Rossiyskaya arkheologiya*, No. 1: 40–53.

Ivanova M.G., Zhurbin I.V., Kirillov A.N. 2013
Fortifications at Idnakar settlement: The findings of interdisciplinary research. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 41 (2): 108–119.

Pervukhin N.G. 1896
Opyt arkheologicheskogo issledovaniya Glazovskogo uyezda Vyatskoi gubernii. Moscow: [Tip. M.G. Volchaninova]. (Materialy po arkheologii vostochnykh guberniy Rossii; vol. 2).

Rabbel W., Erkul E., Stümpel H., Wunderlich T., Pašteka R., Papco J., Niewöhner P., Bariş Ş., Çakin O., Pekşen E. 2015
Discovery of a Byzantine church in Iznik/Nicaea, Turkey: An educational case history of geophysical prospecting with combined methods in urban areas. *Archaeological Prospection*, vol. 22: 1–20.

Spitsyn A.A. 1893
Priuralskiy krai: Arkheologicheskiye rozyskaniya o drevneishikh obitatelyakh Vyatskoi gubernii. Moscow: [Tip. E. Lissnera i Y. Romana]. (Materialy po arkheologii vostochnykh guberniy Rossii; vol. 1).

Vafidis A., Economou N., Ganiatsos Y., Manakou M., Poulioudis G., Sourlas G., Vrontaki E., Sarris A., Guy M., Kalpaxis Th. 2005
Integrated geophysical studies at ancient Itanos (Greece). *Journal of Archaeological Science*, vol. 32: 1023–1036.

Received June 24, 2015.
Received in revised form October 14, 2015.

DOI: 10.17746/1563-0110.2018.46.1.086-099

S.N. Korenevskiy[1] and A.A. Kalmykov[2]
[1]Institute of Archaeology, Russian Academy of Sciences,
Dm. Ulyanova 19, Moscow, 117036, Russia
E-mail: skorenevskiy@yandex.ru
[2]State Unitary Enterprise "Naslediye",
Pr. K. Marksa 56, Stavropol, 355006, Russia
E-mail: kalmykov_a_a@mail.ru

Pit-Grave (Yamnaya) and Pit-Grave-Maikop Burials at Levoyegorlyksky-3, Stavropol

This article describes four unusual burials (No. 4, 8, 13, and 15) displaying features of the Pit-Grave rite under mound 1 at Levoyegorlyksky-3 on the Stavropol Territory, dating to the mid 4th millennium BC. The mound was constructed to mark the main burial (No. 15), which predates the others. While the preservation of the skeletons is poor, the position of the deceased was determined as flexed supine. The mound was encircled by a stone curb (cromlech). Inside the mound and the cromlech, fragments of Early Maikop vessels were found. The main burial, however, contained pottery typical of the steppe Chalcolithic cultures, not tied with the Maikop-Novosvobodnaya community. In the intrusive burial 4, a Maikop-type dagger, a stone beak-shaped hammer, a gold pendant, and a flint flake were found. The dagger has Early Maikop-Novosvobodnaya parallels, whereas the hammer is similar to Late Maikop (Dolinskoye) ones, found on the central piedmont of the northern Caucasus. This burial represents a striking example of the influence of the funerary tradition of the Maikop military elite on the Pit-Grave rite. On the other hand, it suggests that the Dolinskoye-type stone beak-shaped hammers may indicate the influence of the Pit-Grave culture at the early stage of the Maikop-Novosvobodnaya community.

Keywords: *Northern Caucasus, Maikop culture, Pit-Grave (Yamnaya) culture, burial rite, mounds, cromlechs.*

Introduction

It is well known that the tribes of the Maikop-Novosvobodnaya cultural community (MNC) exerted great influence on their northern neighbors—the carriers of the Pit-Grave culture of the northern Caucasus and the Kuma-Manych Depression (Merpert, 1974: 153, fig. 1, II; Korenevskiy, 2004: 93–96). However, we do not yet have a sufficient number of sources with information on the contacts of these two most important components of the population of the northern Caucasus in the fourth millennium BC. Thus, every new discovery in this field deserves special consideration. This article analyzes burials of the Pit-Grave culture, associated with the stage of the emergence and early function of burial mound 1 at Levoyegorlyksky-3 cemetery, which reflects this cultural interaction.

Excavation materials

Levoyegorlyksky-3 cemetery is located in Izobilnensky District of the Stavropol Territory, on the left bank of the Yegorlyk River (a reservoir was made in this area) (Fig. 1). Initially, this cemetery consisted of seven mounds, which were set up in a line along the ridge of the spur of Mount

Verblyud, descending to the river. The total length of the cemetery is approximately 450 m; the elevation difference is about 13 m.

In 2011, A.A. Kalmykov excavated burial mound 1 (2014). Its height was 0.6 m; its diameter was 40 m. The aboveground part of the mound, which was badly damaged by plowing, consisted of two embankments and an underground structure, the cromlech-curb. Fifteen burials, 8 individual finds (IF), a ritual complex, and a complex with animal bones outside of the tomb were discovered in the mound. In addition, dozens of pottery fragments from at least five vessels were found. The vast majority of burials and finds are dated to various periods of the Bronze Age.

For identifying the stratigraphic features of the mound, one baulk oriented along the azimuth 42° 30' due to the configuration of the land plot designated for the study, was left unearthed (Fig. 2). According to its "eastern" face, the buried soil in the center of the mound was located at a depth of –65 cm from the reference level (R). It could be seen in the form of a horizontal strip approximately between the levels of 10.7 m S and 10.4 m N, where it was cut by pits near the mound, which originated from taking the soil for the embankment. The spoil heap, evidently from burial 15, lay on the surface of the buried soil, at the section of 1.7 m S–0.1 m N.

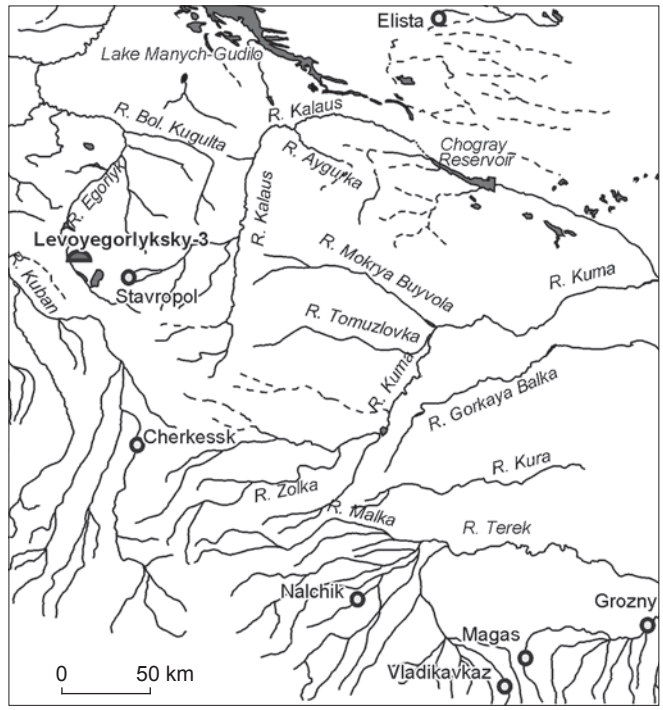


Fig. 1. Location of the Levoyegorlyksky-3 cemetery.

Embankment I of lenticular cross-section was the earliest in the mound; it was located on top of the spoil heap and buried soil. The length of the embankment on its frontal face was slightly less than 10 m; the height was 0.4 m. The slopes of embankment I were covered by cromlech-curb. On one side of the baulk, it could be seen in the form of two groups of stones on both sides of the embankment. The lower stones were laid on the buried soil at the edge of the embankment. Each subsequent stone was laid on the underlying stone covering it not completely, but only partially, with a shift towards the center of the mound (following the principle of "dominoes"). The sides of the stones facing inside the ring rested on the earthen base of embankment I. The angle of inclination of the stones to the horizon reached 35–40°. The greatest number of stones in the cromlech-curb reached 11–12 rows.

Embankment II is of a later date. It covered the earlier part of the mound, and it is not clear which burial it was associated with (Fig. 2, *2*).

In plan view, the cromlech-curb had a ring-like shape and completely surrounded embankment I. The stones were located on the slopes of this embankment and on the adjacent areas of the buried soil. The outer diameter of the stone structure was about 13.5–14.0 m. The width of the stonework (stone ring) in undamaged areas varied from 1.4 to 2.0 m (in a small area in the southwestern sector it was 1 m). The diameter of the space enclosed in the cromlech-curb was approximately 10 m. The greatest preserved height was 0.55 m (Fig. 2; 3, *1*).

Broken stone and slabs of dense fine-grained sandstone of gray and gray-yellow color were mainly used for building the cromlech-curb. Their sizes vary from a length of 0.2–0.5 m to a size of 1.05 × 0.55 × 0.17 m. Several slabs in the southeastern sector were probably trimmed to acquire a subrectangular shape (Fig. 3, *2*, *3*).

The double name of the stone structure underneath the embankment (cromlech-curb) originated from the double function performed by this structure. First, it was a stone ring surrounding the embankment (ritual purpose), and second, it was stonework strengthening the edges of the embankment (practical purpose).

Thus, the cromlech-curb of the mound reflected a special type of slab "megalithism" in the mound architecture of the Maikop-Novosvobodnaya community. It had its own specific features as compared to the cromlechs of some Maikop mounds built mainly from piles of pebbles and stones. The carriers of the proto-Pit-Grave culture of the pre-Maikop period in the fifth millennium BC and the Pit-Grave culture of the northern Caucasus in the fourth millennium BC did not erect cromlechs around their mounds.

The remains of several stone structures located on the surface and inside the early embankment I, were unearthed inside the cromlech-curb. Some of them (in the center and in the eastern half of the space confined by the stone structure) were associated with burials 4, 7, 8, and 13

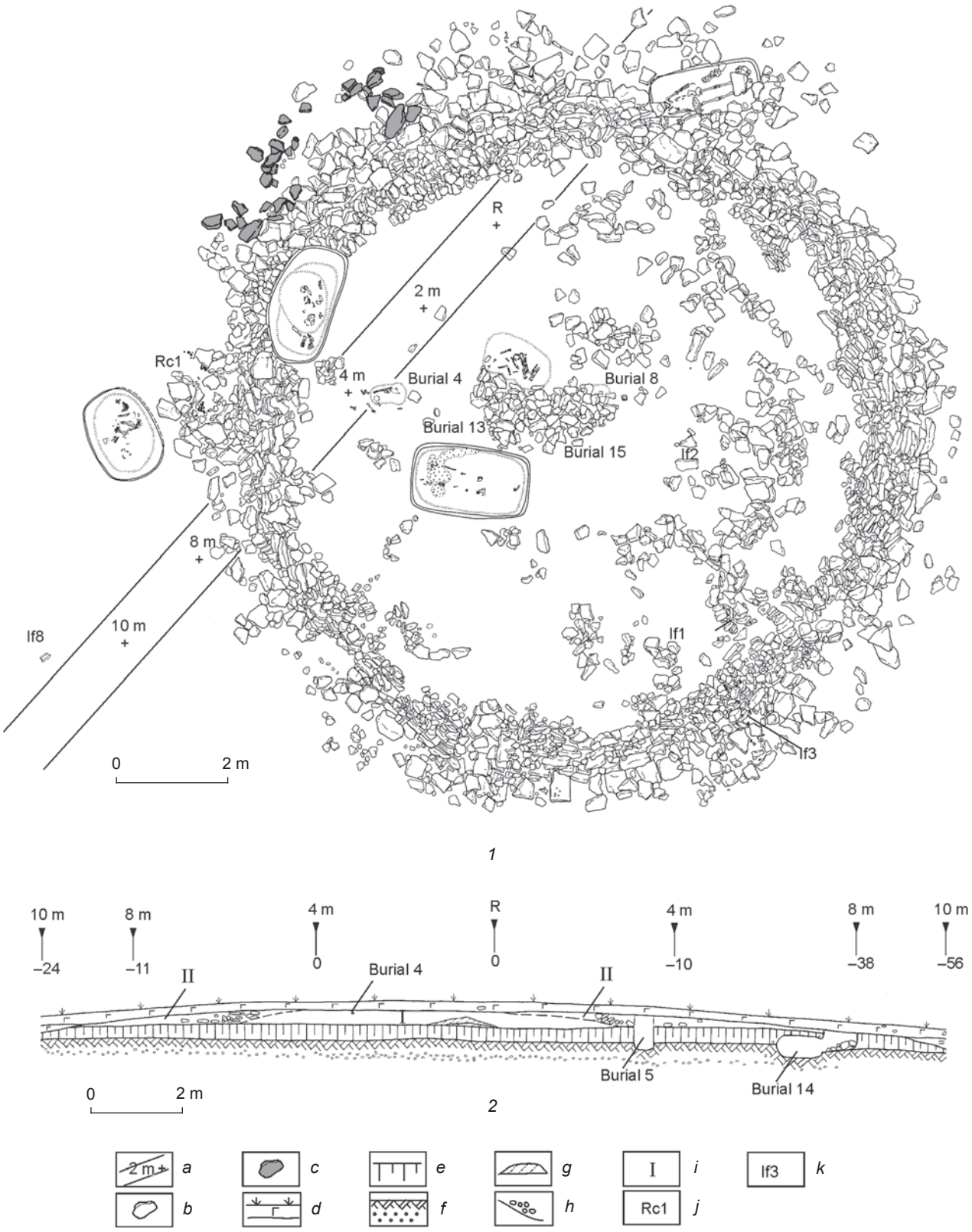


Fig. 2. Map of the cromlech-curb of mound 1 (*1*), and the central part of the "eastern" side of the baulk (*2*).
a – baulk; *b* – stone; *c* – stones of the embankment; *d* – arable layer; *e* – buried soil; *f* – native soil with carbonates; *g* – spoil heap; *h* – stones on the side of the baulk; *i* – embankment and its number; *j* – ritual complex and its number; *k* – individual find and its number.

1

2

3

Fig. 3. Cromlech-curb from mound 1.
1 – general view from the southeast after clearing; *2* – stonework in the cromlech-curb, view from the northeast; *3* – a part of the cromlech-curb with a trimmed slab, view from the south.

(see Fig. 2, *1*). These burials showed deterioration to various degrees, but it is certain that none of them were made according to the canons of burial practices of the Maikop tribes.

According to an entire range of features, the destroyed burial 15 was the main burial in the mound. Graves 4, 8, 13 were the earliest group of intrusive burials. Burial 13 was badly disturbed and yielded little information, thus this article will not consider that burial, although we should note a number of features which show similarities to burial 8 located nearby. Both burials were of approximately the same depth, had their own stone lids covered with joint piling of stones; both burials contained the ribs of large herbivores and pottery fragments from a single vessel (from burial 15).

Several finds dating back to the time when the burial mound was constructed, that is, to the MNC period, were made inside the cromlech-curb and in the embankment. The finds included a flint arrowhead found in the southeastern sector in the stone piling near the interior border of the cromlech-curb, in a hole among the stones. The arrowhead is made of semi-transparent flint of dirty-milky color; it is of subtriangular shape with a shallow notch in the base. Owing to the unevenness of the notch, the lower part of the object acquired a slightly asymmetric shape. The edge of the arrowhead was retouched along the entire perimeter. The length of the object is 3.3 cm, the greatest width is 2.0, the thickness is 0.5 cm, and the weight is 3.1 g (Fig. 4, *1*). This type of arrowhead with a slight notch at the base occurs relatively rarely among the finds from the burial mounds of the Maikop-Novosvobodnaya community. A similar object was found in mound 7 at the Abinsk cemetery belonging to the tribes of the Early Galyugay-Sereginskoye variant

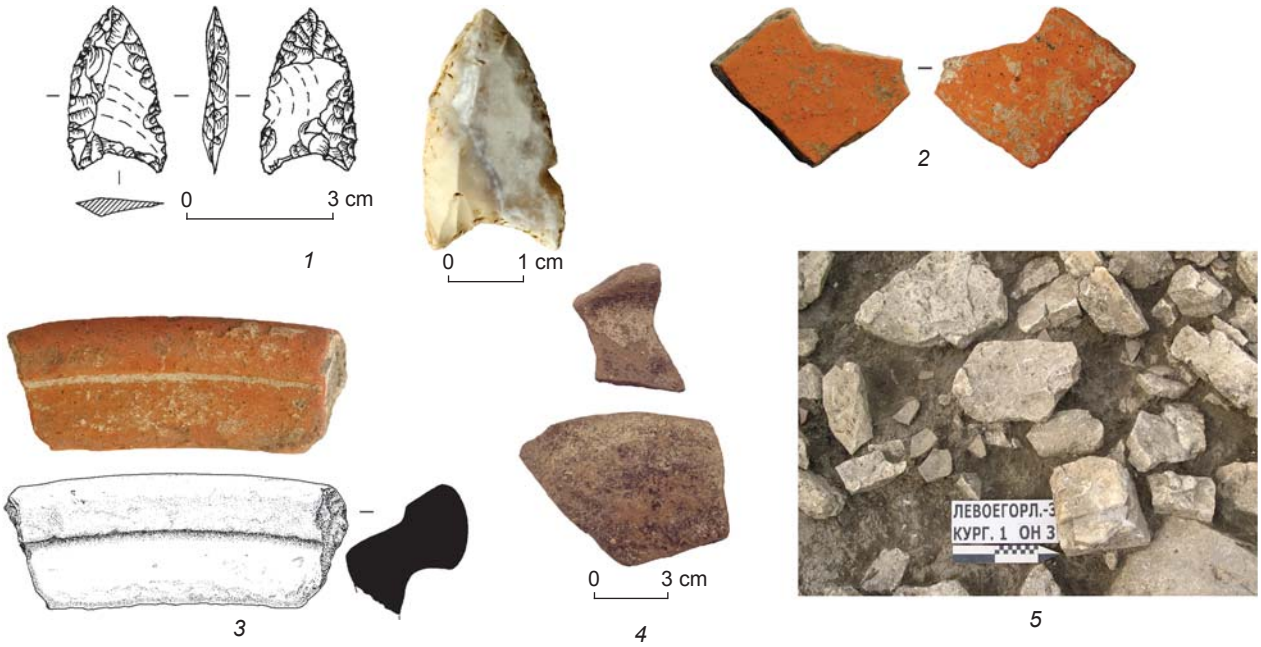


Fig. 4. Individual finds dating from the time of the origin and beginning of the mound's functioning.
1 – flint arrowhead (IF1); *2* – fragment of pottery (IF2); *3* – rim of ceramic receptacle (IF8); *4* – fragments of pottery (IF3); *5* – photo of IF3 *in situ*, view from the east.

of the MNC, but there was no retouching along the edge (Korenevskiy, 2004: 178, fig. 48, *12*). Treatment of the arrowhead edges with serrated retouch clearly reveals that it was the production of Maikop armorers or warrior-hunters of the pre-Caucasian Chalcolithic. In the pre-Maikop period, arrowheads as a rule were not treated in this manner, as is the case with the arrowheads from the Konstantinovka settlement on the Lower Don, which belonged to the steppe Eastern European Chalcolithic. The only exception is a large arrowhead with retouching along the edge from Meshoko (Stolyar, Formozov, 2009: 95, fig. 25, *4*). The arrowhead from mound 1 at Levoyegorlyksky-3 cemetery is smaller and lighter; it is clearly not associated with arrows for the heavy and large bows of the pre-Caucasian Chalcolithic and is better correlated with the small and quick-firing bows of the Maikop population.

Ocher sherds (fragments of the Maikop pottery) occurred in the ancient mound (Fig. 4, *2*, *3*). One of the sherds (IF8) found outside the cromlech-curb at a distance of 9.6 m to the west-southwest of the ancient center of the mound, is of particular interest. It is a rail-shaped rim remaining from a Maikop receptacle (Korenevskiy, 2004: 32, fig. 42, *12*, *13*). The size of the fragment is 14.0 × 5.8 cm; the width of the rim is 5.5; the reconstructed diameter of the vessel is about 93–94 cm. The volume of such a receptacle could reach 20–26 liters. Such vessels are typical of the Early Galyugay-Sereginskoye variant or the related Psekup variant (MNC), but they occur rarely in the mounds of the latter variant. Such receptacles are not typical of the pottery of the Novosvobodnaya group or the Dolinskoye variant of the MNC.

A crushed pottery vessel (IF3), consisting of 45 undecorated fragments of terracotta color, belongs to the MNC. It was discovered at a distance of 7.2 m to the south-southeast of the ancient center of the mound. The fragments were separated by a strip (1.8 × 0.8 m) across the entire stone ring of the cromlech-curb (see Fig. 2, *1*; 4, *5*). Such pottery was not found in other places of the mound and the cromlech-curb. The circumstances of the discovery of the fragments indicate that a ceramic vessel was deliberately broken in this place against the stones in the process of erecting the cromlech-curb. It was not possible to completely reconstruct the shape of the vessel. Its rim was straight, sharply bent outward, and rounded at the top. The reconstructed diameter of the rim is about 16–17 cm; the height of the rim is over 3 cm (see Fig. 4, *4*).

Ritual complex 1, discovered 5.5 m to the west of the ancient center of the mound, also belongs to the time when the cromlech-curb was constructed. It consisted of fragments of two or three ceramic vessels, and fragments of the lower jaw of a large animal, found among the stones of the cromlech-curb. The finds were concentrated in four clusters (see Fig. 2, *1*). Typologically, the forms of that dishware are not reconstructible. The fragments are associated with hand-built pottery. One fragment is covered with a layer of carbon deposits from burning.

Burial 15 (the main burial) was located in the geometric center of the space bounded by the cromlech-curb (see Fig. 2, *1*). It was associated with the removed

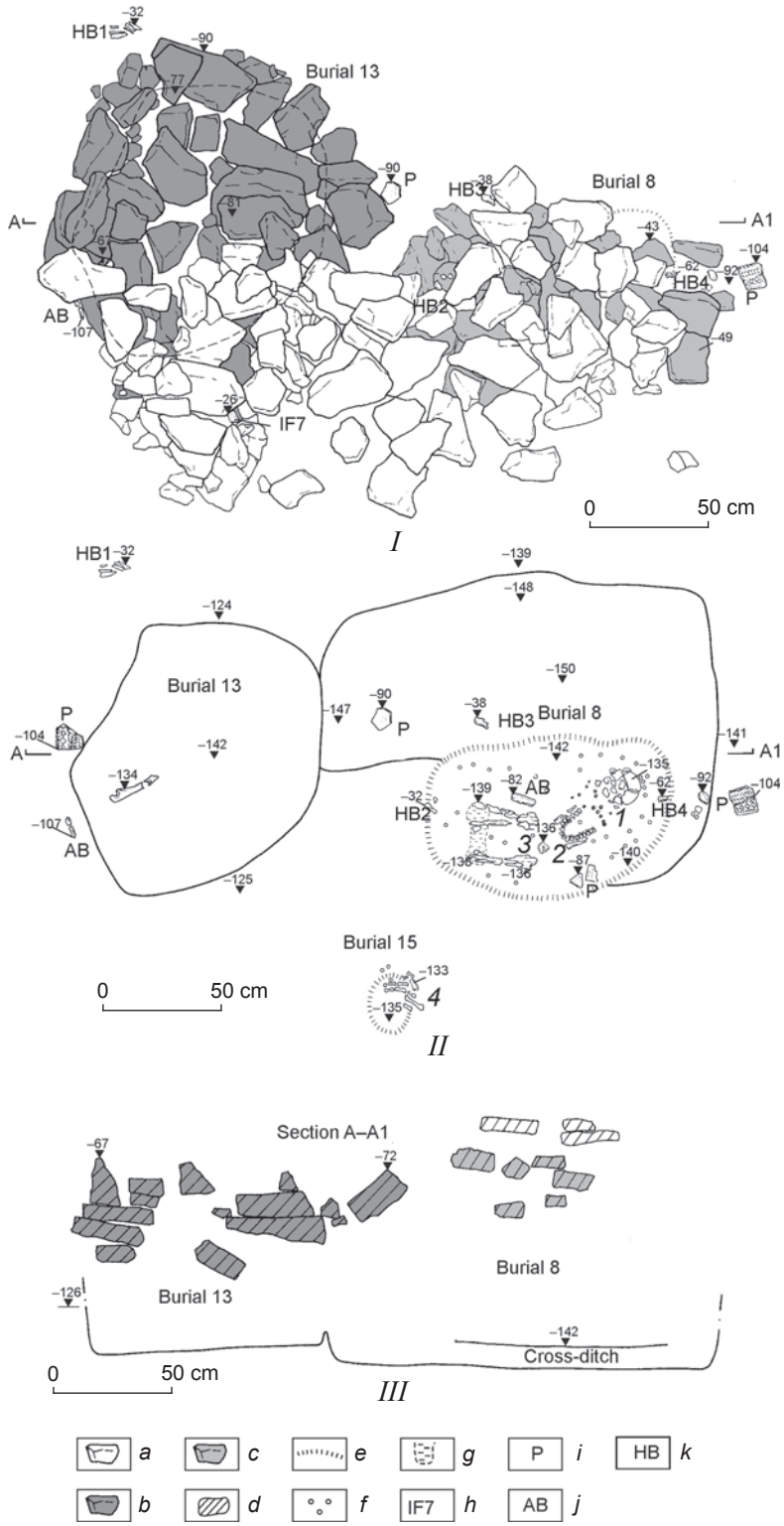


Fig. 5. Covers of burials 8 and 13, and stone embankment on the top (*I*), plans of burials 8, 13, and 15 (*II*), and the cross-section of burial structures (*III*).

a – stone piling above the covers; *b* – stones of the cover of the burial 8; *c* – stones of the cover of the burial 13; *d* – cross-section of a stone; *e* – boundary of the bedding; *f* – ocher; *g* – bone ash; *h* – individual find and its number; *i* – fragment of pottery (from burial 15); *j* – animal bones; *k* – human bones (from burial 15).

1 – stone beads (19 spec.); *2* – bone composite necklace; *3*, *4* – flint flakes.

native soil found on one side of the baulk. The boundaries of the spoil heap in plan view could not be traced. The burial was almost completely destroyed (Fig. 5, *II*), and two more burials (No. 8 and 13) were made in its cross-ditch. In addition, burial 15 was largely damaged as a result of the activities of large burrowing animals. Only a part of the bones of a human foot standing on its sole have been preserved from the burial *in situ*, as well as a flint flake lying on the foot. Ashes of dark brown color and ocher particles were found under the bones. Judging by the level of the buried soil and the remains of the burial, the reconstructed depth of the grave might have reached approximately 0.75 m. Obviously, the fragments of bones and teeth found in various places during the removal of the stone piling over burials 8 and 13 and during the clearing of their filling, were parts of the skeleton of the person from burial 15.

The flint flake is a thin blade spall from a pebble. One edge is sharp and was used for cutting. The stone is semitransparent, brown in color. A weathering crust has survived on a small area. The size of the artifact is 3.7 × 2.2 × 0.4 cm (Fig. 6, *5*).

Fragments of a vessel have been found among the stones of the cover and in the filling of burials 8 and 13 (see Fig. 5, *I*, *II*; 7, *2*). The fragments of this vessel have not been discovered in other parts of the mound. Its shape could not be fully reconstructed, but it was a large thick-walled handmade pot of large diameter with steep shoulders and an outwardly bent rim flattened on the top. The vessel was made of dense clay dough with the addition of a large amount of gruss, chamotte, and fine quartz sand. The firing color is red-brown with extensive gray-brown spots on the external surface. The entire external side of the surviving part of the vessel and the upper edge of the inner side of the rim are covered with a sophisticated geometric pattern consisting of combinations of indented lines and slanting imprints of a nail-shaped stamp. The size of the reconstructed part is 12.8 cm in height including a 3.8 cm rim; the reconstructed diameter of the rim is approximately 32 cm. The thickness of the walls and rim is 1.3 cm (Fig. 7, *1*, *3*, *4*).

This vessel is not associated with the MNC. The lush ornamental décor on the surface of the vessel, extending to the rim and the pre-rim part of the body, makes it possible to attribute the vessel to the objects of the steppe Eastern European cultures of the Early Copper-Bronze Age. Individual examples of such ornamentation can be found on the dishware of the steppe type, for example, on the first group from the Konstantinovka settlement (Kiyashko, 1994: 103–107). It is difficult to find more precise parallels because of the fragmentary nature of the vessel in question.

Burial 8 was found in the cross-ditch of the main burial 15. The shape, size, and boundaries of the grave structure cannot be traced. Only a stone cover and the level of the bottom marked by decay from the bedding, were found from the original burial (see Fig. 5).

The stone cover was a piling of slabs (predominantly) and stones, loosely laid side by side in three to four layers. At the top level, the piling stretched along the west-east line and had a suboval shape measuring approximately 1.3 × 0.9 m. Slabs and stones which constituted the cover showed no traces of processing. They included several slabs of dense white limestone, the latter not being found in the cromlech-curb. The size of the largest slab was 37 × 24 × 11 cm.

During the clearing of the cover and the subsequent removal of soil before discovering the skeleton within the supposed boundaries of the burial, three times there were found fragments of human bones (from the skeleton from the main burial 15), a rib of a large herbivore animal, and several fragments of the above-described ceramic vessel.

The bottom of burial 8 was located about 0.5 m below the base of the stones of the cover; it can be observed from decay remaining from the two-layered bedding. Unstructured decaying of red-brown color lay on top of the lower layer which, judging by the imprint on the ground, was a mat of coarse weaving. The bedding was strewn with ocher, most intensely behind the skull of the deceased.

A skeleton of a teenager in an unsatisfactory state of preservation was unearthed on the bedding. His skull was crushed; only bone ash and imprints of the long bones of the legs, pelvis, and fragmentary humerus bones have survived from the postcranial skeleton. Judging by them, the deceased was buried in a flexed supine position, with his head towards the east. His legs were extremely bent at the knee and hip joints and laid on the abdomen. The shoulder bones were directed towards the pelvis. It can be assumed that his hands were joined together.

Stone beads were found in the area of the anatomical position of the neck and chest of the buried; a necklace of bone pendants was discovered in the chest region, and a flint flake lying flat, with the side with the undamaged weathering crust up, was lying near the left knee joint on the bedding. Most of the beads were located near the neck, in one line at an irregular distance from each other. Six beads were outside this group, near the chest; they lay flat at an identical, short distance from each other, forming a short (about 8 cm) straight line connecting the ends of a necklace of bone pendants. Probably, this group of beads and pendants were the decoration of some breastplate, the woven or leather base of which has not survived (see Fig. 6, *2*).

The beads are made of a solid black mineral. In total, there are 19 of them. The beads have the shape of a short cylinder with a transverse through hole. Their length is 0.35–0.55 cm; their diameter is approximately 0.8 cm; the diameter of the holes is 0.2–0.3 cm (see Fig. 6, *1*). Beads of such shape made of stone, mother-

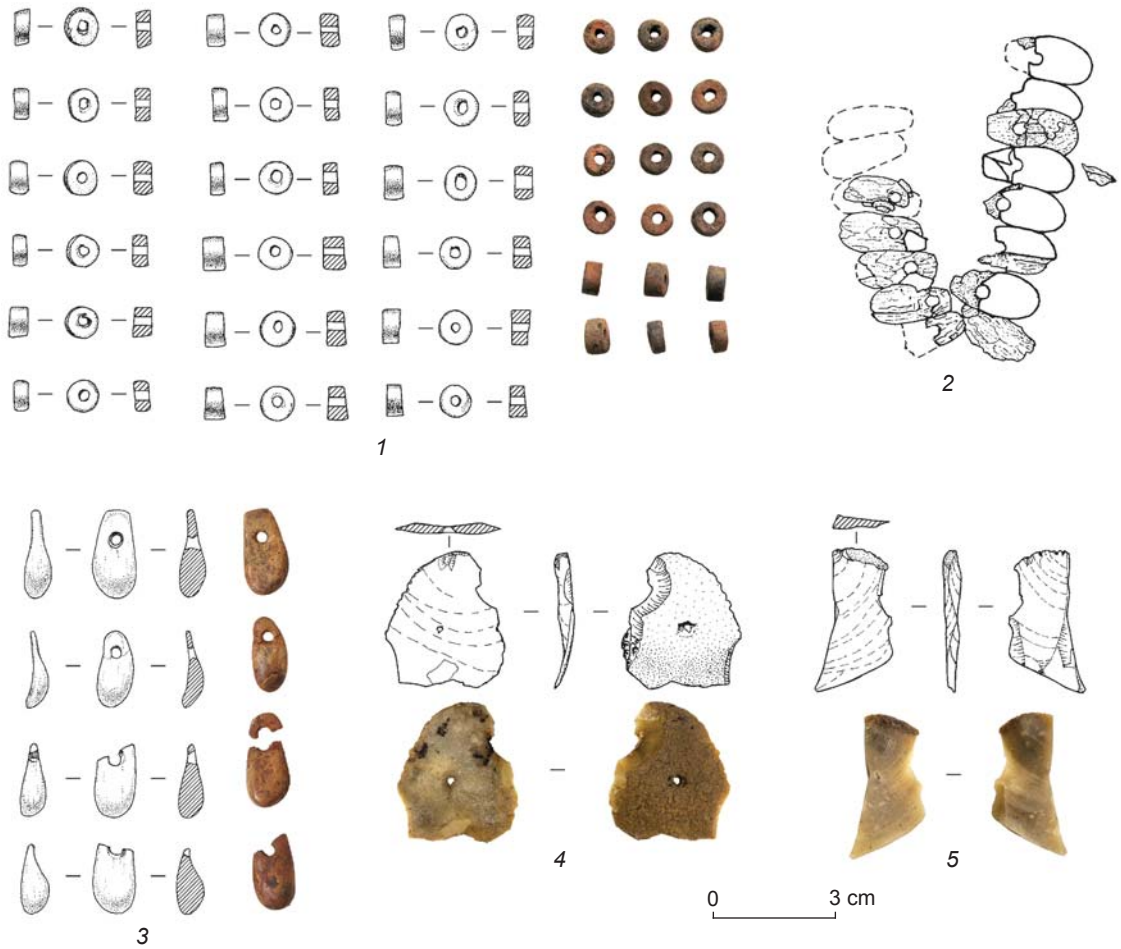


Fig. 6. Grave goods from burials 8 (*1–4*) and 15 (*5*).
1 – stone beads; *2* – composite necklace *in situ*; *3* – bone pendants from the necklace; *4*, *5* – flint flakes.

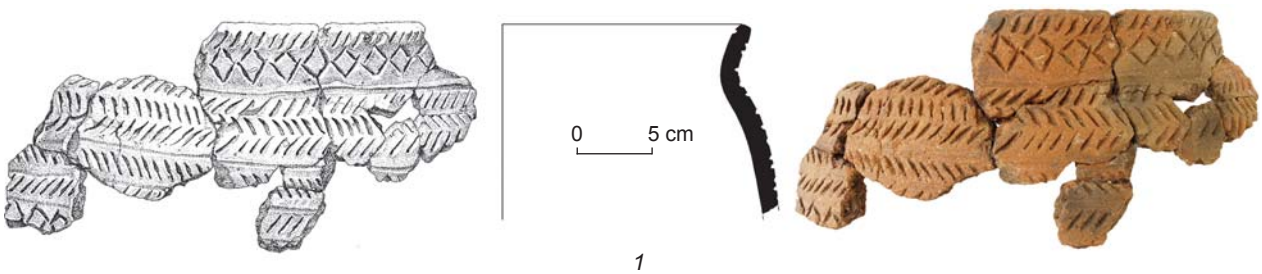


Fig. 7. Ceramic vessel from burial 15, assembled from the fragments found in burials 8 and 13.
1 – restored part of the vessel; *2* – fragment in the filling of burial 8; *3* – ornamental décor on the outer surface of the vessel; *4* – ornamental décor along the upper edge of the inner side of the rim.

of-pearl, and paste are known among the tribes of the pre-Maikop period of the northern Caucasus, and among the carriers of the Maikop culture as an attribute of a particularly prestigious burial outfit. However, a special analysis of this category of items has not yet been carried out.

The composite necklace consisted of at least 16 bone pendants of the same type. They all are drop-shaped with a flattened narrowed upper part, in which a through hole for hanging or sewing was made. In their shape, the pendants clearly imitate deer teeth. A fully preserved pendant has a length of 2.1 cm, a maximum width of 1.1 cm, a maximum thickness of 0.7 cm, with the diameter of the hole 0.25 cm. The sizes of the other pendants are about the same or smaller (see Fig. 6, *2*, *3*).

