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ARCHITECTURAL TRADITIONS OF THE TRANS-URALS FOREST-STEPPE POPULATION IN THE EARLY IRON AGE

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Abstract: By the beginning of the Early Iron Age, under the influence of climatic and socio-political factors, the population of the forest-steppe had several traditions of housing construction. First of all, they were expressed in the variety of types of dwellings and techniques of their construction. During the Transition period from the Bronze Age to the Iron Age, the population of the Itkul culture had small above-ground framed buildings. The Baitovo population that replaced them at the beginning of the Early Iron Age has already recorded two types of buildings — above-ground framed buildings and and dwellings with cribbed walls. In the Gorokhovo-Sargat time, an unprecedented flourishing of house construction is marked. The Gorokhovo population has buildings with the 'zaplot' walls (i.e., built using vertical wooden posts with a lengthwise recess in which timber logs or panels are inserted), and dwellings with cribbed walls, frame-and-pillar structure are widely distributed. The presence of certain standards and traditions in architecture can be traced. The population of the Sargat culture built at least five types of dwellings: insulated and light cone-shaped, those built in the frame-and-pillar technique, dwellings with 'zaplot' walls, and cribbed dwellings. A feature that has clearly manifested itself in Sargat housing construction is the articulation of several chambers, different in structure and functions, into one household complex.

Keywords: Western Siberia; Early Iron Age; dwelling; Itkul Culture; Baitovo Culture; Gorokhovo Culture

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ТРАДИЦИИ ЖИЛИЩНОГО ЗОДЧЕСТВА НАСЕЛЕНИЯ ЛЕСОСТЕПНОЙ ПОЛОСЫ ЗАУРАЛЬЯ В РАННЕМ ЖЕЛЕЗНОМ ВЕКЕ

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Резюме: К началу раннего железного века под влиянием климатических и социально-политических факторов у населения лесостепи складывается несколько традиций жилищного строительства. Прежде всего они выразились в многообразии типов жилищ и техник их строительства. В переходное время от бронзового века к железному у населения иткульской культуры существовали небольшие наземные постройки каркасного типа. У сменившего их в начале раннего железного века баитовского населения фиксируется уже два типа построек — каркасные и жилища со срубными стенами. В горохово-саргатское время отмечается небывалый расцвет домостроительства. У гороховского населения появляются постройки со стенами, сложенными в заплот, и срубные, широко распространены каркасно-столбовые постройки. Прослеживается наличие определенных стандартов и традиций в зодчестве. Население саргатской культуры строило как минимум пять типов жилищ: утепленные и легкие конические жилища, построенные в каркасно-столбовой технике, со стенами в заплот и срубные жилища. Черта, ярко проявившаяся в саргатском домостроительстве, — это сочленение нескольких камер, различных по строению и функциям, в один комплекс домохозяйства.

Ключевые слова: Западная Сибирь, ранний железный век, жилища, иткульская, баитовская, саргатская, гороховская культуры

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Introduction

In the Early Iron Age, extensive ethno-political processes were taking place in the Trans-Urals. In part, that was due to environmental and climatic changes at the end of the 2nd — beginning of the 1st mill. BC [Molodin, 2010], when climate cooling and precipitation caused overflooding of substantial northern territories. The taiga population started actively migrating to the south into the sub-taiga and forest-steppe territories. Later on, due to the change of the arid and humid phases, the steppe population started penetrating into the forest-steppe areas from the south. Those processes stimulated active cultural genesis in the Trans-Urals territory. During the transitional period from the Bronze to Iron Age, the territory was inhabited by the communities of the Itkul, Baitovo, Gorokhovo, and Sargat Cultures. Researchers have been reconstructing the complex social structure of the Early Iron Age communities and the diversity of their economic patterns [Koryakova, 1984; Matveeva, 2000]. This had an impact on housebuilding traditions of the population. This paper proposes

a scheme of the development of the architectural traditions in the Trans-Urals forest-steppe during the Early Iron Age.

Materials

In the beginning of the Early Iron Age, the territory of the forest-steppe and sub-taiga Trans-Urals was occupied by the population of an eastern variant of the Itkul Culture (end of the 8th — 6th c. BC). More than 60 settlements are known, amongst which are the hillforts and unfortified settlements [Zimina, Zah, 2009]. Remains of 14 buildings have been examined at different settlements, including the hillforts of Andreevskoe-7, Vak-Kur-2, Karagay-Aul-1, Karagay-Aul-4, Kyrtym-2, Lesnye Gorki-1, Ust-Tersyuk-8, and the settlement sites of Vak-Kur-2 and Yurtoborsky Most-3 (Fig. 1).

