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On the Occasion of the Tercentenary of Daniel Gottlieb Messerschmidt's Expedition to the Khakass-Minusinsk Basin and the First Scholarly Excavations of Archaeological Sites in Siberia

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Institute of Archaeology and Ethnography
Pr. Akademika Lavrentieva 17,
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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.Y. Pankeyeva
E. Winslow

English texts revised by
L. Baranova
P. Magnussen

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

Findings from the Paleolithic Studies in Siberia

It was long believed that Siberia with its harsh environment and climate had been peopled by humans rather late, and that the culture of early Siberian hominins was primitive. Wide-ranging discoveries of the last 3–4 decades, carried out by archaeologists of Siberia, especially those from the Institute of Archaeology and Ethnography SB RAS in Novosibirsk, with the participation of experts in other disciplines such as geology, geochronology, paleontology, paleobotany, genetics, etc., indicate very early dates of the initial peopling of Siberia and a new taxon, H. s. altaiensis, which is associated with one of the most interesting cultures in Eurasia and, along with the earliest anatomically modern African humans, H. s. neanderthaliensis, and H. s. orientalensis, had participated in the origins of anatomically modern H. s. sapiens.

Keywords: *Siberia, Paleolithic, human evolution, H. heidelbergensis, Denisovans, lithic industry.*

Introduction

300 years have passed since the first academic expedition led by Daniel Gottlieb Messerschmidt in Siberia and his first scientific excavations of archaeological sites in Khakassia (Messerschmidt, 2020). In October 2022 in Abakan and in November of the same year in Novosibirsk (Arkheologicheskiye kultury Sibiri…, 2022), international conferences dedicated to this event were held. Apparently, D.G. Messerschmidt's expedition started not only Siberian, but also Russian archaeology, although Russian explorers showed interest in antiquities even earlier, as they covered great distances in an extremely short time and reached the Pacific coast (Okladnikov, 1961: 15–16). "Early Siberian 'chroniclers' and royal envoys to Mongolia and China, as well as the first foreign travelers" often wrote about antiquities (Kyzlasov, 1962: 43).

Three academic editions of "The History of Siberia" cover former achievements in the studies of the historical and cultural heritage of the peoples inhabiting the vast expanses of Siberia, stretching from the Urals to the Pacific Ocean and from the Arctic Ocean to the border with China, Mongolia, and Kazakhstan. The first edition was prepared by an outstanding scientist, "the father of Siberian history", Academician G.F. Miller, a member of the second Kamchatka expedition (1733–1743). During the expedition, he collected a tremendous in volume and unique in significance information on archaeology, ethnology, history, and languages of the peoples of Siberia. G.F. Miller's "The History of Siberia" was published in Russian and German in the course of several years. The initial five chapters in Russian were published in 1750, and the subsequent chapters 6–8 were printed in 1764 and republished in 1787 (Miller, 1787). This manuscript by Miller, containing 23 chapters, was not published in full during his life. "The History of Siberia" by Miller was published in two volumes in 1937 and 1941; and in three volumes in 1999, 2000, and 2005. Unfortunately, none of these editions are complete. The richest material

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collected by Miller is deposited in Russian archives and is waiting to be studied.

The second academic edition of "The History of Siberia" was prepared by the team of scholars from the Institute of History, Philology and Philosophy of the Siberian Branch of the USSR Academy of Sciences, and published in five volumes in 1968–1969. Two editors-in-chief of the five-volume "The History of Siberia", A.P. Okladnikov and V.I. Shunkov, were awarded the State Prize of the USSR in 1973. The first volume of this publication was devoted to the results of archaeological research in Siberia.

The first two volumes of the third academic (four-volume) edition of "The History of Siberia", published in 2019 and 2022, provide generalizations based on the richest archaeological material of a wide time range—from the initial peopling of this area and to the early settlement of Slavic peoples, primarily Russians, in Siberia, taking into account the former and especially recent findings of field research conducted over the past 40 years. Notably, the results of archaeological research conducted in Siberia are included in the 20-volume "Archaeology of the USSR", as well as in the 6-volume series "The Paleolithic of the World".

The history of the Paleolithic studies is well presented in the first volumes of the two recent academic editions of "The History of Siberia", as well as in two books by V.E. Larichev (1969, 1972), and in monographs by other scholars addressing the results of studying the distant past of Siberian regions. The main goal of this paper is to show, in brief form, the history of development of centers for the Siberian Paleolithic studies, the significance and role of the discovered local Paleolithic sites, providing insights into the issues of origin of the genus *Homo* and development of anatomically modern humans, and their importance for world science.

Results of Paleolithic research in Siberia

The first archaeological excavations in Siberia were carried out in the 18th century, but the study of the Paleolithic of the region began only in the late 19th century. Such a late awakening of attention to the ancient past of man is explained by the fact that Paleolithic studies originated in France as late as ca 200 years ago. Furthermore, for a long time, the idea that the history of mankind was rather short was popular not only in general public, but also among scientists. In this regard, it is very important to note that at the early stage of Paleolithic research in the world, the first Paleolithic site in Russia was discovered in Siberia, the excavations of which provided new information on the ancient history of man on the planet.

In the autumn of 1871, in Irkutsk, during digging the foundation pit for the construction of a military hospital on the high bank of the Ushakovka River, at its confluence with the Angara, the workers found an unusual ball with a carved surface, rings, and other items made, as was later established, from mammoth tusk. Bones of extinct Pleistocene animals and stone tools were also discovered at the work site. Luckily, the finds were examined and their value was immediately identified by I.D. Chersky and A.L. Chekanovsky—scientists with broad scientific interests. According to the conclusion of geologist Chersky, the finds belonged to the post-Pliocene (as the Pleistocene period was called at that time), and the artifacts were manufactured by ancient humans with the help of the stone tools discovered at the same site.

In the 19th century, the study of prehistory in Europe has just begun. Scientists of the world fiercely debated whether ancient stone tools should be recognized as the results of human activity; and the evolutionary theory of Charles Darwin was hotly discussed. In Irkutsk, for the first time, stone tools were discovered in association with the bones of long-extinct animals. A few years later, the famous Russian zoologist I.S. Polyakov revealed the famous archaeological site in the village of Kostenki on the Don; the site became a kind of training school for Paleolithic researchers. In 1879, K.S. Merezhkovsky began his studies of the Mousterian sites in the Crimea, and unearthed a Neanderthal burial in Kiik-Koba Cave.

The site of Voenny Hospital in Irkutsk was the first Paleolithic site (discovered in Russia) that contained archaeological materials suggesting the occupation of Siberia by humans already in the remote past. In addition, it is one of the first sites in the world that yielded pieces of art made by humans in a clear stratigraphic context, in association with ancient stone tools and bones of Pleistocene animals. Thus, this site provided one of the world's earliest evidence that our distant ancestors—mammoth and rhinoceros hunters—had great cognitive abilities and symbolic thinking.

The discovery of the Paleolithic site in Irkutsk inspired another remarkable scholar, I.T. Savenkov, to search for other similar objects in Siberia. After graduating from St. Petersburg University, he worked in Krasnoyarsk. Being a person of versatile interests, a theater-lover, a good chess player, Savenkov is also known for a special thing—he studied several Paleolithic localities and more recent sites in Krasnoyarsk. His name is associated with the discovery of a prehistoric site on Mount Afontova, on the Yenisey bank, in 1884; the site is still being studied today*.

*Subsequently, several sites were found on Afontova Gora (Astakhov, 1999).

Part of the collection from this site was exhibited at the International Anthropological Congress held in Moscow in 1892. At this congress, Savenkov made a report that was of interest to a French archaeologist J. de Baye. In 1893, 1896–1897, J. de Baye visited the sites on the Yenisey and reported about his trips to the French Academy of Sciences and the Paris Geographical Society. So, the Siberian Paleolithic became known in Europe.

In the late 19th century, another unique archaeological site was found in Siberia. In spring of 1896, in Tomsk, in a ravine on the high bank of the Tom River, an accumulation of bones was exposed, which attracted attention of professor of the Tomsk University N.F. Kashchenko. He carried out a thorough cleaning of the finds, perfect for that time, which made it possible to identify numerous mammoth bones over a small area (Kashchenko, 1901). It should be noted that Kashchenko carried out excavations exemplary not only for the late 19th century, but also for the present time. Many years later, M.V. Shunkov, while analyzing the collection of 1896, discovered a flask with charcoal pieces from the hearth. Kashchenko could not assume that many decades later, the radiocarbon method would be invented for determining the age, but he considered it necessary to preserve everything discovered during the excavations. This is a good example for modern archaeologists. It should be understood that excavations are the destruction of the cultural layer of any archaeological object, and only the careful recording of every find in the journal, in drawings and plans, using photo- and video-recording, will make it possible to reconstruct the site as accurately as possible and to derive the most complete information in future. The radiocarbon date of 18,300 ± 1000 BP was generated on the charcoal from the Kashchenko's collection; at that time, the hunters apparently killed the mammoth, butchered the carcass, and occupied this place for some time.

In the late 19th to the first half of the 20th century, search and study of archaeological sites (including Paleolithic) in various regions of Siberia and the Russian Far East were carried out by scientific teams from local universities and museums, academic centers of Moscow and Leningrad, and by members of the Russian Geographical Society. As a result, new Paleolithic sites appeared on the archaeological map of North Asia, indicating that Siberia, which was considered unsuitable for habitation of ancient people for a long time, was settled by hominins as early as in the Pleistocene. As it is hardly possible to recount all the discoveries, I consider it necessary to name only some of the researchers who contributed to the study of the Paleolithic in the east of our country: A.V. Eliseev and Hungarian scholar F. Forkas in the Far East; A.P. Mostits, Y.D. Talko-Gryntsevich, A.K. Kuznetsov, P.S. Mikhno, G.P. Sosnovsky, and G.P. Romanovsky in Transbaikalia; N.K. Auerbach, V.I. Gromov, A.Y. Tugarinov, Austrian archaeologist G.K. Mergart, S.M. Sergeev, M.D. Kopylov, A.P. Markov and others in Siberia.

Noteworthy is the role played by Prof. B.E. Petri, not only in the study of the Stone Age, but also in the creation of the scientific school. He graduated from St. Petersburg University, where he was one of the students of Academician V.V. Radlov; after graduation, he trained at the Peter the Great Museum of Anthropology and Ethnography; starting from 1912, he carried out archaeological and ethnographic research in the Baikal region (Petri, 1914), became a professor at the Irkutsk University founded in 1918, and established the Department of Prehistoric Culture and an ethnology club therein. In the vicinity of Irkutsk, Petri and his students explored Stone Age sites of Verkholenskaya Gora, Pereselenchesky Punkt at Kaiskaya Gora, at the Ushkanka valley, and other sites (Petri, 1923, 1928). Petri made a great contribution to the study of the Stone Age of Siberia; but even more significant were his efforts in the promotion of historical and cultural heritage of the peoples of the Baikal region and the creation of the ethnology club. This club was attended by A.P. Okladnikov, M.M. Gerasimov, G.F. Debets, G.P. Sosnovsky, G.F. Ksenofontov and others; they took part in field archaeological and ethnographic research, mastered the methodology of excavations, and made their first scientific reports at the club's meetings. Subsequently, many of the members of the club became outstanding scientists and founded their scientific schools.

In this regard, the findings made by Gerasimov and Okladnikov during their works in 1920s–1930s are particularly noteworthy. In February 1928, the Irkutsk Museum of Local Lore received a message that in the village of Malta on the Belaya River, a tributary of the Angara, local residents found a great number of animal fossils. In the course of small-scale excavations, a young employee of the local museum M.M. Gerasimov found a unique accumulation of mammoth and reindeer bones and stone tools. The scholar carried out excavations of this site in 1929–1934 and 1956–1957.

Malta is one of the outstanding Paleolithic sites both in Russia and in Eurasia. It is located on a 16–20-meter terrace of the Belaya River (Gerasimov, 1931, 1935, 1958). This site, as other Late Paleolithic localities, yielded a great number of stone tools. The cores were dominated by prismatic, cuboid, edge-faceted, and conical varieties. Primary reduction was targeted at laminar blanks production. These blanks were used for the manufacture of various types of end-scrapers, points, borers, cutting tools with straight or asymmetrically located working edge, straight dihedral, side, angle, and many-faceted burins, chisel-like tools, and combination tools. The bone tools included points made of mammoth

tusk with cut marks at the ends, needles, awls of various shapes and sizes, polishers, etc. The excavations revealed a large number of animal bones: mammoth, reindeer, woolly rhinoceros, bison, horse, arctic fox, wolverine, wolf, and fox. In general, the stone and bone tools, as well as faunal remains, at the Malta site are typical of many other Late Paleolithic sites in Eurasia; however, the Malta assemblage is characterized by a number of unique features. First, the remains of semi-underground dwellings of rounded and quadrangular shape were identified at the site. During construction, the foundations of the dwellings were lined with limestone slabs and vertically set tusks, mammoth skulls, and other large animal bones, primarily mammoth, rhinoceros, and bison. The roof made of reindeer antlers was covered with skins of wild animals. In addition to semi-underground ones, the Malta people also arranged above-ground dwellings. There are quite few Upper Paleolithic sites in the world with such well-marked remains of dwelling structures as at the Malta site. Second, the site yielded a large number of various personal ornaments, images of animals, birds, and female figurines (Gerasimov, 1935; Abramova, 1962, 1966, 1989; Kamenny vek…, 2001: Vol. 1; Istorya Sibiri, 2022: Vol. 1; and others). Malta contains the most numerous collection of pieces of art among all Paleolithic sites of the world. The researchers found here more than two dozen female figurines made from mammoth tusk and reindeer antlers. As compared to the European samples, Malta figurines are graceful, they have a modeled face, and some possibly show a hairstyle. Certain figurines are covered with ornaments, which, according to the researchers, render fur clothes. Of great artistic value are images of birds, a plate made of mammoth tusk with an engraved figure of a mammoth, and a plaque with a stylized drawing of a snake and a spiral pit pattern on the reverse side of the plate. Diverse personal ornaments were found: bracelets, diadems, pendants, beads, and patterned plaques. Third, under the floor of one of the dwellings at the settlement, in an elongated oval pit enclosed with stone slabs at the northern and eastern sides, a paired burial of children about one year old and three or four years old was found. The deceased were oriented with their heads to the northeast, thickly sprinkled with red bloodstone powder, and covered with a slab, on top of which a mammoth tooth was placed. The skulls and postcranial parts of the skeletons were poorly preserved, which made it impossible to reconstruct the morphological features of the buried (Alekseev, Gokhman, 1987; Gokhman, Zubov, 2003).

A series of radiocarbon dates was derived from the Malta materials. In the course of the studies in the 1990s, several stratigraphic levels were identified at the site (Maltinskoye Paleoliticheskoye mestonakhozhdeniye…, 1996; Kamenny vek…, 2001: Vol. 1). The bulk of the finds was attributed to 25–20 ka BP (Istorya Sibiri, 2022: Vol. 1, p. 133). The comprehensive studies of Malta have shown that the material and spiritual culture of the Upper Paleolithic Siberian populations was not lower than that of the populations of other regions in Africa and Eurasia. No other Paleolithic site of that period yielded artifacts similar to those found at Malta—great amount of various personal ornaments, female sculptures, and other items testifying to the cognitive abilities and symbolic thinking of the inhabitants of the site.

Malta is not the only site in the Baikal region with culture-bearing strata indicating a high level of the material and spiritual culture. In 1936, close to Malta, near the village of Nizhnyaya Buret in the Angara valley, Okladnikov discovered a site with remains of dwellings of various designs, stone tools similar to the Malta artifacts, and bone figurines covered with ornaments (1940, 1941a, b; 1960). The discovery of another site with the technical and typological features of stone tools close to those from Malta and with pieces of art made it possible to identify the Malta-Buret culture in the Baikal region, and gave hope that other sites related to this culture will be discovered in Siberia in the future.

In the second half of the 20th century, the studies of Siberian archaeological sites were carried out with the active participation of many well-known scientists from the academic centers of Moscow and Leningrad, as well as a great number of graduates of Siberian universities and pedagogical institutes. At that time, a lot of Paleolithic sites were discovered and explored, and many relevant papers were published*.

A particularly great contribution to the study of the Paleolithic of Siberia was made by well-known archaeologists from the Paleolithic Department of the Leningrad Branch of the Institute of Archaeology of the USSR Academy of Sciences (since 1992, the Institute for the History of Material Culture of the Russian Academy of Sciences): Z.A. Abramova, S.N. Astakhov, S.A. Vasiliev, and N.F. Lisitsyn. Of great importance for the study of the historical and cultural heritage of Siberia were large-scale rescue archaeological surveys carried out under the projects of construction of the Irkutsk, Bratsk, and Boguchany hydroelectric power stations on the Angara River, and Krasnoyarsk and Sayano-Shushenskoye hydroelectric power stations on the Yenisey River in the areas of future flooding of reservoirs. During these works, a significant number of archaeological sites associated with various chronological periods, including the Paleolithic, were examined. Unfortunately, owing to the limited funds on rescue operations and the lack of time to complete the entire scope of research, some of the most important and

*For the most complete list of publications on the Paleolithic of Siberia, see (Istoriya Sibiri, 2022: Vol. 1).

valuable archaeological sites remained unexcavated and were submerged in water.

Z.A. Abramova researched the Yenisey Paleolithic for many years and identified the Afontovo and Kokorevo cultures (1979a, b; 1984; etc.). N.F. Lisitsyn excavated several sites on the Yenisey (1997, 2000; etc.). S.N. Astakhov and S.A. Vasiliev studied open-air Paleolithic sites and stratified complexes in Tuva (Astakhov, 1986, 2008; etc; Vasiliev, 1996; etc.).

Academician A.P. Okladnikov made an outstanding contribution to the Paleolithic studies of Siberia and Asia in general. He started his work in the field archaeological expeditions of the B.E. Petri's club, and as early as in 1926, being an 18-year-old young man, he found Stone Age sites and published his first scientific article (Okladnikov, 1926). During his life, Alexey Okladnikov discovered and studied hundreds of Paleolithic sites in Siberia, Mongolia, Uzbekistan, Turkmenistan, Kyrgyzstan, and other regions.

In the second half of the 20th century, due to the efforts of A.P. Okladnikov and M.M. Gerasimov, small centers for Paleolithic studies were established in the Siberian cities of Irkutsk, Krasnoyarsk, and Ulan-Ude. The Irkutsk school proved to be the most successful. Two researchers of the Irkutsk Museum of Local Lore, M.P. Aksenov and G.I. Medvedev, graduates of the Irkutsk University, participated in the Malta excavations in 1956–1957 headed by Gerasimov. The continuity is traced from Petri to Gerasimov, and from him to these young specialists in the Paleolithic studies. Aksenov and Medvedev explored dozens of Paleolithic sites in the Baikal region; they also brought up a galaxy of talented specialists at the Irkutsk University. Graduates of the Irkutsk University conducted large-scale research in various regions of Siberia: L.V. Lbova and V.I. Tashak in Transbaikalia, N.I. Drozdov on the Yenisey, M.V. Shunkov and K.K. Pavlenok in the Altai.

A great contribution to the study of the Paleolithic of Eastern Siberia was made by the Irkutsk archaeologists E.A. Lipnina, A.I. Generalov, P.E. Shmygun, E.O. Rogovskoy, A.V. Volokitin, and others. In the Angara River basin, the archaeologists discovered more than ten Early Paleolithic sites with pebble-and-flake industry. A large number of Upper Paleolithic sites have been found and studied in the Angara and Lena regions (Stratigrafiya…, 1990; Paleolit Yeniseya, 1991; Kamenny vek…, 2001: Vol. 1, 2; Aksenov, 2009; and others).

At the Krasnoyarsk Pedagogical University, N.I. Drozdov trained such talented archaeologists as E.V. Artemiev, E.V. Akimova, V.M. Kharevich, and others. Over the last 30 years, they have been involved in the study of many sites, especially in the Kurtak archaeological district (Kurtakskiy arkheologicheskiy rayon…, 1990; Drozdov, Chekha, Haesaerts, 2005; Arkheologiya…, 2007; and others). Good results were achieved by L.V. Lbova and V.I. Tashak during the study of Upper Paleolithic sites in Western Transbaikalia (Lbova, 2000; Prirodnaya sreda i chelovek v Neopleistotsene…, 2003; Tashak, 2016; and others). In Eastern Transbaikalia, Prof. I.I. Kirillov, a student of A.P. Okladnikov, established his scientific school (Kirillov, 1979; Okladnikov, Kirillov, 1980; etc.). After the death of I.I. Kirillov, one of his talented disciples, M.V. Konstantinov, together with his students, graduates of the Chita Pedagogical University, made a great contribution to the study of the Late Paleolithic of Transbaikalia (Konstantinov, 1994; etc.).

In the Altai, in the late 20th to early 21st century, Y.F. Kiryushin and his students A.L. Kungurov, V.N. Semibratov, K.Y. Kiryushin explored Upper Paleolithic sites. In Yakutia, effective studies of the Paleolithic of Siberia were carried out under the supervision of Academician of the Academy of Sciences of the Republic of Sakha (Yakutia) Prof. A.N. Alekseev by the Yakut State University (since 2009, North-Eastern Federal University), and under the supervision of Y.A. Mochanov and S.A. Fedoseeva by employees of the Institute for Humanities Research of the Siberian Branch of the Russian Academy of Sciences (Mochanov, 1992; Mochanov, Fedoseeva, 2013).

By the end of the 20th century, many Paleolithic sites were found in Siberia. A number of new cultures were identified: in the Altai—the Early Paleolithic Karama, Middle Paleolithic Denisova and Early Upper Paleolithic Kara-Bom, Karakol, and Srostki; in the Kuznetsk basin—the Bedarevo; on the Yenisey—the Afontova and Kokorevo; in the Cis-Baikal—the Malta, Upper Lena, Badai, Makarovo; in Transbaikalia—the Tolbaga, Tangin, Kunalei, Studenoye, Oshurkovo; in Yakutia—the Dyuktai and Yana; in Kamchatka—the Ushki, in the Far East—the Selemdzha, and Ustinovka archaeological cultures.

The researchers of Siberia repeatedly made generalizations of the accumulated evidence and determined the place of the Siberian Paleolithic in the Eurasian Stone Age. Petri was, perhaps, the first scientist who made an attempt to develop a periodization of the Stone Age in Eastern Siberia and to designate its place in the Paleolithic of Europe (1923, 1928). According to Petri, the Siberian Paleolithic was a part of the European Stone Age, but retained its originality: Paleolithic sites of Cis-Baikal, along with fairly developed types of tools, often contained archaic implements. Until recently, this Petri's conclusion was cited by researchers of this region in their papers; they noted the pebble nature of the industries, the considerable proportion of choppers and chopping tools, classified the Upper Paleolithic as the post-Mousterian, etc. Austrian archaeologist G.K. Mergart (1923), on the basis of materials from the Yenisey sites, identified the lithic industry with archaic stone tools, and the industry with tools similar

to European Late Paleolithic artifacts. He considered the earliest sites of the Afontova Gora type, with spearheads and bone tools, to be chronologically close to the European Aurignacian, and attributed the later sites, such as the Verkholenskaya Gora in the Angara region, to the Siberian facies of the Upper Paleolithic. From the point of view of Mergart, the Siberian Paleolithic was largely formed under the influence of the European culture.

N.K. Auerbach and G.P. Sosnovsky (1932) identified a special Siberian facies of the Upper Paleolithic. The scientists explained its originality, manifested in the use of some archaic types of stone tools along with chopping tools and other implements typical of the Early Paleolithic of Europe, by the features of raw materials, the hominins' need in such a tool set for their subsistence strategy, and, to some extent, by the backwardness of the culture of Siberian populations, which was due to their remoteness and isolation from the more developed European habitation centers. S.N. Zamyatnin (1951), considering the possibility of identifying local variants in the Paleolithic, attributed the Siberian Paleolithic to the vast Siberian-Chinese province.

The peculiar Malta-Buret culture attracted attention of many scholars. Indeed, owing to a considerable number of pieces of art, various personal ornaments, dwellings, and other features of spiritual and material culture, the sites of this culture stay apart in the Siberian Paleolithic and show certain parallels with the European Paleolithic; although, no sites with a similar industry have been found to date over the vast region separating the European sites from the Angara ones. Researchers have no common opinion about the origin of the Malta-Buret culture. In the 1930s, M.M. Gerasimov (1931, 1935), P.P. Efimenko (1938), A.P. Okladnikov (1940, 1941a, b), S.N. Bibikov (1959), and others associated the origin of the Malta-Buret culture with the European Paleolithic and considered it the Siberian parallel to the Aurignacian, Aurignacian-Solutrean, and Late Solutrean. Later, while comparing the Central Asian Mousterian and Siberian Upper Paleolithic sites, Okladnikov admitted that these cultures, including the Malta-Buret, had a common origin (1968a), and did not exclude genetic links of the Malta and Buret populations with the carriers of the Aurignacian cultures of Europe (1968b).

G.P. Sosnovsky (1934) and M.G. Levin (1950, 1951) adhered to the hypothesis of the autochthonous origin of the Malta-Buret culture, but substantiated it in different ways. Sosnovsky rightly noted that the Malta site contained many stone tools similar to those from the Upper Paleolithic Siberian sites. In addition, the scholar believed that some Malta figurines of women and birds showed significant stylistic differences from European pieces of art. Levin explained the parallels in the Malta-Buret and European assemblages by the close Late Pleistocene environmental conditions in Siberia and Europe and similar economic structure of Upper Paleolithic communities of hunters, which suggested the convergent development of many features of material and spiritual culture in Siberia and Europe.

On the basis of materials excavated from the sites in various parts of North Asia, archaeologists identified local cultures and their possible correlations with each other. For example, Z.A. Abramova, taking into account the variability of Paleolithic industries, suggested to use a concept of "cultural area" to combine and separate cultures (1975). She combined the Transbaikalian, Yenisey, and Altai Paleolithic sites into the South Siberian cultural area, some sites of Western Siberia, the North Minusinsk basin and the Angara basin into the Central Siberian area, and the sites of the northeastern part of Siberia into the Northeastern area. Other viewpoints on the classification, combination, and separation of the Paleolithic sites of North Asia were also proposed.

All the theoretical generalizations on the Siberian Paleolithic proposed before the beginning of the 21st century, were formed under the dominance of the idea that in the second half of the Middle to the Early Upper Pleistocene, Eurasia and partly Africa was inhabited by the Neanderthals. In Europe, the Middle Paleolithic was identified, while in Africa the Middle Stone Age, showing certain distinctions. The Middle Paleolithic was often identified with the Mousterian industry of the Neanderthals. All researchers of the Siberian Paleolithic, including myself, attributed the sites of the first half of the Upper Pleistocene to the Mousterian, implying that the Neanderthals settled in this territory too.

A new stage in the Paleolithic studies in Siberia began in the late 20th to early 21st century, and it was largely associated with the research made by the Institute of Archaeology and Ethnography of the Siberian Branch of the Russian Academy of Sciences. This period was marked by large-scale works of archaeologists from Chita and Ulan-Ude in Transbaikalia, the Irkutsk team in Cis-Baikal, researchers from Krasnoyarsk on the Yenisey, the Altai University team in the Altai. Particularly successful were the studies carried out by the research teams of the IAET SB RAS in the Altai. Over 20 cave and open-air sites have been excavated here since 1983.

One of the main tasks of archaeologists studying sites in any region is to solve the issue of the initial peopling of this area. Volume 1 of the second academic edition of "The History of Siberia" (Istoriya Sibiri s drevneishikh…, 1968) did not provide any clear solutions of that problem. The Ust-Kan cave site excavated in 1954 by S.I. Rudenko was the only site that could undoubtedly be attributed to the Late Mousterian.

With regard to the issue of initial peopling, it is necessary to briefly consider the hypothesis of

Y.A. Mochanov on the non-tropical origin for humanity. Mochanov excavated the site of Diring-Yuriakh and estimated its age in the range of 3.2–1.8 Ma BP. Based on this date, he argued that along with Africa, there was another center of human origin—Yakutia (Mochanov, 1992; Mochanov, Fedoseeva, 2013). This is an absolutely unscientific hypothesis. All scientists involved in the studies of human evolution (anthropologists, archaeologists, and geneticists) believe that the ancestral home of the genus *Homo* is Africa. About 6–7 Ma BP, the ancestral line of man in the order of primates was divided into two branches—the higher great apes and australopithecines. Subsequently, the evolutionary development of australopithecines, which settled only in Africa, proceeded along the sapient lineage. Among australopithecines, there were groups that became ancestral to the genus *Homo*; the earliest representatives emerged ca 2.8 Ma BP. Studies of anthropological remains have shown that in the Late Pliocene to Early Pleistocene, three species of the genus *Homo* existed in Africa: *H. rudolfensis, H. ergaster/erectus*, and *H. habilis*. About 1.8 (1.7) Ma BP, *H. ergaster/erectus* left Africa and started settling in Eurasia. In the course of a long and complex evolution, the polytypic species *H. erectus* served as the basis for the development of modern humans, *H. s. sapiens* (Derevianko, 2012, 2017, 2019).

If there was a second center of human origin in Yakutia, there should have been an independent *H. sapiens* lineage in the order of primates that inhabited this territory several million years ago and became the ancestral basis for the Yakutian representative of the genus *Homo*. There is no evidence for this assumption. The possibility of such an evolutionary development is excluded; otherwise, an absolutely different genetic species of anatomically modern humans should have evolved in Yakutia on a different ancestral basis. This should have led to the dispersal of two different human species on the planet—one from Africa, the other from Yakutia. According to the laws of biology, animals of two different species could meet, interbreed, but their offspring would be non-fertile. Thus, the hypothesis proposed by Mochanov as to the non-tropical origin for humanity is not confirmed by any anthropological and reliable archaeological data, and it contradicts the laws of evolution. However, the Mochanov's discovery of Diring-Yuriakh, dated to 267 ± 24 and 366 ± 12 ka BP (Waters, Forman, Pierson, 1997, 1999) (given these dates are real), should be recognized important: this finding shows that humans could have inhabited such remote northern areas at such an early time.

Data of great importance for the study of the Siberian Paleolithic were derived during the study of the Karama site, located in the northwestern Altai, 14 km from Denisova Cave upstream the Anui River (Derevianko, Shunkov, 2005). Three excavation trenches were established at the site at a height of 41, 51, and 57 m above the river level. In trench 2, a stratigraphic sequence 11 m thick was established, and 13 lithological horizons were identified, of which four (7, 8, 11, and 12) bore a pebble-and-flake lithic industry. Correlation of the derived paleogeographic data with geomorphological and lithological-stratigraphic materials suggests that the unit of deposits containing two lower cultural horizons was formed in a warm period corresponding to oxygen-isotope stage 19 (800–760 ka BP). The gray-colored loams overlying the unit were accumulated during a cooling period during isotope stage 18 (760–715 ka BP). The main part of the overlying red-colored stratum with two upper cultural horizons was formed during the warm period corresponding to isotope stage 17 (715–660 ka BP), while its top was formed during the epoch of relative cooling corresponding to stage 16 of the oxygen-isotope scale (660–600 ka BP) (Istoriya Sibiri, 2022: Vol. 1). Thus, the Early Paleolithic layers (7, 8, 11, and 12) belong to the range of 800–600 ka BP, and the upper culture-bearing layer in trench 1 with the Early Middle Paleolithic (Denisova) industry to ca 300 ka BP. The artifacts from the Early Paleolithic layers reflect a long chronological sequence; however, in terms of technical and typological features they form a single technical and technological complex—the Karama lithic industry, associated with *H. erectus*.

The discovery of the Early Paleolithic Karama site, with a clear stratigraphic sequence, in the Altai provides an undoubtedly great insight to a number of fundamental issues. The site is located at 52° N latitude. The materials obtained at the site suggest that *H. erectus*, by the time of their arrival to the Altai, already had great cognitive capabilities and adaptive abilities, which allowed them to settle far in the north of Eurasia. This became possible due to the advanced lithic industry of the Karama people. Comparative analysis of the Karama lithic industry with those of the Early Paleolithic sites of China revealed significant differences between them. Hence, populations of *H. erectus* might have migrated to the Altai from the western regions through the territory of Central Asia. In Mongolia and Kazakhstan, there are many Early Paleolithic sites with pebble-and-flake industry, but all of them show surface occurrence of archaeological materials and do not provide geochronological evidence, which makes it impossible to infer about the time of the initial dispersal of *H. erectus* in Central Asia. The discovery of Karama, whose lowermost cultural layer dates back to ca 800 ka BP, suggests that the earliest occupation of Central Asia by *H. erectus* migrating eastwards from Africa occurred ca 1 Ma BP or a little later.

The Karama lithic industry, demonstrating a sequence of developmental stages, is the basis for another important conclusion. Many researchers refer to the Early Paleolithic

industries in Eurasia as Oldowan or Olduvai, because stone tools were found in association with representatives of the first taxon of the genus *Homo* named *H. habilis* in the Olduvai Gorge. But in my viewpoint, it is incorrect to designate the Early Paleolithic industry in Eurasia as Oldowan (Derevianko, 2016). Most scholars believe that *H. habilis* never left Africa, and that Eurasia was occupied by another taxon, *H. ergaster/erectus*. A paradoxical situation has arisen in the Early Paleolithic studies: the Early Paleolithic industry widespread in Eurasia is named Oldowan, although it belonged to *H. habilis*, which never left Africa.

H. erectus settled in Eurasia, including the Altai (Karama), in areas with different environmental and climatic conditions, landscapes, flora and fauna, stone resources, in small groups and quite isolated from each other. The Early Paleolithic industries discovered Eurasia are rather different and variable, though all of them are based on pebble and flakes. In a generalized sense, it is more reasonable to designate them as pebble-and-flake industries, or Mode 1, as earlier, with a specification of the locality where they were found. For example, in China, two Early Paleolithic industrial complexes are clearly distinguished: Nihewan with a small-sized lithic industry in the north, and Longgupo with large stone tools in the south. The Early Paleolithic industry in Eurasia also shows specific technical and typological features, such as the Dmanisi in Georgia, the Le Vallonet and Atapuerca in Western Europe, the Karama in Siberia, and others.

The research in the Denisova Cave is of particular importance for the study of the Paleolithic of the Final Middle to the first half of the Upper Pleistocene in Africa and Eurasia. The first test pit in Denisova Cave was made by N.D. Ovodov in 1978 at the instruction of A.P. Okladnikov. Since 1983, stationary excavations have been carried out in the cave, as well as at other Paleolithic sites in the Altai. As noted above, the initial occupation of the Altai by *H. erectus* took place ca 800 ka BP. Approximately after 600 (500) ka BP, this territory was uninhabited by humans: no Early Paleolithic sites dating to 600–300 ka BP have yet been found in the Altai.

The second wave of hominin dispersal in the Altai and other regions of Southern Siberia took place ca 300 ka BP. Lowermost cultural layer 22 in Denisova Cave dates back to 287 ± 41 ka BP. A unique stratigraphic sequence was revealed in the cave (Prirodnaya sreda i chelovek v Paleolite…, 2003). The cave deposits, starting from lowermost layers 22.2 and 22.1 up the profile till top layer 9, contain rich and technically and typologically diverse stone implements, which give the possibility to trace the evolution of the industry from the Early Middle to the advanced Upper Paleolithic (Derevianko, Shunkov, 2005; Derevianko, 2022; etc.). On the basis of the materials from Denisova Cave, five main stages in the development of the industry were identified: the early stage of the Middle Paleolithic (300–150 ka BP), the middle stage of the Middle Paleolithic (150–120 (100) ka BP), the terminal stage of the Middle Paleolithic (120 (100)–60 ka BP), transitional stage from the Middle to Upper Paleolithic (60–55 (50) ka BP), and initial (early) stage of the Upper Paleolithic (55 (50)–40 ka BP). The material and spiritual culture of *H. s. altaiensis*, possessing the ability of symbolic thinking, was one of the most ancient and brightest in the initial (early) Upper Paleolithic, as compared to the culture of hominins that settled at that time in Africa and Eurasia. Suffice it to say that it was only in the Altai that so many bone items (11 eyed needles alone), various personal ornaments (diadems made of mammoth tusk, a fragment of a stone bracelet), and other pieces art dating back to 50–40 ka BP were found; among them is the oldest carved bone figurine of a feline animal (Prirodnaya sreda i chelovek v Paleolite…, 2003; Derevianko, Shunkov, Kozlikin, 2020; Derevianko, 2022).

In layer 11.2 in the East Chamber of Denisova Cave, in association with the Upper Paleolithic industry dating back to 63 ± 6 to 55 ± 6 ka BP (Jacobs et al., 2019; Douka et al., 2019), a phalanx of the hominin's little finger was found; the DNA sequencing showed that it belonged to a girl aged 7–9 years of a previously unknown taxon, which genetically differed from both modern humans and Neanderthals (Reich et al., 2010). This taxon was tentatively named after the place of discovery—Denisovan (*H. denisovan*).

Anthropological remains of the Denisovans were recorded in lowermost cultural layer 22.1 of the Main Chamber, at the boundary between layers 12.1 and 11.4, in layer 11.2 of the East Chamber, and in layer 11 of the South Chamber. Genetic material of the Denisovans was extracted from the deposits of layer 15 in the East Chamber. There is every reason to believe that the Denisovans inhabited the cave from the time of its initial occupation ca 300 ka BP (layer 22) and up to 40 ka BP (the upper part of layer 11 of the South Chamber). The observed homogeneity of lithic industries from all cultural layers of the cave can be considered as a reliable evidence of the Denisovan habitation in the cave in this time range.

The discovery of the new taxon became a worldwide sensation. In recent years, dozens of papers presenting the results of archaeological, genetic, anthropological, and genomic studies, as well as the study of origin, material and spiritual culture of the Denisovans, have been published in leading scientific journals. These data made it possible to trace the evolution of the Denisovans, determine their role in the formation of anatomically modern humans, and identify continuity in the development of their bright and distinctive industry

over 250 thousand years (Prirodnaya sreda i chelovek v Paleolite…, 2003; Derevianko, 2012, 2019, 2022; Derevianko, Shunkov, Kozlikin, 2020; and others).

The origin of Denisovans

The evolutionary development of the ancestral form of *H. erectus* in Africa 1.8–0.8 Ma BP led to the appearance of a new taxon, which is known among anthropologists under two names—*H. rhodesiensis* and *H. heidelbergensis*. These human groups belonged to the same biological species both morphologically and genetically, but their subsequent evolutionary histories were different. *Homo rhodesiensis* remained in Africa; their ancestral basis gave rise to the development of anatomically modern humans (*H. s. africaniensis*) 200–150 ka BP. *Homo heidelbergensis* with the Acheulean industry migrated to Eurasia (the site of Gesher Benot Ya'aqov in Israel) ca 800 ka BP. This migration was associated with the first (initial) stage in the formation of three taxa: anatomically modern humans in Africa, Neanderthals and Denisovans in Eurasia. This is confirmed by genetic data: the division of the common ancestral taxon into *H. sapiens*, on the one hand, and *H. s. neanderthalensis* and *H. s. altaiensis*, on the other hand, occurred ca 800 ka BP (Meyer et al., 2012). Part of *H. heidelbergensis* population with the Acheulean industry moved to Europe 700 (600) ka BP, where their assimilation by late *H. erectus* (*H. antecessor*), through intermediate forms of Mauer, Montmorin, Steinheim, Arago 21, Sima de los Huesos, Petralona, and others, led to the formation of classic Neanderthals with the Mousterian industry 200–150 ka BP (Derevianko, 2019).

Homo heidelbergensis in the Middle East 800–100 ka BP was also involved in the important evolutionary processes. The further development of *H. heidelbergensis* in this region could have been influenced by their assimilation by the late *H. erectus*—the descendants of the first wave migrants from Africa to Eurasia (the site of Ubeidiya in Israel). Unfortunately, Middle Pleistocene anthropological fossils in the Near East have been found mainly in Israel (Qesem, Zuttiyeh, and Misliya); the bones are characterized by mosaic morphology (signs of *H. sapiens* and *H. s. neanderthalensis*). In the Middle Pleistocene, in the Levant, two taxa were formed: anatomically modern humans (Skhul and Qafzeh) and Palestinian Neanderthals (Tabun, Amud, and Kebara), who demonstrated similar techno-typological complexes of stone tools. Palestinian Neanderthals differed significantly in their morphology from classic Europeans, and their industry was not similar to the Mousterian.

Some representatives of the Heidelberg taxon, which were not yet diverged genetically and morphologically, migrated to East Asia from the Levant 400–350 ka BP. During this migration, the divergence between Denisovans and Neanderthals was completed. According to the results of the nuclear genome study, the complete genetic separation of these taxa occurred ca 430 ka BP (Meyer et al., 2014). The late *H. heidelbergensis* migrated to the east of Asia along two routes. A small part of them ca 400 ka BP began to move southwards, along the coast of the Persian Gulf. In South Asia, the late *H. heidelbergensis* met the indigenous population and were assimilated by it. Most of the late *H. heidelbergensis* with the Acheulean industry followed the northern route, skirting the largest orographic systems of the Tian Shan, Pamir, and Tibet from the north, and settled in the Iranian Plateau and the territories of modern Turkmenistan, Tajikistan, Kyrgyzstan, Uzbekistan, Kazakhstan, and Mongolia in Central Asia.

Occupation of these vast spaces was slow. In those areas where the *H. heidelbergensis* met the indigenous population (first settlers, late *H. erectus*), there could have been assimilation between newcomers and local residents. Both species had an open genetic system; as a result of interbreeding, fertile offspring were born, apparently with distinct *H. erectus* morphological features. Since Central Asia was probably sparsely and unevenly populated by indigenous populations, admixed groups of various regions, which appeared as a result of assimilation, could have had different sets of erectoid features. The process of dispersal of the late *H. heidelbergensis*, which took place in various environmental conditions, was accompanied by assimilation and gene exchange, and led to the formation of a new taxon—the Denisovans, which ca 300 ka BP occupied Denisova Cave. In the Altai, anthropological finds were found only in this cave, although the Denisova industry was recorded at many sites. The level of genetic diversity in Denisovans was higher than in seven Neanderthals from various regions of Western and Central Europe (for which complete mtDNA genetic sequences have been obtained), but lower than in modern humans (Sawyer et al., 2015). This suggests their wide dispersal in Central, East and Southeast Asia (Meyer et al., 2012; Prüfer et al., 2014; Derevianko, 2022).

In the Early Upper Pleistocene, 120–60 ka BP, three early human taxa settled in Africa and Eurasia: anatomically modern humans in Africa (*H. s. africaniensis*), Neanderthals in Europe (*H. s. neanderthalensis*), and Denisovans in Central and North Asia (*H. s. altaiensis*) (Derevianko, 2012; etc.). Representatives of these taxa interbred with each other and produced fertile offspring. This means that the interbreeding occurred not between subspecies, but within one species. If at the final stage of the evolution of genus *Homo* there were three taxa with an open genetic system, then throughout the 2.5 million years long evolution humans also had an open genetic system,

which allowed representatives of taxa to interbreed and produce fertile offspring. All the so-called species identified by anthropologists on the basis of a small number of remains from Early and Middle Paleolithic sites in Africa and Eurasia were subspecies with an open genetic system. According to the genetic data, the genome of modern humans (non-Africans) preserves 1–2 % of the Neanderthal genetic heritage. The genome of modern inhabitants of Australia and Oceania contains up to 3–6 % of the genetic heritage of Denisovans (Reich et al., 2011). Consequently, Neanderthals and Denisovans contributed to the genetics and morphology of anatomically modern humans, with the stem lineage of the early anatomically modern humans, which evolved in Africa 200–150 ka BP and migrated to Eurasia 80–50 ka BP (Derevianko, 2012, 2019, 2022; Derevianko, Shunkov, Kozlikin, 2020).

In East and Southeast Asia, the process of development of hominins toward *H. sapiens* proceeded from the initial settlement of *H. erectus* in these regions around 1.7–1.6 Ma BP. By now, about 10 anthropological fossils, dating from 120 to 60 ka BP, have been found here, associated by scholars with anatomically modern humans. We should agree with the opinion of Chinese researchers that in these parts of Asia there evolved the fourth subspecies of modern humans (*H. s. orientalensis*), which also took part in the formation of anatomically modern humans, *H. s. sapiens* (Derevianko, 2011).

Neanderthals in Siberia

The Altai yielded anthropological remains of not only a new taxon, *H. s. altaiensis*, which took part in the evolution of modern humans, but also those of Neanderthals. The remains of Neanderthals with the Mousterian industry dating to 60–40 (35) ka BP were found in two caves: Okladnikov and Chagyrskaya. Fossils of Neanderthals and their mtDNA extracted from cultural deposits testify to Neanderthal habitation in Denisova Cave. However, the Mousterian industry was not recorded there; probably, the Neanderthals inhabited the cave for a short time and they were females. The time of emergence of Neanderthals in the Altai is still debatable. In layer 15 of East Chamber, dating to 253 ± 14 ka BP, the Denisovan mtDNA was extracted from the sediments and the Denisovan industry was found; overlying layer 14 yielded the Neanderthal mtDNA, dating back to 197 ± 12 to 187 ± ± 14 ka BP (Jacobs et al., 2019), also with the Denisovan industry. The possibility of such an early appearance of Neanderthals, especially with the Denisovan industry, is highly doubtful (Derevianko, 2019). Notably, the classic Neanderthal type in Europe was formed ca 200 ka BP; in Eastern Europe, in the Caucasus, in the Crimea, and throughout the whole transit area up to the Altai, no anthropological remains nor sites with Mousterian industry older than 100 thousand years have been found.

In this regard, the following hypothesis can be considered the most convincing: the Denisovans and Neanderthals had a common ancestral taxon—*H. heidelbergensis*. In the course of migration of *H. heidelbergensis* with the Acheulean industry to Europe 700 ka BP and assimilation processes with the late *H. erectus* (*H. antecessor*), in the process of evolution of the classic Neanderthals (*H. s. neanderthalensis*), the latter retained part of the ancestral genetic heritage. This is evidenced by the Denisovan mtDNA and Neanderthal nuclear DNA extracted from the individual dated to ca 430 ka BP from Sima de los Huesos (Meyers et al., 2014). The tribes of *H. heidelbergensis*, who migrated to the east of Asia much later (400–350 ka BP) and assimilated the late *H. erectus* in Central Asia, which led to the formation of the Denisovans (*H. s. altaiensis*), also retained part of the ancestral genetic heritage, which is evidenced by mtDNA extracted from cultural layer 14 with the Denisovan lithic industry. This means that *H. heidelbergensis* who settled in the Middle East, Europe, Central Asia, and the Altai were a taxon being in the process of divergence into modern humans, Neanderthals, and Denisovans; and they had open genetic systems, interbreeding ability, as well as retained some part of the ancestral genetic heritage.

Neanderthals with the Mousterian industry began to settle in the Altai ca 60 (70) ka BP. This is evidenced by the data from excavations in Okladnikov and Chagyrskaya caves. The techno-typological complex of Neanderthal stone tools differs from that of the Denisovans. The absence of the Mousterian industry in Denisova Cave suggests that Neanderthals have never settled there for a long time. Probably, Neanderthal women got into the cave as wives. Neanderthals could also have visited the cave for a short time, because their dispersal area was adjacent to that of the Denisovans. One more fact is very important: Denisovans and Altai Neanderthals lived side by side; they had common hunting areas. They met and interbred with each other. This is confirmed by the hybrid *Denisova 11*, whose father was a Denisovan and mother was a Neanderthal. At the initial stage of the Upper Paleolithic (50–40 ka BP), the Denisovan lithic industry was strikingly different from that of the Altai Neanderthals not only in technical and typological characteristics of tools, but also in a great number of bone tools, various personal ornaments, and non-utilitarian items. The Neanderthals living in Denisova and Chagyrskaya caves did not have bone tools, personal ornaments and pieces of art. This unique evidence of differences in the mentality of Denisovans and Neanderthals requires further careful study.

Altai Neanderthals lived in the Altai up to 40 (35) ka BP. Their further development is unknown, but it is possible that most of them were assimilated by the Denisovans and anatomically modern humans. With regard to the dispersal of late Neanderthals (with the Mousterian industry and specific material and spiritual culture) in the Altai, despite the fact that for a long time they lived next to the Denisovans and interbred with them, a very important question arises. Prior the 21st century, when only two taxa were known—modern humans in Africa and Neanderthals with a Mousterian industry in Eurasia—all researchers of the Paleolithic in Southwest, North and Central Asia attributed the lithic industries of the terminal Middle to the first half of the Upper Pleistocene to the Mousterian. The industry of this period from various sites, including Denisova Cave, was considered by researchers of the Altai Paleolithic as Mousterian. The discovery in the region of a new taxon with an industry that significantly differed from the Mousterian required a new consideration of this issue (Derevianko, 2016).

Scholars use the term "Middle Stone Age of Africa" to designate the Middle Paleolithic of Africa, since it differs from the European Mousterian. For a long time, some scientists believed that Neanderthals with the Mousterian industry populated northern Africa, in particular the Jebel Irhoud site. At present, taking into account the new significantly older dates for this site (302 ± 32 and 315 ± 34 ka BP), anthropological remains from it are associated with early modern humans (Hublin et al., 2017; Richter et al., 2017). The Aterian, early and late Nubian cultures, spread in the northwest and northeast of Africa, also cannot be identified with the European Mousterian, because these belonged to the early modern humans. Neanderthals never settled in Africa. Neither they, nor the Mousterian were in Southeast and East Asia, too.

So, we should adhere to the opinion, supported by many researchers in Europe, that the Mousterian industry had lots of local variants, but belonged to Neanderthals. Material and spiritual culture of Neanderthals has been studied for a century and a half: in Europe, about 20 variants of industries associated with the Mousterian have been identified. The study of the Denisovans as a new subspecies of anatomically modern humans has just started; in the future, many local variants of their material and spiritual culture will probably be identified. Four taxa of the Late Middle to Early Upper Pleistocene have been identified: anatomically modern humans in Africa (*H. s. africaniensis*), *H. s. neanderthalensis* in Europe, *H. s. altaiensis* in Central and North Asia, *H. s. orientalensis* in East and Southeast Asia: during this period, all these taxa showed variabilities in the industry and mosaic morphology due to significant differences in the environmental conditions and mineral resources for their subsistence in the places of habitation.

Conclusions

Summing up the history of study of the Siberian Paleolithic, it should be noted that a huge amount of work has been carried out despite the large size of the territory, the severity of climatic conditions and the limited time for field research (June–August), as well as a comparatively small number of Paleolithic experts working in universities, local history museums, and research institutes in Siberia. The world's oldest Paleolithic site of Karama, located at 52° N latitude, was discovered in Siberia; this suggests the significant cognitive capabilities of *H. erectus* developed by the time of 800 ka BP, and the adaptive abilities allowing this population to settle so far north. A significant number of Paleolithic sites have been discovered in Siberia; some of them are quite well studied; over a dozen of cultures have been identified. Importantly, field research and laboratory studies involve the use of various methods of natural sciences, which make it possible to derive maximum information from the excavated materials at the present level of development of science. For eight years (2002–2010), employees of 12 research institutes of the SB RAS, under the leadership of those from the Institute of Archaeology and Ethnography, the Institute of Geology and Mineralogy, the Limnological Institute, and the Institute of Geochemistry, have studied the changes in environmental and climatic conditions in Siberia over the past 300 thousand years. The results of these multidisciplinary studies have been published in several dozen papers. Owing to cooperation between the Institute of Archaeology and Ethnography SB RAS and the Max Planck Institute for Evolutionary Anthropology in Leipzig, Nobel Prize winner Professor S. Pääbo and a team of his talented students, it was possible to sequence the DNA of Neanderthals from the Okladnikov and Chagyrskaya caves, and to identify, based on anthropological remains from Denisova Cave, a new taxon, which was originally named *H. denisovan* and is currently known as *H. s. altaiensis*. This taxon, in the course of assimilation of *H. s. neanderthalensis* and *H. s. orientalensis*, with the stem lineage of *H. s. africaniensis*, 60–40 ka BP contributed to the evolution of anatomically modern humans (*H. s. sapiens*)

The techno-typological complex of the Middle to Upper Paleolithic transition and of the Initial (Early) Upper Paleolithic in Denisova Cave, which includes stone and bone items, various ornaments, and pieces of art, is unique. It represents the sophisticated process of formation of the material and spiritual culture of *H. s. altaiensis*, indicating significant cognitive abilities, developed symbolic thinking and modern behavior of this population. In Denisova Cave, in the cultural layers dating to 50–40 ka BP, a lot more non-utilitarian items, personal ornaments in the form of mammoth tusk diadems, fragments of stone bracelets, and products made

from bone and ostrich egg shells were found than at any other contemporaneous site in Africa and Eurasia. In layer 11, dating back to 45–40 ka BP, the world's oldest nine needles with eyes for threading were found; these needles might have been used by the cave dwellers in sewing clothes not only from processed hides of small animals, but also from fabric. Fragments of a bracelet manufactured using such technical operations as drilling, grinding, and polishing were also recovered from this layer. The world's oldest sculpture of a feline animal was also found in Denisova Cave.

I am convinced that in the future new sites relating to the unique Malta-Buret culture will be found in Siberia. V.V. Pitulko from the Institute for the History of Material Culture of the Russian Academy of Sciences has discovered on the Yana River one more Upper Paleolithic site with a large number of bone tools, well preserved in permafrost conditions (Pitulko, Pavlova, 2010).

The study of Paleolithic sites in Siberia showed that this region was rather early occupied by humans. The Karama site is one of the best-studied Early Paleolithic sites in Russia, with a clear and long stratigraphic sequence. Currently, quite few sites with the Denisova and Malta-Buret lithic industries have been found yet, but there is every reason to hope that the new sites relating to these impressive Paleolithic cultures of Eurasia will be discovered. The available results of the Paleolithic studies of Siberia, including the most important achievement—the discovery of a new taxon, *H. s. altaiensis*, which contributed to the evolution of anatomically modern man—*H. sapiens sapiens*, provide a significant insight into the distant past of mankind.

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M.V. Shunkov and M.B. Kozlikin
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: shunkov77@gmail.com; kmb777@yandex.ru

The Earliest Paleolithic Assemblages from Denisova Cave in the Altai

The article presents the results of multidisciplinary studies of the Early Middle Paleolithic assemblages from the lower part of the Denisova Cave Pleistocene sequence in the East Chamber and the Main Chamber of the cave. Data on geochronology, small and large vertebrate fauna, palynology, stratigraphy and micromorphology of sediments containing the earliest archaeological finds at the site, as well as on petrography, traceology and archaeozoology are presented. We describe human fossils and aDNA studies based on them. These materials demonstrate that the first inhabitants of the cave and those associated with the Early Middle Paleolithic traditions were Denisovans. On the basis of the collection, which includes over 35,000 artifacts, the technology and typology of the Denisova industry are reconstructed. We focus on the comparison of the Denisova Early Middle Paleolithic with chronologically closest industries of North and Central Asia. The most similar industry is the Acheulo-Yabrudian of the Near East. Parallels concern primary reduction techniques and tool types. A hypothesis explaining the appearance of Middle Paleolithic traditions in Southern Siberia is proposed. We demonstrate continuity in the evolution of the lithic industries of Denisova up to the autochthonous emergence of the Upper Paleolithic ca 50,000 years ago.

Keywords: *Altai, Denisova Cave, Pleistocene, Early Middle Paleolithic, lithic industry, Denisovans.*

Introduction

Archaic pebble tools from the deposits of the first half of the Middle Pleistocene, which were discovered at the Early Paleolithic stratified Karama site in the valley of the upper Anuy River, testify to the first appearance of prehistoric humans in the Altai and the entirety of North Asia (Derevianko, Shunkov, 2005; Bolikhovskaya, Derevyanko, Shunkov, 2006). The Karama lithic assemblage includes side-scrapers, choppers, tools with spike-like protrusions, and carinated core-shaped end-scrapers made from pebbles of spherulite effusives, as well as denticulate, notched, and beak-shaped tools made from massive pebble fragments. Ulalinka, located in the basin of the lower Katun River, is another Early Paleolithic site of the Middle Pleistocene in the Altai (Okladnikov, 1972; Pospelova, Gnibidenko, Okladnikov, 1980). The quartzite lithic items found at the site included core-shaped pieces with prepared striking platforms and negative scars of subparallel removals, scraper-like tools on flattened pebbles, choppers, chopping tools, and tools with distinctive spike-like protrusions on massive pebbles.

The next stage in the peopling of Southern Siberia began after a long break, probably caused by general deterioration of the natural environment at the end of the first half of the Middle Pleistocene. The stage was

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associated with the carriers of the Middle Paleolithic, who appeared in the Altai ca 300 ka BP and left traces of their presence in the lower cultural layers of Denisova Cave, located 15 km from the Karama site upstream the Anui River (Fig. 1). For a long time, first habitation stages by prehistoric humans in the cave were known only from sparse archaeological finds of the Early Middle Paleolithic discovered in basal deposits in the Main Chamber of the cave (Prirodnaya sreda…, 2003: 114–118). Comprehensive studies in the last decade have significantly expanded the number of sources from the lower part of cave deposits. Over 35,000 lithic items were found during the excavations of lithological layers 15 and 14 in the East Chamber of the cave. These finds have made it possible to reevaluate the technical and typological traditions of the Altai population in the Early Middle Paleolithic. Judging by the anthropology and paleogenetics data, these humans were the Denisovans.

Archaeological, zooarchaeological, and microstratigraphic studies have revealed that the lower layer of sediments in the Main and East chambers emerged in a time of the most active human habitation in the cave. The Denisovans who left the earliest artifacts in the cave knew the physical properties of stone pebbles from the nearby Anui channel. To produce tools, they selected the pieces that were homogeneous in their key characteristics, had a hardness of 5–6.5 on the Mohs scale, and were mainly sedimentary rocks, such as siltstones and sandstones (70 %), less often volcanic aphyric or porphyritic effusive rocks (Kulik, Shunkov, Kozlikin, 2014).

Two species of horse *Equus ovodovi/ferus*, red deer *Cervus elaphus*, roe deer *Capreolus pygargus*, bison *Bison priscus*, gazelle *Gazella gutturosa*, and Siberian ibex *Capra sibirica* were the main prey for the first inhabitants of the cave (Vasiliev, Shunkov, Kozlikin, 2017). The main part of the taphocenosis in layers 15 and 14 of the East Chamber resulted from human hunting activities. Most of the bones were crushed; cuts commonly appeared on bone fragments. As compared to other layers, these deposits contained the largest amount of bone remains with thermal impact traces, as well as numerous charcoal microparticles (Morley et al., 2019). The edges of lithic tools from layer 15 had microremains of animal fat, and traces of cutting and scraping (Bordes et al., 2018).

This article discusses the lithic processing technologies and typology of implements among the inhabitants of Denisova Cave in the Early Middle Paleolithic, as well as the emergence of the Middle Paleolithic traditions in North Asia.

Fig. 1. Location of Denisova Cave.

Geochronology of Pleistocene deposits and paleogeographic stages of their formation

The periods when the lower unit of Pleistocene deposits was accumulated in the Main and East chambers of Denisova Cave were identified using the results of biostratigraphy and OSL-dating (Jacobs et al., 2019). The earliest Paleolithic evidence was found in the upper part of layer 22 in the Main Chamber, with its roof's OSL-age being 287 ± 41 ka BP (Fig. 2). The formation of this part of the section coincided with wide distribution of forests around the cave, in a stable natural environment, with small fluctuations in temperature and humidity within the interglacial climate. The lithological and stratigraphic equivalents of these deposits in the East Chamber were those of layer 17.1, dated from 305 ± 37 to 284 ± 32 ka BP. Spore and pollen spectra from the lower part of layer 17.1 indicate a warm climate, with the widest possible development of forest biotopes, which gave way to relative cooling during the accumulation of its roof (Bolikhovskaya et al., 2017). Dust-like coating of carbonates on the bones, the presence of lemmings among small mammals, and a complete absence of frogs suggest a short-term cooling in this part of the section (Agadjanian, Shunkov, Kozlikin, 2021). The deposits of layer 17.1 contain numerous primary teeth of bears and the highest content of their DNA (Brown et al., 2021), which suggests the active use of the East Chamber by carnivores in this period, while the more spacious and better-illuminated Main Chamber of the cave was already visited by hominins on a periodic basis.

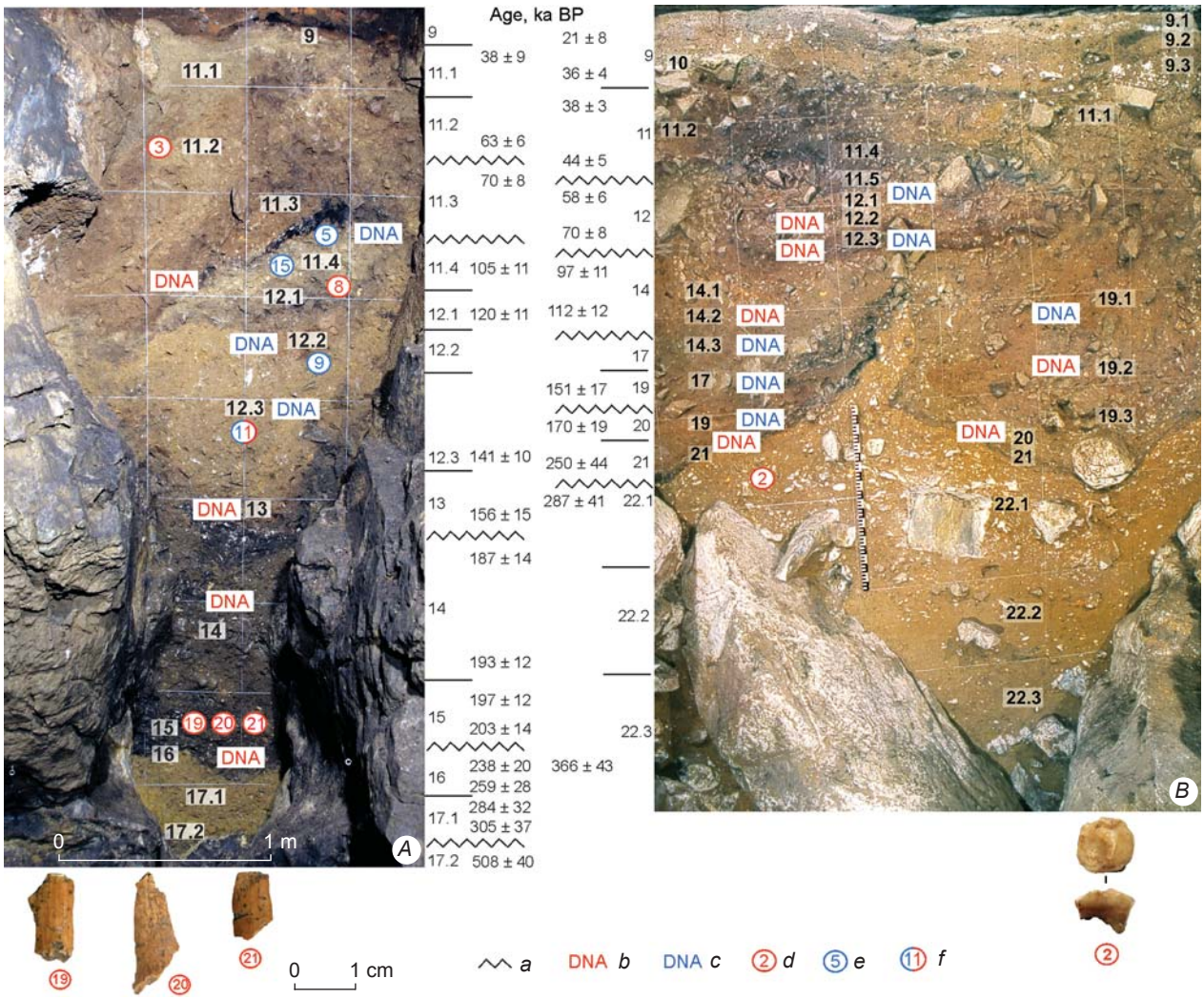

Fig. 2. Pleistocene deposits in the East Chamber (*A*) and Main Chamber (*B*) of Denisova Cave, with an indication of geochronological and paleogenetic evidence, and places of anthropological finds.
a – break in sedimentation; *b* – DNA of the Denisovans from the deposits; *c* – DNA of the Neanderthals from the deposits; *d* – bone remains of the Denisovans; *e* – bone remains of the Neanderthals; *f* – bone remains of a hybrid individual.