Pendants in the form of deer teeth are not typical of the burial outfit used by the MNC tribes, and occur in its assemblages as rare exceptions. For example, they were found in burial 5 of mound 51 at the Klady cemetery (Rezepkin, 2012: 250, fig. 111, IV, *2*). Adornments that have the shape of deer teeth began to appear as prestigious objects long before the MNC period. Thus, they are

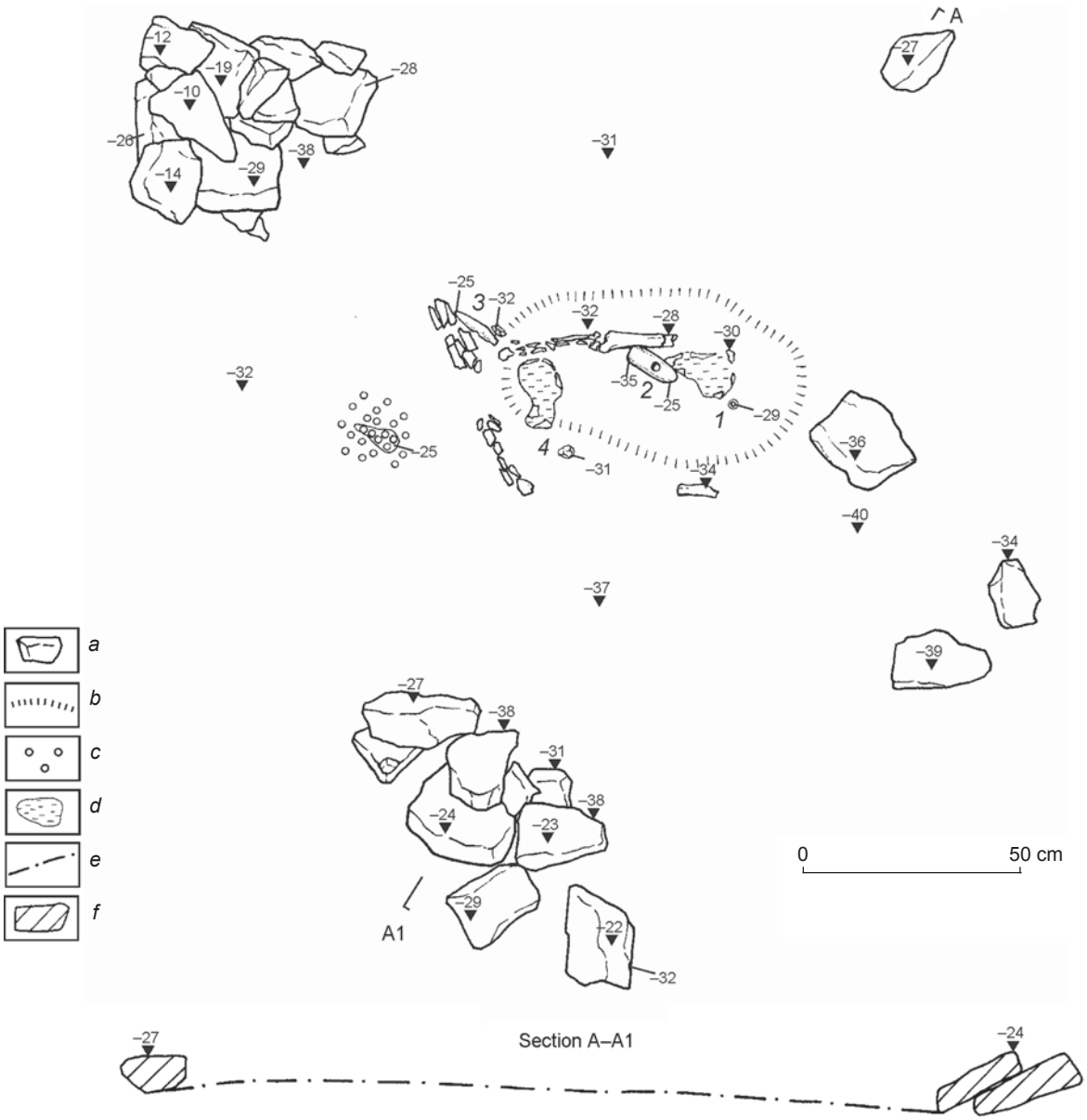


Fig. 8. Plan and cross-section of burial 4.
a – stone; *b* – boundary of the bedding; *c* – ocher; *d* – bone ash; *e* – reconstructed boundary of the bottom of the grave structure; *f* – cross-section of stone.
1 – gold pendant; *2* – stone beak-shaped hammer; *3* – bronze dagger; *4* – flint flake.

1 2

Fig. 9. Burial 4 after clearing.
1 – general view from the southeast; *2* – skeleton and grave goods, view from the south.

known from the assemblages of the Nalchik burial ground (Kruglov, Podgaetsky, 1941: 74, fig. 8, *5*; p. 91, fig. 28, *2*).

The flint flake is a very thin blade spall from a pebble. One side is completely covered with weathering crust. The stone is semi-transparent, of brown color. A small through hole of natural origin with a diameter of approximately 1 mm is in the center. The size of the object is 3.3 × 2.8 × × 0.4 cm (see Fig. 6, *4*).

Burial 4 was made in embankment I, 2.6 m to the west of the ancient center of the mound (see Fig. 2, *1*). The grave has survived in a fragmentary state (Fig. 8; 9, *1*). The upper part of the burial structure and most of the skeleton were destroyed by plowing. Earthen details of the burial structure could not be identified. The bottom of the burial, marked by decay of the bedding, as well as a level of finds and bones, was in the middle of embankment I. Its northwestern corner, composed of several sandstone stones of medium size (ca 25 × 15 × 8 cm), was more fully preserved. It had a clear rectangular shape externally. A cluster of stones to the south of the skeleton and four stones lying along the north-south line to the east of the skeleton could have been related to the structure of the grave. All of the stones were similar to the stones of the cromlech-curb.

The skeleton was in an unsatisfactory state. Most of the bones were missing; the available bones (right hand, a fragment of the left humerus, proximal parts of the femoral bones) were crushed into small fragments. Only bone debris has remained from the skull and pelvis. However, the posture of the buried person can be reconstructed definitively on the basis of the remains: he lay in a flexed supine position, with his head towards the east. His arms were placed along his trunk; his right arm was straightened; his wrist was near his right hip joint. His legs were bent at the hip joints at an angle slightly more than a right angle, and turned with their knees to the right. The destroyed ends of the femoral bones were elevated (see Fig. 8; 9, *2*).

Very thin bedding in the form of unstructured decaying of dark brown color could be seen under the bones. A disintegrated chunk of ocher was found in the area where hypothetically the feet of the deceased were located.

The grave goods included a gold ring-pendant of the headdress, stone beak-shaped hammer, bronze dagger, and a flint flake (Fig. 10).

A *gold pendant* was found near the southern boundary of bone ash, in the place of the anatomical position of the skull. The adornment was made in the form of a wide ring of thick hammered wire. The ends are closed. The size of the pendant is 1.7 × 1.6 cm with a thickness of 0.1 cm, and a weight of 1.9 g (Fig. 10, *2*). Gold single looped rings are typical adornments in the elite burials of the MNC. They were chiefly made of wire and were not hammered (Korenevskiy, 2011).

A *beak-shaped hammer* was located between the right arm and the body of the buried. The end with the hole was raised and directed to the southwest (see Fig. 9, *2*; 10, *1*). The hammer has the form of a parallelepiped with a through hole shifted toward one of the ends (the butt). The butt is beak-shaped and slightly curved downward. The upper edges of the tool are smoothened. The striking part is flat. The hole from the drill is one-sided and is slightly tapered towards the top. Its surface is smooth. The hammer is made of dense volcanic rock of gray-green color with white inclusions of various sizes. Most likely, it is serpentinite. The surface of the tool is polished. The total length of the object is 12.3 cm; the size of the cross-section in the middle part is 4.7 × 3.8 cm; the diameter of the hole ranges from 1.8 to 2.0 cm (see Fig. 10, *1*).

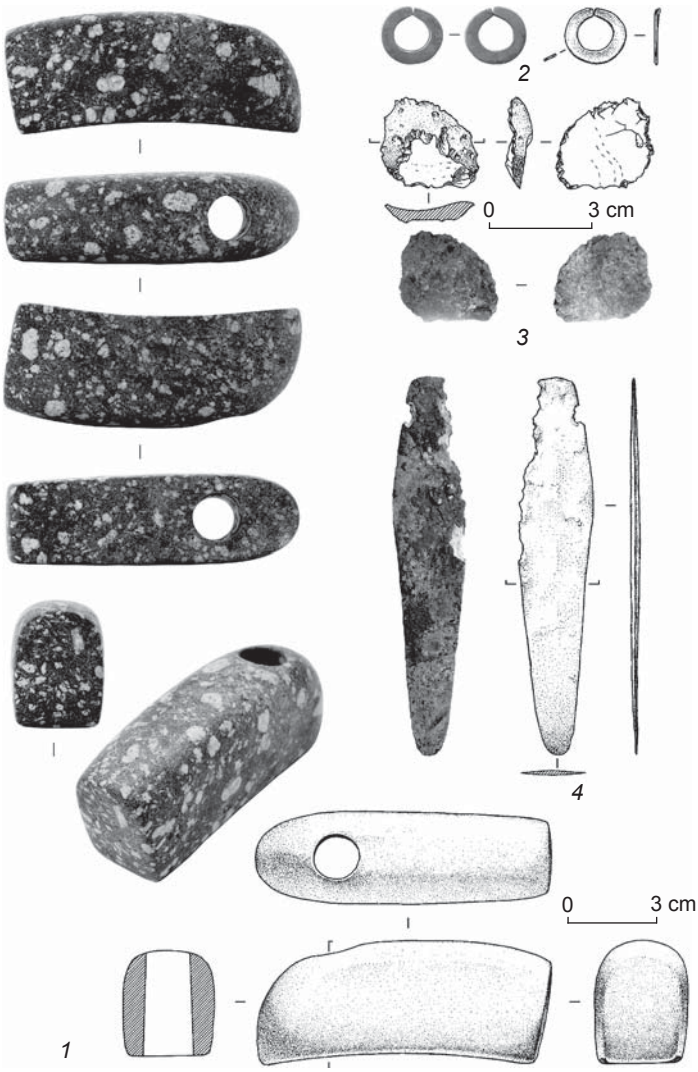


Fig. 10. Grave goods from burial 4.
1 – stone beak-shaped hammer; *2* – gold pendant; *3* – flint flake; *4* – bronze dagger.

Parallels of the beak-shaped hammer from burial 4 are well known. One object is an accidental find from the mounds near Pyatigorsk (Fig. 11, *2*). Other objects are associated with the central piedmont of northern Caucasus, with the assemblages of the Dolinskoye variant of the MNC. Locations of these finds are: Chegem I, mound 1, burial 8 (the hammer lay at the right shoulder of the deceased; an asymmetrical arrowhead was found at the same place) (Fig. 11, *7*), mound 5, burial 2 (Fig. 11, *6*); Chegem II, mound 27, burial 1 (Fig. 11, *5*) (Betrozov, Nagoev, 1984: 9, 10, 28); and Maryinskaya-3, mound 1, burial 18 (Fig. 11, *3*). In the latter assemblage, a beak-shaped hammer made of black stone lay at the right shoulder along with a bronze adze and bronze dagger. Radiocarbon dates for the wood from that burial gave the intervals of 3416–3364 and 3440–3020 BC. The averaging dendrochronological date is 3350 BC, that is, the 34th century BC (Kantorovich, Maslov, 2009: 115). Outside the MNC, such beak-shaped hammers have been found in burial 1 of mound 1 in the village of Konstantinovka of the Zaporozhye Region (Ukraine) (Fig. 11, *1*) and in burial 19 of mound 1 near the village of Stepan Razin in the Volga region (Fig. 11, *4*) (Korenevskiy, 2013; Merpert, 1974: Fig. 10, *5*; Markovin, 1976).

Beak-shaped hammers from the assemblages of the Dolinskoye variant of the MNC are made of brown or black rock, not of serpentinite. Therefore, the serpentinite find from burial 4 of mound 1 at Levoyegorlyksky-3 is in some way unique. In terms of the origin of the rock, it is most likely associated with the central part of the northern Caucasus, where various outcrops of

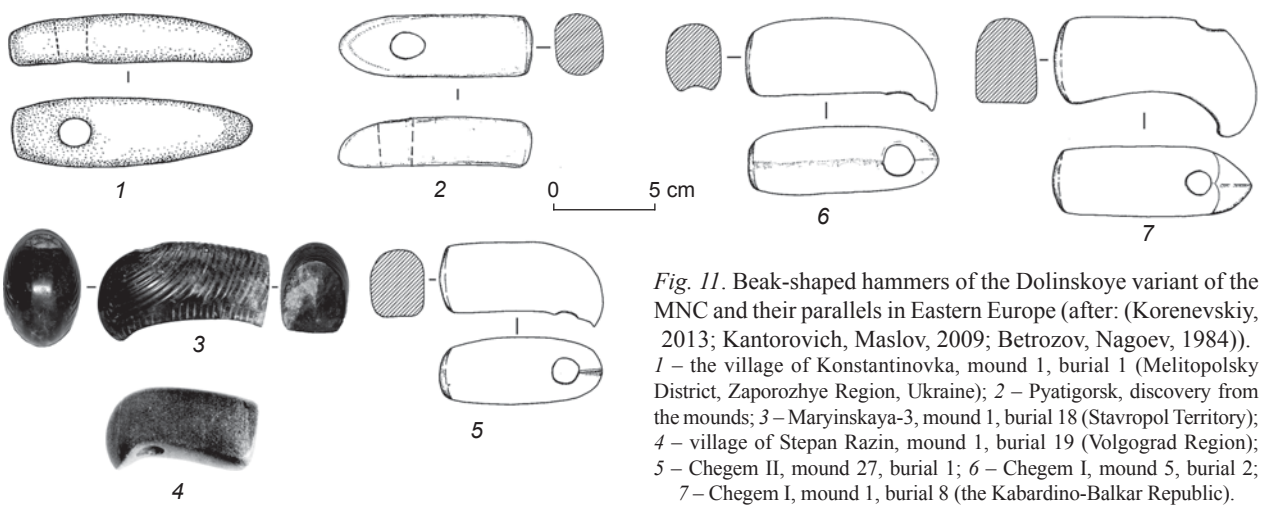


Fig. 11. Beak-shaped hammers of the Dolinskoye variant of the MNC and their parallels in Eastern Europe (after: (Korenevskiy, 2013; Kantorovich, Maslov, 2009; Betrozov, Nagoev, 1984)).
1 – the village of Konstantinovka, mound 1, burial 1 (Melitopolsky District, Zaporozhye Region, Ukraine); *2* – Pyatigorsk, discovery from the mounds; *3* – Maryinskaya-3, mound 1, burial 18 (Stavropol Territory); *4* – village of Stepan Razin, mound 1, burial 19 (Volgograd Region); *5* – Chegem II, mound 27, burial 1; *6* – Chegem I, mound 5, burial 2; *7* – Chegem I, mound 1, burial 8 (the Kabardino-Balkar Republic).

serpentinite (weathering crusts of ancient ultrabasic rocks) occur within the Malkinskoye iron ore field (Kalganov, 1946: 167–168). In the burials of the Dolinskoye variant, the beak-shaped hammers lay near the humerus or thoracic bones of the deceased, exactly as in the burial under consideration.

A *dagger* on a copper base was at the right hip joint. Like the hammer, it was located in an inclined position. The raised point was directed to the northwest. The object belongs to the so-called Early Maikop type of tangless daggers. The blade is two-edged, tapering towards the rounded end. The handle is trapezoidal. A weakly expressed longitudinal rib is in the center of the dagger. The length of the object is 12.7 cm including a blade of approximately 9 cm; the maximum width (reconstructed) is 2.7 cm, and the maximum thickness is 0.25 cm (see Fig. 10, *4*).

The shape of the Levoyegorlyksky dagger fits well with the Early Maikop type of the Galyugay-Sereginskoye and Psekup variants of the MNC. In the Caucasus, it appeared at the beginning of the fourth millennium BC. The dates of several examples of such weapons are known, including a dagger from burial 33 of mound 1 at the Maryinskaya-5 group, from the 38th–37th century BC (3767–3660 BC) (Kantorovich, Maslov, Petrenko, 2013: 92), from burial 13 of mound 14 at the Mandzhikiny cemetery, dated to the 38th–37th century BC (3781–3693 BC), and from burial 3 of mound 1 at the Kudakhurt cemetery, dated to the 36th–35th century BC (3520–3400 BC) (Korenevskiy, 2011: 26–28). A tangless dagger is a part of the assemblage from the Maikop burial mound, which can be dated by the date of burial 70 of mound 1 at the Zamankul cemetery to the 37th–36th century BC (3640–3500 BC) (Ibid.).

Stratigraphically, the daggers of the tangless type have twice shown an earlier position in the mounds in comparison with tanged daggers. A.A. Iessen was the first who pointed this out using the example of the primary and intrusive burials of the Maikop mound (1950). The same situation is confirmed by the stratigraphy of mound 1 at the Maryinskaya-5 burial ground. Dates of burials 12 and 25 there with tanged daggers were in the range of the 34th–32nd centuries BC (Kantorovich, Maslov, Petrenko, 2013: 93).

A *flint flake* lay flat next to the left hip joint, beyond the boundaries of the remaining section of the bedding. It is a piece of pebble with numerous removals. The flint is brown and semitransparent (see Fig. 10, *3*).

Inclusion of a flint flake into the grave goods apparently had a certain stable meaning for the people who left this burial, since such cases have been recorded many times. For example, flint flakes were found in the two burials described above.

General observations

Mound 1 at Levoyegorlyksky-3 was made on an important communication route between the central piedmont of the northern Caucasus and the Kuma-Manych Depression, which is the valley of the Yegorlyk River. Burial 15 was the main burial in the mound. Proceeding from logic, as well as stratigraphic observations, the discharge of ancient soil to the surface is associated with precisely that early burial. Presumably, the place of the burial soon (otherwise, the spoil heap would have been washed away by rainwater) was covered by a small earthen embankment 11–12 m in diameter, the slopes of which were strengthened with a cromlech-curb.

In accordance with the burial rite, fragments of Maikop pottery and an arrowhead ended up in the cromlech-curb. The arrowhead is not an isolated example of such a discovery in a MNC mound. Thus, an arrowhead was found in the embankment over the Maikop burials of the Bolshoy Ipatovskiy mound (Korenevskiy, Belinsky, Kalmykov, 2007: 214, fig. 74, *8*). This may reflect a ritual shot into the embankment of a mound from a fast-firing bow, since arrowheads weighing 3 g with jagged edges belong to the weaponry of that type.

Judging by the pottery fragments and the position of the surviving bones, the main burial 15 is not related to the complexes of the "Maikop mound circle" and is obviously associated with the local tribes of the Pit-Grave cultural community. However, the people who left it clearly adhered to some of the elements typical of the MNC burial traditions, and while erecting the first mound they used first class pottery of the Maikop culture, including the fragments of huge receptacles. Such pottery primarily occurred in the Early Galyugay-Sereginskoye variant of the MNC (Korenevskiy, 2004: 50–53).

Burials 4, 8, and 13 were further made inside of the cromlech-curb. Judging by the position of the buried persons, all the burials belong to the Pit-Grave culture, and do not contain MNC pottery. On the whole, the presented materials suggest that the center of the mound was founded and functioned as a burial place for the members of one or more clans of the carriers of the Pit-Grave culture. The commonness of their burial rites is emphasized by the inclusion of small fragments of flint into their grave goods with some symbolic meaning, since practical use of such small flakes as tools is quite doubtful. Despite strong deterioration of the skeletons in the graves under consideration, it can be stated that the deceased of various ages found their place of repose in the burial mound.

Burial 4 contained grave goods that make it possible to view the burial as an elite grave with the military symbols of the Early Maikop or Psekup variant of the MNC, that

is, a syncretistic burial of the Pit-Grave-Maikop type. At the same time, the burial contained a beak-like hammer typical of the Dolinskoye variant of the MNC in the central part of the northern Caucasus, belonging to its late stage (Ibid.: 54–57), when tanged daggers were typical. All this makes the complex under consideration unique evidence of mutual occurrence of things from the early and late stages of the MNC. Such cases are very rare. One of them is the burial of the Inozemtsevo mound, which was investigated in 1976. That mound contained a bowl of the Galyugay-Sereginskoye type and pottery of the Dolinskoye variant of the MNC with a typical set of bronze objects (Korenevskiy, Petrenko, 1982). This complex can be dated to the 35th–34th century BC (3499–3349 BC) (Korenevskiy, 2011: 29).

The dates of tangless daggers in the central piedmont of the northern Caucasus are associated mainly with the range of 38/37th–36/35th centuries BC. Thus, burial 4 can be dated to at least the late first half to the middle of the fourth millennium BC. Such weapons are unknown in the second half of the fourth millennium, in the interval of 3400–3000/2900 BC. The pottery of the Early Maikop type, discovered in the cromlech-curb of the mound, does not contradict such dating.

The beak-shaped hammer is a very interesting type of object belonging to the Dolinskoye variant of the MNC, since they have a very mysterious configuration and origin. Their parallels made of bone and stone in the south of Eastern Europe have been analyzed earlier (Rezepkin, 2000: 29, Abb. 9; Korenevskiy, 2013: 21, fig. 5). The general conclusion was that stone beak-shaped hammers appeared as an imitation of bone beak-like pickaxes of the Pit-Grave culture (Rezepkin, 2000: 29), moreover, as the development of the shape of the horn pickaxe, a weapon and tool of the Chalcolithic, of the pre-Maikop period (Korenevskiy, 2013). In the case of burial 4, different solutions can be given to the problem of who influenced the emergence of such an object, in the context of a burial rite according to the canons of the Pit-Grave culture.

The first answer is that the tribes of the Dolinskoye variant of the MNC, among the materials of whom beak-shaped hammers have been repeatedly found, exerted influence on the carriers of the Pit-Grave culture. However, such a solution finds serious challenges in the chronology of the assemblages. In burial 4 of mound 1 at Levoyegorlyksky-3, a beak-shaped hammer was found in association with an object of the Early Maikop period of the MNC, a tangless dagger. In the assemblages of the Dolinskoye variant, beak-shaped hammers were associated with tanged daggers and belong to the late stage of MNC.

Another answer to the question is that beak-shaped hammers appeared in the northern Caucasus among the carriers of the Pit-Grave culture as the development of their bone prototypes in the Final Early MNC and were subsequently adopted by the Dolinskoye tribes of the MNC. Such a course of events has additional supporting arguments. The first of these arguments is related to the location of beak-shaped hammers in the burials of the Dolinskoye variant at the shoulder and chest, that is, "at the hand" of the buried person. This reflects not the Maikop, the so-called "abstract tool" tradition of placing a prestigious tool in a burial in a corner or under the wall of the grave, but the Chalcolithic "specific tool" tradition of the proto-Pit-Grave and Pit-Grave cultural communities: near the shoulder, chest, or elbow of the deceased, who lay in a flexed supine or extended position.

A beak-shaped hammer in burial 4 of mound 1 at Levoyegorlyksky-3 cemetery was located precisely in the same way, at the elbow. This version seems to be more justified.

Burial 8 (of a teenager) in mound 1 also contained prestigious personal adornments of clothing of the time, which not so commonly occurred in the burials of the Maikop tribes, such as a necklace made of pendants in the form of deer teeth.

Conclusions

The materials discussed above make it possible to speak about a strong influence of cultic practices and values of the Maikop-Novosvobodnaya cultural community on their northern neighbors (carriers of the Pit-Grave culture) in terms of organizing burial space, constructing cromlechs and curbs, and using broken pottery for building the burial mound. The materials show that prestigious valuable objects of the Maikop military elite, such as tangless daggers, also became the objects of military prestige for the nobility of the carriers of the Pit-Grave culture. At the same time, stone beak-shaped hammers appeared in the set of prestigious objects among the tribes of the Pit-Grave cultural community. This object, which might have had a cultic purpose, was borrowed by the Dolinskoye tribes from the earlier cultural context of the Early Pit-Grave or Early Maikop population. It is difficult to identify the source of the borrowing with more precision because of the scarcity of sources.

References

Betrozov R.Z., Nagoev A.K. 1984

Kurgany epokhi bronzy u seleniy Chegem I, Chegem II i Kishpek. In *Arkheologicheskiye issledovaniya na novostroikakh Kabardino-Balkarii*, vol. 1. Nalchik: Elbrus, pp. 7–87.

Iessen A.A. 1950

K khronologii bolshikh kubanskikh kurganov. *Sovetskaya arkheologiya*, vol. XII: 157–200.

Kalganov M.I. 1946

Malkinskoye zhelezorudnoye mestorozhdeniye i perspektivy ego promyshlennogo osvoyeniya. In *Prirodnye resursy*

Kabardinskoi ASSR. Moscow, Leningrad: Izd. AN SSSR, pp. 167–168.

Kalmykov A.A. 2014

Otchet o raskopkakh kurgannogo mogilnika Levoyegorlykskiy-3 v Izobilnenskom raione Stavropolskogo kraya v 2011 godu. *Arkhiv IA RAN, R-1*. No. 45517, 45518.

Kantorovich A.R., Maslov V.E. 2009

Raskopki pogrebeniya maikopskogo vozhdya v kurgane bliz stanitsy Maryinskoy (predvaritelnaya publikatsiya). In *Materialy po izucheniyu istoriko-kulturnogo naslediya Severnogo Kavkaza*, iss. IX. Stavropol: Naslediye, pp. 83–116.

Kantorovich A.R., Maslov V.E., Petrenko V.G. 2013

Pogrebeniya maikopskoy kultury kurgana 1 mogilnika Maryinskaya-5. In *Materialy po izucheniyu istoriko-kulturnogo naslediya Severnogo Kavkaza*, iss. XI. Moscow: Pamyatniki istoricheskoi mysli, pp. 71–108.

Kiyashko V.Y. 1994

Mezhdu kamnem i bronzoi (Nizhneye Podoniye v V–III tysyacheletiyakh do n.e.). Azov: Azov. kraeved. muzei. (Donskiye drevnosti; iss. 3).

Korenevskiy S.N. 2004

Drevneishiye zemledeltsy i skotovody Predkavkaziya: Maikopsko-novosvobodnenskaya obshchnost, problemy vnutrenney tipologii. Moscow: Nauka.

Korenevskiy S.N. 2011

Drevneishiy metall Predkavkaziya. Moscow: Taus.

Korenevskiy S.N. 2013

Vtulchatoye oruzhiye iz kamnya i kosti v pogrebalnom obryade maikopsko-novosvobodnenskoy obshchnosti. *KSIA*, iss. 229: 11–24.

Korenevskiy S.N., Belinskiy A.B., Kalmykov A.A. 2007

Bolshoy Ipatovskiy kurgan na Stavropolye kak arkheologicheskiy istochnik po epokhe bronzovogo veka na stepnoy granitse Vostochnoy Evropy i Kavkaza. Moscow: Nauka.

Korenevskiy S.N., Petrenko V.G. 1982

Kurgan maikopskoy kultury u poselka Inozemtsevo. *Sovetskaya arkheologiya*, No. 2: 96–112.

Kruglov A.P., Podgaetsky G.V. 1941

Dolinskoye poseleniye u g. Nalchika. *MIA*, iss. 3: 147–211.

Markovin V.I. 1976

Stepi i Severnyi Kavkaz: Ob izuchenii vzaimosvyazi drevnikh plemen. In *Vostochnaya Evropa v epokhu kamnya i bronzy*. Moscow: Nauka, pp. 193–200.

Merpert N.Y. 1974

Drevneishiye skotovody Volgo-Uralskogo mezhdurechya. Moscow: Nauka.

Rezepkin A.D. 2000

Das frühbronzezeitliche Gräberfeld von Klady und die Majkop-Kultur in Nordwestkaukasien. Rahden: Verlag Marie Leindorf. (Archäologie in Eurasien; Bd. 10).

Rezepkin A.D. 2012

Novosvobodnenskaya kultura (na osnove materialov mogilnika "Klady"). St. Petersburg: Nestor-Istoriya.

Stolyar A.D., Formozov A.A. 2009

Meshoko – drevneishaya krepost Predkavkaziya: Otchety Severo-kavkazskoy arkheologicheskoy ekspeditsii 1958–1965 gg. St. Petersburg: Izd. Gos. Ermitazha.

Received February 10, 2016.

DOI: 10.17746/1563-0110.2018.46.1.100-107

L.V. Kuptsova[1], N.L. Morgunova[1], N.P. Salugina[2], and O.S. Khokhlova[3]

[1]Orenburg State Pedagogical University,
Sovetskaya 19, Orenburg, 460014, Russia
E-mail: orelin.84@mail.ru; nina-morgunova@yandex.ru
[2]Samara State Institute of Culture,
Frunze 167, Samara, 443010, Russia
E-mail: nsalug@gmail.com
[3]Institute of Physicochemical and Biological Problems in Soil Science,
Russian Academy of Sciences,
Institutskaya 2, Pushchino, 142290, Russia
E-mail: olga_004@rambler.ru

A Periodization of the Timber-Grave Culture in the Western Orenburg Region: Archaeological and Natural Science-Based Evidence

Stages in the evolution of the Srubnaya (Timber-Grave) culture in the Orenburg region, Western Urals, are reconstructed using a multidisciplinary approach. Using the morphology and composition of buried soils, the relative chronology of burial mounds in the cemeteries was determined. The earliest paleosols indicate arid conditions, whereas the latest ones testify to greater humidity. The comparison of data from various analyses suggests that mounds contemporaneous in terms of ^{14}C dates display resemblance in funerary rite, burial goods, and paleosol characteristics. The technological analysis of ceramics based on A.A. Bobrinsky's approach showed that vessels from earlier mounds are more standardized, whereas those from later ones are more diverse. Based on the set of data, the evolution of the Timber-Grave culture in the region falls into three stages.

Keywords: *Late Bronze Age, Timber-Grave culture, Western Urals, burial mounds, typology, periodization.*

Introduction

The periodization of the Timber-Grave culture still remains a controversial issue, and scholars distinguish from two to four stages in its development in different regions (Kachalova, 1985: 33–36; Gorbunov, Morozov, 1985: 98–102; Vasiliev, Kuzmina, Semenova, 1985: 65–81; Sinyuk, Pogorelov, 1985: 134–138; Semenova, 2000: 161–178; Otroshchenko, 2003: 76–84; Vasiliev, 2010: 68–73). In dividing the development of the Timber-Grave culture in the Volga-Ural region, archaeologists have mainly relied on the typological method owing to the lack of sufficient stratigraphic data. Thus, we may observe that specific features of individual stages in their models of periodization are blurred (Vasiliev, Kuzmina, Semenova, 1985: 64–65, 75–79; Semenova, 2000: 161–165, 171–172, 177–178; Vasiliev, 2010: 72).

The Western Orenburg region is the northeastern periphery of the Volga-Ural region. Identification of particular stages in the development of the Timber-Grave culture in that area is hampered by the fact that it is not possible to determine the chronological position of the burial sites according to stratigraphic data. The mounds in almost all barrows were made over already existing

Archaeology, Ethnology & Anthropology of Eurasia 46/1 (2018) 100–107 E-mail: Eurasia@archaeology.nsc.ru

surface graves, and individual instances of cutting one burial by another have been observed. In this case, the use of the typological method for solving this problem is to a certain extent difficult, since the funerary rite throughout the entire period of the Timber-Grave culture demonstrates similar features; the ceramic vessels from the burials are similar in shape and ornamental decoration, and metal objects are almost always of the same type. For these reasons, in order to determine a clearer chronological position of the burial mounds, in addition to the methods of archaeology, this study will employ the results of radiocarbon dating, paleosol analyses, as well as technical and technological analysis of pottery, for the first time in the history of research on the sites of the Timber-Grave culture in the Orenburg Cis-Urals.

Research objects and discussion

Science-based methods have been used for studying the Skvortsovka, Labazovsky, Bogolyubovka, Mustaevo V, Pleshanovo II, and Uranbash cemeteries. A whole complex of studies (analysis of paleosols, technical and technological analysis of pottery, and radiocarbon dating) was carried out at three of these sites: the Skvortsovka, Labazovsky, and Bogolyubovka burial grounds. Technical and technological analysis of pottery and radiocarbon dating were performed at Pleshanovo II; paleosol analyses were carried out at Mustaevo V, and technical and technological analysis of pottery was made at Uranbash. All the results obtained for each site have been published (Khokhlova, Khokhlov, 2005: 50–60; Morgunova, Golieva, Evgeniev et al., 2009: 40, 42–52, 63–73; Morgunova, Golieva, Degtyareva et al., 2010: 76, 79–98, 119–141; Kryukova et al., 2012; Salugina, 2012; Mukhametdinov, 2012; Bogolyubovskiy kurgannyi mogilnik…, 2014: 99–102, 103–115, 131–159). In this article, for the first time, all these studies have been considered together. The comprehensive approach has made it possible to distinguish three stages in the development of the Timber-Grave culture in the Western Orenburg region (see *Figure*).

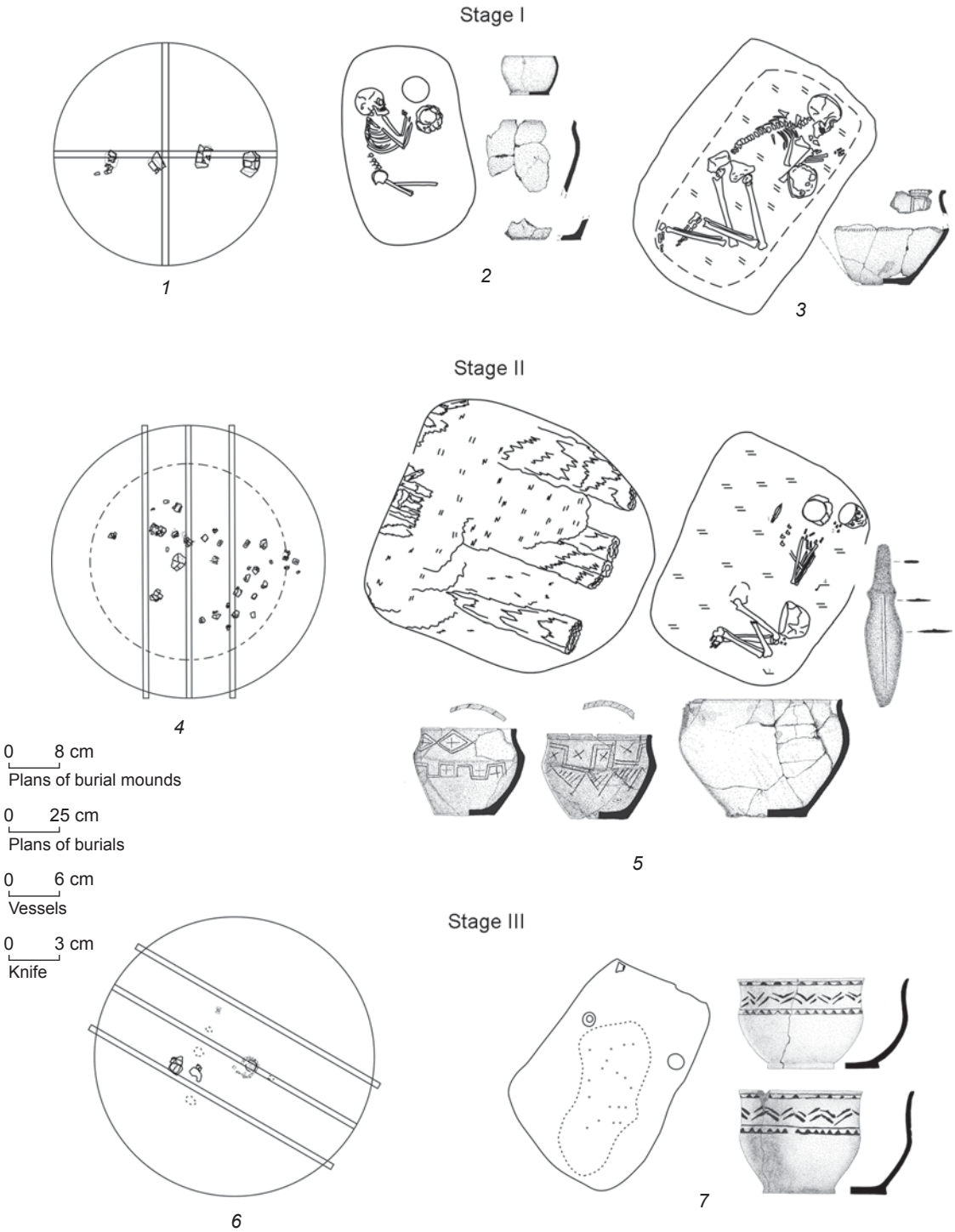
Burial complexes of stage I. All of these complexes are characterized by a small number of burials in the barrow (not more than ten), burial pits of sub-rectangular shape, and orientation of the buried person to the NE or N. The pits are predominantly of medium size (0.7–1.5 m^2), but large pits (2.0–3.4 m^2) have also been found. Burial chambers of oval form, orientation of the buried person to the W or NW, or secondary burials occur rarely. Sometimes, organic matting has been found in the graves. Scarce burial goods are a common feature of burials at stage I; the goods are represented mainly by pottery, including undecorated jars, pots that are bent in the middle of the profile, and smoothly profiled pots. In isolated cases, bones of animals have been found in the burials. If covers are present over the graves, they are made of either stone or wood.

At the present, the historiography of the Timber-Grave culture traditionally recognizes that all the distinctive features mentioned for stage I are inherent in the burial complexes of its developed (or classical) stage, while the sites of the formative period of the Timber-Grave culture are characterized by a more sophisticated set of features and more variegated goods (Semenova, 2000: 161–171; Vasiliev, 2010: 68–70). However, this approach to the periodization of the Timber-Grave antiquities is not always justified (Kuptsova, 2015).

The main features of the funerary rite at stage I of the Timber-Grave culture in the Orenburg region show clear parallels to the preceding post-Catacomb cultural traditions, and to a lesser extent to the cultures of the Sintashta-Potapovka circle (Vasiliev, Kuznetsov, Semenova, 1995: 22; Mimokhod, 2013: 336). From the former, the carriers of the Timber-Grave culture inherited such features of the funerary rite as burial of the deceased in pits of sub-rectangular or oval shape in the flexed position on the left side, with their heads oriented to the N, NE, or E, as well as a scarcity of burial goods. These features are typical of the Lola and the Volga-Don Babino cultures (Mimokhod, 2013: 27, 33, 56; 2014: 102, 103, 109). Placement of undecorated flat-bottomed jar-like vessels with closed and open necks is also associated with the post-Catacomb traditions. Jars were typical for all post-Catacomb cultural entities. Serial production of undecorated jar-like vessels, which at a later time commonly occurred in the Timber-Grave pottery collections, started in this environment (Mimokhod, 2013: 62; 2014: 110). It should be especially emphasized that these features of the funerary rite, inherited from the post-Catacomb population, are dominant and define the outlook of the Timber-Grave culture both at the first and the subsequent stages of its development. Jar-like vessels constitute one of the most common categories of dishware (Mochalov, 2008: 180–181).