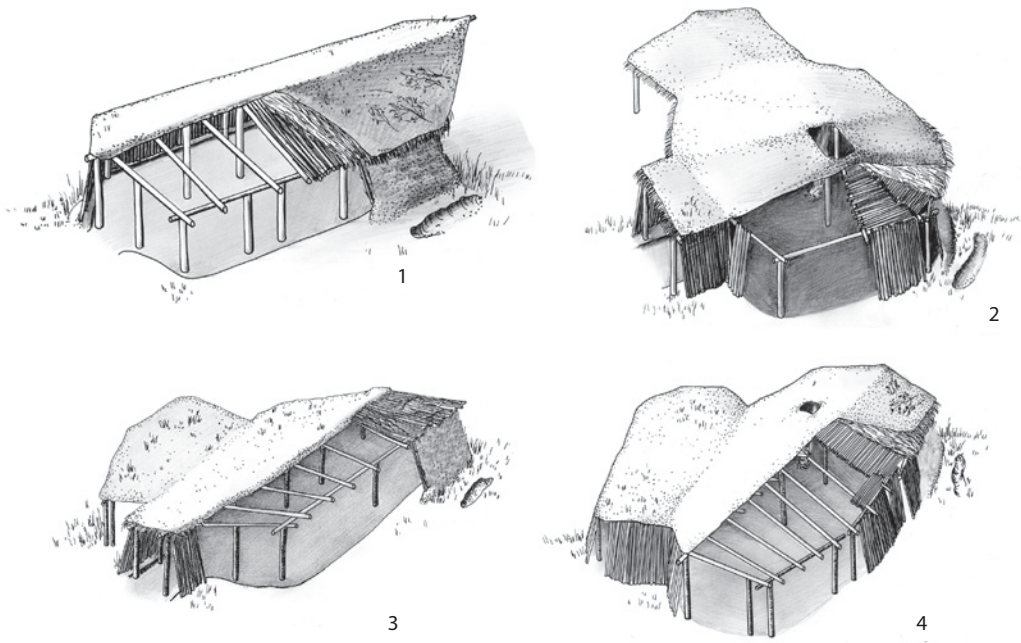

Fig. 1. Dwellings of the Itkul culture. Frame-and-pillar structure: 1 — dwelling. 1 hillfort of Karagay Aul-4; 2 — dwelling. 1 hillfort of Karagay Aul-1B; 3 — dwelling. 2 hillfort of Karagay Aul-1A; 4 — dwelling. 1 settlement sites Vak-Kur-2
Рис. 1. Жилища иткульской культуры. Каркасная техника: 1 — соор. 1 гор. Карагай Аул-4; 2 — соор. 1 гор. Карагай Аул-1Б; 3 — соор. 2 гор. Карагай Аул-1А; 4 — соор. 1 сел. Вак-Кур-2

It has been found that the Itkul population built above-ground structures of 12 to 180 m^2. The principal housebuilding technique was a frame-and-pillar structure. The analysis of mutual spatial arrangement of the post holes allowed establishing the fact of the use of flat-top modules comprising two bearing posts joined by a joist. Such modules defined the perimeter of the dwelling, whereas the span between the modules from above was linked by the joists of the second tier.

The Itkul population built polygonal-circular and rectangular structures. Rectangular elongated buildings featured the end walls with protrusion. The carcass of the walls and roof was banded by roof timbers and poles placed on the roof beam at one end and on the wall at the other.

Burnt fragments of half-beams and poles identified along the walls allowed drawing the conclusion that the span between the carcass elements was filled with tilted poles, split timber, and wood boards. From the above, the structure was insulated with birchbark, grass, and soil. The soil for the wall insulation was taken at the bottom of the wall; during the excavations around the contour of the buildings multiple ditches of different forms were recorded [Zimina, Zah, 2009].

The exit from the buildings located in one of the short (end) walls. It was designed in the form of one longer sidewall and the protruding ridgepole. The bearing post that supported the ridgepole was a carcass element for the entrance group as well [Berlina, Zimina, 2020].

The Itkul housebuilding tradition developed in the territory of the Tobol River in already established form, which suggests that it was brought in by the immigrate population.

Population of the Baitovo Culture inhabited the Tobol-Ishim Interfluve at the end of the 7th through 2nd cc. BC. The sites incorporating buildings of the Baitovo Culture have been studied in the areas of rivers Ishim (hillfort of Lihachevskoe, settlement of Karluga-1, the lake Chencher 6), Tobol (hillforts of Bolshoy Imbiryay-3, Borovushka-2, Bochanetskoe, Yurtobor-20, Uval-4, 5, settlements of Dachnoe-1 and Chepkul-8b), and Iset (hillfort of Baitovo, settlements of Botnikovskoe 1a and Nosilovskoe). The excavations were carried out in 41 dwellings, including 24 at the hillforts and 17 at the settlements.