The overlying deposits in the Main and East chambers emerged after a long break in the sedimentation process. The sequence of layers 21 and 20 in the Main Chamber was formed in the period of 250 ± 44 to 170 ± 19 ka BP. Relatively cold and moderately humid climate was reconstructed for the accumulation time of layer 21. Deposits of layer 20 correspond to a warm and dry climate showing extensive growth of pine and birch forests, with the presence of broad-leaved species (Prirodnaya sreda …, 2003: 109).

The equivalent of the archaeologically sterile black sooty noncarbonate loams at the base of layer 21 were the deposits of layer 16 in the East Chamber, which showed an age of 259 ± 28 to 238 ± 20 ka BP. Pollen evidence from layer 16 included sporadic pollen grains of dwarf birch, which reflects cold climate. The deposits of the middle and upper parts of layer 21 in the Main Chamber correspond to layer 15 sediments in the East Chamber, dated to 203 ± 14 to 197 ± 12 ka BP. The composition of microtheriofauna from layer 15 suggests a relatively cold natural environment in the beginning of its accumulation. The middle and upper parts of that layer were formed under a more favorable climate, which contributed to expansion of the area of forest vegetation. Molars of water vole *Arvicola* were found in these deposits, with the morphological features that were intermediate between the Middle Pleistocene *A. mosbachensis* and the Late Pleistocene *A. cf. Sapidus*. The formation of layer 20 in the Main Chamber corresponds to the period of sedimentation for layer 14 in

the East Chamber, which was 193 ± 12 to 187 ± 14 ka BP. According to biostratigraphy, the deposits of layer 14 emerged in a climate warmer than today's. Mixed forests with broad-leaved species, including hornbeam associations with addition of oak and linden, dominated around the cave at that time.

Lithological and stratigraphic columns of the lower part of the Pleistocene deposits in the Main and East chambers generally complement each other, and reflect the development of a natural environment during two warm and relatively cold climatic periods in the second half of the Middle Pleistocene, corresponding to oxygen isotope stages 9–7.

Anthropological and paleogenetic evidence

Human bone remains from the lower part of Pleistocene deposits in the Main Chamber of the cave include a left lower deciduous second molar (dm_2) found in layer 22.1. This tooth, which was designated as *Denisova 2*, belonged to a child ca 7–8 (Shpakova, Derevianko, 2000) or 10–12 years of age (Slon, Viola, Renaud et al., 2017) according to current standards. The paleogenetic analysis has revealed that the tooth belonged to a Denisovan (Ibid.). The probable age of *Denisova 2*, modeled by the Bayesian method using chronometric (OSL-dating), stratigraphic, and genetic data, is 194,400–122,700 BP (Douka et al., 2019), while the OSL-age of the upper part of the deposits in layer 22 is 287 ± 41 ka BP (Jacobs et al., 2019).

Three fragments of *Homo* representatives (*Denisova 19*, *20*, and *21*) were identified using collagen fingerprinting among the morphologically unidentifiable bone remains from layer 15 in the East Chamber. From these samples, the Denisovan mtDNA was sequenced (Brown et al., 2022). The identity of the mitochondrial sequences of *Denisova 19* and *21* suggests that they belonged to the same person or to maternal relatives. *Denisova 20* sample differed from them by four mtDNA substitutions. The phylogenetic analysis has shown that *Denisova 19*, *20*, and *21* were approximately of the same age or slightly older than *Denisova 2*.

The fragments of the Denisovan mtDNA were discovered in fifty samples of sediments from layers 21 and 20 in the Main Chamber, and layers 15 and 14 in the East Chamber of the cave (Zavala et al., 2021) (Fig. 2). Two samples from the roof of layer 20 in the Main Chamber contained nucleotide sequences of the mtDNA of the Neanderthals, which can be associated with the base of overlying deposits. Initially, the sample containing Neanderthal mtDNA from the East Chamber was erroneously assigned to layer 14 (Slon, Hopfe, Weiß et al., 2017), although in fact it was taken from layer 11.4 (Zavala et al., 2021). Thus, currently available anthropological and paleogenetic evidence from the lower part of the cave's deposits indicates that the Denisovans were the first inhabitants of the cave, and carriers of the Early Middle Paleolithic.

Archaeological evidence

The earliest lithic artifacts in the cave were discovered in the upper part of layer 22 of the Main Chamber. This small collection includes seven items from stratigraphic unit 22.2 and 312 artifacts from deposits of layer 22.1 (Prirodnaya sreda…, 2003: 114–118). Rare core-like items and flakes testify to parallel, radial, and irregular reduction methods. Artifacts made using Levallois technique have also been found. The most distinctive series of side-scrapers in the toolkit includes backed varieties and tools with stepped retouch of the Quina type. Production waste prevails among the finds from layers 21 (293 spec.) and 20 (908 spec.). Several cores belong to parallel single-platform and radial varieties. Shortened flakes with smooth or irregular dorsal scar pattern and smooth or natural striking platforms dominate among the spalls. Pieces with traces of secondary treatment include side-scrapers, as well as denticulate, notched, and spur-like artifacts.

The highest density of Paleolithic artifacts was observed in layers 14 (26,996 spec.) and 15 (9411 spec.) in the East Chamber. Despite significant differences in quantitative indicators, lithics from these layers were identical in their technical and typological features, and can be identified as a single complex.

Within the industry, tools for stone-knapping include hammerstones (13 spec.) and retouchers (7 spec.). Hammerstones are large, rounded, subrectangular, and angular pebbles ranging from 82 × 53 × 50 to 148 × × 74 × 50 mm in size, with intense microflaking on the protruding ribs and ends. Retouchers of 71 × 55 × 38 to 75 × 67 × 30 mm show traces of slight microflaking on faces or ends.

Core-shaped pieces (0.8 %) include typologically identifiable cores (105 spec.) and core-shaped debris (168 spec.). The most diverse are radial bifacial cores (56 spec.) of rounded, more rarely subrectangular or angular, shapes, corresponding to various stages of reduction: from pebble blanks, with traces of initial trimming, to severely exhausted residual pieces. Core sizes range from 46 × 37 × 27 to 137 × 130 × 56 mm, with 60–100 mm on average. Most of the cores were made on large pebbles (Fig. 3, *13*); some of them were made of large massive flakes (Fig. 3, *9*). Several cores

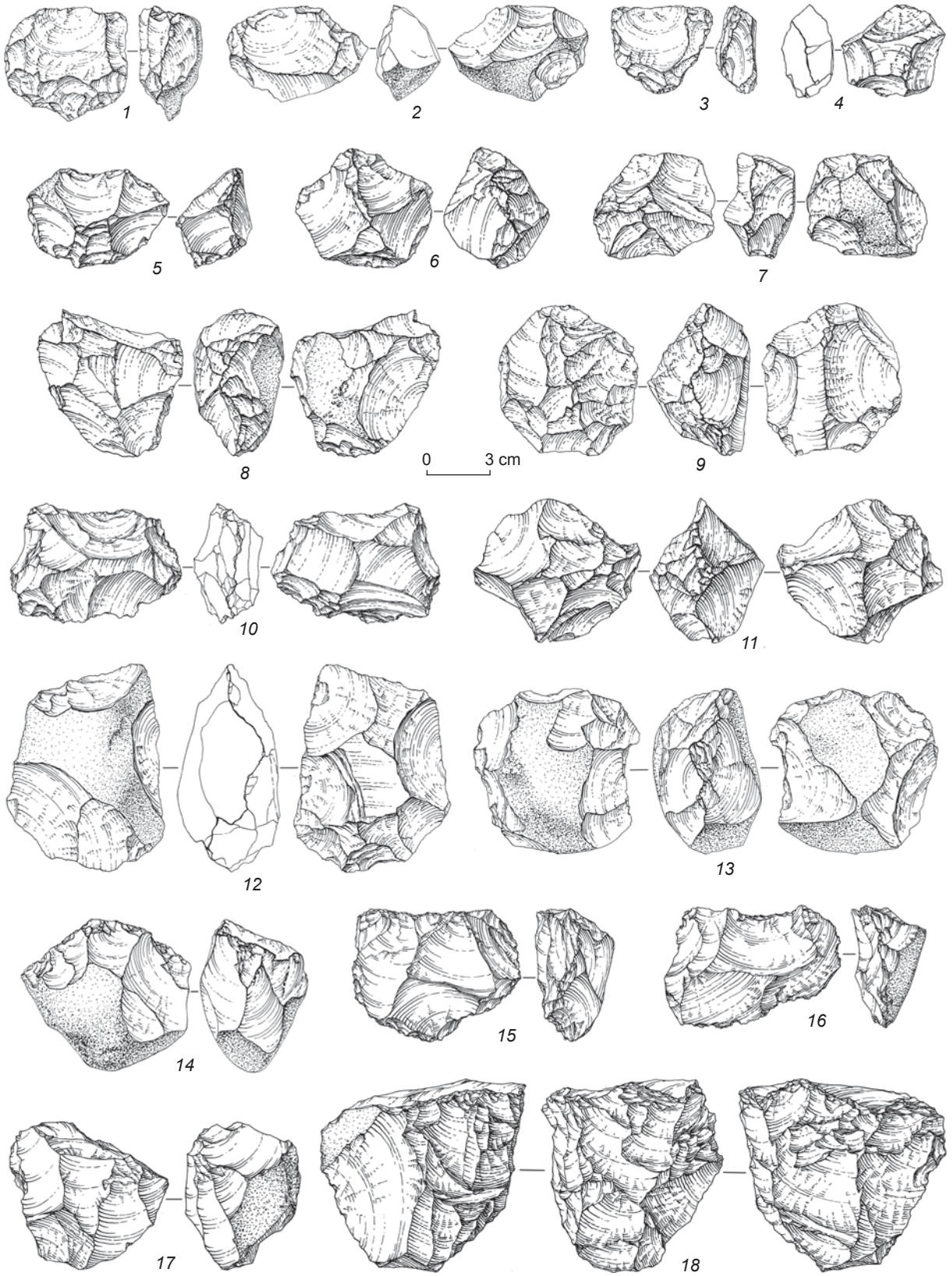

Fig. 3. Cores of the Early Middle Paleolithic from layers 15 and 14 in the East Chamber of Denisova Cave.

do not allow us to establish the type of their blanks, owing to their heavy exhaustion (Fig. 3, *6*, *10*, *11*). Most artifacts show that removals were taken along the entire perimeter of the flaking surface, without preliminary preparation of the edge (Fig. 3, *7*). Radial unifacial cores (28 spec.) are rounded items ranging from 51 × 44 × 24 to 108 × 52 × 25 mm in size, made on large massive flakes or on large pebbles (Fig. 3, *5*, *8*). The flaking surface was most commonly located on the ventral side (Fig. 3, *4*, *12*), and less often on the dorsal side of the blank. Flaking was carried out both from the unprepared edge and from the striking platform fashioned along the perimeter of the core.

Parallel technology is represented mainly by single-platform unifacial cores (15 spec.) of subrectangular shape, made of pebbles (Fig. 3, *14*) or large flakes (Fig. 3, *16*). These items vary in size from 43 × 27 × 19 to 77 × 74 × 66 mm. In most cases, the striking platform was prepared by one large removal, less often by several removals; it could also retain the pebble's surface. In one core, the flaking-arc occupies almost the entire circle of the striking platform (Fig. 3, *18*); in the rest of the cores, flaking-surface is confined to a single face. Double-platform unifacial cores (Fig. 3, *15*, *17*) show negative scars of bidirectional reduction from striking platforms prepared by one or several large removals (3 spec.). They are subrectangular, range in size from 64 × 67 × × 50 to 123 × 73 × 64 mm, and are made of large pebbles.

The utilization of the Levallois reduction method is confirmed by three cores: two were made of flakes, and one was made of pebble (Fig. 3, *1*). These items are processed almost along the entire perimeter of the frontal surface, and show one negative scar of a large removal (Fig. 3, *2*, *3*).

Core-shaped debris (168 spec.) are typically angular stone jointings with single removals or traces of several irregular removals, as well as severely exhausted, typologically unidentifiable cores. Their sizes vary from 37 × 35 × 19 to 132 × 79 × 42 mm.

The spalls (44.4 %) are dominated by flakes (16,850 spec.), including a series of radial core *débordantes* (165 spec.) (Fig. 4, *2*) and Kombewa flakes (179 spec.), both classic forms (Fig. 4, *1*) and lateral removals (Fig. 4, *4*). Complete flakes are medium (1424 spec.) and large (1957 spec.), shortened and short (88 %), or elongated (12 %), with smooth (64.2 %), natural (23.6 %), or unidentifiable (7.5 %) residual striking platform without any traces of overhang reduction. Dorsal scar pattern is mostly longitudinal unidirectional (36.4 %), orthogonal (18.0 %), smooth (13.2 %), or unidentifiable (26.4 %). About a half of the flakes completely (13 %) or partially (35 %) retain pebble surface on their dorsal face. A few blades (81 spec.) show smooth or natural platforms, longitudinal or orthogonal (Fig. 4, *3*) scar pattern; half of them retain a partial or complete pebble-surface. Production waste (52.7 %) includes split pebbles (143 spec.), debris (16,465 spec.), and chips (2575 spec.).

Tools (774 spec., 2.1 %) were mostly made of large short or shortened flakes and fragmented spalls. Most of them were shaped by dorsal marginal or invasive steep subparallel strongly modifying retouch, including stepped Quina-type retouch. Items with thinning are common.

Artifacts subjected to secondary treatment are dominated by large ventral thinned flakes (214 spec.): longitudinal single (70 spec.) and double (61 spec.) (Fig. 4, *7–10*, *12–14*), transverse single (43 spec.) (Fig. 4, *6*) and double (17 spec.) (Fig. 4, *5*, *11*), longitudinal-transverse (15 spec.), and semi-circular (8 spec.). Complete items are mostly short (80 spec.) or shortened (55 spec.), less often elongated (22 spec.), treated with direct ventral percussion by large removals 10 to 60 mm wide.

The second most important group consists of proximally truncated spalls (110 spec.). These are large short or shortened flakes, with their striking platforms removed by a series (64 spec.) (Fig. 4, *15–17*) or a single (46 spec.) large ventral removal. The negative scar width of truncation spalls varies from 5 to 40 mm; in several items, the proximal edge was removed by a large (40–50 mm wide) detachment.

Side-scrapers (73 spec.) show the greatest typological diversity. They include longitudinal items with straight (12 spec.) or convex (18 spec.) (Fig. 5, *7*, *11*) retouched edges, including implements formed on ventrally thinned (Fig. 5, *5*) and proximally truncated blanks, as well as backed items (13 spec.); diagonal side-scrapers with straight (12 spec.) or convex (4 spec.) (Fig. 5, *10*) retouched edges, transverse side-scrapers with convex (14 spec.) (Fig. 5, *3*, *4*) or straight (2 spec.) retouched edges; double (3 spec.) and convergent (7 spec.) (Fig. 5, *1*, *2*, *6*, *8*, *9*) varieties, as well as a semi-circular side-scraper.

The group of denticulate, notched and spur-like tools comprises mainly the items with denticulate longitudinal edges (45 spec.), including backed varieties—with natural back (11 spec.) (Fig. 5, *17*), back-facet (4 spec.), and broken off back (3 spec.), with diagonal (9 spec.) (Fig. 5, *16*), transverse (22 spec.) (Fig. 5, *14*), or longitudinal-transverse (4 spec.) retouched edge, with two working edges (3 spec.) (Fig. 5, *18*), convergent (3 spec.) items, and semi-circular implements (8 spec.). Notched tools (33 spec.) are represented by retouched notches formed on longitudinal (22 spec.) (Fig. 5, *15*) or transverse (11 spec.) edge of the blank, including

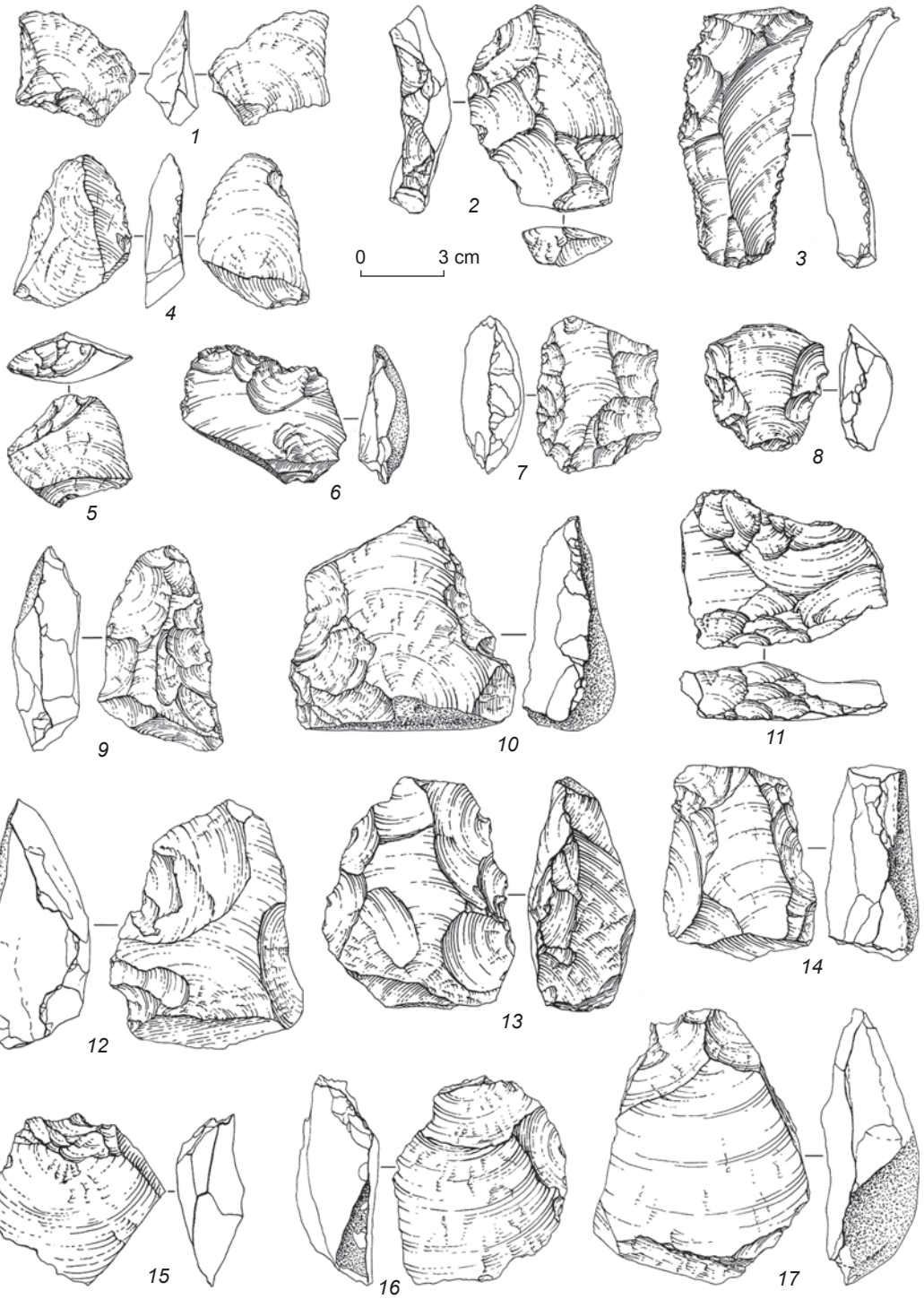

Fig. 4. Lithic artifacts of the Early Middle Paleolithic from layers 15 and 14 in the East Chamber of Denisova Cave.
1, *4* – Kombewa flakes; *2* – radial core *débordantes*; *3* – blade; *5–14* – ventrally thinned flakes; *15–17* – proximally truncated flakes.

backed varieties on marginal and fragmented spalls. The working element in spur-like tools (31 spec.) is located in the middle part of the distal (16 spec.) (Fig. 5, *12*, *13*) or longitudinal (8 spec.) edge, as well as at the corner of the transverse and longitudinal edges (7 spec.).

The collection also comprises 171 flakes and a blade with local retouch, as well as 50 unidentifiable tool fragments.

Generally, the Early Middle Paleolithic industries in Denisova Cave are illustrated by radial and parallel

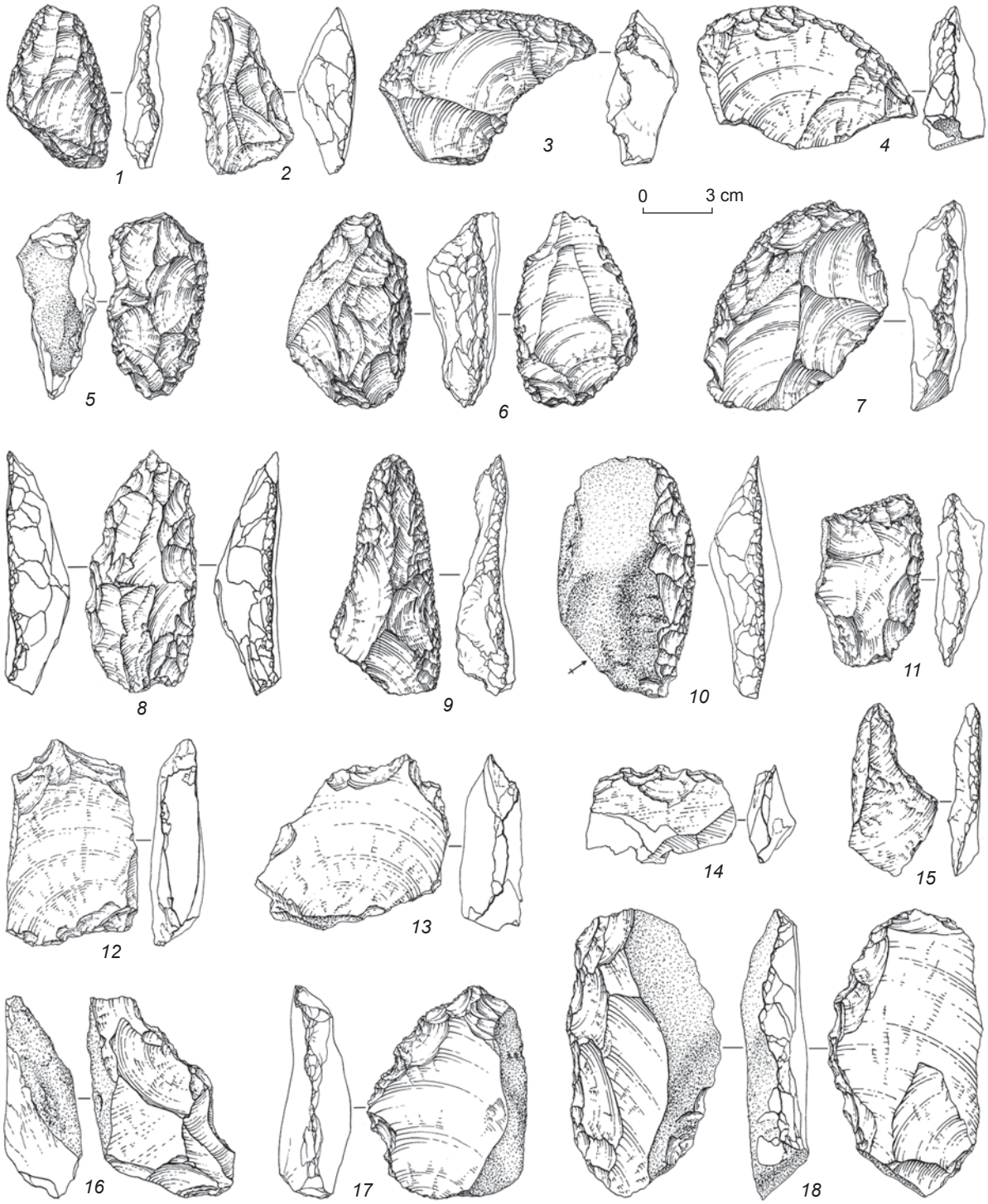

Fig. 5. Lithic artifacts of the Early Middle Paleolithic from layers 15 and 14 in the East Chamber of Denisova Cave.
1–11 – side-scrapers; *12*, *13* – spur-like tools; *14*, *16–18* – denticulate tools; *15* – notched tool.

unifacial single-platform cores made of massive flakes or small boulders. There is some evidence of the use of Levallois technique. Large massive flakes with ventral thinning resulting from wide removals from the distal or one or two longitudinal edges dominate among the artifacts subjected to secondary treatment. Another typical variety of artifact includes basally truncated flakes, with proximal edge truncated by ventral detachments. Side-scrapers with longitudinal, diagonal, transverse, convergent, and angular retouched

edges, including those similar in morphology to Quina-type items, as well as spur-like, denticulate, and notched pieces, appear in large numbers.

Discussion

Among the Altai Middle Paleolithic complexes, the chronologically closest evidence to the earliest industries from Denisova Cave was obtained from alluvial layer 19 of the stratified Ust-Karakol site, and was dated by the RTL-method to 133 ± 33 ka BP (RTL-661) (Derevianko, Shunkov, 2002). These deposits contain sparse corroded lithic artifacts with well-distinguished traces of parallel technology, identified as longitudinal and convergent side-scrapers, an end-scraper, spur-like items, denticulate and notched tools with Clactonian and retouched notches, spalls with traces of secondary treatment, and a truncated spall.

Supposedly, the age of layer 19 at the site corresponds to the lower strata of layers 10 and 9 in Ust-Kan Cave. By several teeth of gray voles of the *Allophaiomys* genus, these deposits were dated to the Late Middle Pleistocene (Agadjanian, Serdyuk, Postnov, 2002), and artifacts found therein were attributed to the Early Middle Paleolithic (Derevianko et al., 2001). However, this was clearly insufficient to confirm the Middle Pleistocene age of the deposits. Numerous remains of the Upper Pleistocene microtheriofauna were found in these layers, together with the *Allophaiomys* teeth. In paleontology and taphonomy, deposits are dated according to the latest components of taphocenosis. In addition, publications provide only a general description of the industrial complex of this stratified site, and the technical and typological appearance of the finds from the lower stratigraphic levels of the cave was unclear. Generally, the Levallois technique was typical of the Middle Paleolithic industry of the cave. The toolkit mainly consists of Levallois spalls, such as flakes, blades, and points, mostly medium-sized and short. Longitudinal and convergent side-scrapers (including those made on large Levallois blades) and Mousterian points dominate among the retouched items. Denticulate and notched tools are scarce, although quite diverse.

In the second half of the Middle Pleistocene, the Middle Paleolithic traditions began to emerge in the Altai, while in other areas of Southern Siberia that period was most likely dominated by pebble industries of Early Paleolithic appearance. Such a distribution of cultural manifestations may reflect specific regional developments in the Early Paleolithic ecumene in the eastern part of Eurasia (Derevianko, 2017: 89–128).

In southern Tuva, the second half of the Middle Pleistocene may be represented by surface finds from the Torgalyk localities, whose most probable age corresponds to the end of oxygen isotope stage 8 (Astakhov, 2008: 29–37). Primary technology in these industries includes flat parallel and radial cores, as well as artifacts with the Levallois reduction elements. The toolkit contains side-scrapers, spur-like points, denticulate, notched, and beak-shaped forms, bifacially treated pebble artifacts, and, according to the published evidence, ventrally thinned and proximally truncated flakes.

In the north of the Minusinsk Basin, corroded pebble artifacts have been found at Razlog II, Razliv, Kamenny Log, and Berezhekovo, in the zone of erosion of Pleistocene deposits by the waters of the Krasnoyarsk Reservoir (Drozdov et al., 2000). Some items may belong to the Middle Pleistocene; this is indirectly indicated by the remains of fossil fauna of the early mammoth complex, such as *Mammuthus chosaricus* and *Equus caballus chosaricus*, found together with pebble artifacts. Core-shaped items in these industries include radial and orthogonal cores, and artifacts in the form of chopping tools with the traces of convergent flaking. Scraper-like tools with backs on "citron" spalls and retouched flakes have also been discovered.

These collections are similar in appearance to surface finds from high terraces in the upper Angara River at the Igetei, Tarakhai, Olonskaya, and other sites (Medvedev, 1975). These industries are based on reduction of radial cores, with some elements of Levallois technique, and of single and double-platform parallel cores. There are also side-scrapers of longitudinal, transverse, and combination variants shaped by steep stepped retouching, and bifacially treatment items.

The small number and apparently uneven age of archaic pebble industries in Tuva and Eastern Siberia make it difficult to assess the level of cultural interaction or possible continuity between them. However, we should note the developed industry of the Torgalyk site, which includes elongated spalls removed from flattened cores and the simplest forms of bifacial pebble tools. The Angara and (to some extent) Yenisey industries show the greatest technical and typological diversity, well-developed methods of bifacial-radial, convergent, and parallel techniques, use of blanks of a deliberate shape, and production of various side-scrapers and other specialized tools.

Some similarities between the Altai industries of the second half of the Middle Pleistocene and the corroded Angara-Yenisey materials are manifested in the wide use of radial reduction along with parallel and Levallois techniques. The predominant tools are side-scrapers of

various types, including the items shaped by stepped retouch, as well as denticulate and notched items, and spalls with ventral thinning and proximal truncation. Given the ambiguity of the chronological context and lack of anthropological evidence at the Angara-Yenisey sites, the question concerning the carriers of these archaic pebble traditions remains open.

Anthropological finds from Baishiya Cave in the northeast of the Tibetan Plateau testify to the wide spread of the Denisovans to the east of Asia. A hominin dated to ca 160 ka BP, a fragment of whose mandible was found in the cave, was identified (on the basis of a paleoproteomic analysis) as a Denisovan (Chen et al., 2019). During further studies of the cave deposits accumulated during 100–60 ka BP, mtDNA fragments of the Denisovans that formed a clade with *Denisova 3* and *4* samples were sequenced (Zhang et al., 2020). According to preliminary data, the lithic industry of Baishiya was dominated by simple methods of knapping pebble raw materials aimed at obtaining flakes (the illustrations show the use of the radial method); typologically expressed tools were rare, and flakes with use-wear traces were predominant.

In the western part of Central Asia, the Early Middle Paleolithic is probably represented by the finds from Selungur Cave in the Fergana Valley, in the western Tian Shan. Although, initially, the cultural and chronological attribution of the site was associated with the Early Paleolithic (Islamov, Krakhmal, 1995), the evidence from the cave is presently considered a new industrial variant of the Middle Paleolithic of Central Asia (Krivoshapkin et al., 2016). The upper complex of the cave was preliminarily dated by the thorium-uranium method to 126 ± 5 ka BP (Krivoshapkin et al., 2017). According to its technical and typological features, the complex is similar to the industries from the lower cultural layers of Denisova Cave. Primary technology in the Selungur industry was aimed at producing shortened massive flakes with large smooth striking platforms, without overhang reduction in a system of radial, orthogonal, or parallel techniques. The toolkit was dominated by various kinds of longitudinal and transverse side-scrapers, including carinated varieties and items with the edge in the proximal part of the blank; ventrally thinned and proximally truncated flakes were common. Specific forms of tools were flat-convex bifacially treated points and side-scrapers, Tayacian points, and Mousterian chisels.

The Early Middle Paleolithic industries of the Altai show the closest similarity with the Acheulo-Yabrudian Cultural Complex (AYCC) in the Middle East (Derevianko, 2018: 112, 264; Derevianko, Shunkov, 2002). This complex was identified by A. Rust, who used the evidence from the Yabrud I rock shelter in Syria (1950). It includes three main industries: Acheulo-Yabrudian, Yabrudian, and Amudian, dating back to 420–200 ka BP (Barkai, Gopher, 2013; Zaidner, Weinstein-Evron, 2016). In the Acheulo-Yabrudian industry, primary reduction was aimed at producing flakes; handaxes and side-scrapers were predominant among the tools. The Yabrudian industry was also mostly flake-dominated, with small number of blades and various side-scrapers of the Quina and semi-Quina type. The Amudian industry had a distinctive laminar appearance.

The evidence from the stratified Misliya and Qesem caves in Israel, which was substantiated by reliable geochronological and paleogeographic research, is a notable part of AYCC (Barkai, Gopher, 2013; Zaidner, Weinstein-Evron, 2016). The Acheulo-Yabrudian industry from Misliya Cave shows three lithic reduction technologies: bifacial; removal of thin flakes from prepared cores, including some elements of the Levallois technique; and detachment of large massive flakes from unprepared cores, which served as blanks for handaxes and scrapers of the Quina and semi-Quina type. All main components of AYCC appeared in different proportions in the stratigraphic sequence of Qesem Cave. The Amudian tradition was dominated by distinctive laminar technologies. The Yabrudian industry of the cave included Quina scrapers and a relatively small share of blades. Rare handaxes appeared in both industries. Such variability was caused by changes in the economic structure and adaptation strategies of cave inhabitants rather than by the change in the carriers of cultural traditions. Geochronological data suggest the coexistence of the Amudian and Yabrudian industries (Barkai, Gopher, 2013).

The earliest assemblage from Denisova Cave and the Middle Eastern evidence were compared to reveal the presence of numerous so-called cores-on-flakes in both industries. For example, materials from Tabun Cave include several hundreds of such items appearing in different variants: with prepared striking platform and without traces of special preparation, with a negative scar of one flake or a series of removals from the ventral or dorsal sides (Shimelmitz, 2015). The use of parallel reduction technique aimed at producing elongated flakes was another important indicator of similarity. The role of blades in the earliest Denisovan industry was insignificant, but individual expressive specimens and carefully prepared cores testify to the developed methods of blade production. Judging by a few items, the Levallois reduction was uncommon; it became widely used in the next stage of the Middle Paleolithic.

A key technical and typological feature of the Denisovan industry denoting possible genetic links with the AYCC cultural traditions are representative series of ventrally thinned flakes and proximally truncated artifacts. The *Nahr Ibrahim* technique in Levantine industries was based on removal of small flakes from large spalls, both from the prepared limited area of the striking platform and from unprepared edge of the blank (Solecki R.L., Solecki R.S., 1970). Older flakes with patinated or rounded surfaces also often served as blanks in the Levant and Denisova Cave industries (Barkai, Gopher, 2013; Shimelmitz, 2015). This technique might have been used to obtain smaller blanks, or to adapt the implement to its fastening in a haft (Prévost, Zaidner, 2016). In Denisova Cave, the evidence of possible use of basal thinning for accommodation has been observed in a series of side-scrapers, and denticulate and spur-like tools.

The Early Middle Paleolithic industry of Denisova Cave and the Levantine complexes demonstrate the typologically expressive series of side-scrapers shaped by the Quina retouch. Their blanks were mainly large, shortened massive flakes (including radial core *débordantes*) and primary flakes. Cores for removing large tool blanks have not been discovered either in Denisova Cave or in Misliya Cave.

The share of bifacially shaped tools in the Altai Early Middle Paleolithic assemblages and at other Siberian sites, supposedly associated with the second half of the Middle Pleistocene, was insignificant, while in the AYCC industries bifacial techniques were important. In this regard, an interesting model was proposed by R. Barkai and A. Gopher. They suggested that the dietary stress caused by the disappearance of elephants from the Middle East led to the replacement of *Homo erectus* by hominins of a new lineage, who were better adapted to hunting smaller and faster animals (Barkai, Gopher, 2013). Biological replacement occurred along with significant cultural changes, resulting in the emergence of AYCC and development of laminar techniques on its basis. Increased mobility contributed to the spread of early populations beyond the Middle East, in particular, deep into Asia, which was accompanied by changes in the appearance of lithic industries affected by new landscapes and climate.

Methods of ventral thinning of massive flakes, widely used by the inhabitants of Denisova Cave, might have been a "residual" manifestation of bifacial technique. The question of whether such flakes, like numerous proximally truncated ones, were tool-like or core-like pieces, still remains open. In the earliest industry of Denisova Cave, flakes less than 5 cm were not subjected to secondary treatment. The use of small (1–3 cm) flakes, detached from the ventral surfaces of larger flakes, without any additional trimming, has been observed in the materials from Qesem Cave (Barkai, Lemorini, Gopher, 2010). Experiments have revealed the high efficiency of such flakes, lenticular in cross-section, with thin sharp edge and back, as knives, especially while cutting carcasses of small and medium-sized animals. In the Early Middle Paleolithic industries of Denisova Cave, the share of thinning flakes, as well as other types of small flake, is rather high, but the purpose of these artifacts is still unclear.

Conclusions

The arrival of carriers of the Middle Paleolithic traditions in Southern Siberia ca 300 ka BP is most likely associated with the eastward migration of the *Homo heidelbergensis* population from the Levant ca 450–350 ka BP (Derevianko, 2019). According to paleogenetic studies, at that time, late *Homo heidelbergensis* separated and populations of the Denisovans and Neanderthals emerged on the ancestral basis (Prüfer et al., 2014; Meyer et al., 2014). While settling in Western, Southern, and Central Asia, late populations of *Homo heidelbergensis* adapted to local environments and came into contact with the descendants of the Asian *Homo erectus*, which resulted in the emergence of a new taxon, i.e. the Denisovans, who inherited a small share of archaic genes through adaptive introgression (Prüfer et al., 2014).

Members of this wave of migration, first identified in Denisova Cave, brought to the Altai the methods of stone tool manufacture on flakes of deliberately prepared shape, removed from well-prepared cores: in particular, strategies of parallel and Levallois techniques. The origins of the technical and typological traditions of the early Denisovans can be observed in the Acheulo-Yabrudian industries of the Levant (Derevianko, 2018; Derevianko, Shunkov, Kozlikin, 2020).

The industry of the Early Middle Paleolithic in the Altai in the second half of the Middle Pleistocene is in good agreement with the evidence from traditional regions of research into the Eurasian Paleolithic. Pre-Mousterian and Early Mousterian industries without Acheulean bifaces, but with stable tool forms on flakes, evolved in Western and Central Europe within the period corresponding to the beginning of oxygen isotope stage 8, along with typical Acheulean complexes (Kuhn, 2013; Kozłowski, 2016). For some Early Mousterian industries, the most typical tools on flakes were still side-scrapers, as well as notched and denticulate items. According to the data on the geochronology of the Paleolithic complexes of Tabun and Misliya caves,

the appearance of the Middle Paleolithic industries in the Near East corresponded to ca 250 ka BP (Zaidner, Weinstein-Evron, 2012).

The lithic industry from the lower cultural layers of Denisova Cave testifies to well-developed lithic technologies and successful adaptation by its dwellers to the natural environment and climate of the Altai Mountains in the second half of the Middle Pleistocene. According to the data of fossil DNA sequencing from anthropological remains and cave deposits of the Middle Pleistocene sediments, the Denisovans were the carriers of the Early Middle Paleolithic traditions (Slon, Viola, Renaud et al., 2017; Slon, Hopfe, Weiß et al., 2017; Zavala et al., 2021; Brown et al., 2022).

Further development of Middle Paleolithic traditions in Denisova Cave is reflected in the evidence from deposits that emerged at a time corresponding to oxygen isotopic stages 6–4. They include industries with different variants of parallel, Levallois, and radial techniques. The toolkit is based on side-scrapers and notched and denticulate tools; Levallois artifacts and Upper Paleolithic varieties occur widely. The typological diversity of cores expands and the number of blades among the spalls increases up the section. The share of tools of the Upper Paleolithic group gradually increases in the toolkit, with a simultaneous decrease of Levallois and denticulate-notched components. Approximately 50 ka BP, an Upper Paleolithic culture with a distinctive set of stone and bone tools, personal ornaments, and items of symbolic activity began to emerge among the inhabitants of the cave on a local Middle Paleolithic basis.

The presence of Denisovans in the cave during the Upper Pleistocene is indicated by anthropological finds and sequenced DNA from the deposits of layers 14 and 12 in the Main Chamber, at the boundary of layers 12.1/11.4 and in layer 11.2 in the East Chamber, and in the lower part of layer 11 in the South Chamber (Krause et al., 2010; Reich et al., 2010; Meyer et al., 2012; Sawyer et al., 2015; Slon, Hopfe, Weiß et al., 2017; Zavala et al., 2021; Brown et al., 2022). Anthropological and paleogenetic evidence of the prolonged stay of the Denisovans in the cave is consistent with the cultural continuity in the development of lithic industries. This suggests that the Denisovans were an autochthonous population, which was associated with the development of the Middle Paleolithic and the emergence of the Early Upper Paleolithic (Derevianko, Shunkov, Kozlikin, 2020). In the Middle Paleolithic layers of Denisova Cave, remains of the Neanderthals have also been found, their DNA has been sequenced from these sediments (Mednikova, 2011a, 2013; Prüfer et al., 2014; Slon, Hopfe, Weiß et al., 2017; Zavala et al., 2021; Brown et al., 2022); a bone has been discovered from a girl whose father was a Denisovan and whose mother was a Neanderthal (Slon et al., 2018). Archaeological evidence from the stratified column of cave deposits indicates the absence of drastic changes in the composition of the technocomplexes, and suggests joint habitation of the Denisovans and the Neanderthals in the cave. The role of Neanderthals in the development of the Middle Paleolithic culture of the Altai has yet to be established. Notably, Okladnikova and Chagyrskaya caves, located 100 km from Denisova Cave and inhabited by the late Neanderthals (Krause et al., 2007; Mednikova, 2011b; Buzhilova, 2013; Mafessoni et al., 2020), yielded lithic industries of the Micoquian appearance, based mainly on radial technique. These industries include predominantly convergent side-scrapers and bifacial tools (Mezhdistsiplinarniye issledovaniya…, 2018: 153–230; Kolobova et al., 2020).

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S.A. Vasiliev
Institute for the History of Material Culture,
Russian Academy of Sciences,
Dvortsovaya nab. 18, St. Petersburg, 191186, Russia
E-mail: sergevasiimk@gmail.com

Upper Paleolithic of the Yenisey: New Discoveries, Old Debates

This paper integrates the results of studies relating to the Upper Paleolithic of the Yenisey, collating traditional ideas with findings made in the latest decades. Excavations on the Upper and Middle Yenisey are being carried out by several research teams. Sites representing the hitherto little known Early Upper Paleolithic (Yasnoye I, Afontova Gora II-Sklon) have been discovered, but so far the findings do not suffice for their cultural attribution. The key site for that period in the region remains Malaya Syia, for which a series of new dates ranging between 34–29 ka has been generated. Traditions revealed there continued at a later site, Sabanikha. The Middle Upper Paleolithic is characterized by the prevalence of various blade industries, which in most cases cannot be separated into clear-cut groups resembling archaeological cultures. Certain industries are archaic, with Mousterian-like lithic assemblages and elaborate bone and tusk processing (Kurtak IV). During the later phase of the Pleistocene, along with cultures such as the Afontova and Kokorevo, blade industries survived, continuing traditions of the preceding stage (Golubaya I, Maltat, Konzhul). A peculiar variant of the Upper Paleolithic has been identified, combining features of both cultures and a series of foliated bifaces (Kuibyshevo II). Discussions are ongoing around the effect of various factors on the cultural differentiation, including the relationship between the Afontova and Kokorevo cultures.

Keywords: *Yenisey, Abakan, Upper Paleolithic, Afontova Gora, Afontova culture, Kokorevo culture.*

Introduction

This brief review characterizes the current state of research on the Upper Paleolithic of the Yenisey. The concentration of well-stratified, often multilayered sites discovered in the basin of the Upper and partly Middle Yenisey, which provided a series of radiocarbon dates and data for the reconstruction of the paleoenvironment, presents crucial information for studying the Upper Paleolithic of North Asia. The archaeological sites of the Yenisey basin have always been of key importance for understanding the nature of the Old Stone Age in Siberia; the proposed interpretations have consistently demonstrated the main stages in the development of Paleolithic research in our country. The pioneering works of I.T. Savenkov at Afontova Gora in the 19th century laid the foundation for discussions of the age and development of the North Asian Paleolithic. Subsequently, the Yenisey sites served as a basis for the stadial development model proposed by G.P. Sosnovsky for the Siberian Paleolithic in the 1930s, and for the local-cultural approach by Z.A. Abramova in the 1960s. The bulk of the data derived during the work of large rescue archaeological expeditions of the 1960–1980s was published in a number of monographs (Abramova, 1979a, b; Astakhov, 1986; Vasiliev, 1996; Lisitsyn, 2000) and in a summarizing study (Paleolit Yeniseya, 1991).

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At present, the study of Paleolithic sites in the Upper and Middle Yenisey is proceeding at an increasing pace (Fig. 1). Large-scale rescue excavations are being actively carried out in the territory of Krasnoyarsk, covering, in addition to the sites of Afontova Gora, the areas along both the banks of the Yenisey (Pozdnepaleoliticheskaya stoyanka…, 2021; Geologiya…, 2020). As compared to the traditional ideas about the Paleolithic of Afontova Gora (Astakhov, 1999), a lot has changed: both the chronological assessment of the sites, owing to the discovery of early materials at the sites of Afontova Gora V and Afontova Gora II-Sklon, and their cultural characteristics—along with the prevailing Afontova materials, traces of the Kokorevo culture, represented by finds from the Krutaya site, were recovered for the first time.

A team headed by E.V. Akimova completed the long-term studies at the sites on the shores of the Derbina Bay of the Krasnoyarsk Reservoir by publishing the concluding monograph (Paleolit Derbinskogo zaliva, 2018). Excavations at the Malaya Syia site were resumed (Lbova et al., 2013). The coast of the Krasnoyarsk Reservoir is being surveyed: the studies at the Sabanikha site has been renewed (Kharevich et al., 2020a, b).

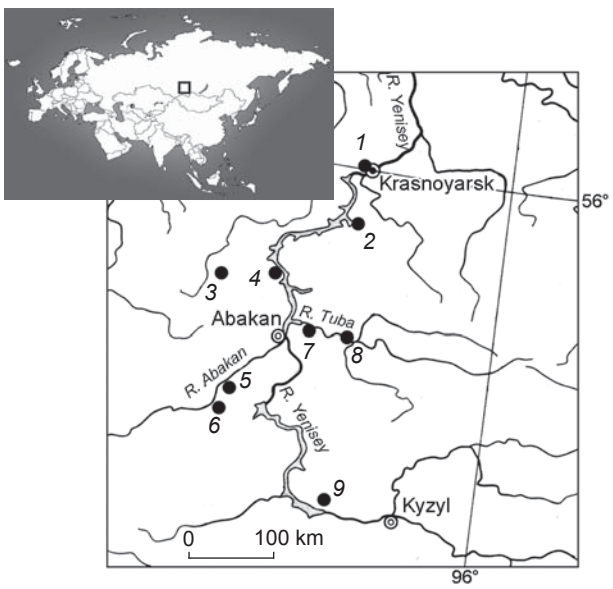

Fig. 1. Location of the main recently discovered and explored sites of the Upper Paleolithic of the Yenisey. *1* – Afontova Gora I–V, Krutaya, Yasnoye I, etc.; *2* – Derbina IV, V, Pokrovka I, II, Ust-Maltat I, II, Maltat, Konzhul, etc.; *3* – Malaya Syia; *4* – Sabanikha; *5* – Matkechik I, II, Ust-Sos; *6* – Kuibyshevo II, Krivoy Chistobai I, Mozharov Uval I, Bolshie Arbaty I, Matros I, etc.; *7* – Pritubinsk I; *8* – Irba II; *9* – Kuylug-Khem I grotto.

In the course of surveys in the southwestern Khakassia, Paleolithic sites were found in the valleys of the Abakan, Tashtyp, Dzhebash, Bolshiye and Malye Arbaty rivers (Zubkov et al., 2019). A group of Russian and Chinese archaeologists led by N.I. Drozdov carried out archaeological works at Ust-Sos and Matkechik on the Abakan River (Drozdov N.I., Makulov, Drozdov D.N. et al., 2017; Drozdov, Makulov, Leontiev et al., 2017). Another team of Krasnoyarsk researchers studied the right bank of the Upper Yenisey, and explored the Pritubinsk I site in the Middle Tuba (Kharevich et al., 2018). Upstream the Yenisey, as a part of the rescue archaeology project of the Kyzyl-Kuragino railway construction, excavations were carried out at a large area of the Final Paleolithic site of Irba II (Vasiliev et al., 2019). Vl.A. Semenov discovered a Paleolithic cave site in Tuva, where previously only open-air sites were known (Semenov, Vasiliev, Kilunovskaya, 2006).

Early Upper Paleolithic

As compared to other regions of Southern Siberia (Altai, Angara basin, Transbaikalia), the Early Upper Paleolithic of the Yenisey remains almost unstudied. There is a large chronological gap between the Levallois-Mousterian assemblage from the lower layers of the Dvuglazka grotto, with a radiocarbon date of 44.4 ka BP*, and the earliest Upper Paleolithic sites.

Recently, on the territory of Krasnoyarsk, several sites yielding unexpectedly ancient faunal remains and lithic artifacts have been identified. Among these is Yasnoye I, located at a great distance from the river, at an elevation of 100 m above the Yenisey River. The pedosediments of the Karginsky age, with dates ranging between 33–28 ka BP, yielded animal-bone remains and lithic artifacts.

The locality of Afontova Gora II-Sklon is associated with slope deposits at an altitude ranging from 25 to 50 m above the river level. Faunal remains (mammoth, Asiatic wiled ass, saiga antelope, woolly rhinoceros, etc.) and lithic artifacts were found in colluvial deposits, dating to 40–28 ka BP, although there are also older estimates. The finds include pebble tools and side-scrapers. The available data are insufficient for detailed description of the industry (Geologiya…, 2020: 58–77; Filatov, Klementiev, 2020).

For a long time, the site of Malaya Syia was considered the main site of the presumably early stage

*In the article, all dates are uncalibrated.

of development of the Yenisey Paleolithic. The site is situated at the slope of the ravine, at a height of 32–35 m. Its thick cultural layer is associated with redeposited buried soil, with traces of cryoturbations, and is covered by a layer of upper loams. The faunal remains are dominated by the bones of reindeer, wild sheep or goat, and bison. The series of radiocarbon age-determinations of the site is discrepant (ranging from 17.8 to 34.5 thousand years). A number of AMS-dates in the range of 34–29 ka BP have recently been obtained. The industry of Malaya Syia is based on large blades, which were used for the production of end- and side-scrapers and burins. The collection yielded numerous retouched bladelets, including those with curved edges. A series of bone and antler points without grooves, blanks of personal ornaments, and pendants with holes made of serpentine were also found (Larichev, Kholyushkin, 1992; Lbova et al., 2013, 2015).

At the site of Sabanikha, located on the shore of the Krasnoyarsk Reservoir, cultural remains were deposited above the brown sandy loam horizon (interpreted as fossil soil of the Karginsky period), in deposits at the level of 40 m high. The bones of red deer, bison, and argali predominated among the fauna. Radiocarbon dates of 26.9–22.9 ka BP were run out on charcoal from the hearths. The lithics include large single- and double-platform cores, retouched blades (including pieces with concave lateral edges, reminiscent of Aurignacian forms), end-scrapers on blades (incl. retouched), typical end-scrapers with pointed bases, bifacial side-scrapers, choppers, etc. A number of artifacts made of bone and antler (adzes, points without grooves, and needles) were found. There are also stone beads. The features of the lithic industry and the ornaments are similar to those of Malaya Syia, which probably suggests the development of a single cultural tradition (Lisitsyn, 2000: 23–26; Kharevich et al., 2020b).

Middle Upper Paleolithic

The Middle Upper Paleolithic of Siberia is characterized by coexisting heterogeneous cultural trends, which made it possible to use the expression "Siberian mosaic" (Vasil'ev, 2000). Along with the prevailing blade-based industries, similar to the European Upper Paleolithic ones, archaic and sometimes Mousterian-looking industries continued to exist in a paradoxical combination with a developed technique of bone and tusk processing.

Among the recent discoveries, noteworthy are the finds from cultural layer 2 at Afontova Gora V. In the Karginsky deposits, a few tools, mainly end-scrapers on blades, were found (Geologiya…, 2020: 29–42). The correlation of the new finds with the previously studied artifacts from layer 5 of this locality, dating to ca 28 ka BP (Drozdov, Artemiev, 1997: 22–24), remains unclear.

A small blade-based assemblage, with a radiocarbon date of about 26.5 ka BP, comes from cultural layer 4 of the Dvuglazka grotto. Its faunal remains are dominated by the bones of mountain sheep, horse, and Asiatic wild ass; the occurrence of Baikal yak is noteworthy. Lithic artifacts include a single-platform core, blades with retouched edges, end-scrapers on retouched blades, and a point. A peculiar wedge-shaped bone tool with grooves and a pendant were also found (Paleolit Yeniseya, 1991: 67–68; Lisitsyn, 2000: 17–18).

Other sites of the Middle Upper Paleolithic are associated with the banks of the Krasnoyarsk Reservoir. The main problem of their study is the correlation of finds from the cultural layer (usually not numerous) and abundant surface material, which homogeneity can always be called into question, and radiocarbon dates may correspond not to the age of the cultural layer, but to the time of redeposition of the remains along the slope (Paleolit Derbinskogo zaliva, 2018: 15).

At the Krasnoyarsk Reservoir, the eroded site of Kashtanka I was studied (Drozdov et al., 1992). Its cultural layers are associated with cryoturbated buried soils of the Kurtak series, overlain by a thick layer of slope loams of the Sartan period. A date of >29 ka BP was obtained for cultural layer 2, and the overlying deposits and cultural layer 1 were dated to 24–21 ka BP. The lithic industry is represented by single- and double-platform large cores, a series of cone-shaped microcores, end-scrapers on blades and flakes, backed bladelets, side-scrapers, chisel-like tools, and choppers. There are several artifacts made from mammoth tusk and reindeer antler, including points, needles, and beads.

The studies of sites of the Derbina group made a significant contribution to Middle Upper Paleolithic research (Paleolit Derbinskogo zaliva, 2018). The main cultural layer of the Derbina V site is dated to 21–20 ka BP. The assemblage of artifacts, coming mainly from surface collections, includes a series of typical foliated bifaces (Fig. 2). The lithic industry is based on blades. Single- and double-platform cores, butt-ended microcores, end-scrapers, retouched blades, side-scrapers, chisel-like tools, and points were found. Other sites of the region are Ust-Maltat I and II, Derbina IV,

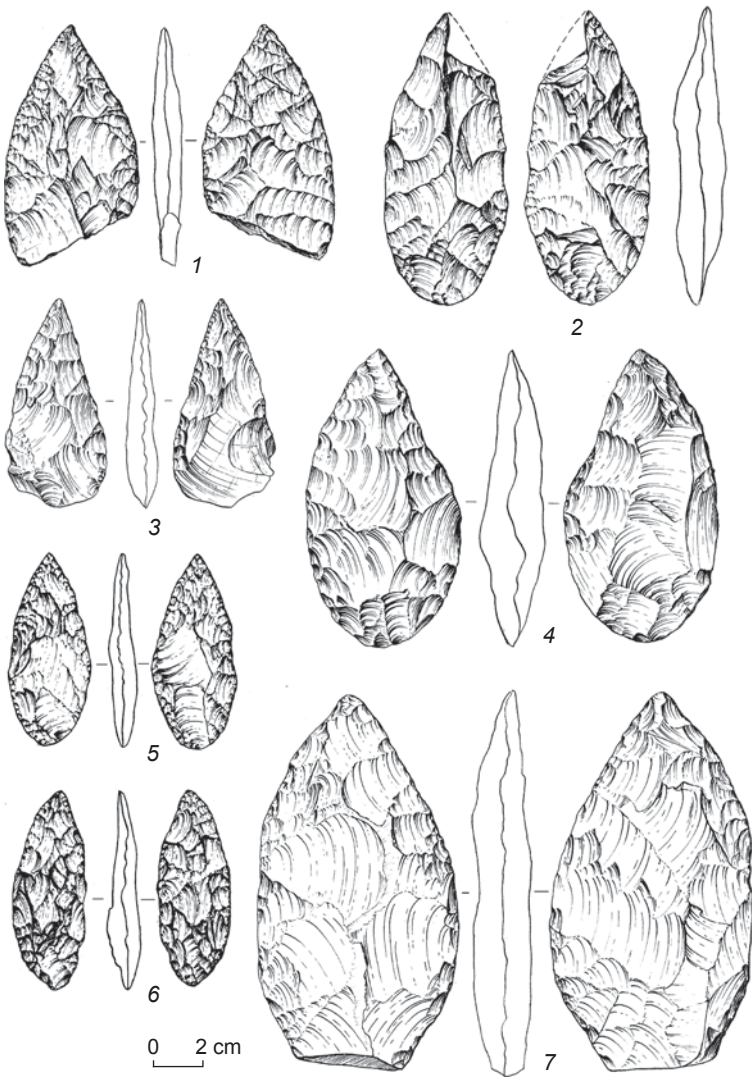

Fig. 2. Bifaces from Derbina V (after (Paleolit Derbinskogo zaliva, 2018: Fig. 12)).

Pokrovka I and II. A fragment of a human skull dating to ca 27 ka BP was found on the exposures close to Pokrovka II.

The Shlenka site belongs to a younger period (Lisitsyn, 2000: 37–38); its cultural layer is associated with deposits of a 70–80 m terrace-like level. The bones of reindeer, mammoth, and horse predominate the numerous faunal remains. A series of radiocarbon dates in the range of 20–18 ka BP has been obtained. These data are in good agreement with the idea of the Early Sartan age of the site. The artifact collection includes retouched bladelets, end-scrapers, retouched flakes, a few borers, burins, side-scrapers, and pebble tools. In general, the assemblage demonstrates well-developed blade technology. A small bone rod was also found.

The Tarachikha site (locus 1) falls into approximately the same chronological range (Ibid.: 33–34). Here, artifacts were associated with colluvial sandy loams uncovered on the ravine's slope. They were accompanied by faunal remains dominated by mammoth and reindeer bones. Available radiocarbon dates determine the age of the site to be in the range of 19–18 ka BP. The expressive blade-based industry includes flat single- and double-platform cores, close in shape to prismatic cores, as well as atypical wedge-shaped cores. Tools are end-scrapers on blades (including on retouched ones) and on flakes, retouched and backed bladelets, peculiar micropoints with retouched bases and longitudinal edges, burins, retouched flakes, side-scrapers, and leaf-shaped bifacial points. A pendant made of a canine was also found.

The cultural layer of the Afanasieva Gora site was associated with upper clays on the slope of a 40-meter terrace. The bones of mammoth, reindeer, horse, and argali were collected in the eroded area near the site; faunal remains from small excavations are unidentifiable. The toolkit (characteristic types of retouched bladelets, points, end-scrapers, burins, etc.) is similar in appearance to the assemblage from Tarachikha, and can be combined with it into a single cultural tradition of the Middle Upper Paleolithic (Ibid.: 31–33).

The youngest assemblage of the period under consideration comes from cultural layer 19 of the Listvenka site, dated to 17–16 ka BP. The blade industry, based on the use of prismatic cores, reveals retouched blades, points, burins, end-scrapers, and backed bladelets. Artifacts made from mammoth tusk were also found (Paleolit Yeniseya…, 2005: 118–133).

E.V. Akimova unites all the "small blade" industries of the Middle and Late Upper Paleolithic on the Yenisey (in the range of 22–11 ka BP) within the "Tarachikha culture" (Paleolit Derbinskogo zaliva, 2018: 166). At the same time, she notes a significant variability of lithic industries. The undoubted unity of the toolkits of two sites (Tarachikha and Afanasieva Gora) can be considered a local grouping. The possible influence of the Malta culture is evidenced by a pendant with typical Malta ornamentation; the artifact was found in cultural

layer 5 of the Kuylug-Khem I grotto in Tuva, dated to 26.1–20.3 ka BP (Semenov, 2021).

Along with blade industries, archaic flake industries, such as the assemblage from Kurtak IV, continued to exist (Lisitsyn, 2000: 18–22). The site of Kurtak IV is associated with a layer of interbedded colluvial sandy loams overlying the buried soil of the Karginsky period, composing the 60–80-meter level. The faunal collection includes remains of a mammoth (the prevailing species), bear, bison, red deer, and others. For the paleosol, the date of ca 27.5 ka BP was run out on the charcoal; for the cultural layer, a series of dates in the range of 24–23 ka BP was obtained. The site yielded a very archaic industry with simple forms of pebble cores, an abundance of end-scrapers, retouched flakes, side-scrapers, borers, and beak-shaped, notched and pebble tools. Artifacts made of tusk and bone, and personal ornaments, were also found.

Among the assemblages with both flakes and blades, the industry of the lowermost cultural layer of the Ui I site is noteworthy. For this layer, a series of dates on bone in the range of 17–16 ka BP, and a date of earlier than 22 ka on charcoal were obtained. The site is probably attributable to the Early Sartan age. The collection includes cone-shaped, prismatic, and wedge-shaped cores, end-scrapers on blades and flakes, retouched bladelets and flakes, as well as an antler point, bone points, a peculiar tool made from a fragment of a tubular bone, and a canine-pendant (Vasiliev, 1996: 145–170).

Late Upper Paleolithic

In the Late Sartan period, starting from 17–16 ka BP, assemblages of the Afontova culture dominated in all clusters of the Paleolithic localities in the Yenisey basin. These were archaic-looking lithic industries, dominated by flakes, single- and double-platform pebble cores, with side-scrapers, end-scrapers, and chisel-like tools prevailing in the toolkit. The discoveries of recent years have significantly supplemented the data on the Afontova culture, primarily owing to large-scale excavations at Afontova Gora. The known area of distribution of the this culture has expanded. The Afontova sites have been discovered in the southeastern part of the Minusinsk Basin, in the vicinity of the village of Kuragino (Irba II), and in the Upper Abakan basin (Matros I, Bolshiye Arbaty I, Mozharov Uval I, etc. (Zubkov et al., 2019)).

Another trend in the Late Paleolithic culture demonstrates a considerable use of the blade technique, although the reduction strategy is more reminiscent of the Middle Paleolithic technologies, rather than European Upper Paleolithic technology. The assemblages of this unity include tools that were fashioned on elongated blanks—Mousterian points and retouched blades. However, the main set of artifacts is similar to the assemblages of the Afontova culture; the differences are observed mainly in the quantitative ratio of typological groups. Such sites, located along the Yenisey River valley from the north of Krasnoyarsk (Druzhinikha) to the Middle Minusinsk Basin, were assigned by Abramova to the Kokorevo culture (1979b: 175–194). New discoveries expand the distribution area of this culture in a southeastern direction, e.g., by the site of Pritubinsk I in the middle reaches of the Tuba River. Two cultural layers of the site date back to 15–12 ka BP. A cache of stone tools is noteworthy (Kharevich et al., 2018).

Until recently, the extreme point of distribution of the Kokorevo culture in the southwestern direction was the Ulugbil site in the Abakan valley (Lisitsyn, Hudiakov, 1997: 14–16). In the Upper Abakan, in the valley of the Krivoi Chistobai stream, on a 35–40-meter terrace, the site of Krivoi Chistobai I was found. Its Paleolithic cultural layer was associated with cryoturbated loams overlying the eluvium. The lithic industry includes single- and double-platform cores, wedge-shaped microcores, side-scrapers, end-scrapers, burins, etc. According to a number of features (blade technique, a series of retouched blades, end-scrapers and burins on blades, and an elongated leaf-shaped Mousterian point), it is close to the Kokorevo assemblages (Zubkov et al., 2019).