The features of the so-called "cultures of the chariot circle" (the Sintashta and Potapovka cultures) also manifest themselves in the burial mounds of stage I. These features include the construction of extensive and in some cases deep grave pits, and the use of organic matting (Vasiliev, Kuznetsov, Semenova, 1995: 5, 11, 12). The spread of pots that are bent in the upper third of the profile, and smoothly profiled pots, is associated with the heritage of those cultures (Tkachev, Khavansky, 2006: 27; Mochalov, 2008: 130–132).

The technological analysis of pottery from the burial complexes testifies to a greater homogeneity of the skills of its manufacturing at stage I as compared to the later stages. Thus, the pottery from burial mound 4 of



Burial complexes of stages I–III of the Timber-Grave culture in the Western Orenburg region.
1 – planigraphy of burial mound 12 at the Bogolyubovka cemetery; *2* – Skvortsovka cemetery, 4/4; *3* – Skvortsovka cemetery, 4/10; *4* – planigraphy of burial mound 1 at the Bogolyubovka cemetery; *5* – Skvortsovka cemetery, 3/20; *6* – planigraphy of burial mound 10 at the Bogolyubovka cemetery; *7* – Bogolyubovka cemetery, 10/5.

the Skvortsovka cemetery and burial mound 12 of the Bogolyubovka cemetery shows the predominance of silty clay with the addition of grog and organic solution as the raw material. The pastes of all vessels in burial mound 3 of the Uranbash cemetery were composed according to the recipe: clay + grog + organic solution.

Close radiocarbon dates were obtained from two sites of stage I of the Timber-Grave culture in the

Western Orenburg region (see *Table*). They correspond to the dates of the terminal stage of final entities of the Middle Bronze Age: the Lola and the Volga-Don Babino culture (the Krivaya Luka cultural group) (Mimokhod, 2011: 29, 32). Also close are some radiocarbon dates of the Potapovka (Kuznetsov, Mochalov, 2012: 53) and Sintashta (Epimakhov, Hanks, Renfrew, 2005: 97–98) cultures.

The calibrated dates of the burial mounds of stage I fall into the chronological range of the 21st–18th centuries BC, presumably encompassing several centuries, which in fact seems to be unlikely. The analysis of paleosols and climate in that period clarifies the situation. All burial mounds of stage I were made in arid climatic conditions before the onset of a more favorable humid period correlating with the later stages of the development of the Timber-Grave culture. This is consistent with the available data on the climate of the late third–early second millennium BC, when the natural conditions were characterized by sharp aridization (Demkin et al., 2009: 181). It can be assumed that burial mounds of stage I of the Timber-Grave culture in the Western Orenburg region were formed at the so-called turning point of climate change, that is, when the direction of the evolution of soils was changing (Khokhlova, 2006: 107), in our case, from the arid to humid period. Reconstructing natural conditions in the beginning of the Late Bronze Age, soil scientists have established that climate amelioration started no earlier than the 18th century BC (Demkin et al., 2009: 181). This is why the probable "turning point" refers to the mid–late 19th century BC, since a certain amount of time was needed before the next stage

Radiocarbon dates of burial sites of the Timber-Grave culture in the Western Orenburg region

Burial complex	Material	^{14}C-date, BP	Calibrated date, BC		Laboratory code
			1σ	2σ	
		Stage I			
Skvortsovka cemetery, 4/8	Human bone	3550 ± 90	2020–1750	2140–1660	Le-8585
Bogolyubovka cemetery, 12/1	Same	3544 ± 80	1980–1760	2060–1680	Spb-680
		Stage II			
Labazovsky cemetery, 1/3	Wood	3480 ± 60	1880–1730	1950–1620	Le-7681
Same	"	3400 ± 80	1815–1608	1873–1565	ИГАН-3354
Labazovsky cemetery, 1/2	"	3530 ± 50	1849–1865	1928–1773	ИГАН-3356
Labazovsky cemetery, 2/2	"	3340 ± 60	1690–1320	1770–1490	Le-7682
Same	Human bone	3490 ± 100	1940–1680	2150–1500	Le-7685
"	Wood	3710 ± 70	2019–1994	2202–1981	ИГАН-3355
Skvortsovka cemetery, 3/20	"	3450 ± 75	1890–1680	1950–1600	Le-8587
Same	Human bone	3680 ± 100	2210–1920	2450–1750	Le-8581
Skvortsovka cemetery, 3/19	Animal bone	3460 ± 40	1880–1730	1890–1680	Ki-16263
Skvortsovka cemetery, 3/5	Human bone	3480 ± 160	2030–1610	2300–1400	Le-8584
Skvortsovka cemetery, 3/30	Animal bone	3400 ± 40	1750–1620	1780–1600	Ki-16265
Skvortsovka cemetery, 3/25	Same	3210 ± 70	1530–1400	1690–1310	Ki-16267
Bogolyubovka cemetery, 1/5	Soot deposits on a vessel	3450 ± 150	1950–1600	2200–1400	Spb-576
Same	Wood	3400 ± 70	1780–1610	1890–1520	Spb-575
Bogolyubovka cemetery, 1/20	"	3300 ± 80	1690–1490	1770–1410	Spb-577
Bogolyubovka cemetery, 1/31	Human bone	3487 ± 100	1950–1680	2150–1500	Spb-681
Bogolyubovka cemetery, 2/2	Same	3432 ± 70	1830–1640	1920–1600	Spb-679
Bogolyubovka cemetery, 2/6	"	3498 ± 100	1950–1680	2150–1500	Spb-685
Bogolyubovka cemetery, 3/2	"	3366 ± 70	1750–1600	1830–1490	Spb-684
Bogolyubovka cemetery, 3/4	"	3360 ± 120	1780–1500	2000–1400	Spb-686
Bogolyubovka cemetery, 11/3	"	3250 ± 150	1740–1380	1900–1100	Spb-683
Pleshanovo II cemetery, 2/5	Wood	3390 ± 30	1700–1660	1760–1610	Le-9897
		Stage III			
Bogolyubovka cemetery, 13/6	Human bone	3424 ± 100	1880–1620	1050–1450	Spb-682

to allow for the formation of soil properties, which make it possible to distinguish the burial mounds of the first and subsequent periods. This date (the 19th century BC) fits the chronological range proposed by a number of scholars as a chronological framework for the Timber-Grave culture (Chernykh, 2007: 86; Molodin, Epimakhov, Marchenko, 2014: 142, 145). Apparently, the earliest sites of this culture were created during the late stages of the post-Catacomb, Sintashta, and Potapovka antiquities.

Burial complexes of stage II. First of all, we should note the spread of multi-burial barrows (sometimes over 30 burials under a single mound). Burial chambers of large sizes located in the center of the barrow and covered either by thick layers of wood or stone slabs occur more frequently than at the sites of stage I. Additional elements, such as organic matting and covering, and sprinkling with ocher, have been found in the burials made over large areas. A new element in the funerary rite of the Timber-Grave culture at stage II is that in some cases stone, wooden, or stone-wooden covers were found under the same mound. Some peripheral burials were made according to the cremation rite. Double burials (face to face) occur in some burial mounds, which must have occurred under the influence of the Alakul funerary rites (Rafikova, 2008: 6, 11).

The typological range of pottery at stage II became wider than at stage I also due to the incorporation of the Alakul component. Burial goods became more varied, too; in addition to pottery, they are represented by adornments, insignia of power, implements of labor, and in isolated cases by wooden dishware.

In technological terms, the pottery from the burial mounds of stage II demonstrates variability. Thus, fundamentally different types of raw materials were selected for manufacturing dishware. Silts, and silty and natural clay was found in the pottery from the Skvortsovka (burial mound 3) and Labazovsky necropolises; silty clay and natural clay was used in the pottery from the Bogolyubovka cemetery (burial mounds 1–3, and 11); silts and clay were present in the composition of pottery from the II Pleshanovo cemetery, and only natural clay was used in the pottery from the Uranbash necropolis. The composition of pastes also varied from 2 (burial mounds 2 and 4 of the Uranbash cemetery) to 13 (burial mound 3 of the Skvortsovka cemetery) recipes. This situation indicates that although the population that left the burial mounds of stage II was culturally relatively homogeneous, this homogeneity was formed on the basis of the interaction of several communities with various skills of pottery manufacturing.

Judging by the results of the summation of radiocarbon dates (with the exception of those that had an error of over 150 years), calibrated with the probability of 1σ, the sites of stage II of the Timber-Grave culture can be dated to the period from the late 19th to 17th century BC (see *Table*). The reconstruction of paleoclimatic conditions has shown that burial mounds of this stage were built at the beginning of climate amelioration with some increase in humidity. According to the study of the paleosols of the Lower Volga region, this climatic situation occurred in the 18th to 16th centuries BC (Demkin et al., 2009: 181). Taking into account the main array of radiocarbon dates, stage II of the Timber-Grave culture in the Western Orenburg region can be dated to the 18th to 17th centuries BC.

Thus, the cultural situation at stage II changed as compared to stage I under the influence of the traditions inherited from the cultures of the Sintashta-Potapovka circle, which began to intensively manifest themselves in the Timber-Grave environment. In addition, ties with the Early Alakul culture started to intensify. In the historiographic tradition, the sites with these features are attributed to the Pokrovsk stage of the Timber-Grave culture (Vasiliev, Kuzmina, Semenova, 1985: 62–75; Semenova, 2000: 161–168; Bogdanov, Khalyapin, 2000: 44–45).

Speaking about the chronological position of the "Pokrovsk" Timber-Grave antiquities, we should mention two different points of view on the correlation of the Pokrovsk and Sintashta-Potapovka sites. According to the first view, the Pokrovsk, Sintashta, and Potapovka complexes were contemporaneous, as evidenced by the similarity of the funerary rite and some categories of burial goods, as well as a number of coinciding ^{14}C-dates (Malov, 2001: 200–201; Zeleneev, Yudin, 2010: 143; Yudin, Matyukhin, 2006: 67–70). The second point of view is that chronologically the Pokrovsk sites followed the Sintashta-Potapovka sites, and the similarity of these complexes is not of a chronological, but a genetic nature (Vasiliev, Kuznetsov, Semenova, 1995: 36–37; Kuznetsov, Semenova, 2000: 130–134).

It seems that only the early "sites of the Pokrovsk type" (in other terminology, the complexes of the late stage of the Don-Volga Abashevo culture (Pripadchev, 2003: 53)) were contemporaneous to the Sintashta and Potapovka sites. The so-called Pokrovsk Timber-Grave complexes definitely appeared after the "chariot" cultural entities. This is confirmed by the archaeological materials of the Orenburg Cis-Urals, where Timber-Grave sites with the "Pokrovsk" features belong already to stage II of the development of the culture, thus following the sites of the Sintashta-Potapovka circle.

Burial complexes of stage III. The appearance of pottery revealing the traditions of the Kozhumberdy, Fedorovka, and West-Alakul pottery in the Timber-Grave complexes should be considered the most important feature of this stage. Sometimes pottery is combined with stone structures in the form of boxes or rings, or with the rite of cremation. There were cases when burials performed according to the ritual of cremation were equipped with stone boxes or fences, yet vessels of a

typical Timber-Grave appearance were placed inside. The combination of stone boxes and stone rings with cremation indicates the Andronovo influence on the funerary rite (Kuzmina, 1994: 42–43). These features were not manifested at the earlier stages of the Timber-Grave culture.

At the same time, it should be emphasized that the actual Timber-Grave traditions, such as the funerary rite performed in the form of inhumation in pits of sub-rectangular shape and orientation of the buried person placed on the left side with his head to the N, NE, or E, also remain the determining features at stage III. Pottery of a typical Timber-Grave appearance was found along with the Timber-Grave-Andronovo vessels. Thus, in spite of a significant influx of different cultures, we cannot speak about complete change in the cultural situation of that period of the Timber-Grave culture development.

Technologically, the pottery of stage III reveals both similarities and differences as compared to the dishware of the previous period, and as a rule demonstrates clear differences from the pottery of stage I. Most of the pottery from the burial mounds of stage III at the Bogolyubovka cemetery (burial mounds 10 and 13) was made of ferruginous clay. This raw material was not found in the complexes of stage I at the same site. Pottery of stage II was made both of silty and natural clay, but as opposed to stage III, the former were dominant. The composition of the molding compounds used for the pottery from the burials of stage III at the Bogolyubovka cemetery is quite standard: clay, grog, and organic solution, often resulting from squeezed manure. Pottery from the burial mounds of stage III at the Uranbash cemetery (burial mounds 8 and 9) technologically demonstrates the greatest variety in paste composition (up to six different recipes were used).

A distinctive aspect of the burial complexes from stage III is partial preservation of vestigial features. Thus, southern, southeastern, and northwestern orientation of the buried, typical of the pre-Timber-Grave period, was observed in a number of cases. Sometimes the arms were found in the position typical of the burial ritual of the post-Catacomb cultures: the left arm was bent at the elbow in such a way that the hand was in front of the face; the right arm was at a right angle so the hand was at the elbow of the left arm; both arms were stretched to the knees. In isolated cases, intermittent ditches were found around the mounds. The features of the pre-Timber-Grave period occur in pottery in exceptionally rare cases.

It is difficult to establish the chronological range of the sites of stage III. Only one radiocarbon date has been obtained (see *Table*). It has a relatively large error and gives a wide interval; thus, it cannot be unequivocally used for dating the entire stage. An entire series of dates has been obtained from the materials of the settlement of Gorny in the Orenburg Cis-Urals, where a large number of earthenware with Andronovo features was found (Lunkov, 2004: 28: 30–31). These dates with a probability of 1σ fit into the interval of the 17th to 14th centuries BC, and may serve as a basis for attributing the site to stage III of the Timber-Grave culture. According to E.N. Chernykh, the settlement of Gorny should be dated to the 17th to 15th centuries BC (Chernykh et al., 2002: 125, 127). The soils under the mounds of stage III show the most "humid" properties, which indicates more favorable climatic conditions than those of the present day. According to the study of paleosols in the Lower Volga region, such a climatic situation occurred in the 16th to 12th centuries BC (Demkin et al., 2009: 181). Proceeding from the above facts, stage III of the Timber-Grave sites in the Western Orenburg region can be dated to the 16th to 15th centuries BC.

Conclusions

The Timber-Grave culture on the territory of the Western Orenburg region evolved in three stages, which is confirmed by the archaeological materials and data obtained using natural science-based methods. The core of this culture emerged on the basis of the traditions of the post-Catacomb tribes and the population that left the sites of the Sintashta-Potapovka circle with the predominance of the former. Its evolutionary development in this territory took place at stage I, which was caused by a lack of contacts with the carriers of other cultures. The natural and climatic situation is characterized by arid conditions before the onset of a more favorable humid period. The chronological range of this stage is the 19th century BC.

At the II and especially at stage III of the Timber-Grave culture, its carriers were involved in a complex process of interaction with tribes belonging to different cultures (the Alakul and the Kozhumberdy cultures), which is manifested in a sophistication of ritual norms and a greater variety of burial goods. The Andronovo component is most pronounced at stage III. Natural and climatic conditions corresponding to stage II are characterized by amelioration with some increase in humidity compared to the previous period. The most favorable situation in terms of humidity has been reconstructed for stage III. The chronological framework of stage II is the 18th to 17th centuries BC, of stage III the 16th to 15th centuries BC.

Acknowledgement

This study is a part of the Public Contract No. 33.1389.2017/ПЧ for performance of research work. Studies of paleosols were performed under the Public Contract No. 01201356686.

References

Bogdanov S.V., Khalyapin M.V. 2000
Pamyatniki pokrovskoy epokhi v stepnom Priuralye. In *Kulturnoye naslediye stepey Severnoy Yevrazii*. Orenburg: Orenburg. guberniya, pp. 44–56.

Bogolyubovskiy kurgannyi mogilnik srubnoy kultury v Orenburgskoy oblasti. 2014
N.L. Morgunova, A.A. Golyeva, A.A. Evgenyev, E.A. Kryukova, L.V. Kuptsova, N.V. Roslyakova, N.P. Salugina, M.A. Turetskiy, A.A. Khokhlov, O.S. Khokhlova. Orenburg: Izd. Orenburg. Gos. Ped. Univ.

Chernykh E.N. 2007
Kargaly. Vol. V: Kargaly: Fenomen i paradoksy razvitiya; Kargaly v sisteme metallurgicheskikh provintsiy; Potayennaya (sakralnaya) zhizn arkhaichnykh gornyakov i metallurgov. Moscow: Yazyki slavyan. kultury.

Chernykh E.N., Lebedeva E.Y., Zhurbin I.V., López Saez J.A., Lopes García P., Martínez Navarrete I.N. 2002
Kargaly: Gorniy – poseleniye epokhi pozdney bronzy: Topografiya, litologiya, stratigrafiya; Proizvodstvenno-bytoviye i sakralniye sooruzheniya; Otnositelnaya i absolyutnaya khronologiya. Moscow: Yazyki slavyan. kultury.

Demkin V.A., Borisov A.V., Demkina T.S., Khomutova T.E., Pampura T.V. 2009
Evolyutsiya pochv i dinamika klimata stepey Nizhnego Povolzhya v IV–II tys. do n.e. In *Problemy izucheniya kultur rannego bronzovogo veka stepnoy zony Vostochnoy Evropy*. Orenburg: Izd. Orenburg. Gos. Ped. Univ., pp. 175–184.

Epimakhov A.V., Hanks B., Renfrew K. 2005
Radiouglerodnaya khronologiya pamyatnikov bronzovogo veka Zauralya. *Rossiyskaya arkheologiya*, No. 4: 92–102.

Gorbunov V.S., Morozov Y.A. 1985
Periodizatsiya srubnoy kultury Priuralya. In *Srubnaya kulturno-istoricheskaya obshchnost (problemy formirovaniya i periodizatsii)*. Kuibyshev: Izd. Kuibyshev. Gos. Ped. Univ., pp. 95–118.

Kachalova N.K. 1985
Periodizatsiya srubnykh pamyatnikov Nizhnego Povolzhya. In *Srubnaya kulturno-istoricheskaya obshchnost (problemy formirovaniya i periodizatsii)*. Kuibyshev: Izd. Kuibyshev. Gos. Ped. Inst., pp. 28–59.

Khokhlova O.S. 2006
Yamnaya kultura po dannym paleopochvennogo izucheniya kurganov v Orenburgskom Preduralye. In *Problemy izucheniya yamnoy kulturno-istoricheskoy oblasti*. Orenburg: Izd. Orenburg. Gos. Ped. Univ., pp. 104–109.

Khokhlova O.S., Khokhlov A.A. 2005
Paleopochvenniye issledovaniya kurgannogo mogilnika Mustayevo V v Novosergiyevskom rayone Orenburgskoy oblasti. In *Arkheologicheskiye pamyatniki Orenburzhya*, iss. 7. Orenburg. Gos. Ped. Univ., pp. 50–69.

Kryukova E.A., Evgeniev A.A., Kuptsova L.V., Matyushko I.V. 2012
Kompleksy pozdnego bronzovogo veka Pleshanovskogo II kurgannogo mogilnika. In *Arkheologicheskiye pamyatniki Orenburzhya*, iss. 10. Orenburg. Gos. Ped. Univ., pp. 112–134.

Kuptsova L.V. 2015
K voprosu o kharakteristike rannego etapa srubnoy kultury. In *Noviye materialy i metody arkheologicheskogo issledovaniya: Materialy III Mezhdunar. konf. molodykh uchenykh*. Moscow: IA RAN, pp. 56–57.

Kuzmina E.E. 1994
Otkuda prishli indoarii? Materialnaya kultura plemen andronovskoy obshchnosti i proiskhozhdeniye indoirantsev. Moscow: Vost. lit.

Kuznetsov P.F., Mochalov O.D. 2012
Potapovskiye kompleksy kurgannogo mogilnika Grachevka II. In *Bronzoviy vek: Epokha geroyev (po materialam pogrebalnykh pamyatnikov Samarskoy oblasti)*. Samara: Izd. Minist. kultury Samar. obl., pp. 37–82.

Kuznetsov P.F., Semenova A.P. 2000
Pamyatniki potapovskogo tipa. In *Istoriya Samarskogo Povolzhya s drevneishikh vremen do nashikh dney: Bronzoviy vek*. Samara: Izd. Samar. nauch. tsentra RAN, pp. 122–151.

Lunkov Y.V. 2004
Keramicheskiy kompleks. In *Kargaly*. Vol. III: Selishche Gorniy: Arkheologicheskiye materialy; Tekhnologiya gorno-metallurgicheskogo proizvodstva; Arkheobiologicheskiye issledovaniya, Ch. 1. Moscow: Yazyki slavyan. kultury, pp. 22–75.

Malov N.M. 2001
Kultury epokhi pozdney bronzy v Nizhnem Povolzhye. In *Bronzoviy vek Vostochnoy Evropy: Kharakteristika kultur, khronologiya i periodizatsiya*. Samara: Nauch.-tekhn. tsentr, pp. 199–202.

Mimokhod R.A. 2011
Radiouglerodnaya khronologiya bloka postkatakombnykh kulturnykh obrazovaniy. *KSIA*, iss. 225: 28–53.

Mimokhod R.A. 2013
Lolinskaya kultura: Severo-Zapadniy Prikaspiy na rubezhe srednego i pozdnego periodov bronzovogo veka. Moscow: IA RAN. (Materialy okhrannykh arkheologicheskikh issledovaniy; vol. 16).

Mimokhod R.A. 2014
Postkatakombniy period v Nizhnem Povolzhye: Ot krivolukskoy kulturnoy gruppy k volgo-donskoy babinskoy culture. *KSIA*, iss. 232: 100–119.

Mochalov O.D. 2008
Keramika pogrebalnykh pamyatnikov epokhi bronzy lesostepi Volgo-Uralskogo mezhdurechya. Samara: Izd. Samar. Gos. Ped. Univ.

Molodin V.I., Epimakhov A.V., Marchenko Z.V. 2014
Radiouglerodnaya khronologiya kultur epokhi bronzy Urala i yuga Zapadnoy Sibiri: Printsipy i podkhody, dostizheniya i problemy. *Vestnik Novosibirskogo gosudarstvennogo universiteta*. Ser.: Istoriya, filologiya, vol. 13. Iss. 3: Arkheologiya i etnografiya: 136–167.

Morgunova N.L., Golieva A.A., Degtyareva A.D., Evgeniev A.A., Kuptsova L.V., Salugina N.P., Khokhlova O.S., Khokhlov A.A. 2010
Skvortsovskiy kurganniy mogilnik. Orenburg: Izd. Orenburg. Gos. Ped. Univ.

Morgunova N.L., Golieva A.A., Evgeniev A.A., Kitov E.P., Kuptsova L.V., Salugina N.P., Khokhlova O.S., Khokhlov A.A. 2009
Labazovskiy kurganniy mogilnik srubnoy kultury. Orenburg: Izd. Orenburg. Gos. Ped. Univ.

Mukhametdinov V.I. 2012
Tekhniko-tekhnologicheskiy analiz keramiki Pleshanovskogo II kurgannogo mogilnika. In *Arkheologicheskiye*

pamyatniki Orenburzhya, iss. 10. Orenburg. Gos. Ped. Univ., pp. 134–139.

Otroshchenko V.V. 2003

K istorii plemen srubnoy obshchnosti. In *Arkheologiya vostochnoyevropeiskoy lesostepi*. Iss. 17: Dono-donetskiy region v epokhu bronzy. Voronezh. Gos. Univ., pp. 68–96.

Pripadchev A.A. 2003

Pamyatniki pokrovskogo tipa i ikh osmysleniye (k istoriografii voprosa). In *Arkheologiya vostochnoyevropeiskoy lesostepi*. Iss. 17: Dono-donetskiy region v epokhu bronzy. Voronezh. Gos. Univ., pp. 51–57.

Rafikova Y.V. 2008

Parniye pogrebeniya srubno-alakulskoy kontaktnoy zony Yuzhnogo Zauralya. *Vestnik Chelyabinskogo gosudarstvennogo universiteta*. Ser.: Istoriya, No. 18: 5–13.

Salugina N.P. 2012

Keramicheskiye traditsii kak pokazatel professionalnogo statusa. In *Arkheologicheskiye pamyatniki Orenburzhya*, iss. 10. Orenburg. Gos. Ped. Univ., pp. 62–70.

Semenova A.P. 2000

Pogrebalniye pamyatniki srubnoy kultury. In *Istoriya Samarskogo Povolzhya s drevneishikh vremen do nashikh dney: Bronzoviy vek*. Samara: Izd. Samar. nauch. tsentra RAN, pp. 152–208.

Sinyuk A.T., Pogorelov V.I. 1985

Periodizatsiya srubnoy kultury Srednego Dona (po materialam pogrebalnykh pamyatnikov). In *Srubnaya kulturno-istoricheskaya obshchnost (problemy formirovaniya i periodizatsii)*. Kuibyshev: Izd. Kuibyshev. Gos. Ped. Inst., pp. 118–145.

Tkachev V.V., Khavansky A.I. 2006

Keramika sintashtinskoy kultury. Orsk, Samara: Izd. Orsk. Gum.-Tekhnol. Inst.

Vasiliev I.B. 2010

Srubnaya kultura lesostepnogo Povolzhya i Priuralya. In *40 let Srednevolzhskoy arkheologicheskoy ekspeditsii*. Samara: Ofort, pp. 64–86. (Krayevedcheskiye zapiski; iss. XV).

Vasiliev I.B., Kuzmina O.V., Semenova A.P. 1985

Periodizatsiya pamyatnikov srubnoy kultury lesostepnogo Povolzhya. In *Srubnaya kulturno-istoricheskaya obshchnost (problemy formirovaniya i periodizatsii)*. Kuibyshev: Izd. Kuibyshev. Gos. Ped. Inst., pp. 60–94.

Vasiliev I.B., Kuznetsov P.F., Semenova A.P. 1995

Pamyatniki potapovskogo tipa v lesostepnom Povolzhye (kratkoye izlozheniye kontseptsii). In *Drevniye indoiranskiye kultury Volgo-Uralya (II tys. do n.e.)*. Samara: Izd. Samar. Gos. Ped. Univ., pp. 5–37.

Yudin A.I., Matyukhin A.D. 2006

Rannesrubniye kurganniye mogilniki Zolotaya Gora i Kochetnoye. Saratov: Nauch. kn.

Zeleneev Y.A., Yudin A.I. 2010

Kurgan u s. Duboviy Gay. In *Arkheologicheskiye pamyatniki Saratovskogo Pravoberezhya: Ot ranney bronzy do srednevekovya (po materialam raskopok 2005–2006 gg.)*. Saratov: Nauch. kn., pp. 134–155.

Received January 14, 2016.

DOI: 10.17746/1563-0110.2018.46.1.108-116

N.P. Matveeva[1], A.S. Yakimov[1, 2], N.S. Larina[1], and L.I. Agafonov[3]

[1]Tyumen State University,
Volodarskogo 6, Tyumen, 625003, Russia
E-mail: nataliamatveeva1703@yandex.ru; yakimov_artem@mail.ru; nslarina@yandex.ru
[2]Earth Cryosphere Institute, Tyumen Scientific Center, Siberian Branch, Russian Academy of Sciences,
Malygina 86, Tyumen, 625026, Russia
[3]Institute of Plant and Animal Ecology,
Ural Branch, Russian Academy of Sciences,
8 Marta 202, Yekaterinburg, 620144, Russia
E-mail: lagafonov@ipae.uran.ru

The Russian Pioneers' Winter Camp on Karachinsky Island, the Lower Tobol River, Western Siberia

In 2014, an expedition from Tyumen State University excavated an underground dwelling on Karachinsky Island, in the floodplain of the Tobol, to check the chronicle data saying that Yermak and his Cossacks had spent a winter at that place during their Siberian campaign. The log structure, measuring 10 m by 5 m by 2 m, consisted of two rooms. Three or four bottom tiers of logs have been preserved. Remains of a cellar were found in the central part east of the oven. The building existed for a short time because the area around it was sterile. Lenses of calcination and charcoal, and traces of fire on the logs of the structure suggest that it had burnt down. Then it was repaired, but the amount of garbage and kitchen waste is small. All household effects were carried out before the dwellers left. Finds include pottery, a grindstone, a potter's scraper, and pieces of slag and metal. An AMS date of the wood, generated at Arizona University, falls within the 17th century. The chemical analysis of background and old soils indicates intense use of the island for pasture and manufacture. In sum, our survey provides no evidence of Yermak's stay on the island during his campaign. According to R.G. Skrynnikov, the Cossacks marched from the Stroganov forts to the Siberian Khanate capital without wintering, which was tactically correct, since the Tatar forces were weak and fragmented because of Mametkul's foray into the Ural towns.

Keywords: *Russian colonization, Siberia, winter camp, Tobol, log dugout, soil analysis, metalworking, buried soil, chemical elements.*

Introduction

Sources contain very scarce information about the great epoch of the Russian conquest of Siberia, and in particular about the campaign of the Cossacks from the Stroganov lands to Qashliq. It has been proved that the "Siberian Chronicles" express the interests of certain groups, and a number of events there are clearly fictitious (Dergacheva-Skop, 1965: 17; Romodanovskaya, 2002: 242). Thus, quantitative data from the sources about the expedition greatly vary. For example, we do not know for certain the duration (from three to six years), numbers (300 to 7000 persons), or the route the detachment took, which is described inconsistently with the indication of various rivers and passes (Skrynnikov, 1986: 151–153, 249–250). Since

the written information is insufficient, another way of verifying historical events is to identify the locations associated with them and conduct comprehensive research of them. To date, only two points of the Siberian campaign have been identified: the capital of the Khanate of Sibir, Qashliq (later, Isker), where evidence of the presence of the Cossack detachment has been discovered (Mogilnikov, 2004: 117), and Chimgi-Tura, with burnt buildings from the Tatar period of the 16th–17th centuries (Rafikova, 2011: 14; Matveeva, Alieva, 2014). However, it was not possible to determine where and how many times the Cossacks spent the winter.

We considered it appropriate to start the analysis of factual evidence behind the Siberian campaign by verifying the most well-founded theory of R.G. Skrynnikov (1986: 215, 241–246), according to which it took two months to take Qashliq after the departure from the Chusovsky town. Thus, we decided to examine Karachinsky Island (Fig. 1) as the most promising place for finding archaeological evidence of a battle or encampment (Matveeva, Anoshko, 2014). According to the Remezov Chronicle, the town of Murza Karacha was conquered two months before the attack on the abatis on the Chuvash Cape (Sibirskiye letopisi…, 2008: 417, 420). During the battle, "riches", cattle, and a prince were captured there (Ibid.: 197). According to one theory (Sergeev, 1959), Yermak's detachment spent nearly a year in the town of Karacha. According to another theory (of R.S. Skrynnikov and S.G. Parkhimovich), the Cossacks spent all winters of the Siberian campaign there because of the small area of the fortress in Isker. R.G. Skrynnikov argued that the Cossacks spent one winter in the Karachin site after the Pelym campaign in 1583 (1986: 241, 244). Parkhimovich suggested that the detachment of Yermak at the beginning of the campaign and the detachment of Semyon Bolkhovsky at the end of the campaign spent a winter there (1984). Some sources do not mention spending a winter in this place. For instance, the Rumyantsev Chronicler reports, "…and they conquered the Ulus of Karacha, and acquired a lot of riches, and brought them to their boats" (Polnoye sobraniye…, 1987: 33). According to the Stroganov Chronicle, "… they battled with Karacha, the Khan's adviser, and conquered his Ulus, and took the Khan's honey and Khan's wealth to their boats"; the Pogodin Chronicler gives the same information (Sibirskiye letopisi…, 2008: 20–21, 277).

In order to establish the facts of the battle and wintering by the detachment of Cossacks, an expedition of the Tyumen University carried out archaeological research in 2014. The place of the battle was identified

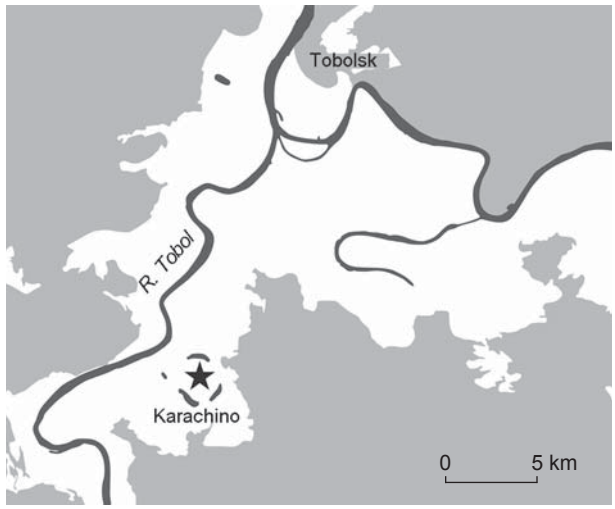


Fig. 1. Location of the research site.

by cartridges from muskets found on the southeastern shore of the island (Fig. 2) (Matveeva, Nagibin, 2014: 31). An excavation trench was made for exploring a dugout that was discovered in 1983.

Research object. This archaeological site is located 1 km to the west of the village of Karachino in the Tobolsky District of the Tyumen Region, on an unflooded wooded ridge of the right bank floodplain of the Tobol River, 30 km upstream of the city of Tobolsk (coordinates: 58°01′20.8″N, 68°08′42.8″E). It was discovered by an exploratory trench made by Parkhimovich, who was told by the locals about plowed Yermak dugouts inside the arch of Karachinsky Lake, but he, himself, studied the Karachin town site in 1982–1983—a settlement of the 18th century consisting of ground dwellings, 240 m to the southwest of our site (Fig. 2) (Parkhimovich, 1985: 236).

On an area of 122.5 m^2, we uncovered a log structure, which was only slightly affected by the excavation of the Ural Archaeological Expedition in 1983. Although we made 15 trenches 10–15 m in length, we did not find other dwellings within a radius of 200 m from the structure. Three lower layers and partly a fourth layer of logs, located at a depth of about 2 m from the native soil, have survived from the original framework (Fig. 3). Clay filling 0.2–0.4 m wide and 0.3 m high was found between the walls and the native soil. This layer protected the structure from the freezing of the walls in the winter and from flooding in the spring. The dwelling was divided by a log partition into two rooms of 12.6 m^2 (eastern room) and 10.6 m^2 (western room). Mixed soil was found under the partition, and below this soil, on both sides of the partition logs, the remains of a stove were discovered in the form of thick layers of fairly uniform calcined soil and thin layers of charcoal,

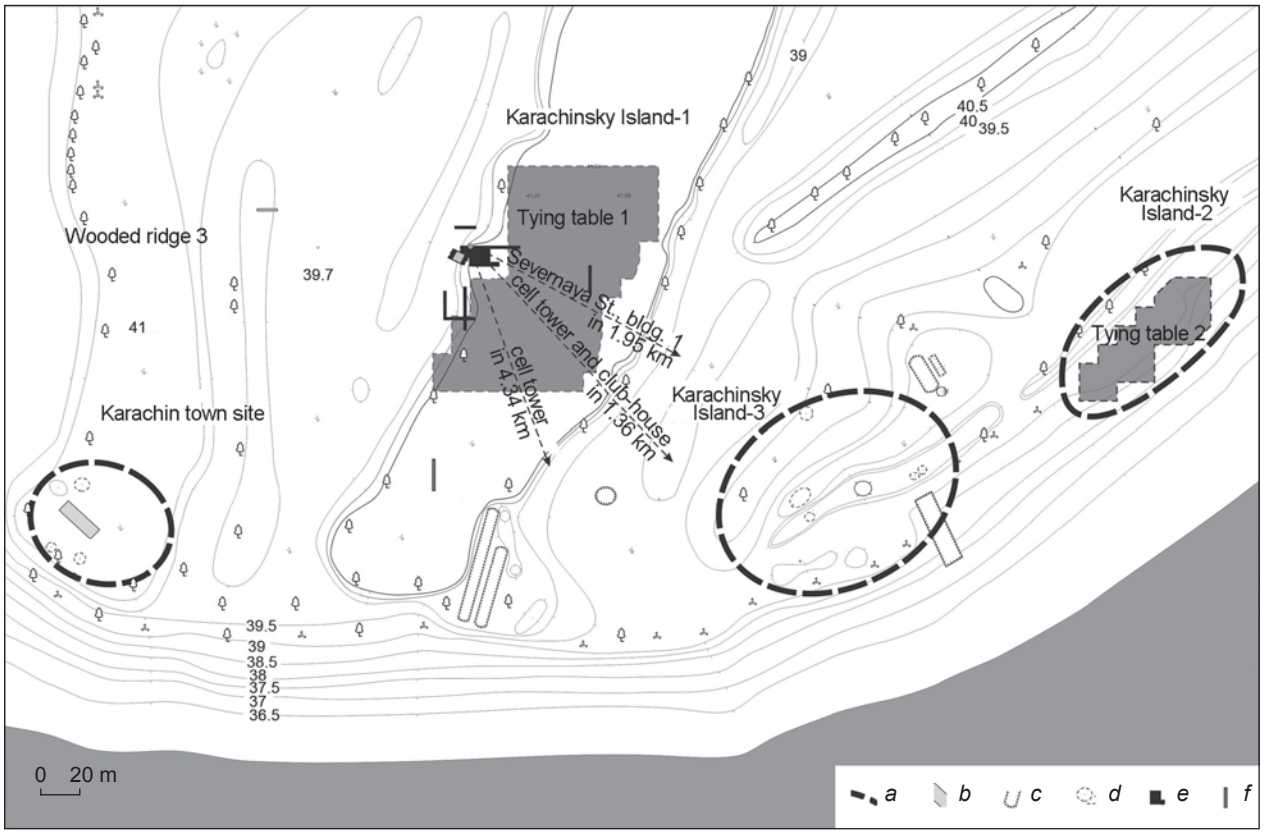


Fig. 2. Layout plan of the research area.
a – boundaries of the monuments; *b* – excavations of S.G. Parkhimovich; *c* – anthropogenic disturbances; *d* – dugouts; *e* – excavation area of the Tyumen Archaeological Expedition of 2014; *f* – exploratory trenches of the Tyumen Archaeological Expedition of 2014.

ranging from 10 cm in thickness at the edges to 40 cm in the middle (Fig. 4). The calcined soil contained many sintered pieces of clay, but there were no remains of bricks. Among the orange lenses of calcination, fragments of slag and metal alloy, nine fragments of weakly baked Russian pottery, and a burnisher made from a shard, were found (Fig. 5). It is possible that broken metal objects were repaired or remelted there. Decay from a wooden spatula was discovered next to the remains of the stove.

At the level of the native soil, the dugout had a rectangular shape measuring 9.5 to 10 × 4.5 to 5.0 m. Steps of various heights and widths were located along the perimeter of the walls. The floor had an overall inclination in the western direction towards the slope of the ridge. A cellar was found to the east of the stove remains, consisting of a pit of irregular oval shape measuring 2.8 × 2.1 m in plan. The remains of a frame made of logs or half-logs 12–16 cm wide, outlining the perimeter of the structure, indicate the presence of a cover, which rested upon the frame. The bottom of this pit was uneven; the central part was deepened by 0.40 m on the western side, and by 0.64 m on the eastern side from the level of the continental floor of the structure. The filling of the pit included several layers and strata. The stove might have fallen onto the cover of the cellar during the fire and filled it with its fragments.

Buried soil from the time when the log structure was built, was unearthed in the southwestern wall of the excavation pit under the discharged soil from the dwelling pit, and its comprehensive study was carried out. A cross-section of the background exposed soil was studied 200 m to the south of the excavation pit (coordinates: 58°01′18.9″N, 68°08′41.9″E). Both soils belong to the alluvial meadow acid subtype (Klassifikatsiya…, 1977: 196).

Methods

For relative dating of the object, the characteristics of pottery identified during the analysis of materials from the excavations in Tobolsk (Anoshko, Seliverstova, 2009; Matveeva, Anoshko, Dolgikh, 2014) were used. Samples for dendrochronological analysis were

Fig. 3. Cleaning up of the dugout filling.

taken*. Two samples of wood were sent to the laboratory of the University of Arizona (USA) for dating using the AMS method.

The research of paleosoils is based on the pedologic-archaeological method (Demkin, 1997: 37). Its essence is combined analysis of background soils and soils buried under archaeological monuments, whose construction time can be determined by the methods of archaeology. Laboratory research and comparative analysis of the distribution of twelve elements: phosphorus (P), calcium (Ca), magnesium (Mg), manganese (Mn), mercury (Hg), zinc (Zn), copper (Cu), lead (Pb), nickel (Ni), cadmium (Cd), cobalt (Co), and strontium (Sr) in the profiles of buried and background soils have been carried out. The content of Ca, Mg, Mn, Zn, Cu, Pb, Ni, Cd, Co, and Sr was determined using atomic absorption spectrometry with flame atomization on SHIMADZU AA-6300; the content of P was identified using the photometric method on a photocolorimeter KFK-3 "ZOMZ"; the content of Hg was established using the atomic absorption method on a mercury analyzer RA-915M with attachment RP-91S.

Findings and discussion

Historical and archaeological interpretation. Let us consider how objective data can confirm or disprove the information from the chronicles. A ditch was found around the dugout, which may have been the base of a palisade. The building did not only have two rooms, but also had a double framework ("framework inside of a framework") in its eastern part, of which two or three layers of logs with a diameter not exceeding 22 cm have been preserved (see Fig. 3). This room most likely was residential, and the western room with a single framework might have been used for manufacturing purposes. The remains of wooden planking probably under the foundation of the stove, have survived. We assume that the entire structure was coated with a thick layer of clay. After the fire, the remains of the dwelling were leveled, and the logs of the inner partition of the

*Twenty-two samples selected and analyzed by L.I. Agafonov were older than the available materials from the excavations in Tobolsk. The resulting tree-ring chronology did not overlap with other chronologies constructed from timber samples from the Russian settlements in Western Siberia.

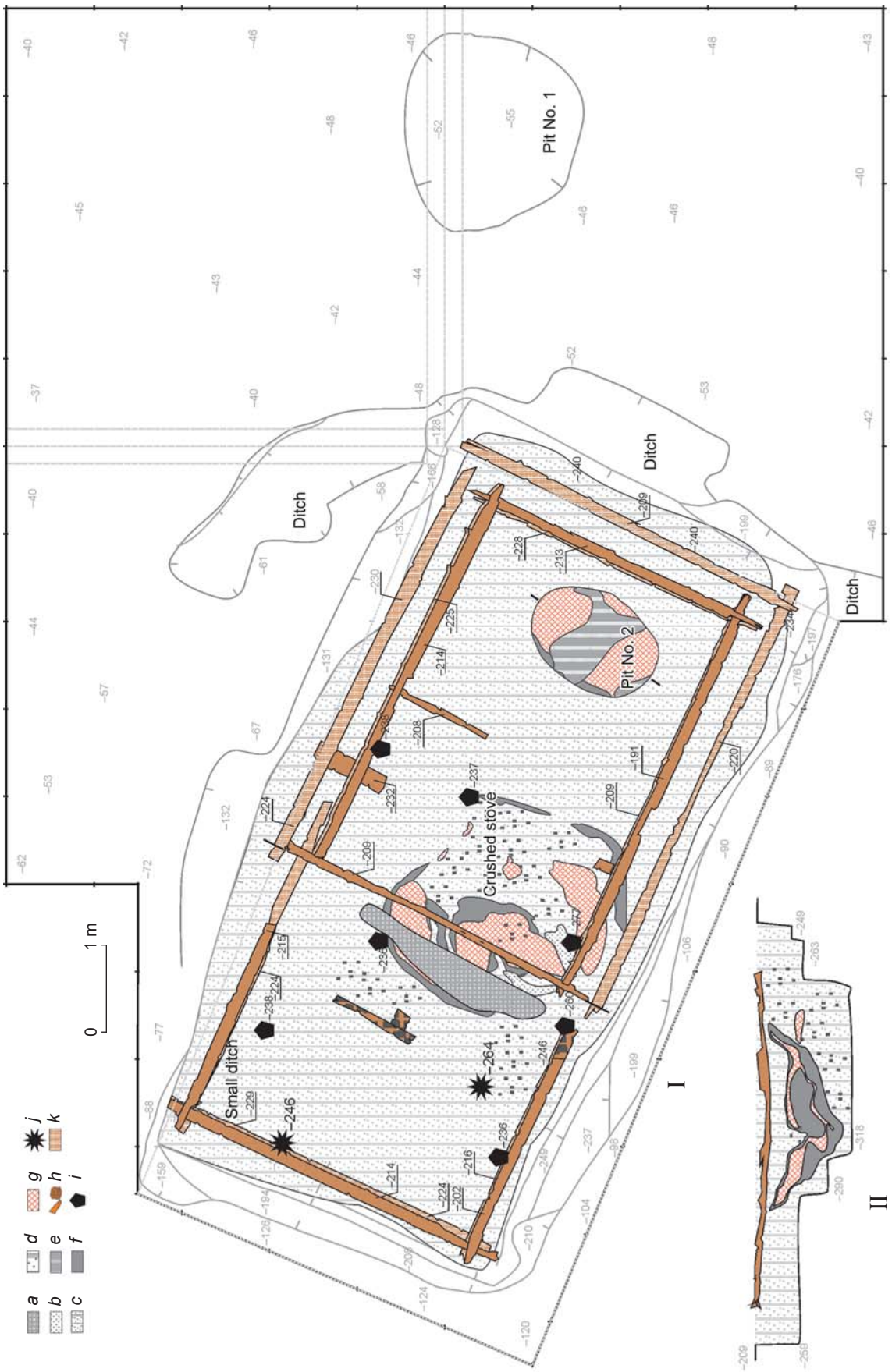


Fig. 4. Plan of the dugout (I) and the cross-section of the stove remains along the partition between the rooms; view from the northwest (II).
a – excavation area of the Ural Archaeological Expedition; *b* – discharged soil; *c* – gray layer; *d* – dark gray mixed layer; *e* – carbonaceous mixed layer; *f* – carbonaceous layer; *g* – calcination; *h* – wood; *i* – pottery fragment; *j* – metal object; *k* – lower level of the dugout.

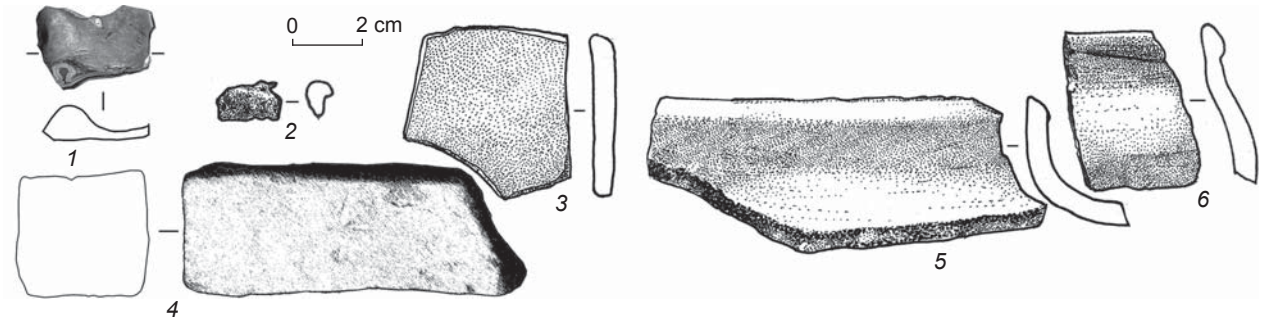


Fig. 5. Finds from the dugout.
1, *3*, *5*, *6* – clay; *2* – metal; *4* – stone.

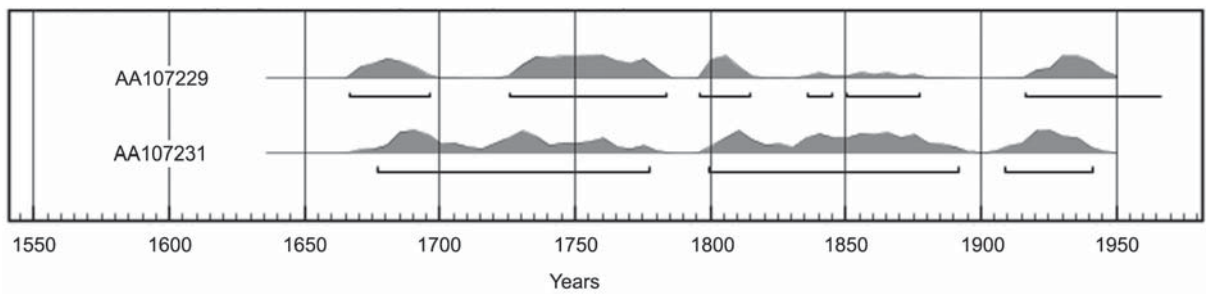


Fig. 6. Diagram of the calibrated dates of wood from the dugout.

dwelling were laid on top of them (Fig. 4). Stoves on wooden planking are known from Russian house building of the 16th–17th centuries. The remains of similar structures have been found in building No. 13 of the lower construction horizon in Mangazeya (Parkhimovich, Vizgalov, 2014: 650). According to morphological and technological features, the pottery discovered in the dugout belongs to the earliest group of Russian pottery that occurs in the layers of the 17th century in the historical part of Tobolsk (Anoshko, Seliverstova, 2009).

Dates of 157 ± 19 (AA107229) and 134 ± 22 BP (AA107231) were obtained from cellulose from two samples of wood. The cumulative interval of their calibrated dates is the late 17th–18th century (Fig. 6). However, since low solar activity occurred in the period of 1630–1750, which led to the formation of the Maunder minimum for the ^{14}C isotope, the radiocarbon age obtained for this historical segment will be later than the real age of the sample*. Therefore, we believe that the dugout under investigation should be dated to the second half of the 17th century.

Judging by the spatial and stratigraphic data, and material evidence, the building existed for a short time and ceased to function because of the fire which is indicated by the lenses of calcination and charcoal in the lower part of the filling, as well as burned logs of the framework. After the fire, the house was repaired, but was used sporadically, as indicated by the small number of discovered artifacts and small amount of household garbage and kitchen waste. In our opinion, the dwelling was built in a dry period, when the island was not flooded. After a short time it turned out to be under water, and the top part of the log structure was washed away.

In general, archaeological observations indicate that the dugout under investigation was used twice in the winter season and this winter dwelling most likely functioned during the initial period of the Russian development of Siberia. Traces of battle (remains of the weapons from the period under discussion) were found nearby on the natural levee (Matveeva, Nagibin, 2014: 31).

This winter dwelling of some group of the Russian population of the mid-17th century is located in an area with semi-hydromorphic natural conditions, characterized by periodic inundation associated with freshets and seasonal flooding. It has been established

*We would like to thank I.Y. Ovchinnikov from the V.S. Sobolev Institute of Geology and Mineralogy of the Russian Academy of Sciences for his expert consultation).

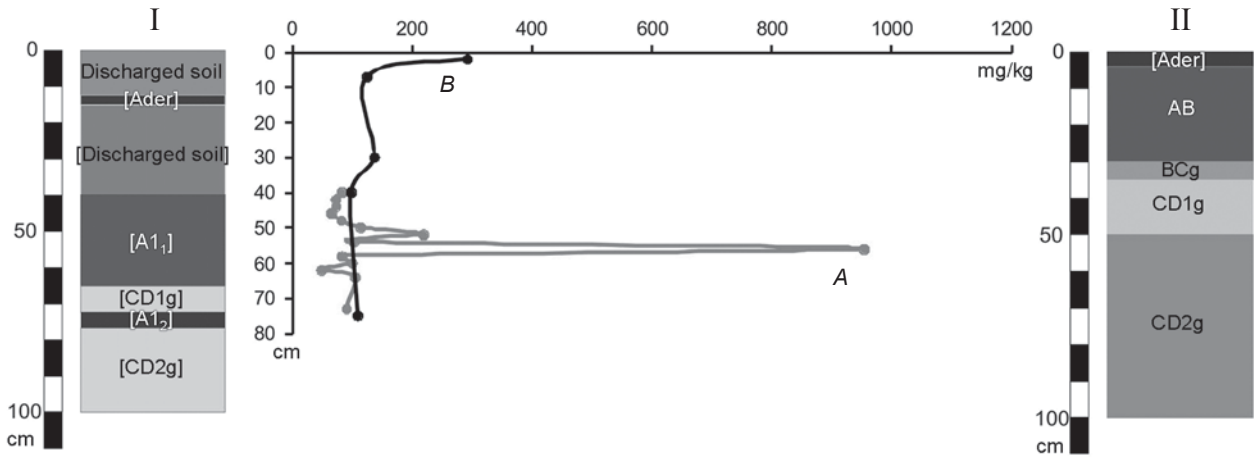


Fig. 7. Distribution of phosphorus (P_2O_5) according to the profiles of the buried (*A*) and background (*B*) soil.
I – soil section under the discharged soil from the pit of the structure; II –section of the background exposed soil.

that the dwelling was built and operated during the period when the territory was not flooded during the year. The dwelling was built into the slope of the natural levee facing the inner part of the island, which provided protection from adverse natural phenomena and wild animals.

Morphological structure of soils. A comparative analysis of the buried and background soils has revealed a number of similar features and differences which did not exceed the indexes of the soil subtype. It has been established that the profile under the discharged soil from the dwelling pit contained two humus horizons of different ages: [A1$_1$]* (40–65 cm) and [A1$_2$] (72–76 cm). The upper horizon [A1$_1$] belongs to the time when the winter dwelling was built. This soil is characterized by a darker color, heavy granulometric composition, as well as better defined structure. For the rest of the morphological features, no significant differences have been observed. Notably, the soil profiles did not react with 10 % hydrochloric acid (HCl).

Distribution of chemical elements in the soils. A comparative analysis was carried out for humus horizons [A1$_1$] and AB of the buried and background soils. The most noticeable differences have been observed for phosphorus (Fig. 7). In the buried soil, its content was 955 mg/kg of soil, which is seven and a half times higher than the phosphorus content in the background soil. The concentration of calcium in the paleosoil was also higher and reached 6600 mg/kg as opposed to 1300 mg/kg of the baseline concentration. The concentration of magnesium in the buried soil was 2.5 times higher than in the background soil (6300 and 2300 mg/kg, respectively).

The distribution of metals is of special interest. The concentration of zinc in the paleosoil was 65 mg/kg as opposed to 43 mg/kg in the background soil; the concentration of nickel was 15 and 9 mg/kg; the concentration of strontium was 5.5 and 3 mg/kg; the concentration of lead in the buried soil was ten times higher than the baseline concentration (10 and 1 mg/kg, respectively); the concentration of copper was two times higher (2.5 and 1.2 mg/kg), as with cadmium (0.7 and 0.3 mg/kg), and the concentration of cobalt was three times higher (6.2 and 2.2 mg/kg). No significant differences were found in the distribution of manganese and mercury.

Thus, the humus horizon of the buried soil [A1$_1$] constituted a geochemical barrier where the accumulation of chemical elements resulting from the economic activities took place.

Reconstruction of economic activities. The study of the general geomorphological situation in the area under consideration as well as the stratigraphy and planigraphy of the site made it possible to establish that the dwelling was built into the highest place of the natural levee. The upper boundary of the humus horizon [A1$_1$] was the boundary of the daytime surface at the time when the winter dwelling was built. We assume that the soil of that time experienced anthropogenic impact until it was sealed. Thus, it seems possible to suggest some considerations on the economic activities of the Russian settlers in the 17th century.

The high content of biogenic elements (phosphorus, calcium, and magnesium) may indicate cattle breeding in the economical system of the population, resulting in the use of the associated foods (meat, milk). Given

*Hereinafter the layers of the buried soil will be indicated in square brackets.

the good preservation of the paleosoil, the sufficient height of the discharged soil which was sealed, and absence of the obvious traces of diagenesis, we may assume that phosphorus was mainly accumulated from to the livelihood of the dwellers, for example, during meat cutting or leaving waste (cattle might have been kept near the dwelling). In addition, prolonged grazing in this area in the time preceding the construction of the dugout might have led to formation of another stable zone of high concentration of biogenic elements, which is observed in the lower part of the pedologic-archaeological cross-section. Thus, prior to the appearance of the Russians, there were some elements of the economic infrastructure of the Tatars present in this area. Indirectly, this is confirmed by the historical sources about the capturing of booty, as well as S.U. Remezov's illustration of herds of cattle and horses grazing on the island in Article 53, dedicated to the capture of the Karacha's ulus (Remezovskaya letopis, 2006: Vol. 2, 157).

High concentration of zinc, copper, lead, nickel, cadmium, cobalt, and strontium may indicate artisanal metallurgical activities of the population who might have been engaged in repairing household objects. Elevated concentrations of copper and zinc indicate that brass objects (copper and zinc alloy) were used in the household. High concentrations of lead may indicate the production of bullets. Nickel, cobalt, cadmium, and strontium are used in metallurgy as alloying additives. The dwellers might well have repaired high-grade steel products; most likely, these were bladed weapons.

Conclusion

Thus, field archaeological studies have not revealed the encampment of Yermak's detachment on the most dry and elevated stretch of the Karachinsky Island. It has been established that the island was regularly flooded and was not suitable not only for permanent, but also for temporary residence of a large group of people. We think that discovery of such an encampment in the future is unlikely. The studied winter dwelling belonged to another group of Russian pioneers who moved to Siberia half a century after the Cossacks of Yermak, and the memory of this wintering was reflected in the historical legends about the development of the region. It has been established that the concentrations of ten chemical elements (P, Ca, Mg, Zn, Cu, Pb, Ni, Cd, Co, and Sr) in the humus horizon of the paleosoil exceeded the baseline values by 1.5–10 times. This is associated with the specific aspects of economic activities practiced by the dwellers. Probably, the basis of their economy was cattle breeding and handicrafts, including manufacturing and repairing of weaponry. The obtained geochemical data on the specific features of economic activity of the Russian population of the 17th century in Western Siberia fit well with the archaeological materials and sources on the culture of the pioneers.

It seems that our study confirms the idea of R.G. Skrynnikov on the lightning-fast campaign of the Cossacks from the Stroganov towns to Qashliq without spending a winter. Such a course of the military campaign also seems to be most tactically justified in the conditions of weak resistance of Tatar forces, fragmented due to the participation of Mametkul's troops in the raid to the Cis-Urals. In addition, data have been obtained that indirectly confirm the reports of the chronicles on the battle of the Cossacks at the headquarters of Karacha and capturing of spoils.

References

Anoshko O.M., Seliverstova T.V. 2009
Kharakteristika russkoy goncharnoy posudy iz raskopok na territorii Verkhnego posada g. Tobolska. *Vestnik Tyumenskogo gosudarstvennogo universiteta*, No. 7: 80–90.

Demkin V.A. 1997
Paleopochvovedeniye i arkheologiya: Integratsiya v izuchenii istorii prirody i obshchestva. Pushchino: ONTI PNT RAN.

Dergacheva-Skop E.I. 1965
S.U. Remezov i ego "Istoriya sibirskaya": Cand. Sc. (Philology) Dissertation. Leningrad.

Klassifikatsiya i diagnostika pochv SSSR. 1977
Moscow: Kolos.

Matveeva N.P., Alieva T.A. 2014
Issledovaniye pamyatnika Tsarevo gorodishche v istoricheskoy chasti g. Tyumeni v 2011 g. In *Trudy IV Vseros. arkheol. syezda v Kazani*, vol. III. Kazan: Otechestvo, pp. 640–644.

Matveeva N.P., Anoshko O.M. 2014
Problemy i perspektivy izucheniya sibirskogo pokhoda Yermaka na osnove kompleksnogo istochnikovedeniya. In *Prisoyedineniye Sibiri k Rossii: Noviye danniye: Materialy Vseros. konf*. Tyumen: Izd. Tyum. Gos. Univ., pp. 16–26.

Matveeva N.P., Anoshko O.M., Dolgikh A.S. 2014
Raskopki zemlyanki na Karachinskom ostrove. In *Prisoyedineniye Sibiri k Rossii: Noviye danniye: Materialy Vseros. konf*. Tyumen: Izd. Tyum. Gos. Univ., pp. 26–28.

Matveeva N.P., Nagibin G.F. 2014
Raboty po obnaruzheniyu polya bitvy Yermaka s tatarskoy druzhinoy na Karachinskom ostrove. In *Prisoyedineniye Sibiri k Rossii: Noviye danniye: Materialy Vseros. konf*. Tyumen: Izd. Tyum. Gos. Univ., pp. 29–33.

Mogilnikov V.A. 2004
O vremeni zaseleniya gorodishcha Isker. In *Tobolskiy khronograf*, iss. 4. Yekaterinburg: Ural. rabochiy, pp. 117–119.

Parkhimovich S.G. 1984
Raskopki russkikh srednevekovykh pamyatnikov na Urale i v Zapadnoy Sibiri. In *Arkheologicheskiye otkrytiya 1982 goda*. Moscow: Nauka, p. 169.

Parkhimovich S.G. 1985
Issledovaniya pamyatnikov Zauralya i Zapadnoy Sibiri. In *Arkheologicheskiye otkrytiya 1983 goda*. Moscow: Nauka, pp. 235–236.

Parkhimovich S.G., Vizgalov G.P. 2014
Malogabaritniye postroyki posada Mangazei. In *Trudy Vseros. arkheol. syezda v Kazani*, vol. III. Kazan: Otechestvo, pp. 648–651.

Polnoye sobraniye russkikh letopisey. 1987
Vol. 36: Sibirskiye letopisi. Ch. 1: Gruppa Yesipovskoy letopisi. Moscow: Nauka.

Rafikova T.N. 2011
Rezultaty izucheniya Tsareva gorodishcha (2007–2009 gg.). In *Istoriya, ekonomika i kultura srednevekovykh tyurksko-tatarskikh gosudarstv Zapadnoy Sibiri*. Kurgan: Kurgan. Gos. Univ., pp. 11–15.

Remezovskaya letopis. 2006
V 2 t. Vol. 1: Faksimile. Vol. 2: Istoriya Sibirskaya. Letopis Sibirskaya, kratkaya Kungurskaya: Issledovaniye. Tobolsk: Obshchestv. fond "Vozrozhdeniye Tobolska".

Romodanovskaya E.K. 2002
Izbranniye trudy: Sibir i literatura XVII v. Novosibirsk: Nauka.

Sergeev V.I. 1959
K voprosu o pokhode v Sibir druzhiny Yermaka. *Voprosy istorii*, No. 1: 126–130.

Sibirskiye letopisi: Kratkaya Sibirskaya letopis (Kungurskaya). 2008
Ryazan: Aleksandriya.

Skrynnikov R.G. 1986
Sibirskaya ekspeditsiya Yermaka. 2nd edition. Novosibirsk: Nauka.

Received May 30, 2016.

DOI: 10.17746/1563-0110.2018.46.1.117-122

Chang Seok Oh[1], In Uk Kang[2], Jong Ha Hong[1], Jun Bum Park[3], and Dong Hoon Shin[1, *]

[1]Institute of Forensic Science, Seoul National University College of Medicine, 103 Daehak-ro (Yongon-dong), Jongno-gu, Seoul, 03080, Republic of Korea
E-mail: oxman@snu.ac.kr; archaev@gmail.com; cuteminjae@gmail.com
[2]Kyung Hee University, 26 Kyungheedae-ro, Dongdaemun-gu, Seoul, 02447, Republic of Korea
E-mail: kanginuk@khu.ac.kr
[3]Sangmyung University Seoul Industry Academic Cooperation Foundation, 20 Hongimun 2-Gil, Jongno-Gu, Seoul, 03016, Republic of Korea
E-mail: amimuseo@nate.com

An Experimental Assessment of the Cause of Mummification in the Joseon Period Burials, Republic of Korea

This article presents the results of experiments aimed at testing the hypothesis that the mummification of human bodies in Joseon Dynasty burials was caused by an exothermic reaction and the consequent destruction of intestinal flora. Well-preserved mummies of that period were discovered only in the Hoegwakmyo tombs, where the lime-soil-mixture barrier was present. Experiments were conducted using animals' bodies placed in miniature grave models. Immediately after contact with moisture, the temperature inside the coffin surrounded by a lime-soil-mixture increased to 130.8±23.5°C and remained stable for 141.0±64.7 minutes. The examination of bacterial cultures on MacConkey or blood agar plates showed that the entire flora normally existing in the rat's intestine was completely sterilized by high temperature. We also demonstrate that the same mummification can be reproduced regardless of the sizes of miniature graves.

Keywords: *Korea, mummies, Joseon, experiment, animals, lime-soil mixture, Hoegwakmyo.*

Korean Mummies of the Joseon Period

Well-preserved Korean mummies have been discovered during the past several decades in tombs of the Joseon Dynasty (1392–1910 AD) (Fig. 1, *A*). One of the most important characteristics we have noticed of Korean mummies is their near-perfect status of preservation (Fig. 1, *B*) as compared to those found in other countries. Certainly, well-preserved Joseon mummies have yielded invaluable information to scholars, though the latter have also encountered internal organs, the morphologies of which had been deformed by dehydration and long-acting gravitational forces (Shin et al., 2003; Kim et al., 2006) (Fig. 1, *C*).

The Korean mummies have been extensively studied by interdisciplinary research teams in South Korea (Shin et al., 2003; Kim et al., 2006; Lee et al., 2013; Seo et al.,

*Corresponding author.

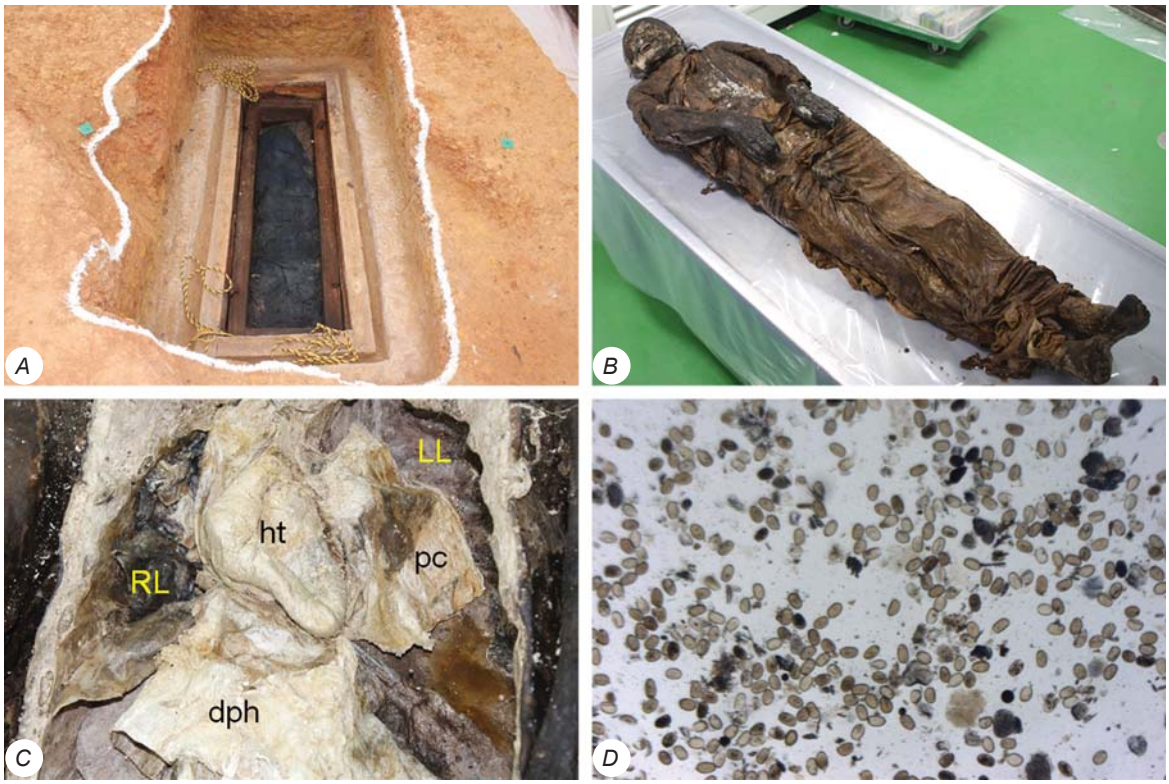


Fig. 1. The Joseon tomb where the well-preserved (Sacheon) mummy and artifacts such as clothing and documents etc. were discovered in 2011 (*A*); perfect preservation status of Korean mummy discovered at Hwasung (*B*); well-preserved internal organs remained within the body cavity of Hwasung mummy (*C*): LL – left lung, RL – right lung, ht – heart, pc – pericardium, dph – diaphragm; Ancient parasite *Paragonimus* eggs from (Yongin) mummy sample (*D*).

2014). Briefly, the signs of congenital or acquired diseases have been identified by gross anatomical examination, as well as histological and radiological investigations (Kim et al., 2014; Kim et al., 2015).

Further, microscopic or molecular techniques have been applied to the paleoparasitological analysis of ancient parasite eggs in Joseon mummy feces (Fig. 1, *D*). Our paleoparasitological studies over the past years have yielded data indispensable to the determination of parasitic infection patterns prevailing in historic Korean populations (Seo et al., 2014). When we compared the paleoparasitological data attained from Joseon mummies with South Korean national survey data to date, we were able to identify secular changes in the prevalence of parasitic infection throughout history (Seo et al., in press).

For the analysis of mummified remains and the pathogenic microbes or parasites infecting such individuals while they were living, ancient DNA (aDNA) analyses have been used. Since aDNA in the brain is much better preserved than in other areas, that organ has been the preferred resource for genetic analysis in Korean mummy studies (Oh et al., 2013). In the case of pathogen aDNA meanwhile, remarkable findings have been reported from ancient parasite eggs remaining inside Joseon mummy-feces (Seo et al., 2014). In fact, these results have proved academically significant to Korean researchers, who have found them to be very useful for reconstruction of pre-modern Korean peoples' physical and pathological traits (Song, Shin, 2014).

How did mummification occur inside Joseon tombs?

Since the actual mechanism of mummification in Korea has yet to be fully elucidated, it is difficult to subsume the Joseon mummy into any category of mummies discovered worldwide. As far as we know, there were no specific embalming techniques employed in Korea; therefore we rule out the possibility that Joseon mummies were artificially formed (Kim et al., 2006). Considering especially that natural conditions in Korea are actually unsuitable for mummification, the Joseon mummy definitely does not belong to any category of natural mummification (e.g. dry land or permafrost zone) reported worldwide (Shin et al., 2003).

In this connection, Korean scholars speculate that the Joseon mummy was not formed by any known

simple mechanism, but rather under a very unique condition not commonly seen in other countries. Actually, Joseon mummies have been found exclusively in graves of a unique structure (*Hoegwakmyo)*. Inside such a grave, the coffin is completely sealed by a wall of lime-soil mixture (Shin et al., 2003). We therefore considered the *Hoegwakmyo* tomb's unique structure with lime-soil-mixture barrier as an explanation for mummification. Nevertheless, the scientific evidence has been inconclusive. In an effort to answer this question definitively, a series of experiments have been recently performed using laboratory animals (rats) and miniature *Hoegwakmyo* tombs (Oh, Shin, 2014).

Temperature rising by exothermic reaction

In those experiments (Ibid.), a lime-soil mixture (lime : fine sand : yellow soil = 3 : 1 : 1) was filled into the space between the grave and the rat-containing coffin, as well as spread upon the coffin lid (Fig. 2, *A*). After a certain period of time, the lime-soil mixture hardened, thus forming a coffin-surrounding wall (Fig. 2, *B*). A second, wall-less miniature coffin was used as a negative control (Ibid.).

After enough time had passed, we found that the rats inside the miniature *Hoegwakmyo*-mimicking tombs were completely mummified (Fig. 2, *C*). The mummified tissues had maintained perfect morphologies with only minor taphonomic changes. Moreover, as no mummified rats were found in the negative control tombs, the presence of the coffin-surrounding lime-soil-mixture wall seemed highly correlated to mummification (Ibid.).

Next, in this study, we measured a temperature-change inside the *Hoegwakmyo* tombs. As is well known, quicklime (calcium oxide)'s contact with moisture induces an exothermic reaction. Likewise, when the lime-soil mixture of the *Hoegwakmyo* tomb meets moisture, heat could be generated. Considering that all species of bacteria can be sterilized by 100 °C heating for 90 minutes (atmospheric pressure) (Ananthanarayan, Paniker, 2006), the high heat maintained by the lime-soil-mixture wall over the course of a sufficient time period might have contributed to a condition of bacterial sterilization inside the *Hoegwakmyo* coffin.

To confirm the validity of our hypothesis, we conducted an additional experiment in this study, using the same animal model. We formed the lime-soil mixture around the coffin, and then determined the extent to which the temperature rose and how long it was sustained. To measure the temperature inside the coffins, a digital thermometer (KTH300 model, KIMO, France) was installed in the lid (Fig. 2, *D*). The temperature was measured over the course of 4 hours at 10-minute intervals. The treatment of animals during our experiments followed *The Guide for the Care and Use of Laboratory Animals* (Guide…, 1985). The Institutional Animal Care and Use Committee (IACUC) of Seoul National University also approved this study (SNU-100806-2).

The results were astonishing. We observed a very strong heat generated by the lime-soil-mixture wall. During the experiments (n=10), the average temperature inside the lime-soil-mixture-walled coffin was sustained at 130.8 ± 23.5 °C for 141.0 ± 64.7 minutes (Fig. 2, *E*). Theoretically, this high temperature is enough to kill nearly all of microbes that might be present inside such coffins.

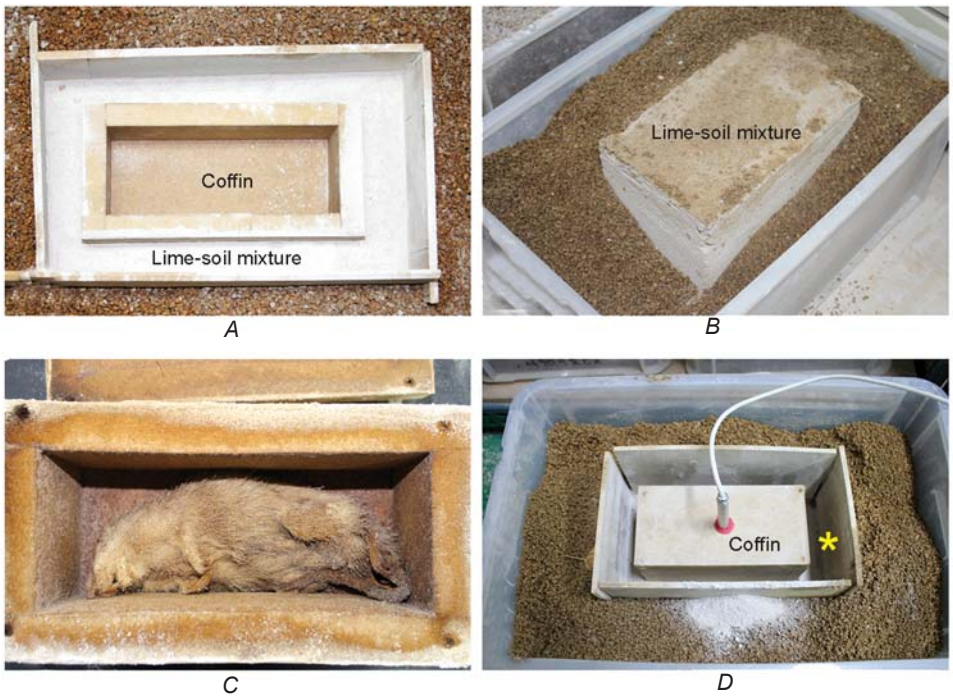
Indeed, the microorganisms present in the human body can grow rapidly after death, which is the main factor inducing decomposition (Gill-King, 2000). We thus believe that such a high and long-sustained temperature contributed to the prevention of post-mortem bacterial-induced decomposition inside Joseon tombs. We conducted another experiment to ascertain if microorganisms in a mummy could actually be sterilized by the lime-soil-mixture wall's exothermic reaction.