The significance of differentiation of the Yenisey Late Paleolithic industries into the Afontova and Kokorevo cultures is still debated. V.S. Zubkov has proposed to focus on a structural approach to the analysis of lithics, emphasizing the variability in the forms of tools and core-like pieces and the fluctuations in technical and typological features throughout the development of the industry (2016). The sites combining the features of the Afontova and Kokorevo cultures have long been known. At the site of Berezovyi Ruchei I, located in the Beresh River valley in the Nazarovo Basin, the cultural layer was noted in association with the upper loams of the terrace level corresponding to the third terrace of the Chulym River. The layer yielded a lithic industry with butt-ended and wedge-shaped microcores, side-scrapers on flakes and blades, end-scrapers on retouched blades, atypical points, choppers and limaces, along with the bones of bison, reindeer, and horse. The toolkit also

includes flattened antler and bone points with grooves. According to researchers (Vishnyatsky et al., 1986), the industry is based on a combination of "Afontova" and "Kokorevo" features. While the tools on flakes are predominant (burins and Mousterian points are atypical), the collection includes a series of end-scrapers on blades and retouched blades.

Another example of a combination of features of the two cultures is the site of Kokorevo IVB. Both culture-bearing layers of this site are associated with upper sandy loams and sands of the elevated part of terrace II. The fauna is represented by the reindeer remains. The lowermost layer has been radiocarbon dated to 15.5 ka BP. The lithic industry, with flakes and side-scrapers prevailing, is similar to that of the Afontova assemblages (especially with Kokorevo II). Noteworthy is the hearth made of obliquely set stone slabs, which was found in cultural layer 2; the hearth is similar to those identified at Kokorevo I and is considered one of the typical features of the Kokorevo culture (Astakhov, 1966, 2014).

As compared to the Late Upper Paleolithic trends listed above, some lithic industries are probably genetically related to the assemblages of the previous, Middle Upper Paleolithic period; these industries show a well-developed prismatic technique. Until recently, only the industry of the lower cultural layer at the site of Golubaya I, dated to 13–12 ka BP, could

Fig 3. Stone tools from Kuibyshevo II (after (Zubkov et al., 2019: Fig. 4)).
1–3 – end-scrapers; *4* – borer; *5*, *18* – side-scrapers; *6*, *16*, *17* – cores; *7*, *10* – combination tools; *8* – point; *9*, *11* – burins; *12–15* – foliated bifaces; *19*, *20* – retouched blades.

be attributed to this group (Astakhov, 1986: 99–109). During the works in the Derbina site cluster, the Final Paleolithic sites with a microblade industry typologically different from the Golubaya I complex were discovered. Among the late sites of the Derbina group, Maltat is the most important. The obtained radiocarbon dates, in the range of 10.5–9.5 ka BP, are considered rather young for this site. The Derbina sites show a blade-based industry with single- and double-platform cores, retouched blades, burins, end-scrapers, and chisel-like tools. Beads made of soft stone were found. A similar assemblage was recorded from the site of Konzhul, where the lower cultural layer with the remains of a hearth was dated to ca 12 ka BP (Paleolit Derbinskogo zaliva, 2018: 146–151).

The number of variants of the Late Upper Paleolithic is increasing, as evidenced by the assemblage from the huge lithic workshop site of Kuibyshevo II, located in the valley of the Dzhebash, a tributary of the Abakan. Its cultural remains are associated with thin upper loams covering the eluvium at a level of 70–75 m (there are finds at levels of 60–65 and 90 m). The site is located close to the outcrops of veined quartzite found less than 1 km westwards. The main part of the lithic industry is similar to the Afontova assemblages, with the predominant use of flakes as blanks, with large single-platform cores, wedge-shaped microcores, side-scrapers, end-scrapers, and chisel-like tools. The collection also demonstrates typical burins, including elongated varieties, fashioned on retouched blades, similar to those found in the Kokorevo assemblages. Noteworthy is a series of thin foliated bifaces described for the first time at the Late Upper Paleolithic sites (Fig. 3) (Zubkov et al., 2019).

Conclusions

Recent discoveries clearly demonstrated a much greater diversity in the disposition of the Upper Paleolithic sites in the region than traditional estimates. On the one hand, sites were found at high elevations, up to the areas close to watersheds, and located far from the modern river system (Yasnoye I). On the other hand, sites associated with unusually low levels were discovered, almost at the level of modern high floodplains (Irba II). It becomes obvious that it is necessary to revise the search criteria previously focused on exploration at low terrace levels along river valleys.

Another important consequence was the understanding of the more complex (than previously thought) structure of the Yenisey Upper Paleolithic at the middle and late stages of its development. The number of cultural variants is multiplying, and it becomes clear that factors of site differentiation should be taken into account. E.V. Akimova points out the factors that influenced the nature of lithic industries: seasonality of habitation, location in river valleys, and the availability of certain types of raw materials (Paleolit Derbinskogo zaliva, 2018: 166). A comprehensive analysis of the previously known assemblages with respect to these factors is a matter for the future.

There are many other issues. One concerns the extremely uneven state of study of the vast territory. The Paleolithic of the Yenisey valley downstream from Krasnoyarsk is still practically unknown, and Druzhinikha is in fact the only known site of the Old Stone Age. On the left bank of the Yenisey, the Kuznetsk Alatau foothills adjacent to the site of Malaya Syia, and the northern piedmonts of the West Sayan, stretching from Sayanogorsk to Bondarevo, have not been surveyed. On the right bank of the Yenisey, the main part of the Tuba valley, the basin of the Kazyr River and its tributary Kizir have not been surveyed either. The "Paleolithic potential" of these areas can be very high.

Finally, a purposeful search for stratified sites in Tuva is necessary. The assemblages of surface-collected artifacts allowed S.N. Astakhov to outline the general chronological stages of the Upper Paleolithic of the region and to show its heterogeneity (1986). Given the lack of stratified and dated sites, it is unclear whether this phenomenon should be interpreted as reflection of the temporal or cultural variation.

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I.M. Berdnikov[1], N.P. Makarov[2], T.M. Savenkova[3], N.E. Berdnikova[1], N.B. Sokolova[1], A.M. Kim[4], and D. Reich[4, 5, 6, 7]

[1]Irkutsk State University,
K. Marksa 1, Irkutsk, 664003, Russia
E-mail: geoarch.isu@gmail.com; nberd@yandex.ru; snb-87@mail.ru
[2]Krasnoyarsk Regional Museum of Local Lore,
Dubrovinskogo 84, Krasnoyarsk, 660049, Russia
E-mail: mnp@kkkm.ru
[3]Voino-Yasenetsky Krasnoyarsk State Medical University,
Partizana Zheleznyaka 1, Krasnoyarsk, 660022, Russia
E-mail: reis_05@bk.ru
[4]Harvard University,
Cambridge, MA 02138, USA
E-mail: akim@genetics.med.harvard.edu; reich@genetics.med.harvard.edu
[5]Harvard Medical School,
Boston, MA 02115, USA
[6]Broad Institute of MIT and Harvard,
Cambridge, MA 02142, USA
[7]Howard Hughes Medical Institute, Harvard Medical School,
Boston, MA 02446, USA

Middle Neolithic Burials in Baikal-Yenisey Siberia: Problems of Cultural Identity and Genesis

The study focuses on the analysis of Middle Neolithic burial complexes of the Baikal-Yenisey Siberia. Based on a series of reliable radiocarbon dates, their age lies within the range of 6190–5900 cal BP. It partly corresponds to the end of the hiatus in the mortuary traditions of Cis-Baikal. Features of the burial rite and funerary offerings are analyzed and compared with those of neighboring territories. One of the most frequent images in the art of the Middle Neolithic Baikal-Yenisey Siberia is that of the waterfowl, rendered as figurines. The common grave goods are leaf-shaped stone arrowheads, shell beads, and pendants made of animal bones and teeth. The funerary rite included the use of fire and reddish mineral pigment, as well as disrupting the anatomical integrity of the skeletons, possibly due to partial burial (the data are tentative). Most burials of the late stage of the hiatus are evidently those of hunter-gatherers manufacturing the Ust-Belaya ceramics, which were found in certain burials. A bone arrowhead with a biconical point and figurines representing waterfowl suggest cultural ties with the Urals and Western Siberia; but their nature has yet to be clarified, which requires large-scale AMS-dating and paleogenetic analysis.

Keywords: *Baikal-Yenisey Siberia, Neolithic, hiatus, funerary rite, radiocarbon dating, waterfowl image.*

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Introduction

In the archaeology of the New Stone Age of Baikal-Yenisey Siberia*, one of the most urgent issues is that of hiatus (absence of burial complexes) in the interval between the early and late stages of the Neolithic (see review: (Berdnikov, Krutikova, Dudarek et al., 2020)). The numerous attempts to solve it have only led to reduction of the chronological interval from ~1300/1200 to ~600 years (Weber et al., 2021). During this process, the main question concerning the identification of the Middle Neolithic population remained open for a long time.

In the last three years, work has been carried out aimed at solving the problem of hiatus, for which a database was created on burials with indeterminate cultural and chronological affiliations (Berdnikov et al., 2021; Sokolova, Berdnikov, 2022). As a result, the materials from cultural horizons with Ust-Belaya and Posolskaya ceramics are proposed to refer to the Middle Neolithic (hiatus). Among the many unattributed burials, especially interesting are the comp lexes with ornithomorphic pendants and the Ust-Belaya-type vessels from Krasnoyarsk and the Angara region, as well as a destroyed burial on the upper Lena, containing a Shigir-type arrowhead. Recently, we have received a series of reliable radiocarbon dates allowing us to discuss the cultural and chronological attribution, and some questions of the genesis, of these unique burials.

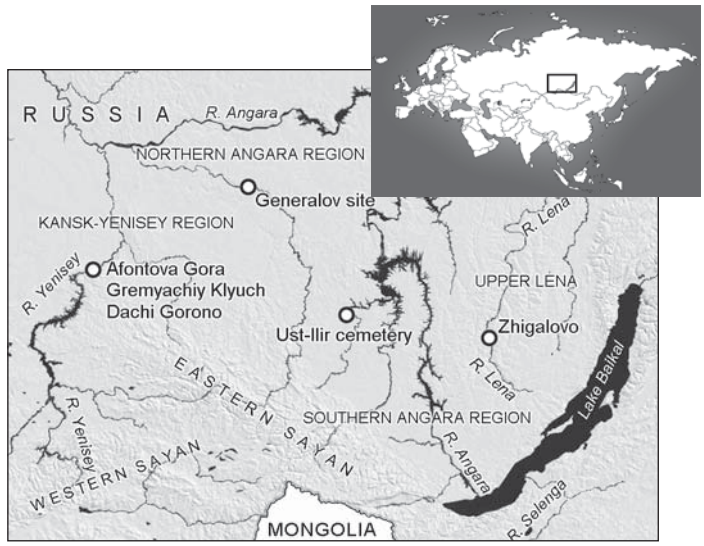

Fig. 1. Archaeological sites with burial complexes of the Middle Neolithic on the map of Baikal-Yenisey Siberia.

Material and methods

The materials of eight burial complexes of Baikal-Yenisey Siberia (Fig. 1), whose cultural and chronological affiliation has been the subject of discussions for many years, are analyzed. These are primarily the graves on the territory of modern Krasnoyarsk: near the brook called Gremyachiy Klyuch, near children's summer camps of the city education authority (Dachi Gorono), and three burials of Afontova Gora (Okladnikov, 1949; Glusskaya, 1963a, b; Vdovin, Makarov, 2016). The rest are represented by graves at the site named after A.G. Generalov (Generalov site) on the Chunya River; at the mouth of the Ilir River (Ust-Ilir cemetery), in the southern Angara region; and on the territory of the airport of the Zhigalovo settlement, on the upper Lena (Dzyubas, Abdulov, Drulis, 1996; Berdnikova, 2013; Berdnikova et al., 2014).

During this study, radiocarbon dates for four burial complexes were obtained. In addition, the dating results for the burial in Zhigalovo were used (Berdnikova, 2013). The values of all radiocarbon dates were calibrated in the OxCal 4.4.4 program (Bronk Ramsey, 2021), using the IntCal20 atmospheric curve (Reimer et al., 2020), with a probability of 95.4 %. To assess the correctness of the results obtained, data on stable isotopes of carbon and nitrogen were analyzed. Methods of comparative analysis and analogs (with the identification of culturally significant features of the funerary rite and categories of grave goods) were used to identify links with the evidence from typologically similar and contemporaneous archaeological complexes of Baikal-Yenisey Siberia and adjacent territories.

Results

Brief description of the archaeological complexes. We give only the main characteristics

*Baikal-Yenisey Siberia is understood as the territory of the south of Central Siberia, which additionally includes part of the southwestern zone of the Baikal Rift (Tunka Valley) and the Oka Plateau of the Eastern Sayan.

of the burials under consideration. They certainly require a fresh look and a separate detailed analysis, but that is beyond the scope of this study. Most of the materials have been published; therefore, to clarify the information, one can refer to the primary information sources (Okladnikov, 1949; Glusskaya, 1963a, b; Dzyubas, Abdulov, Drulis, 1996; Berdnikova, 2013; Berdnikova et al., 2014; Vdovin, Makarov, 2016).

Gremyachiy Klyuch. This object (probably two burials) was discovered in 1959, during construction works on a 35-meter terrace-like surface of the left bank of the Yenisey River, approximately 0.4 km west of the mouth of the ravine of Gremyachiy Klyuch brook. Given the amateur nature of the excavations, it can conventionally be suggested that the deceased were oriented with their heads to the east, downstream of the river; burials could have been partial, and fire was used in the ritual.

The grave goods are quite diverse (Fig. 2, *1–14*, *16–24, 26*). There are 99 finished items made of animal bones and teeth (pendants, points, needle case), 272 items made of shells (beads), 12 items made of stone (a pendant, an abrader, an adze, and arrowheads). The rest of the finds are various blanks, dominated by processed fragments of shells. Bone pieces of art include an ichthyomorphic pendant (Fig. 2, *22*) and an artifact in the form of an elk's head (Fig. 2, *23*) (both with carved ornamentation), as well as 11 pendants with images of waterfowl. Ten of the latter are made in low relief on plates, and are subdivided into three types, in accordance with the

Fig. 2. Materials from the Middle Neolithic burials in Baikal-Yenisey Siberia.
1–14, *16–24*, *26* – Gremyachiy Klyuch; *15*, *30–32* – Afontova Gora, 1977; *25*, *39* – Dachi Gorono; *27–29*, *33* – Afontova Gora, 1932; *34, 35* – Afontova Gora, 1937; *36*, *40–45*, *47–58* – Ust-Ilir cemetery; *37*, *38*, *46* – Generalov site; *59* – Zhigalovo. Author of photos and drawings *1–26*, *30–32*, *36*, *38*, *39*, *43–47*, *50*, *51*, *53* is I.M. Berdnikov, the rest are adapted after (Okladnikov, 1949: Fig. 1; Dzyubas, Abdulov, Drulis, 1996: Fig. 1, 2, 4–6; Vdovin, Makarov, 2016: 345; Berdnikova, 2013: Fig. 2; Berdnikova et al., 2014: Fig. 11).

style of the birds' images: 1) with the head facing forward in relation to the body, and a wide bent neck (Fig. 2, *4*); 2) with the head thrown back on a long neck, and an elongated beak (Fig. 2, *5–7*, *24*); 3) with the head in profile and a noticeably curved beak-tip (Fig. 2, *8–12*). One more pendant is a miniature three-dimensional figurine of a flying (?) bird (Fig. 2, *21*).

Dachi Gorono. This burial was excavated by Z.K. Glusskaya in 1955 on the left bank of the Yenisey River, about 6 km upstream from Gremyachiy Klyuch. The remains of a 30–35-year-old woman were found in the grave (Alekseyev, 1960); her skull was used by M.M. Gerasimov to make a reconstruction (Fig. 2, *25*). The burial is apparently partial. The supposed orientation of the buried is with her head to the north, perpendicular to the river's flow. The total number of finished items from the burial is at least 84, including pendants and beads made of bone, stone, and shells, a bone needle case (Fig. 2, *39*), stone tools (an adze, a biface, scrapers, a knife-shaped item, and a disc-shaped one). The collection of finds also contains a small amount of faunal remains with traces of treatment (probably tool blanks).

Afontova Gora, 1932. The burial was discovered by A.F. Katkov at the edge of a 15–18-meter terrace on the left bank of the Yenisey River (2 km downstream from Gremyachiy Klyuch), 20 m southwest of the museum-estate of G.V. Yudin (his former summer house/dacha). It was partially destroyed, and only a few teeth, bones, and a skull were preserved from the skeleton of a 30–35-year-old man (Solodovnikov, Bagashev, Savenkova, 2020). The deceased was possibly buried with his head directed to the south (perpendicular to the river's flow). Pieces of reddish mineral pigment and traces of its use in a powdered form ("ocher") were recorded in the grave. The grave goods include 373 items: shell beads, pendants made of animal bone and teeth (Fig. 2, *27*, *28*, *33*), and a three-dimensional bone pendant in the form of a swimming bird (Fig. 2, *29*).

Afontova Gora, 1937. This grave was excavated by A.P. Okladnikov, 3 m east of the previous burial. The remains belonged to at least two adults, but their skeletons did not retain anatomical integrity. As was established, the buried were oriented with their heads to the east (downstream of the river). Traces of "ocher" were noted throughout all the unearthed area. The total number of items from the grave is unknown. A significant number of mother-of-pearl beads, a few thin, rounded white beads (made from indeterminate material), bone points, and a stone flake have been found. Of greatest interest are a bone awl-like rod with a pommel in the form of a human head, and a small Ust-Belaya-type ceramic vessel (Fig. 2, *34*, *35*).

Afontova Gora, 1977. This burial complex was identified only by the exhibited finds collected by schoolchildren near the Afontova Gora burials described above. These include 46 shell beads, an item (a pendant or a plate) made of white mineral (talcite?), an arrowhead (Fig. 2, *15*, *31*, *32*), a bone needle case, three pendants made of animal bones and teeth, and one bone pendant with the image of a waterfowl (Fig. 2, *30*), identical to the items of the third type from the Gremyachiy Klyuch collection.

Generalov site. The site (more precisely, a campsite) is located on a 10–13-meter terrace-like surface on the right bank of the Chuna River, about 2 km upstream from the border of the Irkutsk Region and the Krasnoyarsk Territory. The burial was discovered during rescue works at the site. The grave-pit yielded traces of fire, as well as a part of the occipital bone of the skull, four teeth, and unidentifiable skeletal remains. The deceased was likely buried in an extended position, with his head to the northeast (upstream of the river). The sparse grave goods (nine finds in total) were dominated by stone items: an adze, an end-scraper, two arrowheads (Fig. 2, *37*), a knife (Fig. 2, *46*), two fragments of bladelets and a small pebble. In the area of the head of the deceased, there was a small Ust-Belaya-type ceramic vessel, placed upside down (Fig. 2, *38*).

Ust-Ilir cemetery. The grave was found approximately 2 km northeast of the Pribrezhnyi settlement, Bratsky District, Irkutsk Region, on a high (up to 10 m) left mouth section of the Ilir River (left tributary of the Iya River), partially flooded by the waters of the Bratsk Reservoir. A lot of human bones and archaeological artifacts have been collected on the beach surface: fragments of Ust-Belaya-type vessels (Fig. 2, *40–42*, *48*, *49*), pendants made from deer teeth, bone harpoon-tips (Fig. 2, *53*), arrowheads (Fig. 2, *36*), and other stone items, including polished ones (Fig. 2, *43–45*). The grave contained the remains of three individuals, buried in extended positions, with their heads to the

east-southeast, as well as traces of fire and "ocher" spots. Most of the surface finds were also painted with "ocher", which suggests their direct association with the burial.

The grave goods are quite rich and include a total of 107 items: stone tools (arrowheads, a knife, an adze, and an end-scraper), pendants made of deer teeth and bone (Fig. 2, *47*), decorated bone needle cases (Fig. 2, *50–52*), and a blank of a bone tool. In addition, the collection contains five bone pieces of art with representations of waterfowl: a plate with a symmetrical figure (Fig. 2, *57*) and four three-dimensional items, which can be divided into two types. The first includes three figurines, stylistically identical to the images on pendants of the third type from the Gremyachiy Klyuch (Fig. 2, *54–56*). The second one is a figurine of a swimming bird (Fig. 2, *58*), similar to the pendant from the Afontova Gora burial excavated in 1932.

Zhigalovo. This burial was completely destroyed during construction works. Its description was made from the words of local residents: the deceased was laid in the grave on his side (possibly with his legs bent), with his head to the northeast (perpendicular to the Lena River flow). The grave goods contain a bone clip of a side-bladed tool, a boar's tusk, and a bone arrowhead with a biconical point and a broken rod (Fig. 2, *59*).

Results of radiocarbon dating. Six new radiocarbon AMS-dates have been obtained for the burial complexes under consideration. Additionally, we use two more dates for the Zhigalovo burial (one obtained by the AMS-method, the other by the liquid scintillation counting (LSC) method), made more than ten years ago (see *Table*). All the AMS-dates look quite correct, as evidenced by the sufficient content of collagen in the samples, and the values of the carbon-nitrogen atomic ratio (C/N_{at}), which are within the normal range (Kuzmin, 2017: 181).

For almost all the burials (the exception is Afontova Gora, 1932), there are estimates based on bones of mammals that do not require correction for the freshwater reservoir effect (FRE), because $\delta^{13}C$ values (from 4.0 to 5.5‰) show a low trophic level of organisms, typical of herbivorous animals. The calibrated values of these dates range from 6251 ± 99 to 5864 ± 62 cal BP. If we do not take into account the LSC-date Ki 16434, they will range from 6182 ± 70 to 5864 ± 62 cal BP.

Results of radiocarbon dating of Middle Neolithic burials in Baikal-Yenisey Siberia

Lab code	Location	Year of excavations	Sample	$\delta^{15}N$, ‰	$\delta^{13}C$, ‰	Collagen, %	C/N_{at}	^{14}C-date, BP	Calibrated values, BP	
									Interval	Average
IGANams 9455	Gremyachiy Klyuch	1955	Bone (point), Cervidae	4.9	–21.2	35.7	3.1	5280 ± 25	6182–5943	6074 ± 66
PSUAMS 7549	Dachi Gorono	1955	Molar, *Homo sapiens*	13.1	–20.1	14.9	3.3	5845 ± 30	6742–6561	6662 ± 49
"	"	1955	Bone (blank of tool), Cervidae	5.5	–20.9	8.3	3.2	5130 ± 25	5984–5753	5864 ± 62
IGANams 9452	Afontova Gora (1932)	1932	Skull bone (petrous), *Homo sapiens*	13.8	–20.3	9.8	3.0	5790 ± 30	6664–6497	6589 ± 47
PSUAMS 7666	"	1932	"	13.1	–20.3	16.6	3.3	5720 ± 25	6622–6410	6510 ± 48
UCIAMS 260525	Ust-Ilir cemetery	1990	Bone of a large ungulate (harpoon)	4.0	–20.5	1.7	3.3	5370 ± 15	6275–6012	6182 ± 70
Ki 16434	Zhigalovo	1984	Tusk, *Sus scrofa*	…	…	…	…	5470 ± 80	6437–6004	6251 ± 99
TKa unnumb.	"	1984	Bone of a mammal (arrowhead)	5.4	–21.4	…	…	5310 ± 25	6189–5998	6090 ± 60

For the Dachi Gorono burial, in addition to the estimates based on faunal remains, a date from an anthropological sample was obtained, which is expectedly older owing to the radiocarbon offset caused by the FRE. The radiocarbon dating data for the 1932 Afontova Gora burial, obtained in different laboratories, closely matched, which once again testifies to their reliability; however, they do require a correction for FRE. It is also noteworthy that the AMS- and LSC-dates for the Zhigalovo burial showed similar values. Of course, the first looks more reliable, but the second is not much older, although with a wider calibrated interval.

Discussion

Among the burials described in this study, two groups can be distinguished on the basis of the features of grave goods. The first group is characterized by the presence of pendants with images of waterfowl (Gremyachiy Klyuch, Afontova Gora, 1932 and 1977, Ust-Ilir cemetery), the second, Ust-Belaya-type vessels (Afontova Gora, 1937, Generalov site). The Dachi Gorono burial should apparently be attributed to the first group, judging by the similar nature of its grave goods. The destroyed burial in Zhigalovo differs from the above burials and requires separate consideration.

Referring to the first group, it should be noted that, despite the significant remoteness of the Ust-Ilir cemetery from the Krasnoyarsk burials, their grave goods show an apparent similarity both in the tradition of depicting waterfowl (among which, the images of merganser, duck, and loon are well recognizable), and in categories of artifacts—arrowheads, ornamented bone needle cases, pendants made of bone and animal teeth. Some analogs can also be traced in the elements of the funerary rite. The dates of the burials of this group, judging by the data on faunal remains, fall within the range from 6182 ± 70 to 5864 ± 62 cal BP, or rounded to tens of years without indicators of standard deviation 6190–5900 cal BP. In general, these dates (excluding the date for the Dachi Gorono burial) correspond to the end of the hiatus (Fig. 3). The Afontova Gora burial of 1932, according to all archaeological evidence, should be contemporaneous with the burials of the group under consideration.

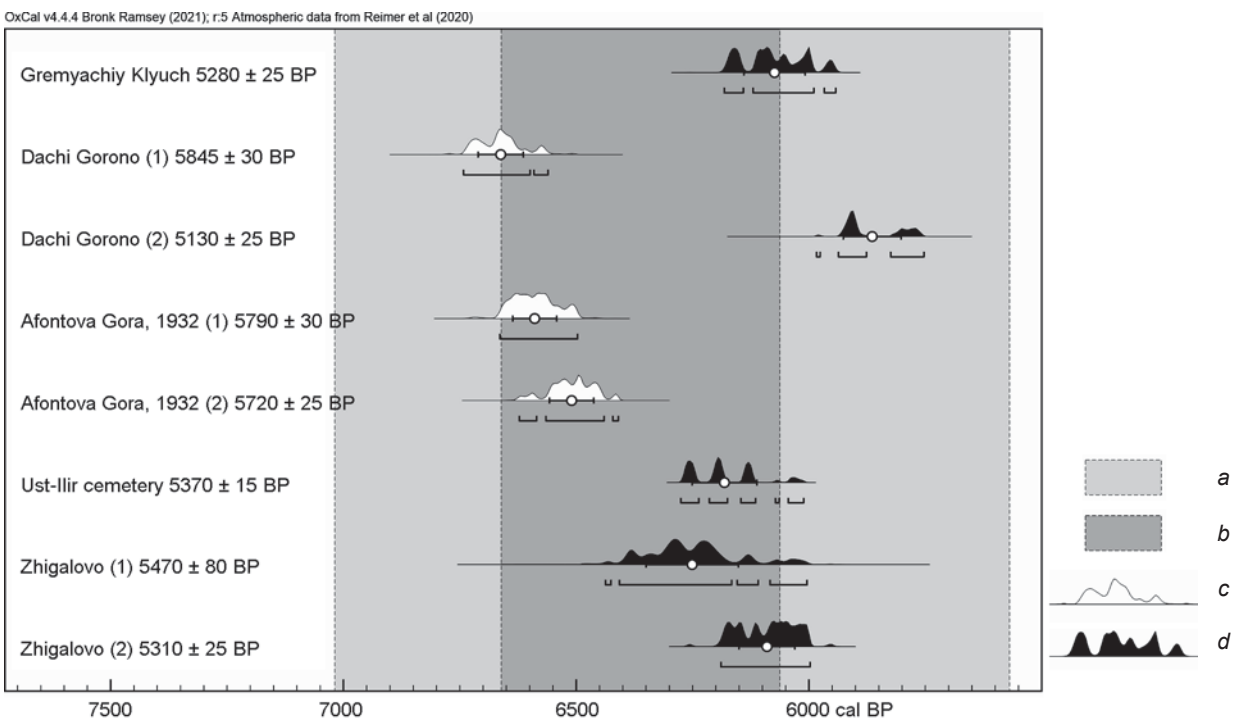

Fig. 3. Calibrated values of radiocarbon dates and their correlation with the period of the Middle Neolithic / hiatus.
a – Middle Neolithic / hiatus, after (Weber et al., 2016); *b* – Middle Neolithic / hiatus, after (Weber et al., 2021); *c* – dates obtained from human bones; *d* – dates obtained from faunal remains.

Burials of the second group are less informative. There are no radiocarbon dates for them either. However, the presence of Ust-Belaya-type vessels in the graves makes it possible to correlate them with the Middle Neolithic hiatus, on the basis of a reliable series of radiocarbon dates (~6.7–6.3 ka cal BP) for the pottery of this type in the southern Angara region (Berdnikov, Goryunova, Novikov et al., 2020). The burial from Generalov site also shows some similarities with the burials of the first group in the form of arrowheads, and partly in the funerary rite.

The burial complexes of the first group were possibly also left by hunter-gatherers who made Ust-Belaya-type ceramics. This assumption is supported not only by the fragments of vessels of this type from the Ust-Ilir cemetery (which are most likely associated directly with the burial), but also by a three-dimensional ornithomorphic figurine from the lower horizons of Sergushkin-1 site (Point A) in the northern Angara region (German, Leontiev, 2013: Fig. 9, *15*), associated with the Ust-Belaya ceramic complex, which is clearly represented at the site.

Analyzing fragmentary data on the funerary rites of both groups, we can say that some burials are probably partial, and the deceased were often oriented with their heads to the east (towards the sunrise?). There are also such manifestations of the rite as the use of fire and "ocher", but these signs are indicative.

The Zhigalovo burial is a unique phenomenon for Baikal-Yenisey Siberia, because its grave goods include a bone arrowhead with a biconical point, which is atypical of the region. We know of only one report of a similar find in the middle Yenisey (Okladnikov, 1957: 49). Such arrowheads were widely spread in the Mesolithic-Chalcolithic archaeological complexes of European Russia and the Urals (see, e.g., (Zhilin, 1996; Serikov, 2018; Lozovskaya, 2019)). If we turn to the materials from the burials, then the closest territorial parallels are the finds from the Neolithic and Early Metal Period sites of Western Siberia, including such cemeteries as Vaskovskiy, Yaiskiy, Lebedi-2, Ust-Aleus, Sopka-2, Vengerovo-2A, Ust-Tartas-2 (Borodkin, 1967; Molodin, 2001: Fig. 2, *1*; 27, *1*; Marochkin, 2014: 18–45, fig. 2, *6*; Molodin, Mylnikova, Nesterova, 2016: Fig. 13, *9*; Molodin et al., 2020: Fig. 3, *4*).

The image of waterfowl is another important category for comparative analysis. In the art of the Neolithic-Chalcolithic of Eastern Europe, the Urals, and Western Siberia, it is a rather common subject (Gurina, 1972; Chairkina, 1998; Zhulnikov, Kashina, 2010; Morozov, Umerenkova, 2015; Serikov, 2019). Ornithomorphic bone images are also found in burials. In the territory of the Urals and Western Siberia, these are known from such cemeteries as Yaiskiy, Korchugan, Vengerovo-2A, Trekino, as well as from the burial in the grotto of the Dozhdevoi Stone (Matyushchenko, 1961: Fig. 47, *1*; Bobrov, 1990: Fig. 1, *1*; Molodin, Novikov, Chikisheva, 1999: Fig. 4, *2–10*; Molodin, Mylnikova, Nesterova, 2016: Fig. 13, *9*; Serikov, 2019: Fig. 2, *9–12*). Leaf-shaped stone arrowheads and bone pendants (drop-shaped and oval) are also rather common categories of Neolithic grave goods in burials of Western Siberia (see, e.g., (Polosmak, Chikisheva, Balueva, 1989: 21–25; Molodin, Novikov, Chikisheva, 1999; Marochkin, 2014; Molodin, Mylnikova, Nesterova, 2016; Molodin et al., 2020; Borodaev et al., 2022)).

It is rather difficult to compare the features of the funerary rite at the burials in Baikal-Yenisey Siberia with those at the above West Siberian complexes owing to the disproportionality of the available data, both in quantitative and qualitative terms. Nevertheless, among the common (but, apparently, not always mandatory) elements, we can single out the partial nature of burials, and the use of fire and "ocher" for ritual purposes (Molodin, Mylnikova, Nesterova, 2016).

Radiocarbon dating results have not yet allowed us to clarify the nature of interregional relations, because of the scarcity of correct determinations for the Neolithic burials of Western Siberia. Recently, sufficiently reliable dates for the circle of burials, which include Vengerovo-2A (with an ornithomorphic pendant and a Shigir-type arrowhead), were obtained for the Avtodrom-1A cemetery (Bobrov, Marochkin, Yurakova, 2020). Their calibrated values lie in the range of 6744–6495 cal BP (our calibration). Taking into account that the dates were obtained from samples of human bones, this cemetery is contemporaneous to the Middle Neolithic burials in Baikal-Yenisey Siberia. However, archaeological complexes of this type are associated with the Artyn culture (Molodin et al., 2020; Bobrov, Marochkin,

Yurakova, 2020), whose ceramics have little in common with the pottery traditions of Baikal-Yenisey Siberia. Consequently, it is inappropriate to speak of direct parallels in this case.

Conclusions

On the basis of reliable radiocarbon data obtained for Baikal-Yenisey Siberia, a group of burial complexes was revealed, whose age (6190–5900 cal years) corresponds to the Middle Neolithic. They partly fill the late stage of the hiatus identified based on the materials from the Cis-Baikal region.

As a result of the analysis of features of the burial practices and grave goods of the Middle Neolithic complexes, a circle of internal and external relations was identified in general terms, allowing the following conclusions to be drawn.

1. One of the leading subjects in the art of the population of this stage is an image of waterfowl, and the most common categories of grave goods are leaf-shaped stone arrowheads, shell beads, and pendants made of animal bones and teeth.

2. The funerary rite shows cases of ritual actions with the use of fire and "ocher", and of disrupting the anatomical integrity of the skeletons (in two cases, the burials are supposedly partial, but this requires verification).

3. Most of the burials were apparently left by the carriers of the Ust-Belaya pottery tradition.

4. The culture of the Middle Neolithic population of Baikal-Yenisey Siberia is quite distinctive, but the presence, among the grave goods, of the Shigir-type arrowhead and figurines representing waterfowl suggests cultural ties with the Urals and Western Siberia.

The issues of the chronological break in mortuary traditions are not fully resolved by the present study. However, in this case, it is important to understand that the Middle Neolithic of the region is a more complex phenomenon than the hiatus, and their chronological ranges may not coincide. The issues raised in this article should be solved with the wide use of interdisciplinary data, primarily those obtained from radiocarbon AMS-dating and paleogenetic studies.

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V.I. Molodin
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: molodin@archaeology.nsc.ru

The Most Important Archaeological Discoveries Relating to the Neolithic to Early Iron Age Cultures of Siberia

On the basis of the current knowledge, key archaeological discoveries made in Siberia and the Russian Far East over the three centuries, and spanning the interval from the Neolithic to the Early Iron Age, are assessed. Principal scholars and their works are listed. Rescue excavations have made it possible to construct archaeological typologies and to model historical and cultural processes. D.G. Messerschmidt's role as the discoverer of the Early Iron Age of Khakassia and of the Tom rock art site is described. Later, this rock art site was thoroughly studied by A.P. Okladnikov and A.I. Martynov. Achievements of the 20th century continued those of the 18th and 19th centuries. On the basis of typologies elaborated by S.A. Teploukhov for Khakassia, similar cultural and chronological models for neighboring areas of Western Siberia were constructed. A.P. Okladnikov's typology for the Cis-Baikal Neolithic and Bronze Age were elaborated by his colleagues and students. The earliest stages of the Amur Neolithic with the most ancient ceramics in Northern Asia, dating to 16,780–14,200 cal BC, were described. E.N. Chernykh's and S.V. Kuzminykh's theory of Seima-Turbino—a transcultural phenomenon of key importance for the Eurasian Bronze Age—is outlined. While its basic features are better known today, their theory has retained its relevance. With regard to the Early Iron Age, the major excavations concerned mounds such as Arzhan-1, Arzhan-2, and Chinge-Teya-1 in Tuva. In the Altai Mountains, likewise outstanding Pazyryk kurgans (600–200 BC) were excavated. An entirely new stage in Scythian age archaeology was marked by N.V. Polosmak's excavations of "frozen", undisturbed burials of middle-ranking and low-ranking Pazyryk people on the Ukok Plateau. Similar burials were excavated by Z. Samashev and H.P. Francfort on the western slopes of the Altai. Pazyryk chronology was elaborated owing to the use of the tree-ring analysis.

Keywords: *Siberia, Far East, Early Iron Age, hypotheses, discoveries, cultural and chronological models, researchers.*

Introduction

It has become clear today that importance of any discovery depends largely on the level of knowledge obtained from interdisciplinary studies of archaeological sources, which highlights the fundamental nature of the discovery (Derevianko, Molodin, Shunkov, 2007).

Archaeological research currently carried out as a part of rescue works often yields a conceptually new assessment of unique discoveries made, for example, in the north of Siberia. The evidence from rescue excavations allowed researchers to elaborate the models for historical and cultural periodization (see M.P. Gryaznov for the Upper Ob region (1956) and V.F. Gening and his students for the Middle Irtysh region (1970), etc.).

A fundamentally new research area, which has been developing more and more actively each year, is archaeology of Russians in Siberia. A good example is the study of Mangazeya, initiated by M.I. Belov, O.V. Ovsyannikov, and V.F. Starkov (1980, 1981).

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Especially important results were obtained from excavations of lower permafrost layers under direction of G.P. Vizgalov (Vizgalov, Parkhimovich, 2008). Clearly, the written sources on the development of Siberia by the Russians cannot be exhaustive, and excavations of sites left by the Russian population contribute to expanding the corpus of material sources for the study of military, political, economic, and cultural development of Siberia by the Russians in the 16th–18th centuries (Tataurova et al., 2022).

Research into rock art of Siberia and the Far East, initiated and largely carried out under the leadership of A.P. Okladnikov and his students, has undoubtedly resulted in some of the most important discoveries in archaeology of Siberia. Remarkable rock art sites were discovered and copied on the Angara, Tom, Lena, and Amur rivers, Lake Baikal, and in the Altai Mountains and Mongolia (see, e.g., (Okladnikov, 1959, 1966, 1971)).

Noteworthy are many years of preparation and publication of the "Archaeology of the USSR" (published in 20 vols.), where considerable space was given to various periods of archaeology of Siberia in several volumes. The general idea of this edition belongs to B.A. Rybakov (see, e.g., (Epokha bronzy…, 1987)).

The purpose of this article is to describe the most significant discoveries in archaeology of the Late Bronze Age in Siberia.

Research results

The works of D.G. Messerschmidt (2020) in Khakassia should be mentioned as the most important study in archaeology over the past three hundred years. In this region, Messerschmidt made first scholarly excavations of the Early Iron Age cemeteries, which were later attributed to the Tagar archaeological culture (Radlov, 1888: App. 13). These studies were carried out at a fairly high scholarly level for their time. The discovery of the Yenisey inscriptions on the Uibat stele by Messerschmidt is if particular importance. The inscriptions were deciphered in our time by the corresponding member of the Soviet Academy of Sciences S.E. Malov (1952).

Information on the wonderful world of Siberian archaeology was first published in Stockholm in 1730 in a book of P.J. Strahlenberg (1730), who took part in the Messerschmidt's expedition. The book was republished in Germany, was translated into English, French, and Spanish, and became world famous.

Apparently, Messerschmidt may also be credited with discovery of the Tomskaya Pisanitsa, a remarkable rock art site on the Tom River* (Tunkina, Savinov, 2017). Many scholarly and popular works have analyzed the images from the Tom rock art site. The studies clarified available data and suggested new ideas for its interpretation (see, e.g., (Kovtun, 2013; Rusakova, 2012; and others)). In 1970s, Academician A.P. Okladnikov and A.I. Martynov made a great contribution to studying this site. They also wrote the monograph "Treasures of the Tom Rock Art Sites" (1972).

Scholars of the 18th–19th centuries laid the foundation for further research, which allowed researchers of the 20th century to reach a qualitatively new level of comprehensive interpretation of evidence. Almost a hundred years ago, S.A. Teploukhov proposed his periodization of history for some regions of Siberia, and it became the basis for developing periodizations of historical and cultural processes for a number of Siberian regions. The chronological model for the development of archaeological cultures in Southern Siberia was preceded by targeted eight-year excavations by Teploukhov in Khakassia, as well as his careful study of museum collections. According to Teploukhov's research (1927, 1929), thirteen "chronological groups" successively replaced each other in the region: 1) Afanasyevo culture; 2) Andronovo culture; 3) Karasuk culture; 4–7) Minusinsk Kurgan culture (with four stages in its development); 8, 9) Tashtyk culture (two stages were distinguished); 10) stone kurgans of the 5th–7th centuries; 11) single stone kurgans of the 7th century; 12) stone kurgans of the 8th–10th centuries, and 13) flat graves of the 11th–12th centuries. Notably, Teploukhov both elaborated a typology and also proposed the chronological framework for the stages (and he did it without radiocarbon analysis, which was not available in the 1930s).

Although periodization by Teploukhov should have included the Okunev culture identified by G.A. Maksimenkov (1965) between the Afanasyevo and Andronovo, it remains a working model even today. Models for historical and cultural development of the adjacent regions of Western Siberia have been developed on its methodological basis, including periodization of processes in the Upper Ob region, proposed by M.P. Gryaznov (1956), in the Ob region of the Tom by V.I. Matyushchenko (1973a, b, c; 1974), in Tuva by A.D. Grach (1980), in the southern taiga zone of Western Siberia by M.F. Kosarev (1981), in the Plain Altai by Y.F. Kiryushin (1986), in the forest-steppe Ob-Irtysh region by V.I. Molodin (1983), etc.

Periodization of the Neolithic and Bronze Age cultures in the Baikal region by A.P. Okladnikov (1950, 1955), which has not lost its scholarly value until today, was one of the most successful historical and cultural models based on the representative and original evidence. Chronological boundaries of individual stages identified by Okladnikov have been corrected using radiocarbon dates. Periodization was further developed in the works

*Its publication by P.J. Strahlenberg was already a "planigraphic composite" (Kovtun, Rusakova, 2021).

of N.N. Mamonova, L.D. Sulerzhitsky (1989, 2008), L.P. Khlobystin (1996), and N.A. Saveliev (1989). Currently, following up the model by Okladnikov, scholars continue to improve systematization of the Neolithic complexes in the region.

Particularly noteworthy is the periodization of the Amur Neolithic based on the evidence from large-scale excavations by the Far Eastern Archaeological Expedition led by Okladnikov, identifying the earliest periods of the Neolithic (dated to the Late Pleistocene) with the earliest pottery in North Asia. These periods correlate with the Gromatukha culture in the Western Amur region (Okladnikov, Derevianko, 1977), dated to 10,400–13,300 BP (Radiouglerodnaya khronologiya…, 1998: 87), and Osinovka culture in the Lower Amur region, dated to 13,260–9890 BP (Derevianko, Medvedev, 1995). In addition, another four successive Neolithic cultures—the Mariinskoye, Malyshevo, Kondon, and Voznesenskoye—have been identified in the region. Distinctive and original material evidence of these cultures (Medvedev, 2022) testifies to emergence of pottery production in the Amur region in the Late Pleistocene.

The importance of discovering ancient pottery goes beyond the scope of individual field of Humanities, because this was the first ever invention of an artificial material. The range of the carbon dates for the earliest pottery in the Lower Amur region ranges from 16,780 to 14,200 cal BC.

Currently, Gasya is the only site in Russia yielding the early pottery which paste contains only two components: clay and organic matter. According to V.E. Medvedev and Y.B. Tsetlin (2013, 2017), raw material for producing the earliest pottery in the region was not clay, but silt. Traces of artificial admixture ("organic solution") have been detected in the shards of some finds. A specific feature of the Gromatukha pottery is the presence of vegetable organic matter in the paste (Okladnikov, Derevianko, 1977). The common features of the earliest pottery assemblages from East Asia are their paucity and fragmentation. The collections include from several tens to several hundreds of small vessel fragments. One of the features of the earliest pottery from the Lower Amur region is the flat bottom. Such dishes were rarely decorated. When present, ornamental decoration was applied to the upper part of the vessels by imprints of comb, smooth, and rope stamps, and pit impressions of a stick with rounded end (Medvedev, Tsetlin, 2017). Firing was predominantly low-temperature and weak, and was carried out in ordinary open fire (Derevianko, Medvedev, 2006).

Articulation by E.N. Chernykh and S.V. Kuzminykh of the issue of the Seima-Turbino bronzes—identification of place and time of discovering the thin-walled castings (specific bronze weapons in the form of massive forked spearheads, celts, and single-edged daggers with figurate pommels)—was certainly of fundamental importance for studying the Bronze Age of Eurasia (1987: 100–105; 1989).

The Seima-Turbino transcultural phenomenon and the related issues are supplemented with new details because of the discovery of new funerary and settlement complexes studied in the field (see, e.g., (Korochkova, Stefanov, Spiridonov, 2020; Satyga XVI…, 2011; Molodin et al., 2015)), expansion of collections with artifacts from these sites, such as solid cast bronze daggers (Molodin, 2015), and finds of similar items in China. Chernykh and Kuzminykh elaborated the first typology of the Seima-Turbino bronzes, which remains unchanged to this day. The theory of the Seima-Turbino cultural phenomenon has not lost its relevance; however, the currently available opportunities allow the interpretation of its individual components in a new way. For example, Chernykh proposed to consider the place of origin of the Seima-Turbino bronzes ("the starting point of the phenomenon") more southern regions of Xinjiang than previously thought (2013: 391). The carriers of the Seima-Turbino technological traditions moved up the Irtysh River to Western Siberian forest-steppe not only in the northwestern, but also in the northeastern direction. However, the presence of the second, Eastern Siberian, component has not been confirmed so far.

The chronological framework of this phenomenon also needs to be corrected. It is believed today that it emerged in the mid–second half of the 3rd millennium BC; therefore, its time of existence significantly increases (Molodin, 2013). Obviously, in the future, with accumulation of sources, we may expect new discoveries related to the Seima-Turbino transcultural phenomenon and new ideas for its interpretation.

An important event in archaeology of Siberia became the excavation of the Early Scythian kurgans of Arzhan-1, -2, and Chinge-Teya-1 (the latter is still in the process of excavation) in Tuva, which contained burials of "kings" or chiefs. Arzhan-1 has the most sophisticated structure of huge logwork consisting of numerous compartments, which is covered with stone embankment. One hundred and sixty riding horses were buried in the compartments. Six log chunks are located around the central logwork, where several people and horses were buried. The kurgan is surrounded by numerous altars. According to Gryaznov, in that burial mound, the "king" and "queen" wearing lavish clothes were buried. They were accompanied by rich grave goods, including a massive (unparalleled in size) bronze plaque of a predator curled up into a ring. The buried horses might have been the gifts from the vassal and independent neighboring tribes. The site was initially dated to the 8th–7th centuries BC, but radiocarbon analysis and dendrochronology gave the date of the 9th century BC. Gryaznov described the evidence from

Arzhan in a brilliant monograph (1980), for which he was awarded the State Prize of the USSR.

Excavations in the Valley of the Kings in Tuva continued at the turn of the 21st century. Research of the Arzhan-2 kurgan was carried out under the leadership of K.V. Chugunov, H. Parzinger, and A. Nagler (Čugunov, Parzinger, Nagler, 2006; Chugunov, Parzinger, Nagler, 2017). A male and female burial, containing many items, was discovered in the kurgan. A large golden torque, horse figurines crowning the headdress, various gold plaques, and items of richest military equipment made of iron and decorated with gold, accompanied the deceased male. The outfits of the buried persons were decorated with golden figurines of panthers. The assemblage included bronze cauldrons and wooden dishware. The kurgan was dated to the 7th–6th centuries BC. Several funerary chambers with burials of people and horses were found under the mound. The studies of the Arzhan-2 kurgan yielded unique and highly artistic items, which have been comprehensively studied by scientific methods.

In 2022, Chugunov began to explore the royal tomb named Chinge-Teya-1 in Tuva. Male burial No. 9, which was found there, was similar to the male burial from Arzhan-2 in terms of grave goods and funerary rite. The finds from this assemblage included a classic vase of glass made by the artisans of the Assyrian state. This burial is a unique complex of the Early Scythian period; its materials significantly expand the wealth discovered in Arzhan-2.

World-class complexes belonging to the Pazyryk culture of the Early Iron Age (6th–3rd centuries BC) have been discovered and explored in the Altai Mountains and adjacent regions of Southern Siberia. Academician V.V. Radlov studied first burial complexes of the Pazyryk culture in 1865, during the excavations of the Berel and Katanda kurgans (1989). The culture gained wide popularity after research of the 1st Pazyryk mound by Gryaznov (1950), as well as four mounds at the Pazyryk cemetery and two probably royal mounds at the Bashadar cemetery by S.I. Rudenko (1953, 1960). These complexes reveal an unprecedented world of material and spiritual culture of the Siberians living in the Altai Mountains in the Scythian period. The finds, often highly artistic, were preserved by permafrost lenses. They strike the viewer with sophisticated technique of metal, fabric, fur, leather, and wood processing. The collections include amazingly perfect items of weapons and everyday life, as well as magnificent carpets and fabrics, saddle covers, vehicles made of wood, and imported items from China and Asia Minor. Plastic and applied arts, which evolved in the framework of canons of the Scythian-Siberian animal style, manifest the richness of the spiritual world of the Pazyryk people.

A qualitatively new stage in studying not only the culture, but also Scythian issues in general, was associated with the discovery of Pazyryk kurgans with permafrost on the Ukok plateau by N.V. Polosmak (1994, 2001). "Frozen" undisturbed burials of the middle class representatives of the Pazyryk society, as well as ordinary nomads, were studied for the first time in the world. Field research was carried out at a qualitatively new level, with restoration and conservation of numerous items and mummies of a female and a male. The sources obtained were interpreted using natural and exact sciences (Fenomen…, 2000), which significantly expanded our knowledge on the culture and its carriers who lived in Southern Siberia. Z. Samashev and H.P. Francfort (Samashev, 2011) carried out excavations of Pazyryk kurgans with permafrost on the western Altai slopes. According to A.A. Tishkin and P.K. Dashkovsky, over a thousand Pazyryk burials have been studied (2003); yet, complexes with permafrost remain the main source of information.

The chronology of the Pazyryk sites in the Altai Mountains has been clarified using the methods of dendrochronology. It has been established that all sites in Ukok and adjacent areas of Mongolia belonged to a time span of fifty years with the calendar interval of 326–275 BC (Slyusarenko, 2011: 248). Multidisciplinary studies reveal ethnic syncretism of the Pazyryk people, while data from archaeology, linguistic paleontology, and anthropology indicates autochthonous Mongoloid component as a basis for these people, who at the same time were associated with representatives of the Saka ethno-cultural community (Chikisheva, 1996, 1997). According to paleogenetic studies, the set of the mtDNA variants of the Pazyryks in the Altai Mountains was close to those of the Samoyeds (Molodin et al., 2000). The mtDNA variants identified in the carriers of the Pazyryk culture in Northwestern Mongolia suggest the western vector of connections typical of the east of Southwest Asia (Pilipenko et al., 2010). The dominants of the indigenous (Samoyed) and alien (Iranian) components could be different in different parts of the Pazyryk area (Molodin, 2011). For the study of the unique Pazyryk complexes, the researchers were awarded the State Prize of the Russian Federation in the field of science and technology.

Main discoveries in the archaeology of Siberia and the Far East have been described in the two volume "The History of Siberia" (Istoriya Sibiri, 2019: Vol. 2; 2022: Vol. 1). Leading scholars, mostly from the Institute of Archaeology and Ethnography of the Siberian Branch of the Russian Academy of Sciences, as well as other scientific centers of Russia, participated in the edition. Large-scale exploration of Siberia continues, and there is no doubt that future brilliant world-class discoveries will further enrich our knowledge of the history of Russia.

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L.V. Zotkina and S.V. Sutugin
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: lidiazotkina@gmail.com; sutuginsergey@gmail.com

Possibilities of Direct Dating of Rock Art in the Khakass-Minusinsk Basin

The study addresses modern methods of absolute dating of rock art. We review prospective approaches to dating petroglyphs under various conditions: AMS, OSL, uranium-thorium, and cosmogenic isotope. Not so much methods per se are discussed as principles of their application to certain reliably dated rock art sites of various periods in Europe, Asia, America, and Australia. Examples of satisfactory outcomes in international practice are cited alongside our assessment of prospects and limitations to be considered with regard to the method of dating the earliest petroglyphs and rock paintings in the Khakass-Minusinsk Basin. The review suggests that the basic conditions for the use of the uranium-thorium method are not met, the AMS method requires a preliminary analysis of the context, whereas OSL and cosmogenic isotope method are the most prospective.

Keywords: *Rock art, direct dating, Khakass-Minusinsk Basin.*

Introduction

In the Khakass-Minusinsk Basin, dated rock art images from almost all historical periods are known: the Early Bronze Age is represented by Okunev art, the Late Bronze Age by petroglyphs of the Karasuk tradition, the Iron Age by Tagar, Tes, and Tashtyk art, the medieval period by a peculiar figurative tradition of the Yenisey Kyrgyz. The association of these art styles with the archaeological cultures of the region is considered proven; however, the correlation of the rock images with certain ancient periods, without reliable connection to the archaeological context, is not well grounded.

Most researchers consider the "Minusinsk" style to be the earliest in the region (Podolsky, 1973; Miklashevich, 2020). They argue that the petroglyphs of this style are made in an archaic manner, which is atypical of the younger periods, for example, the Bronze Age. The subject (wild animals, often large in size) also indicate an old age (Miklashevich, 2015). In palimpsests, images of the "Minusinsk" style are always overlaid with later petroglyphs (Sher, 1980: 191; Zotkina, 2019). However, this evidence can only be considered as circumstantial.

There are various hypotheses concerning the chronology of the "Minusinsk" style. N.L. Podolsky proposed to date it to the Neolithic–Late Bronze Age (1973); Y.A. Sher did not exclude the possibility of an Upper Paleolithic age for this style (1980). N.B. Pyatkin and A.I. Martynov attributed the "Minusinsk" style to the Stone Age (1985), and E.A. Miklashevich (2015) agreed with this attribution. Y.N. Esin and I.D. Rusakova dated this style to the Early Bronze Age and attributed it to the Afanasyevo culture (Esin, 2010; Rusakova, 2005). I.V. Kovtun correlated the "Minusinsk figurative type" with the

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Late Bronze Age (2001: 152–153). However, none of these hypotheses has been fully justified (Miklashevich, 2020). Thus, the time of emergence and existence of the "Minusinsk" style, as well as the origins of the rock art in the Khakass-Minusinsk Basin, are still debatable.

Until recently, petroglyphs on open surfaces were dated exclusively through the method of analogs or stratigraphic analysis. Twenty years ago, most of the absolute dating techniques were almost unused to determine the age of discovered rock art sites (Devlet, 2002: 64–70). Modern approaches to dating have led to qualitative changes in the strategy of rock art studies and chronological attribution. Direct dating of the earliest rock art of the Minusinsk Basin can be one of the techniques to solve the issue of its age.

This article provides an overview of effective methods and approaches to rock art dating, which have been tested at sites in various parts of the world. The presented information provides the basis for correlating the available research experience with the tasks of dating the earliest rock art of the Khakass-Minusinsk Basin and other areas, with respect to the regional specifics.

Dating techniques

Radiocarbon analysis. The age (time of death) of the studied organism is determined by comparing the initial (at the moment of equilibrium with the concentration of atmospheric carbon) and the residual amount of ^{14}C therein. Under normal circumstances, the limit for measuring the ^{14}C decay rate is eight half-lives (5730 ± 40 years), i.e. approximately 45 thousand years (Walker, 2005: 19). The AMS-dating technique is suitable for charcoal rock paintings (Valladas, 2003). Any other organic residues detectable in the composition of the pigments (binders) can also be dated by the AMS method. In most cases, the organic components of ancient dyes have not survived, but sometimes it is possible to identify the products of their decomposition—calcium oxalates, which can be used to establish radiocarbon dates.

One of the main limitations of the radiocarbon method is the half-life limit of ^{14}C (Walker, 2005: 19; Lowe, Walker, 1997); it does not apply to most rock art sites known to date, because in only very few of them can the estimated age fall outside this limit*.

*Today, the oldest reliably proven age of rock art in the world is 45 thousand years (Sulawesi Island, Indonesia) (see, e.g., (Finch et al., 2021)).

Uranium-thorium (U-Th) dating. The technique is based on the measurement of the ^{230}Th–^{234}U isotope ratio in the carbonate formation ($^{238}U = {}^{234}U + {}^{230}Th$). Uranium dissolves in water and is easily transferred to calcite; thorium does not dissolve, it is the product of uranium decay in the rock. The dating materials are various carbonate formations. This method is used in studies of objects aged in the range of 10 thousand to 350–400 thousand years (Kuzmin, 2017: 187–191).

Limitations are associated with detrital contamination of samples—microscopic particles of clay and dust, adsorbing radioactive substances, which can provide additional supply and leaching of uranium. In this case, the system is not closed, and its dating may lead to an incorrect age estimation of the sample. The considerable thickness of the sample does not guarantee a closed system, since the process of uranium supply or leaching could be restarted, and not simultaneously (Pons-Branchu et al., 2020). Sampling in stratigraphic order can prove that the sample is stable, if the dates derived are chronologically consistent (Ochoa et al., 2021: 96–97).

Optically stimulated luminescence (OSL) dating. This method is used to determine the time elapsed since the object under study was last exposed to radiation (sunlight), and the duration of the object's exposure to light. The method is based on measuring the intensity of luminescence (sunlight) resulting from the release of energy accumulating in the crystal structure of minerals (namely quartz and feldspar) being part of the rocks. The usability of quartz and feldspars for dating is based on two main processes: energy accumulation and its zeroing or illumination (Panin, 2010; Duller, 2008; Murray et al., 2021). When using quartz as a dosimeter mineral, the OSL-method is applicable for dating the samples from 1 year to 120–150 thousand years old; using feldspar, up to 300–500 thousand years old (Kuzmin, 2017: 207–211).

The OSL-method is used mainly for dating loose deposits. This technique can be used for determining the age of rock art in the case where sedimentation took place under special conditions, and the deposits at least partially overlap the images. OSL-dating of the rock itself involves more complex sample preparation (Brill et al., 2020). Fragments of the rocky surface associated with various episodes of the geological history of the studied object can be used as samples (Sohbati et al., 2012).

Cosmogenic isotope dating (based on terrestrial cosmogenic nuclides (TCN)). This method is based on measuring the amount of daughter nuclides formed in the surface layers of the rock during splitting of the

atoms that make up the minerals of quartz, feldspar, beryllium, chlorine, etc., due to the interaction of high-energy particles, entering the atmosphere from space, with atoms of air gases. The amount of terrestrial nuclides determines the age of rock outcrops (Granger, 2014; Fujioka et al., 2022). The TCN-method is used to obtain the age of rock exposure in the range from 100 years to 5 million years (Akçar, Ivy-Ochs, Schlüchter, 2008).

The limitations of this method are associated with erosion processes, which lead to the loss of nuclides accumulated in the rock's surface, and with rock's shielding from cosmic radiation by vegetation, snow cover, and loose deposits (Panin, 2010: 51).

Benefits and limitations of direct dating of rock art

AMS-dating. There are many known cases of successful determination of the age of rock paintings by the charcoal used. These are associated mainly with classic cave art sites in Europe, such as Chauvet-Pont d'Arc, Niaux, Gargas, Cosquer, Altamira, and others (Valladas et al., 1992, 2010, 2017; Atlas…, 2020; García-Diez et al., 2013: Tab. 2). The method of direct AMS-dating of pigment has proven to be very effective, and gives the possibility of determining the time of creation of charcoal paintings with great accuracy. Today, this approach is broadly used for chronological attribution of rock art sites all over the world (O'Regan et al., 2019; Moya-Canoles et al., 2021; Šefčáková, Levchenko, 2021; Rowe et al., 2021; Bonneau et al., 2022). However, until recently, direct radiocarbon dating of many paintings made with mineral pigments has been considered impossible. In some cases, the composition of pigments shows organics: for example, fibers, surviving components of binders, or their decomposition products (calcium oxalates); these substances can be dated by the AMS-method (Ochoa et al., 2021). An important advantage of this approach is that it is applicable to many paintings made with manganese or iron oxide, and even to those on open surfaces (Pecchioni et al., 2019). Organic substances are most often not detected in the composition of pigments; however, some binders (for example, animal fat, blood, etc.) might have been converted into calcium oxalates—a product of microbial activity (Watchman, 1993; Arocena, Hall, Meiklejohn, 2008; Lofrumento et al., 2011). An important preparatory stage for this dating includes comparative analysis of the chemical composition of the analyzed pigments, substrate, and deposits at the site (Pecchioni et al., 2019: 333). In such a way it is established whether the formation of calcium oxalate at a given locality is related to environmental features (Livingston, Robinson, Armitage, 2009). If it can be proven that the calcium oxalate in the dye is a product of the decomposition of organic binders intentionally added by humans, the pigment can be successfully dated by the AMS-method (Brook et al., 2018; Pecchioni et al., 2019; Steelman, Boyd, Allen, 2021).

Spanish researchers used a rather peculiar approach to the dating of calcium oxalates of painted images on the walls of the rock shelters of Sierra de las Cuerdas and Cueva del Tío Modesto (Hernanz, Gavira-Vallejo, Ruiz-López, 2007). The red pigment contained no organic components, but the overlapping bluish-gray crust associated with lichen activity yielded calcium oxalates. Microstratigraphy of the samples taken showed that the pigment had been applied more than once, and had been repeatedly overgrown with lichen (Ibid.: 515, 518). The rock paintings were shown to have been created between 5000 and 1000 BC (Ruiz et al., 2009).

U-Th-dating. In recent years, Indonesian rock art has been reliably dated through a series of predominantly U-Th dates (Aubert et al., 2014, 2018, 2019; Ilmi et al., 2021; Brumm et al., 2021). By now, the proven oldest age of rock art in the world has been established on the basis of coralloid speleothems overlaying naturalistic images of Javan pigs in the caves of Leang Bulu' Sipong-4 (43,900 BP) and Leang Tedongnge (45,500 BP) on Sulawesi. An important advantage of speleothems from Indonesian sites (as compared, for example, with calcites from sites in other regions of the world) is the closed system, which is reliably proven by the stratigraphy.

AMS- and U-Th-dating of images has been used successfully in cave sites on the Iberian Peninsula. More than 100 radiocarbon and more than 130 uranium-thorium dates provide solid evidence of the appearance of parietal art in this area as early as in the Aurignacian (Ochoa et al., 2021). The age of the images in La Pasiega Cave—64,800 BP (U-Th)—arouses considerable debate (Hoffmann et al., 2018). Such an early date caused great doubt in the scientific community (Slimak, Fietzke, Geneste, 2018; White et al., 2019). The study of rock paintings in Nerja Cave has convincingly proven that speleothems of great thickness may have been an open system, in which the processes of uranium input or leaching were restarted, so the dates obtained are not reliable (Pons-Branchu et al., 2020).

AMS-dating was used to determine the age of the charcoal paintings in Altamira Cave in the range from 19,000 to 15,000 BP, which suggested attribution of the images to the Magdalenian period (Valladas et al., 1992; Moure et al., 1996; Moure, Gonzalez Sainz, 2000). At the same time, as based on the stratigraphy of archaeological layers, the period of human occupation of the cave was determined by the radiocarbon method in the range of 26,784–16,866 BP (Gravette to Middle Magdalenian). Later, eight U-Th dates were derived from a thin calcite coat covering most of the polychrome paintings; the dates show the lower chronological boundary of 35,559, and the upper of 15,204 BP. Thus, the most ancient examples of the art of Altamira belong to the Aurignacian, the archaeological evidence of which was not found in the cave. The period of creation of the pieces of prehistoric art spans 20 thousand years (García-Diez et al., 2013). This example proves the importance of cross-dating rock art sites by different methods.