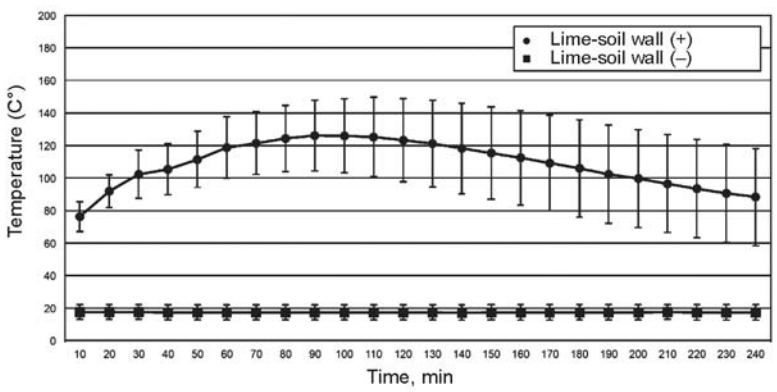
Bacterial culture on agar plates

Briefly, we cultured samples obtained by autopsy from the intestines of adult Sprague-Dawley rats (n=4), which had been placed inside the miniature coffins with or without a lime-soil-mixture wall. These samples, collected after 24 hours of burial, were spread on a MacConkey (MAC) or blood agar plate (BAP) (Asan Pharmaceutical, Seoul, Korea). MAC agar is generally used for primary selection of gram-negative bacilli. BAP supports all but the most fastidious clinically significant bacteria (Forbes et al., 2007).

After the bacteria had been incubated for 24 hours under the aerobic or anaerobic condition, we observed the results. In the case of the rat intestine samples obtained from the miniature *Hoegwakmyo*-mimicking tomb (with lime-soil-mixture barrier), neither aerobic nor anaerobic bacteria were cultured on MAC or BAP (Fig. 2, *1*, *F*). Meanwhile, the sample from the grave without any lime-soil-mixture wall showed bacteria growing well on the same plates. This means that the strong heat generated by the lime-soil-mixture wall sterilized the microbes, thus making possible mummification inside of the tomb much more likely.

Our experiments were very meaningful in estimating the mummification mechanism inside of Joseon tombs. However, as the difference in the sizes of the miniature- and actual tombs was so huge, a query was raised as to whether the same outcome could be reproduced in an experiment with a larger-sized animal. We thus repeated our experiment with New Zealand White Rabbits (n=6, average weight=2.6 kg, Samtako Bio Korea Co., Ltd., Korea).





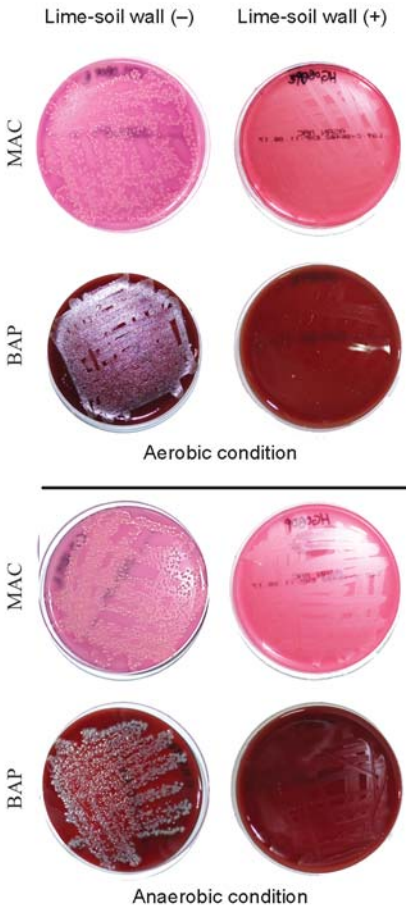


Fig. 2. Experimental mummification of the rats in a miniature Joseon grave (*1*): *A* – the lime-soil mixture (LSM) filled in the space outside of the coffin (Co), *B* – after a while, LSM was hardened to be the wall around the coffin, *C* – the rat was mummified inside the tomb, *D* – to measure the temperature inside the coffin, a digital thermometer was installed (asterisk is the space where LSM would be filled); the average temperature inside the coffin (round line – the tomb walled by LSM; square line – the tomb without lime-soil wall) (*2*); bacterial cultivation on MAC and BAP plates under aerobic or anaerobic condition (*3*). In the case of the rat intestine sample from the lime-soil wall (+) tomb, neither aerobic nor anaerobic bacteria were grown on the plates; whereas the bacteria were grown well on the plates for the rat intestine samples from lime-soil wall (–) tombs.

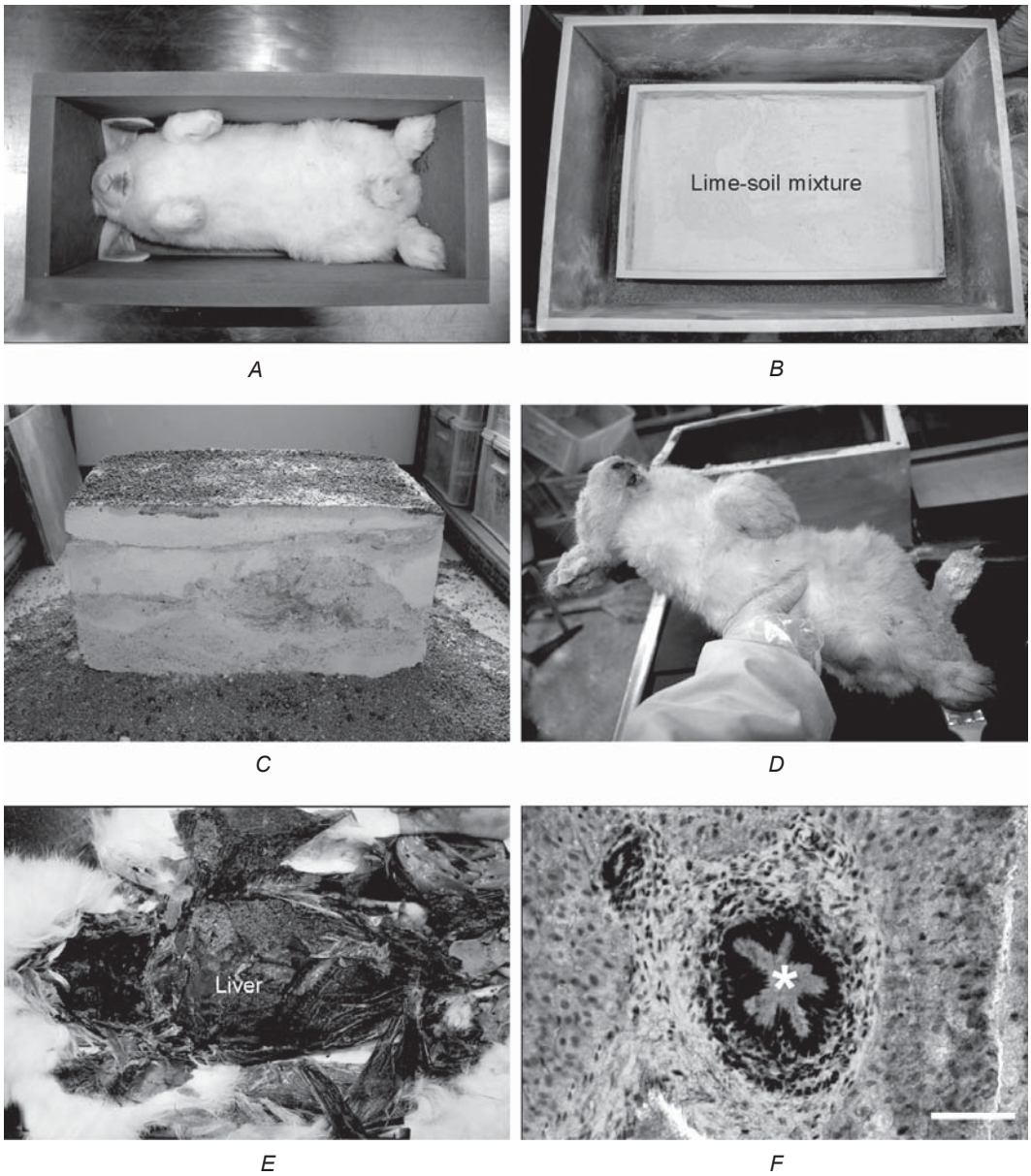


Fig. 3. Mummification of the rabbits in the miniature Joseon tomb. Rabbit were placed inside the miniature coffin (*A*); lime-soil mixture (LSM) was filled around the coffin (*B*); the LSM wall made after enough time has passed (*C*); mummified rabbit placed inside the miniature Joseon tomb (*D*); well-preserved liver found in autopsy on the mummified rabbit (*E*); liver tissue histology of mummified rabbit (asterisk indicates the portal vein; scale bar = 100 mm) (*F*).

In our anatomical and histological analysis, we saw that the rabbit's mummification also occurred in the miniature Joseon tomb with lime-soil mixture wall (Fig. 3, *A–D*). Although the miniature tombs used at this time were much larger than those of rat model experiments, our study exhibited perfect preservation status of the mummified rabbit tissues from the miniature Joseon tombs, while the same phenomenon was not observed in the cases without the lime-soil mixture walls (Figs. 3, *E*, *F*). We know that the same mummification could be reproduced regardless of the sizes of miniature Joseon graves and experimental animals used.

Conclusions

By a series of animal experiments, our hypothesis on the role of the lime-soil-mixture barrier in the mechanism of mummification inside Joseon tombs was demonstrably proven. This discovery is really important for estimating

the mechanism of mummification inside the *Hoegwakmyo* tombs of Joseon dynasty.

Actually, there were arguments for a long time about the causes of mummification inside the Joseon tombs. The Korean archaeologists suspected that the mummification might have been caused by the presence of lime-soil-mixture barriers that completely sealed the Joseon tombs. No matter how persuasive, what they have speculated amounts only to a simple presumption. To strengthen the hypothesis, the actual process of mummification inside the *Hoegwakmyo* tombs must be proven by well-designed archaeological experiments, possibly using miniature grave-models.

In this study, we successfully showed that the mummification occurring inside the miniature Joseon tombs seems to have been influenced by the exothermic reaction of the lime-soil mixture in contact with moisture. We also exhibited that the mummification of the *Hoegwakmyo* tombs was likely to have been induced by the bacterial sterilization of the same exothermic reaction. Although this study can confirm the archaeologists' earlier guesses about the mechanism of mummification in Joseon tombs, it is still difficult to be sure that the same phenomenon of mummification by exothermic reaction will actually occur in actual-sized *Hoegwakmyo* tombs. An answer to this question will have to await more archaeological experiments in forthcoming days.

Acknowledgements

This study was supported by the National Research Institute of Cultural Heritage, Korea (NRICH-1207-B03F), and Seoul National University Research Grant in 2015.

References

Ananthanarayan R., Paniker C. J. 2006
Textbook of Microbiology. 7th ed. Lucknow: Orient Blackswan.

Forbes B.A., Sahm D.F., Weissfeld A.S. 2007
Bailey and Scott's Diagnostic Microbiology. 12th ed. St. Louis: The C.V Mosby Co.

Gill-King H. 2000
Chemical and ultrastructural aspects of decomposition. Forensic Taphonomy, Haglund W.D., Sorg M.H. (eds.). Florida: CRC Press.

Guide for the Care and Use of Laboratory Animals. 1985
(NIH publication No. 86–23). Bethesda, Maryland: Department of Health and Human Services.

Kim M.J., Kim Y.-S., Oh C.S., Go J.-H., Lee I.S., Park W.-K., Cho S.-M., Kim S.-K., Shin D.H. 2015
Anatomical confirmation of computed tomography-based diagnosis of the atherosclerosis discovered in 17th century Korean mummy. *PLoS ONE*, vol. 10 (3). URL: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0119474

Kim M.J., Park S.S., Bok G.D., Choi Y.H., Lee I.S., Shin K.J., Han G.R., Youn M., Han S.H., Kang I.W., Chang B.S., Cho Y.J., Chung Y.H., Shin D.H. 2006
Medieval mummy from Yangju. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 4 (28): 122–129.

Kim Y.-S, Lee I.S., Jung G.-U., Oh C.S., Yoo D.S., Lee W.J., Lee E.-J., Cha S.C., Shin D.H. 2014
Radiological diagnosis of congenital diaphragmatic hernia in 17th century Korean mummy. *PLoS ONE*, vol. 9 (7). URL: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0099779

Lee E.-J., Oh C.S., Yim S.G., Park J.B., Kim Y.-S., Shin M.H., Lee S.D., Shin D.H. 2013
Collaboration of archaeologists, historians and bioarchaeologists during removal of clothing from Korean mummy of Joseon dynasty. *International Journal of Historical Archaeology*, vol. 17 (1): 94–118.

Oh C.S., Lee S.J., Lee S.D., Kim M.J., Kim Y.-S., Lim D.-S., Shin D.H. 2013
Amplification of DNA remnants in mummified human brains from medieval Joseon tombs of Korea. *Anthropologischer Anzeiger*, Bd. 70 (1): 57–81.

Oh C.S., Shin D.H. 2014
Making animal model for Korean mummy studies. *Anthropologischer Anzeiger*, Bd. 71 (4): 469–488.

Seo M., Araujo A., Reinhard K., Chai J.Y., Shin D.H. 2014
Paleoparasitological studies on mummies of the Joseon dynasty, Korea. *Korean Journal of Parasitology*, vol. 52 (3): 235–242.

Seo M., Oh C.S., Hong J.H., Chai J.-Y., Cha S.C., Bang Y., Cha I.G., Wi Y.G., Park J.M., Shin D.H. (In press)
Estimation of parasite infection prevalence of Joseon people by paleoparasitological data updates from the coprolites of Pre-Modern Korean mummies. *Anthropological Science*.

Shin D.H., Choi Y.H., Shin K.J., Han G.R., Youn M., Kim C.Y., Han S.H., Seo J.C., Park S.S., Cho Y.J., Chang B.S. 2003
Radiological analysis on a mummy from a medieval tomb in Korea. *Annals of Anatomy*, vol. 185 (4): 377–382.

Song M.K., Shin D.H. 2014
Joseon mummies identified before bioanthropological studies began in Korea. *Papers on Anthropology*, vol. XXIII/1: 117–134.

Received April 26, 2017.

DOI: 10.17746/1563-0110.2018.46.1.123-132

A.V. Baulo
Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: bau194@yandex.ru

Celestial Bodies on the Ob Ugrian Ritual Artifacts (Based on Archaeological and Ethnographic Sources of the 2nd Millennium AD)

This study explores the religious role of celestial bodies depicted on Ob Ugrian ritual artifacts from several Russian museums, with reference to ethnographic, folkloric, and artistic sources. While neither the sun nor the moon play a major role in the Ugrian religion, they are personified and feature in legends and myths. Khanty and Mansi rites refer to lunar phases (new moon) and the position of the sun. Solar signs are present mostly on ritual artifacts relating to the Celestial Horseman cult, possibly derived from early cosmogonic ideas. In Western Siberia, the symbols of the sun and the moon appear no earlier than AD 800. In the 10th–12th centuries, such artifacts were cast in the eastern Urals. The 13th to 14th century silver plaques from Western Siberia showing a falconer testify to the Vogul (Mansi) migration from the Western Urals to their current place of residence. The scene featuring a falconer surrounded by animals, the sun, and the moon is still represented on cloth paraphernalia of Mir-Susne-Khum, the Ob Ugrian cultural hero. Solar signs have been used by the Mansi and Khanty to decorate the sacrificial offerings to the goddess Kaltas, the gables of ritual barns, and burial structures. Also, they were used for signatures on documents.

Keywords: *Sun, moon, solar signs, Mansi, Khanty, ritual art.*

Introduction

Celestial bodies—the sun and the moon—were rarely the objects of scholarly research of the mythology and sacral fine art of the Ob Ugrian peoples. A. Kannisto believed that the sun played a relatively insignificant role in the beliefs of the Voguls (Kannisto, Liimola, 1958: 86). K.F. Karjalainen agreed with this and argued that the sun did not have any religious significance, was not the object of religious ceremonies (except for a few rituals of the Ostyaks in the basin of the Vasyugan River), nor was there reliable information concerning the worship of the moon. He explained this by the fact that the Ob Ugrians did not reach the agricultural stage: in his opinion, only farmers might understand the importance of the sun for the livelihood (Karjalainen, 1996: 44–47).

At the turn of the 19th–20th centuries, the Ostyaks personified the celestial bodies as the Sun Old Woman and the Night Old Man/Crescent Moon Old Man (Ibid.: 45, 47). On the Severnaya Sosva River, the Voguls perceived the sun as a woman: it is day when she walks about, and it is night when she stays at home (Kannisto, Liimola, 1958: 86). In the Vogul fairy tales, the Sun Woman (*Khotal-ekva*) and the Crescent Moon (*Etpos-oika* – 'Night light old man'), on the one hand, acted as sister and brother, and, on the other hand, as husband and wife (Chernetsov, 1935: 15). During the home rituals, the Northern Mansi would put a shot glass of vodka, which was intended for *Khotal-ekva*, on the window sill; they would simultaneously ignite the chaga mushroom so the smoke would be seen by the goddess. The Kazym Khanty believed that the sun was a woman with two daughters;

Archaeology, Ethnology & Anthropology of Eurasia 46/1 (2018) 123–132 E-mail: Eurasia@archaeology.nsc.ru

in the winter time the daughters stayed to watch over the people; the sun and the moon were considered husband and wife (Pyatnikova, 2008: 12, 17).

The literature does not describe the cases of making representations of deities in the form of the sun or the moon. In our field experience, we have found only one exception: in 2004, in the village of Yamgort (Shuryshkarsky District of the Yamal-Nenets Autonomous Okrug (YNAO)), in one of the bags with ritual paraphernalia kept in the barn of the Khanty E.K. Pyresev, we observed sacrificial scarves and three figures of home patrons: the Sun, Earth, and Water, made of many robes and head scarves put on each other.

The legends, "The daughters of the sun and the moon", "The origin of the crescent moon", "About the people of the sun and of the moon" (Mify…, 1990: 65–66) were recorded among the eastern Khanty; the legend, "How they fetched the sun and the crescent moon…" (Ibid.: 293–294) was recorded in Vezhakary on the Ob River, as well as the legend, "How the moon came to earth" from among the Lyapin Mansi (Ibid.: 109). The following names of the Mansi fairy tale heroes are known: *Etpos-agi*—daughter of the crescent moon, *Khotal-ekva*—the Sun Woman, *Khotal-agi*—daughter of the sun; the crescent moon was considered masculine, while the sun was feminine (Balandin, 1939: 31). According to one informant, "Old people say: the sun sits in a sled, and a horse drags the sled. The sun is a woman, and the crescent moon is her son, a young lad, *Etpos-pyg*. He grows and comes to an end. Then he grows again. He goes hunting and hits an elk with a stick, and something happens to his eyes; he ends up striking his eye, then gets sick and comes to an end. His mother tells him, 'You hit your eye all the time, you would be better off as the moon, you would grow again'"; "You cannot look at the sun with two eyes—one eye looks, and the second eye squints. The sun looked down and said, 'The Mansi are bad people, totally ugly'. And the crescent moon answers her, 'You yourself shine this way, but I shine quietly; people look at me, and I see—good people'" (Gemuev, Baulo, 1999: 121).

Cosmogonist beliefs of the Voguls were more frequently expressed in the form of signs associating the sunset with good weather; weather forecasts were also made from the moon; an eclipse of the sun announced a change of the tsar (Kannisto, Liimola, 1958: 86). Kannisto recorded a spell that was used to call out the sun: on a cloudy day, a Vogul would comb the air with each of his hands in the direction of the sun and say, "Old Woman Sun, comb, comb! Why did you go up in your father's dirty pants? You have no shame in the whole village, in the whole town". The spell could only be successfully executed by a representative of the *mos* phratry; if a man from the *por* phratry attempted to do this, the weather might only get worse (Ibid.).

All rituals of the Ob Ugrians were tied to the waxing moon; during the waning of the moon, the rituals were not conducted. In ritual actions, any forward movement or turns around were made exclusively in the direction of the sun (clockwise). The ritual of feeding the moon among the Kazym Khanty has been described in detail by T.R. Pyatnikova (2008: 20–22).

Ritual ceremonies and some types of economic activities were supposed to be completed before the sunset. Variants of the legend about the evil mythical character, the Twister of tendons, who punished women for housework in twisting tendon cords after sunset, are widely known; they have been recorded among the Sosva (Kannisto, Liimola, 1951: 204–206) and Lyapin (Balandin, 1939: 32; Istochniki…, 1987: 199–200; Soldatova, 2008: 114) Mansi, as well as among the Kazym (Lekhtisalo, 1998: 79–80), Berezovo (Lapina, 1998: 39; Baulo, 2002: 39), and Shuryshkary (FMA*, 2001) Khanty.

Representations of solar signs among the Ob Ugrian peoples

Representations of solar signs do not often appear on the ritual artifacts of the Ob Ugrians. Most such signs occur on objects related to the worship of *Mir-susne-khum* (*Mir-vannty-kho*, *Mir-lyarty-kho*, *Urt-iki*, *Otyr*): "The Man Who Watches (Drives around) the World", the Warrior Old Man, the younger son of the supreme god *Numi-Torum*. The Mansi and the Khanty represent him in the form of a Celestial Horseman who travels around the sinful world and protects people day and night. *Mir-susne-khum*, the Sun and the Moon (the Crescent Moon) are the characters that often intersect in myths and legends. In the legend of "How the sun and the moon were obtained, and how birds and beasts appeared on the earth", "the warrior who has the appearance of a yellow wagtail" (one of the names of *Mir-susne-khum*) obtained the sun and the moon from the underground kingdom of *Khul-Otyr*, threw them upward, "and they hung there" (Chernetsov, 1935: 29–31). According to other legends, *Mir-Susne-khum* was married to the daughter of the Moon Man, then to the daughter of the Sun Woman (Rombandeeva, 1993: 159), and to *Etpos-ai*, the daughter of the Moon (Gemuev, Baulo, 1999: 206).

In a number of myths, the epithets related to the solar luminary are used to describe *Mir-susne-khum*. According to B. Munkácsi, one of the names of this deity was "the Man who emits light" (cited after (Gemuev, 1990: 192)). In the invocatory songs of the late 19th century, *Mir-susne-khum* was addressed as follows, "As a golden braid of the rising sun / To the ring-shaped round earth / Reflect as a ray on the street!"; "…like the golden ray of the rising

*Field materials of the author.

sun / Light up above!"; "…Put on an outfit like that of the rising sun!"; "…*Otyr* with the braids of the rising sun" (Geroicheskiy epos…, 2010: 65, 95). At the same period, it was believed on the Severnaya Sosva River that *Mir-susne-khum* was the son of *sōrńipos*—'the golden light' (Kannisto, Liimola, 1958: 111). When referring to the deity, people would say, "The golden solar hand (that is, the bundle of sunrays penetrating through the window)" (Ibid.: 114). The Mansi legend about the creation of the earth contains a description of the horse of *Mir-susne-khum*, "There stands a horse with the image of the moon, with the image of the sun…" (Mify…, 1990: 275).

V.N. Chernetsov considered the cult of *Mir-Susne-khum* an echo of the cosmogonist views of the Ugrians. In his opinion, the Celestial Horseman was the personification of the sun, "Approaching the appearance of *Mir-susne-khum* from this perspective, in his cult we can understand the presence of silver dishes associated with the solar cult" (Chernetsov, 1947: 121). In this citation, Chernetsov meant the dishes that were used by the Ural hunters, including those used as representations of sacred disks, which illuminated the earth day and night (for a stronger impression, the ring-shaped bases of the dishes were removed), or as faces symbolizing the luminaries (Orbeli, Trever, 1935: XII). Chernetsov specified that in this information Orbeli relied on "one old source" of the 16th century, according to which two dishes turned to the worshipers with their back sides, would hang on a tree during a sacrifice among the Voguls. Their bases were removed and the dishes looked like convex metal disks representing the sun and the moon. With the arrival of the horse breeding Ugrians in the north, the role of the cosmogonist views in the beliefs of the Ob-Ural population increased, and metal disks, mirrors, and dishes representing the sun and the moon began to be used in cultic practices (Chernetsov, 1947: 123, 125). Gemuev agreed with this point of Chernetsov and argued that the notion of the essential closeness of *Mir-susne-khum* and the solar disk was clearly reflected in the attributes. He explained this not only by the demand for eastern silver in ancient times, but also by the demand for silver saucers, which were purchased from Russian merchants and given as a gift to *Mir-susne-khum* (Gemuev, 1990: 192).

Signs of the sun and the moon appear on the Nildino silver dish (8th–9th centuries, Central Asia; we should also mention a double—a silver dish found near the village of Bolshaya Anikovskaya in Cherdynsky Uyezd of the Perm Governorate (Orbeli, Trever, 1935: 20)), which would be hung on a leather cord during the rituals at the sanctuary of the Northern Mansi; the Mansi saw *Mir-susne-khum* in one of the riders depicted on the dish (Gemuev, Baulo, 1999: 107–118). According to N.V. Fedorova, the signs of the sun and the moon appeared in Western Siberian art in the 9th century under the possible influence of a subject where the deity was shown with the sun and the moon in his hands. This scene is depicted on four Khwarezmian bowls of the 6th–7th and the first half of the 8th century (Darkevich, 1976a: 106, 107; Marschak, 1986: Abb. 86), found in the Perm Urals. Fedorova believed that while considering possible borrowings from distant cultures, one should take into account availability of objects with a certain scene to local artisans and the possibility of communication between artisans and the carriers of knowledge about the persons represented. The information that a certain character was an "important deity" and his attributes were also "divine" might have triggered the desire of local artisans to impart this "divinity" by means of similar signs to some new images, typical of local, Western Siberian, cultures (Brusnitsyna, Fedorova, 2016: 110).

A local artisan, already in Siberia, engraved the sun and the moon in the upper part of a well-known diskos with the representations of angels on the sides of the cross (Mesopotamia, 6th century), acquired in Berezovo before 1868 (Smirnov, 1909: Cat. 37). V.Y. Leshchenko believed that these drawings could have been made around the 7th to 8th centuries or later (1976: 179). According to Fedorova, the date of engraving was closer to the 9th century, and the images of solar signs were the earliest known among the population of the north of Western Siberia (Brusnitsyna, Fedorova, 2016: 110).

An anthropomorphic figurine of low-grade silver (?), which was found during unauthorized excavations in the Ob region, can be preliminarily attributed to the 10th–12th centuries. The images of the sun and the moon are located on the upper part of the chest, on the sides of the "sign of life" (Fig. 1). Although their meaning is unclear, it is important that solar signs were already present and carried a certain semantic message in the local Siberian casting in the early second millennium AD. One such example is the plaque of the 11th–12th centuries, which was a part of the family sacred objects of the Khanty in the Shuryshkarsky District of the YNAO; the plaque has a sophisticated scene with the representations of "solar" and "lunar" signs (Ibid.: 105). Similar signs were found on the objects of bronze casting found at medieval sanctuaries in the basin of the Severnaya Sosva (Baulo, 2011: Cat. 163–164).

A silver plaque (12.7 cm in diameter), which was a part of the family cultic attributes of the Synya Khanty, belongs to the 10th–12th centuries. Images of male and female figures, the horse, sun, moon, and beaver were engraved on its front side (Ibid.: Cat. 379). This may be an illustration of the Ob-Ugrian myth of the creation of the earth, which narrates about the travels of *Mir-susne-khum*. During his wandering, he successively married the daughters of a witch, water king, Southern woman, Crescent Moon Old Man, Old Woman Sun, etc. (Mify…, 1990: 258–290). Notably, *Sorni-pokh* (*Muv-verty-kho*), "the Golden Son" ("the Man who travels around

Fig. 1. Anthropomorphic figurine with representations of the sun and moon. Size 10.0 × 2.7 cm. Western Siberia, 10th–12th centuries.

the earth"), was the guardian spirit of the inhabitants of Ovolyngort village (Shuryshkarsky District of the YNAO), where the plaque was discovered.

According to Fedorova, the beginning of the second millennium AD in northwestern Siberia was marked by global changes in the life of society, which were also reflected in the so-called high-status art. New subjects appeared in this art: a rider with a hunting bird, and the images of the sun and the moon. They firmly entered the art of the local population and have been preserved until the present day. A series of round plaques depicting a rider surrounded by animals and birds (a falconer) is typical of the turn of the 13th–14th centuries in the Northern Urals and northwestern part of Western Siberia. The mandatory attribute of this image is the sun and the moon on the sides of the falconer's head (Fedorova, 2014: 162). Most of these plaques were found in the Cis-Ural region, in the Cherdynsky Uyezd of the Perm Governorate (16 spec.); eight were found at the burial grounds in the basin of the Vym River, one on Vaygach Island, and nine in Western Siberia. Fedorova considered them as the products of the Bulgarian artisans who moved from the urban centers of the Volga Bulgaria to the Perm region and had close contacts with artisans and customers on both sides of the Northern Urals (Ibid.: 163–165, 169).

The number of known plaques "with the falconer" has increased in recent years owing to unauthorized excavations in Western Siberia. Three objects were found on the lower reaches of the Irtysh River; two objects are known from the Surgutsky District of the Khanty-Mansi Autonomous Okrug–Yugra, and three from the burial ground in the basin of the Severnaya Sosva River (Berezovsky District of the Khanty-Mansi Autonomous Okrug–Yugra) (Fig. 2).

Two silver plaques, preliminarily dated to the 13th–14th centuries, originate from the destroyed burial ground in the north of the Perm Territory (Cherdyn). The first plaque is a thin, convex, silver disk (7.2 cm in diameter) with a bronze loop riveted to it. The edge of the disk is decorated with two rows of "pearls"; a rider wearing a high helmet with a falcon on his right hand, and the signs of the sun and the moon are engraved on the front side (Fig. 3). The second plaque (10 cm in diameter) was forged from a bar of silver, and a bronze loop was riveted to it. A row of "pearls" and small "pyramids of pearls" were embossed on the back side along the edge of the plaque facing inwards. The center of the plaque, which most likely symbolizes the solar disk (gilded) with diverging rays, is decorated in the same way, but with the pyramids facing outwards from the circle. The "sun" is surrounded by engraved elk heads (Fig. 4).

Summarizing the above-mentioned findings and arguments of scholars, we may propose a preliminary outline for the appearance and further distribution of objects with the depictions of the signs of the sun and moon (or the crescent moon) in the Urals and Western Siberia. The appearance of such objects is associated with imported goods. Most of the eastern silver products reached the Urals not earlier than the 9th century (Darkevich, 1976b: 74). This stage may be illustrated by four Khwarezmian bowls from the Perm Cis-Ural region, the Anikovskaya dish from the Cherdynsky Uyezd of Perm Governorate, and the Nildino dish from the Severnaya Sosva. In all these cases, the celestial bodies are organically included into the compositions on the objects. The diskos from Berezovo, on which the sun and the moon were engraved by the local population, can be attributed to the same stage. The objects with images of celestial bodies, cast in the Ural-Siberian region, including the plaque from Shuryshkary, small bronze plaques with images of masks with diverging rays, silver anthropomorphic figurine, and the plaque from Ovolyngort belong to the 10th–12th centuries.

Finally, the plaque with the gilded solar sign and a series of silver plaques "with the falconer" belong to the 13th–14th centuries. The latter objects were found in important places: in the west, in the vicinity of Cherdyn; in the east, in the lower reaches of the Irtysh River and the Surgut region of the Ob; and in the north, in the Severnaya Sosva basin and the Anzhigort village

Fig. 2. Silver plaque with representations of a falconer, animals, and solar signs. Diameter 5.9 cm. 12th–14th centuries.

Fig. 3. Silver plaque with the representation of a falconer. Diameter 7.2 cm. 13th–14th centuries.

of the Shuryshkarsky District of the YNAO (where a silver plaque symbolized the face of the Khanty family guardian spirit) (Baulo, 2007: 147–148). We may suggest that the plaques with the representations of the falconer in fact mark the advance of the Voguls (the Mansi) from the Western Urals to their current places of residence. It is known that before the 14th–16th centuries, the Mansi lived much more to the west of the current areas, up to the Pechora River (the Cherdyn Voguls preserved their culture at the turn of the 19th and 20th centuries (Glushkov, 1900)). The territory outlined by the Mansi place names gradually decreased and partially moved in the direction from the west to the east and from the south to the north (Narody…, 2005: 199). This route can also be traced using a relatively conservative element of the traditional Mansi culture—the cultic paraphernalia, namely, the sacrificial veils with the representation of the rider. Their area in the 20th century was quite distinctive: the western border was Verkhoturye; the southern border was Karymkary (the Ob River); the eastern border was Yuilsk (the Kazym River), and the northern border was Khanty-Muzhi (the Malaya Ob River). The Mansi who came from the Cis-Urals to the Ob, brought the paraphernalia associated with the cult of *Mir-susne-khum* to their new places of residence.

We have already argued that the Iranian (in a broader sense, eastern, southern) roots of modern imagery that is present on the veils of the Mansi and the Khanty are quite obvious. Analyzing the influence of the representations

Fig. 4. Silver plaque with the representation of a solar sign surrounded by two elk heads. Diameter 10 cm. 13th–14th centuries.

located on silver plaques from Volga Bulgaria ("the falconer surrounded by animals and birds") on the iconography of the Celestial Horseman on sacred veils, we have emphasized that the veils with the figure of a rider surrounded by animals and birds is a phenomenon of the Mansi culture, which was formed when the ancestors of the modern Mansi lived in the southern part of the Western

Fig. 5. Sacrificial veil with two figures of riders and signs of celestial bodies. Mid-20th century. The Synya Khanty.

Fig. 6. Sacrificial veil with seven figures of riders, representation of a bird, and signs of celestial bodies. Mid-20th century. The Lyapin Mansi.

Urals and had contacts with Volga Bulgaria (Gemuev, Baulo, 2001: 51–52).

We can see the signs of the moon and the sun next to the image of the rider on the plaques; in various variants, they are also present on the attributes of *Mir-susne-khum*, such as veils, belts, or helmets (see, e.g., (Ibid.: No. 39, 40, 59, 76 , 85, 136, 146)). The first variant is associated with the joint representation of the sun and the moon: they can be placed around the head of the main character, repeating the location on the plaques "with the falconer" (Fig. 5), or separately, in front of the figures of the riders (Baulo, 2013: Fig. 181). The informants said, "*Mir-susne-khum* rides around the earth. The sun goes around the earth, and so does the moon, thus the moon and the sun are on the veil". The second variant is the image of the crescent moon next to a bird or anthropomorphic figure inside a circle, which symbolizes the rising sun (Fig. 6). More often, the bird is *Reitartan-uirishch*, the bird of *Ekva-pyrishcha**. The Mansi thus explained the crescent moon to the right of the bird: "…they would make the *yalpyn* (the sacrificial veil) at the half moon, and finish it during the full moon" (Gemuev, 1990: 36–37).

A belt with distinctive representations is known among the finds made in the areas of the Lyapin Mansi: it was made to be placed on the back of the deer (two animal figures) sacrificed to *Mir-susne-khum* (the rider), who rides around the earth day and night (the sun and the moon). A bird-like figure in a circle (in the sun) signifies the local guardian spirit *Tovlyng-Yipyg-oiku*—'The Winged Eagle-Owl Old Man' (Baulo, 2013: Fig. 196).

The remaining variants are associated with the sole representation of the solar sign. Most often this is a small "star" with seven rays above the head of the rider (Ivanov, 1954: 51, fig. 29) (Fig. 7), a large disk with rays, shown separately (Fig. 8)** or together with images of birds—ornithomorphic guardian spirits of the Khanty families (Fig. 9), and the rider *Mir-vannty-kho*. More rare representations include the image of the sun as a stylized "centipede beetle". This was found twice: on a veil (Fig. 10) and on the headwear of the family deity (Gemuev, Baulo, 1999: Fig. 46, *c*). We should also mention the variants with an anthropomorphic figure (Gemuev, Baulo, 2001: No. 48, 51) or representation of a bird (Ibid.: No. 45) inside a solar circle (without the joint presence of the crescent moon) or standing on the circle. The warrior's helmet with four figures of *Mir-vannty-kho* stands out from among the objects: two of the figures represent ordinary riders, while the heads of other two are not shown, and their raised hands form the sign of the sun (Fig. 11).

The cultic attributes of the Ob Ugrians include a group of objects related to the cult of *Kaltas-ekva*—the main goddess who measures a person's life. A pin cushion of woolen cloth would be made in the family of a girl at her birth, and would be brought as a gift to the goddess with the request to help the newborn become a good handywoman. Various stylized images are embroidered

*The folklore name of *Mir-susne-khum*.

**The "sun" here is close in shape to the solar sign on the silver plaque from Cherdyn (see Fig. 4).

Fig. 7. Helmet of *Mir-susne-khum* with the solar sign. 1920s–1930s. The Ob Mansi.

Fig. 8. Warrior's helmet with the solar sign. First third of the 20th century. The Shuryshkary Khanty.

Fig. 9. Sacred belt with the figures of birds and the solar sign. Mid-20th century. The Synya Khanty.

in the center of the pin cushions, including the *khatl*—'the sun'; a bird figure is often present near the *khatl* (inside the circle) (Moldanova, 1999: 162, fig. 24, *5–7*). This is a relatively old tradition. Thus, a pin cushion with the solar sign was found during the excavations at Fort Nadym in the layer of the mid-17th century (Kardash, 2009: 231).