The thickness of successfully dated carbonate formations at most of the described sites is at least 1 cm, and often even exceeds this size. However, as shown by the studies of the Spanish caves of La Pasiega and Nerja, even a large thickness of calcite deposits does not guarantee the closeness of the system of dated material.

OSL-dating. The study of the famous Fariseu site in the Côa Valley (Portugal), with specific sedimentation conditions, was one of the first cases of successful application of the OSL-method in the study of open-air rock art sites (Aubry et al., 2010). The surface with petroglyphs was covered by undisturbed deposits, including archaeological layers; these were dated by OSL-method. On the basis of the derived dates, two periods of human occupation were identified: 18,400–15,000 BC and 12,000–11,000 BC. Judging by the location of the dated deposits, the rock images were made prior to the period corresponding to the lower boundary of the sedimentation process—18,400 BC (Ibid.: 3309).

Another example of successful OSL-dating of rock images by covering sediments is associated with the open-air site of Qurta in northern Egypt. Researchers determined the age of eolian deposits, partially overlapping the surfaces bearing images of bovids, as ca 15 ka BP (Huyge et al., 2011; Huyge, Vandenberghe 2011). An important advantage of this method is that the presence of overlapping cultural layers is not a prerequisite for dating the petroglyphs; any deposits are sufficient, although such situations are quite rare at rock art sites.

An unusual dating strategy was chosen to determine the age of rock images on the ceilings of rock shelters and small caves in the Kimberley region in northern Australia. Dating samples were collected from seven petrified nests of mud-wasps covering the images. Nests usually consist of organic remains (pollen, spores, phytoliths) and mineral components. The results of OSL-dating of quartz grains have shown that two of the five samples date back to 16,400 and 17,500 BP (Roberts et al., 1997). Subsequently, a more representative series of samples was analyzed by the AMS-method. Dating of 15 samples from mud-wasp nests covering ten images, collected from six rock art sites in the region, has shown that the images had been made over a rather long period—from 17,500 to 13,000 BP (Finch et al., 2021). The described approach cannot be defined as universal for open-air sites, since it can be used to determine the age of images only in localities where the probability of survival of ancient nests of mud-wasps is higher. However, that study demonstrates the importance of assessing the local conditions and possibilities for dating at each particular site.

OSL-dating of exposed rock surfaces has been successfully used to determine the age of rock paintings (Liritzis, Evangelia, Mihalis, 2017). The Great Gallery site in Canyonlands National Park in southeastern Utah, USA, is a classic example of such research. Geological events that took place undoubtedly after the creation of the rock images were dated: the age of the alluvial deposits and the time of the rock fall, which partially damaged some of the images, were established; the period of exposure of the painted surface of the Great Gallery was determined. The period, during which the rock paintings on this large panel were made, was comparatively short—1000–1100 years AD; it corresponds to the period of the Fremont culture of pre-Columbian America (Chapot et al., 2012; Pederson et al., 2014).

The method of OSL-dating of the rocky surface by a sandstone block with deep grooves and holes is described in detail; the block was found during excavations at the entry zone of Daraki-Chattan Cave at the Rewa River in India. The derived date of 13 ka BP, according to the researchers, is the lower chronological boundary, marking the time of the block's fall; this time coincided with a sharp climate change in the Early Holocene and the associated intense denudation processes (Liritzis et al., 2019).

Apparently, this approach suits well for dating open panels with petroglyphs containing no pigments. It does not require sampling directly from images, and

hence minimizes the possibility of destructive impact. The only limitation is the probability of establishing a too broad time range between the lower (the age of the panel) and the upper (geological event) chronological boundaries.

Cosmogenic isotope dating. This dating method started to be used in rock art studies with the attempts to determine the time of exposure of panels with images from the three sites of Ribeira de Piscos, Canada do Inferno, and Penascosa in the Côa River valley. The analysis of ^{36}Cl isotope has shown that the rock surfaces were accessible for making the petroglyphs in the Paleolithic (136,000–16,000 BP) (Philips et al., 1997; Stuart, 2001). The derived data, albeit indirectly, confirmed, for the first time, the assumption of the oldest age of the Foz Côa rock images, which was later convincingly proven (Aubry et al., 2010).

Cosmogenic dating of the blocks forming the rock shelters in the Borologa locality (Kimberley, Australia) showed that the processes of destruction and subsequent downslope movement of these giant boulders took place 130,000–90,000 BP, and formed the landscape at the site. According to the geomorphological study, some rather large slabs were deliberately split and subsequently moved by man. A radiocarbon date of ca 9500–9300 BP was derived by a sample of an mud-wasps' nest from one of the panels with rock art, from which the slab was removed (Finch et al., 2019). The age of the eolian deposits partially overlapping this surface with images is 2700–2500 BP. Since the slab lay on top of Late Holocene deposits, it was concluded that in the range of 9300–2500 BP, it was deliberately moved (Delannoy et al., 2020). That study proved the effectiveness of a comprehensive consideration of geomorphological context of rock art sites.

An unusual approach to the use of the TCN-method was proposed to determine the lower chronological boundary of Western Australian rock art. Measurement of the amount of nuclides in granophyres and gabbro rocks (16 samples, ^{10}Be in quartz composition) with petroglyphs, found on the Burrup Peninsula and the adjacent area of the Dampier Archipelago, indicated an extremely slow erosion process (on average, ca 0.30–0.40 mm/1000 years) (Pillans, Fifield,

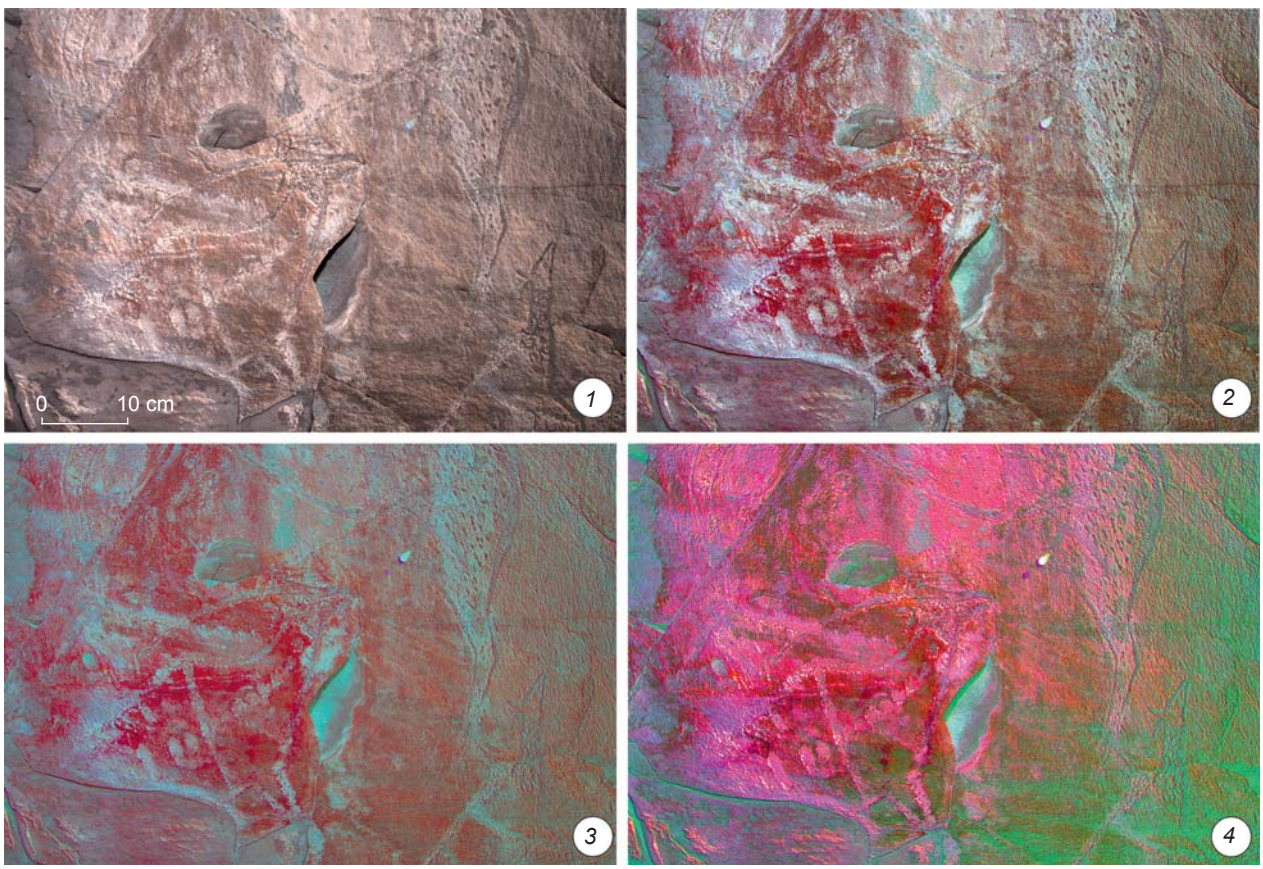

Fig. 1. Zoomorphic image in the "Minusinsk" style, whose pecked contours show red pigment thereunder. Sukhanikha I, panel 7.
1 – general view, photo with natural diffused light; *2–4* – photo 1 treatment by DStrech.

2013). Experts came to the conclusion that these data indirectly confirm the radiocarbon date of 18,000 BP obtained from mollusk shells from the cultural layer of the Gum Tree Valley site, where fragments of slabs with petroglyphs were found (Lorblanchet, 1992: 42), but suggested an older lower chronological boundary, with an age limit of 60,000 years (Pillans, Fifield, 2013: 105). However, this assumption looks disputable, because it is hardly possible to take into account the screening factors and climatic changes over such a long period, which increases the likelihood of an error in estimating the age by erosion processes (Watchman, Taçon, Aubert, 2014). The approach based on measurements of erosion dynamics is useful for solving the issues of conservation and restoration of petroglyphs, but can hardly be used for indirect dating.

Benefits and limitations of direct dating of the rock art in the Khakass-Minusinsk Basin

The proposed review leads to the conclusion that the considered methods can be used to determine the age of the earliest rock art in the Khakass-Minusinsk Basin. About 15 localities with ancient images are known in this region. The most significant are the rock art sites of Oglakhty, Tepsey, Ust-Tuba, Shalabolino, Boyary I, Georgievskaya Gora, Moiseikha, Sukhanikha, and Maidashinskaya.

The earliest examples of rock art in the region are dominated by rock carvings, mostly pecked images. Paintings or petroglyphs, containing the remains of red pigment, have been found at the sites of Tepsey I, Sukhanikha I, Oglakhty (Mount "Sorok Zubyev"), and the Shalabolino rock art site (Fig. 1, 2). Some images

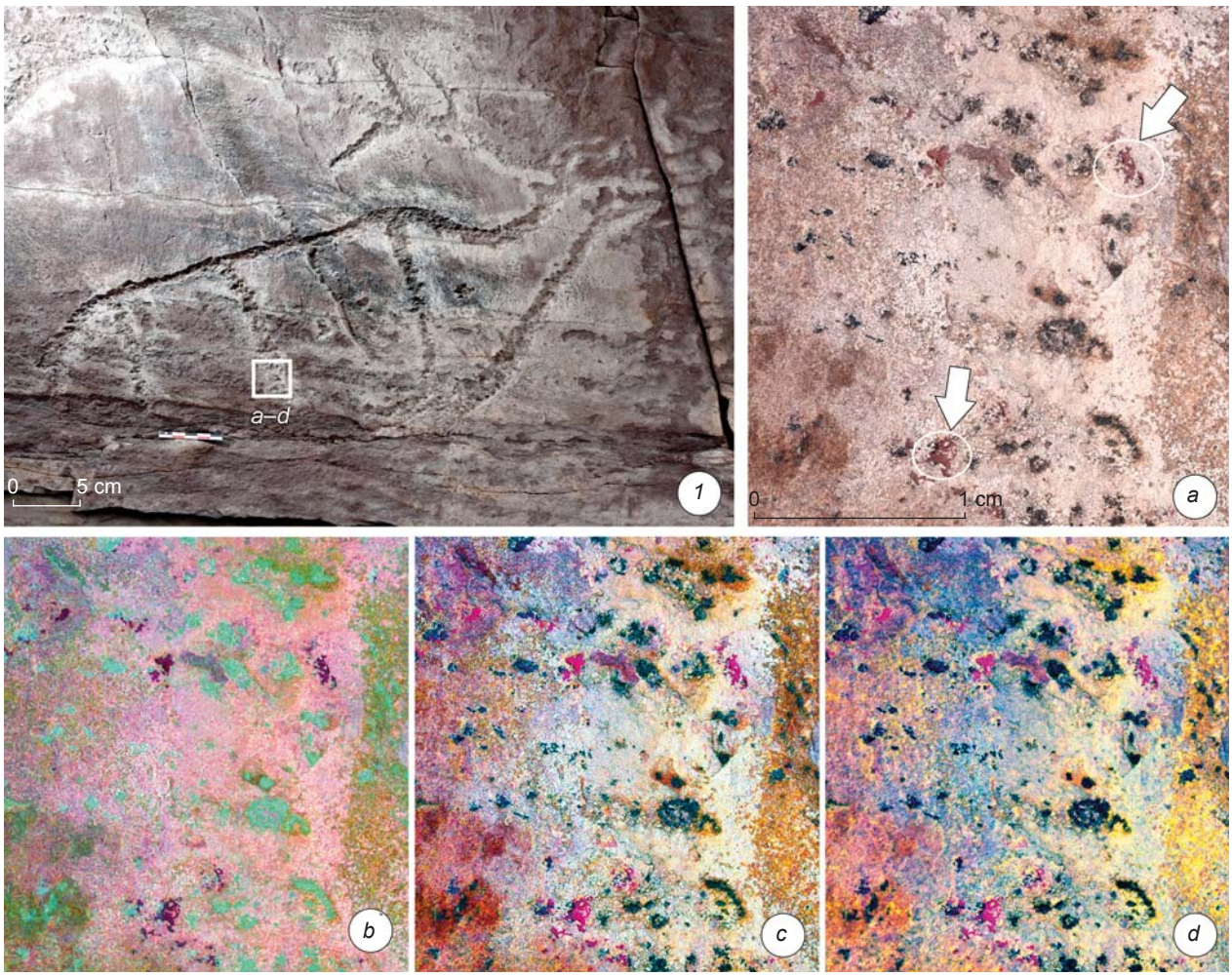

Fig. 2. Image of a deer in the "Minusinsk" style; the protruding areas of its pecked contours show red pigment. Oglakhty IV. "Pervy Zub".

1 – general view, with macrophoto area marked (flash photo): *a* – macrophoto of the area with particles of red pigment; arrows show calcite overlapping pigment; *b–d* – macrophoto *a* treatment by DStrech.

are partially covered with calcite deposits. It is possible that the mineral pigments on the images from the above-mentioned sites may contain calcium oxalates, which today can be dated by the AMS-method. To check this possibility, the chemical composition of both the pigment and the rock's surface without images and deposits closest to them should be analyzed. This will exclude accidental admixture of organic substances from the environment into the pigment, and prove that the dated calcium oxalate is a product of decomposition of an organic binder deliberately added by an ancient artist (see, e.g., (Pecchioni et al., 2019; Steelman, Boyd, Allen, 2021)) if it is the case. On exposed surfaces, the likelihood of organic contamination is high, and calcium oxalate could have formed in the pigmented area both before and after the image's creation (Sauvet, 2015: 214). To determine the possibility of using the AMS-dating of calcium oxalates, a series of preliminary chemical analyses should be conducted for each locality where the earliest rock paintings are present.

It was found that the thickness of calcite deposits and crusts overlying the earliest rock images at Tepsey I, Sukhanikha I, and Oglakhty is insufficient for sampling for U-Th dating. In all the cases known to us, calcite forms crusts no thicker than a few millimeters (Fig. 3), which is not enough to conduct the U-Th analysis. In addition, open-air rock surfaces are most likely affected by detrital contamination. Thus, the application of this method to the sites in the Khakass-Minusinsk Basin is impossible owing to the lack of basic conditions.

The methods of cosmogenic and OSL-dating of rock surface fragments can be considered the most suitable for the issues set out here. Both methods are carried out on rocks. These methods of dating do not require sampling directly from the surfaces of images, i.e., the risk of damage is minor. The purpose of the study is to establish the lower chronological boundary—the time of the surface's exposure, and the upper one—the geological event that followed the creation of the image. These methods do not

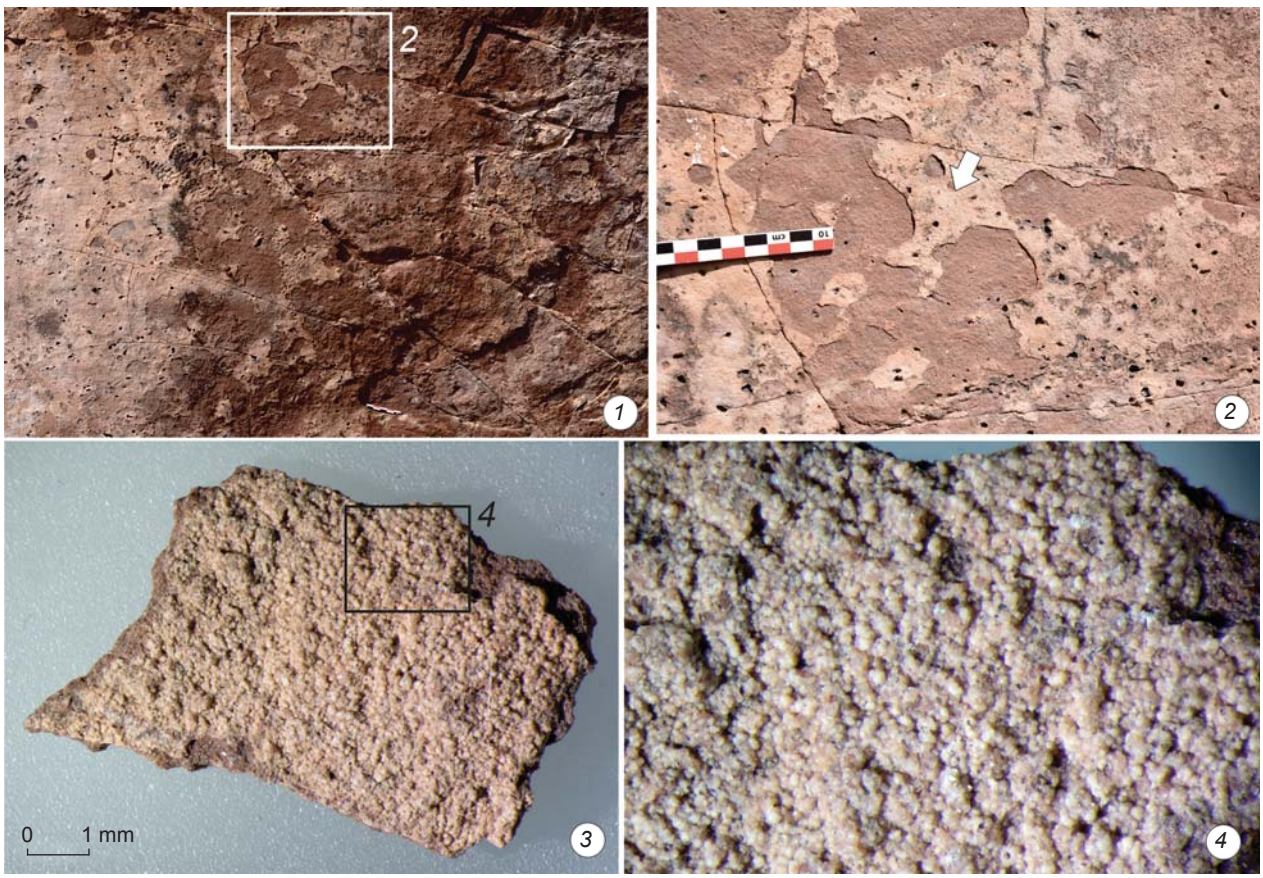

Fig. 3. Panel with earliest petroglyphs, covered with calcite crust. Georgievskaya Gora.
1 – zoomorphic image (general view), with calcite sampling area marked; *2* – macrophoto of the area with exfoliated calcite crust; arrow shows the sampling area; *3*, *4* – macrophoto of the calcite sample less than 1 mm thick (×20 and ×56 magnification, respectively).

determine the absolute age, but establish the period when a petroglyph was created. A preliminary test for the traces of penetration of light into quartz granules of red-colored Devonian sandstone from the Khakass-Minusinsk Basin (on a block from the vicinity of the Shalabolino rock art site) showed that this rock transmits light and, therefore, is promising for OSL-dating (Zotkina et al., 2022: Fig. 1).

The method of rock age estimation by the cosmogenic ^{10}Be isotope is applicable for dating the Middle Yenisey sandstone, which contains a high proportion of quartz. Such dating is most suitable for the reconstruction of the chronology of geomorphological processes at the site, when the access to the panels with rock art is destroyed and the platforms under and over the rock are missing. The dates obtained for these geological events can be younger than the "upper" dates of the time of images creation. Taking into account that many earliest petroglyphs are located at high tiers, dating the process of destruction of the ways of access to them can be promising in terms of revealing the most ancient images.

Conclusions

The above review does not claim to be complete or cover all the recent works on the absolute dating of rock art, if only because the number of such studies is growing every year, qualitatively new changes appear in the mechanisms of method application: problems that were earlier considered insurmountable are solved and errors are corrected. Nevertheless, the review of methods and approaches in terms of benefits and limitations with regard to specific scientific tasks and region can be useful for choosing a strategy of dating rock art sites in the Khakass-Minusinsk Basin and elsewhere.

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A.A. Kovalev
Institute of Archaeology,
Russian Academy of Sciences,
Dm. Ulyanova 19, Moscow, 117292, Russia
E-mail: chemurchek@mail.ru

On the Chronological Position of Siba Culture Metal Artifacts, Northwest China

This study shows that bronze artifacts typical of the Siba culture (Gansu, China), such as cast convex plaques with loops, open-gap hook earrings with trumpet-shaped ends, and lamellar stemmed daggers, are similar to those from burials of the Late Krotovo (Cherno-Ozerye) and Andronovo (Fedorovo) cultures in Western Siberia, while the socketed celt-adze from the Ganguya cemetery is paralleled by those from Late Krotovo, Alakul, and Srubnaya complexes. Open rings with two opposed cast trumpet-shaped ends, open-gap hook earrings with trumpet-shaped ends, and cast convex plaques with loops, as well as stemless lamellar bronze knives with triangular section along the entire length, synchronize Siba with the cultures such as Munkh-Khairkhan, Late Qijia, Lower Xiajiadian, and Late Glazkovo. Therefore, radiocarbon dates of the Siba culture are confirmed, suggesting that it falls within the 1800–1400 BC interval. If so, Siba bronze knives with curved spines and I-beam-shaped section of handles, as well as cast convex plaques with loops, can be considered prototypes of Late Bronze Age types of the Karasuk and Irmen cultures. Populations of western China preserved earlier (Seima-Turbino?) traditions of metallurgy, having influenced the culture of the mountain-steppe zone of Northern Eurasia in the last third of the 2nd millenium BC.

Keywords: *Siba culture, Late Krotovo (Cherno-Ozerye) culture, Andronovo cultural unity, Qijia culture, Munkh-Khairkhan culture, Glazkovo culture.*

Introduction

Descriptions of individual bronze items that were attributed by Chinese archaeologists to the Siba culture (Gansu Province, China) (Li Shuicheng, Shui Tao, 2000) provided highly diverse evidence. Therefore, a number of Russian scholars perceive it as a "territorial association of sites of separate cultures" or a cultural community with an extremely wide chronological framework (from the Middle Bronze Age to Early Iron Age) (Molodin, Komissarov, Solovyev, 2016). The presence of bronze items belonging to the Final Bronze Age types (backed knives with I-shaped handles, convex cast plaques with loops, etc.) in the complexes of the Siba culture was puzzling. According to a number of scholars, these finds could only be interpreted as resulting from the influence of the Karasuk culture, which creates a kind of "paradox", since Siba sites are radiocarbon dated to an earlier period than Karasuk sites (Zhang Liangren, 2017). This approach is similar to the old theory of "stadiality": "leading" types are strictly linked to a specific period. However, the "leading" positions of these types across the continent might have been preceded by centuries of their existence in a more limited region; the spread of even undoubtedly progressive technologies could have been hindered or interrupted for a long time for a number of reasons.

Unbiased consideration of the chronology of the Siba culture metal artifacts should include both radiocarbon

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analysis of materials from its sites and cross-dating of metal items from the closed assemblages, using parallels from the regional column sequences of steppe and forest-steppe Eurasian cultures, including China. Until now, this work has been hampered by the fact that among the excavated Siba settlements and cemeteries, only the Donghuishan burial ground (Minle County), with the minimum number of bronze items, has been described in the literature (Minle Donghuishan kaogu…, 1998), and studies of bronzes of this culture by science-based methods often do not provide drawings, nor photographs, of the artifacts (see, e.g., (Huoshaogou Siba…, 2003)). The situation was significantly improved with the complete publication of evidence from the Ganguya burial ground in Jiuquan prefectural city (107 graves) (Jiuquan Ganguya, 2016)—one of the two largest excavated cemeteries of the Siba culture. Wang Lu's dissertation on technologies used in bronze production in the Qijia and Siba cultures (2018) contains photographs of items from burials at the major cemetery of Huoshaogou in Yumen county city. The first five (!) out of 312 complexes from this burial ground were described only at the end of 2021 (Gansu Yumen…, 2021). In the last decade, there appeared publications of evidence from the stratified site of Xichengyi in the Zhangye prefectural city, where the layers of the Machang culture were covered by six layers of the Siba culture, which were divided by the authors into two horizons (Zhang Xuelian et al., 2015), as well as large-scale excavations at the Mogou burial ground in Lintan County of Gansu Province, where over a thousand graves from the Qijia culture, adjacent to the Siba culture, were studied (see (Wang Lu, 2018; Wang Lu et al., 2022)).

Data on the absolute chronology of Siba sites

Publications of complete evidence from the Donghuishan and Ganguya cemeteries testify to the cultural homogeneity of the settled population who left them. This is confirmed both by the funerary rite and by the standard set of pottery, which dominated among grave goods. This allowed Li Shuicheng to propose a periodization of the Ganguya burial ground, using the approach traditional in Chinese archaeology, which stems from the "typological method" of O. Montelius (see (Su Bingqi, 1984)), based on the evolutionary features of pottery forms and their combinations in closed assemblages (Jiuquan Ganguya, 2016: 222–240). Eight radiocarbon dates obtained by the LSC-method from the wood discovered at Huoshaogou and Ganguya, after calibration, fit into the interval from the 20th to the turn of the 14th–13th centuries BC, with a probability of 95.4 % (Ibid.: 296–297). In 2005, fourteen samples of grains from cultivated plants and two samples of charcoal were taken from the sequential layers in the cultural horizon of the Donghuishan settlement. These samples were dated in the laboratory at Peking University, using the AMS-method, to the range of the 18th–15th centuries BC, with a probability of 95.4 % (Flad et al., 2010). Later, two AMS-dates of 3330 ± 30 and 3300 ± 30 BP (1690~1520 and 1670~1500 cal BC; 95.4 %) were established in the same laboratory, using human bones from grave 47 at Huoshaogou (Gansu Yumen…, 2021: 21). In Xian, eighteen dates were obtained using the AMS-method on the materials from the Siba layers at the Xichengyi settlement: nine of these for layers 5 and 6 (early period) fit the chronological range of 1880–1680 cal BC with a probability of 68.2 %, and nine dates for layers 3 and 4 (late period) 1670–1530 cal BC (Zhang Xuelian et al., 2015: 39–41) (Fig. 1). These data, as well as typological similarity of Siba assemblages with materials from the sites of other cultures, allowed the Chinese scholars to attribute the Siba culture to the 19th–15th centuries BC (Lin Shirui, 2021).

Parallels to the Siba artifacts in materials from the Advanced Bronze Age sites in Eurasia

The presence of knives with curved spines and "tailed" knives with I-shaped sections of their handles, often with ring pommels, in the assemblages from the sites of the Siba culture is especially noteworthy in the light of data on their absolute chronology. Such items were found in burials M26, M44, M50 (blade fragment), M74, M94 upper, and M100 at the Ganguya burial ground (Jiuquan Ganguya, 2016: 185–187) (Fig. 2, *2–7*) and in at least two graves (M137, M218) at Huoshaogou (Wang Lu, 2018: Fig. 5, *25*, *29*). A "tailed" knife with a thickened ring-shaped pommel and handle decorated by longitudinal wavy lines was discovered at the Xichengyi settlement, on the floor of dwelling F78, belonging to layer 3 (the second period of the Siba culture) (Chen Guoke, 2017: 79, 83, fig. 7, *1*) (Fig. 2, *1*). In addition, cast convex plaques with loops were found in burials M24, M27 lower, M36, and M79 at the Ganguya burial ground and in burials M14, M19, M44, M47, M56, M124, M136, and M262 at Huoshaogou; three socketed arrowheads with laurel-leaf blades and "spikes" were discovered in grave M100 at Ganguya (Fig. 2, *9–11*, *16*, *19–21*) (Jiuquan Ganguya, 2016: 187–188; Wang Lu, 2018: 144, 148–150).

All these items find parallels in the materials from the Late Bronze Age sites of Siberia and East Kazakhstan, which clearly disagrees with the absolute ^{14}C dates of the Siba culture (no later than the 16th century BC). However, such parallels are insufficient to refute the

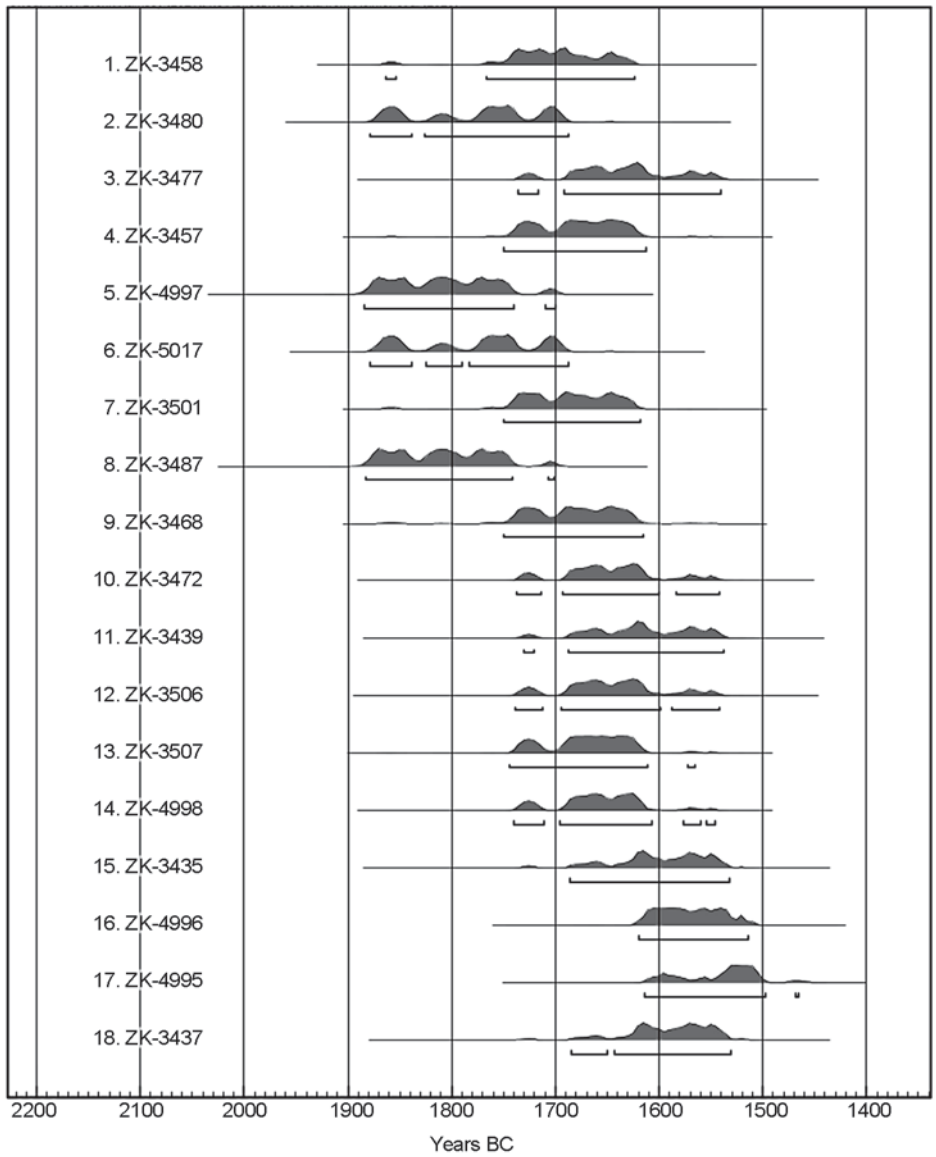

Fig. 1. Radiocarbon dates of the Siba culture layers at the Xichengyi settlement (after (Zhang Xuelian et al., 2015), using the OxCal v. 4.4.4 software).
1–9 – layers 6 and 5 (period 1); *10–18* – layers 4 and 3 (period 2).

radiocarbon dating. Cast convex plaques with loops, lamellar daggers, open-gap hook earrings with trumpet-shaped ends, belonging to the Siba culture metal artifacts (Fig. 2, *9–11*, *13*, *18–21*, *24*), occur at the sites on the periphery of the Andronovo cultural and historical community in Western Siberia, as well as in the adjacent East Kazakhstan Region. Such items were typical of the Late Krotovo (Cherno-Ozerye) culture of the Irtysh region and Baraba forest-steppe in the first half of the 2nd millennium BC, especially at the late "Cherno-Ozerye" stage (Fig. 3, *1–5*, *7–12*) (Gening, Stefanova, 1994: Fig. 2, *10*, *12*, *16*, *17*; Molodin, Grishin, 2019: 100–113, 142–153). A cast convex plaque with a loop was found together with a typical Fedorovo vessel in grave 25 at the Marinka cemetery near the village of Zevakino in the East Kazakhstan Region. Scholars attributed the assemblage to the "Marinka stage of the Kanay culture" (second quarter of the 2nd millennium BC) (Tkacheva, Tkachev, 2008: 98–99, 262–265, fig. 30, *8*; 31, *3*) (Fig. 3, *13*). The Elovka I and II cemeteries (forest-steppe Ob basin) contain many similar items; however, owing to the problem of dating the Elovka culture, which is often considered a part of the Elovka-Irmen continuum (Titova, Troitskaya, 2008), we will limit ourselves to finds from the Elovka II burial ground burials with the predominantly Andronovo (Fedorovo) pottery, attributed by V.I. Matyushchenko to the Andronovo community. These are at least eight

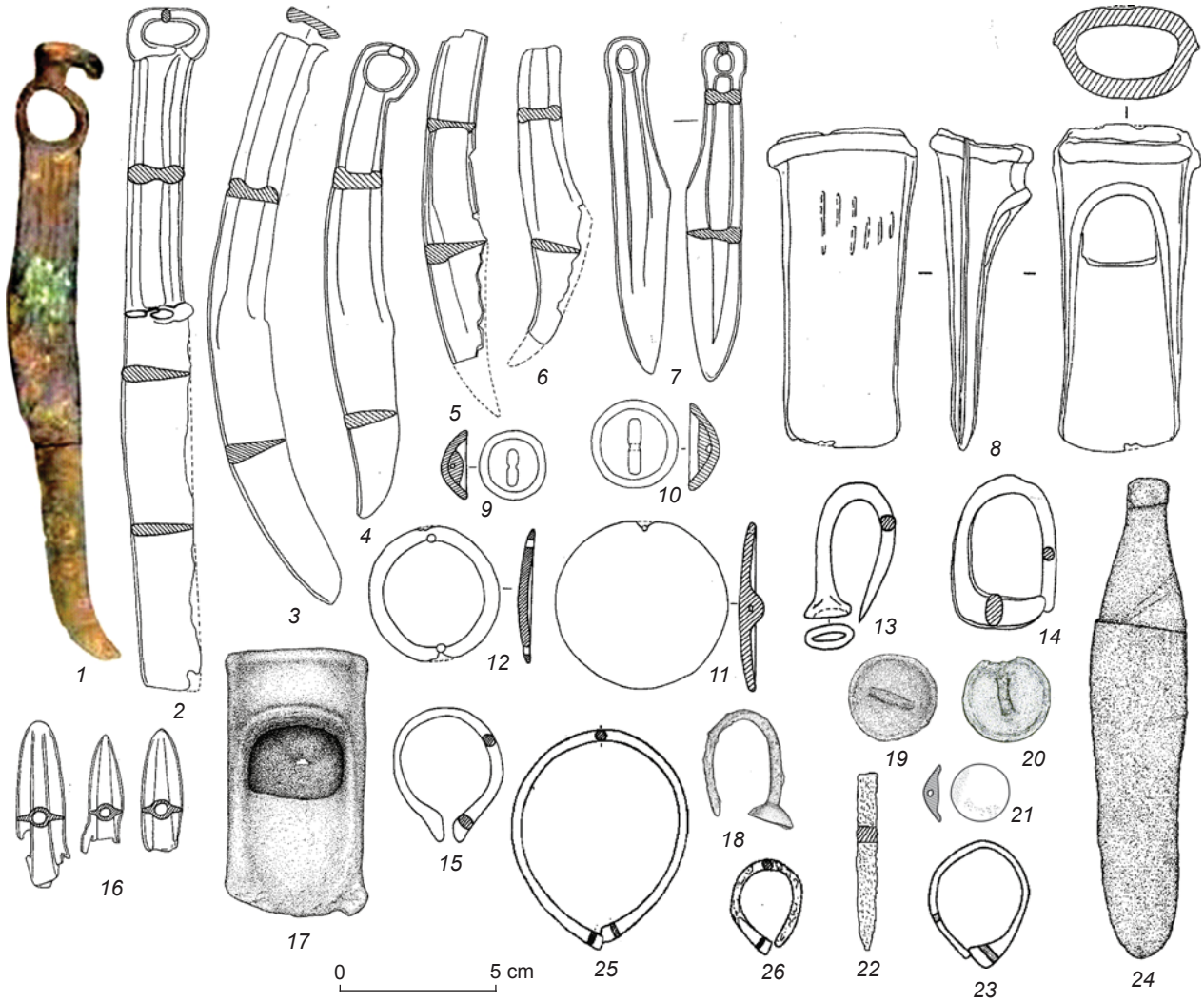

Fig. 2. Metal items of the Siba culture (after (Minle Donghuishan kaogu…, 1998; Jiuquan Ganguya, 2016; Gansu Yumen…, 2021; Yumen wenwu, 2014; Chen Guoke, 2017; Wang Lu, 2018)).
1 – Xichengyi, dwelling F78; *2–16* – Ganguya: *2* – grave M44, *3* – grave M26, *4*, *6* – grave M74, *5*, *16* – grave M100, *7* – grave M94 upper, *8* – grave M19, *9* – grave M27 lower, *10*, *11* – grave M79, *12* – grave M44, *13* – grave M73, *14* – grave M14, *15* – grave M26; *17–24* – Huoshaogou: *17*, *18* – grave not indicated in the source, *19* – grave M14, *20* – grave M56, *21–23* – grave M47, *24* – grave M153; *25*, *26* – Donghuishan: *25* – grave M21, *26* – grave M79. *22* – gold, others – bronze.

assemblages, containing cast convex plaques with loops, lamellar daggers, and open-gap hook earrings with trumpet-shaped ends (Matyushchenko, 2004: 24, 25, 49, 66, 94, 111, 137, 155, 237, 241, 163, 164, 165, 171) (Fig. 3, *14–24*).

It is also important to compare the socketed celt-adze from grave M19 at Ganguya with a similar item from burial 55 at Sopka-2/5 (see Fig. 2, *8*; 3, *6*; 4, *4*, *6*) (Jiuquan Ganguya, 2016: 184; Molodin, Grishin, 2019: 100–101). Both items have ridges along the edges of the socket, and a pronounced stop. A similar tool has also been found at the Huoshaogou site (see Fig. 2, *17*) (Yumen wenwu, 2014: 141). Several similar celt-adzes and a casting mold for their manufacture have been found in Xinjiang (Li Xiao, Dang Tong, 1995: 41; Wang Linshan, Li Suyuan, Wang Bo, 2008: 40; Sichou zhi lu…, 2014: 102–103) (see Fig. 4, *1*, *5*). This casting mold, from Fukang county city, also served for casting socketed arrowheads with laurel-leafed blades, and might have belonged to the complex with a similar stone mold for manufacturing socketed spearheads and arrowheads with laurel-leafed blades, which was found there (see Fig. 4, *2*) (Sichou zhi lu…, 2014: 115). A ceramic mold for casting the same kind of celt has been found “on the floor” of a rectangular room of copper-smelting complex 1, at the Atasu I settlement in Kazakhstan (see Fig. 4, *3*) (Kadyrbaev, Kurmankulov, 1992: 33–34). The authors suggested that this building was constructed in the Alakul period, on the basis of several arguments, including the absence of pottery

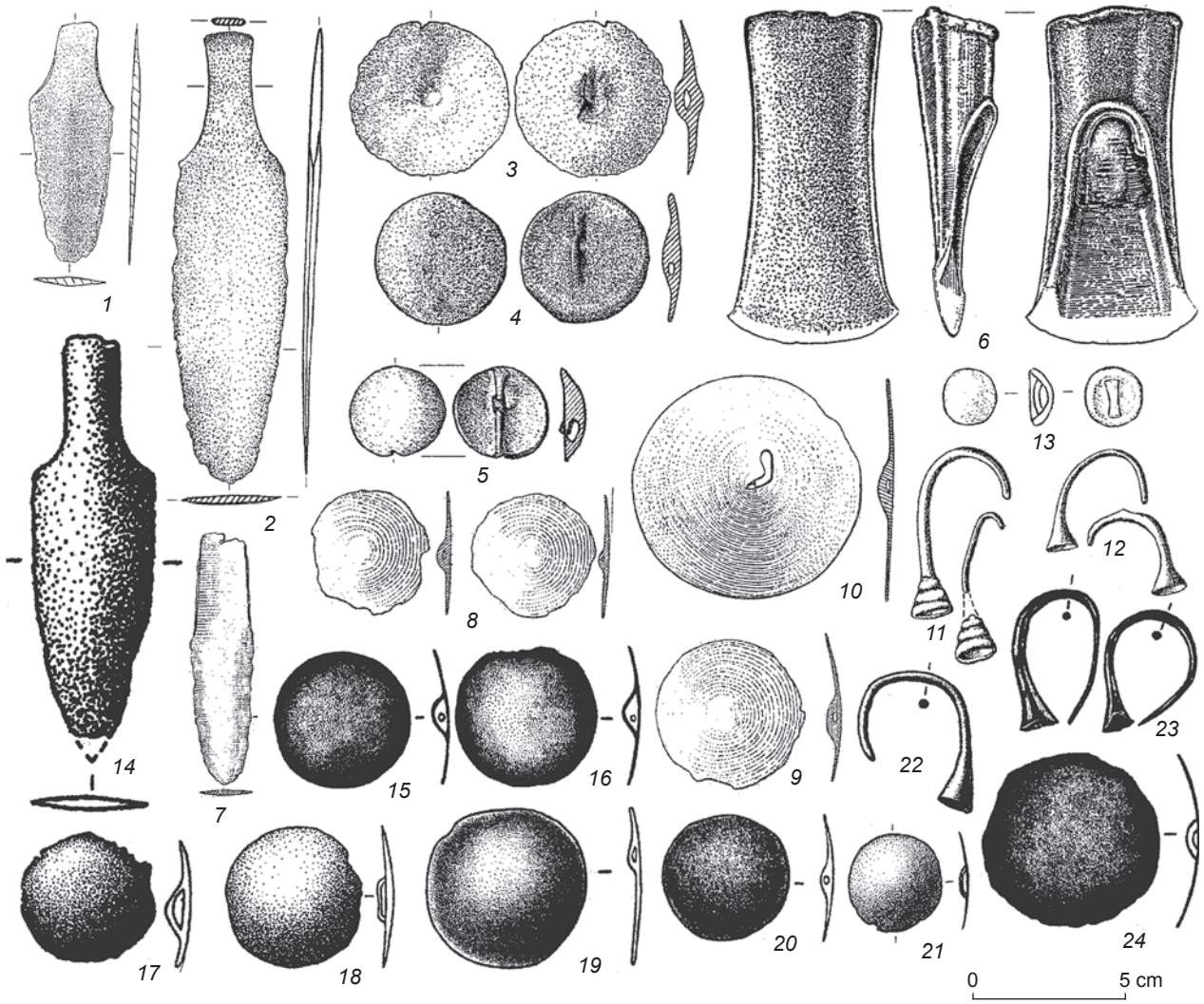

Fig. 3. Parallels to metal items of the Siba culture.
1–12 – Late Krotovo (Cherno-Ozerye) culture (after (Molodin, Grishin, 2019; Gening, Stefanova, 1994)): *1–6* – Sopka-2/5 (*1* – burial 335, *2* – burial 54, *3* – burial 103, *4* – burial 146, *5* – burial 332, *6* – burial 55), *7–12* – Cherno-Ozerye I (*7* – burial 91, *8* – burial 61, *9* – burial 96, *10*, *11* – burial 5, *12* – burial 69); *13–24* – Andronovo (Fedorovo) culture (after (Tkacheva, Tkachev, 2008; Matyushchenko, 2004)): *13* – Marinka, grave 25, *14–24* – Elovka II (*14*, *17* – grave 3, kurgan 50, *15*, *16* – grave 302, *18* – grave 158, *19* – grave 300, *20* – grave 307, *21* – grave 14, *22*, *23* – grave 262, *24* – grave 209). Everything – bronze.

of the Zamaraevo or Ilyinskoye types, associated with the later construction of rounded structures here (Ibid.: 197). However, contrary to their stratigraphic observations, they dated the casting mold to the Late Bronze Age solely on the basis of the observation that a similar celt-adze was allegedly a part of the so-called hoard from the village of Palatsy in East Kazakhstan Region, together with a dagger of the "Karasuk type" (Ibid.: 230–231). Nevertheless, this "hoard" cannot be considered a closed assemblage, because it contained items from clearly different periods: an Andronovo bracelet with spiral-shaped ends converging to a cone, and the same "Karasuk" dagger dating back to no earlier than the 12th century BC (Chernikov, 1960: Pl. 10) (cf.: (Kovtun, 2019)). Thus, the casting mold found at Atasu I should be synchronized with the period of constructing rectangular buildings and use of the "Atasu type" pottery*. To the west of the Baraba forest-steppe, three complexes with celt-adzes without eyelets and with open sockets, but without stops or ridges are

*Another false "assemblage" with a celt-adze from Kazakhstan is recorded in the catalog of the Bochum exhibition: an item similar to the ones in question was presented there as a part of the so-called Andreevsky hoard (village of Kabanbai in the Almaty Region) of the Late Bronze Age, although in fact this hoard contained another, typologically later, celt-adze with a frontal eyelet and without a ridge along the lower edge of the socket (see (Unbekanntes Kasachstan…, 2013: No. 183; Karabaspakova, 2011: 155, pl. 57, 2; Dzhumabekova, Bazarbaeva, 2013: 14–15, app. 2)).

Fig. 4. Casting molds (*1–3*), celt-adzes (*4–8*, *10*), and a knife-dagger (*9*).
1, *2* – town of Liangheer, Ziniquanzi township, Fukang county city, Xinjiang (after (Sichou zhi lu…, 2014)); *3* – Atasu I settlement, Dzhezkazgan (now Karaganda) Region (after (Kadyrbaev, Kurmankulov, 1992)); *4* – grave M19 at Ganguya, Jiuquan prefectural city, Gansu Province (after (Jiuquan Ganguya, 2016)), *5* – Tacheng county city near the Sandaohe dam, Xinjiang (after (Li Xiao, Dang Tong, 1995)); *6* – burial 55 at Sopka-2/5, Novosibirsk Region (after (Molodin, Grishin, 2019)); *7* – Uk III settlement, Tyumen Region (after (Stefanov, Korochkova, 2000)); *8*, *9* – Gladunino hoard, Kurgan Region (after (Korochkova et al., 2013)); *10* – Ilderyakovsky hoard, Republic of Tatarstan (after (Bochkarev, 2017)). *1*, *2* – stone; *3* – clay; *4–10* – bronze.

known. The Gladunino hoard (Kurgan Region) with such a tool, as well as knives-daggers with waisted blades (see Fig. 4, *8*, *9*), was attributed to the Alakul culture (Korochkova et al., 2013). A similar celt has been found in an Alakul culture dwelling at the settlement of Uk III (Tyumen Region) (Stefanov, Korochkova, 2000: 38–39) (see Fig. 4, *7*). The Ilderyakovo hoard (Tatarstan) with such a tool was attributed by V.S. Bochkarev to chronological group III (Srubnaya), contemporaneous with the Alakul culture (2017: 171) (see Fig. 4, *10*). I suppose that this evidence makes it possible to date the assemblages with celt-adzes from Ganguya and Sopka-2/5 to the 18th–15th centuries BC.

Parallels to the grave goods of the Siba culture have also been discovered at the sites of other cultures of the Advanced Bronze Age. At least two metal open rings—

gold and bronze—with two cast opposing trumpet-shaped ends have been found at Huoshaogou (Fig. 5, *1*, *2*) (Yang Junchang, Paul Jett, Chem Jianli, 2017: Fig. 1, *1*; Yumen wenwu, 2014: 180). Such items were typical of the Munkh-Khairkhan culture of the 18th (19th) to 15th centuries BC (Mongolia, Tuva) and also appeared in the Glazkovo assemblages contemporaneous with it (Kovalev, Erdenebaatar, 2014; Kovalev, 2017: 62, fig. 4; Bokovenko, Kovalev, Lazaretov, 2019: 63–64, fig. 19) (Fig. 5, *3*, *4*). At least two similar rings have been found in the assemblages of the Late Qijia culture at the Mogou cemetery, in Gansu Province (Fig. 5, *5*, *6*). Eight graves of the same culture at that cemetery (M112, M132, M212, M463, M611, M694, M769, and M771) yielded cast convex plaques with loops, and five graves (M72-B, M101, M110, M358-C, and M711) open-gap hook earrings with trumpet-shaped ends (Wang Lu, 2018: 66–76, Wang Lu et al., 2022: Fig. 2)

Fig. 5. Selected common varieties of artifacts of the Siba culture and cultures of the adjacent regions.
1–6 – rings with two cast trumpet-shaped ends: *1*, *2* – Siba culture, Huoshaogou (after (Yang Yunchang, Paul Jett, Chem Jianli, 2017; Yumen wenwu, 2014), *3* – Munkh-Khairkhan culture, Khar-Uulyn-Gozgor, kurgan 1/113, Bulgan Aimag, Mongolia (after (Bokovenko, Kovalev, Lazaretov, 2019)), *4* – Glazkovo culture, Sukhaya Pad I, burial 3, Irkutsk Region (after (Kovalev, 2017)), *5*, *6* – Qijia culture, Mogou, graves M303-B, M358-C (after (Wang Lu, 2018; Wang Lu et al., 2022)); *7–14* – items of the Qijia culture, Mogou: *7* – grave M401-A, *8* – grave M463, *9* – grave M212, *10* – grave M112, *11* – grave M611-A, *12* – grave M110, *13* – grave M358-C, *14* – grave M72-B (after (Wang Lu, 2018; Wang Lu et al., 2022)); *15–19* – items of the Lower Xiajiadian culture: *15* – Weifang, excavation area T4, layer 3, *16* – Pingdingshan, sq. G104, layer 2, *17* – Zhangjiayuan, dwelling F4, *18* – Xiayuegezhuan, dwelling H5, *19* – Dadianzi, grave M453 (after (Zhongguo zao…, 2008)); *20*, *21* – items of the Erlitou culture: *20* – Erlitou, grave 80IIIM2, *21* – Xishicun, excavation T9 (after (1980 nian qiu Henan…, 1983; Zhongguo zao…, 2008)); *22*, *23* – items of the Siba culture, Huoshaogou: *22* – grave M84, *23* – grave M47 (after (Gansu Yumen…, 2021)); *24*, *25* – items of the Bayanlig culture (Khalikhyn-Bulag, kurgan 1, Bayanlig Sum of Bayankhongor Aimag; *photo by A.A. Kovalev*).
1 – gold; *23*, *25* – stone; others – bronze.

(Fig. 5, *12–14*). The Late Qijia culture is synchronized with the Erlitou culture (18th–16th centuries BC) (Zhongguo zao…, 2008: 198). Three AMS-dates for two burials belonging to the late stage of the Mogou cemetery (Siwa culture) fit the chronological range of 15th–13th centuries BC (Chen Jianli et al., 2012: 47), which confirms the conclusion that the Qijia graves that were made here at an earlier period can be dated to the first half of the 2nd millennium BC. The authors of a recent article consider the Qijia complexes at Mogou chronologically close to the fourth period of the Erlitou culture (1565–1530 BC) (Wang Lu et al., 2022: 82). Nevertheless, in grave 80IIIM2 in Erlitou, belonging to the third period of the culture (ca 17th to early 16th century BC), a knife with a curved spine, thickenings along the edges of the handle, and a ring-shaped pommel has been found, imitating the Seima-Turbino prototypes and similar in design to the Ganguya knives (1980 nian qiu Henan…, 1983: 201–202, fig. 10, *9*; Kovalev, 2013: 140) (Fig. 5, *20*); and the layer of the same period yielded a bronze punch with rectangular cross-section (Zhongguo zao…, 2008: 143–144) (Fig. 5, *21*). A bronze pick-punch was found in grave M47 at Huoshaogou (1980 nian qiu Henan…, 2021: 7) (Fig. 5, *22*). Punches rectangular in cross-section were discovered by this author, together with Mongolian colleagues, during the excavations in Bayanlig Sum of Bayankhongor Aimag in Mongolia in two burial mounds of a previously unknown culture of the Advanced Bronze Age (which we named the "Bayanlig" culture) (Kovalev, Erdenebaatar, Iderkhangai, 2012). One of these mounds (Khalikhyn-Bulag-1) contained a combination stone tool similar to that from the grave goods of grave M84 at Huoshaogou (Brief report…, 2021: 10) (Fig. 5, *22*, *24*, *25*). Open-gap hook earrings with trumpet-shaped ends, as well as rings with flattened ends, similar to the finds from Gansu (Fig. 5, *15–19*), were discovered to the northeast of the Central Plain, at the sites of the Lower Xiajiadian culture (Hebei, Tianjin, Inner Mongolia). This culture is also synchronized with the third and fourth periods of Erlitou (Zhongguo zao…, 2008: 174–177).

Since 2013, this author has published some studies on synchronization of cultures of the first half of the 2nd millennium BC by the use of stemless lamellar single-edged knives with triangular section along the entire length (Kovalev, 2013, 2017; Kovalev, Erdenebaatar, 2014). New descriptions of finds from China (Wang Lu, 2018; Wang Lu et al., 2022) confirm attribution of the sites with these items to the 18th (19th)–15th centuries BC. Such knives were typical of the Petrovka, Late Krotovo, Munkh-Khairkhan, Glazkovo, Late Qijia culture, and the Lower Xiajiadian culture. Today, one can add the Huoshaogou cemetery to these sites (Wang Lu, 2018: 146, 150).

Conclusions

Thus, the Siba culture metal artifacts belong to the chronological horizon of cultures of the Advanced Bronze Age (Andronovo, Late Krotovo, Munkh-Khairkhan, Bayanlig, Erlitou, Lower Xiajiadian cultures, Late Qijia, Late Glazkovo, etc.): to the first half–mid 2nd millennium BC. The items that find parallels in the materials from the later sites of East Kazakhstan and Siberia can be considered the evidence of penetration of the corresponding forms from western China. Bronze knives of the Siba culture, with curved spines, I-shaped handles, and ring pommels, may be a heritage of the Seima-Turbino traditions. This fills in the chronological gap between the Seima-Turbino single-edged knives and similar items spread since the 14th century BC from Western Siberia to Manchuria (Irmen, Karasuk, Chaodaogou, Weiyinzi, Lijiaya cultures, etc.). After the period of Andronovo expansion, the population of western China, which had preserved the earlier traditions, influenced the emergence of the material culture of the mountain-steppe zone of Northern Eurasia.

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V.I. Molodin
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
Novosibirsk State University,
Pirogova 1, Novosibirsk, 630090, Russia
E-mail: molodin@archaeology.nsc.ru

The Current Model of Historical and Cultural Processes in the Stone and Bronze Ages of the Ob-Irtysh Forest-Steppe

This article presents a current perspective on the historical and cultural development of the population in the forest-steppe zone of the Ob-Irtysh interfluve in the Stone and Bronze Ages, using various methods of the natural and exact sciences, as well as archaeological findings from adjacent parts of the Ob and Irtysh basins. A geographic description of the region is given. The history of excavations in the region is outlined beginning from the 19th century to the present. A considerable amount of new materials has been accumulated, providing the basis for historical and cultural reconstructions. The study spans the period from the Upper Paleolithic through to the Late Middle Ages and the recent centuries. The initial peopling of the Baraba forest-steppe occurred 18 thousand years ago. Cultures of the Early and Late Neolithic, Early, Middle and Late Bronze Ages, and the transition to the Early Iron Age are listed. All periods have a reliable timescale. The archaeological potential of the region provides a basis for further elaborations of this model.

Keywords: *Ob-Irtysh forest-steppe, Neolithic, Bronze Age, cultural evolution model, absolute chronology, archaeological sites, researchers.*

Introduction

The expedition of D.G. Messerschmidt to Siberia (Fig. 1) essentially was the beginning of archaeological research over the vast subcontinent of Siberia. The history of archaeology evolved differently in each of the numerous corners of North Asia; yet, without assessing all the available evidence, it is impossible to have a complete picture of the dynamics of historical and cultural phenomena over this enormous region. This article discusses stages in studying historical and cultural processes in the forest-steppe part of the Ob-Irtysh interfluve. The conceptual framework explaining the development of the population that inhabited the region in the Stone and Bronze Ages will probably continue to be clarified over the following decades, since the scale of archaeological research in the region leaves much to be desired. Experience has shown that even in seemingly unpromising locations for research, there appear archaeological sites with evidence that fundamentally changes views on the historical past.

Study results

The forest-steppe Ob-Irtysh region was a strategically important part of the West Siberian Plain (Fig. 2).

Over all periods of the Stone and Bronze Ages, life flourished there, starting from the first appearance of humans in the region.

The forest-steppe belt between the Ob and Irtysh rivers (Fig. 3) covers a vast territory from east to west for over 700 km. In the north, the forest-steppe is bounded by the Vasyugan swamps and taiga zone, in the south by the Kulunda steppe. The length of the forest-steppe from north to south reaches about 200 km. The Ob and Irtysh Rivers—the largest watercourses of North Asia—flow from south to north, linking Central Asia with the taiga and tundra zones of Western Siberia. Fairly large rivers, such as Om, Tara, and Tartas, cross the forest-steppe from east to west and flow into the Irtysh River. The small Aley and Chaus rivers flow into the Ob River in the forest-steppe area. There are hundreds of lakes in the Ob-Irtysh forest-steppe, including Lake Chany, one of the largest in North Asia, and Lake Ubinskoye. Rivers and lakes of this region have huge fish supplies, which have attracted humans of all times. The river systems served as zones for population movement both in the meridional and latitudinal direction.

The Ob-Irtysh forest-steppe was characterized by a fairly mild climate favorable for life, and the wealth of biomass, which provided humans and wild and domestic animals with high-quality food. The set of herbs and grasses of unmatched quality has made it possible over the centuries to produce unrivalled dairy products there, for example, Baraba butter—the best in the world. In the spring-autumn period, numerous waterfowl colonies nested on the lakes, which were hunted by humans. The rivers and lakes were rich in fish, which at all times fed the humans.

Fig. 1. Statue of D.G. Messerschmidt—part of a sculptural composition of great explorers of Siberia, Khanty-Mansiysk.

Thus, this territory has always attracted the attention of humans. However, the lack of high-quality raw materials for the production of stone tools,

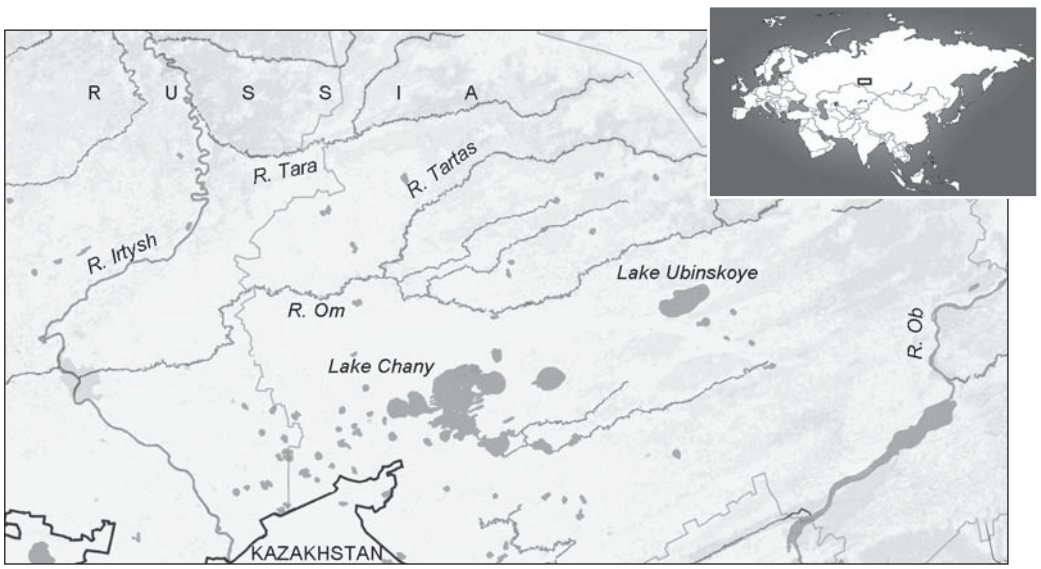

Fig. 2. Map of the Ob-Irtysh forest-steppe region.

Fig. 3. Ob-Irtysh region in summer and autumn.

and lack of copper ore for the manufacture of bronze items forced the inhabitants of the region to make expeditions to the south, to the Kazakh Uplands, and to the Irtysh basin, where these raw materials were available. Over time, search routes for places with resources needed for stone and bronze tool production became more extensive.

The arrival of humans in the Ob-Irtysh interfluve was associated with the end of the Pleistocene, when the retreat of the glacier to the north made the region accessible and attractive to the mammoth fauna, bison, giant deer, and horses, whose herds densely inhabited the plain, which was rich in herbage. The region remained just as favorable for life throughout the Holocene until the arrival of Russian explorers. It is no coincidence that many archaeological sites have been found there and their number has increased with every year.

The history of archaeological research in the region goes back to the 19th century. In 1879, N.M. Yadrintsev explored the forest-steppe Ob region and the Baraba forest-steppe. He mentioned numerous burial mounds in the forest-steppe Ob-Irtysh region and foresaw that in the future this territory would become a field for archaeological studies (Yadrintsev, 1883: 187) (Fig. 4). In 1886, Prof. D.N. Anuchin described a stone fish-bait found in Baraba (1886). Later, A.P. Okladnikov attributed it to the Serovo period of the Neolithic in the Baikal region (1950: 250). Thus, this find showed good prospects for a search for Neolithic sites in the forest-steppe Ob-Irtysh region.

In 1894, G.O. Ossovsky carried out archaeological research on the Om River (1896), and in 1895–1897, S.M. Chugunov, the Prosector of Tomsk University (1895, 1897a, b, 1898), performed large-scale excavations of burial mounds on the Baraba forest-steppe. Academician V.V. Radlov studied archaeological sites in the Altai, including the forest-steppe Ob-Irtysh region, in 1862–1902. In the vicinity of Lake Ubinskoye, he unearthed a large number of cemeteries (Martynov, 1964: 17). Although all these excavations, which were large-

Fig. 4. N.M. Yadrintsev.

scale for their time, did not reveal evidence of the Stone and Bronze Ages, they made it possible to establish directions for archaeological research in this region.

The first Stone Age site in the Ob-Irtysh region—the Neolithic site of Bugristoye near the city of Barabinsk in Novosibirsk Region—was discovered by E.M. Besser-Zasetsky in 1926 (Talitskaya, 1953: 337). The site contained extremely scarce evidence. In 1926–1928, V.P. Levashova studied the basin of the Om River (Ibid.), after which there was no scholarly research made in the region for a long time.

Large-scale archaeological works were carried out in the construction zone of the Novosibirsk hydroelectric power station on the Ob River in 1952–1954 by an expedition from the Leningrad Branch of the Institute of Archaeology of the Soviet Academy of Sciences, under the leadership of M.P. Gryaznov. Gryaznov and M.N. Komarova discovered several settlements and cemeteries of the Neolithic, and Early and Advanced Bronze Age in that area. Komarova identified the Kiprino and Irbino stages of the Neolithic, as well as sites of the Krotovo type, using evidence from the Ob sites (1956). The finds from the settlement of Irmen-1, explored by Gryaznov, made the basis for identifying the Irmen culture of the Late Bronze Age by N.L. Chlenova (1955). A monograph by Gryaznov on the history of the ancient population from the Upper Ob region (1956) also discussed issues of studying the Bronze Age on the Altai plain.

Starting in 1957, the Novosibirsk Archaeological Expedition from the Novosibirsk State Pedagogical Institute and the Novosibirsk Regional Museum of Local History, which was organized and headed for many years by T.N. Troitskaya, did research in Novosibirsk Region (Troitskaya, 1966). For over forty years, the teams of this expedition, led by Troitskaya and her students, discovered and explored a large number of settlements and cemeteries, including those of the Neolithic and Bronze Age (Troitskaya, Molodin, Sobolev, 1980).

An undoubtedly important event in studying the Ob-Irtysh interfluve was the discovery and research of the Rostovka cemetery on the lower reaches of the Om River, containing a rich set of magnificent bronze items of the Seima-Turbino type (Matyushchenko, Lozhnikova, 1971; Matyushchenko, 1975). Later, evidence from this site was described in a monograph by V.I. Matyushchenko and G.I. Sinitsyna (1988).

In the late 1960s, an expedition from the Ural State University under the leadership of V.F. Gening carried out large-scale research in the left-bank region of the Irtysh, including Baraba, as a part of rescue works.

In 1966, the Institute of History, Philology, and Philosophy of the Siberian Branch of the Soviet Academy of Sciences (now the Institute of Archaeology and Ethnography of the Siberian Branch of the Russian Academy of Sciences), which was organized as a part of the Siberian Branch of the Soviet Academy of Sciences and directed by Academician A.P. Okladnikov, initiated archaeological exploration of the forest-steppe Ob-Irtysh region. The first site researched in the region by Okladnikov was the Paleolithic site of Volchya Griva (1971). This site has been studied by various employees of the Institute to this day. Its excavations in 1975 were carried out under the leadership of the present author, and in recent years under the leadership of V.N. Zenin.

In 1973, the Western Siberian Archaeological Team of the North Asian Integrated Expedition was established at the Institute, under the leadership of the current author. One of the main goals of the team was archaeological research in the forest-steppe Ob-Irtysh region. Sites of the Stone and Bronze Ages where large-scale research was carried out included Abramovo-4, Vengerovo-2 and -3, Grishkina Zaimka, Kargat-6, Krokhalevka-1 and -4, Novochekino-1 and -3, Om-1, Preobrazhenka-3 and -6, Sopka-2, Tartas-1, Chicha-1, etc. Not only the present author, but also his students, as well as the students of Troitskaya, participated in field and analytical works for studying these sites, including N.V. Polosmak, A.P. Borodovsky, V.A. Zakh, L.N. Mylnikova, A.I. Solovyev, V.I. Sobolev, A.E. Grishin, I.A. Durakov, V.S. Elagin, L.S. Kobeleva, N.S. Efremova, Y.N. Nenakhova, M.S. Nesterova, A.V. Novikov, O.I. Novikova, D.V. Selin, M.A. Chemyakina, Z.V. Marchenko, Y.N. Garkusha, D.A. Nenakhov, E.A. Sidorov, and O.N. Khokhlova.

Starting in 1999, experts from the Eurasian Department of the German Archaeological Institute (Berlin) have worked in close cooperation with the team. The project was initiated by H. Parzinger, and included S. Hansen, A. Nagler, S. Reinhold (see, e.g., (Parzinger et al., 1999; Molodin et al., 2017 (2021))), J. Schneeweis, and H. Piezonka.

Starting in the early 2000s, the Neolithic and Bronze Age sites in the region were actively explored by an expedition from Kemerovo State University, under the leadership of V.V. Bobrov, A.G. Marochkin, and A.Y. Yurakova (see, e.g., (Bobrov, Marochkin, 2011; Yurakova, 2017; Bobrov, Marochkin, Yurakova, 2017a)).

An enormous amount of evidence on the Stone and Bronze Ages of Western Siberia, which was

accumulated over the years of intensive excavations in the forest-steppe Ob-Irtysh region, has made it possible to elaborate and publish a number of historical and cultural concepts, which are constantly being updated and clarified. This is actively facilitated by increasingly wide application of methods of the natural and exact sciences, and primarily geophysical monitoring of archaeological research. Fundamentally new data on the ancient history of the region have been obtained from studies with close collaboration of archaeologists and geophysicists (Epov, Molodin, Chemyakina, 2006), physicists and chemists (Fiziko-khimicheskoye issledovaniye…, 2006), paleogeneticists (Molodin et al., 2013), and anthropologists (Chikisheva, 2012).

The current concept of historical and cultural development of the region in the Stone and Bronze Ages is based on the work of scholars in the areas immediately adjacent to the Ob-Irtysh region and in the interfluve. An important contribution to research into the ancient history of the forest-steppe Ob region was made by V.I. Matyushchenko. In his 4-volume monograph *The Ancient History of the Population of the Forest and Forest-Steppe Ob Region* (1973a–c; 1974), he analyzed the evidence from the Novosibirsk region of the Ob obtained mainly in the excavations by Gryaznov and Komarova. The concept of historical and cultural evolution of populations living in the Ob region from the Neolithic to the Late Bronze Age proposed by Matyushchenko is directly related to cultural and historical processes that took place in the Ob-Irtysh region during that period.

V.F. Gening and his students elaborated a highly useful model of historical and cultural development of the left-bank forest-steppe Irtysh basin from the Neolithic to the Late Bronze Age (Gening et al., 1970). In this region, Gening and his students V.T. Petrin and L.L. Kosinskaya discovered the Upper Paleolithic (Gening, Petrin, 1985) and Mesolithic (Gening, Petrin, Kosinskaya, 1973) sites; their findings have contributed to our understanding of the evidence from this historical and cultural layer, found in the forest-steppe Ob-Irtysh region.

The works of M.F. Kosarev are also important. When studying the regions of Western Siberia adjacent to the forest-steppe belt (Trans-Urals, taiga zone of the Tom region), Kosarev constantly used evidence from the Ob-Irtysh region and correlated it with his new ideas (see, e.g., (1974, 1981, 1991)).

The research by E.N. Chernykh and S.V. Kuzminykh (1989) on Seima-Turbino bronzes, including their classification, typology, and origin of the Seima-Turbino transcultural phenomenon, are undoubtedly important for understanding the ancient history of the Ob-Irtysh region.

Y.F. Kiryushin and his students have made a valuable contribution to studying the past of the Ob-Irtysh forest-steppe. They elaborated a concept of historical and cultural evolution of the Altai plain, closely related to the problems of the Bronze Age in the Upper Ob region (Kiryushin, 2002; Kiryushin, Grushin, Tishkin, 2003).

In the mid-1970s, the current author suggested a model for historical and cultural development in the forest-steppe of the Ob-Irtysh interfluve in the Neolithic and Early Bronze Age (Molodin, 1977); some aspects of that model remain pertinent until today.

In the 1980s–1990s, an ambitious task was given by Academician A.P. Okladnikov to his student and author of this article to develop a model for historical and cultural development of the human populations that lived in the Baraba forest-steppe (the Ob-Irtysh interfluve), from the initial appearance of humans in the region to arrival of the Russians in the late 16th century. By 1983, this task was generally fulfilled and was presented as a post-doctoral dissertation (Molodin, 1983), defended already after the death of A.P. Okladnikov. This conceptual framework covered a gigantic period from the Late Upper Paleolithic to the Late Middle Ages–Modern Period. Subsequently, active field and analytical research was continued and several monographs were written using evidence obtained and study results. The most important study was *Baraba in the Bronze Age* (Molodin, 1985) and four volumes under the common title *Sopka-2* (Molodin, 2001, 2012; Molodin, Grishin, 2016, 2018). As a part of this task, fundamentally new sources were described, the concept of historical and cultural processes in the forest-steppe Ob-Irtysh region as a whole and at individual stages was clarified, and data on newly discovered cultural communities were included into the model. An attempt to present the model of historical and cultural evolution in the region on a qualitatively new level was made in a special study by the author of this article (Molodin, 2010).

The concept of historical and cultural development, formulated in 2010 and subsequently clarified, has changed significantly by now; therefore, a periodization elaborated with the current level of knowledge should be presented in this article.

In the 1980s, the appearance of humans in the forest-steppe Ob-Irtysh region, associated with the Final Upper Paleolithic, was detected at three sites—Volchya Griva, Vengerovo-5, and Novotartas,

where long-term excavations have been carried out (Okladnikov, Molodin, 1983). Discussion of the updated concept of historical and cultural processes in the forest-steppe Ob-Irtysh should begin with the recent discovery of a reliably stratified Upper Paleolithic site with lower cultural horizon dating back to 18 ka BP (Fig. 5) by V.N. Zenin, during excavations of the well-known site of Volchya Griva. Stone tools made of rock crystal contained in that horizon testify to connections of inhabitants of that site with the population of the Kazakh Uplands. The upper cultural horizon of the site was dated to ca 13 ka BP (Leshchinskiy, Zenin, Bukharova, 2021). The dates for the lower and upper horizons at the Volchya Griva site indicate that the initial human settlement in the region occurred much earlier than was previously believed. It is obvious that the latest discoveries at Volchya Griva have dramatically changed the ideas about the time when the first humans appeared in the south of the West Siberian Plain and the duration of their stay there in the Final Pleistocene.

Discovery and study in 2015–2017 of a settlement complex with household and ritual features at Tartas-1 in the Middle Irtysh region (Molodin et al., 2017 (2021)) (Fig. 6), for which radiocarbon dates have been obtained (Molodin, Reinhold, Mylnikova et al., 2018; Molodin, Nenakhov, Mylnikova et al., 2019), and the discovery of a number of similar sites in the vicinity of the Tai locality, primarily the sanctuary at Ust-Tartas-1 (Molodin, Mylnikova, Nesterova et al., 2022), have made it possible to identify the Barabinskaya culture of the Early Neolithic (Molodin, Kobeleva, Mylnikova, 2017). Its main feature was distinctive flat-bottomed pottery.

In addition to the cultural layers of the settlements, both sites included distinctive storage pits for fish with ritual offerings of animals, and Ust-Tartas-1 also had a sanctuary with rich plastic art. On the basis of over twenty dates, the culture was attributed to the late 8th–6th millennium BC. Its genesis is yet unclear, but there are reasons to search for its origins in the local Upper Paleolithic culture, which is especially vivid at the Cherno-Ozerye II site, studied in the left-bank region of the Irtysh (Gening, Petrin, 1985).

After reconsidering the evidence obtained earlier at Tartas-1, Ust-Tartas-1, and Vengerovo-2, which was necessary after identification of the Barabinskaya culture, scholars came to the conclusion that the Avtodrom-2/2 (Bobrov, Marochkin, Yurakova, 2017b) and Stary Moskovsky Trakt-5 (Bobrov, Marochkin, Yurakova, 2017a) sites, which had been previously associated with the Boborykino culture, actually belonged to the Barabinskaya culture.

It is clear today that the period between the Final Upper Paleolithic and Initial Early Neolithic (8th millennium BC) consisted of industries from Mesolithic sites, which were most similar to the evidence from the Mesolithic site of Cherno-Ozerye II (Gening, Petrin, Kosinskaya, 1973).

An undoubted innovation in studying the Neolithic in the Irtysh region was the assignment of previously studied and newly discovered sites of the region to the Late Neolithic Artyn culture (Bobrov, Marochkin, 2011). Our knowledge on burial practices among the carriers of this culture has been significantly expanded primarily through research on the large burial complexes at Vengerovo-2A and Ust-Tartas-2 (Molodin, Mylnikova, Nesterova, 2016), discovered

Fig. 5. Artifacts made of rock crystal (*1*) and the section's wall (*2*). The Paleolithic site of Volchya Griva. Excavations by V.N. Zenin.

Fig. 6. Type list of the Early Neolithic in the Ob-Irtysh region.
1–10 – Tartas-1; *11–13, 15* – Ust-Tartas-1; *14* – Vengerovo-2.

by Polosmak in the Northern Baraba forest-steppe (Polosmak, Chikisheva, Balueva, 1989). At these sites, accompanying earthworks in the form of ring-shaped ditches, pits, and layered burials were found for the first time in the burial practices of the Late Neolithic population. A specific set of grave goods included distinctive pottery, portable art, stone and bone tools. This culture fits the chronological period of the 5th to early 4th millennium BC.

The Early Bronze Age included two lines of cultural development. The first line is represented by settlements and burial grounds of the Comb-Pit community. The second line contains the contemporaneous sites of the Ust-Tartas culture. Materials of the Comb-Pit community have been found scattered over the Western Siberian forest-steppe, and also in the western, southwestern, and even eastern areas of the left bank of the Yenisey (Molodin, 2010). The Ust-Tartas culture was rooted in the local Neolithic and coexisted with the Comb-Pit cultural community. There was continuity in the burial practices of the Artyn and Ust-Tartas: round ditches, layered and secondary burials, stone and bone items with archaic appearance, and almost complete absence of pottery in the graves. Bronze items included tubular beads and items made of bronze foil (Molodin, Kobeleva, Reinhold et al., 2018). Stratigraphic observations and radiocarbon dates make it possible to date these cultural communities to the 4th millennium BC.

Two lines of development in the Ob-Irtysh forest-steppe were distinctly manifested in the Early to Advanced Bronze Age, in the settlements and burial grounds of the Odino and Krotovo cultures.

Stratigraphic observations indicate that the Odino culture existed earlier than the Krotovo (Molodin, Mylnikova, Novikova et al., 2011), although later they certainly coexisted. Despite some chronological proximity, the cultures differed in pottery, house-building traditions, and burial practices, and their carriers had their own anthropological and genetic distinctiveness (Chikisheva, 2012; Molodin, Pilipenko, Chikisheva et al., 2013). The Odino pottery most likely reflects an autochthonous line of development. The Odino archaic stone and bone assemblage contained advanced forms of bronze tools and weaponry; there is also some evidence of bronze casting (Durakov, Mylnikova, 2021), including spearheads and celts of the Seima-Turbino type. Ornithomorphic staffs, anthropomorphic and zoomorphic figurines as attributes of irrational activities occupied a special place in the material complex of the Odino people. Noteworthy is the presence of imported items (beads) and bones of domestic animals (sheep), which suggest migration from Western and Eastern Turkestan to the Western Siberian forest-steppe. According to radiocarbon dates (Molodin, 2012), the Odino people lived in the Irtysh region in the 3rd millennium BC.

The Krotovo culture of the Advanced Bronze Age, represented by extensive evidence from settlements and burial grounds, is distinguished by specific pottery, bone and bronze items, as well as by its traditions of house building and burial practices. The carriers of the Krotovo culture had bronze casting production and were engaged in the manufacture of Seima-Turbino bronzes. In the second half of the 3rd millennium BC, they coexisted with the Odino people. A part of the Odino population dissolved into the Krotovo people, while another part was forced to migrate to the north, into the southern taiga zone, and might have influenced the emergence of the Early Suzgun population. Over forty radiocarbon dates indicate the existence of the Krotovo people in the mid 3rd to early 2nd millennium BC (Molodin, Grishin, 2016).

In the early 2nd millennium BC, the Krotovo culture reached a late stage in its development, illustrated by the evidence from the Irtysh region (Gening, Stefanova, 1994). Currently, this culture is considered to be Late Krotovo (Cherno-Ozerye) (Molodin, 2014a); it shows specific burial practices, as well as weaponry and personal adornments, which reflected the change of bronze implements of the Seima-Turbino type to Andronovo timber-grave forms. This change originated under the influence of the Andronovo (Fedorovo) culture on the Late Krotovo (Cherno-Ozerye), and took place when the Andronovo (Fedorovo) people migrated to the region from the west-southwest. A series of radiocarbon dates indicate that the Late Krotovo (Cherno-Ozerye) culture existed in the early 2nd millennium BC.

Migrations of the Andronovo (Fedorovo) population from different habitation areas to the forest-steppe Ob-Irtysh region were cyclical. They resulted in the emergence of various models of cultural synthesis (Molodin, 2011).

Our knowledge of the Andronovo (Fedorovo) culture has been significantly expanded with evidence from the fully studied Stary Tartas-4 site, containing classic burial complexes of migrants from the west (Molodin, Novikov, Zhemerikin, 2002), the Andronovo cemetery of Stary Sad (Molodin, Mylnikova, Selin et al., 2016), and some sections of Tartas-1, where the number of the Andronovo

Fig. 7. Type list of the Pakhomovo culture of the Late Bronze Age.
1, *2*, *11–13* – Novo-Shadrino VII; *3–5*, *16*, *18*, *20*, *22–26*, *29* – Stary Sad; *6*, *15*, *27*, *28* – Grishkina Zaimka; *7*, *19*, *21* – Oskino Boloto (after (Korochkova, 2010)); *8–10* – Ir II (after (Korochkova, 2010)); *14* – Preobrazhenka-3; *17*, *30–37* – Tartas-1.

(Fedorovo) burials studied to date exceeds five hundred. Burial grounds of this culture, though having some peculiarities, in general show stable features of burial practice and grave goods typical of the Andronovo (Fedorovo) culture.

New evidence was obtained from the study of a recently discovered settlement complex of the Andronovo (Fedorovo) culture at Tartas-5, located in a constantly flooded floodplain (Molodin, Kobeleva, Reinhold et al., 2021). The latter fact is extremely

important: it is probably this landscape zone where we should look for the Andronovo (Fedorovo) settlement complexes.

A significant number of radiocarbon dates suggests the existence of that culture in the forest-steppe Ob-Irtysh region from the first centuries of the 2nd millennium BC until the 14th century BC.

In the Late Bronze Age, diverse cultures existed in the Ob-Irtysh region. Among them, the Irmen culture clearly dominated, spanning vast expanses of the forest-steppe. The study of the Irmen culture over its entire area (Molodin, 1985) produced new data indicating the 14th–10th centuries BC as the time of its existence (Chicha…, 2009). Its chronological framework was clarified using Bayesian statistical methods (Schneeweis et al., 2018). The carriers of the Barabinskaya variant of the Suzgun culture, with a distinctive pottery complex and architecture, lived in the north of the region, in the pre-taiga zone (Molodin, 1985).

Rich information has been accumulated on the eastern variant of the Pakhomovo culture, whose carriers entered the region under study in the Late Bronze Age from the Irtysh region along the banks of the Om and Tara rivers, and left burial grounds, ritual complexes, and settlements. The concept of a mosaic of cultures in the Ob-Irtysh region in the Late Bronze Age is complemented by evidence from the Stary Sad cemetery, described in a monographic study (Vostochniy variant…, 2017) (Fig. 7). The series of radiocarbon dates for that site generally fits the period from the late 2nd millennium to the first centuries of the 1st millennium BC.

Conclusions

The ethnic and cultural situation evolving in the Ob-Irtysh interfluve during the Late Bronze Age is reflected by a mosaic of the above-mentioned cultural entities, which became the basis for cultures in the transitional period from the Bronze to Iron Age (Molodin, 2014b).

It is hard to overestimate the potential of large-scale multidisciplinary studies on the settlement of Chicha (Baraba forest-steppe), whose findings have made it possible to reconstruct the situation in the south of the West Siberian Plain in the transitional period from the Bronze Age to the Early Iron Age at a qualitatively new level (Chicha…, 2001, 2004, 2009). Cultural complexes of the Late Irmen, Krasnoozerka, Atlym, Zavyalovo, Berlik, and Gamayun cultures have been identified at this site (Mylnikova, 2015). A series of over forty radiocarbon dates reliably attribute the transition from the Bronze Age to Early Iron Age to the 10th–8th centuries BC.

There is no doubt that new studies in this region will continue to bring about remarkable discoveries into the historical past of Siberia.

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N.V. Polosmak
Institute of Archaeology and Ethnography,
Siberian Branch, Russian Academy of Sciences,
Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: polosmaknatalia@gmail.com

The Pazyryk Dwelling

Archaeological findings suggest that the Pazyryk burial chambers made from larch logs replicated dwellings, being a key symbol of culture. Log structures were built on both winter and summer pastures. Parts of them were placed in graves as substitutes for entire houses. Their inner structure corresponded to that of the house. All artifacts in the graves had been used in everyday life, being intrinsically related to the owners' earthly existence. Felt artifacts functioned in the same way in elite burials and in those of the ordinary community members, although their quality was different. Felt carpets decorating the walls of the Pazyryk leaders' houses were true works of art, while those found in ordinary burials were simple and rather crude. The typical form of the late 7th–3rd century BC wooden burial chambers in the Altai-Sayan was pyramidal. In the Southern Altai, this form survived until the 1800s–early 1900s in Telengit above-ground burial structures.

Keywords: *Pazyryk culture, transhumance, funerary logwork, dwelling features, interior furnishing, felt carpets.*

Introduction

M.P. Gryaznov was the first scholar who pointed out that the Pazyryk people had permanent log buildings (1950: 59–60). He used the evidence from archaeological excavations revealing logworks in burials of early nomads, in particular in the 1st Pazyryk mound, which he explored. Gryaznov would have had even more grounds for such conclusion if he had known that it was not a robbers' cut in the northern wall of the logwork in that mound, as he believed (Ibid.: 16, pl. III, *2*), but a doorway. As V.P. Mylnikov established in our days, the burial chamber of the 1st Pazyryk mound was a part of logwork of a surface dwelling with a surviving doorway (1999: 29). The studies of recent decades have shown that the Pazyryk people reproduced the image of their homes in burial chambers. However, not all experts agree with this well-founded conclusion of archaeologists who personally studied the burial mounds of the Pazyryk culture. The newly discovered sites and their evidence compel us to readdress the topic of Pazyryk dwellings, which were, in our opinion, one of the key symbols of their culture. The purpose of the study is to prove the existence of log houses among the Pazyryk people.

Burial chamber as underground dwelling

After analyzing the evidence from the 1st Pazyryk mound, Gryaznov came to conclusion that "the Pazyryk tribe knew well the technique of building log houses, and undoubtedly lived in such houses" (1950: 59–60). The Pazyryk people led a nomadic lifestyle, which, according to Gryaznov, was confirmed by the entire set of grave goods containing no items that could not be used in nomadic life. Yet, in their places of wintering, they built sturdy houses, using larch-bark and birch-bark as roofing material. In addition, they could also have

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had simpler dwellings of hut-type, covered with birch-bark, bark of other trees, or possibly with felt (Ibid.: 60). S.I. Rudenko also believed that the Pazyryk people created dwellings of three types—houses made of logs, birch-bark yurts, and felt yurts (1953: 78)—and were excellent carpenters: "This conclusion is supported by extensive burial chambers of the nobility of the Altai Mountains, discovered in large burial mounds we excavated…" (1960: 200). He believed that log houses were intended for the rich, while the poor lived in cone-shaped huts made of poles and covered with larch-bark (Ibid.). Rudenko also gave a detailed description of the internal structure of a Pazyryk log house, their furniture, felt carpets, and other household items, based on the evidence he discovered in burial chambers of large Pazyryk mounds (1953: 79–89). According to Rudenko, in the natural environment of the Altai Mountains, it was easier to build houses of logs or poles than felt-covered dwellings. It is known from ethnographic evidence that only families with large herds of sheep could afford to produce the amount of felt needed to cover such dwellings. Representatives of such families were buried in the "royal" mounds (Ibid.: 79). Finally, according to V.D. Kubarev, who studied numerous ordinary Pazyryk burials, burial chambers of the Pazyryk people were imitations of their dwellings. The Pazyryk burial chamber, he wrote, was a larch-log cabin cut "with saddle joint with extending ends of logs" (this technique was used in the construction of dwellings, with the ends of uncut logs remaining at the corners), with the ceiling or roof made of one-sidedly hewn logs (with ends of the cover overhanging the walls of the logwork); covering the ceiling with sheets of birch- and larch-bark and pressing the sheets of birch- and larch-bark on the roof (or ceiling) with large boulders*; covering the gaps between wooden slabs with specially adjusted short poles and coating cracks in the walls and log-joints with clay; with the floor made of either wood slabs hewn on two sides or half-logs, covering floor and walls with felt and paving the platform for the logwork with pebbles (1987: 19–21; 1991: 27–29; 1992: 15–16). Thus, all leading scholars of the Pazyryk culture, who excavated both "royal" and ordinary mounds with surviving burial chambers (which is especially important), considered Pazyryk burial chambers to be the most reliable evidence of their well-developed housebuilding.

A different interpretation of Pazyryk burial structures was proposed by A.A. Tishkin and P.K. Dashkovsky (2003). From their point of view, "the logwork was not a typical dwelling of Early Iron Age nomads, who led a mobile lifestyle", and therefore, "in graves of cattle breeders, there should have been made a semblance of a structure that had been common for most members of society for a long time. Most likely… this had to be a vehicle (wagon, cart, etc.) or portable dwelling such as a yurt" (Ibid.: 262). Referring to burial chambers of the Scythians and carriers of the Catacomb culture, Tishkin and Dashkovsky argued that "in many burial structures of ordinary Pazyryk people, the structure inside the grave indeed reflected the type of dwelling at the semantic level, yet in this case it was not a stationary dwelling, but probably some type of wagon. In addition, the wooden structure in the grave more closely resembles the base (box) or frame of a vehicle in terms of size and appearance. …The presence of a horse burial, combined with a typical structure inside the grave, shows the embodiment of the Pazyryk people's idea of a funerary wagon (dwelling) for moving the dead to a distant afterlife, which was typical of Indo-European mythology" (Ibid.: 262–263). Those who have seen the Pazyryk burial chambers, built of larch logs, would agree that they least of all resemble the body of a wagon. The groundlessness of such statements is especially clear if we consider the recent findings of Mylnikov (1999, 2008, 2012; Samashev, Mylnikov, 2004). His thorough and comprehensive studies of Pazyryk wooden burial structures found in the Russian and Mongolian Altai and Kazakhstan allowed him to conclude that the people who left these structures possessed all professional skills and tools needed for constructing dwellings and utility buildings, and had extensive experience in constructing dwellings from logs. We fully share this opinion, and believe that all the burial chambers had real prototypes and were the reduced replicas of Pazyryk dwellings. As far as the "mobile lifestyle of nomads of the Altai Mountains" is concerned, their nomadic roaming was seasonal and occurred within a limited space, from winter to summer pastures (see, e.g., (Kubarev, 1991: 17–19; Polosmak, 2001: 19–20)). As S.V. Kiselev suggested (1951: 357), the Pazyryk people also built their stationary dwellings on summer pastures. Forest resources of the Altai Mountains could easily have provided timber for any needs of such construction.

The tradition of building log structures in the Altai-Sayan goes back to the Early Scythian period, or possibly even earlier. The "royal" Early Scythian burial mounds of Tuva suggest professional skills in wood-processing. Skillfully constructed cribworks were found in Arzhan-1. Double logwork, more perfect in structure than Pazyryk logworks, was discovered in Arzhan-2: its shape resembled a truncated pyramid; hewing of logs flat on the inside with rounded corners in the interior logwork finds direct parallels in structural features of interior logwork in the 5th Pazyryk mound (Mylnikov, 2017: 244)—the most recent structure from the chain of large Pazyryk mounds (Slyusarenko, Garkusha, 1999: 499).

Burial structures of the Pazyryk people were closely related to their earthly prototypes. Burial logworks were often assembled from individual elements of dwellings,

*These are ordinary burial chambers of the Altai Pazyryk people.

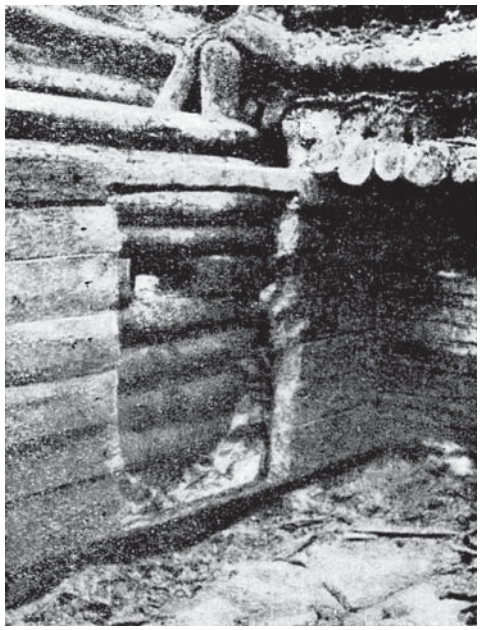

Fig. 1. Doorway in the northern wall of the logwork. The 1st Pazyryk mound. *Photo by M.P. Gryaznov. 1929.*

which in these cases served not only as building materials, but also as a symbol of the house (Fig. 1). It is likely that the Pazyryk people also had cone-shaped yurts*, covered with birch-bark sheets. In burials, birch-bark was used to cover the ceilings of wooden chambers**. We have not yet found any more reliable evidence on the existence of dwellings of this type among the Pazyryk people. However, we know for sure that they had structures made of poles. An indirect evidence is the presence of felt carpets with rows of ribbons sewn on them. One such carpet was found in a burial of an ordinary Pazyryk in mound 3 at the Verkh-Kaldzhin-II cemetery (excavations by V.I. Molodin); it covered a wooden bed (Molodin, 2000: 93). The trapezoid-shaped carpet was sewn of two pieces of dark brown soft and thick felt (Fig. 2). Its overall height was about 176 cm. The top edge, 164 cm wide, was neatly trimmed with woolen thread. The lower edge was unevenly cut off; its width was about 2 m. Long felt ribbons were sewn on the upper part of the cloth, in two rows. Each one was sewn only on the rounded edge; the ribbons tapered down and hung freely. The top row consisted of 14 ribbons (11 have survived), located at distances of no more than 2 cm from each other. The length of the longest surviving ribbon is 119 cm; a knot is tied at the torn end of one of the ribbons of the upper row. The bottom row of the same ribbons was sewn at a distance of about 59 cm from the upper line of the top row. Initially, there were probably also 14 of them; six sewn-on ribbons have survived. The whole item shows obvious traces of long-term use: many ribbons have been torn off from the cloth; ends of most of the ribbons have been torn off; felt has been worn out. The decoration pattern of this carpet, with two parallel horizontal rows of long ribbons sewn in the same way, is exactly the same as the famous large felt carpet from the 5th Pazyryk mound (Rudenko, 1968: 56–57). Notably, ribbons cut from the same felt look natural on a simple dark felt from the ordinary burial, but they look like alien elements on the elegant carpet from the 5th Pazyryk mound—simple and crude, these

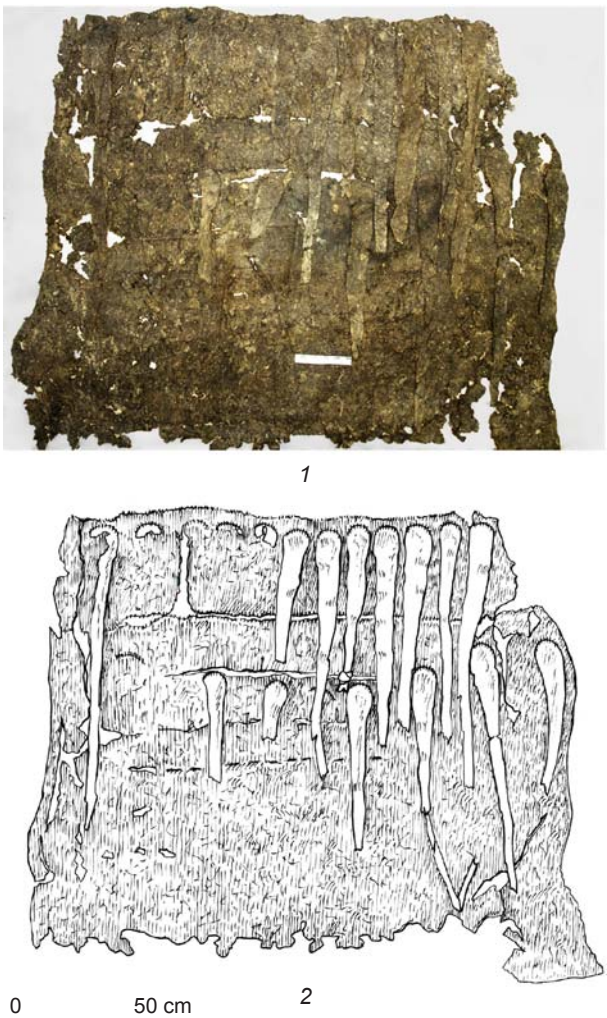

Fig. 2. Photo (*1*) and trace-drawing (*2*) of felt carpet-cover. Mound 3 at Verkh-Kaldzhin II. *Photo by K. Timokhin, trace-drawing by N. Khodakova*.

*In the past, such dwellings were predominant among the Telengits and Altaians, and have not undergone any serious changes up until now (Toshchakova, 1978: 81–82).

**It is known that among the Yakuts, when one of the family members died, the grave was covered with birch-bark from the cover of a *urasa*—a traditional summer frame dwelling. Birch-bark was not specially prepared for the burial. It was a kind of symbol of the house, which the deceased took with him to live in another world (Hochstrasser-Petit, Petit, 2012: 82).

tightly sewn black ribbons only spoil the appearance of the item. They had a purely utilitarian purpose*. Black felt ribbons were sewn by the Pazyryk people in order to tie the carpet to the frame of poles. Several poles are known to have been found along with the carpet, suggesting that this was a part of the frame and covering of a summer dwelling. However, there is another explanation for these finds. Gryaznov and Rudenko disagreed about the purpose of the large felt carpet from the 5th Pazyryk mound: Rudenko considered the carpet to be a wall decoration for a log house (1951: 113), while Gryaznov believed that it was a cover of a tent (see (Galanina et al., 1966: 99–100)). Objecting to the attribution of the felt carpet from the 5th Pazyryk mound as the cover on the walls of a winter dwelling, Gryaznov noted that it had a sub-trapezoidal shape atypical of carpets (1960: 238). However, as it turned out, the outer logwork (rectangular in plan view, measuring 7 × 4 m at its lower level, and 2 m in height) of the 5th Pazyryk mound, which was additionally explored in 2017–2019, was made in a form of truncated pyramid. All its walls noticeably narrowed upwards and had sub-trapezoidal shapes in profile (Konstantinov et al., 2019: 418) (Fig. 3). The unusual configuration of the felt carpet from this burial mound is quite consistent with the shape of the walls of the burial logwork, which as we believe, was a part and a reduced replica of a real house. Pyramidal placement of logs, due to which the Pazyryk burial chambers looked like truncated pyramids, was first noted by Kubarev (1987: 20). Logwork not only for "royal" mounds, but also for ordinary small structures (Fig. 4, 5) throughout the entire area of the Pazyryk culture, including the Mongolian and Kazakh Altai, was made in this way. This tradition was rooted in the Early Scythian period. Pyramid-shaped wooden structures have been found not only in the Altai Mountains. An above-ground burial chamber in the Baigetobe mound at the Shilikty-3 cemetery in East Kazakhstan had the shape of a truncated pyramid (Toleubaev, 2018: Fig. 45, p. 175) (Fig. 6). Winter dwellings of the Pazyryk people might have had the same truncated pyramid shape, but this "pyramid" was much higher than the burial chamber. In order to understand fully the purpose of the carpet, we should turn to the earlier evidence from burial 5 in the Arzhan-2 mound. Its burial chamber was the same underground house—an imitation of an above-ground dwelling, like that of the Pazyryk people. In addition to its wooden structure, repeating in some distinctive and important details the burial chamber of the 5th Pazyryk mound, the burial logwork in Arzhan-2 had the shape of truncated pyramid (Mylnikov, 2017) (Fig. 7). In addition, elements of a special structure were found inside the chamber: thin transverse poles were attached to vertically installed posts along the walls, and were additionally tied to interior walls of the chamber. Posts were fastened in specially made square holes in the floor of the chamber along the walls. According to the leaders of the excavations, these elements served as basis for drapery of the walls with colored felt carpets (Chugunov, Parzinger, Nagler, 2017: 35). One more hollow, found in the center of the floor, according to Mylnikov, could have probably been associated with the erection of a frame structure, such as light tent-canopy, over the buried persons (2017: 243). In the "royal" burial of Arzhan-2, there was probably the structure for attaching the felt, piled, or woven carpets, which has survived in destroyed form. Such systems were set inside the dwellings of ancient nomads. We believe that in real life, in seasonal dwellings, carpets were not attached to the walls with bronze nails and wooden pegs, as the Pazyryk people did in burial chambers, but were hung on frames made of poles. Apparently, holes for the poles were found in burial 5 of the Arzhan-2 mound. In the 5th Pazyryk mound, elements of such a structure—poles*, corresponding in length to the height of the felt carpet, and the carpet itself were located in the horse compartment (Rudenko, 1953: 55, fig. 26). The felt carpet was too large for the burial chamber, and its walls were decorated with other felts (Rudenko, 1968: 66).

With this method of hanging, wall carpets (valuable textile products) remained intact, and could be reused and easily transported. Together with the rest of the belongings, they were carried from summer to winter pastures and back. This is why they ended up in the horse compartment, next to the parts of the cart on which they were transported. Only after the owner of the house had departed for another world were large felt carpets cut into pieces to required sizes and left forever on the walls of his last dwelling. The Gryaznov's objections regarding the purpose of the carpet from the 5th Pazyryk mound also concerned the height of the item, 4.5 m. The scholar doubted that the Pazyryk people could have had such "huge mansions". We do not have good knowledge about possible types of ancient dwellings. By way of example, it may be pointed out that the height of a *urasa* Yakut summer frame-dwelling, covered with birch-bark sheet panels, could reach 10 m (Sokolova, 1998: 71).

The structure of Pazyryk wooden dwellings cannot be reconstructed in all details. Burial complexes provide information only about some structural parts, but even this is extremely important, since the structure of the house

*The carpet was most likely an imported item, since the outfits of the rider and the goddess depicted on it have nothing to do with real clothes of the Pazyryk people.

*Notably, not all elements of the structure were placed into the burials. Only a part was sufficient, which represented the whole structure. For example, the Telengits removed one or two poles from the yurt and left them in the grave of the deceased, so that he could build a dwelling for himself in another world (Toshchakova, 1978: 132).

Fig. 3. Burial chamber. The 5th Pazyryk mound. Assembly on the territory of the Anokhin National Museum of the Republic of Altai. *Photo by V.P. Mylnikov*.

Fig. 4. Logwork. Mound 3 at Verkh-Kaldzhin II. *Photo by V.P. Mylnikov*.

Fig. 5. Logwork. Mound 1 at Olon-Kuriyn-Gol-10 (excavations by V.I. Molodin, H. Parzinger, A. Nagler). *Photo by V.P. Mylnikov*.

reproduces the worldview of the Pazyryk people (Baiburin, 1983: 14). For example, the entrance to the dwelling was made on the northern side, where in Pazyryk burials killed horses were usually located. The deceased were placed in the southern half of the

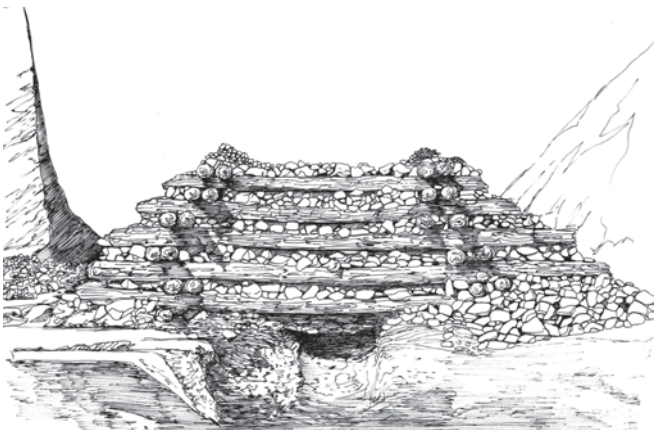

Fig. 6. Above-ground burial chamber in the Baigetobe mound at Shilikty-3, East Kazakhstan (after (Toleubaev, 2018)). *Trace-drawing by E.V. Shumakova*.

Fig. 7. Logwork. Burial 5 of the Arzhan-2 mound. *Photo by V.P. Mylnikov*.

logwork; in the house, this was the sleeping place of the owners. If a male and female were buried in the grave, the body of the male was always placed next to the southern wall, and that of the female next to the male. If two males or two females were buried, the bodies of the older persons were placed closer to the southern wall.

Pazyryk burials contained furniture, which was absent from the Early Scythian "royal" burials. Various kinds of wooden beds were present in burial chambers, and larch hollowed woodblocks in burials of the nobility. In the epics of the Altaians, woodblocks are called "cradles" (Yamaeva, 2021: 188). This identification is confirmed by the fact that besides the noble deceased, children were also buried in hollowed woodblocks (Kubarev, 1991: 31, fig. 6). The burial of mummified bodies in a woodblock-"cradle" might have symbolized the return to the origins of life. Sometimes, in "royal" burial mounds, scholars have found beds*. Such wooden beds from the Great Katanda burial mound were sketched and described by V.V. Radlov: "At the bottom of the grave, there were two tables on four legs, directed from east to west. A skeleton with its head to the east lay on each of these tables… The tables were very carefully processed with an axe, but were not planed, and there was a rim about 1 inch high around each edge. The board, rim, and legs in the shape of truncated cones were made from a single piece of wood…" (1989: Pl. 6, fig. 8: 448). A similar bed, judging by this description, was discovered by Rudenko in the 1st Tuekta mound (Rudenko, 1960: 201, pl. LIV, *1*; Mylnikov, Stepanova, 2016). The beds' height and proportions were commensurate with burial chambers, not to mention the dwelling. Notably, in the yurts of nomads, there were also many wooden items, such as chests, beds, and tables (Dzhanibekov, 1990: 139–140), and the yurts of the Altaians and Telengits always contained wooden beds, in the complete absence of any other furniture (Toshchakova, 1978: 100).

Conclusions

The key symbol of the Pazyryk culture was not dwellings made of poles, not felt yurts, but permanent stationary buildings—their log houses. Larch burial structures of the Pazyryk people were the embodiment of their earthly dwellings and their eternal home. Unfortunately, the perfect mastery of house building in the Altai Mountains was subsequently lost. According to the conclusion of ethnographers, "only in the early 19th century did the Altai log yurt appear, which was a transitional type from a cone-shaped and cylindrical yurt to log cabin or house… It took decades for Altaian nomads to learn the building technique borrowed from the Russian peasants" (Ibid.: 96).

*The funerary rite of the Pazyryk people shows many "situational" features. Probably, if it was not possible to make a hollowed woodblock, the deceased were buried on their beds. Some burials contained both a bed and woodblock.

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I.V. Tunkina
St. Petersburg Branch of the Archive of the Russian Academy of Sciences,
Kievskaya 5, bldg. 9, St. Petersburg, 196084, Russia
E-mail: tunkina@yandex.ru

D.G. Messerschmidt's Collection of Siberian Antiquities in Drawings at the St. Petersburg Archive of the Academy of Sciences

This study focuses on the drawings of items collected during D.G. Messerschmidt's first multidisciplinary expedition to Siberia in 1719–1727. Pictures of the artifacts have been preserved among the documents held by the Academy of Sciences Archive in the personal papers of the traveler, which includes his field journals, the appendices of his reports to the Pharmaceutical (Medical) Registry, and a large handwritten treatise "Sibiria Perlustrata" (1727), outlining the expedition's findings. In 1728, Messerschmidt's archaeological collection was included as part of Peter the Great's Siberian Collection, exhibited at the Kunstkamera. Watercolor and pencil drawings and engravings depicting the exhibits are identified. Handwritten descriptions and drawings of the items have made it possible to a certain extent to reconstruct the first encyclopedist's Siberian archaeological collection, which perished during the 1747 fire at the Kunstkamera. As Messerschmidt's graphic works demonstrate, he documented items spanning the time from the Bronze Age to the Late Middle Ages and covering the territory from the Urals to the Trans-Baikal region, including things imported from Western Europe, China, and Central Asia. Also, he collected archaeological items representing virtually all cultures of the Minusinsk Basin. It is concluded that in the first third of the 18th century, Messerschmidt's collection was the world's largest and most representative assemblage of artifacts from northeastern Eurasia.

Keywords: *Academy of Sciences Archive, D.G. Messerschmidt, personal papers, Kunstkamera, Peter the Great's Siberian Collection, drawings of archaeological artifacts.*

Introduction

One of the most valuable collections in the first scientific archive of Russia (currently the St. Petersburg Branch of the Archive of the Russian Academy of Sciences) is that of Daniel Gottlieb Messerschmidt (1685–1735)—Doctor of Medicine, scholar and encyclopedist, who first explored the northeast of Eurasia (Novlyanskaya, 1970; Perviy issledovatel…, 2019; K 300-letiyu…, 2021; Lehfeldt, 2023). Messerschmidt, a Pomeranian German from Danzig, was invited to serve in Russia and was assigned to the Pharmaceutical (since 1721, Medical) Registry. On November 15, 1718, upon the decree of Peter the Great, he was sent to Siberia, "to search for all sorts of rarities and pharmaceutical items, herbs, flowers, roots, and seeds, and other articles belonging to medicinal compositions…" (Perviy issledovatel…, 2019: 201). During the eight-year expedition (1719–1727), D.G. Messerschmidt expanded this research program and, on his own initiative, made surveys and studies in the ancient history and archaeology of Siberia, examined collections of archaeological objects (and their drawings) collected by private individuals, including the first Siberian Governor M.P. Gagarin and his successor the Governor-General A.M. Cherkassky, governors and commandants of forts, merchants, exiled Swedes and

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Germans ("Carolins"), grave robbers, etc. (Tunkina, Savinov, 2017; Savinov, Tunkina, 2022).

Visualization of archaeological objects discovered and recorded during Messerschmidt's expedition played a crucial role in his research (Bondar, Zorin, Tunkina, 2019; Tunkina, 2021). In his travel journal, on May 28, 1722, Messerschmidt wrote bitterly that he was unable to engage his companions in scholarly works, which consisted mostly in making records and drawings (SPbF ARAN. F. 98, Inv. 1, D. 1, fol. 144v). Therefore, he had to take the drawing duties on himself. Starting in July 1722, sporadic drawings, including those of archaeological artifacts, appeared in the expedition journals. The daily records include pages with empty spaces left where drawings, ground plans, and sketches of maps were intended to be included in the future.

At the beginning of 1720, Messerschmidt did not yet realize the necessity for making mandatory copies not only of official correspondence with the authorities, but also of all maps and drawings which were sent along with reports to the Pharmaceutical (Medical) Registry, for his own archive. Five years later, on August 12, 1725, after a conversation with Vitus Bering in Yeniseysk, he wrote in his journal: "…I showed him my protocols along with the original documents, which contained drawings of things from burial mounds… including those made by myself. When viewing them, Captain Bering advised me to make copies of the drawings, with the help of St. Petersburg artists, and of their descriptions. He warned me that in St. Petersburg they might also demand the things that I bought with my own money, with subsequent reimbursement of the costs, according to the bill presented, and they would definitely take away my journal containing information about the route traveled…" (Putevoy zhurnal…, 2021: 412). V. Bering's warning turned out to be prophetic.

On January 7, 1728, after his return to St. Petersburg, owing to a conflict with the Archiater J.D. Blumentrost, who headed the Medical Registry, almost all expedition materials of Messerschmidt were arrested and handed over to the Kunstkamera of the newly founded St. Petersburg Academy of Sciences and Arts. The traveler was forbidden under oath to study his own collections and publish descriptions and drawings of "curious things" (Materialy…, 1885: 288–290, 296–297, 347–349, 374–375, 382–384; Tunkina, Savinov, 2017: 135–137). Thereby, the Kunstkamera was supplemented with a large number of "amazing antiquities", most of which burned down in the catastrophic fire on the night of December 5, 1747. Both the Königsberg scholar G.S. Bayer, the first academician-historian and sinologist of the St. Petersburg Academy of Sciences, and the captured Swedish Captain Philip Johan Tabbert von Strahlenberg (1677–1747), a companion during the first stage of D.G. Messerschmidt's expedition, initiated publication of a number of archaeological artifacts discovered by Messerschmidt. The latter became the closest assistant to Messerschmidt and, on behalf of the doctor, kept the expedition journal from March 1, 1721 to May 28, 1722. Ph.J. von Strahlenberg invited a Livonian nobleman Karl (Carl) Gustav von Schulmann (1702–1765), a 20-year-old native from Narva, to take on the drawing duties for the expedition. In the beginning of January 1722, they carried out "winter" excavations of a burial mound on the Yenisey, the results of which were examined by Messerschmidt (Tunkina, Savinov, 2017: 87–90). As D.G. Savinov established, visual materials produced by Messerschmidt strikingly differ in the manner of execution from the drawings of the expedition drawer K.G. von Schulmann, who returned to his motherland in May 1722. The drawings by Messerschmidt are lighter, made with thin lines, without an emphasized contour, with hatching and fine oblique grid, sometimes with the designation of the cardinal points. The drawings by K.G. von Schulmann are made with confident clear lines, without hatching, with designation of the contour of the image, with the volume rendered by shading, and with fractures on the rocks depicted by torn lines thinning at their ends (Ibid.: 120, 121).

Archaeological sites of the Urals and Siberia in archival documents

Today archival documents are the only source for reconstructing the archaeological collection of D.G. Messerschmidt. Visual records of the artifacts of Siberian archaeology are available in the five volumes of Messerschmidt's handwritten journals, individual files of his personal papers, which include illustrated appendices of reports to the Pharmaceutical (Medical) Registry, and in his handwritten work summarizing the results of the expedition, entitled "Sibiria Perlustrata" ("Opisaniye Sibiri", 1727; facsimile ed.: (Messerschmidt, 2020)). The same artifacts are depicted in watercolor pictures of the Kunstkamera exhibits (Fig. 1), made in the 1730s–1760s by masters and apprentices of the Drawing Chamber at the St. Petersburg Academy of Sciences ("Narisovanniy muzey"…, 2003–2004; The Paper Museum…, 2005). The artistic quality of many of the drawings leaves much to be desired. Starting in 1742, the masters of the Engraving Chamber at the St. Petersburg Academy of Sciences began to engrave images of the Kunstkamera exhibits on copper and print test prints of engravings. One set was bound, handed over to the Imperial Archaeological Commission, and received the name "Academic Atlas" in the archaeological literature (NA IIMK. R. I, Inv. 1, D. 1231). Watercolor drawings and engravings made from them were supposed to illustrate two unpublished books—a catalog of "curiosities" of the museum (in 1741, only a text catalog of "man-made" artifacts of

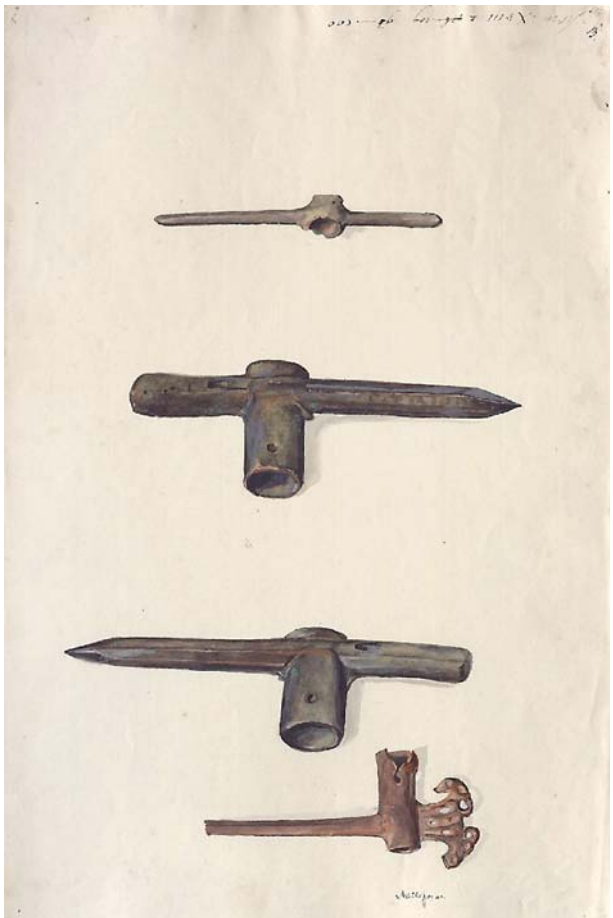

Fig. 1. Unknown artist. Bronze pickaxes of the Tagar culture from the Minusinsk Basin (No. 1, 5th–4th centuries BC; No. 2 and 3, 7th–6th centuries BC; No. 4, 3rd–2nd centuries BC). Collection of D.G. Messerschmidt. Watercolor drawing depicting the exhibits of the Kunstkamera. Watercolor, brush, pen. 1730s. ©St. Petersburg Branch of the Archive of RAS. R. IX, Inv. 4, D. 287, fol. 1.

the Kunstkamera was published (Musei…, 1741)) and "Monumenta Sibiriae" ("Monuments of Siberia"). They were not published due to destruction of most of the artifacts and engravings with their images in the catastrophic fire in the Kunstkamera in 1747. In 1750, 25 separate sheets of engravings were put on sale, which already by the early 19th century were considered to be very rare (Spitsyn, 1906: 235, n. 1; Rudenko, 1962: 10; "Narisovanniy muzey"…, 2004: II). However, many of the engravings greatly misrepresented the depicted objects, because part of the blocks were engraved not from the originals, but from the drawings made by academic artists.

Comparative source analysis of the descriptions and drawings of artifacts surviving in the documents has made it possible not only to reconstruct the part of Messerschmidt's collection, which ended up in the Kunstkamera (Kopaneva, 2006, 2012), but also to clarify the circumstances of discovering a number of objects, and to establish their cultural and historical attribution (Tunkina, Savinov, 2017: 78–115, pl. I–XVI; Savinov, Tunkina, 2018, 2022).

Messerschmidt regularly reported to the Pharmaceutical (Medical) Registry headed by Archiater J.D. Blumentrost, the elder brother of the first President of the St. Petersburg Academy of Sciences L.D. Blumentrost, on the progress of his expedition. Three out of 22 reports had illustrated appendices: the fourth (June 25, 1720) from Tobolsk, tenth (May 20, 1722) from Krasnoyarsk, and fourteenth (February 15, 1724) from Irkutsk. Appendices of the fourth and tenth reports have some relation to archaeology.

According to the terms of the Peace of Nystad in 1721, Messerschmidt's companions Ph.J. Tabbert and K.G. von Schulmann, like other captured Swedish and German officers ("Carolins") exiled to Siberia, were allowed to return to their homeland. The tenth report of May 20, 1722 by Messerschmidt to the Medical Registry and its appendix with drawings were delivered to St. Petersburg and copied for his own purposes by Tabbert, who then returned to Sweden, for a book he intended to publish on Siberia. In 1737, the archive and library of Ph.J. von Strahlenberg were burned in a fire in his house in Stockholm. The travel journal where he took travel notes during his journey throughout Siberia, and a number of drawings made in the field had already been lost before the incident (Strahlenberg, 1730: 411). They probably included the plan of the burial mound excavated in January 1722 on the banks of the Yenisey, which was known to have been made from the text of the expedition journal. Therefore, the letters of Ph.J. von Strahlenberg (Tabbert) to the prominent figure of the Swedish Enlightenment Erik Benzelius the younger (1675–1743) (Tunkina, 2020a, b) and to the botanist and Doctor of Medicine Johann Philipp Breyne (1680–1764), owner of the famous Cabinet of Naturalia in Danzig, who recommended Messerschmidt to Peter the Great for service (Tunkina, Savinov, 2017: 20–24, 36, 42, 61, 65), are of significant value. The drawings copied from the originals by K.G. von Schulmann, rendering stone statues, Orkhon-Yenisey written records, and Siberian rock art representations discovered by Messerschmidt and Tabbert have survived in appendices of the letters of Ph.J. von Strahlenberg in 1724 in Linköping (Sweden) and Gotha (Germany) (Lehfeldt et al., 2021: Fig. 3–8; Bondar et al., 2022: Fig. 2–3). Ph.J. von Strahlenberg published the images of artifacts that were discovered with his participation in the form of engravings from the originals made by K.G. von Schulmann (Strahlenberg, 1730: Pl. II, V, c, d, VIIIB, XI, XII, XX).

The search for the original reports of Messerschmidt and their appendices in the collection of the Medical Registry in the Russian State Archive of Ancient Acts was unsuccessful. Only the documents which survived

in the academic archive under the personal papers of Messerschmidt are available (Tunkina, 2017). The releases of appendices of reports with some (by far not all!) drawings have come down to us. Visual records of a number of archaeological and epigraphic artifacts of the Urals and Siberia mentioned in the documents, in Latin or German annotations of the traveler from the descriptions of appendices of reports, and in the third volume of "Sibiria Perlustrata" are missing (Tunkina, 2021: 267–269).

Field journals of the expedition, published in East Germany in an incomplete form along with individual drawings, mention a number of ancient monuments seen by Messerschmidt (1962–1977). For example, the journal includes sketches of the Ust-Es Kys-Tash and Kurtuyak-Tash stone statues of the Okunev culture of the Bronze Age (16th–14th centuries BC), discovered by the traveler on August 18, 1722, drawn with the Rhine fortification scale, as well as drawings of the now lost burial mound slabs of the Saragash stage of the Tagar culture of the 5th–3rd centuries BC in the Es-Teya-Abakan steppes. The drawing of the Turkic stone anthropomorphic statue "Daurian kurtuyak" in the Argun steppe (described in the journal in the entry on September 14, 1724) escaped the attention of scholars for three hundred years (Tunkina, 2019: Fig. 6). Handwritten journals and appendices of reports contain sketches of the Tom, Novoselovo, and Biryusa rock art sites, and the "Painted Stone" on the right bank of the Angara River, near the village of Klimovaya, etc. (Tunkina, Savinov, 2017: Pl. XIV, 4, 5; XV).

Messerschmidt attached to his fourth report of June 25, 1720 from Tobolsk a "philological sample from the Fetka caves on the cliff"—drawings of petroglyphs from the Irbit rock art site in the Middle Urals, which Messerschmidt believed to be an unknown script. They are represented by copies of drawings made in 1703 by S.U. Remezov and his son Leonty taken from Remezov's "Service Book", which were made by someone for Messerschmidt in Tobolsk. Another "sample" included "ancient grave goods, shaitans, figurines adorned with precious stones, coins, and so on and so forth", which, in the opinion of the traveler, were meant to clarify the dark history of the Siberian peoples. Messerschmidt assembled his collection of artifacts at his own expense, and sent the first parcel of antiquities in a "safely sealed" box to St. Petersburg to the Archiater J.D. Blumentrost, together with the fourth report (Perviy issledovatel…, 2019: 260). We may have some idea of the "sample" that included antiquities from the surviving list of the plates; however, only two plates—a plan of Kungur Cave and a drawing of a Western European aquamanale in the shape of a knight—have survived out of nine illustrative appendices in Messerschmidt's personal papers (Fig. 2).

Illustrated appendices of the tenth report of Messerschmidt of May 20, 1722 from Krasnoyarsk

Fig. 2. Unknown artist. Bronze aquamanale in the shape of a mounted knight. Hildesheim, Lower Saxony. Ca 1200 or the early 13th century. ©St. Petersburg Branch of the Archive of RAS. F. 98, Inv. 1, D. 20, fol. 50.

included both "philological examples" (petroglyphs) and "examples of antiquities" (archaeological artifacts), as well as "philological antiquities" (stone statues with Orkhon-Yenisey runic writings discovered by the traveler). These contain a drawing by K.G. von Schulmann representing a stone object 15–20 cm in size, which was found at the mouth of the Karaulnaya River, at its confluence with the Yenisey (Fig. 3). According to L.R. Kyzlasov, it was an image of a fish-bait from the Serov stage of the Baikal Late Neolithic culture (late 4th to mid 3rd millennium BC) (1962: 51). However, it is possible that the drawing depicted a fragment of a lepidodendron, or scale tree fossil—an extinct tree-like lycopsid plant of the forests of the Carboniferous Period. Fossil specimens show imprints from the bases of fallen leaves on the trunk and branches of this plant, which form "cushions" resembling scales of a fish, snake, or alligator.

In St. Petersburg, at the end of 1727, Messerschmidt compiled his handwritten three-volume final work "Sibiria Perlustrata" ("Description of Siberia"), which

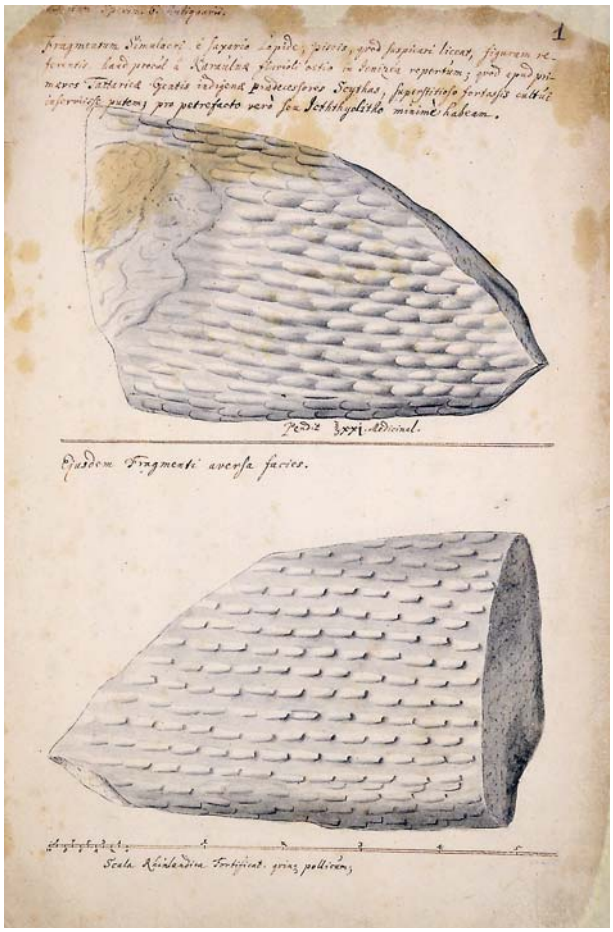

Fig. 3. K.G. von Schulmann. Fragment of a stone statue of a Neolithic fish-bait, or fragment of a lepidodendron (scale tree) fossil. ©St. Petersburg Branch of the Archive of RAS. F. 98, Inv. 1, D. 37, fol. 1.

he dedicated to the young Emperor Peter II. The monograph summed up the Siberian journey not only in terms of natural scientific knowledge. The third volume of the manuscript "Philologico-Historico-Monimentario et Antiquario-Curiosus" ("Philological and Historical, Related to Artifacts and Curious Antiquities") (SPbF ARAN. F. 98, Inv. 1, D. 22, fols. 327–393) (Messerschmidt, 2020: Fols. 327–393) contains a subsection "Curiosa Sibiriae Monimentaria" ("Curious Artifacts of Siberia") (Ibid.: Fols. 334–393). The manuscript "Description of Siberia" is preceded by a list of plates planned for publication, "Idea Operis cum serie iconum opera suis locis inseredarum" ("The Idea of the Work with a Series of Images…") (Ibid.: Fols. 12–14v, No. 68–124). A separate subsection of the list is entitled "XI. Antiquitatis hactenus ignoratae Monimenta Sibirica, iconismis aliquot seqq. repraesentata" ("Hitherto Unknown Siberian Antiquities Represented in Several of the Following Images"). The plates related to archaeology have the author's headings (Fig. 4), but the manuscript contains only 36 drawings with the author's explanations; twenty two sheets were left blank for drawings with annotations and references to the images from the appendices of the fourth (1720) and tenth (1722) reports to the Medical Registry, that is, to the initial stage of the Messerschmidt's journey, when the expedition explored the environs of Tobolsk and the Minusinsk Basin. This subsection of the third volume consists of brief annotations to the drawings of Siberian archaeological artifacts (stone statues, burial mounds, petroglyphs, grave goods—amulets, vessels, utensils, ornaments, weapons, and horse harnesses) (Savinov, 2021). Contamination of the visual materials and texts of Messerschmidt makes it possible to reconstruct a number of images missing from "Sibiria Perlustrata".