Twice, solar signs have been found in the decoration of the cultic barns of the Mansi in the basin of the Severnaya Sosva: the sun with eight rays was depicted on the gable of the dwelling of the thunder god *Shchakhel-torum*, (Gemuev, 1990: 133); the sun and the moon were drawn with charcoal above the entrance hole of the sacred barn of *Torum-oiki* (*Mir-susne-khum*) (Gemuev, Baulo, 1999: 76–77). On the basis of Chernetsov's materials (1936–1937), a decoration in the form of a solar sign was on the gable of a Mansi house on the upper reaches of the Severnaya Sosva River (Istochniki…, 1987: 209).

The signs of the celestial bodies do not often occur in the shamanic practices of the Ob Ugrians*. We can

*Perhaps this is caused by certain underdevelopment of shamanism among the northern groups of the Ob Ugrians. In developed shamanism, for example among the Selkups, representations of the sun and the moon often appear on breastplates (Ivanov, 1954: 70, fig. 54), tambourines (Ibid.: 70–71, 73–74), beaters of the tambourine (Ibid.: 77), and lids of birch-bark boxes for keeping the shaman's paraphernalia (Ibid.: 76).

Fig. 10. Sacrificial veil with the figures of horsemen and solar signs. Mid-20th century. The Sosva Mansi.

Fig. 12. Lead plaque in the form of a disk with outgoing rays. Mid-19th century. The Khanty from the Polui River.

Fig. 11. Warrior's helmet with four figures of riders (the raised arms of two riders form the sign of the sun). 1950s. The Shuryshkary Khanty.

mention a quiver with arrows for shamanistic rituals in the dark yurt from the sacred barn in Loktokurt (the Ob Khanty). Stylized images of the sun with diverging rays and cross in the center are carved on the front (8 spec.) and back (4 spec.) walls of the quiver (Grevens, 1960: 434). A lead plaque (10.0 × 7.5 cm in size, 0.5 cm thick) in the form of a solar disk with diverging rays was found in a damaged shaman's sled in a sacred place of the Khanty, in the Polui River basin (Priuralsky District of the YNAO) (Fig. 12). An anthropomorphic figure wearing a "three-rayed crown" appears on the front of the plaque. Supposedly, this is the image of a deity or a shaman. Copper chains and a silver coin (5 kopeks) of 1813 are attached to the lower beams of the plaque with leather straps.

An iron head of a deer with antlers, wrapped in two red scarves, was found in the sacred chest of the Lyapin Mansi (Baulo, 2013: Fig. 223). Tin and copper round plaques were attached to the head. The meaning of the composition can be associated with the understanding of the deer as a celestial animal (the Mansi mythology has stories of a deer running across the sky (Kannisto, Liimola, 1958: 89)), and the round disks denote the sun and the moon. All three objects can be dated to the late 19th century. Most likely, in earlier times, these were used as pendants in the shaman's outfit. The collection

of the Museum of Nature and Man (Khanty-Mansiysk) contains a wooden bird-like figure (XM-402), to which two round plaques (7.5 cm in diameter) made of white metal are tied. On the surface of one plaque, a representation of a human face is scratched. The objects were sent to the museum in 1939 from the Kazym National Council; they were taken from the shaman P.G. Togolmazov. In this case, the plaques probably also denoted the sun and the moon.

The signs of the celestial bodies play a certain role in the funeral rite: the sun and the moon are drawn with charcoal or chalk on the lid (on the lower plank in the middle Ob region) of the coffin, so that the deceased, having them with him, would not try to get out of the grave (Chernetsov, 1959: 144). Among the Khanty of the Beloyarsky District of the Khanty-Mansi Autonomous Okrug–Yugra, before carrying out the body, a half-sun (*in that life, it will no longer shine so brightly*), full moon (*the night is there all the time, and the moon should shine*), and some animal similar to the elk, but without the tail, are drawn with charcoal on the right side of the coffin, near the head of the deceased. It is believed that the animal will carry the deceased to the Lower World. Drawings on the coffin can only be made by a male—a stranger or distant relative (Baulo, 2002: 62; Pyatnikova, 2008: 17).

Beyond religious attributes, the images of celestial bodies occur as the *tamgas* of the Ostyaks in the 17th century: the signs of the sun and the moon in the form of irregular circles with diverging rays, sometimes with a point in the center; the sign of the moon in the form of a semicircle with or without rays (Ivanov, 1954: 32, fig. 13, *10–14*). In the well-known *toscher-voy* game of the Khanty and Mansi, wooden images of the moon and the sun are used (Shukhov, 1916: 111–112; Ivanov, 1970: 12, fig. 1, *8*; and others).

Conclusions

Using a variety of archaeological, folklore, ethnographic, and visual sources, this study generally supports the opinion of Kannisto and Karjalainen that the sun played an insignificant role in the beliefs of the Ob Ugrians and did not have its own religious significance. The celestial bodies in the worldview of these peoples are limited to personifications of the sun and the moon translated through myths and legends. Ritual practices take into account the lunar phases and the position of the sun.

Representations of the solar signs on the ritual artifacts of the Ob Ugrians occur mostly on objects associated with the cult of *Mir-susne-khum*. Some scholars (V.N. Chernetsov, I.N. Gemuev) considered his cult an echo of ancient cosmogonist beliefs, and the Celestial Horseman himself as a personification of the sun associated with the use of imported silver bowls in the rituals.

The sources currently available indicate that the objects with representations of celestial bodies appeared in the Urals and Western Siberia not earlier than in the 9th century, together with the general flow of eastern silver objects to the north. The first known engraved image of the sun and moon on an imported diskos belongs to the same period. Such objects cast in the Ural-Siberian region already became common in the 10th–12th centuries. Silver plaques with the representation of a falconer, which mark the movement of the Voguls from the Western Urals to the current places of residence, arrived in this territory in the 13th–14th centuries. This route can also be traced by the sacrificial veils of the Mansi: the scene of "the falconer surrounded by animals, the sun, and the moon" becomes transferred to cloth paraphernalia of *Mir-susne-khum* (veils, belts, and helmets).

Solar signs also occur on pin cushions—the sacrificial gifts to the supreme goddess *Kaltas-ekve*, on the gables of the barns of the celestial gods, and on a number of shaman's attributes; they play a role in the burial ritual and have been used for signing documents.

Acknowledgements

This study was supported by the Russian Science Foundation (Project No. 14-50-00036).

References

Balandin A.N. 1939
Yazyk mansiyskoy skazki. Leningrad: Glavsevmorput.

Baulo A.V. 2002
Kultovaya atributika berezovskikh khantov. Novosibirsk: Izd. IAE SO RAN.

Baulo A.V. 2007
New Medieval silver artifacts from Northwestern Siberia. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 1 (29): 145–150.

Baulo A.V. 2011
Drevnyaya bronza iz etnograficheskikh kompleksov i sluchainykh sborov. Novosibirsk: Izd. IAE SO RAN.

Baulo A.V. 2013
Svyashchennye mesta i atributy severnykh mansi v nachale XXI veka: Etnograficheskiy albom. Khanty-Mansiysk, Yekaterinburg: Basko.

Brusnitsyna A.G., Fedorova N.V. 2016
"Protecting the mistress": A plaque with an anthropomorphic representation, from Shuryshkary, Yamal-Nenets Autonomous District. *Archaeology, Ethnology and Anthropology of Eurasia,* vol. 44 (1): 104–113.

Chernetsov V.N. 1935
Vogulskiye skazki. Leningrad: Goslitizdat.

Chernetsov V.N. 1947
K voprosu o proniknovenii vostochnogo serebra v Priobye. *TIE*. Nov. ser., vol. 1: 113–134.

Chernetsov V.N. 1959
Predstavleniya o dushe u obskikh ugrov. *TIE*. Nov. ser., vol. 51: 116–156.

Darkevich V.P. 1976a
Khudozhestvenniy metall Vostoka: Proizvedeniya vostochnoy torevtiki na territorii evropeiskoy chasti SSSR i Zauraliya. Moscow, Leningrad: Nauka.

Darkevich V.P. 1976b
Argonavty srednevekoviya. Moscow: Nauka.

Fedorova N.V. 2014
Sprava ot solntsa, sleva ot mesyatsa: Blyakhi s sokolnichim (Preduraliye i Zapadnaya Sibir, epokha srednevekoviya). In *Arkheologiya Arktiki*, iss. 2. Yekaterinburg: Delovaya pressa, pp. 162–174.

Gemuev I.N. 1990
Mirovozzreniye mansi: Dom i kosmos. Novosibirsk: Nauka.

Gemuev I.N., Baulo A.V. 1999
Svyatilishcha mansi verkhoviyev Severnoy Sosvy. Novosibirsk: Izd. IAE SO RAN.

Gemuev I.N., Baulo A.V. 2001
Nebesniy vsadnik: Zhertvenniye pokryvala mansi i khantov. Novosibirsk: Izd. IAE SO RAN.

Geroicheskiy epos mansi (vogulov): Pesni svyatykh pokrovitelei. 2010
E.I. Rombandeeva (comp.). Khanty-Mansiysk: Print-klass.

Glushkov I.N. 1900
Cherdynskiye voguly. *Etnograficheskoye obozreniye*, vol. 15 (2): 15–78.

Grevens N.N. 1960
Kultoviye predmety khantov. In *Ezhegodnik Muzeya istorii religii i ateizma*, iss. 4. Leningrad: pp. 427–438.

Istochniki po etnografii Zapadnoy Sibiri. 1987
N.V. Lukina, O.M. Ryndina (publ.). Tomsk: Izd. Tom. Gos. Univ.

Ivanov S.V. 1954
Materialy po izobrazitelnomu iskusstvu narodov Sibiri XIX–nachala XX v. Moscow, Leningrad: Izd. AN SSSR. (TIE. Nov. ser.; vol. 22).

Ivanov S.V. 1970
Skulptura narodov Severa Sibiri XIX–pervoy poloviny XX v. Leningrad: Nauka.

Kannisto A., Liimola M. 1951
Wogulische Volksdichtung. Bd. I: Texte mythischen Inhalts. Helsinki: Suomalais-ugrilainen seura.

Kannisto A., Liimola M. 1958
Materialien zur Mythologie der Wogulen. Helsinki: Suomalais-ugrilainen seura. (MSFOu; vol. 113).

Kardash O.V. 2009
Nadymskiy gorodok v kontse XVI–pervoy treti XVIII v.: Istoriya i materialnaya kultura. Yekaterinburg, Nefteyugansk: Magellan.

Karjalainen K.F. 1996
Religiya yugorskikh narodov, vol. 3, N.V. Lukina (trans., publ.). Tomsk: Izd. Tom. Gos. Univ.

Lapina M.A. 1998
Etika i etiket khantov. Tomsk: Izd. Tom. Gos. Univ.

Lekhtisalo T. 1998
Mifologiya yurako-samoyedov (nentsev). N.V. Lukina (trans., publ.). Tomsk: Izd. Tom. Gos. Univ.

Leshchenko V.Y. 1976
Ispolzovaniye vostochnogo serebra na Urale. In *Darkevich V.P. Khudozhestvenniy metall Vostoka: Proizvedeniya vostochnoy torevtiki na territorii yevropeiskoy chasti SSSR i Zauraliya*. Moscow, Leningrad: Nauka, pp. 176–188.

Marschak B.I. 1986
Silberschätze des Orients: Metallkunst des 3.–13. Jahrhunderts und ihre Kontinuität. Leipzig: E.A. Seemann Verlag.

Mify, predaniya, skazki khantov i mansi. 1990
N.V. Lukina (comp., pref., comm.). Moscow: Nauka.

Moldanova T.A. 1999
Ornament khantov Kazymskogo Priobya: Semantika, mifologiya, genezis. Tomsk: Izd. Tom. Gos. Univ.

Narody Zapadnoy Sibiri: Khanty. Mansi. Selkupy. Nentsy. Entsy. Nganasany. Kety. 2005
I.N. Gemuev, V.I. Molodin, Z.P. Sokolova (eds.). Moscow: Nauka.

Orbeli I.A., Trever K.V. 1935
Sasanidskiy metall: Khudozhestvenniye predmety iz zolota, serebra i bronzy. Moscow, Leningrad: Academia.

Pyatnikova T.R. 2008
Traditsionniye obryady khantov ust-kazymskogo Priobya. Yekaterinburg: Basko.

Rombandeeva E.I. 1993
Istoriya naroda mansi (vogulov) i ego dukhovnaya kultura. Surgut: Severniy dom.

Shukhov I.N. 1916
Iz otcheta o poyezdke vesnoyu 1914 goda k kazymskim ostyakam. *Sbornik MAE*, vol. 3: 103–112.

Smirnov Y.I. 1909
Vostochnoye serebro: Atlas drevney serebryanoy i zolotoy posudy vostochnogo proiskhozhdeniya, naidennoy preimushchestvenno v predelakh Rossiyskoy imperii. St. Petersburg: Izd. Imp. arkheol. komissii.

Soldatova G.E. 2008
Materialy po folkloru obskikh ugrov. In *Traditsii i innovatsii v sovremennom folklore narodov Sibiri*. Novosibirsk: Arta.

Received December 6, 2016.

DOI: 10.17746/1563-0110.2018.46.1.133-143

T.A. Chikisheva[1], A.L. Krivoshapkin[2], D.V. Pozdnyakov[1], and P.V. Volkov[1, 3]

[1]Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: chikisheva@ngs.ru; dimolka@gmail.com; volkov100@yandex.ru
[2]Novosibirsk State Medical University,
Krasny pr. 52, Novosibirsk, 630091, Russia
E-mail: alkr01@yandex.ru
[3]Novosibirsk State University,
Pirogova 1, Novosibirsk, 630090, Russia

Craniotomy as a Prehistoric Medical Practice: A Case of Antemortem Cranial Trepanation in Southern Siberia in the Late Bronze Age

Complete trepanation with the removal of the inner bone plate was studied on a cranium of a male aged ca 35, from a Late Bronze Age burial at Anzhevka, in the Krasnoyarsk-Kansk forest-steppe, dating to 1000–700 BC. Certain burials, including that with a trephined cranium, reveal traces of post-funerary rituals. The individual displays the Paleosiberian (Baikal) combination of craniometric and dental characteristics. The results of the macro- and microscopic analysis of the affected area, along with multislice computed tomography (MSCT), suggest that the trepanation was performed to treat osteomyelitis of the parietal bone with an epidural abscess (empyema), caused by an open depressed fracture of the left parietal bone, inflicted by a tool with a small contact area. In modern forensic practice, such perforations are attributed to hammer blows. This would explain the absence of linear fractures of the parietal bone around the zone of trepanation. Craniotomy with the removal of the osteomyelitic focus and the emptying of the epidural abscess led to a prolonged preservation of the patient's life. The results of a traceological analysis suggest that the aperture was made by scraping, and a thin tetrahedral tool was used to remove the bone fragment. Possibly the use of bronze instruments, known to have antiseptic properties, helped the ancient healer to cope with an advanced infectious process.

Keywords: *Late Bronze Age, trepanation, multislice computed tomography, epidural abscess.*

Introduction

Some manifestations of the antemortem manipulations found in archaeological skulls can be attributed to craniotomies with positive results. Such phenomenon has been known for at least 10–12 millennia, beginning in Mesolithic times (Goykhman, 1966; Crubezy et al., 2001; Lillie, 2003). According to Prioreschi (1996: 22), more than 15 thousands of trepanned skulls were excavated at archaeological sites in Eurasia, North Africa, and America. The shapes of the edges of the trepanation wounds unequivocally suggest that many of them were performed antemortem. The mortality rate for the Mesolithic and Neolithic individuals who underwent such a surgery was about 10 %, while in the Bronze Age it increased to 30 % (Mednikova, 2004: 53). It can be thus hypothesized not only that the ancient healers were skilled in the trepanation surgery, but that they also knew anesthesia techniques, were able to stop bleeding from the abundantly supplied soft

and bone tissues of the skull, and, finally, were aware of how to prevent infection of the wound.

The first important question to be solved when studying a case of ancient antemortem craniotomy is: why was it performed? Such surgical intervention is not completely safe and harmless even with the use of modern neurosurgical methods (Krivoshapkin et al., 2014). Three kinds of reason are usually considered: therapeutic, magic or ritual, or a combination thereof (Lisowski, 1967; Prioreschi, 1991). The first kind includes cases of healing of traumas (fractures or wounds), neurological symptoms of increased intracranial pressure, tumors or infections. All these pathologies leave easily recognizable signs on the cranial bones. But even the most detailed consideration of such pathological manifestations can lead to reversal of causes and effects, as was done by Slepchenko et al. (2017). The present study is partially dedicated to a revision of the results of the work of Slepchenko and his colleagues.

Magical or ritual trepanations, both ante- and postmortem, were performed for several purposes. First, they could have opened an entrance/exit for some substances of the unmanifested world or spirits. The piece of bone cut from the skull could be later used as an amulet or talisman. The trepanation apertures made antemortem might have provided access to the parts of the brain that could be manipulated by ancient magicians in order to alter the behavior or consciousness of an individual. Trepanations of this type are difficult to recognize. If there are no pathological manifestations or bone-remodeling around the aperture, it cannot be firmly interpreted as ante- vs. perimortem, because the patient might have died during the operation. Moreover, a craniotomy performed in order to heal a disease not related to changes in bone tissue (e.g. extraction of a helminth) can be erroneously interpreted as magical or ritual. Symbolic trepanations associated with initiation rituals (i.e. transition of an individual to the next social level) display a wide range of modifications. They are usually performed without perforating a bone (Mednikova, 2001: 125–131; 2003).

But medical and ritual (magical) aspects of ancient cranial surgery can be tightly intertwined. Actually, the only unambiguous evidence for the magical or ritual motivation for a craniotomy is the archaeological context of the burial, i.e. some features of the burial customs that distinguish it from other burials.

In Eurasia, skulls with manifestations of antemortem craniotomy were found in burials dated to the period from the Mesolithic to medieval times (see, e.g., (Goykhman, 1966; Mednikova, 2001; Chikisheva, Zubova, Krivoshapkin et al., 2014; Chikisheva, Krivoshapkin, 2017; Crubezy et al., 2001; Lillie, 2003; Lorkiewicz et al., 2005; Weber, Wahl, 2006; Erdal Y.S., Erdal Ö.D., 2011; Kangxin, Xingcan, 2007; Papagrigorakis et al., 2014; Gresky et al., 2016; Slepchenko et al., 2017)). In most cases, when studying complete antemortem trepanations not related to trauma healing, the authors of the cited studies (mostly physical anthropologists) could not come to definite conclusions regarding the reasons for carrying out those operations. These were usually interpreted as magical or ritual manipulations (Gresky et al., 2016). It seems that the role of ritual behavior in the motivation for antemortem craniotomies is to some extent exaggerated. The cases of trepanation from the Bronze and Early Iron Age burials from southern Siberia previously published by the authors of the present study (notably, these are almost all such cases known in the region) did not give any grounds to question their medical purpose (Chikisheva, Zubova, Krivoshapkin et al., 2014; Chikisheva, Krivoshapkin, 2017).

One of the latest such finds, dated to the Bronze Age, was studied by S.M. Slepchenko et al. (2017). We have obtained permission to re-survey this specimen and found it necessary to publish the results of our differential diagnosis and a use-wear analysis, and provide a more detailed description of the archaeological and anthropological context of the specimen.

Archaeological context of the burial*

A skull with signs of trepanation was found during a rescue excavation near Kansk city, Krasnoyarsk Territory, in 2015. Official name of the site is "Anzhevka. Camp site Nefteprovod-2 (Novosmolenka-2)", while its short name used in publications is "Nefteprovod-2". It is located in the Ilansky District of the Krasnoyarsk Territory, 1.8 km south of the abandoned village of Anzhevka, 4.3 km southwest of the Karapsel settlement, on the right bank of the Kan River, 3 km upstream from the present-day border of Kansk city. The heads of the excavation tend to consider this site as

*The archaeological data for this part of the present study were kindly provided by A.V. Vybornov, a researcher at the Institute of Archaeology and Ethnography of the SB RAS, the holder of the Permit for archaeological excavations and surveys No. 750 issued June 30, 2015.

a part of the Anzhevka archaeological complex, which includes sites with dates ranging from the Paleolithic to ethnographic modernity.

During the rescue excavations, several burials were detected. Some of the burials were situated separately, while others formed groups at two levels: lower (above-flood) and upper altiplanation terraces. At Nefteprovod-2, fourteen flat-grave burials were identified, the main part of which was concentrated in a small area in the center of the lower altiplanation terrace. Most of the burials contained complete human skeletons. The deceased were buried in an extended supine position; their heads were predominantly oriented to the south-east, upstream of the Kan River. In several cases, the outlines of the graves could be traced in the plan view. The tops of some burials were marked by masonry. Grave goods included bronze knifes, bone daggers, bone tools, and bronze adornments. Some burials contained only fragmented bones, compactly folded in small pits, sometimes covered with masonry. Some bones and stones displayed traces of high-temperature burning. Judging by the grave goods and the artifacts found in the layer where the stone roofs of the burials were found, the main part of the burials was preliminarily dated to the Late Bronze Age (the first third of the 1st millennium BC).

Burial 14, in which the trepanned skull was found, belongs to horizon 4. The grave can be described as an irregularly-shaped pit with unclear boundaries, 1.5× 2.0 meters in size, and 0.4 m in depth. The pit is filled with gray (or black) and brown sandy loam. Inside the pit, lithic artifacts, animal bones, and bone and bronze tools were found. Among these, scattered human skeletal remains were found as well, including a skull and a mandible. The mandible exhibits a green spot due to contact with a bronze object near the chin. The skull was oriented vertically, with the face directed towards the south-east. Under the skull, an assemblage of artifacts was found, including a bone dagger of the Karasuk type, a composite elbow knife, and two arrowheads. The dagger lay horizontally, with the tip oriented towards the south-east; the knife lay parallel to the dagger, with the blade oriented towards the north-east; the arrowheads were stacked on the dagger.

Anthropological description of the skull

The skull belonged to a male, who died at about 35 years of age (Fig. 1). The age determination was based on the incomplete obliteration of the sutures of the endocranial surface, and the moderate dental wear (point 3 at the incisors, canines, and premolars, and point 4 at the molars). The facial skeleton was fragmentary. The cranial base had been broken down by several blows from a heavy object to the occipital bone (Fig. 2), so the cranial base is absent. But there were no direct traces detected of the contact between the object and the skull. This led us to the assumption that the blows occurred at some distance from the fracture's edge, which is uneven and ragged. The mandible was probably destroyed by those blows as well: its condyles and the lateral parts of the corpus (to the level of molars, for about a half of its height) were split off (Figs. 3, 4). The nature of the fractures on both sides might suggest that the mandible had been separated from the skull's base by breaking out. The damage is more pronounced in the left side.

All manipulations with the remains listed below were carried out after they were partially skeletonized: the skeleton was incomplete—the remaining bones were commingled; the skull was destroyed and placed in a vertical position on the postcranial remains, above the assemblage of grave goods. But the pattern of fractures shows that these were not caused to dry bone, but to bone retaining some of its elastic properties. This is probably a case of a ritual post-inhumation penetration of the grave, which was widespread among various peoples and tribes in the past, and also in ethnographic modernity. In southern Siberia, this tradition was comprehensively studied using the data from the Bronze Age burial assemblages of the Ob-Irtysh interfluve, including the sites belonging to the Irmen culture in its entire area, including the Tomsk region of the Ob (Elovka II cemetery) (Bondarenko, 2016: 14–30), where the Irmen people were contacting the Karasuk population (Matyushchenko, 1974: 158). There has been no such systematic research on disturbed burials in the eastern regions of southern Siberia (Yenisei steppes, Minusinsk Basin, Tuvinian uplands)—which does not actually mean the absence of that phenomenon there.

The set of craniometric traits it was possible to measure was limited:

1. Cranial length	188
8. Maximum cranial breadth	140
9. Minimal frontal breadth	89.1
Forehead transverse curvature height	11.2
Forehead transverse curvature angle	151.8
10. Maximal frontal breadth	115

Fig. 1. Skull from burial 14 at Anzhevka (*a*) and its internal surface (*b*).

Fig. 2. Traces of destruction of the cranial base: directions of the destructive blows (*a*) and the pattern of bone crushing (*b*).

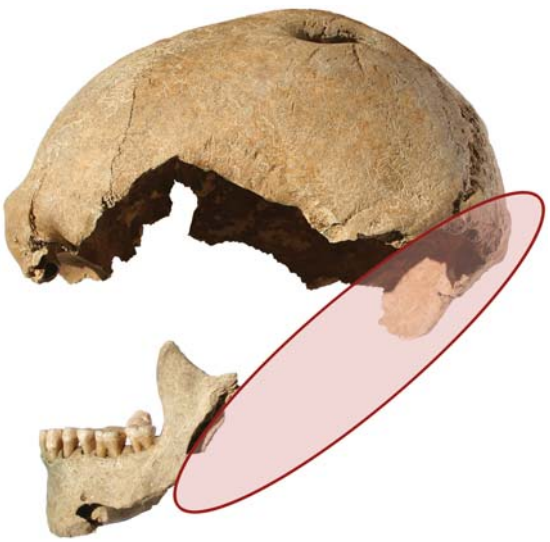


Fig. 3. Reconstruction of the plane in which the destructive blows were caused.

Fig. 4. Fracture of the mandible, and the directions of the destructive blows.

29. Frontal chord	101
Frontal subtense	18.6
30. Parietal chord	113
26. Frontal arc	119
27. Parietal arc	127
11. Cranial base breadth	127
12. Occipital breadth	128
45. Bizygomatic breadth	137
43. Upper facial breadth	107
43 (1). Biorbital breadth	96.8
Subtense from nasion to biorbital breadth	11.9
77. Nasomalar angle	152.4
61. Alveolar breadth	64
63. Palatal breadth	35
67. Anterior mandibular width	46
69. Mandibular symphyseal height	32
69 (3). Width of the mandibular corpus	11

Nevertheless, the anthropological type of this individual can be broadly characterized based on these data. The horizontal dimensions of the skull are large, the cranial index is 74.5 (dolichocranic), the skull base is wide (it was possible to measure it, owing to the preservation of auricular points). The skull vault's contour is ellipsoid in the vertical norm, while it is intermediate between ellipsoid and tall variants in the lateral norm because of the substantial sagittal curvature of the parietals (the curvature index is 89.0); the vault is roof-shaped in the occipital norm. The contours of the vertical walls of the vault are of trapezoid shape.

The frontal bone is short and narrow with a developed brow-ridge (point 2) and an eminent glabellar region (point 5), weakly bulging (the index of convexity is 18.4), weakly curved (index of curvature is 84.9), and flattened in the transverse section (the angle of transverse curvature of the forehead is 151.8). According to a visual evaluation, the vertical profile of the forehead is sloped. The occiput is wide; the nuchal lines form a massive torus; the external occipital protuberance is moderately developed (point 2).

The facial skeleton is wide and strongly flattened in the horizontal plane at the level of nasion. The lower border of the piriform aperture is of the shape of *sulcus prenasalis*. The anterior nasal spine's development can be described as point 2. *Torus mandibularis* and *maxillaris* are absent. The maxillary alveolar process is of medium breadth, the palate is narrow. The mandibular corpus is average in size. Specific features of this individual include an accessory mental foramen observed just below the main right mental foramen, and the hypodontia of the third lower molars. The upper right third molar is also hypodontic, while at the left side of the maxilla an alveolus of a reduced tooth was identified. The lower right first molar was lost antemortem (removed).

The craniological complex of the individual differs from that of the skulls of the Karasuk culture, while the burial itself might be associated with this culture, judging by its preliminary date and grave goods. Many of the metric variables crucial for racial diagnostics could not be measured in this specimen, including cranial and facial heights, dimensions of the nasal region, and the zygomaxillary angle. Nevertheless, it is undoubtedly more similar to the Mongoloid pattern than to the phenotypically admixed Mongoloid-Caucasoid anthropological types of the Altai-Sayan highlands. Populations of the Andronovo culture were involved in the formation of the anthropological type of the Karasuk population, and this resulted in the generally Caucasoid cranial morphology of the latter. This Caucasoid pattern was, however, "softened" by the influence of the autochthonous substrate of descendants of the Okunev culture, and also by a Mongoloid admixture of Central Asian origin (Rykushina, 2007: 19–20, 91, 123). A stable feature of the cranial morphology typical of populations of the Karasuk culture is the brachycranic cranial vault, while the studied skull is dolichocranic.

The dental traits of the individual that can be used to differentiate his anthropological type are considered below. A remarkable feature is the double shoveling of the upper right medial incisor, expressed as point 3 at the lingual surface (Zubov, 2006: 36) and as point 2 at the vestibular surface (Scott, Turner, 1997: 27–28). This is a reliable marker of the Mongoloid complex (Zubov, 2006: 36). The upper right lateral incisor is barrel-shaped (Hillson, 1996: 19) with a V-shape depression on the vestibular side. The apex of the depression is in the center of the crown at the middle of its height, and its ridges diverge towards the edges of the tooth. A microscopic study revealed no signs of scratches that would have suggested an intentional modification. The upper and lower molars do not exhibit signs of reduction: the development of the hypocone of the M^1 and M^2 achieves the highest possible point 4, while the metacone is only slightly smaller than the paracone (point 2); the M_1 is five-cusped. No styloid formations or accessory cusps were found in the molars. The cervical enamel projection (outgrowth of enamel found between the roots on the vestibular surface of the tooth) is strongly pronounced (point 6) in both upper and lower second molars. In the cases when this trait can be scored as points 5 and 6, it

can be used for individual diagnostics (Zubov, 2006: 39). Such diagnostically important traits of the lower molars as the distal trigonid crest and the deflecting wrinkle of the metaconid could not be assessed, owing to a strong dental wear. Nevertheless, the number of cusps and the groove pattern can be scored. The M_1 displays a "+" 5 shape, the right M_2 "X" 4, and the left M_2 "+" 4. Notably, the "+" groove pattern in the first molar is quite often found in Mongoloids (Ibid.: 56), while the "X" and "+" patterns in the second molars are typical of modern humans in general.

The results of the analysis of non-metric dental traits, in accordance with the cranial metric data, seem to confirm the presence of genes of "Eastern" or "Mongoloid" origin in the genome of the studied individual. We do not intend to make far-reaching conclusions and model any genetic relationships based on a study of one fragmentary skull; but we believe it is necessary to point out peculiar features of the skull and find at least some morphological analogies. Those features include a dolichocranic head shape, a visceral eurymorphy, and a horizontally flattened supraorbital region. The morphological complex is complemented with narrow, short, weakly curved, weakly convex, and inclined. Such a combination is not found in the Bronze Age cranial samples of the Altai-Sayan highlands but it has a long history in the circum-Baikal region, going back to at least Neolithic times, and is typical of the Paleosibirian or Baikal anthropological type.

Use-wear analysis of the trepanation lesion

From the results of the use-wear analysis of traces found on the bone surface around the trepanation lesion, it can be concluded that the craniotomy was performed in two stages. The operation started by making a perforation in the bone by scraping the posterior part of the future aperture (Fig. 5, *a*). The pattern of traces confidently suggests the use of a knife as a surgical tool. The traces are sharp and exhibit characteristic stepped contours, which are similar in terms of kinematics to the traces previously observed on the trepanned skulls of the Pazyryk culture of the Altai Mountains (Chikisheva, Volkov, Krivoshapkin et al., 2014; Krivoshapkin et al., 2014). The anterior part of the aperture was made at the second stage of the surgery (Fig. 5, *b*). The traces on bone point to the use of the same tool, or another tool of the same size, and a "stepped" scraping of bone. The surgical intervention in the second stage probably required faster action by the surgeon during the craniotomy. A tetrahedral tool was used several times in the course of the operation, most probably for the removal of cut-off bone fragments. Traces of that tool are found along the lateral margin of the aperture (Fig. 5, *c*). This could have been an "awl"—the tool widely used in the Late Bronze Age for the removal of stones stuck in horses' hooves. Also, traces of a chisel-like tool with a blunted edge were detected on the surface of the skull, around the trepanation lesion (Fig. 5, *d*, *e*).

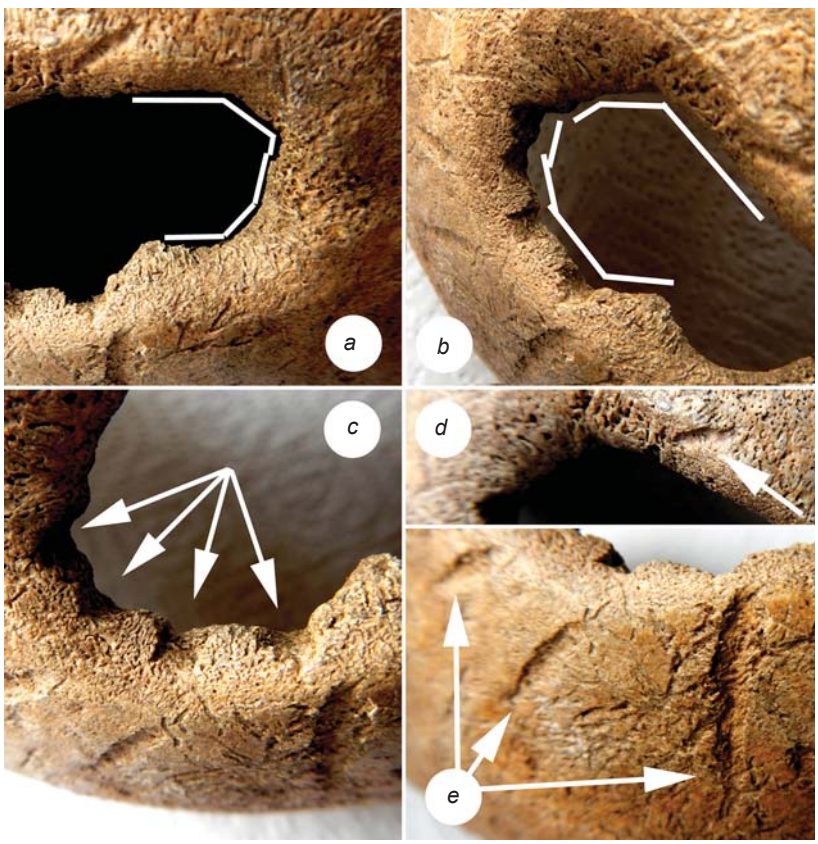


Fig. 5. Traces of the first (*a*) and second (*b*) stages of the trepanation, separation of the cut-off bone fragment (*c*), and additional traces in the area affected by the operation (*d*, *e*).

Differential diagnostics of the trepanation

The penetrating aperture in the area of the left parietal tuber is oval-shaped. The inner plate adjacent to the convexital part of the skull is removed. The maximum internal dimensions of the aperture are 3.4 × 1.8 cm. The edge of the lesion is slightly inclined owing to the removal of a part of the outer plate, so the total size of the lesion is 4.4 × 3.2 cm. A visual assessment reveals that the structure of the outer plate was changed as a result of an inflammatory process, which affected bone posterior to the aperture up to the lambdoid suture. On the surface of the inner plate adjacent to the lesion, the manifestations of the inflammation were spread 2.3 cm anteriorly, 1.3 cm medially, and 2.1 cm laterally.

Multislice computed tomography (MSCT) revealed even more extensive post-inflammatory lesions to the bone that are spread up to the sagittal and coronal sutures, and involve the diploe and both inner and outer plates. A large area of the inner plate is notably thickened: 3.7 and 5.9 cm from the aperture in the direction of the sagittal and coronal sutures, respectively (Fig. 6). The area of apparent post-inflammatory changes is clearly visible on the internal surface of a virtual reconstruction of the skull (Fig. 7). The maximum dimensions of the trepanation lesion are 3.8 cm on the outer plate, and 3.2 cm on the inner plate (Fig. 8, *a*). The edges of the aperture exhibit clear signs of neoplastic change of bone, which is indicative of healing of the wound, and survival of the patient long after the surgery (Fig. 8, *b*). A bone usuration, 1.6 cm long, is observed 0.6 cm from the edge of the lesion (Fig. 8, *c*). Ray-shaped traces of sawing of the outer plate were detected in the parietal bone, below the lateral boundary of the aperture. Two of the rays are visible in a snapshot of the reconstruction (Fig. 9), while a visual examination reveals three saw marks clearly observable in a digital photograph (see Fig. 1, *a*).

The pattern of bone change suggests that the individual had suffered an osteomyelitis of the parietal bone, complicated by an epidural abscess (empyema). The trepanation, during which the affected area was removed and the empyema was emptied, led to the individual's surviving a long time.

An epidural abscess can be triggered by such diseases as acute otitis media or an inflammation in the paranasal sinuses. When combined with an epidural empyema, it is usually the result of a penetrating wound or a surgical intervention. Osteomyelitis of the cranial bones might also be a consequence of a closed trauma, without penetrating the skin. The development of a hematoma between the periosteum and bone as a result of a blow to the head, and its subsequent infection through the hair follicles, usually lead to the emergence of surface osteomyelitis. In such cases, the sequestration is limited to the outer plate of the skull. But this scenario is rarely observed.

In the case of an open fracture or a surgical intervention, severe osteomyelitis might develop

Fig. 6. Computed tomography image of the skull: the slice depicting thickening of the inner plate of the parietal bone.

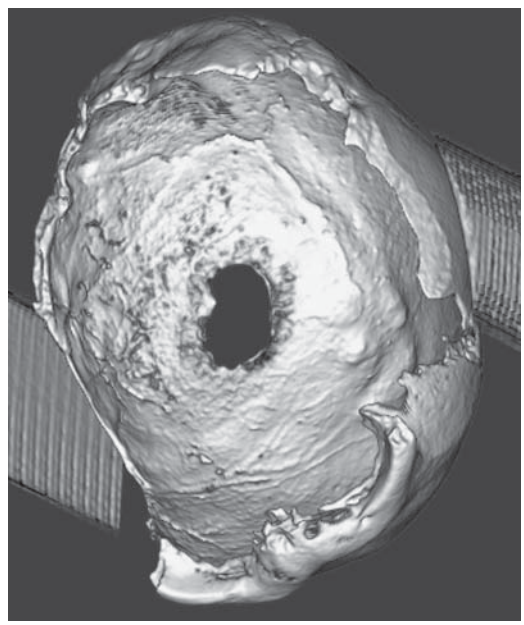


Fig. 7. Virtual 3D reconstruction of the convexital part of the skull, showing the spread of post-inflammatory lesions of the bone.