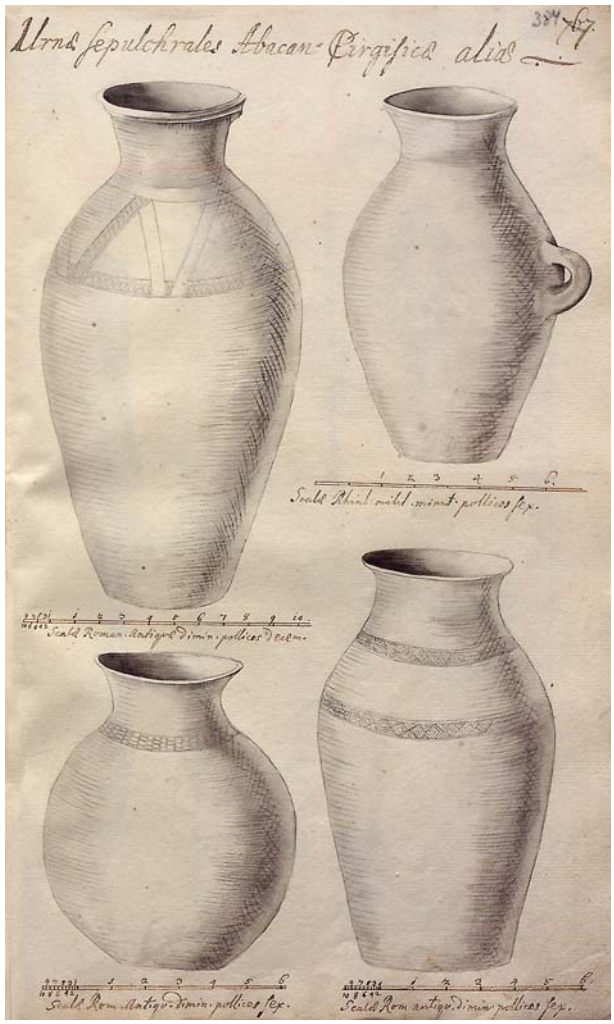

Fig. 4. "Abakan-Kyrgyz burial urns" (No. 1, 3, and 4, decorated (so-called "Kyrgyz") vases, 7th–9th centuries; No. 2, vessel with smooth walls and small vertical handle on the body, 8th–9th centuries). Illustration for the manuscript of "Sibiria Perlustrata" by D.G. Messerschmidt. 1727. ©St. Petersburg Branch of the Archive of RAS. F. 98, Inv. 1, D. 22, fol. 384.

It is known that the artist and engraver, master of map-making and letter-cutting Georg Johann Unverzagt (1701–1767), who traveled with the embassy of L.V. Izmailov to China (1719–1720) and whom Messerschmidt made acquaintance with earlier in 1719, made hand-drawn copies of "many curious things" brought by Messerschmidt to St. Petersburg (Materialy…, 1885: 347, 349, 375, 382, 391, 393–394). It is probable that he was the author of the majority of the highly artistic botanical, zoological, and archaeological illustrations to Messerschmidt's manuscript, "Sibiria Perlustrata" (2020), which contains only a few single-color line drawings made by the author. Most likely, Unverzagt made his drawings under private commission; for such practices he was subsequently fired from the St. Petersburg Academy of Sciences and Arts (Tunkina, 2021: 269).

The literature concerning Messerschmidt often reproduces not the original drawings, but trace drawings of them (Borisenko, Hudiakov, 2005: Fig. 5, 6, 14–20). Many images were previously published in fragments; not from the originals, but from copies from the unpublished album of V.V. Radlov "Original Skitzen einiger Gegenden in Hoch-Asien. Aufgenommen von Dr. W. Radloff auf seiner Reise durch den Altai. 1861" (1861–1918), which is kept in the collection of illustrations in the Department of Archaeology at Peter the Great Museum of Anthropology and Ethnography (Kunstkamera) of the Russian Academy of Sciences (Coll. No. 5041). Out of 75 sheets only a few sheets with medieval artifacts have been published (Korol, 2008: App. 10, pl. VIII, XI, XIII, XVI, XXXIX, XL–XLII). The name of the album was misleading to a number of scholars (including G.G. Korol), who attributed the finds represented in the album exclusively to the Altai. On the contrary, the copied illustrations from Messerschmidt's "Sibiria Perlustrata", presented in the form of applications in the album of V.V. Radlov, primarily rendered artifacts from the Minusinsk Basin.

Conclusions

This long-term study, summed up in a monograph (Savinov, Tunkina, 2022), was intended to present all, without any exception, the original drawings of Siberian archaeological artifacts from the collection of D.G. Messerschmidt, with scientific commentary and cultural and historical attribution (Tunkina, 2017; 2019: 48, 49; Savinov, 2021). Field journals, appendices of the traveler's reports to the Pharmaceutical (Medical) Registry with illustrations, all Latin texts and drawings from the third volume of "Sibiria Perlustrata" related to the archaeology of Siberia, and items from Messerschmidt's collection preserved in the drawings of the Kunstkamera exhibits were analyzed. The visual evidence has made it possible to evaluate the nature, volume, and chronological range of Messerschmidt's archaeological collection. The importance of these materials also results from the fact that most of the artifacts perished during the fire in the Kunstkamera on December 5, 1747. Consequently, the texts of the scholar and sketches made during the expedition and after it turn out to be almost the only source allowing us to evaluate the collection as a whole.

One century after the fire in the Kunstkamera, some artifacts from Messerschmidt's collection, at the request of Emperor Alexander II, were handed over to the Imperial Hermitage in 1859 as a part of the Siberian collection of Peter the Great. However, today it is extremely problematic to identify the items collected by Messerschmidt. In the inventories of the 18th century, only a few artifacts from Peter the Great's Siberian collection were identified as having been part of the collection gathered by the pioneer of the archaeological study of Siberia.

The main conclusion of this study is that the collection of D.G. Messerschmidt was the first archaeological collection in Russia purposefully compiled during a scholarly expedition, as opposed to the Siberian collection of Peter the Great (about 250 items) or the collection of the Dutchman N. Witsen, which included drawings of about forty things, which fit onto four or five plates of his compilation work "Northern and Eastern Tartaria" (depending on the edition of 1692, 1705, or 1785). Messerschmidt's collection contained not only highly artistic items made of gold and silver, which were procured in Siberia by grave robbers, but mostly ordinary artifacts (things made of iron or copper (bronze), pottery) reflecting almost the entire range of archaeological cultures of the Minusinsk Basin, from the Bronze Age to the Late Middle Ages, as well as images of petroglyphs and stone statues with signs of writing unknown to science at that time (Savinov, Tunkina, 2022: 11, 15). This is the main difference between the collection of Messerschmidt, together with academicians G.F. Miller and I.G. Gmelin, who followed in his footsteps in the Academic team of the Second Kamchatka Expedition (Zavitukhina, 1978), from the much better known collections of N. Witsen (Radlov, 1888: 3–5; Zavitukhina, 1999) and Peter the Great's Siberian collection (Spitsyn, 1906; Rudenko, 1962; Zavitukhina, 1977, 2000; Korolkova, 2006, 2012), which consisted mainly of gold and silver artifacts. The attention of Messerschmidt to the characters written on statues and ancient grave goods, which could give a clue to understanding which peoples had left them, was not accidental. Documents confirm that Messerschmidt made it a priority to discover a number of monuments, in particular rock art sites, stone statues, and the Orkhon-Yenisey script of the medieval population of the Minusinsk Basin. The corpus of images proves that at that

time Messerschmidt's collection, which included about 370 artifacts, was the largest and most representative collection of Siberian archaeological artifacts not only in Russia, but also in the whole world.

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I.P. Lazaretov[1], A.V. Poliakov[1], V.M. Lurye[1], and P.B. Amzarakov[2]

[1]Institute for the History of Material Culture, Russian Academy of Sciences, Dvortsovaya nab. 18A, St. Petersburg, 191186, Russia
E-mail: lazaretov@yandex.ru; poliakov@yandex.ru; verqa@list.ru
[2]ANO "Archaeology of Khakassia", Prigorsk 6B, office 15, Chernogorsk, 655156, Russia
E-mail: petr_amzarakov@mail.ru

The Final Bronze Age in the Minusinsk Basin

Based on the most recent excavation findings, this article discusses a disputable group of burials, previously believed to represent the Bainov stage of the Tagar culture (900–700 BC) in the Minusinsk Basin. Analysis of these burials unambiguously supports I.P. Lazaretov's idea that they fall into two independent and unrelated groups. One of them continues Late Bronze Age traditions, whereas the other demonstrates new features exclusively associated with the Tagar culture. Most complexes of the Bainov type represent the final stage in the evolution of Late Bronze Age traditions. This is evidenced by various categories of grave goods, features of burial structures, and the funerary rite. These burials can be attributed to stage IV of the Late Bronze Age in the Minusinsk Basin. The second, smaller group reveals entirely new features, typical of the Podgornoye stage of the Tagar culture. These include novel structural features in kurgan architecture, different female funerary attire, and the custom of placing weapons in graves. This attests to the arrival of a new population group with its own traditions, resulting in the emergence of a Scythian type culture on the Middle Yenisey. These burials should be attributed to the beginning of the Podgornoye stage of the Tagar culture. Hopefully, future studies will help to separate out a special late group of Bainov burials, contemporaneous with the early Podgornoye kurgans. Currently, it is possible to discern certain features suggesting that this population took part in the origin of the Tagar culture.

Keywords: *Minusinsk Basin, Middle Yenisey, Late Bronze Age, Tagar culture, Bainov stage, Podgornoye stage.*

Introduction

Interpreting sites of the transitional period from the Bronze Age to the Early Scythian period in the Minusinsk Basin is an important issue. According to traditional views on the emergence of the Tagar culture, a special (Bainov) group of sites can be distinguished as the earliest stage, which combined both obvious manifestations inherited from the traditions of the Bronze Age and early cultural features of the Scythian period (Teploukhov, 1926: 90, 94; Kiselev, 1937: 166; 1951: 187–188; Gryaznov, 1956: 70; 1968: 188–189; Vadetskaya, 1986: 96–100). Thereby, unconditional continuity between two successive archaeological cultures, the Karasuk and Tagar, has been postulated.

It is true that on the chronological scale of the region, sites of the Bainov type occupy an intermediate position between the Lugavskoye complexes and most complexes from the Podgornoye stage of the Tagar culture (Poliakov, 2022: 227–312). However, a detailed analysis of these sites has revealed their clear heterogeneity. Some of the complexes, including the eponymous Bainov Ulus burial

site, clearly demonstrate consistent development of local traditions of the Late Bronze Age in funerary rite, kurgan architecture, pottery shapes and decoration, as well as in the main categories and types of bronze items. However, these complexes do not contain anything that could connect them with the sites of the Tagar culture, primarily, elements of the Scythian triad. It has been suggested considering the complexes of this kind as belonging to the final stage IV (Bainov) of the Late Bronze Age (Lazaretov, 2007; Lazaretov, Poliakov, 2008; Poliakov, 2020; 2022: 285–289). On the contrary, another part of the transitional sites manifest fully formed features typical of the Scythian period, with minimal manifestations of the previous period. Such sites should be attributed to the classic Tagar culture as early Podgornoye stage complexes.

Currently, among the sites of the Late Bronze Age, burials of stage IV (Bainov) have been studied the least. The total number of complexes attributed to this stage does not exceed several dozen, which is a result of their scarcity, very short time of existence (second half of the 9th to early 8th century BC), and late identification as an independent group of sites. Ordinary cemeteries of this group consist of no more than five to ten burial structures. Until recently, the largest cemetery of the transitional period was the Byrganov V complex containing 17 burial mounds; some of them showed clear influence of the Tagar culture, and one should be definitely interpreted as an early Podgornoye burial.

The problem of selecting the previously studied complexes and individual burials of the Bainov type as parts of burial grounds of different periods should be especially addressed. Without the necessary detailed analysis, these have often been attributed to the Tagar culture. It has often been observed that the Tagars reused burial mounds of the Late Bronze Age, completely or partially destroying central early burials and making their own burials in their place. Meanwhile, the Bainov enclosure structures, and even children's graves beyond their eastern walls, were often preserved. However, the evidence from such burial mounds is usually interpreted as being purely Tagar. There are also frequent cases when basically early Podgornoye complexes are unjustifiably attributed to the Bainov stage. Such confusion results from the lack of clear criteria for distinguishing between the sites of the Late Bronze Age and the Scythian period.

In 2020–2022, the Sayan expedition from the Institute for the History of Material Culture of the RAS, together with the "Archaeology, and Historical and Cultural Expertise" Research and Production Center carried out extensive excavations of settlement and burial complexes in the south of the Republic of Khakassia. Three complexes contained burials of the Final Bronze Age (IV, Bainov stage). Thirty burial mounds of the Bainov type were explored only at the burial ground of Ust-Kamyshta-1. Good preservation of burial structures, as well as numerous pottery and bronze implements, make it possible to establish clear features that distinguish this special group of sites. This work should be compared with the previous stage III complexes (Lugavskoye) and early Podgornoye burial mounds located at the same cemetery.

Architecture and grave structures of the burial mounds

According to their external features, burial mounds belonging to the Bainov stage of the Late Bronze Age are noticeably different from the early complexes of the Tagar culture. They consist of flat platform enclosures, with the entire internal space evenly filled with native soil (Fig. 1, *1*). Usually, the upper edges of the enclosure

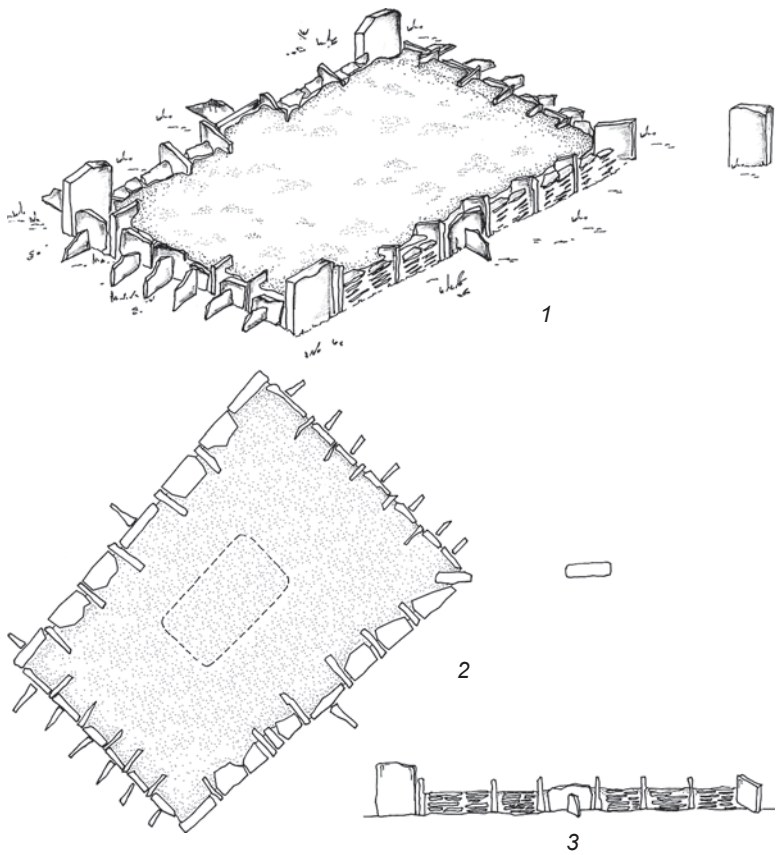

Fig. 1. Burial mound of the Bainov stage.
1 – reconstruction of the original appearance; *2* – ground plan of a typical burial mound; *3* – reconstructed facade of the enclosure wall.

were carefully made even and almost did not protrude above the surface of the modern steppe (Fig. 2). During large area excavations, numerous pits from which soil was taken for making the mound have been discovered in the space between individual complexes. This tradition originated at the sites of stage III (Lugavskoye) of the Late Bronze Age and ceased to exist upon the emergence of the Tagar culture.

The enclosures were of square or rectangular shape. The rectangular enclosures usually had their long walls along the SW-NE line, along the axis of the grave (Fig. 3). Quite often, there were trapezoidal structures,

Fig. 2. Burial mound of the Bainov stage: example of making the height of the enclosure wall even.

Fig. 3. Enclosure of the burial mound of the Bainov stage (view from the northeast).

with the southwestern wall shorter than northeastern one. The slabs of the enclosure were laid horizontally one on another, with their ends adjacent to each other; vertical slabs were regularly set between them (see Fig. 1, *2*). In some enclosures, vertical slabs only appeared in the central part of two sides or all four sides, whereas the corners were formed by horizontal stonework (Fig. 4). According to the ground plan, these structures resembled brackets; therefore, such enclosures are referred to as "bracketed".

A distinctive feature of the Bainov stage structures was the presence of numerous buttresses to protect the burial mound-platform from destruction caused by soil pressure. Corners of the enclosures were often marked by large vertical slabs, which reached a height of 1.5–2.0 m. In the eastern corner, the stone could be set diagonally rather than parallel to the wall, dissecting the corner, and could also be set outside the enclosure at a distance of 1.0–1.5 m east of it (see Fig. 1, *1*, *2*).

Only one grave was located in the center of the burial mound. Children's burials, if any, were made beyond the northeastern wall of the enclosure. Most often, graves were shallow soil pits, with traces of low logwork. Wedging of small sandstones or broken stone slabs was sometimes observed between the logwork and pit wall. The flooring consisted of thin logs laid in a longitudinal direction at the level of the ancient daylight surface. They were sometimes lined with sandstone slabs or broken stone.

The deceased were placed in an extended supine position, with their heads directed to the southwest or northeast. It has not yet been possible to detect any regularities in this choice. Typically, there were two vessels, large and small, for each buried person in the grave. The larger vessel was located near the head; the smaller vessel was nearby or could have been set towards the legs. Cutlery in the form of a knife and awl was usually placed on the smaller vessel. The remains of a sacrificial animal, i.e. sheep or cow, were present near the feet of the buried person. It is interesting that traces of red pigment, which might have been used for painting the footwear of the dead, can be clearly seen on the shin bones of the deceased in many burials.

Grave goods

Pottery from the burials of the Bainov stage can be classified into two types: slightly profiled jars with a wide mouth (Fig. 5, *2*, *3*, *5*, *13–15*) and spherical vessels with a high narrow neck (Fig. 5, *1*, *4*, *16*, *17*). This division emerged already in the complexes of the middle to final period of stage III (Lugavskoye) of the Late Bronze Age and came to its peak at stage IV (Bainov). A number of vessels, especially large jars, show traces of smoothing with a toothed stamp or wood chip on their inner and outer surfaces. Ornamentation was relatively meager and monotonous, with a tendency toward focusing on the upper part of the vessels. It usually combined rows of slanting stamp impressions or notches, thin horizontal lines, or rhombic imprints, sometimes supplemented with a horizontal zigzag, "hanging" triangles, or groups of notches or slanting lines from stamp imprints. The vessels were predominantly decorated with a toothed stamp. Imprints of a smooth ornamenting tool and carved lines were much less common. A typical feature of pottery at

Fig. 4. Enclosure facade of the burial mound of the Bainov stage (view from the southwest).

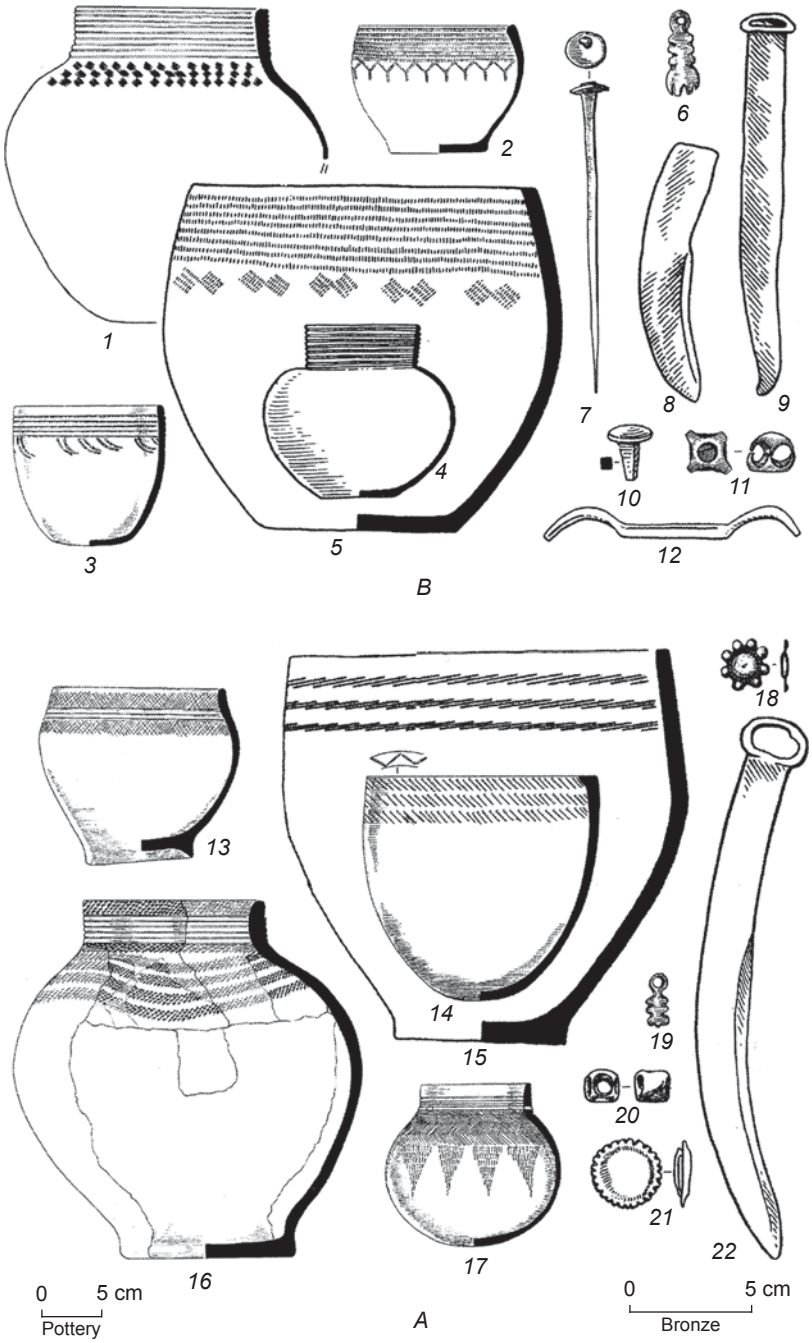

Fig. 5. Grave goods from the burials of the Bainov stage.
A – early chronological horizon; *B* – late chronological horizon.
Byrganov V: *1*, *6*, *11* – kurgan 9, grave 7; *7* – kurgan 2, grave 2; Lugavskoye III: *2* – kurgan 1; Beloye Ozero I: *3* – kurgan 5, grave 1; *13* – kurgan 63, grave 3; *14* – kurgan 53; *16* – kurgan 40, grave 2; *17*, *19* – kurgan 62, grave 2; Bainov Ulus: *4* – kurgan 1; *8* – kurgan 4; Samokhval: *5* – kurgan 9, grave 2; Ilyinskaya Gora: *9* – kurgan 1; Minusinsk VII: *10*, *12* – kurgan 4, grave 1; Efremkino: *15* – kurgan 8; *20*, *21* – kurgan 7; Ust-Chul: *18* – kurgan 6, grave 3; Askiz VI: *22* – kurgan 3.
1–5, *13–17* – pottery; *6–12*, *18–22* – bronze.

the Bainov stage was a straight, strictly horizontal cut of the rim. Quite often, there was a small bulge on its inner side (Fig. 5, *14*), formed during molding, when the vessel was placed on a flat solid surface with its mouth down. In spherical narrow-necked containers the edge could be straight or rounded. The bottom of the vessels at the time of molding was rounded and possibly pointed. During its flattening on a flat horizontal surface, a base typical of Bainov pottery was quite often formed at the bottom part of the vessels (Fig. 5, *2*, *15*, *16*).

Burials, especially those of females, contained rich and diverse bronze items, such as numerous temporal rings, clips, and tubular beads, three- and four-lobed pendants, mirrors, rings with biconical signet, and buttons with an eyelet, bridge, or peg with a mushroom-shaped end. Figured plaques with four, six and eight ribs, and triangular plates with punched ornamentation have been found sporadically (Fig. 6). A figurate bone comb with ornamentation of triangles pointing towards each other is of particular interest. In its appearance and decor, it is much closer to similar items from the previous periods than to Late Tagar artifacts. It is especially similar to a comb found in burial 2, kurgan 7 at the Iyus cemetery (Poliakov, 2005: Fig. 1, *13*). This burial belongs to stage III (Lugavskoye) of the Late Bronze Age.

Because of the almost total looting of burial mounds of the pre-Scythian period, massive bronze items have rarely survived in graves. These could be items of unknown purpose, tetrahedral awls with a mushroom-shaped cap, laminar knives, and knives with a ring pommel or half-ring pommel ("arch on a bracket"). However, more common are not complete items, but their bronze blades, which previously were inserted into a wooden haft.

Sites of the Bainov type and complexes of the Late Bronze Age

Comparison of the Bainov complexes with burial mounds of stage III (Lugavskoye) of the Late Bronze Age shows numerous and detailed similarities in almost

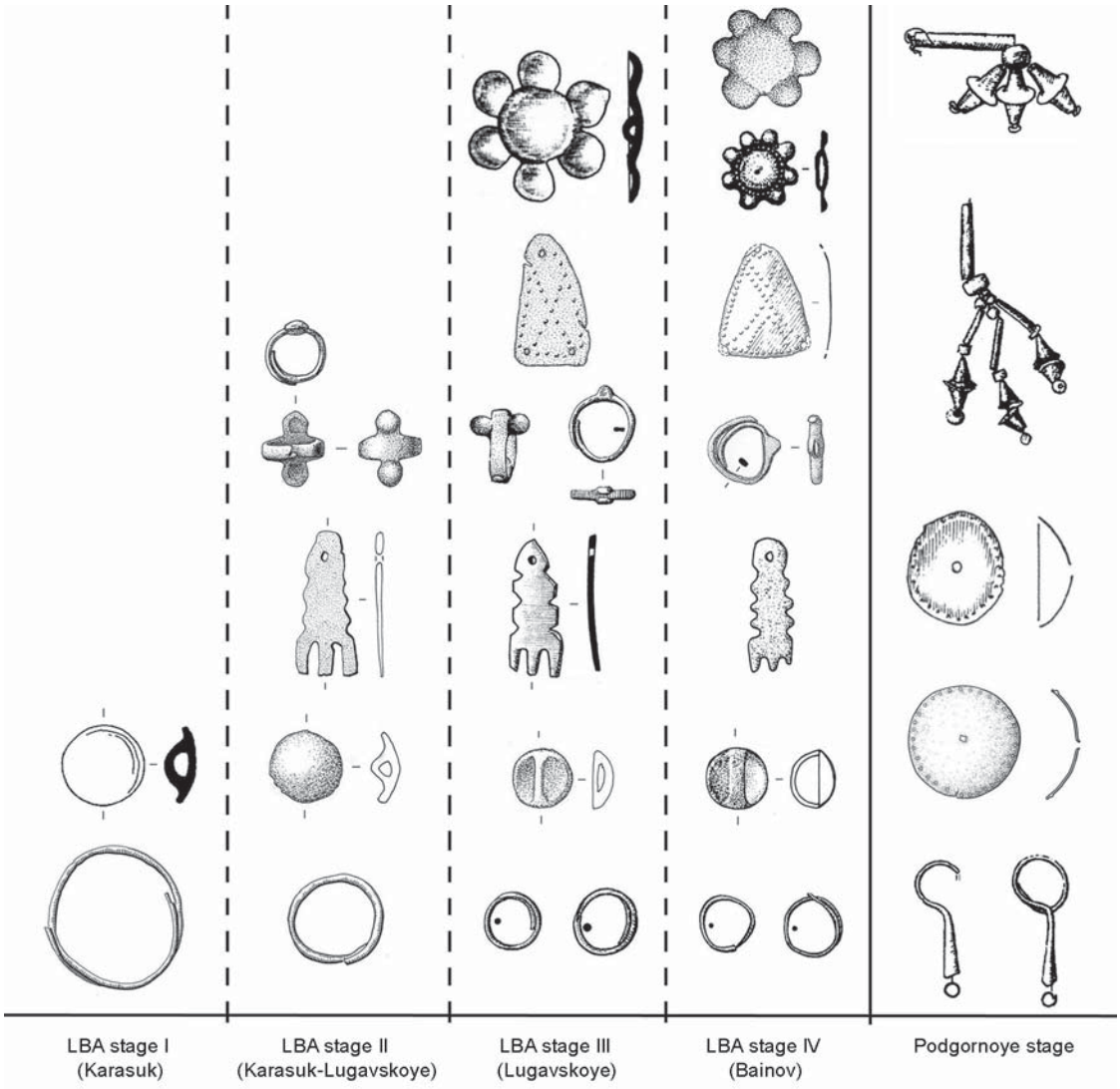

Fig. 6. Comparative table of female ornaments of the Late Bronze Age (LBA) and of the Podgornoye stage of the Tagar culture.

all their aspects, including burial structures, funerary rituals, pottery, and bronze items. For example, the Bainov flat burial mound-platforms clearly originated from similar structures of the previous time. Excavations of large areas at the Lugavskoye part of the Ust-Kamyshta-1 cemetery revealed exactly the same pits for soil extraction as those appearing near the Bainov burial mounds. Combinations of horizontal stonework and vertical slabs forming bracketed structures often appeared in both Lugavskoye and Bainov enclosures. Protruding corner stones and sometimes protruding wall stones were widespread. Such features of the Bainov funerary rite as placement of children's graves beyond the eastern wall of the main enclosure, the supine position of the buried person, presence of two vessels in the burial, and placement of a knife and awl on the small vessel emerged starting in the middle of the Lugavskoye stage. The division of pottery into two main types (slightly profiled jars and spherical vessels with high and narrow necks) took place at the same time. Gradual transition from the Lugavskoye round-bottomed vessels to the Bainov flat-bottomed vessels is clearly noticeable. There are many examples of their combination in the early graves of the Bainov period. The same is true for the ornamental tradition: all elements of Bainov decor, their placement zones and application technique directly followed from Lugavskoye prototypes.

Nearly all main categories and types of grave goods of the previous period occur among the Bainov bronze items. This is primarily true for large scale ornaments, i.e. elements of the female outfit. These have a traditional appearance or are slightly transformed by simplification and miniaturization (Fig. 6). The relatively rare items of the male prestigious complex underwent significant

changes. Bronze belt distributors (see Fig. 5, *11*, *20*), awls with a mushroom-shaped cap (see Fig. 5, *7*), laminar knives without a distinctive pommel (see Fig. 5, *8*), as well as knives with a ring or half ring pommel (see Fig. 5, *9*, *22*), appeared in the graves. Ringed and half-ringed knives completely replaced curved Lugavskoye knives with mushroom-shaped pommels.

Thus, recent large-scale studies at the burial grounds of Smirnovka-4, Ust-Kamyshta-1, and Kirba-Stolbovoye-3 have significantly expanded and reinforced the previously suggested links between stage III (Lugavskoye) and stage IV (Bainov) of the Late Bronze Age. There have appeared additional arguments for attributing the sites of the "Bainov Ulus type" to the final Late Bronze Age.

Bainov-type sites and the Tagar culture

Comparison between Bainov-type sites and early complexes of the Tagar culture shows a completely different situation. These were two fundamentally different architectural traditions. Similar to Bainov burial mounds, the Podgornoye kurgans had a rectangular shape, but were elongated along the NW-SE line rather than the SW-NE line (Fig. 7, *2*). This was caused by a desire to place two, three, or more graves in a row instead of one inside the main enclosure. In the Bainov type enclosures, there was only one burial in the center. Visible differences also occur in the method of erecting the walls. Horizontal stonework technique was not used in construction of enclosures at the Podgornoye stage. Enclosures were built of vertical slabs which overlapped, or two slabs were placed with a gap and were secured on the outside by a third slab. Such a system did not require a large number of buttresses (Fig. 7, *1*, *3*).

Enclosures of early burial mounds at the Podgornoye stage were not completely filled with soil, and their slabs rested on the edge of the subsoil or an earthen truncated-pyramidal grave structure (Fig. 7, *2*). They usually had a noticeable inward slope. Even with complete collapse of the structure above the grave, the mound did not exert substantial pressure on the stone walls. As opposed to the Bainov enclosures, the upper edges of Podgornoye enclosures were not even, and the slabs show significant differences in height. Some of them are still clearly visible on the modern surface of the steppe. Outlying stones were quite often found near Podgornoye burial mounds; however, unlike Bainov stones, they were set not beyond the eastern corner of the enclosure, but to the southwest of it, exactly in alignment with the axis of the central grave (Fig. 7, *1*, *2*).

The Podgornoye stage pottery tradition differed significantly from the Bainov tradition. All of their pottery can be conditionally divided into three types: slightly profiled jars (Fig. 8, *5*, *6*), pots with bulging body and low, narrow neck (Fig. 8, *1*), and vessels of various shapes (Fig. 8, *2–4*). The latter were reddish or rarely black, and were carefully polished small vessels with rounded bottoms, ring-shaped base, or nipple-like legs.

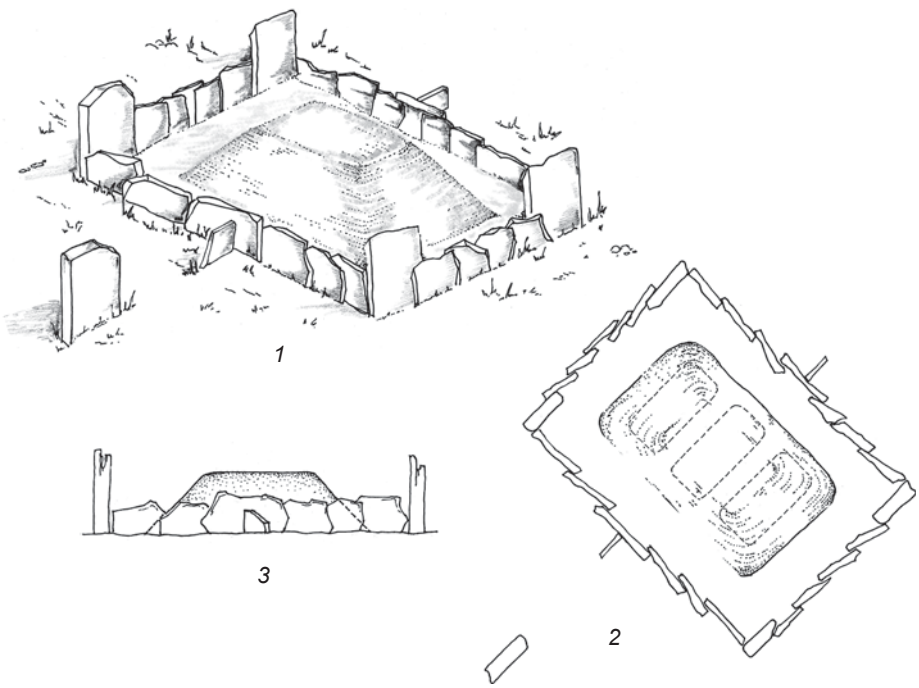

Fig. 7. Burial mound of the Podgornoye stage of the Tagar culture.
1 – reconstructed original appearance; *2* – ground plan of a typical burial mound; *3* – reconstructed facade of the enclosure wall.

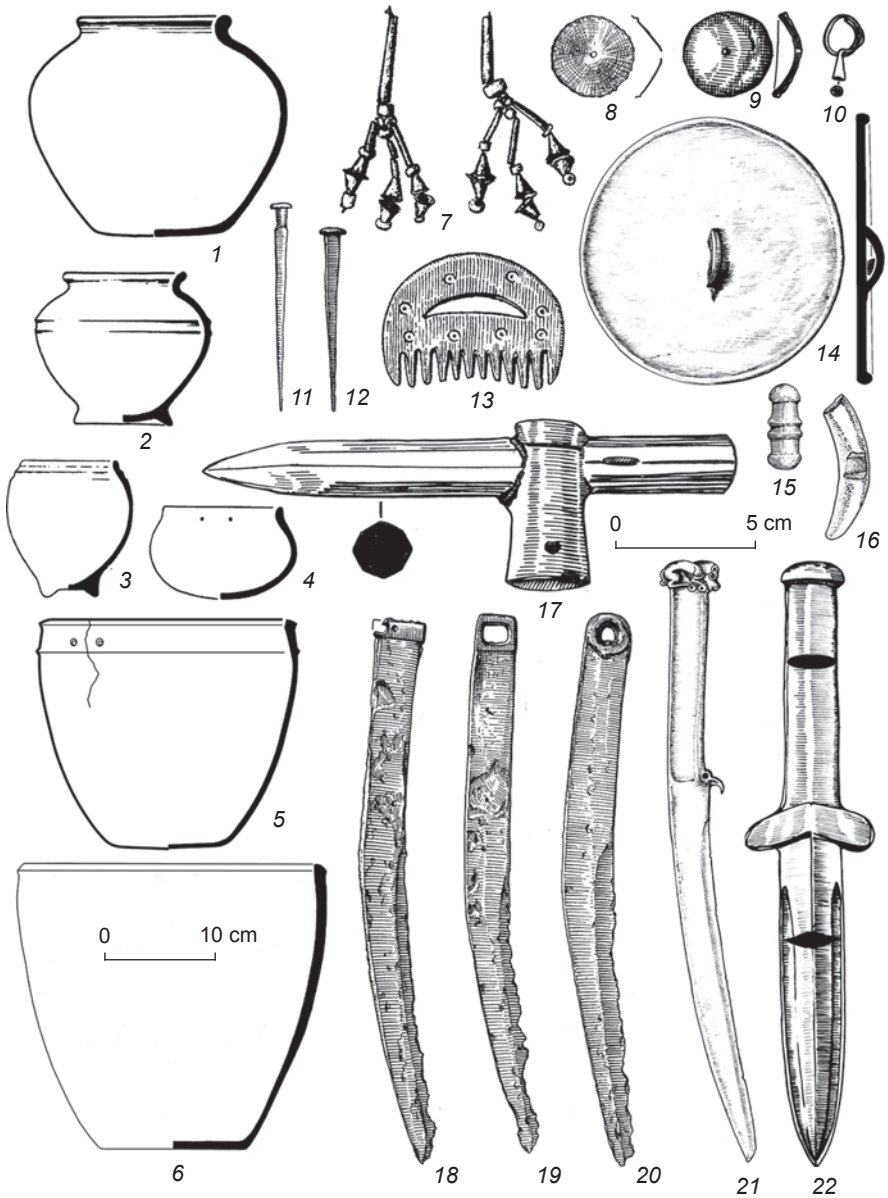

Fig. 8. Grave goods of the burials of the Podgornoye stage of the Tagar culture.
Grishkin Log I (after (Maksimenkov, 2003)): *1* – kurgan 20, grave 3; *2*, *20* – kurgan 8, grave 2; *3* – kurgan 1, grave 16; *4* – kurgan 21, grave 3; *12* – kurgan 9, grave 2; *13* – kurgan 12, grave 2; *15* – kurgan 16, grave 3; *18* – kurgan 9, grave 9; *19* – kurgan 8, grave 1; Verkh-Askiz, point 3 (excavations by N.Y. Kuzmin in 1987, 1988): *5*, *9* – kurgan 2, grave 1; *10* – kurgan 3, grave 1; Sektakh (after (Lazaretov, 2007)): *6*, *14*, *21* – kurgan 1, grave 1; Shaman-Gora (after (Bokovenko, Smirnov, 1998)): *7* – kurgan 1, grave 2; Verkh-Askiz, point 1 (excavations by N.Y. Kuzmin in 1988, 1989): *8* – kurgan 14, grave 5; *11* – kurgan 14, grave 2; *16*, *17*, *22* – kurgan 14, grave 1.
1–6 – pottery, *7*, *8*, *11*, *12*, *14*, *15*, *17–22* – bronze, *9* – bronze, gold, *10* – gold, *13*, *16* – bone.

A distinctive feature, which makes it possible to combine them into a single group, is the mandatory presence of two holes for hanging. Such vessels have been regularly found in women's and some children's burials of the Podgornoye period, and were absent from the complexes of the Bainov stage. Sudden emergence of this pottery type, in the context of the theory of the autochthonous origins of the Tagar culture, requires an additional valid explanation.

The two other groups of Podgornoye vessels did not differ dramatically from the Bainov pottery. Notably, the Tagar jars had a slightly different profile. Their upper, rim part was usually slightly everted, and the edge was obliquely cut outward. These vessels were molded from the bottom up rather than from the side of the rim, as was the case with the Bainov jars. There were absolutely no traces of smoothing with wood chips or toothed stamp on the Tagar pottery. Its outer surface was usually polished.

The Podgornoye spherical vessels also differed from the Bainov vessels in the design of the upper part: their necks were always low and the edge of the rim was everted.

If a visual comparison of individual Podgornoye and Bainov vessels can reveal some resemblance of their outlines, their decoration fundamentally differs. The hallmark of the Early Tagar pottery consists of so-called cornices and wide grooves. In fact, these were molded bands, one of which was located directly under the edge of the rim, and the second was 3–5 cm from it. A maximum distance between these bands was observed in the vessels from the earliest Podgornoye graves, close in time or contemporaneous with the latest Bainov complexes. Subsequently, the number of bands gradually increased, and gaps between them became smaller. Ultimately, by the final Podgornoye stage, the bands turned into a purely decorative element of drawn horizontal lines. Additional ornamentation of the Early Tagar vessels was extremely minimal; it could involve a number of pits or "pearls", sparse oblique notches, as well as groups of stick or smooth stamp imprints. The ornamental band on the Podgornoye vessels was not located in the rim zone, as was the case with the Bainov vessels, but significantly lower, under the molded bands. It can be considered a vestige of the relief-band ware tradition, where ornamentation both performed a decorative function and contributed to stronger attachment of molded elements to the vessel body.

The tradition of using appliquéd and molded bands for pottery decoration in Southern Siberia had very deep roots. It appeared in the region already at the end of stage I (Karasuk) of the Late Bronze Age. The problem is that this tradition completely degraded by the middle of stage III (Lugavskoye), and ultimately became extinct by the end of this stage, after the same development chain that we observed in the Podgornoye vessels: 1) large appliquéd single bands in the area where the rim was attached to the body; 2) several molded bands of smaller size; 3) thin drawn lines. Neither appliquéd nor molded bands are known in the classic Bainov pottery. Sudden revival of the relief-band tradition in such an archaic version as that appearing in the Early Podgornoye complexes has no explanation from the point of view of the autochthonous origin of the Tagar culture. We believe that the origins of its reoccurrence should be sought outside the Minusinsk Basin.

A similar situation occurred with a number of widespread Tagar bronze and bone items. With the emergence of Podgornoye complexes in the Minusinsk Basin, a complete and almost simultaneous change in the entire set of female personal ornaments and small household items took place. Burials began lacking items traditional for the Late Bronze Age, such as temporal rings, four- and six-petaled plaques, paw-shaped pendants, triangular plates with punched ornamentation, as well as rings and buttons. They were replaced by numerous hemispherical plaques sewn onto a headdress (Fig. 8, *8*, *9*), earrings with a cone-shaped socket (Fig. 8, *10*), composite three-partite pendants made of large tubular beads and bronze biconical and cylindrical stone beads (Fig. 8, *7*). Buttons that remained unchanged for several centuries became replaced by bronze, stone, and bone grooved fasteners (Fig. 8, *15*, *16*). Previously unknown "head knives" (polished bone plates) and slotted combs with circular ornamentation appeared (Savinov, 2012: Pl. XIV, *1*, *6*, *7*, *9*, *10*) (Fig. 8, *13*). Some of the categories of bronze items retained their importance, but their types changed. Mirrors with a rim began appearing frequently, along with the usual disc-shaped mirrors (Fig. 8, *14*); awls with a mushroom-shaped cap acquired a neck, which was round in cross-section (Fig. 8, *11*, *12*). Typically, the Podgornoye knives were sharpened only on one side, while Bainov knives had double-sided sharpening. Their pommels showed amazing diversity: they could be triangular, with a square loop, with a teardrop-shaped hole, bar-shaped, or tubular (Fig. 8, *18–20*). Knives with a ring and half ring continued to exist. However, they differed from the Bainov knives in the smaller size of the pommel, which almost did not protrude beyond the handle, but exceeded it in thickness, forming a relief band along the perimeter of the hole.

Pommels in the animal style (Fig. 8, *21*) have been discovered in the Podgornoye burials, albeit in small numbers. Knives with sculpted animal heads appeared in the Minusinsk Basin as early as the beginning of stage II of the Late Bronze Age. However, first of all, they differed from the Tagar items by the set of characters and methods of their rendering. Second of all, by the mid-stage III of the Late Bronze Age, this pictorial tradition declined and completely ceased to exist. We do not know a single artistic bronze item from the Bainov complexes. As in the case of relief-band pottery, one should look for an external source for the sudden revival of the Tagar animal style at a new qualitative level. Finally, the Podgornoye burials contained weaponry, such as bronze pickaxes, daggers, and arrowheads (Fig. 8, *17*, *22*), while in Bainov complexes no traces of the emerging custom of placing weapons in graves have been observed. This tradition appeared suddenly and precisely at the moment of the Tagar culture formation.

Another specific feature of the Tagar sites was a widespread use of bronze ornaments covered with gold foil and less often entirely made of gold (Fig. 8, *9*, *10*) in the funerary rite. Moreover, as the evidence accumulates, an interesting regularity can be observed: the earlier the complex of the Podgornoye stage, the greater the number of such items it contains. In the late sites, gold was present mainly in elite burials, while in the early Podgornoye burials gold foil was regularly discovered even in the graves of ordinary persons. At the same time, no such

finds are known from the huge number of Late Bronze Age complexes in the Minusinsk Basin, including the Bainov complexes. What could have occurred to cause the ban on using gold in the funerary rite suddenly be removed? Such a drastic event could not have occurred on its own, without a serious external impact.

Continuity between the Bainov and Podgornoye complexes is most noticeable in the funerary rite. Both had a similar design of graves and similar system of linking children's burials. The common features included placement of the dead on their backs and variants of their orientation, presence of two vessels and their location in the graves, as well as remains of a sacrificial animal in the burial. However, in the burials of the Podgornoye stage, utensils consisting of a knife and awl were placed on the belt of the buried, as opposed to their placement on a small vessel, as was the case with the Bainov complexes. These knives were full-sized items rather than blade fragments inserted into wooden hafts. The problem is that the vast majority of the investigated Early Podgornoye burials belonged to the period of active interaction with the Bainov population. It is still unknown where the Podgornoye complexes were located and what they looked like before the initial contact between the two cultural groups.

Conclusions

All the above evidence suggests that a dramatic change in the cultural paradigm occurred in the Minusinsk Basin precisely at the time when the first Podgornoye complexes appeared, but not earlier. In all their typical features, the Bainov-type sites were natural heirs and successors of the Late Bronze Age traditions. They should be excluded from consideration of the Tagar culture and be viewed as the final stage of the Late Bronze Age.

The emergence of different kurgan architecture, the relief-band ware tradition, a number of innovative bronze and bone items, including weapons and items made in the Scytho-Siberian animal style in the Podgornoye-type complexes marks the beginning of a new period in the history of the region. These features did not have local roots and were brought to the Middle Yenisey region from outside as a result of migration processes. Based on the rapid transformation of ideological beliefs and composition of grave goods not only of prestigious, but also of ordinary nature, this migration was fairly large in scale.

However, the arrival of a new population to Southern Siberia at the turn of the 9th–8th centuries BC did not lead to complete displacement or extinction of the indigenous people. The Bainov heritage in the Tagar culture of the Scythian period can be seen quite clearly, primarily in the funerary rite traditionally followed in the area. Previously, we already identified two chronological horizons, IVa and IVb, as being part of the Bainov stage (Lazaretov, 2006: 26–28; Lazaretov, Poliakov, 2008: 46–47; Poliakov, Lazaretov, 2020). The current job would be to identify the layers of post-Bainov burials, contemporaneous with the appearance and initial existence of the Early Podgornoye complexes. These include some of the burials at the cemeteries of Byrganov V, Verkh-Askiz, point 1, and some other sites, and clearly stand out from among the main bulk of Bainov burials by a large amount of undecorated pottery, individual vessels and items of the Podgornoye appearance, as well as cases of violating the original basic principle: one burial mound – one grave. Notably, a maximum concentration of actual Bainov complexes, including those of the latest generation, has been observed in the southwestern areas of the Minusinsk Basin, where some vestiges of the previous period (e.g. in the kurgan architecture) continued to exist already in the Podgornoye time.

An equally important job would be to identify and attribute the earliest part of the Podgornoye burials, which appeared before the active interaction between the two population groups. Most of the known Podgornoye complexes already show some traces of this interaction, manifested by the funerary rite: burial of the dead in an extended supine position, presence of two vessels and their arrangement in the grave, and remains of a sacrificial animal. The location and appearance of the initial burials of the Tagar culture still remain a mystery. Judging by sporadic evidence, the population of the Early Podgornoye period might have placed the dead on the side, in a more or less crouched position. If we assume that the initial region of migration was the territory of the present day Tuva or Mongolia, the earliest Podgornoye burials might have also lacked grave goods.

Acknowledgments

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A.A. Tishkin[1] and O.V. Orfinskaya[2]
[1]Altai State University,
Pr. Lenina 61, Barnaul, 656049, Russia
E-mail: tishkin210@mail.ru
[2]Centre for Egyptological Studies,
Russian Academy of Sciences,
Leninsky pr. 29, bldg. 8, Moscow, 119071, Russia
E-mail: orfio@yandex.ru

A Study of Silk Fabric from the Xiongnu Age Under-Headdress Discovered at Yaloman II Mound 51 in the Central Altai

We describe a large fragment of fabric from the under-headdress excavated from mound 51 at Yaloman II—a site on a high terrace near the place where the Bolshoy Yaloman flows into the Katun, Central Altai. Various criteria, including radiocarbon analysis, suggest that the burial dates to the Xiongnu Age (200 BC to 100 AD). The structure of the textile was assessed microscopically. On the basis of morphological criteria, the fibers were identified as silk. The fabric is described according to the accepted international standards. Results attest to the use of a treadle loom for producing polychrome silk fabric, from which the early nomads sewed a headdress in the form of a cap or bonnet. Such a prestigious material was produced in limited quantities in China to decorate details of clothing worn by the elite. Decorative silk items could have been imported from there to the Altai as gifts received by the leader of the nomadic Xiongnu Empire in Inner Asia. The Altai was part of this empire, as demonstrated by the entire assemblage of funerary items from Yaloman II.

Keywords: *Central Altai, Yaloman II, Xiongnu Age, early nomads, under-headdress, decorative silk fabric.*

Introduction

Excavations of the ancient necropolis of Yaloman II in the Central Altai provided a wealth of information about the material culture of the ancient nomads (Tishkin, Gorbunov, 2003; Tishkin, 2007a; Tishkin, 2011; Tishkin, Mylnikov, 2016: 43–55, fig. 7–40; and others). Analysis of the finds showed certain parallels, mainly with the collections from the Xiongnu sites in Inner Asia (Tishkin, Gorbunov, 2005; Gorbunov, Tishkin, 2006; Tishkin, 2011; and others), as well as the presence of ancient Chinese goods (Tishkin, 2006, 2007a; Novikova, Marsadolov, Tishkin, 2018; and others). These conclusions indicate that the early Bulan-Koba population (Tishkin, Gorbunov, 2006) was strongly influenced by the Xiongnu people during the period of their domination, and represented one of the groups of a large nomadic association in the Altai (Tishkin, Gorbunov, 2005: 332; Tishkin, 2007b: 176–178).

Various categories of items from the mounds of Yaloman II have already been studied and described (see References). The main objective of this article is to present the results of a comprehensive study of the fabric used for the manufacture of an under-headdress. The remaining part of this piece decorated with sewn-on plaques made of precious metal was found in mound 51 at the Yaloman II

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cemetery. The site is located on a high floodplain terrace in the Katun River valley, near the mouth of the Bolshoy Yaloman River (Ongudaisky District of the Altai Republic). The map showing its location, description, and photographs have been repeatedly published elsewhere (Tishkin, 2011; Tishkin, Mylnikov, 2016: 7–8, fig. 4–8; etc.), which allows us not to dwell on the presentation of this information.

Description of the investigated archaeological object

The above-ground burial structure of kurgan 51 was a stone-earthen mound (diameter 4.5 m, height 0.25 m), which was clearly visible among the nearby features hardly noticeable on the surface. Larger stones were placed around its foot, but did not form a clear stone circle. Under the mound, a horse was interred in a shallow grave-pit over the cover of a stone box built of massive slabs. This undisturbed burial chamber (length 1.8 m, width 1 m, height ca 0.5 m) contained the remains of a young woman (20–25 years old) and typical grave goods (Fig. 1, *1*, *2*). The finds include a copper cauldron, wooden utensils, a stone incense burner, two belts, a handbag, and ornaments. Organic remains around the skeleton suggest the presence of clothing and footwear (Tishkin, 2005). Of particular importance was a leather belt with a metal buckle in the shape of a lizard, which was produced using the ancient Chinese lacquer-coating technique (Tishkin,

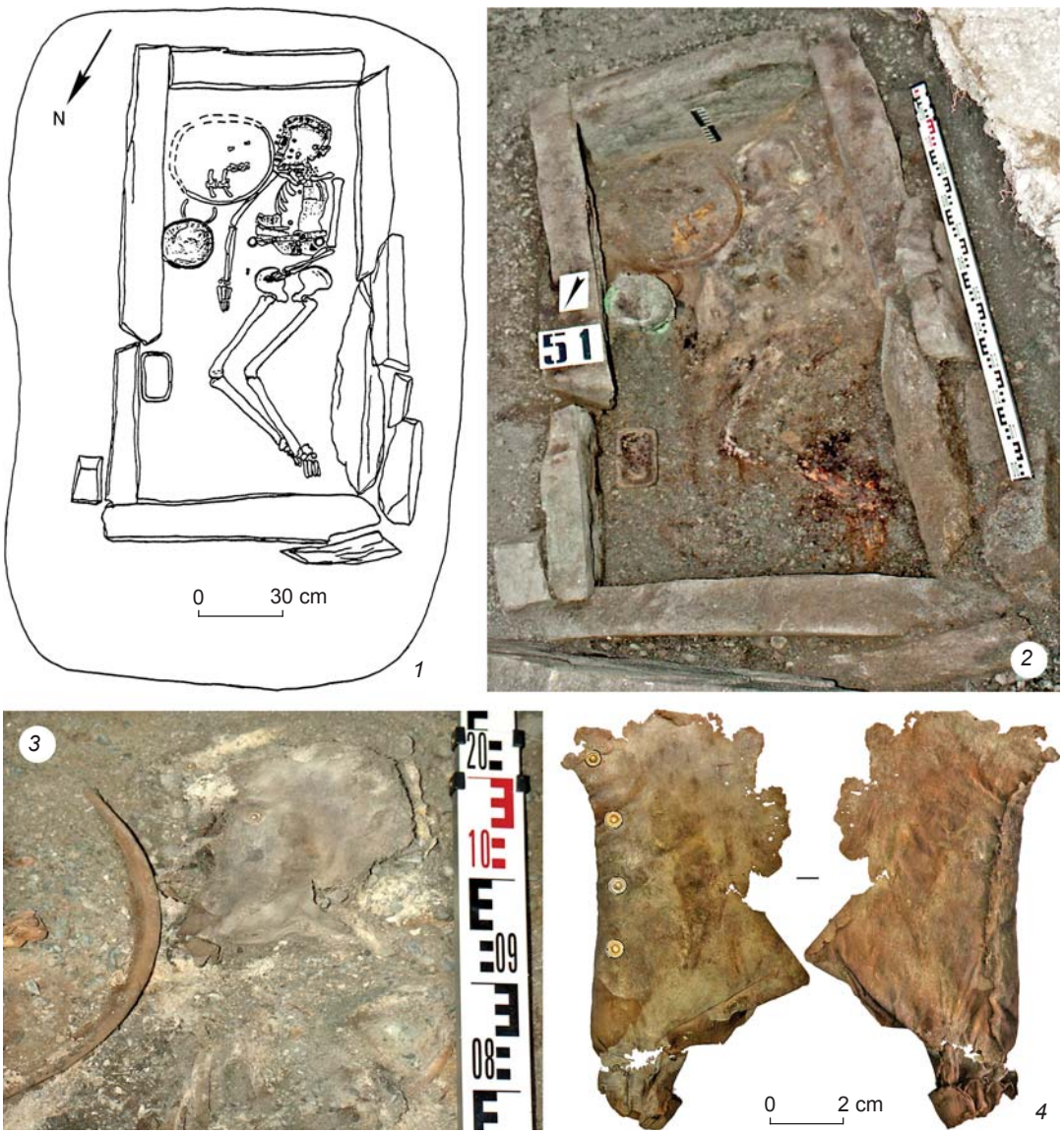

Fig. 1. Burial mound 51.
1 – map; *2* – photo; *3* – survived piece of fabric; *4* – part of under-headdress.

2011: Fig. 7; Novikova, Marsadolov, Tishkin, 2018: 114, 115, fig. 6). The bag, embroidered with beads, contained a copper bell and a small fragment of a bronze Chinese mirror (Tishkin, 2006: 111–113; Tishkin, 2011: Fig. 6, *27*; 8, *25*, *26*). The cist did not contain soil, which ensured the preservation of a part of the fabric headdress, lying *in situ* on the skull (Fig. 1, *3*). On the basis of this find, decorated with ten sewn-on plaques (Fig. 1, *1*, *4*), attempts were made to reconstruct the item, which likely represented a bonnet or a cap (Tishkin, 2005: Fig. 2; Tishkin, 2019: Fig. 1, *6*). The recorded location of the decorative sewn-on plaques made it possible to identify similar headdresses in other burials at Yaloman II and at the contemporaneous site of Ust-Edigan (Hudiakov, 2003). This confirms their broad distribution among the Altai nomads in the Xiongnu Age, along with other types of headdresses. The studies of materials of the preceding Pazyryk culture have demonstrated a completely different practice in the manufacture and use of headdresses (Polosmak, 2001: 143–162; Yatsenko, 2006: 89–94).

The piece of fabric from mound 51 is currently stored in the Museum of Archaeology and Ethnography of Altai at Altai State University (Barnaul, Russia), and in the Accession Register has catalogue number 181/563. A special study of this item was carried out by the Department of Archaeological Heritage of the Likhachev Russian Research Institute for Cultural and Natural Heritage (Russian Heritage Institute) in Moscow. The description was carried out in accordance with the accepted international standards.

Research methods, description and characteristics of fabric

The pattern of textile weaves and the type of threads in the fabric were determined through microscopic analysis in reflected natural light, using a textile Flash Magnifier (up to ×10 magnification) and a Stemi 2000-CS stereomicroscope (up to ×100 magnification). The features of fibers, as well as the degree of their contamination and damage, were determined by the microscopic analysis in transmitted polarized light, using the Olympus BX41 microscope (magnification up to ×100–400). For research, permanent immersion preparations in fir balsam were made. These were compared with reference textile fibers from the collections of the Center for Historical and Traditional Technologies of the Russian Heritage Institute. Silk fibers were identified both by morphological features and by the presence of the so-called interference color, which can be observed in transmitted polarized light (dark field).

Two fragments of the recovered fabric were analyzed (Fig. 1, *4*). Their maximum dimensions before restoration were approximately as follows: 29 × 18 cm (upper) and 4.5 × 4.5 cm (lower). Visually, the fabric is perceived as smooth and monochrome (Fig. 2, *1*). Microscopic analyses revealed that the warp threads overlap the weft threads in the 3:1 pattern, as in twill; however, in twill, the vertical shift (So) is equal to one, and in the fabric under analysis, it is two. The weave pattern on both sides is exactly the same (3:1 and 1:3). The micrograph (Fig. 2, *2*) shows that the order of change of weaves is not constant, i.e. the warp thread that overlaps one weft is located either to the right or to the left of the warp thread that overlaps three wefts. Such a phenomenon for this fabric with a high warp density can be considered normal, because it was made as double-sided material, where the main threads were arranged in pairs one under the other. With this system, the fabric should be two-colored.

The fabric could have be produced on a four-shaft weaver loom (according to the reconstruction of the European version of the loom). It is hardly possible to imagine a simpler version (without a shaft system) of producing a fabric with a density of 120–140 warp threads per 1 cm. Two equivalent schemes for threading a four-shaft loom are possible. The first variant (Fig. 2, *3*): weave pattern corresponds to a twill 2:2, with a shift of warp; the first warp thread runs along the wrong side (system 1:3), and the second along the front side (system 3:1), with the first thread "falling" under the second and being almost invisible from the front side; the third and fourth threads "behave" similarly, only mirrored and with a shift, with the fourth thread going under the third one. In the second variant (Fig. 2, *4*), such a fabric can probably be classified as one-and-a-half-layer fabric with a double warp (according to the modern Russian classification) or warp-faced compound tabby (according to the English terminology). In this system, the second and fourth threads go under the first and third ones, respectively; in the shaft system, the opening of the shed for the first and third row of the weft is ensured by raising the same shafts (Fig. 2, *5*).

In the lower (small) part of the headdress under consideration, a transverse strip is clearly visible (the same on the front and back sides along the weft threads), where the warp threads overlap not three, but five weft ones. Perhaps this was not a mistake in weaving, but a premeditated decision by the artisan (Fig. 3, *1*, *3*). Such a feature could have appeared as a result of skipping two weft rows (Fig. 3, *1*). On the large (upper) fragment, a horizontal line passes through its entire width, while on the small (lower) fragment, it runs over a small area, and then goes into the usual weave pattern of this fabric (Fig. 3, *2*). This means that two passes of the weft threads on a part of fabric do not disappear anywhere. This phenomenon can be explained only by a special decision by the artisan. Perhaps, near one of the (for example, left-side) edges (in our case, the edges are missing), to align the canvas and strengthen the edges, the weft was

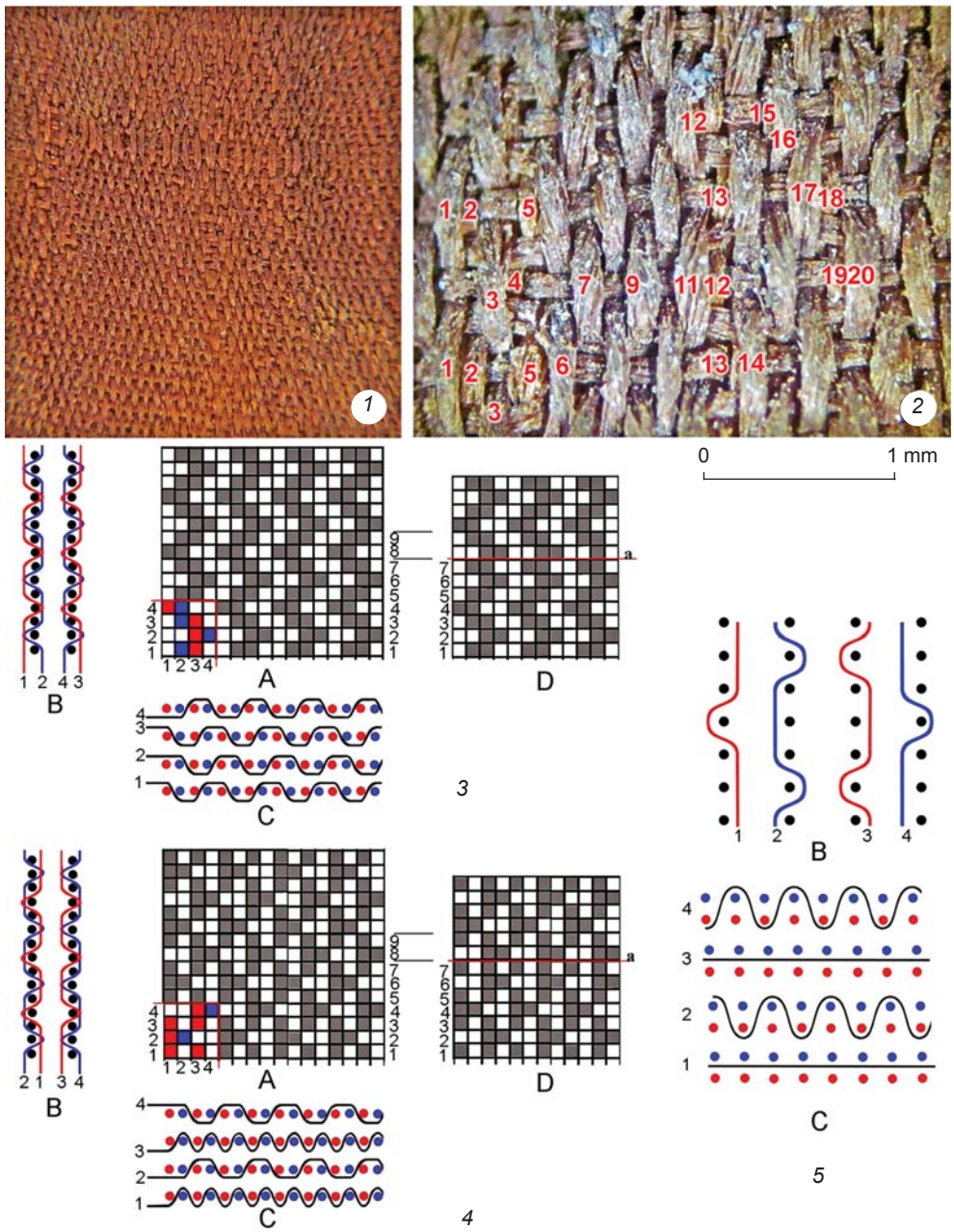

Fig. 2. The results of study of the large (upper) fragment of the fabric.
1 – micrograph of a fabric section (side of a square 1 cm); *2* – micrograph of a fragment, where the warp threads visible from one side are marked with numbers; *3* – weave pattern: twill 2:2, shifts in warp; *4* – scheme of one-and-a-half-layer fabric; *5* – a scheme of multiple plain weave with a warp cover. A – weave pattern; B – section view with the warp threads located vertically; C – section view with weft threads located horizontally; D – the pattern of weaving threads on a section of fabric with a horizontal stripe (odd warp threads are marked in red, even ones are marked in blue).

passed to a short distance from left to right (first pass), then returned back from right to left (second pass), after which the pass was made through the entire canvas. In this case, two passes are "lost" on the main part of the canvas, i.e. a visual horizontal stripe is formed. The area with the vertical strip (Fig. 3, *3*, *4*) is observed only on a small fragment. This situation is possible only if the warp threads are combined into pairs.

Throughout the canvas, there are numerous losses in the weave pattern, which can be considered as errors. However, a detailed microscopic examination showed that these were not errors, but the places of transition of the warp threads from the front side (3:1) to the wrong side (1:3) or vice versa (Fig. 4). Such a weave pattern might imply that one side of the fabric had one color, and the other side had another; the transition of colored warp

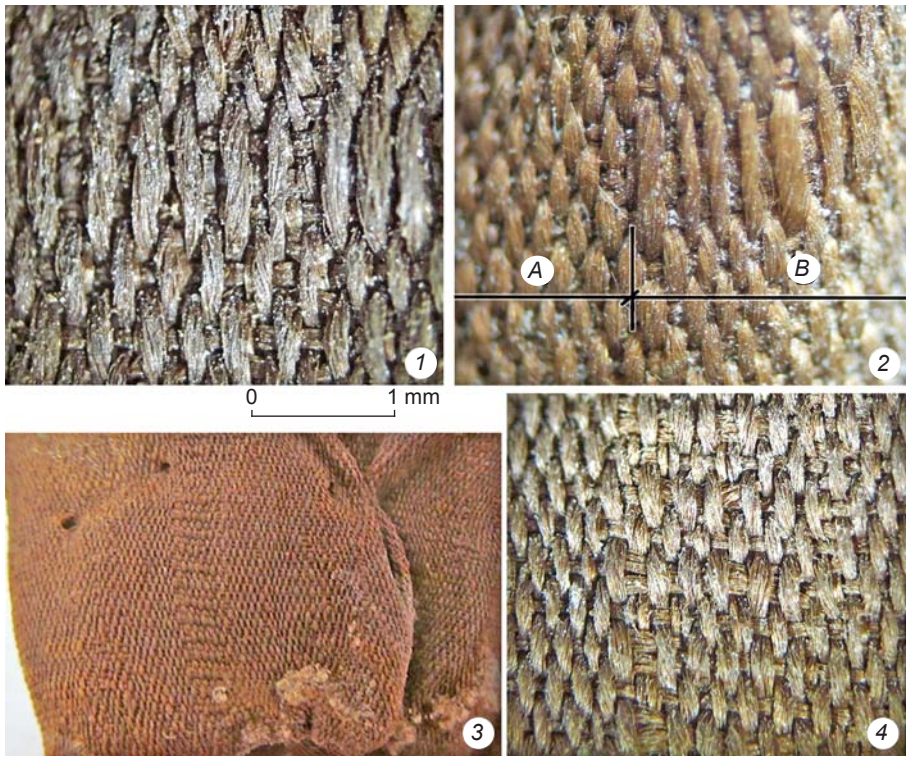

Fig. 3. The results of study of the small (lower) fragment of the fabric.
1 – micrograph of the section with a transverse stripe; *2* – micrograph of the section where it disappears (A – without a stripe; B – with it); *3* – vertical stripe on the fabric (general view of the fragment); *4* – a micrograph of the section with this stripe.

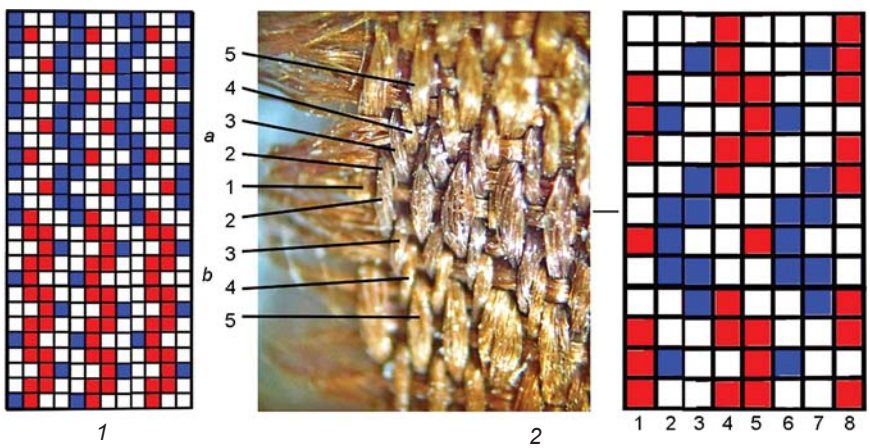

Fig. 4. The results of study of the fabric with the color change on its surface.
1 – weave pattern of colored warp threads: *a* – section where threads of one color predominate, *b* – section where threads of a different color predominate; *2* – micrograph of the section with color change, and the relevant scheme (numbers indicate the order of the warp threads).

threads from one side to the other means a color pattern (on both sides). Microscopic studies of the silk fibers (Fig. 5) showed no difference in color. However, on the images of the warp threads' change, using the minimal computer processing of photographs, it was possible to identify small areas of fabric with a color pattern (Fig. 6, *1*).

Significant contamination is observed in all the threads, but there is very little damage to the fibers (taking into account the age of the fabric). In the dark field, it can be seen that the bulk of the fibers has an iridescent color. This suggests the correct (undisturbed) packing of molecules in the fiber, i.e., a fairly good state of the fiber preservation.

According to the studies conducted, the following characteristics of the fabric from Yaloman II mound 51 have been established: patterned with two warps; the

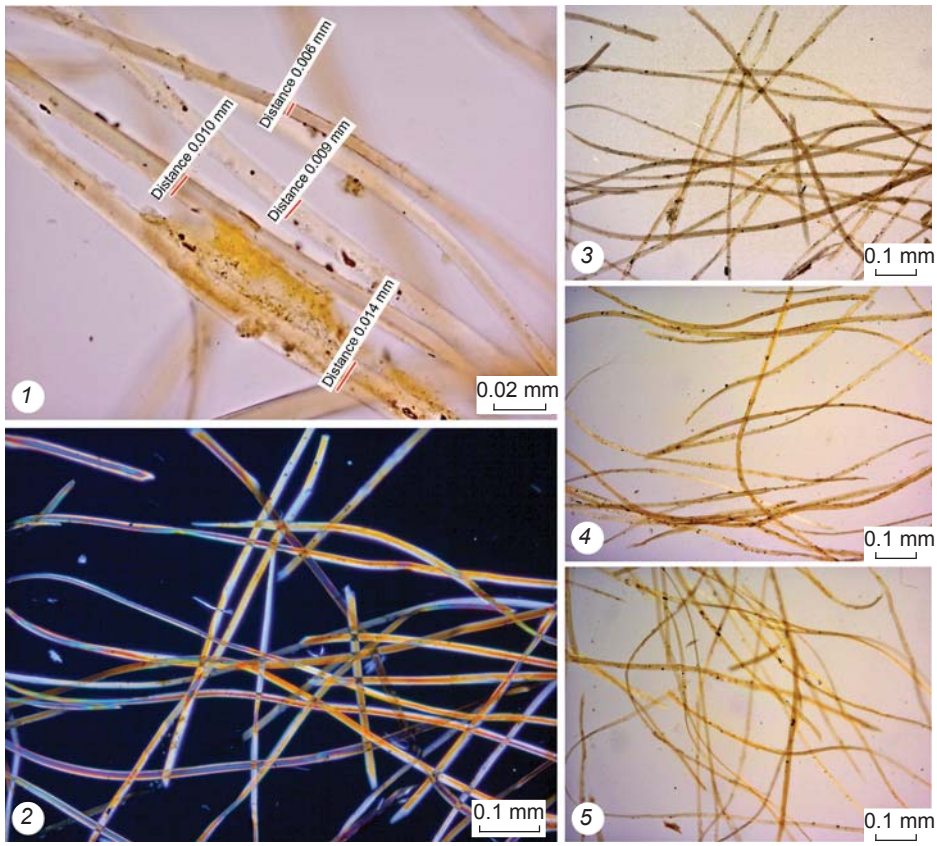

Fig. 5. Micrographs of silk fibers.
1 – in the light field; *2* – in the dark field; *3–5* – threads of light (*3*) and dark (*4*) warp and weft (*5*).

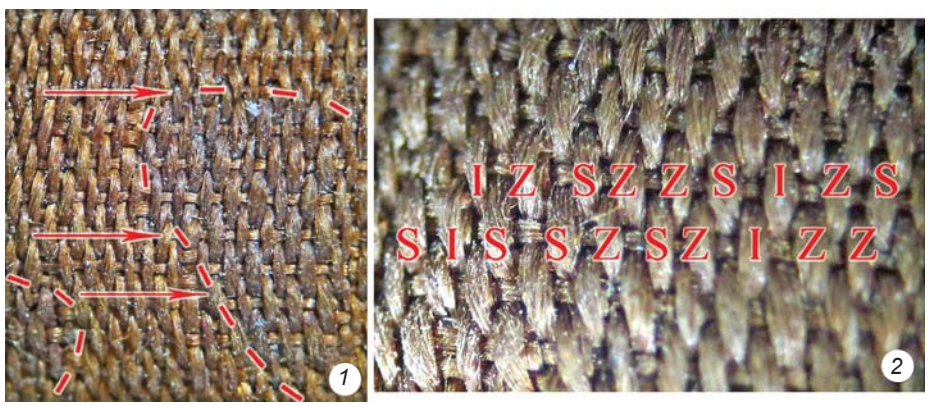

Fig. 6. Micrographs of fabric sections with pattern (*1*) and with threads of various twists (*2*). Arrows show the places with the warp color changes; a dotted line shows the approximate contour of the pattern.

warp threads (both light and dark) are brown silk of various tonality (visual assessment) with weak Z- and S-twist or without it (I); no pattern in the alternation of threads with different twists was noted (Fig. 6, *2*); solitary warp threads break into two strands; the weft threads are brown silk without twist; the average thread thickness is 0.1 mm; the density of the fabric is 120–136/60–66 threads per 1 cm.

Discussion

The Xiongnu nomadic empire existed during the Han period (202 BC to 220 AD). At that time, the weave pattern, in which the warp thread overlapped three weft threads and went under one thread (3:1), was widely used in China. E.I. Lubo-Lesnichenko (1994: 129) argued that this technique had existed since the Yin (or Shang,

1554–1046 BC) period. During the Han dynasty, looms with two treadles were used. "The loom had a wooden frame with two spinning beams—front and rear. The front beam was intended for winding the ready fabric; the warp thread was wound on the rear beam, located at an angle of 45 degrees with respect to the weaver. The loom was equipped with two treadles, with the help of which the shafts parted the warp threads and formed a shed" (Ibid.: 145). Most likely, the considered patterned fabric with two warps is a "double jin" (Ibid.: 130). This fabric is a kind of polychrome decorative silk based on twill or plain weave (Shelkovyi put, 2007: 199). It was popular during the Han dynasty (Hanyu, 1992: 258). However, later, the term "jin" was used to designate brocade as well (Kravtsova, 2004: 734). Therefore, it's easy to get confused. In ancient polychrome fabrics, the pattern was formed by changing the warps, which overlapped three, five, or seven weft threads. This technique existed in Chinese silk weaving until the Tang dynasty (618–907) (Zhao Feng, 1992: 56–57). In modern English-language literature, this type of fabric is identified as "warp-faced compound tabby" (Chinese Silks, 2012: 523).

The fabric under study was polychrome (two colors), so it can most likely be attributed to the *jin* type. "Jin fabrics were produced on a small scale. According to the 'Ceo's Commentary', the gifts sent and received by the rulers of the principalities amounted to 'one basket of jin fabrics' (Sato Gaketoshi, 1978: Vol. 1, p. 71–72)" (Lubo-Lesnichenko, 1994: 130). Such a fabric was used to decorate clothes and to edge the collar and sleeves (Ibid.).

The under-headdress in question was entirely silk, which protected its owner from parasites. The warp threads of two colors were used in weaving the fabric. On order to determine the dyes, additional study on a high-performance liquid chromatograph is required; but such an analysis needs large samples. The microscopic analysis in transmitted light did not identify the color of fibers.

The use of threads with various twist directions may be the result of a conscious artisan's decision, the same as in woolen fabrics of the same time. The ancient Chinese fabrics included silk crepe, but it was woven from the threads of uneven twist (from weak to strong), not of various directions. The present authors have not found descriptions of silk with such characteristics of threads in the literature. It is more likely that this was a natural process, when the weak S-twist was unraveled (i.e. lost the twist (I)) and turned into a weak Z. It is also possible that the warp threads were shifted manually.

The fabric under consideration was produced on a treadle loom (for ancient Chinese looms see: (Becker, Wagner, 2009: 10–15)). The available data suggest that the silk was manufactured in the handicraft workshops of China during the reign of the Han dynasty.

Conclusions

Given its polychromy and high density (more than 100 warp threads per 1 cm), it can be concluded that the headdress from Yaloman II mound 51 was made of an expensive and prestigious Chinese patterned silk fabric. Such fabric was produced in limited quantities to decorate details of clothing worn by the elite. It could have been imported to the Altai as a gift for chanyu-leader and his entourage (Kradin, 2001: 112). In this situation, the mound under study may well be the burial of a young woman from the Xiongnu nomad elite. The burial age was determined on the basis of the grave goods and a small series of radiocarbon dates (Tishkin, Gorbunov, 2006; Tishkin, 2007b: 267–268, 270–274; Tishkin, 2011: Fig. 16). The two calibrated dates (AMS) are 2065 ± 35 (GU-14916) and 2080 ± 35 (GU-14923) BP; they indicate the periods (with a probability of 95.4 %) from 171 BC to 3 AD and from 178 to 36 BC, respectively. These data are well correlated to the historical events and the conclusions of archaeologists. Recently, in the laboratory of the University of California at Irvine (USA), a date of 2085 ± 20 BP (UCIAM-S250255) was derived from the sample of a horse skeleton from a nearby burial mound, which confirmed the previous determinations. In conclusion, it should be noted that ancient Chinese silk has also been found at the Ust-Edigan site (Hudiakov, 2003; Borisenko, Hudiakov, 2004; and others), which has also been attributed to the Xiongnu Age and gave its name to the early stage of the Bulan-Koba culture (Tishkin, Gorbunov, 2006). This research has good prospects, and will expand our knowledge about the culture of the ancient nomads of Inner Asia and their contacts with Han China.

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P.B. Amzarakov
ANO "Archaeology of Khakassia",
Prigorsk 6B, off. 15, Chernogorsk, 655156, Russia
E-mail: petr_amzarakov@mail.ru

Origin and Evolution of the Earliest Iron-Smelting Technologies in the Khakass-Minusinsk Basin

The Khakass-Minusinsk Basin is archaeologically one of the best studied regions of Russia. Bronze artifacts from the pre-Scythian and Scythian epoch from that area are famous worldwide. However, iron production appears rather late there. From 2009 to 2018, a joint Russian-Japanese expedition excavated several sites documenting the earliest iron manufacture in the Khakass-Minusinsk Basin. On the basis of these excavations and experiments, metallurgical technology was reconstructed. The results suggest an evolutionary model of metal production in the Khakass-Minusinsk Basin during the Xiongnu-Sarmatian period. Three types of iron-smelting furnaces are described, structurally differing in terms of air-blasting and slag removal. The conclusion is made that the initial iron production technology had been borrowed, and later evolved in situ.

Keywords: *Tes culture, Tashtyk culture, ancient metallurgy, bloomery furnace, slags.*

Introduction

The Khakass-Minusinsk Basin is one of the best archaeologically studied regions in the steppe belt of Eurasia. Scholarly expeditions have been working there since 1722. The first detailed periodizations of the archaeological cultures of the Khakass-Minusinsk Basin were elaborated in the 20th century, and since the middle of it, the region has become a kind of center of rescue archaeology. The scale of works done was unprecedented (Krasnoyarsk expedition, Middle Yenisey expedition, etc.) (Kyzlasov, 1962; Vadetskaya, 1973, 1986; Belokobylsky, 1986; Savinov, 2009; and others). Currently, scholarly information on the cultures of the region is being actively accumulated, and their periodization is being improved (Polyakov, 2022).

Thus, since the late 20th century, because of the good state of research, detailed chronology, and well-elaborated typology, archaeological evidence from the Khakass-Minusinsk Basin has become a model for the study of the antiquities of the Eurasian steppe belt, from the Danube to Lake Baikal. It has been used for comparative analysis of the widest circle of assemblages of almost all chronological periods from the Chalcolithic to the Middle Ages.

It is traditionally believed that archaeology of the Khakass-Minusinsk Basin focuses solely on studying burial sites. Until recently, settlement complexes have become the subject of archaeological studies mostly by accident (Torgazhak, Byrganov V, Kamenny Log I, etc.) (Savinov, 1996: 13; Lurie, Lazaretov, 2021; Polyakov, Marsadolov, Lurie, 2022: 8, 9, 13). However, ancient economy and production are of

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crucial interest to modern archaeology, answering a number of questions on the development of technologies and economic models for exploitation of the natural resources of the region.

The works of Y.I. Sunchugashev, who dedicated his life to the study of the ancient metallurgy and irrigation systems of the region, significantly contributed to our knowledge of ancient production in the Khakass-Minusinsk Basin. He wrote several monographs, which are now basic for research into ancient metal production (Sunchugashev, 1969, 1975, 1979, 1993). Studies of the Russian-Japanese expedition, which began in 2009, are largely based on the works of Sunchugashev, confirming and sometimes complementing and developing his scholarly conclusions (Murakami, 2015).

The highest level of copper metallurgy in the Khakass-Minusinsk Basin in the Late Bronze Age is indisputable, and is clearly illustrated not only by the quantity, but also by the quality of artifacts from collections in various museums. It is also confirmed by the unique production sites such as the Yuliya mine near the village of Tsvetnogorsk, and Mount Temir, where copper production reached an industrial scale (Sunchugashev, 1975: 34–40). The Khakass-Minusinsk Basin is extremely rich in occurrences of easily accessible polymetallic ore bodies. Noteworthy also are ores containing arsenic, which can produce low-alloy bronze of natural origin during smelting. However, the emergence and development of iron metallurgy in this region is still extremely debatable. It appeared significantly later there than in the neighboring territories, despite the success in bronze metallurgy. The wealth of the Khakass-Minusinsk Basin deposits of copper, plus the mass production of bronze items, might have influenced the delay in the coming of the Bronze Age to the region. The monoethnicity of the local population probably also affected the development of metallurgy, since the social group of people dealing with metal was always quite closed in the ancient world.

Most scholars attribute the first evidences on the use of iron in the Khakass-Minusinsk Basin to the late stage of the Tagar culture (5th–3rd centuries BC). Most often, these are randomly discovered non-domestic iron or polymetallic items (mostly weaponry). These belong to the Tagar culture only typologically, since they were found outside an archaeological context.

Numerous finds made of iron, identified directly in funerary and settlement assemblages, belong to the Tes archaeological culture of the 2nd–1st centuries BC, as also the first reliably known sites of ancient iron metallurgy (Amzarakov, 2008: 65). In the 3rd–2nd centuries BC, archaeological cultures in the Khakass-Minusinsk Basin changed with the arrival of a new group of population with well-developed funerary traditions; therefore, it should be assumed that the advanced iron metallurgy technologies were brought to the Middle Yenisey basin from the outside.

To date, in the Khakass-Minusinsk Basin, not a single production complex of ferrous metallurgy is known that can be reliably attributed to the Tagar culture (Sunchugushev, 1979: 20; Zavyalov, Terekhova, 2015: 219). At the same time, during the excavations led by Sunchugashev in the 20th century and expeditions led by the present author in 2009–2018, dozens of sites were explored that definitely belonged to the Tes culture of the 2nd–1st centuries BC. It should also be mentioned that in the adjacent territories of Central Asia (Tuva, Altai, or northern Mongolia), no reliably dated sites of ferrous metallurgy earlier than the Xiongnu period are known either (Vodyasov et al., 2022); however, there are iron items from closed assemblages of the Scythian period (Arzhan-2 kurgan, kurgan 2 at the Teplaya cemetery, etc.) (Chugunov, Parzinger, Nagler, 2017: 44–46, 51–53; Bokovenko, 2014: 379).

A number of scholars suggest an imported origin for early iron items (Chlenova, 1992: 222; Zinyakov, 1980: 73; Zavyalov, Terekhova, 2015: 219). Especially noteworthy is the bimetallic production technology (Fig. 1), which was practiced in the Khakass-Minusinsk Basin in the Tagar period: if a part of an iron item was lost, it was replaced by a bronze one, even if its utilitarian properties were lost (replacement of the cutting part). This was possible with the presence/combination of two factors—the high prestige of an iron item, and the absence of a different technological possibility (ferrous metallurgy) for its restoration.

Study results

Since 2009, the Russian-Japanese expedition under the leadership of Professor Yasuyuki Murakami (Matsuyama, Japan) and the present author has been carrying out a joint project aimed at studying ancient iron metallurgy. The sites, discovered by Sunchugashev, have been examined; a number of new

Fig. 1. Bimetallic daggers from the collection of the Martyanov Minusinsk Regional Museum of Local History.

sites have been identified, and some of these have been excavated. The most important results were obtained from studying the metallurgical complexes at Troshkino-Iyus (Shirinsky District of Khakassia, excavations of 2011–2012) and Tolcheya (Bogradsky District of Khakassia, excavations of 2015 and 2018). The first was radiocarbon dated to 1906 ± ± 27 BP (IAAA-103644), the second to 1983 ± 24 BP (IAAA-150561), 2007 ± 24 BP (IAAA-150562), and 2111 ± 24 BP (IAAA-150563). According to these dates, the sites belonged to the Tes and Early Tashtyk periods. The preliminary results from the excavations have been published (Amzarakov, 2014, 2015a, 2015b). Eight and nineteen furnaces were excavated at the Troshkino-Iyus and Tolcheya sites respectively. Such a large number of metallurgical objects investigated over a limited area demonstrates a high level of iron production in the period under discussion.

Using the evidence from excavations, the technology of metal smelting was reconstructed and tested in two scholarly experiments (2017, Niimi, Japan; Krasnoyarsk Territory, Russia). A technological model for evolution of iron-smelting furnaces can be proposed based on experimental results. Such approach, involving analysis of technologies, methods, and practical principles of metal production, as well as support from experiments, seems relevant, since the available typology of iron-smelting furnaces of the Altai-Sayan suggested by Sunchugashev and elaborated by a team of authors (Vodyasov et al., 2022) is based mainly on geometric (primarily spatial) parameters of furnaces, without proper attention to the technological aspects.

The furnaces studied at Troshkino-Iyus and Tolcheya can be divided into three conventional types, in accordance with their technological differences.

Type 1 (Fig. 2–4) includes almost all the furnaces from excavations at Tolcheya (except for objects P1-5, P1-27, P1-30, and P1-33), and one furnace (No. 10–11) at Troshkino-Iyus. The technological process of iron-smelting in this type of furnace was the following. The pit was dug with sizes suitable for smelting (at the sites in question, it was oval, from 0.8 × 0.5 to 1.6 × 1.2 m, and reached 1 m in depth), and a rounded production pit (with a diameter from 0.8 to 1.3 m, and a depth corresponding to the furnace pit) was made next to it. These were connected by an underground tunnel, which most often approached the central part of the long side of the furnace, but in some cases could be shifted or even connected to the short wall (object No. 10–11 at Troshkino-Iyus). Ceramic nozzles (from two to four) were joined to the outer side of the furnace from the surface level for upper air-blasting, and an area for bellows was made (Fig. 5). The locations of the nozzles were identified by their fragments in the slag-conglomerate masses, and by directions of slag streaks.

The process of smelting began with heating the furnace. At the first stage, larch firewood and natural air-draught from the underground tunnel were used; at the second stage, larch charcoal and artificial air-blasting with bellows through the nozzle from the tunnel (Fig. 6, *1*). Bellows for the lower blow were located in the production pit (it was apparently needed to place and maintain the bellows). The evidence of their use was recorded in furnace P1-10 at Tolcheya, where the external end of a ceramic nozzle was found in the monolith of leaked slag and conglomerate. After reaching the required temperature and uniform combustion over the entire area of the furnace, upper air-blasting was initiated from the outside of the

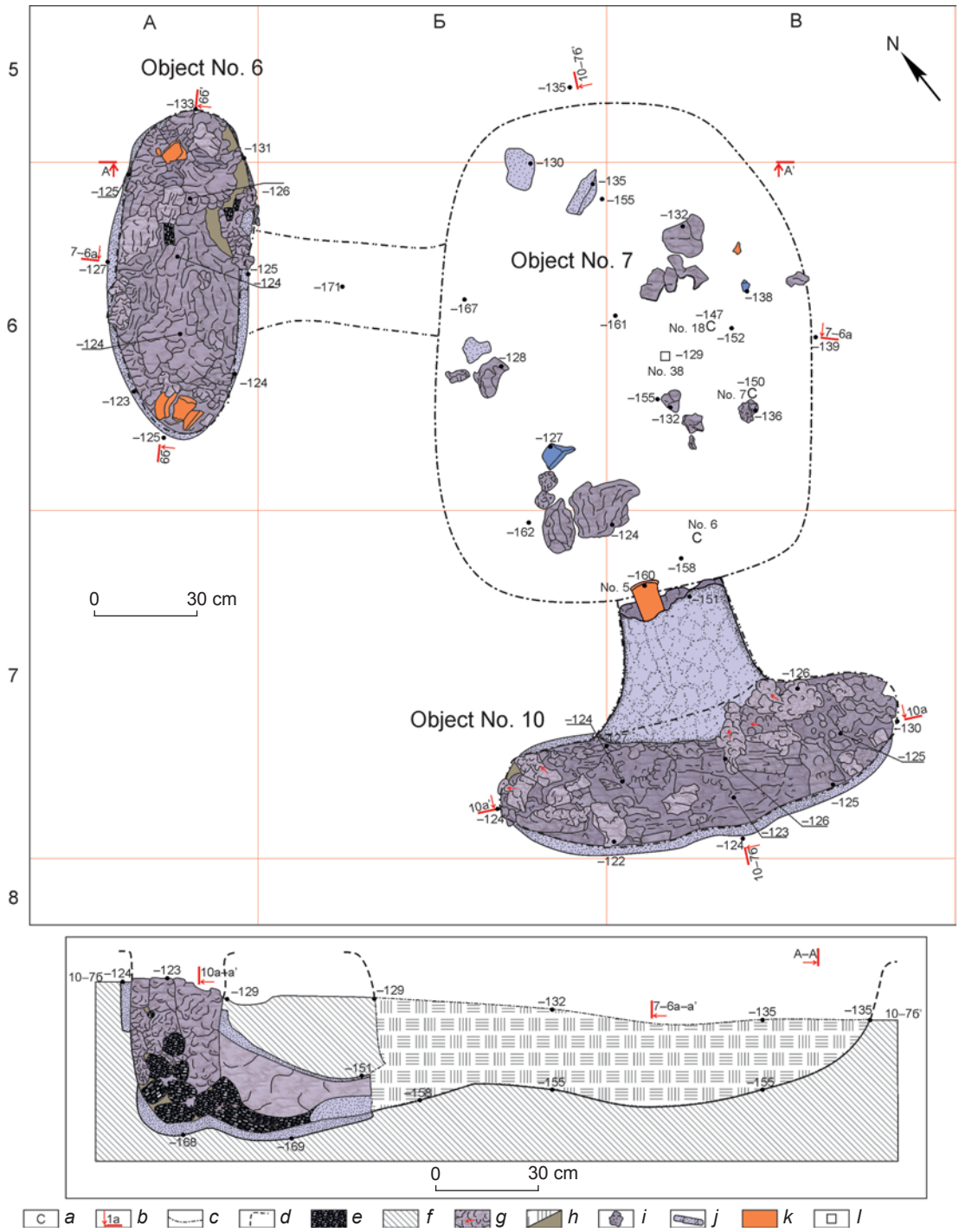

Fig. 2. Ground plan and cross-section of complex P1-10 at the Tolcheya site. Iron furnaces. Excavations of 2015 by the author.

a – nozzle fragment; *b* – direction and names of profiles; *c* – outline of the pit; *d* – estimated level of the buried surface; *e* – charcoal; *f* – virgin soil; *g* – direction of slag streaks; *h* – filling of the pit; *i* – slag; *j* – vitrified fragment of soil; *k* – ceramic nozzle; *l* – undecorated pottery fragment.

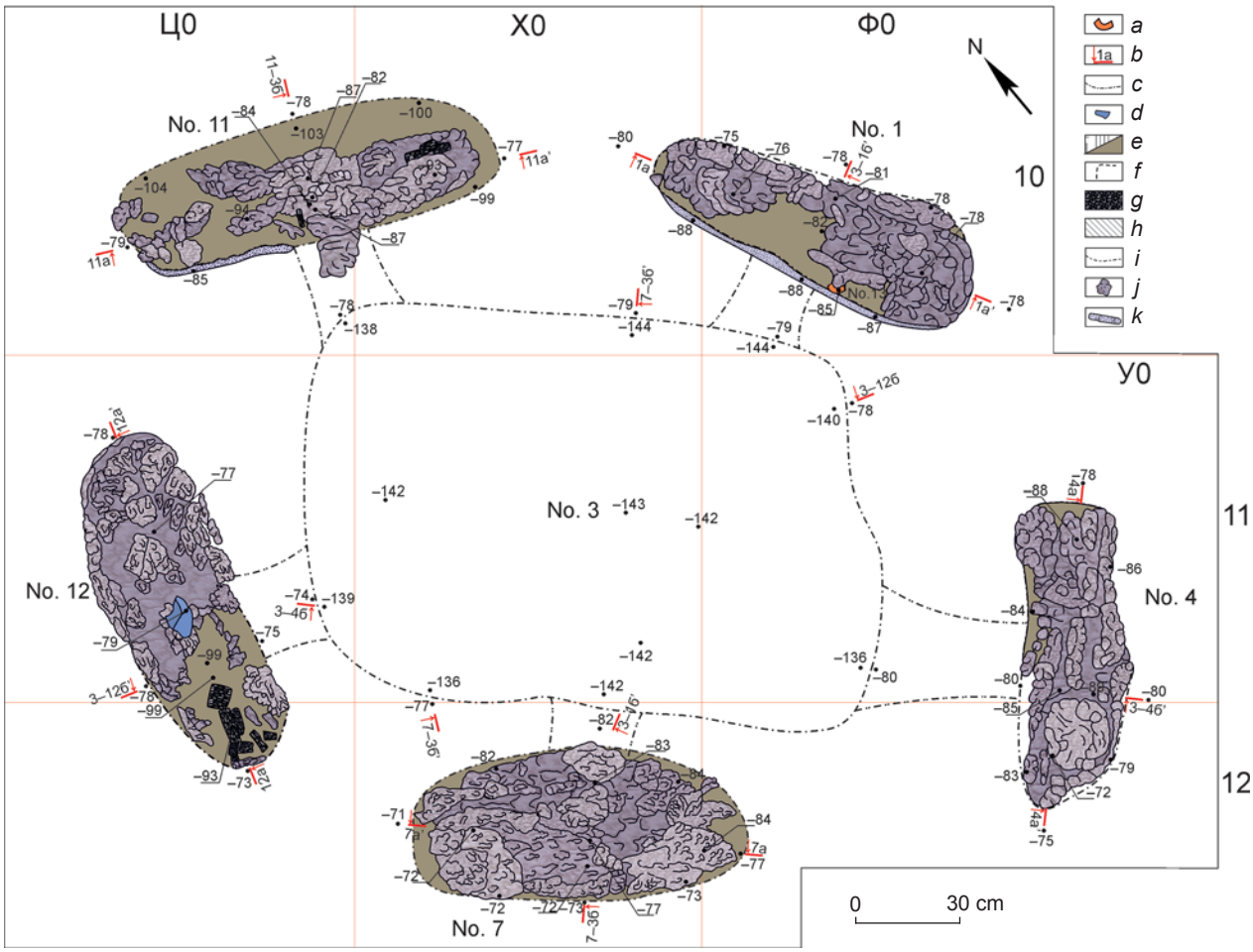

Fig. 3. Ground plan of complex of objects in excavation 2 at the Tolcheya site. Iron-smelting furnaces. Excavations of 2015 by the author.

a – nozzle fragment; *b* – direction and names of profiles; *c* – outline of the pit; *d* – stone; *e* – filling of the pit; *f* – estimated level of the buried surface; *g* – charcoal; *h* – virgin soil; *i* – outline of the air-blowing tunnel; *j* – slag; *k* – vitrified fragment of soil.

Fig. 4. Complex of objects in excavation 2 at the Tolcheya site. Iron-smelting furnaces. Excavations of 2015 by the author.

Fig. 5. Reconstructed iron-smelting furnace. Experiment of 2017 by the author.

Fig. 6. Processes of warming up the furnace (*1*), loading furnace charge (*2*) and upper air-blasting (*3*). Experiment of 2017 by the author.

furnace, and charcoal and burden layers of crushed iron ore were loaded* (Fig. 6, *2*).

Smelted slag and conglomerate with a main concentration of fayalite (2 $FeO{\cdot}SiO_2$ and Fe_2SiO_4) and wustite (FeO) with smelt ore flowed to the bottom of the furnace and reached the yield of the air-blowing tunnel. Depending on the tunnel's angle of inclination, the liquid fraction of the conglomerate and slag either (with a positive angle) accumulated in the outlet of the tunnel and, after cooling down, blocked it; or (with a negative angle) flowed along the tunnel towards the production pit. In any case, air-blasting from below stopped at this stage, and air was further blown only from above (Fig. 6, *3*). The presence of molten conglomerate and slag at the base of the furnace had a positive effect on the stability of the smelting temperature. Although a large amount of ore was lost on conglomerate that did not react and did not yield iron. The process of smelting was finished when the level of slag masses reached the level of the nozzles. After that, blooming iron formed under the nozzles was extracted from the furnace (Fig. 7). With rare exceptions (the sorting ground of object P1-12 at Tolcheya), there is no evidence for additional systematic sorting-out of conglomerate-slag masses, despite the presence of layers and grains of blooming iron therein.

After extracting blooming iron and slag from the furnace, the production process was repeated. In the radial objects of the Tolcheya site (with a central production pit and oppositely located furnaces), it could have occurred sequentially, almost without pauses.

*Magnetite (Fe_3O_4) with inclusions of hematite (Fe_2O_3) and hedenbergite ($CaFe(Si_2O_6)$) were identified by Eiji Izawa (Kyushu University), using a Rigaku Ultima IV X-ray diffractometer.

Type 2 (Fig. 8, 9) includes furnaces P1-5, P1-27, P1-30, and P1-33 at Tolcheya. The basic technological process was identical to type 1, but the smelters tried to reduce the volume of ore lost to wustite and fayalite, and increase the percentage of the resulting iron relative to ore spent. This was achieved in two main ways: early termination of lower air-blasting by closing the mouth of the underground tunnel, and purposeful filling the lower part of the furnace with tightly stacked firewood. The latter method reduced the volume that could be filled with conglomerate, since the smelting

Fig. 7. Monolith of a conglomerate with inclusions of bloomery iron. Experiment of 2017 by the author.

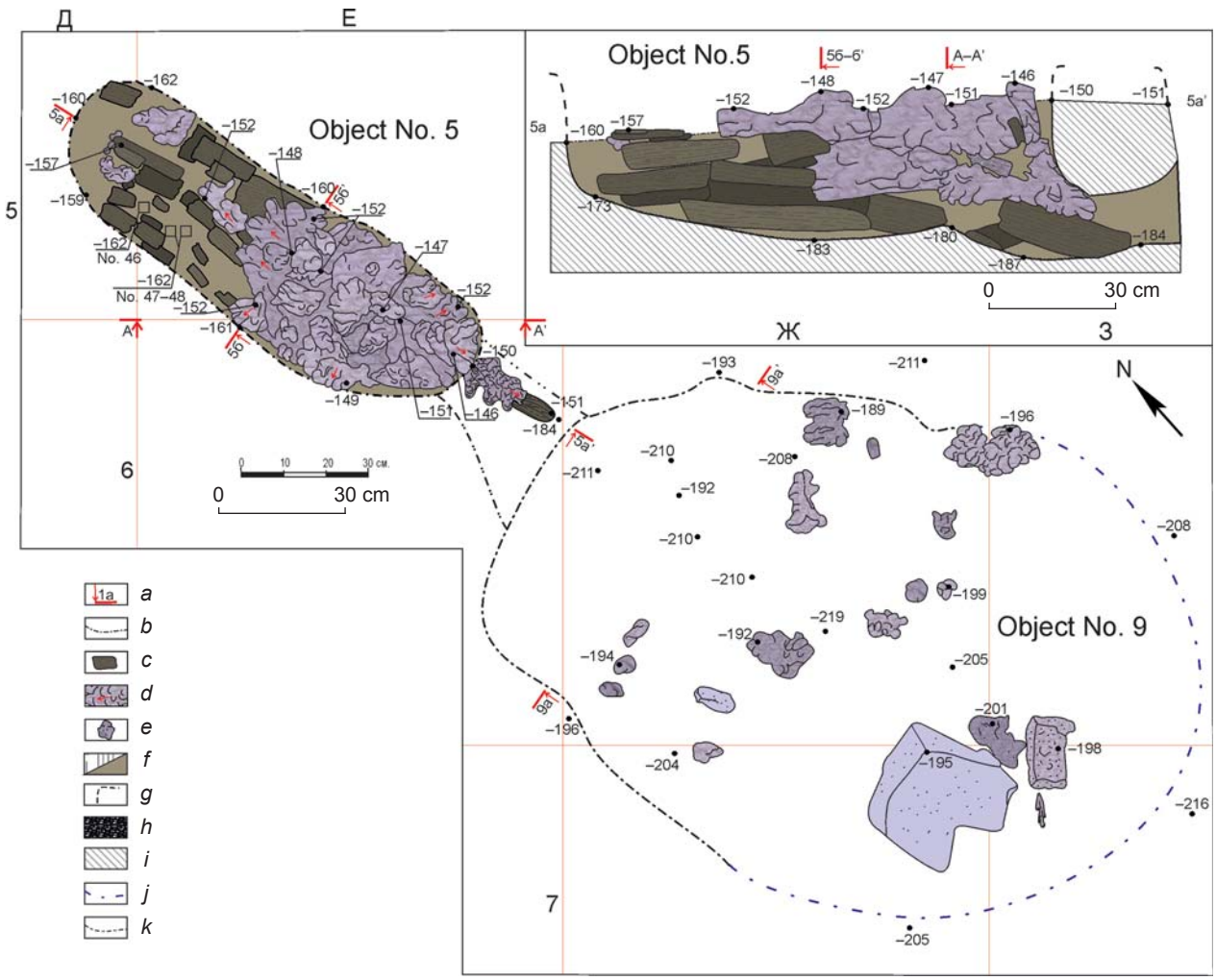

Fig. 8. Ground plan and cross-section of complex P1-5 at the Tolcheya site. Iron-smelting furnaces. Excavations of 2015 by the author.

a – direction and names of profiles; *b* – outline of the pit; *c* – burnt wood; *d* – direction of slag streaks; *e* – slag; *f* – filling of the pit; *g* – estimated level of the buried surface; *h* – charcoal; *i* – virgin soil; *j* – estimated outline of the pit; *k* – circuit of air-blowing tunnel.

Fig. 9. Physical section of object P1-30 at the Tolcheya site. Iron-smelting furnaces. Excavations of 2018 by the author.

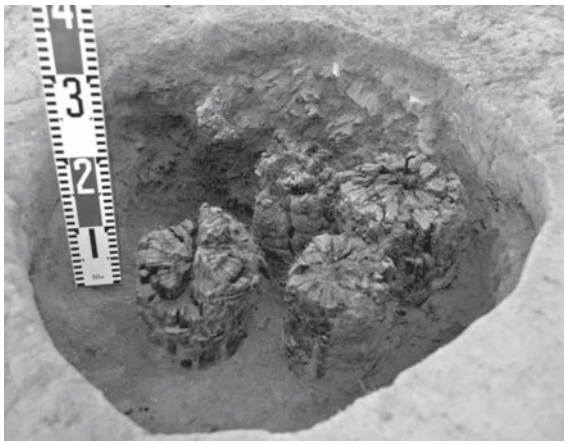

Fig. 10. Charred firewood in the lower part of iron-smelting furnace near the village of Balyktuyul, in the Altai Mountains (after (Bogdanov et al., 2018)).

process took place only opposite the upper nozzles, where the temperature and chemical environment ensured the necessary conditions. In this case, most of the ore was subjected to the process of chemical transformation (deoxidizing). Without lower air-blasting and powerful padding of the slag conglomerate, it would become more difficult to maintain the temperature conditions, which demanded a higher quality of upper air-blasting. A similar technological approach—reduction in the volume of the smelting chamber by tightly stacking the lower part with firewood—has also been observed at the Balyktuyul site in the Altai Mountains (Fig. 10) (Bogdanov et al., 2018: 226).

Type 3 (Fig. 11, 12) includes almost all the studied furnaces at the Troshkino-Iyus site (except No. 10–11). The main parameters of the smelting process were similar to those of type 1. The furnaces had an underground structure. They are relatively small: from 0.8 × 0.4 to 0.9 × 0.5 m, and up to 0.7–0.8 m in depth. A rounded production pit measuring from

Fig. 11. Object No. 5 at the Troshkino-Iyus site. Ground plan and cross-section. Excavations of 2012 by the author.

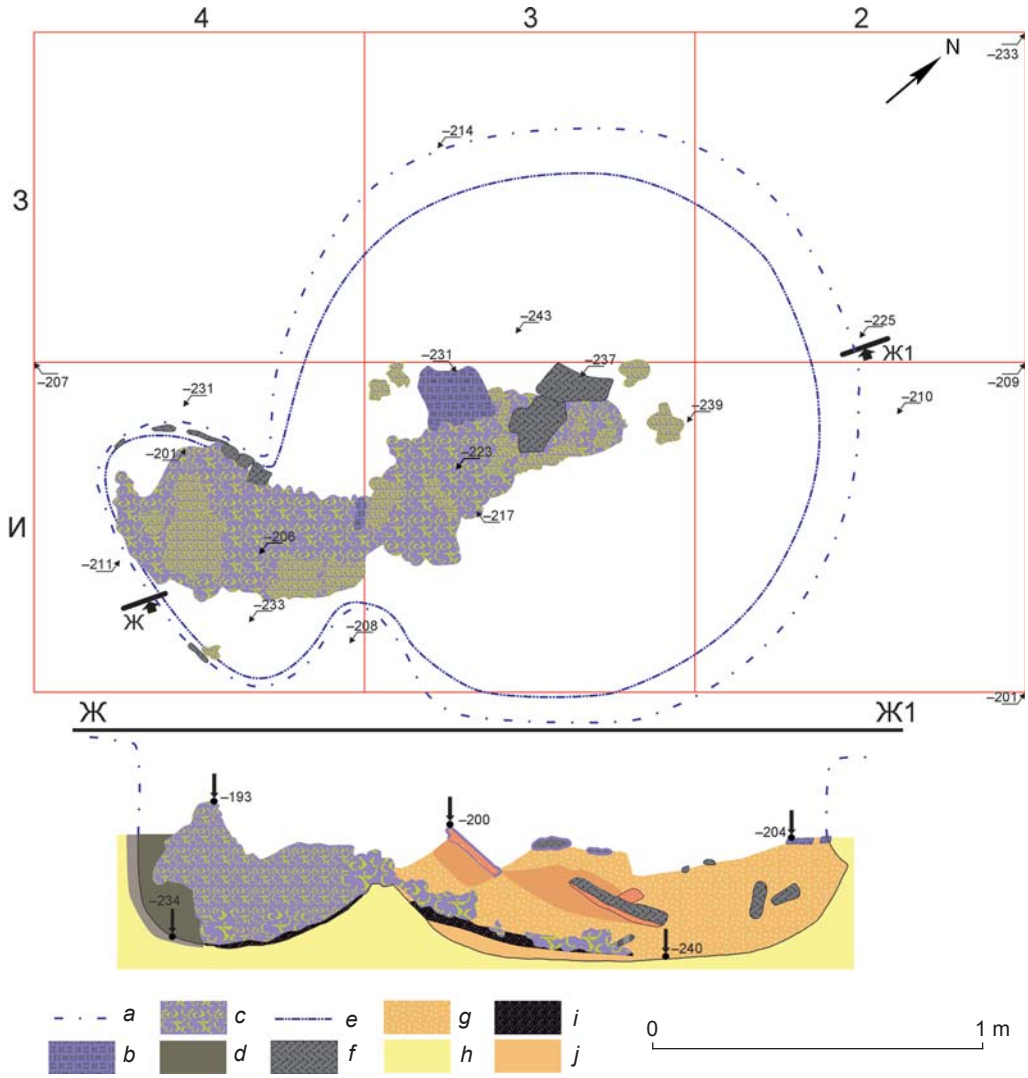

Fig. 12. Ground plan and cross-section of object No. 7 at the Troshkino-Iyus site. Excavations of 2012 by the author.

a – outline of pit surface; *b* – slagged fragment of furnace wall; *c* – slag fragment; *d* – layer of dark gray calcined soil; *e* – outline of pit bottom; *f* – fragment of gray-black coating on the furnace wall; *g* – filling of the object; *h* – whitish loam; *i* – slag fragment; *j* – charcoal; *k* – layer of humified dark brown sandy loam.

1.1 × 1.2 to 1.7 × 1.8 m was also nearby. However, unlike types 1 and 2, the production pit was not connected to the furnace pit by the underground tunnel. It shows horizontal layers of slag, ore, and vitrified walls of the furnace. Air-blasting was carried out only from above, through the nozzles inserted into the furnace from the level of the ancient surface. Their locations and remains of ceramic nozzles have been repeatedly recorded. After the process of smelting was finished, the earthen wall between the furnace and the production pit was immediately destroyed and liquid slag was poured down into the production pit, which facilitated the removal of blooming iron formed under the nozzles.

Conclusions

On the basis of the types of furnaces described above, the following evolutionary and technological theory can be proposed.

1. At first, ancient metallurgists used the technology of a pit iron-smelting hearth with double synchronous air-blasting: from above—the level of the present-day surface, and from below—the tunnel. As a result, large quantities of molten conglomerate and slag flowed down the bottom of the furnace, which created temperature conditions favorable for smelting. This simplified the smelting process,

but led to a low percentage of the resulting iron as compared to the ore used.

2. The next step was the attempts to save the ore by filling the bottom of the furnace with firewood and charcoal, as well as by early cessation of air-blasting from below. This could increase the amount of iron produced relative to ore spent, but complicated the process and required the development of technology or air-blasting technique. The increased amount of iron in the bodies of furnaces of type 2 implies violation of temperature conditions.

3. Finally, the metallurgists abandoned the technology of lower air-blasting through the tunnel. Now, air-blasting was carried out only from the level of the present-day surface. It was difficult to ensure the required amount of air and its uniform supply. Apparently, this became possible after changing the technique and technology of air-blowing. Given the decrease in the diameter of the nozzles in this type of furnace, as confirmed by material evidence, bellows with a hard frame might have been used, which could provide higher pressure of the supplied air.

These conclusions must be additionally confirmed by new experiments, focusing on type 3 technology with different varieties of bellows and different conditions. Experimental method is important for studying ancient technologies.

Thus, briefly summarizing all the above, the following conclusions can be made.

1. The first products made of bloomery iron appeared in the Khakass-Minusinsk Basin in the Tagar period (5th–3rd centuries BC).

2. Iron items, typologically related to the Tagar culture, were most likely imported.

3. To date, the existence in the Khakass-Minusinsk Basin of iron production earlier than the Tes archaeological culture (2nd–1st centuries BC) has not been reliably established.

4. The technology of ferrous metallurgy emerged in the region spontaneously and at a fairly high level, which may suggest its appearance together with carriers of these metallurgical traditions.

5. Further development of iron production in the Khakass-Minusinsk Basin was associated with the search for effective technological solutions aimed at production optimization and increasing the ratio of the resulting product to resources consumed.

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O.A. Mitko
Novosibirsk State University,
Pirogova 2, Novosibirsk, 630090, Russia
E-mail: omitis@gf.nsu.ru

"D.G. Messerschmidt's Cups"

We describe two metal vessels, procured by looters and offered to D.G. Messerschmidt, who in 1722 traveled across southern Krasnoyarsk Territory. A bronze cup, judging by a description in researcher's journal and by the accompanying drawing, resembled Old Turkic specimens. However, the hunting scene engraved on its body suggests Chinese provenance. A silver vessel from the vestry of Fort Karaulny church is peculiar to 7th–10th century Sogdian toreutics. It evidently belongs to a group of vessels with polygonal bodies, specifically to type 1—octagonal. Having been manufactured in Sogd, polygonal vessels were exported to China. Chinese jewelers copied the form of "wine cups" and adorned them with traditional floral designs and various scenes. An octagonal silver cup with an Uyghur inscription, found in 1964 in a kurgan at a medieval cemetery Nad Polyanoi, was likewise manufactured by Tang artisans. Other polygonal silver cups are listed—heptagonal and sexagonal. It is concluded that vessels made of precious metals testify to stable trade relations that emerged in 700–1100 and connected Siberia with Sogd and the Tang Empire.

Keywords: *Altai-Sayan, Tang Age, Kyrgyz, Sogdians, octagonal cup, large metal vessels.*

Introduction

300 years ago, studies of large pieces of medieval toreutics of Southern Siberia began with a drawing of two metal vessels. In 1722, D.G. Messerschmidt traveled through the valleys of the Yenisey and Abakan rivers, and had the opportunity to purchase "rare" items from the local kurgan-looters. However, owing to lack of funds, he sometimes was not able to buy anything, as was the case with two silver cups. Today, only brief descriptions in journals and graphic images made by Messerschmidt and his companions provide us with information about these ancient rarities. The drawings differ in their technique and accuracy of representation of individual details. These sketches can be used as sources for studying various issues of medieval history and archaeology, for instance, identification of tribal nobility, only through a comparative analysis of these images with similar finds from other regions.

The history of discovery of the vessels and their description

Information about one of the two cups has survived in the form of a brief description and two graphic images. In the scientific literature, this item is known under different names, which causes difficulties not only with its typological definition, but with cultural attribution in general (Fig. 1).

In October 1722, Messerschmidt wrote in his journal that he stayed in Krasnoyarsk, at the apartment of "a nobleman, Ilya Nashivishnikov-Surikov". As the researcher noted, after lunch a kurgan-looter (another Ilya) arrived, "and offered me to buy a beautiful jug with silver coins, on which a very nice leaf ornament was engraved, [weighing] 67 zolotniks; he asked for 12 kopecks for a zolotnik, which in total amounted to 8 rubles and 4 kopecks. I offered him 7 kopecks for

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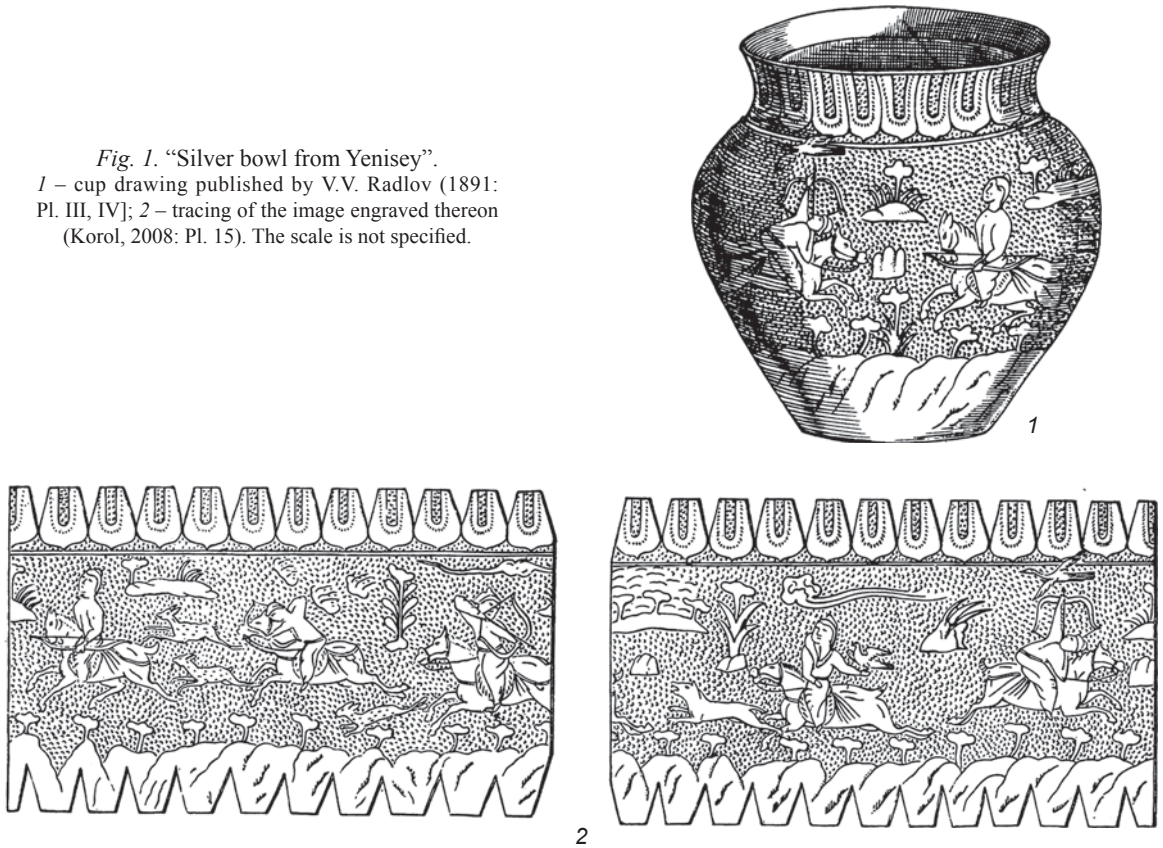

Fig. 1. "Silver bowl from Yenisey".
1 – cup drawing published by V.V. Radlov (1891: Pl. III, IV]; *2* – tracing of the image engraved thereon (Korol, 2008: Pl. 15). The scale is not specified.

a zolotnik, 4 rubles and 69 kopecks in total. He did not want to bargain for a jug, and I had to let him go for lack of salary and money, in the hope that maybe at another time he could sell cheaper" (2012: 157). It was noted in the literature that Messerschmidt acquired ancient rarities but rarely indicated their provenance in his records; the vessel in question was not properly annotated either (Tunkina, Savinov, 2017: 82). Captain P. Tabbert (Strahlenberg), a member of Messerschmidt's expedition, designated the "jug" as an "urn"; Radlov, in his work of 1861, named the item a "bronze vessel" (see (Korol, 2008: 133, pl. 15, *B*)), while in his publication of 1891 a "silver bowl from the Yenisey" (1891: Pl. III, *F*; IV *A*, *C*). In the monograph by L.A. Evtyukhova, the caption to the image of the item states: "Silver cup of Messerschmidt" (1948: Fig. 85).

The history of this vessel is quite well described by G.G. Korol (2008). It notes that the two sketches show significant differences in the shape of the vessel and its ornament. Having analyzed the word-for-word translation of an excerpt from Messerschmidt's journal, Korol came to the conclusion that the researcher did not know the exact place where the looter found this "apparently bronze item". She believed that judging by the scenes of hunting with a hunting bird, framed with vegetable and landscape motifs (Fig. 1, *2*), the vessel could have been made in the Tang Empire, China (Korol, 2008: 133). In its morphological characteristics, it is close to the group of ancient Turkic mug-type vessels; but unlike the latter, it is decorated with a scene covering its entire surface, and does not have a base nor a handle. Among the described items of the Tang tableware, no parallels to the "silver bowl from the Yenisey" have been identified, although hunting motifs with scenes of riding and archery appeared in Chinese ornamentation as early as the previous periods of the Northern and Southern dynasties and are associated with the Middle Eastern artistic tradition of the Six Dynasties.

On February 19, 1722, several copper items from the "kurgans" of the Middle Yenisey were brought to Messerschmidt, who arrived with his companions from the village of Sisim at Fort Karaulny (Verkhny). As Stralenberg noted, these items included "a very old silver cup with a handle", which Messerschmidt ordered someone to draw. "Mister doctor really wanted to buy this cup, but the owner was absent, and they said that the cup was pledged in the church" (Messerschmidt, 1962: 182–183). The doctor instructed the sexton to tell the owner to bring the vessel to Krasnoyarsk, where he could "give good money" for it (Messerschmidt, 2012: 39–40). The cup hasn't survived; however, according to N.P. Kopaneva, it was nevertheless brought to Krasnoyarsk and bought by Messerschmidt. This is

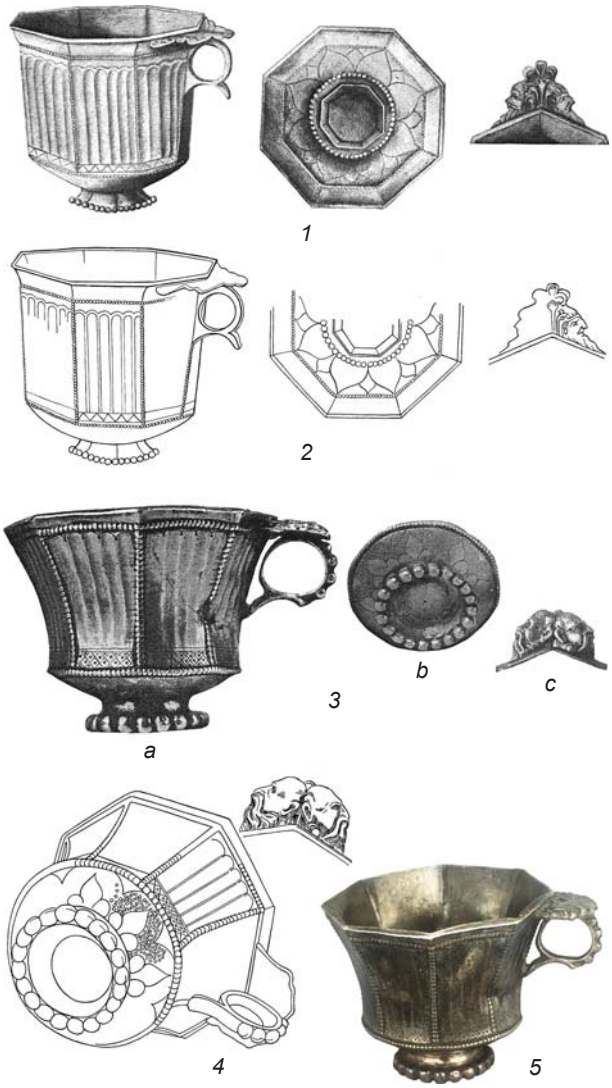

Fig. 2. Octagonal cups.
1 – drawing of the cup from the vestry of Fort Karaulny church (Smirnov, 1909: Pl. XLVIII, 115); *2* – tracing of the cup from the vestry of Fort Karaulny church (Marshak, 1971: Pl. 14); *3* – cup from the Perm Governorate (Smirnov, 1909: Pl. XLVIII, 114); *4* – tracing of the cup from the Perm Governorate (Marshak, 1971: Pl. 26); *5* – photo of the cup from the Perm Governorate (©State Hermitage, St. Petersburg). The scale is not specified.

confirmed by the fact that the drawings in three planes were made in St. Petersburg by a professional artist and included in the album "Sibiria perlustrata" (Fig. 2, *1*, *2*) (Kopaneva, 2006: 78).

Parallels to the vessels

An almost complete parallel to the silver vessel from the vestry of Fort Karaulny church is a cup found in the Krasnoufimsky Uyezd, Perm Governorate (Fig. 2, *3–5*). This similarity was noted by Y.I. Smirnov, who included the images of both cups in the atlas of oriental silver (1909: Pl. XLVIII, *114*, *115*). In our viewpoint, the distinguishing features of cups of this type are not only the polygonal shape of the vessel's body, but also the paired image of the faces of bearded men on the horizontal shield of the handle.