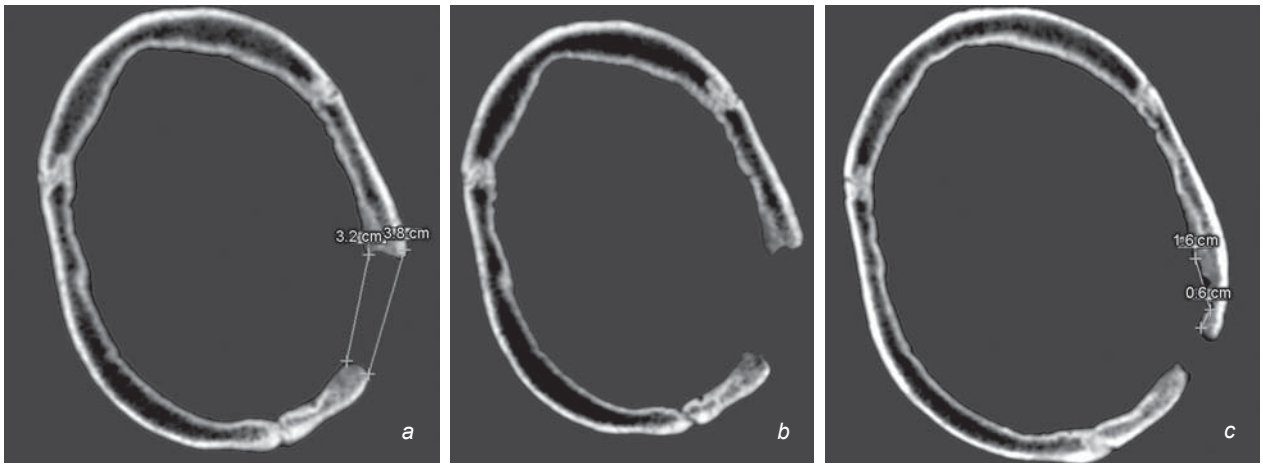


Fig. 8. Computed tomography images of the skull: the slices demonstrating maximum dimensions of the trepanation defect (*a*), manifestations of bone neoplasm along its edges (*b*), and signs of bone usurpation (*c*).

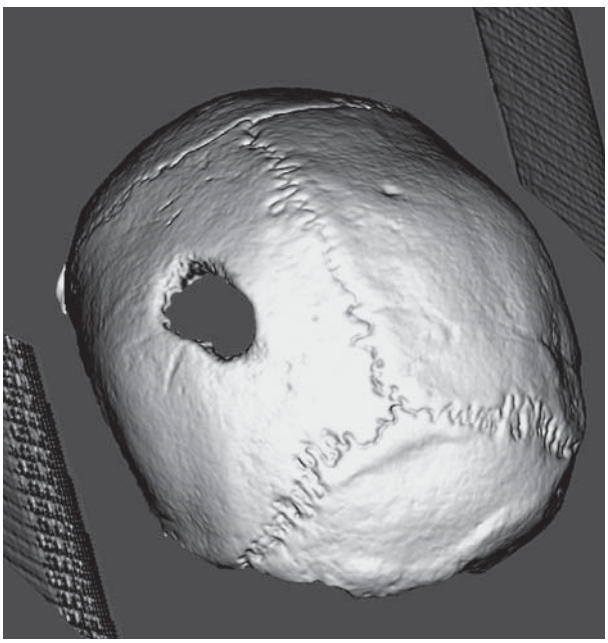


Fig. 9. Virtual 3D reconstruction of the skull.

around the lesion. The trauma provokes bleeding into the diploe, and secondary infection of this layer of bone accompanied by thrombophlebitis of the diploietic veins, which leads to disruption of bone supply, necrosis and sequestration of the affected area, and suppuration. The presence of fractures in bone promotes the dispersal of osteomyelitis. Open depressed fractures are particularly often complicated by osteomyelitis and the formation of an epidural abscess, since the wound gets contaminated by pieces of skin, hair, and other infected foreign bodies. The principles of modern neurosurgery require an obligatory revision of the wound in order to remove not only foreign bodies but also fragments of the affected bone.

Sub-acute or chronic progressing osteomyelitis of the cranial bones is clinically difficult when it affects a large area. Fistulas open in the affected skin as a consequence of the sequestration of bone. The bone appears in CT images as a segment with "wormholes" and usuration of bone tissue (see Fig. 8, *c*). The boundary between affected and healthy bone is difficult to delimit. The method of choice for healing in such cases is complete removal of the whole affected region, including the deformed inner plate, up to healthy bone. The epidural abscess should be emptied and drained. If skin is rendered molten by a purulent process, the affected edges of the wound should be segmented. A lasting infectious process is observed in the edges of the bone defect after such an operation, before complete healing.

The epidural abscess manifests as a slowly growing intracranial voluminous body. The disease progresses slowly. Growing headaches, nausea, and vomiting usually appear as a result of increased intracranial pressure. Focal neurological symptoms (motor, sensitive, and speech disorders due to a lesion of the leading brain hemisphere) emerge when adjacent parts of the brain get increasingly suppressed by the purulent content of the abscess. Partial or generalized epileptic seizures may be observed.

Owing to the obscure clinical picture of the epidural abscess, the right diagnosis, even at present, is usually made only when complications, such as oppression of consciousness, or meningeal symptoms, appear. A blowout of the purulent content of empyema through

the *dura mater* into the subdural space is also possible, and this is accompanied by a sharp worsening of the patient's condition. However, this scenario is rarely found in practice, as the *dura mater* is a strong barrier against pus drain. Thus, in modern conditions and with the use of antibiotics, the treatment prognosis is positive for the patients after emptying of the epidural abscess.

The visual and CT examination of the studied skull suggests the following reconstruction of the event, which took place three thousand years ago. The man most probably received an open depressed fracture of the left parietal bone as the result of a blow caused by a tool with a small contact area. In modern forensic practice, such "perforated" lesions to the skull are typically caused by hammer-blows. This explains the absence of linear fractures of the parietal bone radiating from the trepanation area. The localization of the lesion is typical for a blow caused by a right-hander. This was followed by an infection to the untreated wound, which led to the formation of bone osteomyelitis (note typical manifestations of bone usuration observed in the CT images), and a contact epidural empyema. A pronounced hyperplasia of the inner plate evidences the long duration of the abscess and its dispersal through a large area above the left brain-hemisphere. The limited change of the inner plate can be explained by the attachment of the *dura mater* close to the sutures. The resection of strongly affected bone tissue and emptying of the abscess resulted in the lasting survival of the patient, as is evident from the healing of the edges of the trepanation aperture.

Judging by the pattern of change in the trepanation area, the ancient surgeon was segmenting bone tissue with an already thickened inner plate. The lower margin of the lesion with squared usurations and the ray-shaped saw marks of the adjacent bone might point towards the use of a thin tetrahedral tool for elevation and removal of infected and depressed bone fragments. It seems that an ancient surgeon three thousand years ago performed a life-saving operation in accordance with modern principles of neurosurgery. The use of bronze tools, which have antiseptic properties, plausibly helped to cope with the far gone infectious process in that pre-antibiotic era.

The account in which the ancient healers carried out a trepanation that led to a severe infectious complication (Slepchenko et al., 2017) is not confirmed by our CT data. Also, this version cannot explain how it was possible to overcome the advanced infectious process.

Conclusions

The case of trepanation considered in this study is yet one more case of antemortem craniotomy carried out by ancient healers in southern Siberia (Chikisheva, Zubova, Krivoshapkin et al., 2014; Chikisheva, Krivoshapkin, 2017). All these operations are unique in terms of their advisability for the patients: in all cases, serious pathologies were diagnosed, which required intracranial interventions. The summary of the cases of true trepanations studied by the authors of the present study, and comparison of those cases with the data published by other researchers, suggest that the role of the ritual component in the rationale for performing such operations is exaggerated in the scientific and popular literature. At least in southern Siberia, all cases of trepanation described for the time span from the Early Bronze Age to the Early Iron Age (i.e. three thousand years) were life-saving operations due to traumas.

It can be hypothesized that thanks to the use of bronze tools, which have antiseptic properties (Krivoshapkin et al., 2014), the ancient healer was able to cope with a far gone infectious process, which was triggered by an open depressed fracture of the left parietal bone of the male buried in grave 14 at Anzhevka. Modern methods of differential diagnostics revealed that the individual had suffered an osteomyelitis of the parietal bone complicated by an epidural abscess (epyema). The trepanation, accompanied by a removal of the focus of osteomyelitis and emptying of the epyema, resulted in the lasting survival of the individual.

A thorough morphological examination of the remains, aimed at determining what Siberian anthropological type the male could have belonged to, has shown that the closest analogies can be found in the Paleosibirian (or Baikal) anthropological type, which emerged in the circum-Baikal region. On the other hand, some associated grave goods, for instance the bone dagger, find parallels among artifacts of the Karasuk culture. Archaeological research in the Krasnoyarsk-Kansk forest-steppe demonstrates that in the late 2nd to early 1st millennia BC a distinctive archaeological culture was forming in this region. This culture experienced a strong influence from the south and west Siberian cultural provinces (Makarov, 2016). But the influence of east Siberian cultures, which existed in the region during the Neolithic period (Ibid.), was most probably still present in the Late Bronze Age; this is indirectly suggested by the cranial morphology of the studied individual.

Some features of the burial point towards a post-inhumation penetration of the grave and ritual destructive manipulations with the partially skeletonized corpse. It is not possible to conclude definitely if such a ritual was exclusive to this individual or not, until a detailed analysis of all burials of the Anzhevka complex is carried out. Notably, some burials of the complex contain fragmented bones with traces of high-temperature exposure. Such bones were compactly stacked into special pits. Thus, the existence of special post-funerary rites in the Anzhevka population can be hypothesized.

Acknowledgement

This study was supported by the Russian Science Foundation (Project No. 14-50-00036).

References

Bondarenko A.V. 2016
Postpogrebalniye praktiki naseleniya lesostepnoho Ob-Irtyshya v epokhu bronzy: Cand. Sc. (History) Dissertation. Moscow.

Chikisheva T.A., Krivoshapkin A.L. 2017
Kompleksnoye issledovaniye prizhiznennykh trepanatsiy u drevnego naseleniya Yuzhnoy Sibiri. In *Multidistsiplinarniye metody v arkheologii: Noveyshiye itogi i perspektivy: Materialy Mezhdunar. simp*. Novosibirsk: Izd. IAE SO RAN, pp. 382–391.

Chikisheva T.A., Volkov P.V., Krivoshapkin A.L., Titov A.V., Kurbatov V.P., Zubova A.V. 2014
Early Iron Age surgical technologies: Ante-Mortem trepanation among the Early Nomads of Gorny Altai. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 42 (4): 146–154.

Chikisheva T.A., Zubova A.V., Krivoshapkin A.L., Volkov P.V., Titov A.T. 2014
Trepanation among the Early Nomads of Gorny Altai: A multidisciplinary study. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 42 (1): 130–141.

Crubezy E., Bruzek J., Guilaine J., Rouge D., Cunha E., Jelinek J. 2001
The antiquity of cranial surgery in Europe and in the Mediterranean basin. *Comptes Rendus de l'Academie des Sciences. Paris. Earth and Planetary Sciences*, vol. 332: 417–423.

Erdal Y.S., Erdal Ö.D. 2011
A review of trepanations in Anatolia with new cases. *International Journal of Osteoarchaeology*, vol. 21 (5): 505–534.

Goykhman V.A. 1966
O trepanatsii cherepa v epokhu mezolita. *Voprosy antropologii*, iss. 23: 111–118.

Gresky J., Batieva E., Kitova A., Kalmykov A., Belinskiy A., Reinhold S., Berezina N. 2016
New cases of trepanations from the 5th to 3rd millennia BC in Southern Russia in the context of previous research: Possible evidence for a ritually motivated tradition of cranial surgery? *American Journal of Physical Anthropology*, vol. 160: 665–682.

Hillson S. 1996
Dental anthropology. Cambridge: Cambridge Univ. Press.

Kangxin H., Xingcan Ch. 2007
The archaeological evidence of trepanation in early China. *Indo-Pacific Prehistory Association Bulletin*, vol. 27: 22–27.

Krivoshapkin A.L., Chikisheva T.A., Zubova A.V., Kurbatov V.P., Titov A.V., Volkov P.V. 2014
Scythian trepanations in the Gorny Altai at hippocratic times: Modern expert appraisal of ancient surgical technologies. *World Neurosurgery*, vol. 82 (5): 649–650.

Lillie M. 2003
Cranial surgery: The Epipaleolithic to Neolithic populations of Ukraine. In *Trepanation: History, Discovery, Theory*, R. Arnott, S. Finger, C. Smith (eds.). Lisse: Swets and Zeitlinger, pp. 175–188.

Lisowski F.P. 1967
Prehistoric and early historic trepanation. In *Diseases in antiquity: A Survey of the diseases, injuries and surgery of early populations*, D.R. Brothwell, A.T. Sundison (eds.). Illinois: C.C. Thomas, Springfield, pp. 651–672.

Lorkiewicz W., Stolarczyk H., Smiszkiewicz-Skwarska A., Zadzinska E. 2005
An interesting case of prehistoric trepanation from Poland: Re-evaluation of the skull from the Franki Suchodolskie site. *International Journal of Osteoarchaeology*, vol. 15 (2): 115–123.

Makarov N.P. 2016
Krasnoyarsko-Kanskaya lesostep v dialoge kultur neolita i bronzovogo veka Zapadnoy i Vostochnoy Sibiri. *Vestnik Tomskogo gosudarstvennogo universiteta*, No. 4: 94–97.

Matyushchenko V.I. 1974
Drevnyaya istoriya naseleniya lesnogo i lesostepnogo Priobya (neolit i bronzovyi vek). Pt. 4: Yelovsko-irmenskaya kultura. Tomsk: Izd. Tom. Gos. Univ. (Iz istorii Sibiri; iss. 12).

Mednikova M.B. 2001
Trepanatsii u drevnikh narodov Yevrazii. Moscow: Nauch. mir.

Mednikova M.B. 2003
Ritual initiation in prehistoric Eurasians based on cranial data: Symbolic trephination. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 1: 147–156.

Mednikova M.B. 2004
Trepanatsii v drevmen mire i kult golovy. Moscow: Aleteya.

Papagrigorakis M.J., Toulas P., Tsilivakos M.G., Kousoulis A.A., Skorda D., Orfanidis G., Synodinos P.N. 2014
Neurosurgery during the Bronze Age: A skull trepanation in 1900 BC Greece. *World Neurosurgery*, vol. 81 (2): 431–435.

Prioreschi P. 1991
Possible reasons for Neolithic skull trephining. *Perspectives in biology and medicine*, vol. 34 (2): 296–303.

Prioreschi P. 1996
A History of Medicine. Vol. I: Primitive and ancient medicine. 2nd edition. Omaha: Horatius Press.

Rykushina G.V. 2007
Paleoantropologiya karasukskoy kultury. Moscow: Izd. IEA RAN.

Scott J.R., Turner C.G. II. 1997
The Anthropology of Modern Human Teeth. Dental Morphology and its Variation in Recent Human Populations. Cambridge: Cambridge Univ. Press.

Slepchenko S.M., Vybornov A.V., Slavinsky V.S., Tsybankov A.A., Matveev V.E. 2017
Ante mortem cranial trepanation in the Late Bronze Age in Western Siberia. *International Journal of Osteoarchaeology*, vol. 27 (3): 356–364.

Weber J., Wahl J. 2006
Neurosurgical aspects of trepanations from Neolithic times. *International Journal of Osteoarchaeology*, vol. 16 (6): 536–545.

Zubov A.A. 2006
Metodicheskoye posobiye po antropologicheskomu analizu odontologicheskikh materialov. Moscow: Izd. IEA RAN.

Received July 31, 2017.
Received in revised form September 19, 2017.

DOI: 10.17746/1563-0110.2018.46.1.144-153

V.A. Batsevich, O.V. Yasina, and A.V. Sukhova
Lomonosov Moscow State University Research Institute and Museum of Anthropology, Mokhovaya 11, Moscow, 125009, Russia
E-mail: vbatsevich@rambler.ru; okyasina@yandex.ru; alla-sukhova@bk.ru

Secular and Age-Related Dynamics of Biological Characteristics in the Rural Population of Mongolia: A Study of Environmental Adaptation

This study explores the temporal and age-related variations in anthropometric, physiological, and radiographic data collected in 1986–1990 in five rural Mongolian populations (four Khalkha and one Khoton), living in different natural environments and practicing a traditional lifestyle. The sample comprises 970 adult men and women aged 18–80. In Khalkha Mongols, the effect of climate and other environmental characteristics on anthropometric traits is negligible. These groups demonstrate temporal stability of anthropometric traits over the last 40 years and, if published data are considered, since the late 1800s. Age changes in hand skeleton are low to moderate. Sexual maturation in females is slow: the average age at menarche is 15.8 years, and no secular trend has been detected. The respective age in Khoton females is even higher—16.8 years. Unlike Khalkha females, Khoton females show a secular trend in body size, whereas the tempo of sexual maturation and skeletal ageing is accelerating. The totality of biological parameters indicates successful environmental adaptation in Khalkha Mongols. The Khoton migrants tend toward the adaptive norm typical of the native population.

Keywords: *Anthropology, Mongols, Khalkha, Khoton, anthropometry, radiography, human ecology.*

Introduction

Answering the questions about how well human populations of various times and places are adapted to environment, and what factors affect the process of adaptation most, is the main, if not single, aim of anthropoecology. The former question can be gradually answered by collecting the data describing various adaptive changes in populations. The diversity of these changes is great, but not boundless. During the several last decades, dozens of populations have been studied from the points of view of morphology, physiology and biochemistry. The range of intergroup variation in Eurasia is generally determined by now (Alekseeva, 1986: 89–149; 1998: 112–196; Antropoekologiya Tsentralnoy Azii, 2005: 85–237; Antropoekologiya Severo-Vostochnoy Azii, 2008: 238–312). But the possibility of determining the main factors affecting the adaptive process is the most important and the most challenging at the moment. It will be discussed in detail below.

The adaptation in human populations is specific. During early stages in the history of humanity, climatic factors dominated (Alekseeva, 1986: 150–154). But the role of collective labor and sociogenesis gradually increased in the course of human evolution (Alekseev, 1984: 348–383; Lambert, 1987; Khrisanfova, Perevozchikov, 1999: 108–119). The ultimate action of both abiotic and biotic environmental factors is strongly limited or even neglected by the economic

Archaeology, Ethnology & Anthropology of Eurasia 46/1 (2018) 144–153 E-mail: Eurasia@archaeology.nsc.ru

and cultural practices of human societies. According to T.I. Alekseeva, "…adaptation to environment at all stages of human society's development has been brought about via two 'channels': biological and social, with the latter being dominant" (1972: 105). Further, Alekseeva outlines the following main features of well-adapted populations: equilibrium between the population and its environment, high survival rate, stability of morphofunctional status, and optimal accordance of economic and cultural customs with the ambient environment (Ibid.). These ideas were developed and detailed further by a number of authors (Okruzhayushchaya sreda…, 1979: 8; Prokhorov, 1991: 59).

In the modern world, the influence of humans on the transformation of the biosphere is growing at a pace exceeding the rate of biological evolution in living organisms, including humans. As a result, old ecological niches are disappearing, while new ones are being formed, and these latter are more difficult to adapt to. A conflict emerges between environment and adaptive features developed in previous generations but useless at present. In the last decades, both anthropologists and physicians have noted the widespread changes of somatic features emerging as results of developmental acceleration, as well as a sharp increase in the prevalence of diseases previously rare in youth: obesity, diabetes, allergies, autoimmune diseases, psychological dysfunctions (Auxology…, 2013: 110–129; Brüne, Hochberg, 2013).

In anthropoecology, attention is paid primarily to specific adaptive features. These include adaptive variation of morphological and physiological variables, particularly specifics of growth and development in populations occupying particular environments.

Owing to the large diversity of environmental factors, adaptive processes in human populations can only be evaluated through complex morphofunctional studies. When using other sources of data, special attention is also paid to the study of the tempos of growth, all stages of which are informative from the adaptive point of view, because all adaptive morphophysiological traits emerge and start functioning during ontogeny. The object of analysis in this study is traditional anthropometric variables, but also age-related changes of the hand bones that are identified and fixed, not only in childhood and adolescence, but also later in ontogeny (Rokhlin, 1936: 21–36, 181–190). The OSSEO technique developed for X-ray data can be successfully used for evaluation of the adaptive status of populations as well (Pavlovsky, 1987: 228–234; Pavlovsky, Maksinev, Batsevich, 1998; Batsevich et al., 2006; Kobyliansky, Livshits, Pavlovsky, 1995).

It was previously shown that in populations with increased longevity the disharmony of growth processes is absent, while maturation and aging of the hand bones occurs more slowly and age-related bone pathologies are rare (Batsevich et al., 2009, 2014; Kalichman et al., 2011). These data are in good agreement with the results of complex studies (demographical, socio-ethnographical, and biomedical) in centenarian populations of Abkhazia and Azerbaijan (Fenomen dolgozhitelstva, 1982: 59; Abkhazskoye dolgozhitelstvo, 1987: 94; Dolgozhitelstvo v Azerbaydzhane, 1989: 171). Judging by the results of the above-mentioned research, the populations with increased longevity can be confidently considered the most adapted groups of humans in terms of biology, demography, and socio-ethnography. These data, combined with knowledge about the morphophysiological peculiarities of the populations of particular regions (adaptive types), can be used as references for a comparative evaluation of the ecological status of the studied groups.

This study sets out to determine the adaptive status of rural populations of Mongolia, inhabiting various climates and keeping to traditional ways of life up to present time. To these ends, a comparative analysis of the rate of age-related skeletal changes was carried out in four samples of the adult Khalkha Mongols and one sample of the Khotons. The temporal dynamics of a number of morphophysiological features was studied in every population and in all Khalkha samples combined.

Materials and methods

Anthropometric and X-ray data were collected during the anthropoecological expeditions carried out by a joint team of the Research Institute and Museum of Anthropology (MSU) and the Institute of Biology of the Mongolian Academy of Sciences in 1986–1990. The studied area included Uver-Khangay (Bat-Ulziy and Burd somons, combined), Bayankhongor (Bayan-Lig village), Khubsugul (Zhargalant village), Ubsunur (Tarialan village), and Eastern (Khalkhgol village) aimags of Mongolia. The sample included 970 males and females from

18 to 80 years of age. The studied Mongolian populations are ethnically homogeneous, they all belong to the Khalkha Mongols, the largest ethnic group of the country. The Khotons from the Tarialan somon are descendants of migrants who were forcibly moved in the 18th century to what is now Western Mongolia (Grumm-Grzhimaylo, 1926: 274). From the point of view of physical anthropology, linguistics, and religion, the Khotons are similar to Central Asian groups of Eastern Turkestan, though their exact origins are still unknown. Originally, they were agriculturalists, but herding has gradually taken over. At the time of the expeditions, all studied populations shared the traditional nomadic and semi-nomadic economy of arid zones. As in the past, most food was produced domestically, while social differentiation between and within groups was minimal. Thus, the studied Mongolian populations occupy different geographical zones but share many cultural features, and therefore may serve as a good model for exploring anthropoecological associations.

All data were collected following the principles of bioethics. According to the law on personal data, all entries were anonymized before performing statistical analyses. Anthropometric data were collected following the standard protocol (Smirnova, Shagurina, 1981). The original OSSEO technique for the evaluation of age-related changes to the hand bones in individuals and populations was developed at the Research Institute and Museum of Anthropology (MSU) and described in a number of publications (Pavlovsky, 1987: 9–32; Pavlovsky, Maksinev, Batsevich, 1998; Batsevich et al., 2009). Some details of the technique, important for understanding the results of the present study, are outlined below.

The following variables (points) of the age osteomorphic status were evaluated:

A – the empirical age of the beginning of age-related changes in a population after full maturation of the hand skeleton. Late emergence of such changes is considered an advantage;

B – the empirical age at which all individuals in a population display at least some age-related changes to the hand bones. Again, this stage is achieved at an older age if the ontogenetic dynamic is optimal in the population;

B – A – the difference between the two ages (in years). Describes the period during which both individuals with age-related changes and without them are observed in a population. We hypothesize that the duration of this period might be proportional to the level of ontogenetic harmoniousness.

Standard samples were formed in each group for both sexes. The term "standard sample" in the OSSEO means individuals in the age range between A (see above) and 60 years. Such samples are used in order to exclude the possible influence of a difference in age distribution between samples on the results. The rationale behind this methodology is comprehensively described elsewhere (Antropoekologiya Tsentralnoy Azii, 2005: 214).

Tempo of age-related changes of the hand skeleton

First manifestations of age-related skeletal changes (the empirical point A) appear relatively early in both males and females of the studied populations, at 26–28 years of age (Table 1). There is a marked inter-group variation in this variable among the populations, more pronounced in females. The Kalkha Mongols from Bayan-Lig and Zhargalant and the Khotons from Tarialan reach point A earlier.

The second post-definitive stage (point B), during which all individuals in a sample display manifestations of aging, begins at different ages in different populations (Table 1). In males, it ranges from 38 to 52 years, and in females from 35 to 55 years. This variation covers almost fully the range of values of this variable previously observed in 46 populations from various ecological conditions (Table 2). A relatively earlier appearance of age B was detected in the Khalkha Mongols from Bayan-Lig and the Khotons from Tarialan, while there was a later appearance in Bat-Ulziy, Zhargalant, and Khalkhgol, which is typical of populations with an optimal pace of ontogeny.

The interval between points A and B, the time of accumulation of age changes, also varies in duration (see Table 1). It is lengthy in Bat-Ulziy, Zhargalant, and Khalkhgol, where in some cases in females (max = 26 years) it approaches the world maximum typical for centenarian populations. In the Bayan-Lig population (Gobi zone), this interval is minimal among all Mongolian populations studied. If this population is excluded, the Khalkha Mongols in general differ from other populations in having a higher duration for this interval (see Table 2). The Khotons, both males and females, display intermediate values of this variable.

Table 1. **Main sample statistics of the OSSEO variables in the studied populations**

Population, aimag	Sex	n_1	Age, years (min–max)	A	B	B – A	n_2	*a*	*b*
Uver-Khangay, 1986	Male	97	23–78	28	46	18	75	–6.25	0.218
	Female	99	18–72	31	55!	24	53	–2.99	0.133
Bayankhongor, 1987	Male	64	20–80	26	38	12	50	–5.67	0.269
	Female	79	19–73	24	35	11	68	–8.32	0.336
Khubsugul, 1988	Male	76	22–73	26	41	15	63	–5.76	0.239
	Female	79	19–72	28	54	26	47	–2.47	0.125
Eastern, 1990	Male	61	19–65	30	52	22	34	–7.50	0.251
	Female	81	18–66	32	51	19	42	–4.22	0.138
Ubsunur (Khotons), 1989	Male	39	18–63	28	45	17	31	–9.55	0.365
	Female	56	19–54	27	41	14	25	–7.96	0.301

Note. n_1 – total size of the sample; n_2 – size of the "standard sample", from the point A (the empirical age of the beginning of age-related changes in a population) to the age of 60; *a* – constant term of the linear regression equation in standard samples; *b* – coefficient of the linear regression equation describing the rate of age-related changes in standard samples.

Table 2. **Reference values of the OSSEO variables in 46 rural populations**

Variable	Males			Females		
	Min	Max	*M*	Min	Max	*M*
A	21.0	41.0	27.3	21.0	39.0	28.5
B	28.0	57.0	41.1	31.0	66.0	43.7
B – A	3.0	30.0	13.9	6.0	30.0	15.2
*b**	0.148	0.816	0.360	0.084	0.784	0.366

*See the note to the Table 1.

The rate of accumulation of age-related changes in the hand bones was assessed using regression analysis. The results of the analysis (Fig. 1) show that among all populations from Mongolia employed in this study, males and females of two groups (the Khalkha Mongols from Bayan-Lig (Gobi desert) and the Khotons from Tarialan) exhibit relatively high rates (Batsevich, Yasina, 2000). As compared to the previously studied populations from the former USSR, Israel, and Sinai Peninsula, all Mongolian populations display low to medium rates of skeletal aging (cf. Tables 1 and 2).

Thus, the adult population of Mongolia can be divided into two contrasting groups of populations in terms of their age-related osteomorphic status. The populations displaying an advantageous (delayed) rate of aging inhabit the central, northern, and eastern regions of the country (Khalkha Mongols of the Uver-Khangay, Khubsugul, and Eastern aimags). The adaptively disadvantageous, accelerated tempos of aging of the hand bones, for reasons still unclear, were observed in the Khalkha Mongols from the South (Bayankhongor aimag). Certain biological features of the latter (total body size, temporal stability of body morphology, decelerated maturation of children and adolescents, etc.) do not differ from other Khalkha populations. An influence from climatic, geographical, and geochemical environmental factors of the southern desert, that are different from the typical environment for Mongolian groups, can be hypothesized.

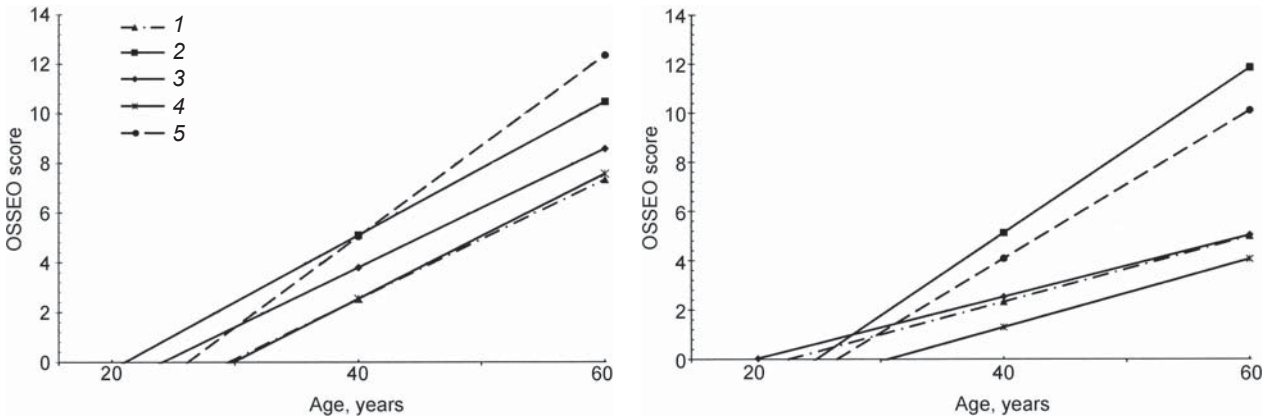


Fig. 1. Rates of age-related changes of the hand skeleton.
A – males; *B* – females.
1 – Bat-Ulziy and Burd; *2* – Bayan-Lig; *3* – Zhargalant; *4* – Khalkhgol; *5* – Tarialan (Khotons).

The Khotons of the western Ubsurun aimag display an accelerated tempo of ontogeny as well. This population was forced to migrate some 10–12 generations ago, and changed not only their environment but also their subsistence strategy. Thus it can be reasonably suggested that adaptation in this group is not complete, and the high rate of age-related changes in the hand skeleton is a manifestation of that disadaptation. Similar examples of differences in the pace of skeletal aging between native groups and recent migrants in other regions were described in our previous studies (Batsevich et al., 2009; Batsevich, Kobyliansky, Yasina, 2013).

Age at menarche

The pace of ontogeny of females in adolescence can be assessed based on the age at puberty. The mean age at menarche and its dynamics during long time periods are an indicator of historical and social changes, and the health and well-being of the population (Lehmann, Scheffler, Hermanussen, 2010). Data on the age at menarche were collected in three Khalkha populations (excluding Uver-Khangay aimag) and in one of the Khotons. A preliminary exploration of these data has shown that this variable does not differ significantly among females of those populations. In this connection, pooled data for all the Mongolian females was used further in inter-group comparisons of age and temporal dynamics of sexual maturation rate.

The mean age at menarche of the Mongolian females was 15.8 years (n = 188, σ = 1.23). Its temporal changes have been undirected (Fig. 2, *A*), which is confirmed statistically (the p-values are shown in the figure). The tempos of sexual maturation in the Khoton females have been changing substantially during the same period of time (Fig. 2, *B*). The mean age at menarche was the highest in the 1940s (app. 18 years), and decreased during the following three decades. In the 1970s, it averaged 16 years, approaching the values typical for the Khalkha females. The mean age at menarche for the whole studied time span was 16.8 years (n = 64, σ = 1.18). The direct changes of this variable evidence active adaptive processes in this population due to changes in environment.

Temporal dynamics of anthropometric variables

For the study of temporal change of anthropometric variables, we employed a set of metric traits including main lengths and transverse skeletal dimensions of the body segments that were previously shown to change as a result of growth acceleration and the secular trend: lengths of body, torso and arm, and shoulder width. Each of these variables exhibits a specific growth trajectory. The variation of stature and torso length in long-term perspective can be affected by both secular and age-related factors. This issue was addressed in detail in our previous study (Batsevich, Yasina, 2015). But the shoulder width and arm length variation is not substantially affected by age-related changes after reaching maturity.

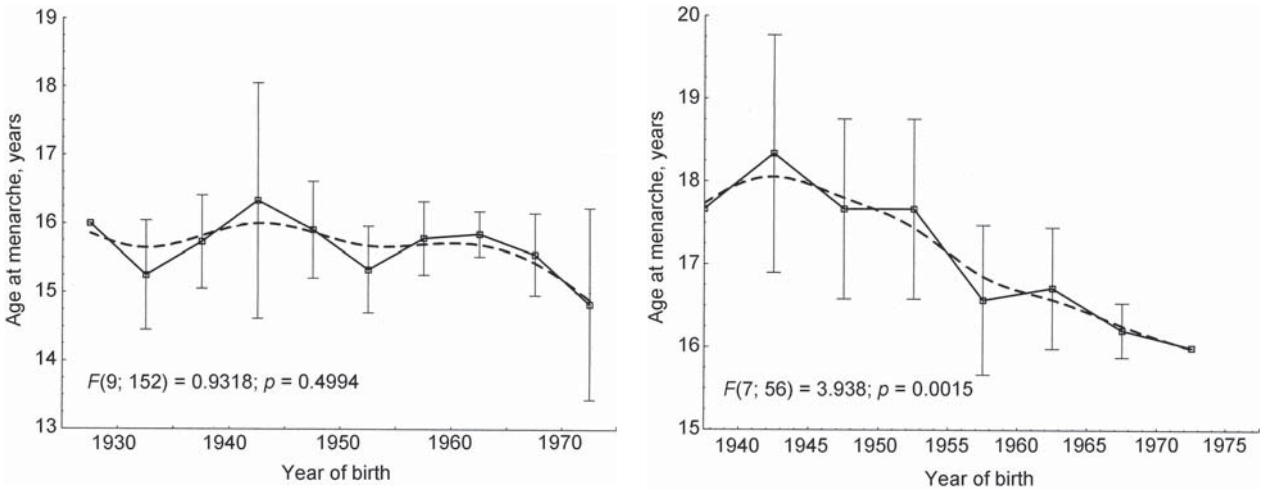


Fig. 2. Temporal dynamics of the age at menarche of the Khalkha (*A*) and Khoton (*B*) females.

In order to assess the direction and intensity of temporal changes in the anthropometric variables, correlation coefficients between their values and the birth dates of all individuals were calculated (Table 3). There were no significant associations found at the level of single populations in any of the Khalkha Mongolian groups, neither in males nor in females. Thus, it can be reasonably assumed that the somatic status of the rural Mongols was stable between the 1930s and the 1970s. In the Khotons, in the same time span, statistically significant changes in stature and shoulder width were detected in females, and in torso length in males. The increase in these and some other anthropometric variables is slight and does not usually reach the level of statistical significance. The growth acceleration and secular trend is

Table 3. **The association between anthropometric variables and birth date in the Khalkha Mongolian and Khoton populations**

Population, aimag	Sex	*n*	Stature		Shoulder width		Torso length		Arm length	
			Correlation coefficient	*p*	Correlation coefficient	*p*	Correlation coefficient	*p*	Correlation coefficient	*p*
Uver-Khangay, 1986	Male	141	–0.083	0.32	0.134	0.122	0.019	0.825	–0.103	0.221
	Female	152	0.102	0.21	0.049	0.547	0.012	0.880	0.073	0.371
Bayankhongor, 1987	Male	54	–0.006	0.96	–0.228	0.091	0.020	0.882	0.007	0.958
	Female	71	0.118	0.31	0.134	0.249	0.187	0.109	0.113	0.327
Khubsugul, 1988	Male	75	0.090	0.42	–0.106	0.342	0.026	0.815	0.093	0.405
	Female	98	0.109	0.27	–0.148	0.131	0.069	0.483	–0.053	0.591
Dornod, 1990	Male	56	–0.147	0.25	0.058	0.650	–0.142	0.262	–0.131	0.301
	Female	78	0.058	0.60	0.044	0.695	–0.104	0.349	–0.115	0.303
Ubsunur (Khotons), 1989	Male	48	0.079	0.56	0.087	0.503	**0.273**	**0.033**	0.212	0.100
	Female	86	**0.214**	**0.04**	**0.277**	**0.008**	0.149	0.157	0.119	0.262

Note. Statistically significant coefficients are given in bold.

more pronounced in females, while in males it is commonly found in the form of tendencies. A similar picture of temporal changes in body morphology, accompanying social and economic changes, was previously observed in the Bashkirs. The observed morphological differences between the two sexes are probably related to the gender role differences typical of the ethnic culture (Ibid.).