Both cups belong to the group of vessels with a polygonal body on a low base and with a ring-shaped handle, type 1 – octagonal (octahedral), variant 1 – cylindrical shape with fluted edges and a handle decorated with anthropomorphic heads. Researcher of the Tang metal tableware Bo Gyllensvärd noted that cups with polygonal bodies find prototypes among Sasanian vessels ("wine cups") (1957: 63–64). On the basis of analysis of the influence of the artistic traditions of the steppe world and the artistic techniques and subjects typical of the urban culture of Central Asia and the Middle East on the toreutics made of Chinese craft centers, he singled out a group of vessels with hexagonal and octagonal bodies (Ibid.: Fig. 24, *a–d*). B.I. Marshak believed that the shape and motifs of the decor made it possible to date the Yenisey cup reliably to the second half of the 7th century, and the Perm cup to the turn of the 7th–8th centuries. He associated both vessels with a separate craft school ("C") of the Sogdian craftsmen of the 7th–10th centuries, the time when Sogdian and Sasanian techniques merged in the workshops of this school (Marshak, 1971: 28–29, 47, pl. 14, 26).

Variant 2 of the same type—octagonal (octahedral)—includes small cups with the dimensions standard for polyhedral vessels: height 6–7 cm, width in the upper part 6–9 cm, with an expanding rim and a low conical base. Their characteristic feature is the facets richly decorated with floral designs or various scenes with images of people, animals, and insects. The images are made through engraving and punching techniques. The catalogs of European and American private collections, museum collections, and auctions provide descriptions and photographs of octagonal silver vessels of the Tang and Liao periods, called "flowers and bird" (Fig. 3, *1*); these are decorated with a large image of a fantastic bird among twining foliage, and have a looped handle in the shape of a trefoil (Fig. 3, *2*).

The facets of a silver gilded cup from the Metropolitan Museum of Art are decorated with floral motifs, applied over a chased background. The ring-handle with a horizontal shield and the bottom part of the cup also bear floral motifs in the form of shoots, palmettes, and small and large flowers (Fig. 3, *3*).

In the Middle Yenisey, the only cup of variant 2 was discovered in 1964 in the tomb of the Nad Polyanoi cemetery, near the village of Bateni (Fig. 4, *1*). Its facets bear the images of a phoenix, an animal with lion's paws and a wide tail, a running animal resembling a fox, and two fallow deer; the fragment of handle contains the

Fig. 3. Octagonal silver cups.
1 – cup decorated with floral design (Michael, 1991: Pl. 21); *2* – "Phoenix" cup (Gyllensvärd, 1953: No. 104); *3* – cup from the Metropolitan Art Museum (E. Erickson Foundation; https://www.metmuseum.org/art/collection/search/42182). The scale is not specified.

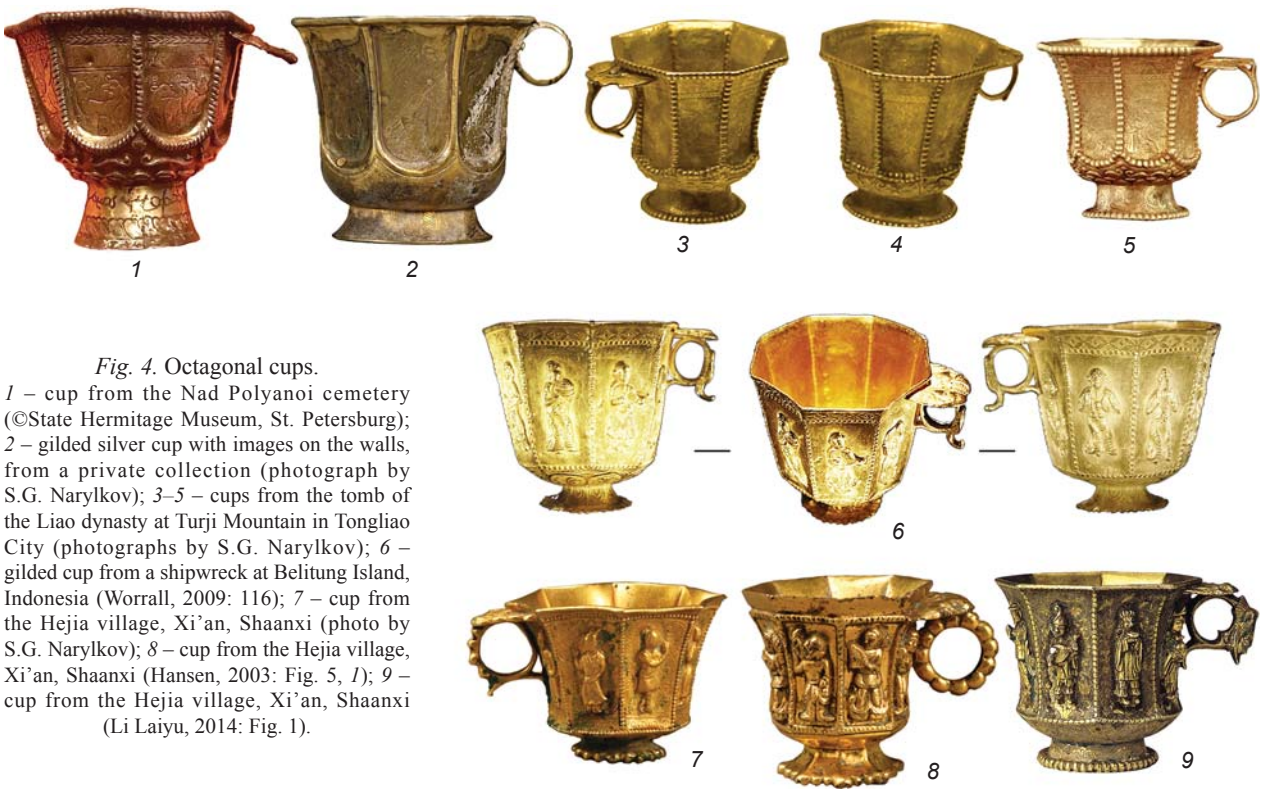

Fig. 4. Octagonal cups.
1 – cup from the Nad Polyanoi cemetery (©State Hermitage Museum, St. Petersburg); *2* – gilded silver cup with images on the walls, from a private collection (photograph by S.G. Narylkov); *3–5* – cups from the tomb of the Liao dynasty at Turji Mountain in Tongliao City (photographs by S.G. Narylkov); *6* – gilded cup from a shipwreck at Belitung Island, Indonesia (Worrall, 2009: 116); *7* – cup from the Hejia village, Xi'an, Shaanxi (photo by S.G. Narylkov); *8* – cup from the Hejia village, Xi'an, Shaanxi (Hansen, 2003: Fig. 5, *1*); *9* – cup from the Hejia village, Xi'an, Shaanxi (Li Laiyu, 2014: Fig. 1).

image of a butterfly or a bee. A.A. Gavrilova dated the cup to the late 9th–early 10th centuries and argued that its shape was close to that of a *charka* 'goblet' (1968: 26, 29). Notably, the use of the word *charka* in the Russian-language classification of medieval oriental ware made of precious metals to designate a group of vessels having such a small size and shape is quite appropriate. As M. Vasmer noted, according to one version, the word *chara* is associated with the Indo-European linguistic layer (*carus* 'cauldron', 'sacrificial bowl', 'pot', and even 'skull'), according to another, it is a borrowing from the Turkic and Altai languages (*čara* 'big bowl') (1987: 316). Along the edge of the base, there is an engraved inscription representing an early type of Uyghur writing of the 8th–11th centuries. One version of its translation reads: "Holding a sparkling bowl, I fully (or: I, Tolyt) found happiness" (Shcherbak, 1968).

All available parallels to this vessel are associated with China, where faceted gold vessels were common in the Tang Dynasty period (Fig. 4, *2–5*). Most often, such vessels had seven or eight facets, which were either decorated with sophisticated scenes or ornamental patterns, or remained smooth. According to Gyllensvärd, the prototypes of Chinese products were Sasanian vessels (1957: Fig. 24).

Abundant Tang artistic products discovered in 1998 aboard the shipwreck close to the western coast of Belitung Island in the Java Sea provide significant information about trade and economic relations and routes along which silver and gold or gilded cups bearing

various scenes were distributed. Most likely, the ship was transporting a large number of mass-produced products to the Middle East. A richly decorated octagonal vessel from a set of silver and gold tableware found in the shipwreck was dated to a period no earlier than the 8th century (Fig. 4, *6*) (Louis, 2011).

Noteworthy are the octahedral cylindrical mugs that were part of the Hejiacun hoard, and those discovered in the Hejia village, Xi'an (Fig. 4, *7–9*). Like the vessel from the shipwreck, their facets are decorated with sculptured figures of musicians and dancers, which represent Sogdian motifs in Chinese art. The depicted humans have deep-set eyes and protruding noses, and bear pointed or corrugated headdresses on their heads. On the basis of analysis of more than 30 similar items, Chinese researcher Qi Dongfang inferred that these do not belong to the traditional Chinese tableware and can be subdivided into three groups: vessels imported from Sogd; vessels made by Sogdian craftsmen in China; and vessels made by Chinese craftsmen in China "under Sogdian influence" (1998). The proposed classification is based on variations in the shape of only one element—handles; although, in our opinion, a detailed typology should also take into account the morphological features of other vessel parts. Some researchers argue that production of vessels with ring handles is typical of the period of the highest economic and political stability of the Tang Dynasty. Decoration of the body with ornaments with relief figures became a technological and artistic innovation of vessels in that time (Kieser, 2015: 63; Szmoniewski, 2016: 237–238, fig. 1).

The heptagonal (seven-sided) and sexagonal (hexagonal) vessels make up special types of polygonal cups.

Heptagonal cups are represented by one variant. Two such cups have been found at Liao Dynasty sites in Inner Mongolia. One of them (Fig. 5, *1*) was discovered during excavations of the grave of a major Khitan official of the ruling dynasty Yelü Yuzhi (890–941) (Du Hanchao, 2014). The cups, slightly over 6 cm high, with diameters of the mouth over 7 cm, were made of silver sheet with full gold cover produced by fire-gilding. Their features are a low wide stem decorated with a floral ornament with small "pearls", and a handle in the form of a horizontal shield and a small hook instead of a ring. The facets bear engraved figures of sitting elders framed by bamboo branches and leaves over the chased background (Fig. 5, *2*). In our opinion, the images on both vessels are

Fig. 5. Heptagonal cups from Inner Mongolia.
1 – cup from the tomb of a Khitan official (Du Hanchao, 2014: Photo on p. 176); *2* – silver gilded cup (Treasures on Grassland, 2000: Tab. 339). The scale is not specified.

Fig. 6. A modern copy of a gilded octagonal cup from a private collection (photograph by S.G. Narylkov) (*1*), graphical reconstruction of a silver octagonal cup with a handle in the form of a griffin (photo by the author) (*2*). The scale is not specified.

associated with the plot of the popular Chinese story about "seven wise men in a bamboo grove".

Notably, all polygonal cups are made at a high professional level and are highly artistic products. The creative impulse inherent in the products of Tang artisans was perceived by modern Chinese craftsmen: they manufacture high-quality full-fledged copies and replicas. Cups made of metal (Fig. 6, *1*) and porcelain can be found on sale.

Archaeologically intact sexagonal cups (type 1 – with a handle in the form of a horse-shaped griffin's head) have not survived to this day. Available solitary fragments make it possible to reconstruct the shape of a vessel. For instance, the burial with a horse in the kurgan of Nainte-Sume, in the Tola River basin in Mongolia, yielded a destroyed hexagonal rim of a vessel, and an accompanying cast handle in the shape of a griffin's head (Borovka, 1927). There is every reason to believe that these are parts of one cup. Two more similar handles were found in the south of Siberia. One of them was discovered in 1989 during excavations of a burial with a horse in kurgan 34 at the Markelov Mys II cemetery, in the Novoselovsky District of the Krasnoyarsk Territory (Mitko, 1999). The other handle was found outside of an archaeological context near the village of Chernoye Ozero, in the Shirinsky District of the Republic of Khakassia, in 2012 (Oborin, 2019: Fig. 17). Comparative analysis allows us to draw a conclusion about the typological identity of the three handles and to make a graphical reconstruction of the cup (Fig. 6, *2*).

Conclusions

Ancient artistic products made of precious metals had little chance of surviving to this day and getting into museum collections. At all times, gold and silver things became the desired prey for "treasure hunters". Very often they were broken, crushed, and valued by the weight of the precious metal.

There is no doubt that, having seen a bronze vessel with a representation of a hunting scene and a cup from the vestry of Fort Karaulny church, such an insightful and versatile scientist as D.G. Messerschmidt could not help but appreciate its artistic and historical value. The researcher managed to purchase the cup and deliver it to St. Petersburg; it was included in the collection of "oriental silver" of the Hermitage, but it has not survived to this day.

Assessing the significance of imported metal tableware in the context of the development of the Yenisey Kyrgyz culture, it should be noted that it evidences the inclusion of the Altai-Sayan population as a full partner into the system of trade and economic relations between the central and eastern parts of Eurasia. The appearance of octagonal cups in the Middle Yenisey falls in the 8th–9th centuries, the time of the Kyrgyz-Uyghur confrontation and the political and economic rise of the Kyrgyz Khaganate. We should agree with Marshak that the morphological and stylistic features of the cup from the vestry of Karaulny Fort church suggest affiliation of its origin to the craft school of Sogdian toreutics.

In archaeology, imported items are considered trade markers. According to written records, the Kyrgyz maintained constant contacts with the Arabs (dashi), Tibetans (tufan), and Karluks (galolu), and periodic contacts with the Chinese. From the country of Dashi, a caravan of 20 (sometimes 24) camels, loaded with silk fabrics, arrived to them every three years. Judging by the archaeological finds, the imported Western goods included glass and stone beads and, probably, metal tableware. In return, musk, furs, birch wood, and Hutu horn (tusks of

walruses and narwhals) were exported (Bichurin, 1950: 55; Bartold, 1963: 490, 493). The question of the origin of sexagonal cups with handles in the form of a horse-shaped griffin's head is debatable (Fig. 6, *2*). In our opinion, these could also have been made by Sogdian artisans.

The bronze vessel bearing a hunting scene and the octagonal cup with an Uyghur inscription from the Nad Polyanoi cemetery are of Chinese origin. The iconography includes complex syncretic animal and plant symbolism created by Tang artists. Jewelers produced realistic images on small-sized facets. As for the silver cup from the vestry of Fort Karaulny church, its shape was popular not only in the western regions of Asia, but also in China, thanks to Sogdian merchants.

Gavrilova, who excavated the Nad Polyanoi medieval cemetery, did not consider the similarity of the images on the cup's facets to Chinese images as evidence that the vessel was made in China, and suggested "to look for the master" in the Turfan oasis (1968: 28). In our opinion, this cup could have been delivered to the Turfan principality by the trade route from one of the main centers of mass production of luxury goods. During the reign of the Tang Dynasty, these were capital cities, each with a population of million: Chang'an in the western part of the empire, Luoyang in the eastern part of the empire. The demand for luxury goods stimulated here the development of jewelry production and the concentration of a huge number of merchants and travelers from many parts of Asia, students and monks, poets and artists, representing various aesthetic trends and forming a creative atmosphere. These included the culture of drinking alcoholic beverages, which was, judging by the poetic works, as high culture as the tea ceremony.

In Turfan, in accordance with the tradition prevailing in the Turkic environment, the cup from Nad Polyanoi was provided with an engraved inscription, and during the long existence of the Kyrgyz-Uyghur frontier, it ended up in the Middle Yenisey.

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A.V. Kharinsky
Irkutsk National Research Technical University,
Lermontova 83, Irkutsk, 664074, Russia
Irkutsk State University,
Karla Marksa 1, Irkutsk, 664003, Russia
E-mail: kharinsky@mail.ru

Use of Parts of Ram Carcasses in the Funerary Practices of the Baikal Region Population in the 13th–14th Centuries

In the 13th and 14th centuries, there was a custom of placing parts of a ram/sheep carcass in the grave as an offering in the Baikal region. Materials from three areas, which were then parts of the Mongol Empire, are described: southeastern Trans-Baikal, northern Khövsgöl, and southern Angara. Graves are described with a focus on sheep bones, their composition, and location in the grave. In the southern Trans-Baikal, the shank was usually placed near the buried person's head. Scapulae and vertebrae are much less frequent than shank bones. The latter are most often found under the human pelvic bones or under the upper femur. In the Khövsgöl area, a ram's shank was placed near the deceased person's arm or leg. On the Angara, a ram's head—or the entire dorsal part—was placed near the deceased's legs. In the Sayantui type burials, located south of Lake Baikal and representing the Mongols' funerary tradition of the imperial period, the most common offering was a ram's shank, placed upright. Elsewhere in the Baikal region, other ways of arranging parts of a ram carcass are observed, apparently because of the absence of the Mongol population and its elite in those areas.

Keywords: *Mongol Empire, Baikal region, Sayantui funerary rite, ram bones, shank bones, vertebrae.*

Introduction

At the beginning of the 13th century, the region south of Lake Baikal became part of the Mongol Empire. This event significantly affected the various aspects of life of the local population, including their funerary rite. The economic structure and cultural traditions of the steppe region population differed only slightly from the founders of the empire—the Mongols. This made it easier for the locals to acquire new cultural trends common among the titular nation, which after some time spread nationwide.

One of the common features for a significant part of the burials in imperial territory, including the Baikal region, is the presence of ram/sheep skeletal remains in the grave. In various proportions, these included primarily shank bone, as well as scapulae and bones of dorsal part of the carcass. The custom of placing a ram's shank in the graves probably had both utilitarian and sacral significance. Moreover, ram's hind leg, placed upright in the grave, is considered by a number of researchers as the most important cultural element, characterizing the Mongolian milieu in the first half of the 2nd millennium AD. For example, N.V. Imenokhoev attributed the medieval burials with the ram/sheep shank bones to the archaeological culture of the 8th–14th centuries, which territory covers part of the Irkutsk Region, the Olkhon Region, western and eastern Trans-Baikal, and northern Mongolia (1988). This culture was proposed to be called Early Mongolian (Konovalov, 1989; Imenokhoev, 1989, 1992).

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In order to understand how stable was this tradition of placing a ram/sheep hind leg in burials of the 13th–14th centuries in the Baikal region, let us compare materials from the three regions of the area: the valleys of the Urulyungui and Onon rivers in the Trans-Baikal Territory, the valley of Angara River in the Irkutsk Region, and from the northern shore of Lake Khövsgöl in Mongolia.

Burials with ram bones

In the 13th–14th centuries, in the southeastern Trans-Baikal, the unification of the funerary ritual is noted. Its main elements include the placement of parts of a ram/sheep carcass in the grave, which is well recorded in the materials of the Okoshki cemetery, located on the left bank of the Urulyungui River (Kharinsky et al., 2014). A sheep shank, forming a single unit with the heel and talus bone, is most often found in the burials of the necropolis. The shank of the animal was placed near the wall of the grave, to the right of the head of the deceased (Fig. 1, *1*). Most of the graves of the cemetery were looted. However, despite the loss of the anatomical integrity of the human skeletons, the bones of the ram's leg retained their position in the northwestern corner of the grave-pits (Fig. 1, *2*). In the graves of the Okoshki cemetry, the shank bone of the animal is turned with the upper epiphysis down. The body of the deceased was placed in an intra-burial structure—a wooden frame, a coffin, a log, or a stone sarcophagus, while the ram's shank was put outside, most definitely at the northwestern corner of the structure (Fig. 1, *3*, *4*). According to the data from burial 17, the shank was installed in the pit even before the intra-burial structure was placed there: under the weight of the coffin, the bone broke, and part of the shank was under it (Kharinsky et al., 2019). In some cases, the leg bones of the ram were raised above the bottom of the grave-pit by 20–25 cm and were at the level of the facial area of the buried, which suggests the presence of a special small step.

The placement of the ram's shank at the head of the deceased was also recorded in the burials in the Onon River valley. In burial 2 of the Budulan cemetery, a sheep shank was found in the northeastern part of the grave, near the skull of the buried human (Aseev, Kirillov, Kovychev, 1984: 46, 47). At the Chindant cemetery, ram bones were found near the northeastern end of the log coffin in burial 6; on the cover of the log coffin, at the same end, in burial 10; and on a stone slab covering a wooden coffin, at the northern end, in burial 11 (Ibid.: 49–56). In burial 10 of the Ulan-Khada III cemetery, a ram's leg bone was discovered in the northwestern corner of the grave, outside the log coffin (Ukhinov, 2014). A similar practice was noted in the Onon River valley also before the 13th century. In burials 1 and 7 (Fig. 1, *6*, *7*) of the Malaya Kulinda cemetery (excavations of 2003), dated back to the 11th–12th centuries, ram's shanks placed upright were found near the northeastern corner of the coffin (Kovychev, 2004b; Kovychev, Dushechkina, 2004), as well as in another group of graves of this burial ground, excavated in 1980 and attributed by E.V. Kovychev to the12th–13th centuries (2004a: Fig. 17) (Fig. 1, *5*), which suggests a significant stability of this tradition.

In addition to the ram's shank bones, in the 13th–14th centuries burials of the southeastern Trans-Baikal, ram's lumbar vertebrae and scapulae are also found. At the Okoshki cemetery, vertebrae were discovered in five burials (in four, they retained their original position), and scapulae in two burials. In burial 49, the scapula was located vertically near the northeastern corner of the log coffin in which an infant was buried, and the vertebrae were located under the bottom of the log coffin (Fig. 1, *3*, *4*).

Despite the fact that during the imperial period, in most of the Baikal region, common burial traditions were formed, known as Sayantui type burials (Kharinsky, 2018), a certain individuality was preserved in some of its areas. This included the placement of the ram's carcass parts into the grave, along with the deceased. One of these areas was the northern shore of Lake Khövsgöl (Mongolia). To date, five undisturbed and six partially disturbed burials of the 13th–14th centuries have been excavated there, which yielded sheep bones (Kharinsky, Erdenebaatar, 2011, 2019; Orgilbayar et al., 2019; Orgilbayar…Bayansan, 2019).

In burial 2 of the Zuun-Khyaryn-Denzh-1 cemetery, the deceased was buried in an extended supine position, with his head to the northwest (Fig. 2, *1*). Near the bones of the right hand, there was a rectangular piece of birch-bark, possibly the remains of a quiver. Under it, the bones of the hind leg of the ram (tibia, talus, and heel bone) were found in anatomical order, which were located horizontally and directed with their upper parts to the northwest. Under the right ischium of the pelvis of the deceased, two lumbar vertebrae of a sheep were found adjoining each other, with their front parts to the northwest.

At the cemetery of Urd-Khyar-1, in burial 9, the deceased was buried in a log coffin in an extended supine position, with his head to the northeast. Between the log and the wall of the grave-pit, southeast of the upper part of the left human femur, there was the metacarpal bone of a sheep vertically set with its lower epiphysis upwards. Three ram's lumbar vertebrae were found under the right femur of a human. During the burial, they were in an articulated state, and were oriented with their front parts to the west.

Three burials with ram's bones were excavated at Urd-Khyar-2. In burial 23, the deceased was buried

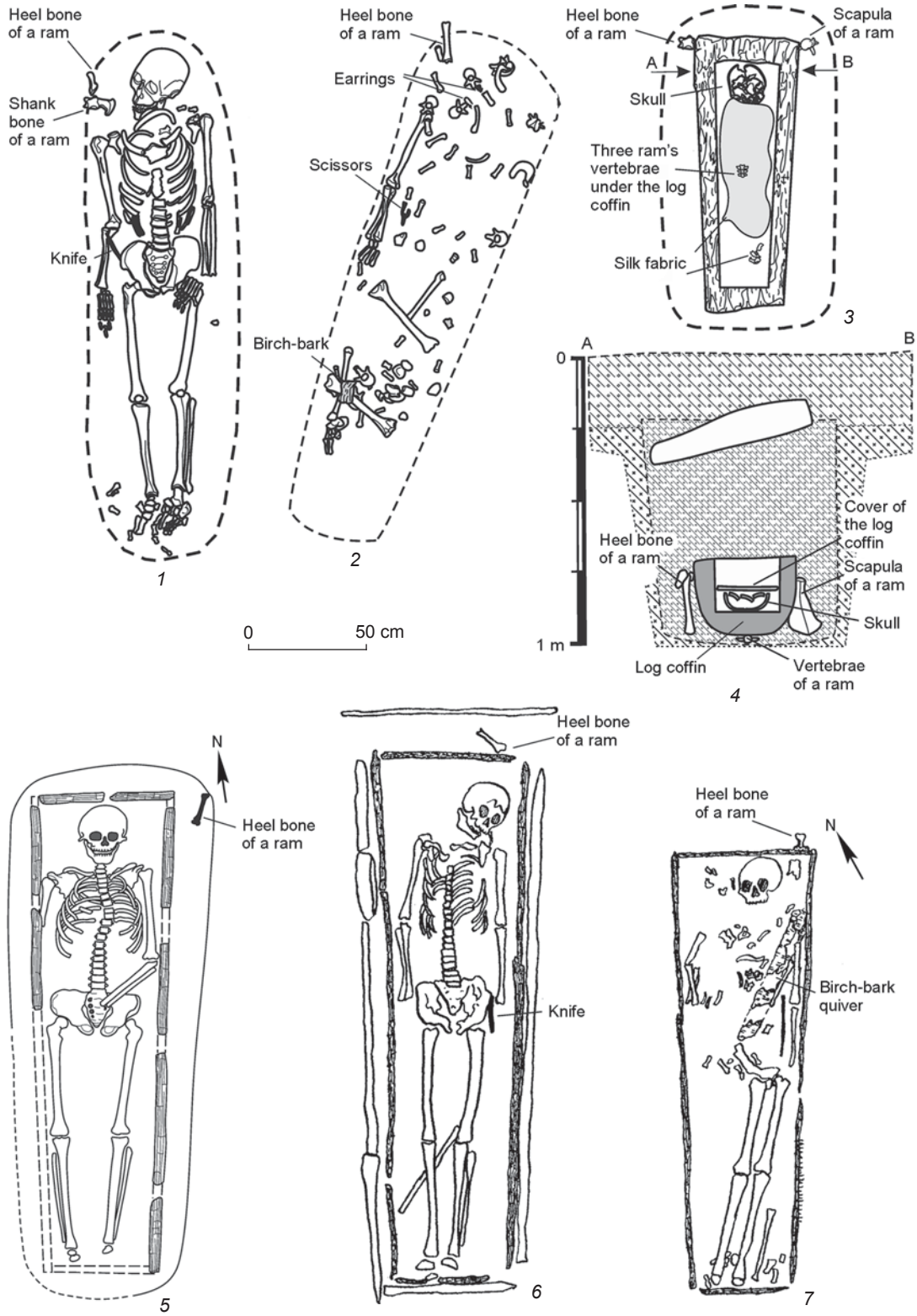

Fig. 1. Burials with sheep bones in the southeastern Trans-Baikal.
1–4 – Okoshki cemetery: *1* – burial 20, *2* – burial 48, *3*, *4* – burial 49; *5* – Malaya Kulinda, 1980, burial 22 (Kovychev, 2004a: Fig. 17); *6*, *7* – Malaya Kulinda, 2003 (Kovychev, 2004b: Fig. 1): *6* – burial 1, *7* – burial 7.

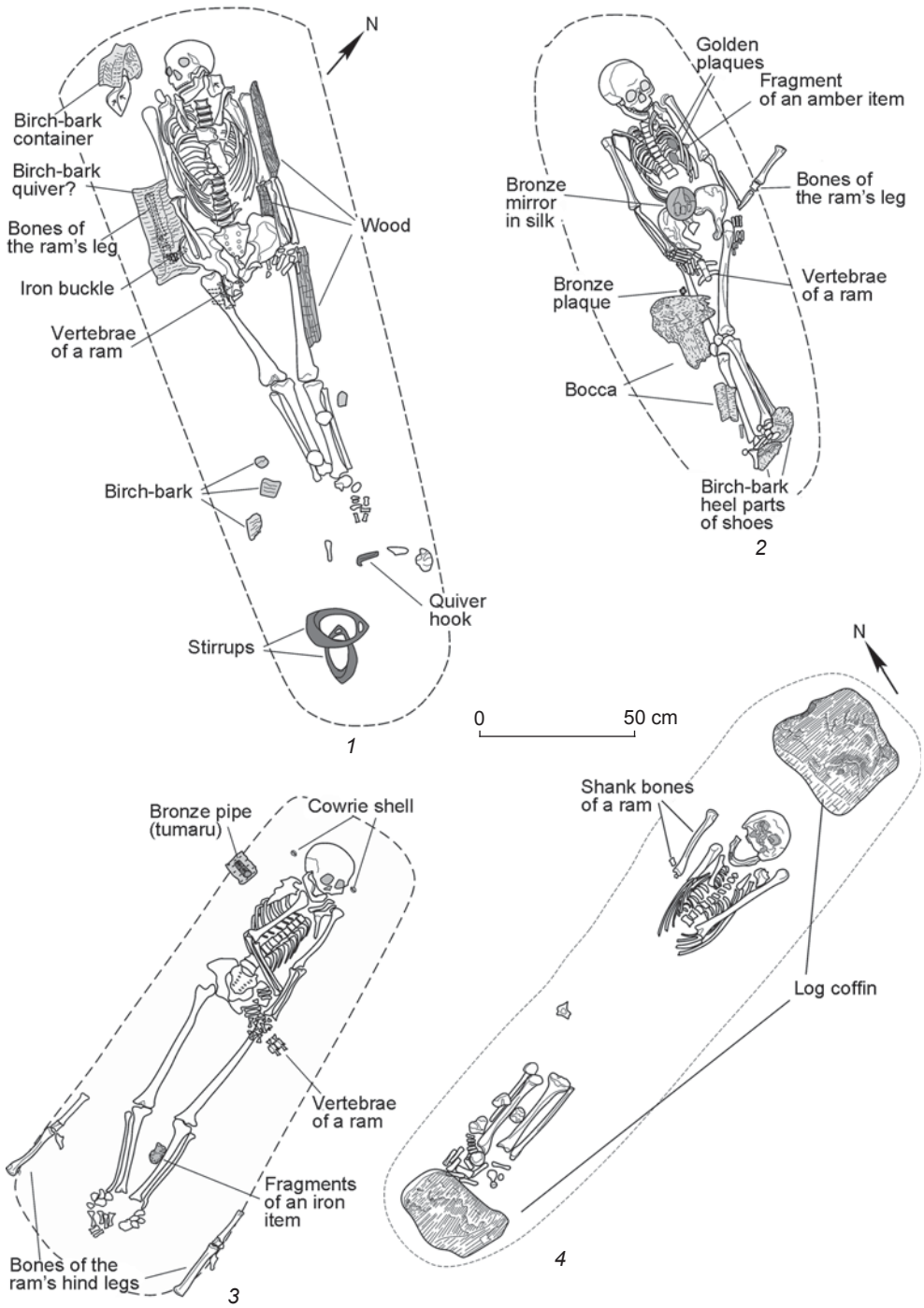

Fig. 2. Burials with ram's bones on the northern shore of Lake Khövsgöl.
1 – Zuun-Khyaryn-Denzh-1, burial 2; *2–4* – Urd-Khyar-2: *2* – burial 23; *3* – burial 24; *4* – burial 26.

in an extended supine position, with her head to the northwest. She was covered by a wooden ceiling. To the left of the human left hand bones, along the wall of the grave-pit, bones of the ram's hind leg (tibia, tarsal, metatarsal) were found in anatomical order. They were located obliquely, with their upper epiphyses to the northeast. Between the human femurs, there were two ram's lumbar vertebrae. During the burial, they were in an articulated state, and were oriented with their front parts to the southeast (Fig. 2, *2*).

In burial 24, the deceased was laid in the same way as the previous one, but with his head to the northeast.

In the southwestern part of the grave-pit, along the northwestern and southeastern walls, there were the bones of the ram's hind legs (tibia, tarsal, metatarsal) in anatomical order. They were located obliquely, with their upper epiphyses to the southwest (Fig. 2, *3*). Two ram's vertebrae were found near the left femur of the buried. During the burial, they were in an articulated state. One meter northeast of the grave, a round pit was located, where the skull and leg bones of a lamb were found. Probably, before burial, they formed a single whole with a skin taken from a killed animal and placed in the pit.

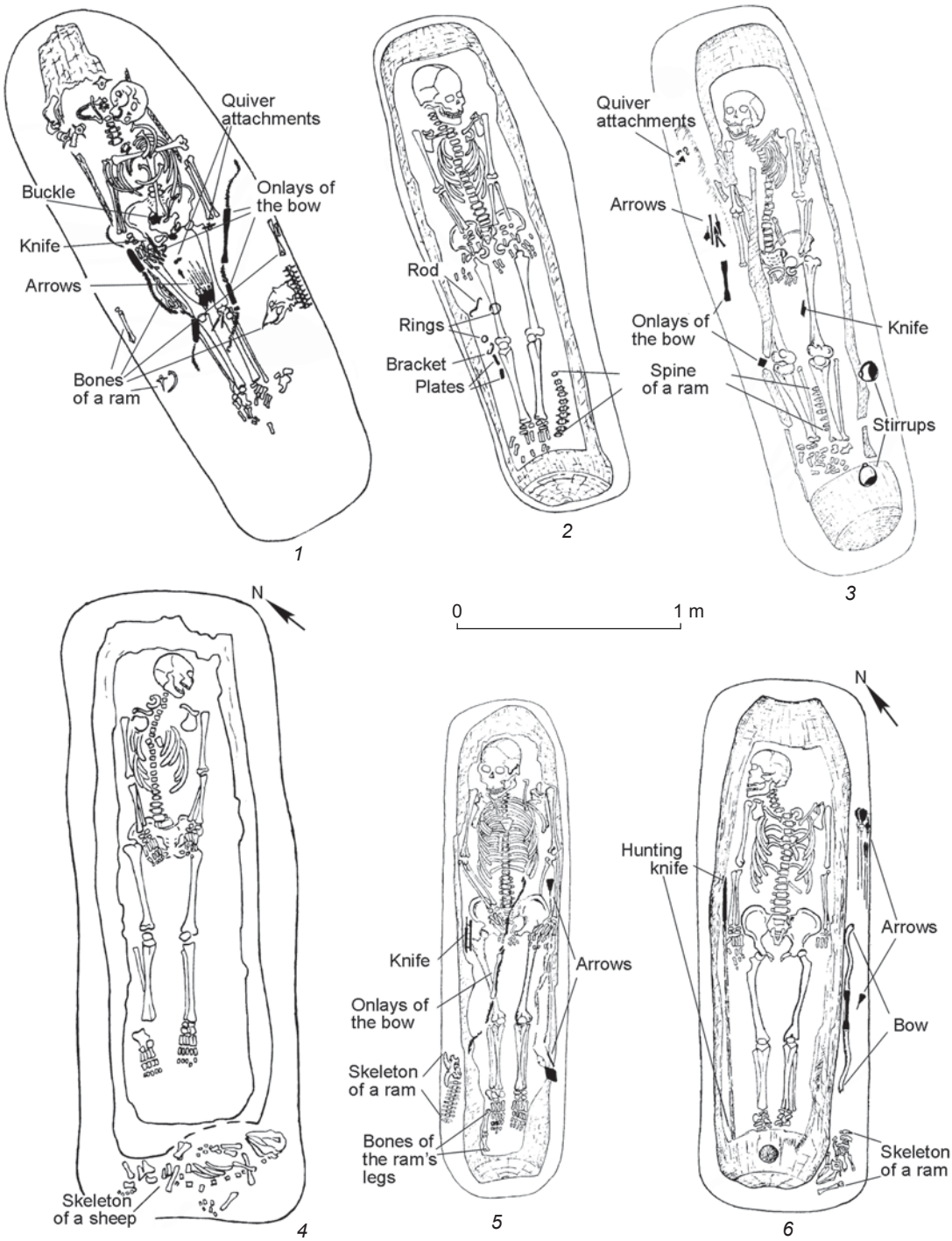

Fig. 3. Burials with ram's bones in the southern part of the Angara River valley (Nikolaev, 2004).
1 – Doglan cemetery, burial 15; *2*, *3* – Shebuty III cemetery: *2* – burial 5, *3* – burial 6; *4–6* – Ust-Uda cemetery: *4* – excavation 4, burial 1, *5* – excavation 6, burial 4, *6* – excavation 6, burial 10.

In burial 26, the deceased was buried in a log coffin in an extended supine position, with his head to the east-northeast. The bones of the middle part of the skeleton were absent. The ram's tibia and tarsal bones were found to the right of the skull and humerus of the interred (Fig. 2, *4*). At the time of burial, they formed a single unit, oriented by its upper epiphysis to the east-northeast and located parallel to the human skeleton.

The placement of ram's bones in the burials of southern part of the Angara River valley differed from those in the southeastern Trans-Baikal and the northern shore of Khövsgöl. At the Doglan cemetery, the ram's shanks were found in a grave-pit on both sides of the legs of the deceased, whose head was oriented to the northwest (burials 14 and 15). In addition, in burial 15, near the northeastern wall (southeast of the ram's leg bones), there was ram's skull and part of its spine, and at the southwestern wall (southeast of the ram's leg bones) its cervical vertebra and a rib (Fig. 3, *1*). At the cemetery of Shebuty III, several burials were excavated, in which the deceased were placed in log coffins and were oriented with their heads to the northwest. In each of them, a ram's spine was found. In burials 5 and 7, it lay near the bones of the lower part of the human left leg (Fig. 3, *2*), and in burial 6 between the tibia of the deceased (Fig. 3, *3*). In all the cases, the animal spine was in anatomical order and was oriented in the same direction as the human skeleton (Nikolaev, 2004: Fig. 49, 52, 66–68).

In three burials of the Ust-Uda cemetery, where the deceased were buried in log coffins, skeletons of sheep/ram were found. In burial 1 of excavation 4, the deceased was oriented with his head to the northeast. The sheep skeleton was located along the southwestern wall of the log coffin, with its skull to the southeast (Fig. 3, *4*). In burial 4 of excavation 6, the buried was oriented with his head to the north. The ram's skull and spine were to the west of the southern end of the log coffin. The animal's skeleton was oriented with its skull to the north (Fig. 3, *5*). The bones of the ram's leg were located in the log coffin, along its wall to the southwest of the bones of the human's right foot. In burial 10 of the same excavation, the deceased was oriented with his head to the northeast. The ram's skeleton was located at the southwestern end of the log coffin, along its southeastern wall, with its skull to the southwest (Fig. 3, *6*) (Nikolaev, 2004: Fig. 86, 94, 99).

Discussion

The tradition of placing a vertically installed ram's shank in the grave was widespread in the Mongol Empire. This element of the funerary rite is primarily typical of the Mongols themselves, but was probably also borrowed by the culturally close peoples. In the south of Siberia, most of the burials of the 13th–14th centuries with this funerary feature were recorded in the southern Trans-Baikal.

It is still difficult to identify where the tradition of placing a ram's shank in the grave at the head of the deceased was originally developed. According to E.V. Kovychev, in the Onon River valley, this custom has been already known in the 11th–12th centuries (1981, 2004b). At about the same time, it was practiced in the southwestern Trans-Baikal, in the Selenga River valley. At the Kibalino cemetery of the 11th–14th centuries, seven of the eight excavated graves contained vertically or obliquely arranged ram's shanks. In four cases, the bone was in the northeastern corner of the grave-pit, in two cases in the northwestern corner, and in one case behind the skull of the buried human. Sheep vertebrae were found in the central part of two burials of the cemetery (Konovalov, Danilov, 1981). Sheep bones were also found in a grave on the right bank of the Selenga River, 1 km from the bridge along the Ulan-Ude – Kyakhta route. At the left clavicle of the deceased, there was a tubular ram's bone, placed upright, and at the right hand humerus, on the outside, there were three ram's vertebrae (Aseev, Kirillov, Kovychev, 1984: 34). A paired burial was excavated 15 km east of Ust-Kyakhta, in the Subuktui area. The male skeleton lay in the western part of the grave, the female in the eastern. A vertically standing tubular bone of a ram was found next to the man's skull, and ram's vertebrae near the right hand bones. One ram's vertebra was located at the elbow joint of the woman's left hand (Ibid.: 36). In burial 1 of the Varvarina Gora cemetery, a ram's leg bone was placed upright in the northwestern corner of a burial chamber (*domovina*) made of boards, near the skull of the deceased (Ibid.: 38).

Judging by the materials of the 13th–14th centuries burials in the southeastern Trans-Baikal, ram's shanks were found in about half of them. In most cases (about 90 %), these were placed upright near the skull of the interred person. Sheep scapulae and vertebrae occur in burials much rarer than shanks (Kharinsky, 2015). The latter are most often discovered under the pelvic bones or the upper part of the femurs of the buried.

Funerary rite of inhabitants of the Khövsgöl region in the 13th–14th centuries, as in the southern Trans-Baikal, included the active use of parts of a ram/sheep carcass. In four of the five cases we examined, these were two or three lumbar vertebrae, belonging to the loin part of the animal carcass. It was laid at the bottom of the grave-pit before the deceased was placed there. In the funerary practices of Khövsgöl population, the ram's shank placed upright in the grave near the head of the deceased was not recorded. Here, it was placed in other parts of the grave-pit. In two cases, the ram's shank was located horizontally to the right of the right hand of the deceased, and in one case obliquely to the left of the left hand. Another

grave contained two ram's hind legs, which were located obliquely between the walls of the pit and the legs of the deceased. Near this grave, there was a separate burial of the lamb's skin, with head and legs. Only in one case, a vertical placement of the lower part of the sheep shank in the grave was recorded, to the left of the left leg of a deceased person.

The Angara burials, where ram/sheep bones were found, belong to the Ust-Talkin culture (11th–14th centuries) (Nikolaev, 2004: 158), widespread in the northern periphery of the Mongol Empire. There was no imperial elite, nor the Mongol population here, which contributed to the preservation of a number of Ust-Talkin own cultural traditions, including the placing of parts of a ram/sheep carcass in the grave. These were located at the feet of the deceased in the log coffin or outside of it. Unlike the Trans-Baikal and the Khövsgöl region, in the Angara region, a whole sheep carcass or a significant part of it was placed in the grave. The presence of a sheep shank near a human's skull has not been recorded in the Ust-Talkin culture. One of the most important features of this culture is the construction of separate burials of horses, cows or rams near the graves of people.

Conclusions

Despite the unification of funerary rite in the Mongol Empire in the 13th century, there were still areas in the Baikal region where cultural identity was preserved, including a custom of placing parts of a sheep carcass in the grave. The Sayantui type burials, reflecting the funerary practices of the Mongols of the imperial period, show the custom of placing a ram/sheep shank in a vertical position in the grave, while in other parts of the region there were other traditions. The Ust-Talkin culture people, who represented the easternmost enclave of the Kypchak circle of cultures, placed mainly the loin of a sheep at the feet of the deceased. On the shores of the Khövsgöl, where the Tumats lived, a sheep shank was placed in the grave near the hand or foot of the deceased. The preservation of these local differences was probably due to the absence of the Mongolian population and its elite in the northern peripheral regions of the empire.

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We Just Dream of Rest…
Academician A.P. Derevianko's 80th Birthday

Anatoly Panteleyevich was born on January 9, 1943, in the Kozmo-Demiyanovka village, Tambovsky District, Amur Region, in a working-class family. His father, Panteley Alekseevich, and mother, Evdokiya Semenovna, raised their three sons in the spirit of diligence and kindness, and instilled in them a sense of responsibility for themselves and their loved ones, and deep love for the Motherland and their people. These qualities formed the basis of the character of Anatoly Panteleyevich. In the difficult post-war years, at the age of nine, he began to earn his "daily bread", and at the age of 11 he already became a full-time worker to earn his living. Anatoly learned to read and write very early on, reading was his favorite pastime. His inclination for the humanities, especially history, was manifested while studying at school, and after he participated in a geological expedition, he developed an interest in working in the field.

After graduating from high school, A.P. Derevianko entered the Department of History and Philology at the Blagoveshchensk Pedagogical Institute. A turn in the life of a young student was determined by a meeting with the famous scientist Alexey Pavlovich Okladnikov. After completing an accelerated degree program and graduating from the institute with honors in 1963, A.P. Derevianko entered the postgraduate school of the Institute of History, Philology and Philosophy of the Siberian Branch of the USSR Academy of Sciences, where Academician A.P. Okladnikov became his leading professor and research advisor.

Thanks to the participation in the expeditions under the leadership of the outstanding scientist and excellent teacher, discussion with him of key problems of archaeology and ancient history, A.P. Derevianko, as a postgraduate student, developed the broadest outlook and creative approach to solving the issues of archaeology, a serious attitude to the sources, and the ability to work in difficult field conditions. As early as 1963, A.P. Derevianko already conducted his first independent excavations at the Neolithic settlement of Novopetrovka on the Amur. The results of these studies served as a basis for identifying the Novopetrovka archaeological culture. Commitment to the archaeology of the native Amur region, which developed at that time, permeated his entire creative biography.

In 1965, A.P. Derevianko brilliantly defended his Candidate Dissertation entitled "Ancient Cultures of the Middle Amur (the Stone Age)". In 1970, his first monograph "The Novopetrovka Blade Culture in the Middle Amur" was published, which was awarded the Lenin Komsomol Prize—the country's highest award for young scientists.

At that time, in Novosibirsk Akademgorodok (Academic Town), the center for the humanities in Siberia was formed under the leadership of Academician A.P. Okladnikov. The stake was placed on talented young people, capable of formulating and solving complex scientific problems. It was in these conditions that the outstanding qualities of the creative personality of A.P. Derevianko were revealed. In just five years, Anatoly Panteleyevich rose from Junior Researcher to Deputy Director for Research at the Institute of History, Philology and Philosophy of the Siberian Branch of

the USSR Academy of Sciences. At that time, his research was devoted to the study of sites and artifacts of various cultures and eras on the territory of the Amur region. In 1971 (at the age of 28!), A.P. Derevianko defended his Doctoral Dissertation entitled "The Amur Region in Antiquity (Before the Common Era)". Based on the results of comprehensive studies of multiple archaeological sites of the Russian Far East, Anatoly Panteleyevich wrote the monographs "The Early Iron Age of the Amur Region" and "The Amur Region in the 1st Millennium BC", which are still in demand by researchers in the region today.

The rich career path of Anatoly Panteleyevich includes not only his large-scale scientific and organizational, but also social and political activities. In 1976, he was elected secretary of the Komsomol (All-Union Leninist Young Communist League) Central Committee, and after that, in 1979–1980, he worked as Secretary of the Novosibirsk Regional Committee of the Communist Party of the Soviet Union. This field of activity allowed A.P. Derevianko to improve his organizational skills. Responsible work on a national scale took almost all the time and effort, but Anatoly Panteleyevich invariably spent his vacations in archaeological expeditions to the Far East, and all his spare time he devoted to scientific research. It was at this time that one of his most famous popular science books, "In Search of the Golden Antlers Deer", was written, dedicated to the legendary life story of his teacher, Academician A.P. Okladnikov. The book was translated into several European languages and published abroad.

In 1979, Anatoly Panteleyevich's contributions to science of our country were recognized: at the age of 36, he was elected a Corresponding Member of the USSR Academy of Sciences. Shortly after this event, A.P. Derevianko returned to his native Akademgorodok and became the Rector of Novosibirsk State University. Since 1983, A.P. Derevianko again works in the system of the USSR Academy of Sciences. Becoming the successor to A.P. Okladnikov as Director of the Institute of History, Philology, and Philosophy of the Siberian Branch of the USSR Academy of Sciences, in a short time he significantly strengthened the scientific potential of the institute and turned it into one of the largest academic centers for humanitarian research in the country. One of his main activities in these years was the study of the first peopling of the territory of North, Central and East Asia. As before, Anatoly Panteleyevich spent a lot of time in archaeological expeditions through different regions of Siberia, the Far East, and Mongolia. He discovered hundreds of unique archaeological sites, and headed the large-scale stationary excavations of many of them. The outstanding achievements of this period of creative activity were duly appreciated by the scientific community: in 1987 Anatoly Panteleyevich was elected to become a Full Member of the USSR Academy of Sciences.

In the turbulent 1990s, a most difficult period for Russian science, A.P. Derevianko proved himself to be an outstanding administrator, a far-sighted, sensitive, and committed leader. On his initiative, the Joint Institute of History, Philology and Philosophy of the SB RAS was divided into four thematic institutes, with established scientific schools and the necessary staff. Thus, the Institute of Archaeology and Ethnography became an independent institution within the system of the SB RAS. Essentially, A.P. Derevianko created a new institute with a modern infrastructure, which included, in addition to scientific divisions, a restoration and research department provided with the latest instruments and high-performance scientific equipment, a publishing and printing center with a first-class printing base allowing for the production of high-quality full-color publications, a transportation department with a fleet of expedition vehicles ensuring the simultaneous work of more than 40 archaeological teams, as well as a scientific and educational department with joint laboratories based on large universities in Irkutsk, Yakutsk, Tobolsk, Kemerovo, Barnaul, Blagoveshchensk, Khabarovsk, and Voronezh.

It was during these years that the Institute launched the international scientific tourism system and organized several international exhibitions in the Republic of Korea, Japan, Australia, directing the earned funds to scientific activities and support of its employees.

In the 1990s, the staff of the Institute implemented a large-scale project to create Russia's largest archaeological research station "Denisova Cave" in the Altai. It marked the beginning of long-term complex interdisciplinary studies of the most informative stratified Paleolithic sites of Siberia.

The undoubted merit of Anatoly Panteleyevich is the organization, based on the Institute, together with the Institute of Geology and Geophysics and the Institute of Nuclear Physics of the Siberian Branch of the Russian Academy of Sciences, of the Center for Collective Use "Cenozoic Geochronology". It united the efforts of experts in the natural and human sciences in conducting interdisciplinary research in the field of archaeology and paleogeography, paleoclimatology, paleoecology, chronostratigraphy, anthropology, etc. An inter-institutional laboratory of paleogenetics was created jointly with the Institute of Cytology and Genetics of the SB RAS.

An important stage in the activities of A.P. Derevianko became the organization of the Institute's museum complex. The pearl of the Open-Air Museum is the Zashiversk Church of the Transfiguration of Our Savior, recreated thanks to the perseverance and organizational talent of Anatoly Panteleyevich. The Museum of the History and Culture of the Peoples of Siberia and the

Far East exhibits unique artifacts of various eras—from the Paleolithic to the ethnographically modern period, obtained through large-scale expeditionary activities of the Institute's staff. In recent years, the Institute has been widely presented in many domestic and foreign exhibition halls.

A.P. Derevianko invested a lot of effort in the organization and development of the Institute's rescue and conservation activities. Large-scale studies were carried out in the beds of the reservoirs of the Boguchanskaya and Bratskaya hydroelectric power stations, in the areas of development of oil and gas complexes in the northwestern Siberia, and in the zone of construction of modern transport infrastructure in Khakassia.

It is difficult to overestimate the scientist's contribution to the development of research publishing in Siberia. Anatoly Panteleyevich was the initiator of the creation and editor-in-chief of the unique series of books "Folklore Heritage of the Peoples of Siberia and the Far East". In 2002, for the publication of the first ten volumes, the team of authors headed by Anatoly Panteleyevich was awarded the State Prize of the Russian Federation in the field of science and technology. On his initiative, the international academic journal *Archaeology, Ethnography and Anthropology of Eurasia* was founded, which is published in Russian and English. The journal is included in the largest bibliographic domestic and foreign databases and takes leading positions in the ratings of specialized scientific periodicals. Anatoly Panteleyevich has been the Editor-in-Chief of this journal for more than 20 years. A.P. Derevianko initiated the work on the preparation and publication of the four-volume "History of Siberia", which reflects modern concepts of the development of this greatly important region from antiquity to the present. Two volumes of this unique edition already came out.

Anatoly Panteleyevich Derevianko is one of the leaders of world science, an outstanding researcher of the ancient history of Eurasia. Among the priority areas of his scientific research are the fundamental issues of modern archaeology: the first peopling of Eurasia, interaction between ancient humans and the natural environment; reconstruction of historical processes in the territory of North, Central and East Asia from the Paleolithic to the Middle Ages. A.P. Derevianko plays a leading role in the organization of interdisciplinary studies of ancient archaeological sites, in the study of paleolandscapes and paleoclimates, in the development of chronostratigraphy and correlation of ancient cultures of Siberia, the Far East, Mongolia, Kazakhstan, Kyrgyzstan, Uzbekistan, Dagestan. Under his leadership, dozens of scientific discoveries were made, which are among the outstanding achievements of Russian and world archaeology. They fundamentally changed the ideas about the time and ways of the first peopling of Central, North and East Asia.

The main scientific achievements of A.P. Derevianko are the development of the chronology of the most ancient sites of Northern Eurasia, reflecting the first habitation of the continent in the Lower Paleolithic at the stage of early hominins; substantiation of the earliest manifestation of the Upper Paleolithic culture 50 thousand years ago; reconstruction of the models of the Middle to Upper Paleolithic transition in Africa and Eurasia. Anatoly Panteleyevich proposed a new concept for the formation of anatomically modern humans: *Homo sapiens* evolved simultaneously both in Africa and in Eurasia, where *Homo erectus* settled and where the process of their evolution towards physically modern humans took place independently.

Under the leadership of A.P. Derevianko, in Denisova Cave in the Altai, anthropological materials were discovered; paleogenetic study of the finds revealed a distinct hominin, previously unknown to science, called the Denisovan. This discovery was included in the top three world's most significant scientific events in 2011 and 2012, according to *Science*. In 2012, Academician A.P. Derevianko was awarded the State Prize of the Russian Federation for the outstanding results in the study of ancient history of mankind.

A.P. Derevianko made a great contribution to the development of the humanities in Russia. He successfully implemented many years of experience as an administrator of science, working as the Academic Secretary of the Department of Historical and Philological Sciences of the Russian Academy of Sciences in 2002–2013. During these years, he was also a member of the Presidium of the Russian Academy of Sciences. For more than 30 years, A.P. Derevianko has been a member of the Presidium of the Siberian Branch of the Russian Academy of Sciences, being a head of the United Scientific Council of SB RAS for the Humanities. A.P. Derevianko was elected co-chairman of the Russian Historical Society. On his initiative, in 2021, a regional branch of the Russian Historical Society was established in the Novosibirsk Region.

With such a large administrative and organizational workload, A.P. Derevianko always finds the time for scientific work. The findings of his research have been published in dozens of books and hundreds of articles. He is the author of over 1200 scientific publications, including over 100 monographs published in 14 languages. Anatoly Panteleyevich spent 57 field seasons in Eurasia, from the Adriatic and Caspian Sea to the Far East and Southeast Asia and America. One of his main achievements was the creation of a brilliant scientific school based on the multidisciplinary approach to the study of Paleolithic sites. Among his direct students, there are more than 60 doctors and candidates of historical sciences.

A new stage in the creative activity of Anatoly Panteleyevich is the preparation of a multi-volume

fundamental work "Three Global Human Migrations in Eurasia", six volumes of which have already been published and have been met with great interest from the world scientific community. The multiregional model of anatomically modern human origin, proposed by A.P. Derevianko, reflects the great range of the research scope, the originality of the scientist's thinking, and his deep understanding of the topic.

The international recognition of the scholar is evidenced by the election of A.P. Derevianko as a Foreign Member of the Mongolian Academy of Sciences (1998), of the Montenegrin Academy of Sciences and Arts (2008), of the National Academy of Sciences of the Republic of Kazakhstan (2013), as a Corresponding Member of the German Archaeological Institute (1984), a Member of the UNESCO Intellectual Forum (since 1992), Scientific Advisor of the Research Center for Ancient Civilizations of the Chinese Academy of Social Sciences (2001), Honorary Professor and Doctor of Science at a number of prestigious foreign and domestic universities.

The merits of Anatoly Panteleyevich Derevianko to the Fatherland and science are marked by high government awards and prestigious prizes, including foreign. He is a holder of the Orders of the Red Banner of Labor (1982), Honor (1998), "For Merit to the Fatherland" IV degree (2002), "Polar Star" (Mongolia, 2006), Friendship (2012), Alexander Nevsky (2018). A.P. Derevianko is a laureate of the Lenin Komsomol Prize (1972), twice a laureate of the State Prize (2002, 2013), the Demidov Prize (2004), the Academician Lavrentiev Prize (2005), "Triumph" Prize (2005), laureate of the Lomonosov Gold Medal (2014).

Anatoly Panteleyevich's whole conscious life is devoted to serving science. This is evidenced by his annual expeditions to the Altai, where the search for traces of early human habitation is ongoing; by daily desk work, where new ideas, articles and books are born; and finally, by his most beloved creation—the Institute, whose prosperity gave meaning to his whole life!

With all our hearts, we wish him health, inspiration, and great creative ideas for the benefit of domestic science.

V.I. Molodin, M.V. Shunkov,
A.I. Krivoshapkin, A.V. Baulo,
N.V. Polosmak, M.S. Nesterova

AN SSSR – USSR Academy of Sciences

ASGE – Archaeological Collection of the State Hermitage Museum

BAR – British Archaeological Reports

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

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

IA RAN – Institute of Archaeology, Russian Academy of Sciences (Moscow)

IAET SO RAN – Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences (Novosibirsk)

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

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

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

KSIE – Brief Communications of the Institute of Ethnography of the USSR Academy of Sciences (Moscow)

KSIIMK – Brief Communications of the Institute for the History of Material Culture

MAE RAN – Peter the Great Museum of Anthropology and Ethnography (Kunstkamera), Russian Academy of Sciences (St. Petersburg)

MAR – Materials for the Archaeology of Russia

MIA – Materials and Investigations on Archaeology in the USSR

PNAS – Proceedings of the National Academy of Sciences

RFFI – Russian Foundation for Basic Research

SAI – Collection of Archaeological Sources

SPbF ARAN – St. Petersburg Branch of the Archive of the Russian Academy of Sciences

Amzarakov P.B., Head of the ANO "Archaeology of Khakassia", Prigorsk 6B, off. 15, Chernogorsk, 655156, Russia. E-mail: petr_amzarakov@mail.ru; https://orcid.org/0000-0003-4094-9459

Berdnikov I.M., Deputy Director, Scientific Research Center "Baikal Region", Irkutsk State University, K. Marksa 1, Irkutsk, 664003, Russia. E-mail: geoarch.isu@gmail.com; https://orcid.org/0000-0002-1943-7507

Berdnikova N.E., Senior Researcher, Scientific Research Center "Baikal Region", Irkutsk State University, K. Marksa 1, Irkutsk, 664003, Russia. E-mail: nberd@yandex.ru; https://orcid.org/0000-0002-2470-6230

Derevianko A.P., Professor, Scientific Director, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: derev@archaeology.nsc.ru; https://orcid.org/0000-0003-1156-8331

Kharinsky A.V., Professor, Irkutsk National Research Technical University, Lermontova 83, Irkutsk, 664074, Russia; Professor, Irkutsk State University, Karla Marksa 1, Irkutsk, 664003, Russia. E-mail: kharinsky@mail.ru; https://orcid.org/0000-0002-4815-6069

Kim A.M., Doctoral Student, Department of Anthropology, Harvard University, 11 Divinity Avenue, Cambridge, MA 02138, USA. E-mail: akim@genetics.med.harvard.edu; https://orcid.org/0000-0001-5894-8062

Kovalev A.A., Researcher, Institute of Archaeology, Russian Academy of Sciences, Dm. Ulyanova 19, Moscow, 117292, Russia. E-mail: chemurchek@mail.ru; https://orcid.org/0000-0003-2637-3131

Kozlikin M.B., Senior Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: kmb777@yandex.ru; https://orcid.org/0000-0001-5082-3345

Lazaretov I.P., Director, South Siberian Branch of the Institute for the History of Material Culture, Russian Academy of Sciences, Dvortsovaya nab. 18A, St. Petersburg, 191186, Russia. E-mail: lazaretov@yandex.ru; https://orcid.org/0000-0002-9054-6220

Lurye V.M., Junior Researcher, Institute for the History of Material Culture, Russian Academy of Sciences, Dvortsovaya nab. 18A, St. Petersburg, 191186, Russia. E-mail: verqa@list.ru; https://orcid.org/0000-0003-0400-1396

Makarov N.P., Head of the Department of Archaeology and Ethnography, Krasnoyarsk Regional Museum of Local Lore, Dubrovinskogo 84, Krasnoyarsk, 660049, Russia. E-mail: mnp@kkkm.ru; https://orcid.org/0000-0003-3221-5359

Mitko O.A., Associate Professor of the Institute for Humanities, Department Head, Novosibirsk State University, Pirogova 2, Novosibirsk, 630090, Russia. E-mail: omitis@gf.nsu.ru; https://orcid.org/0000-0002-7741-3167

Molodin V.I., Professor, Department Head, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia; Chief Researcher, Novosibirsk State University, Pirogova 1, Novosibirsk, 630090, Russia. E-mail: molodin@archaeology.nsc.ru; https://orcid.org/0000-0002-3151-8457

Orfinskaya O.V., Senior Researcher, Centre for Egyptological Studies, Russian Academy of Sciences, Leninsky pr. 29, bldg. 8, Moscow, 119071, Russia. E-mail: orfio@yandex.ru; https://orcid.org/0000-0001-5473-805X

Poliakov A.V., Director, Institute for the History of Material Culture, Russian Academy of Sciences, Dvortsovaya nab. 18, St. Petersburg, 191186, Russia. E-mail: poliakov@yandex.ru; https://orcid.org/0000-0002-3418-2469

Polosmak N.V., Chief Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: polosmaknatalia@gmail.com; https://orcid.org/0000-0002-3760-265X

Reich D., Professor, Harvard University, Cambridge, MA 02138, USA; Professor, Harvard Medical School, Boston, MA 02115, USA; Senior Associate Member, Broad Institute of MIT and Harvard, Cambridge, MA 02142, USA; Howard Hughes Medical Institute Investigator, Harvard Medical School, Boston, MA 02446, USA. E-mail: reich@genetics.med.harvard.edu; https://orcid.org/0000-0002-7037-5292

Savenkova T.M., Senior Laboratory Assistant, Voino-Yasenetsky Krasnoyarsk State Medical University, Partizana Zheleznyaka 1, Krasnoyarsk, 660022, Russia. E-mail: reis_05@bk.ru; https://orcid.org/0000-0002-0426-6522

Shunkov M.V., Chief Researcher, Department Head, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: shunkov77@gmail.com; https://orcid.org/0000-0003-1388-2308

Sokolova N.B., Junior Researcher, Scientific Research Center "Baikal Region", Irkutsk State University, K. Marksa 1, Irkutsk, 664003, Russia. E-mail: snb-87@mail.ru; https://orcid.org/0000-0003-3638-941X

Sutugin S.V., Laboratory Assistant, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: sutuginsergey@gmail.com; https://orcid.org/0000-0001-8488-9860

Tishkin A.A., Professor, Department Head, Altai State University, pr. Lenina 61, Barnaul, 656049, Russia. E-mail: tishkin210@mail.ru; https://orcid.org/0000-0002-7769-136X

Tunkina I.V., Director, St. Petersburg Branch of the Archive of the Russian Academy of Sciences, Kievskaya 5, bldg. 9, St. Petersburg, 196084, Russia. E-mail: tunkina@yandex.ru; https://orcid.org/0000-0001-5793-3977

Vasiliev S.A., Research Advisor, Department Head, Institute for the History of Material Culture, Russian Academy of Sciences, Dvortsovaya nab. 18A, St. Petersburg, 191186, Russia. E-mail: sergevasiimk@gmail.com; https://orcid.org/0000-0001-5834-6969

Zotkina L.V., Senior Researcher, Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia. E-mail: lidiazotkina@gmail.com; https://orcid.org/0000-0002-1912-3882