It was previously demonstrated by T.P. Chizhikova and N.S. Smirnova (2011) that the intergenerational change in stature in a number of populations (Russians, Abkhazians, Chuvash, Bashkirs) was determined by the level of stability of social and cultural conditions. Weakly pronounced or absent changes in body morphology are found when a tradition way of life is kept. A similar association between skeletal maturation and aging rates on one hand and the stability of ecological conditions on the other hand was observed previously (Batsevich et al., 2009).

Another way of assessing temporal changes in body morphology is to compare the results of researches carried out in various years in the past. The data for stature from the literature are

Table 4. **Published data on stature of the adults of rural populations of the Khalkha Mongols studied in various years**

Source	Population, aimag											
	Kobdos	Gobi-Altay	Bayankhongor	Uver-Khanga	Khubsugul	Ara-Khanga	Bulgan	Central	South Gobi	East Gobi	Sukhe-Bator	Eastern
Males												
(Talko-Gryntsevich, 1902)	…	…	…	…	…	…	…	161.8 (36)	…	…	…	…
(Vlček, 1965)	…	…	…	…	…	164.8 (59)	…	…	…	…	…	…
(Nyamdorj, 1988)	…	…	…	…	…	165.1 (170)	…	…	165.4* (427)	…	…	…
(Zolotareva, 1990)	164.8 (92)	164.3 (105)	…	166.1 (106)	166.4 (76)	…	…	164.9 (95)	164.2 (104)	165.0 (93)	164.6 (68)	165.1 (99)
(Tumen, 1992)	…	…	…	…	…	165.9 (50)	165.9 (35)	…	…	…	163.7 (53)	162.6 (73)
(Antropoekologiya Tsentralnoy Azii, 2005)	…	…	164.6 (54)	165.5 (69)	165.7 (75)	…	…	…	…	…	…	165.2 (56)
Females												
(Vlček, 1965)	…	…	…	…	…	151.3 (49)	…	…	…	…	…	…
(Nyamdorj, 1988)	…	…	…	…	…	154.9 (120)	…	…	153.9* (707)	…	…	…
(Tumen, 1992)	…	…	…	…	…	153.4 (76)	153.7 (43)	…	…	…	151.2 (66)	153.8 (72)
(Antropoekologiya Tsentralnoy Azii, 2005)	…	…	154.1 (71)	153.5 (70)	154.4 (98)	…	…	…	…	…	…	154.5 (78)

Note. Sample size is given in parentheses.
*Pooled data for South Gobi and East Gobi aimags.

presented in Table 4. Taking into account the dates of publications and age distribution of the samples, the temporal dynamic of stature in Mongolia during the last hundred years can be traced (though some adjustment on the number and geographic distribution of the studied samples is certainly needed). The mean stature of the Khalkha Mongolian males ranges from 161.8 to 166.1 cm irrespective of the population's location and year of study (Table 4). The minimal value of this variable, 161.8 cm, was reported in the earliest study by Talko-Gryntsevich (1902), carried out in Urga (present day Ulan-Bator) in the middle of the 1890s. The author of that study emphasized that his sample employed young males retaining a potential for further growth. The delayed biological maturation of the Mongols in the early 20th century, which could last until 25–26 years of age, was also reported by Rokhlin (1936: 162). The mean stature of the Khalkha Mongolian females varies from 151.2 to 154.9 cm (Table 4), which, like that of the Mongolian males, fits into the range of values typical for related populations.

Notably, stature in other ethnic groups of Mongolia studied during the 1980s was similar to that in the Khalkha populations. D. Tumen, in his dissertation (1992), reports stature values in 22 ethnic and sub-ethnic groups. No substantial differences in total body size relating to linguistic, ethnic, or geographic differences among the samples were detected. Thus, it can be reasonably hypothesized that the similarity in some anthropometric variables among Mongolian populations is due to the influence of similar and stable environmental conditions.

The temporal dynamic of a number of anthropometric and also physiological variables is a result of the change in the pace of ontogeny due to the influence of changing social and economic factors. During 50 years of research in Mongolia, accelerated growth was only observed in children and adolescents of Ulan-Bator city (Tsolmon, 1994; Otgon, Efimova, Korytov, 2009; Uranchimeg, 2011; and others). An exploration of the data collected in various years demonstrates a gradual increase in total body size in all age cohorts. But the tempo of these changes is not the same in different periods. For instance, a steep acceleration of growth and its differentiation according to social status was observed in Ulan-Bator at the turn of the 21st century (Uranchimeg, 2011). The complex influence of urban stresses on the biological features of citizens is well studied, and the consequences of such influence are broadly similar in various parts of the world (Nikityuk, 1989; Godina, Miklashevskaya, 1990; Purundzhan, 1990; Bogin, 1988). In this respect, the urban dwellers from Mongolia repeat the path of the population of other countries that experienced an early urbanization.

The research on growth and development of rural children of 8 aimags and 11 somons, carried out in 1987–1998, revealed a similar rate of maturation in various climatic and geographic zones of Mongolia (Antropoekologiya Tsentralnoy Azii, 2005: 127–153; Erdene, 2007). The definite body size of male and female adolescents of older age cohort do not differ from that of adults of previous generations. This suggests that the secular trend and growth acceleration are absent in these populations in the studied period.

Conclusions

The results of the present study show that the adult rural Khalkha Mongolian populations, leading a traditional way of life, retain the optimal adaptive balance with their environment. No temporal changes in the age at menarche or total body size in both sexes were observed in the studied samples. Our X-ray data revealed a delayed rate of aging of the hand bones in adults. The migrant Khotons, who have changed their traditional culture and economy, exhibit manifestations of an accelerated pace of ontogeny as compared to the adapted native population. A similar situation was found in migrant groups in Transcaucasia and Israel (Batsevich et al., 2009; Batsevich, Kobyliansky, Yasina, 2013). In the Khotons, an increase in stature and transverse body-dimensions was observed as well. Their morphology is similar to that of other local Mongolian ethnic groups of the Ubsunur aimag: the Bayads and Derbets. Apparently, the Khoton population is gradually approaching the biological adaptive norm typical of the native population of this region.

Judging by a number of biological variables explored in this study, the Khalkha Mongolian populations described here can be considered well-adapted to the complex of environmental factors. In terms of their level of adaptation, they are most similar to the centenarian groups of the Caucasus. Such a high level of adaptation of the modern Mongolian population can be explained in most cases by the long-term socio-economic stability of their habitat. The situation observed in the Khotons seems to confirm the above-mentioned conclusion.

Acknowledgement

This study was supported by the Russian Science Foundation (Project No. 14-50-00029).

References

Abkhazskoye dolgozhitelstvo. 1987
V.I. Kozlov (ed.). Moscow: Nauka.

Alekseev V.P. 1984
Stanovleniye chelovechestva. Moscow: Politizdat.

Alekseeva T.I. 1972
Biologicheskiye aspekty izucheniya adaptatsii u cheloveka. In *Simpozium "Antropologiya 70-kh godov"*. Moscow: Znaniye, pp. 103–128.

Alekseeva T.I. 1986
Adaptivniye protsessy v populyatsiyakh cheloveka. Moscow: Izd. Mosk. Gos. Univ.

Alekseeva T.I. 1998
Adaptatsiya cheloveka v razlichnykh ekologicheskikh nishakh Zemli (biologicheskiye aspekty). Moscow: MNEPU.

Antropoekologiya Severo-Vostochnoy Azii: Chukotka, Kamchatka, Komandorskiye ostrova. 2008
Moscow: Taus.

Antropoekologiya Tsentralnoy Azii. 2005
T.I. Alekseeva, V.A. Batsevich, M.B. Mednikova, O.M. Pavlovsky, G.S. Samoylova, V.A. Spitsyn, N.K. Spitsyna, O.V. Yasina. Moscow: Nauchniy mir.

Auxology — Studying human growth and development. 2013
M. Hermanussen (ed.). Stuttgart: Schweizerbart.

Batsevich V., Kobyliansky E., Yasina O. 2013
Age-related skeletal changes in adult populations under various social and geographical conditions: An anthropo-ecological study. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 41 (4): 146–154.

Batsevich V.A., Mansurov F.G., Yasina O.V., Danilkovich N.M. 2014
Ekologicheskiye variatsii tempov sozrevaniya kostey kisti u detey i podrostkov. *Vestnik Moskovskogo universiteta*. Ser. XXIII: Antropologiya, No. 4: 62–73.

Batsevich V.A., Pavlovsky O.M., Maksinev D.V., Yasina O.V., Mansurov F.G. 2006
Vozrastniye osteomorfniye pokazateli kostey kisti kak indikator ekologicheskogo blagopoluchiya populyatsii. *Vestnik Tambovskogo universiteta*. Ser.: Yestestvenniye i tekhnicheskiye nauki, vol. 11 (4): 513–517.

Batsevich V.A., Pavlovsky O.M., Mansurov F.G., Yasina O.V. 2009
Regionalniye aspekty antropoekologii i dinamika ontogeneza v populyatsiyakh cheloveka. *Rasy i narody: Sovremenniye etnicheskiye i rasoviye problemy: Yezhegodnik*, iss. 34: 78–115.

Batsevich V.A., Yasina O.V. 2000
Tempy ontogeneza u naseleniya Mongolii. *Voprosy antropologii*, iss. 90: 87–103.

Batsevich V.A., Yasina O.V. 2015
Dolgovremenniye izmeneniya somaticheskikh pokazateley i vozrasta menarche u selskogo chuvashskogo i bashkirskogo naseleniya v XX veke. *Vestnik Moskovskogo universiteta*. Ser. XXIII: Antropologiya, No. 4: 4–13.

Bogin B.A. 1988
Rural-to-urban migration. In *Biological Aspects of Human Migration*, C.G.N. Mascie-Taylor (ed.). Cambridge: Cambridge Univ. Press, pp. 90–129.

Brüne M., Hochberg Z. 2013
Secular trends in new childhood epidemics: Insights from evolutionary medicine. *BMC Medicine*, vol. 11. URL: https://bmcmedicine.biomedcentral.com/articles/10.1186/1741-7015-11-226.

Chizhikova T.P., Smirnova N.S. 2011
Morfologiya tela nekotorykh grupp bashkir. In *Antropologiya bashkir*, ch. IX. St. Petersburg: Aleteya, pp. 193–216.

Dolgozhitelstvo v Azerbaidzhane. 1989
Moscow: Nauka.

Erdene E. 2007
Osobennosti rosta i razvitiya detey iz razlichnykh geograficheskikh rayonov Mongolii. In *Chelovek v kulturnoy i prirodnoy srede: Trudy Tretyikh antropologicheskikh chteniy: K 75-letiyu so dnya akademika V.P. Alekseeva*. Moskva, 15–17 noyab. 2004 g. T.I. Alekseeva (ed.). Moscow: Nauka, pp. 366–373.

Fenomen dolgozhitelstva: Antropologo-etnograficheskiy aspect issledovaniya. 1982
S.I. Bruk (ed.). Moscow: Nauka.

Godina E.Z., Miklashevskaya N.N. 1990
Vliyaniye urbanizatsii na rostoviye protsessy u detey i podrostkov. In *Urboekologiya*. Moscow: Nauka, pp. 92–102.

Grumm-Grzhimaylo G.E. 1926
Zapadnaya Mongoliya i Uryakhansky kray, vol. 3 (1). Leningrad: Gos. geogr. obsch.

Kalichman L., Korostishevsky M., Batsevich V., Kobyliansky E. 2011
Hand osteoarthritis in longevity populations. *Aging Clinical and Experimental Research*, vol. 23 (5/6): 457–462.

Khrisanfova E.N., Perevozchikov I.V. 1999
Antropologiya: Uchebnik. 2nd edition. Moscow: Izd. Mosk. Gos. Univ.

Kobyliansky E., Livshits G., Pavlovsky O. 1995
Population biology of human aging: Methods of assessment and sex variation. *Human Biology*, vol. 67 (1): 87–109.

Lambert D. 1987
The Cambridge Guide to Prehistoric Man. Cambridge: Cambridge Univ. Press.

Lehmann A., Scheffler C., Hermanussen M. 2010
The variation in age at menarche: An indicator of historic developmental tempo. *Anthropologischer Anzeiger*, Jg. 68 (1): 85–99.

Nikityuk B.A. 1989
Akseleratsiya razvitiya (prichiny, mekhanizmy, proyavleniya i posledstviya). In *Itogi nauki i tekhniki*. Ser.: Antropologiya. Vol. 3: Rost i razvitiye detey i podrostkov. Moscow: VINITI, pp. 5–76.

Nyamdorj Y. 1988
Nekotoriye antropoekologicheskiye osobennosti naseleniya Gobiyskoy zony MNR: Manuscript. NII i Muzey antropologii MGU im. M.V. Lomonosova. Iz nauchnogo arkhiva T.I. Alekseevoy. *Arkhiv laboratorii antropoekologii*, No. 8.

Okruzhayushchaya sreda i zdorovye cheloveka. 1979
Moscow: Nauka.

Otgon G., Efimova N.V., Korytov L.I. 2009
Dinamika antropometricheskikh pokazateley detskogo naseleniya Mongolii. *Sibirskiy meditsinskiy zhurnal*, vol. 88 (5): 106–108.

Pavlovsky O.M. 1987
Biologicheskiy vozrast u cheloveka. Moscow: Izd. Mosk. Gos. Univ.

Pavlovsky O.M., Maksinev D.V., Batsevich V.A. 1998
Sravnitelniy analiz sovremennykh metodov v vozrastnoy osseografii. *Vestnik Tambovskogo universiteta*. Ser.: Yestestvenniye i tekhnicheskiye nauki, vol. 3 (2): 159–164.

Prokhorov B.B. 1991
Ekologiya cheloveka: Sotsialno-demograficheskiye aspekty, A.G. Vishnevsky (ed.). Moscow: Nauka.

Purundzhan A.L. 1990
Morfologicheskiye osobennosti naseleniya bolshikh gorodov. In *Urboekologiya*. Moscow: Nauka, pp. 86–92.

Rokhlin D.G. 1936
Rentgenoosteologiya i rentgenoantropologiya. Pt. I: Skelet kisti i distalnogo otdepa predplechya. Moscow, Leningrad: Ogiz-Biomedgiz.

Smirnova N.S., Shagurina T.P. 1981
Metodika antropometricheskikh issledovniy. In *Metodika morfofiziologicheskikh issledovaniy v antropologii*. Moscow: Izd. Mosk. Gos. Univ., pp. 4–43.

Talko-Gryntsevich Y.D. 1902
K antropologii Zabaykalya i Mongolii. *Russkiy antropologicheskiy zhurnal*, No. 2: 34–67.

Tsolmon C. 1994
Sostoyaniye zdorovya shkolnikov ryada regionov Mongolii s uchetom faktorov, yego opredelyayushchikh: Cand. Sc. (Medicine) Dissertation. Moscow.

Tumen D. 1992
Antropologiya sovremennogo naseleniya Mongolii: D. Sc. (Biology) Dissertation. Moscow.

Uranchimeg S. 2011
Vliyaniye sotsialno-ekomonicheskikh faktorov na rost i razvitiye detey i podrostkov Ulan-Batora. *Obshchestvo. Sreda. Razvitiye (Terra Humana)*, No. 3: 69–75.

Vlček E. 1965
A contribution to the anthropology of the Khalkha-Mongols. In *Acta facultatis rerum naturalium Universitatis Comeniane. Anthropologia*, vol. IX, fasc. VI/VII. Bratislava: pp. 285–367.

Zolotareva I.M. 1990
Nekotoriye itogi antropologicheskogo issledovaniya sovremennogo naseleniya MNR. In *Arkheologicheskiye, etnograficheskiye i antropologicheskiye issledovniya Mongolii*. Novosibirsk: Nauka, pp. 173–184.

Received July 18, 2016.

Always Moving Forward: On the Seventy-Fifth Birthday of A.P. Derevianko

Anatoly Derevianko was born on January 9, 1943, in the village of Kozmo-Demyanovka in the Amur Region. His parents played a major role in the formation of his character. Simple workers, they raised him to be industrious, strive for knowledge, and love his Motherland. The childhood of Anatoly was during the Second World War and the post-War years. At the age of nine, he started to work at a construction site to help his parents. Already at the age of eleven, he became a foreman; at the same time, he was a good school student and liked to read.

After graduating high school in 1959, Anatoly entered the Blagoveshchensk Pedagogical Institute. He already started publishing his first novels in a district newspaper, and wanted to become a journalist. At the same time, Anatoly was fascinated by the allure of the search. While still a school student, he had a chance to work in a geological field party; thus, he happily joined an archaeological expedition headed by the outstanding scholar Alexey Okladnikov. The year 1961 became decisive in the life of young Derevianko: he became fascinated with archaeology, to which he would dedicate his entire life.

In 1963, Anatoly Derevianko received an external degree with honors from the Pedagogical Institute, and entered the Doctoral Program under the supervision of Alexey Okladnikov. During the program, saturated with months of expeditions to various parts of Siberia, the young archaeologist received an invaluable experience as a field researcher.

Already at this early stage of his scholarly career, Anatoly Derevianko manifested his marked abilities. He conducted independent excavations at the Neolithic settlement of Novopetrovka in the Amur region, and identified a previously unknown Neolithic culture, using the materials of his excavations. In 1965, ahead of time, Anatoly Derevianko defended his dissertation, *Ancient Cultures of the Middle Amur (The Stone Age)*. That study clearly revealed his skills to accumulate representative sources and innovatively conduct their interpretation. In 1970, his first monograph, *The Novopetrovka Blade Culture on the Middle Amur* was published, which in 1972 was awarded the prestigious Lenin Komsomol Prize.

An energetic and talented young scholar entered the Institute of History, Philology, and Philosophy of the Siberian Branch of the Academy of Sciences of the USSR.

Working in the Institute, in just five years, he went from Junior Researcher to Deputy Director for Science. This was the time when the center for academic humanities in Siberia was organized under the leadership of Alexey Okladnikov, and the time of large-scale archaeological research in the Asian part of Russia—the time of "filling the blanks" on its map.

At that period of his life, Anatoly Derevianko studied the sites of various periods and cultures in the Amur region, which was the contact zone between the north and south of the Far Eastern region. In 1971, he brilliantly defended his post-doctoral dissertation, *Amur Basin in Ancient Times (Before the Beginning of Our Era)*. His monographs, *Early Iron Age in the Amur Basin* and *The Amur Basin (First Millennium BC)* became

the results of his analysis of enormous material on the Russian Far East.

By the age of thirty, Anatoly Derevianko was already a well-known archaeologist, Deputy Director of the Institute, Professor at the Novosibirsk State University, author of numerous scholarly works, including nine monographs. In 1974, Anatoly Derevianko was elected the Chairman of the Council of Young Scientists at the Central Committee of the Komsomol, in 1976 the Secretary of the Central Committee of the Komsomol, and later the Secretary of the Novosibirsk Regional Communist Party Committee. This was a completely new field of work, in which he acquired the knowledge and skills of a manager on the national scale.

In 1979, Anatoly Derevianko became a corresponding member of the Academy of Sciences of the USSR, the youngest among the scholars in humanities, and returned to Novosibirsk Akademgorodok. He was first appointed the Rector of the Novosibirsk State University, and after the demise of Academician Alexey Okladnikov in 1983, the Director of the Institute of History, Philology, and Philosophy of the Siberian Branch of the Academy of Sciences of the USSR.

A new stage in the activities of Anatoly Derevianko was associated with one of Russia's largest academic centers for research in humanities. In this period, the institute increased its scholarly capacities; the priority areas of research were established and successfully developed. As before, Derevianko spent much time in archaeological surveys and excavations in various regions of Siberia, Far East, and Mongolia. His expeditions went thousands of miles on difficult routes through vast expanses of North and Central Asia. Anatoly Derevianko discovered hundreds of unique archaeological sites; many of them were studied through excavations. In the late 1980s, fundamental research started in the Altai: in Denisova Cave and in multilayered Paleolithic sites in the vicinity of the cave, discovered by the expedition of Anatoly Derevianko. Outstanding achievements of those years were duly noted by the scholarly community, and in 1987 Anatoly Derevianko was elected a full member of the Academy of Sciences of the USSR.

In the 1990s, when Russian science was subjected to serious challenges, Anatoly Derevianko showed himself as originator of bold ideas, as well as sagacious, talented, and strong-willed leader. On his initiative, the United Institute of History, Philology, and Philosophy was divided into four thematic institutes with the appropriate human resources and already established scientific schools. In this way, the Institute of Archaeology and Ethnography became an independent organization in the system of the SB RAS. Essentially, Anatoly Derevianko established a new institute with modern infrastructure. In addition to basic scholarly departments, the institute included a museum and restoration department, publishing and printing center, transportation department, as well as research and educational department with joint laboratories in several large Siberian universities, which clearly demonstrated the effectiveness of integrating academic and university science. During these years, the institute established and strengthened wide scholarly contacts with foreign colleagues, conducted international conferences, implemented joint international projects, and arranged exhibitions outside of Russia.

Employees of the institute have been carrying out a large-scale project of creating the largest in Russia archaeological research complex in the Altai—"Denisova Cave". The project involves long-term interdisciplinary studies of the most informative Paleolithic complexes of Siberia—primarily, Denisova Cave and Karama, the earliest Paleolithic site in North Asia.

An important task of Anatoly Derevianko was to establish the first in Russia "Geochronology of the Cenozoic Era" Center for Collective Use, at the premises of the institute. The center includes several well-equipped laboratories, where research is conducted in the field of paleogeography, paleoclimatology, chronostratigraphy, anthropology, paleontology, and other related scientific disciplines. A paleogenetic laboratory was created jointly with the Institute of Cytology and Genetics of the SB RAS. The Institute of Archaeology and Ethnography is active in the field of rescue archaeology. Large-scale research has been conducted in the reservoir of the Boguchany Dam, in the areas of oil and gas development in the north of Western Siberia, and in the zone of construction of a modern transport infrastructure in the Crimea.

Anatoly Derevianko invested much energy in creation of the museum complex of the institute. The Transfiguration Church, which was brought from the town of Zashiversk on the Indigirka River in Yakutia, was reconstructed through his will and perseverance. Today, the church embellishes the architectural museum under the open sky, which also exhibits a part of the Kazym fortress with watchtowers, and over a hundred stone sculptures from the Bronze Age to the Old Turkic period; an original pavilion with the reconstructed funeral complex in a burial mound of the Pazyryk culture was also recently created. The Museum of History and Culture of the Peoples of Siberia and the Far East, which is part of the structure of the institute, houses unique exhibits from various periods and cultures from the Paleolithic to the ethnographic modernity.

Anatoly Derevianko is the initiator and Editor-in-Chief of the Journal *Archaeology, Ethnology and Anthropology of Eurasia*, published in Russian and English languages. Currently, the Journal has the highest rating in its field among the specialized academic periodicals in Russia; its English version is indexed in the Web of Science.

Many times Anatoly Derevianko showed himself as a generator of creative ideas. He was one of the authors of

the Russian Foundation for the Humanities. The support of the foundation gave an opportunity for Russian scholars in the humanities to implement many field research and publishing projects. Anatoly Derevianko came forward with the initiative to publish the multivolume collection of the monuments of folklore of the peoples of Siberia and the Far East. For the first ten volumes, the team of editors headed by Anatoly Derevianko was awarded the State Prize of the Russian Federation in 2002.

In recent years, the main efforts of Anatoly Derevianko have been focused on the development of large-scale field research in the territory of Eurasia, from the Adriatic and the Caspian to the Far East and Southeast Asia. Dozens of scientific discoveries, which rightfully represent the outstanding achievements of Russian and international archaeology, have been made under his leadership. They have significantly changed the knowledge on the time and routes of the initial human populating of Central, North, and East Asia, as well as the development of the earliest historical processes in these territories.

A landmark event in the scholarly life was the discovery of the remains of a previously unknown fossil hominin, who subsequently received the name of the Denisovan, in Denisova Cave in the Altai, where Anatoly Derevianko has been leading the excavations for almost thirty years. According to the journal *Science*, this discovery was among the ten most important scientific discoveries in the world in 2010–2012.

In 2012, for outstanding research in the earliest history of mankind, Academician Anatoly Derevianko was awarded the State Prize of the Russian Federation. In 2014, together with the paleogeneticist, Professor Svante Pääbo, Anatoly Derevianko was awarded the highest award of the Russian Academy of Sciences—the Lomonosov Grand Gold Medal.

The invaluable experience of the organizer of science has been accumulated by Anatoly Derevianko as the Academician-Secretary of the Department of History and Philology of the Russian Academy of Sciences, which he held from 2002 to 2013. During this period, he was also a member of the Presidium of the Russian Academy of Sciences, and for over thirty years, a member of the Presidium of the SB RAS and the Chairman of the Joint Scientific Council of the Humanities of the SB RAS. While holding these positions, Anatoly Derevianko successfully directed his institute and spent much time in expeditions.

Academician Anatoly Derevianko brilliantly used his rich experience of the organizer of science during the reform of the Russian Academy of Sciences. Having become the Scientific Director of the institute, Anatoly Derevianko has managed to find the optimal solutions to organizational problems, in particular, to successfully rejuvenate the institute management.

The next upturn in his creative activity happened in this period. Anatoly Derevianko wrote first two volumes of the fundamental study on the earliest history of mankind. With his participation, the Lower Paleolithic sites in Vietnam have been discovered. Anatoly Derevianko pays much attention to expanding the collaboration of the RAS and the Federal Agency for Scientific Organizations, aimed at improving the organization of science in Russia. Under his supervision, several major international symposia on the problems of the Paleolithic and development of modern humans have been conducted, and also the All-Russian archaeological congresses.

Anatoly Derevianko has reached his next anniversary celebration with brilliant creative results. Suffice it to say that he is the author and co-author of over 1200 scholarly works, including over 100 monographs. Anatoly Derevianko is the founder and creative driving force of a scholarly school, which is well-known in the world—over sixty doctoral and post-doctoral dissertations have been defended under his supervision.

Anatoly Derevianko is a foreign member of the Academy of Sciences of Mongolia, Montenegro, and Kazakhstan, corresponding member of the German Archaeological Institute, honorary professor of several foreign and Russian universities, and a member of several major international commissions.

Anatoly Derevianko has been twice awarded the State Prize of the Russian Federation in the field of science and technology (2002, 2012); he is the holder of the highest award of the Russian Academy of Sciences—the Lomonosov Grand Gold Medal (2014), the Demidov Prize (2004), the M.A. Lavrentiev Prize (2005), and the Triumph Prize (2005). He was awarded the Order of the Red Banner of Labor (1982), Order of Honor (1998), Order IV Class "For Merit to the Fatherland" (2002), Order of Friendship (2012), and many medals. In 2017, he was awarded the title of the "Honorary Citizen of the Novosibirsk Region".

Anatoly Derevianko is an ardent researcher, organizer, and generator of ambitious projects. He is a brilliant example of a selfless worker, who devoted his life to learning about the history of mankind. We wish him health, inspiration, and new creative victories.

V.I. Molodin and M.V. Shunkov

AN SSSR – USSR Academy of Sciences

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

IA RAN – Institute of Archaeology, Russian Academy of Sciences (Moscow)

IAE SO RAN – Institute of Archaeology and Ethnography, Siberian Branch of the Russian Academy of Sciences (Novosibirsk)

IEA RAN – Institute of Ethnography and Anthropology, Russian Academy of Sciences (Moscow)

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

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

MAE RAN – Peter the Great Museum of Anthropology and Ethnography (the Kunstkamera), Russian Academy of Sciences (St. Petersburg)

MarNII – Mari Scientific Research Institute (Yoshkar-Ola)

MIA – Materials and Investigations on Archaeology in the USSR

MNEPU – International Independent University of Environmental and Political Sciences (Moscow)

MSFOu – Mémoires de la Société Finno-Ougrienne

ONTI PNT RAN – Scientific and Technical Information Division, Pushchino Scientific Center, Russian Academy of Sciences (Pushchino)

TIE – Transactions of the Institute of Ethnography

TOKM – Slovtsov Tyumen Regional Museum (Tyumen)

UrO RAN – Ural Branch of the Russian Academy of Sciences

VINITI – All-Soviet Institute for Scientific and Technical Information (Moscow)

VSEGEI – A.P. Karpinsky Russian Geological Research Institute (St. Petersburg)

YaNAO – Yamal-Nenets Autonomous Okrug

Abdykanova A.K., Associate Professor, American University of Central Asia, Aaly Tokombaev 7/6, Bishkek, 720060, Kyrgyz Republic. E-mail: abdykanova@gmail.com

Agafonov L.I., Laboratory Head, Institute of Plant and Animal Ecology, Ural Branch, Russian Academy of Sciences, 8 Marta 202, Yekaterinburg, 620144, Russia. E-mail: lagafonov@ipae.uran.ru

Alisher kyzy S., Graduate Student, Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia. E-mail: saltanat.alisher.kyzy@gmail.com

Batsevich V.A., Leading Researcher, Lomonosov Moscow State University Research Institute and Museum of Anthropology, Mokhovaya 11, Moscow, 125009, Russia. E-mail: vbatsevich@rambler.ru

Baulo A.V., Leading Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: bau194@yandex.ru

Chang Seok Oh, PhD candidate, Institute of Forensic Science, Seoul National University College of Medicine, 103 Daehak-ro (Yongon-dong), Jongno-gu, Seoul, 03080, Republic of Korea. E-mail: oxman@snu.ac.kr

Chikisheva T.A., Department Head, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: chikisheva@ngs.ru

Dashkovsky P.K., Department Chair, Laboratory Head, Altai State University, pr. Lenina 61, Barnaul, 656049, Russia. E-mail: dashkovskiy@fpn.asu.ru

Deryugin V.A., Associate Professor, Far Eastern Federal University, Sukhanova 8, Vladivostok, 690091, Russia. E-mail: tsukuba01@mail.ru

Dong Hoon Shin, Professor, Institute of Forensic Science, Seoul National University College of Medicine, 103 Daehak-ro (Yongon-dong), Jongno-gu, Seoul, 03080, Republic of Korea. E-mail: cuteminjae@gmail.com

Doronicheva E.V., Researcher, ANO "Laboratory of Prehistory", 14-ya liniya 3, St. Petersburg, 199034, Russia. E-mail: edoronicheva@hotmail.ru

Ermolenko L.N., Professor, Kemerovo State University, Krasnaya 6, Kemerovo, 650043, Russia. E-mail: lyubov.ermolenko@mail.ru

Fedorchenko A.Y., Junior Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: winteralex2008@gmail.com

In Uk Kang, Professor, Kyung Hee University, 26 Kyungheedae-ro, Dongdaemun-gu, Seoul, 02447, Republic of Korea. E-mail: kanginuk@khu.ac.kr

Ivanova M.G., Professor, Deputy Director, Udmurt Institute of History, Language and Literature, Ural Branch, Russian Academy of Sciences, Lomonosova 4, Izhevsk, 426004, Russia. E-mail: margrig45@mail.ru

Jong Ha Hong, Graduate Student, Institute of Forensic Science, Seoul National University College of Medicine, 103 Daehak-ro (Yongon-dong), Jongno-gu, Seoul, 03080, Republic of Korea. E-mail: archaev@gmail.com

Jun Bum Park, Professor, Sangmyung University Seoul Industry Academic Cooperation Foundation, 20 Hongimun 2-Gil, Jongno-Gu, Seoul, 03016, Republic of Korea. E-mail: amimuseo@nate.com

Kalmykov A.A., Chief Specialist, State Unitary Enterprise "Naslediye", Pr. K. Marksa 56, Stavropol, 355006, Russia. E-mail: kalmykov_a_a@mail.ru

Khokhlova O.S., Leading Researcher, Institute of Physicochemical and Biological Problems in Soil Science, Russian Academy of Sciences, Institutskaya 2, Pushchino, 142290, Russia. E-mail: olga_004@rambler.ru

Kolobova K.A., Leading Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia; Leading Researcher, Altai State University, Lenina 61, Barnaul, 656049, Russia. E-mail: kolobovak@yandex.ru

Korenevskiy S.N., Leading Researcher, Institute of Archaeology, Russian Academy of Sciences, Ulyanova 19, Moscow, 117036, Russia. E-mail: skorenevskiy@yandex.ru

Krajcarz M.T., Associate Professor, Institute of Geological Sciences, Polish Academy of Sciences, Twarda 51/55, Warsaw, 00-818, Poland. E-mail: mkrajcarz@twarda.pan.pl

Krivoshapkin A.I., Professor, Deputy Scientific Director, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia; Department Chair, Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia. E-mail: shapkin@archaeology.nsc.ru

Krivoshapkin A.L., Professor, Department Chair, Novosibirsk State Medical University, Krasny pr. 52, Novosibirsk, 630091, Russia. E-mail: alkr01@yandex.ru

Kulkova M.A., Associate Professor, Herzen State Pedagogical University of Russia, nab. r. Moyki 48, St. Petersburg, 191186, Russia. E-mail: kulkova@mail.ru

Kuptsova L.V., Laboratory Head, Orenburg State Pedagogical University, Sovetskaya 19, Orenburg, 460014, Russia. E-mail: orelin.84@mail.ru

Kurmankulov Zh.K., Chief Researcher, A.K. Margulan Institute of Archaeology, Committee of Science of the Ministry of Education and Science of the Republic of Kazakhstan, pr. Dostyk 44, Almaty, 050010, Kazakhstan. E-mail: kurmankulov@gmail.com

Larina N.S., Professor, Tyumen State University, Volodarskogo 6, Tyumen, 625003, Russia. E-mail: nslarina@yandex.ru

Matveeva N.P., Professor, Laboratory Head, Institute of Social Science and Humanities, Tyumen State University, Volodarskogo 6, Tyumen, 625003, Russia. E-mail: nataliamatveeva1703@yandex.ru

Mogritskaya V.Y., Senior Researcher, I.S. Shemanovsky Yamal-Nenets District Museum and Exhibition Complex, Chubynina 38, Salekhard, 629008, Russia. E-mail: marginalkadenna@inbox.ru

Morgunova N.L., Professor, Chief Researcher, Orenburg State Pedagogical University, Sovetskaya 19, Orenburg, 460014, Russia. E-mail: nina-morgunova@yandex.ru

Muriy A.A., Junior Researcher, Sergeev Institute of Environmental Geoscience, Russian Academy of Sciences, Ulansky per. 13, bldg. 2, P.O. Box 145, Moscow, 101000, Russia. E-mail: amuriy@gmail.com

Nedomolkin A.G., Researcher, National Museum of the Republic of Adygea, Sovetskaya 229, Maykop, 385000, Russia. E-mail: nedomolkinandrei@mail.ru

Nosevich E.S., Doctoral Student, Saint Petersburg State University, Universitetskaya nab. 5, St. Petersburg, 199034, Russia. E-mail: katenosevich@mail.ru

Pavlov A.D., Junior Researcher, Institute of Chemistry, Far Eastern Branch, Russian Academy of Sciences, pr. 100-letiya Vladivostoka 159, Vladivostok, 690022, Russia. E-mail: yalyonya@gmail.com

Pozdnyakov D.V., Senior Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: dimolka@gmail.com

Prudnikova T.N., Senior Researcher, Ubsunur International Center for Biosphere Research, Internatsionalnaya 117a, Kyzyl, 667007, Russia. E-mail: tprudnikova@inbox.ru

Romanenko M.E., Graduate Student, Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia. E-mail: maxsim.romanenko194@mail.ru

Salugina N.P., Associate Professor, Samara State Institute of Culture, Frunze 167, Samara, 443010, Russia. E-mail: nsalug@gmail.com

Sapelko T.V., Senior Researcher, Institute of Limnology, Russian Academy of Sciences, Sevastyanova 9, St. Petersburg, 196105, Russia. E-mail: tsapelko@mail.ru

Shalapinin A.A., Researcher, Samara State University of Social Sciences and Education, Maksima Gorkogo 65/67, Samara, 443099, Russia. E-mail: anton-shalapinin@ro.ru

Shnaider S.V., Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: sveta.shnayder@gmail.com

Soloviev A.I., Leading Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: easolovievy@mail.ru

Stepanova N.F., Senior Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: nstepanova10@mail.ru

Sukhova A.V., Senior Researcher, Lomonosov Moscow State University Research Institute and Museum of Anthropology, Mokhovaya 11, Moscow, 125009, Russia. E-mail: alla-sukhova@bk.ru

Sukhoverkhov S.V., Laboratory Head, Institute of Chemistry, Far Eastern Branch, Russian Academy of Sciences, pr. 100-letiya Vladivostoka 159, Vladivostok, 690022, Russia. E-mail: svs28@ich.dvo.ru

Taylor W., Researcher, Max Planck Institute for the Science of Human History, Kahlaische St. 10, Jena, 07745, Germany. E-mail: taylor@shh.mpg.de

Ujiie Yoshihiro, Professor, Hirosaki University, Bunkyo-cho 3, Hirosaki, Aomori, 036-8561, Japan. E-mail: ujiie@hirosaki-u.ac.jp

Volkov P.V., Leading Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia; Leading Researcher, Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia. E-mail: volkov100@yandex.ru

Yakimov A.S., Leading Researcher, Earth Cryosphere Institute, Tyumen Scientific Center, Siberian Branch, Russian Academy of Sciences, Malygina 86, Tyumen, 625026, Russia; Associate Professor, Tyumen State University, Volodarskogo 6, Tyumen, 625003, Russia. E-mail: yakimov_artem@mail.ru

Yasina O.V., Junior Researcher, Lomonosov Moscow State University Research Institute and Museum of Anthropology, Mokhovaya 11, Moscow, 125009, Russia. E-mail: okyasina@yandex.ru

Zhurbin I.V., Laboratory Head, Physico-Technical Institute, Ural Branch, Russian Academy of Sciences, Kirova 132, Izhevsk, 426000, Russia. E-mail: zhurbin@udm.ru