More than a half of the known dwellings are above-ground (21). The major structural feature is their circular-subrectangular shape. On the ground surface, the dwellings appear as rather small 30–40 cm high mounds with small pits at the edge and in the centre [Tsembalyuk, 2009; Zah, Tsembalyuk, 2009].

The Baitovo Culture settlements are located predominantly on the sandy grounds, and the dwellings are not deepened in the ground. Scanty traces of the structure, i.e., holes from the bearing posts and shallow ditches, is a characteristic feature of the building remains. Perhaps most of them did not survive due to the percolative soil water regime.

The Baitovo housebuilding features above-ground framed buildings, dug-in framed buildings, and dwellings with cribbed walls.

The above-ground buildings had the carcass of vertical bearing posts linked together with joists at the top. The space between the carcass elements of the walls was filled with poles, similarly to the Itkul dwellings. At the hillfort of Lihachevskoe, V.F. Gening several times noted the presence of burnt remains of pole-beams of 6-8-12 cm in diameter at the edge of the buildings, which were positioned either parallel to the walls, or slightly tilted (those probably fell down during the fire event), or perpendicular to the wall; fixation of the birchbark atop the burnt poles of the collapsed part of the roof were recorded [Tsembalyuk, Berlina, 2014] (Fig. 2). Compared to the dwellings of the Itkul Culture, poles and carcass bearing posts were set in a ditch running around the perimeter of the dwelling.

The roof of the carcass dwellings rested on the bearing pillars. The post holes recorded in the dwellings, arranged in a line or rectangle, suggest that the roof had two or four sloping

surfaces. In general, this type of dwellings continues the Itkul tradition. The difference is that the Baitovo dwellings have larger area and are often polygonal in shape; a trend for imbedding the dwellings in the ground gradually emerges.

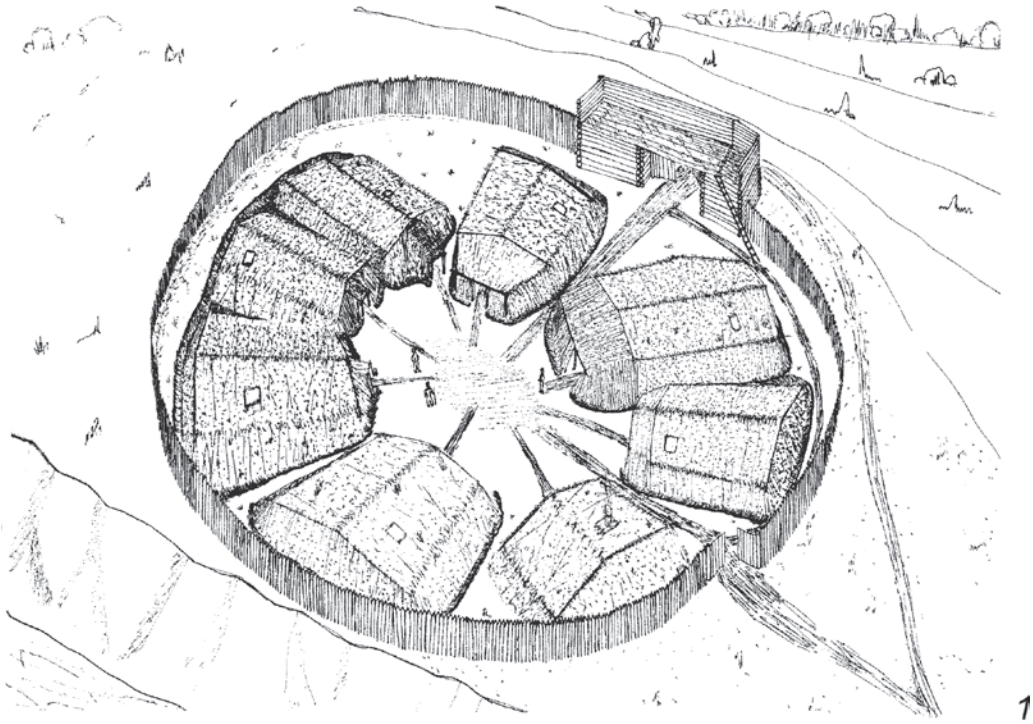

Fig. 2. Dwellings of the Baitovo culture. Reconstruction of the appearance of dwellings of the hillfort of Lihachevskoe
Рис. 2. Жилища баитовской культуры. Реконструкция внешнего вида жилищ городища Лихачевское

The dug-in dwellings have been recorded in the settlement of Kaluga-1, lake Chencher-6, hillfort of Lihachevskoe (dwelling 1) in the Ishim River area; Botnikovskoe-1a in the Iset River area; and in the hillforts of Uval-V, Baitovo, Bochanetskoe, Bolshoy Imbiryay-3, settlement of Chepkul-8b (dwelling 7) in the Tobol River area. They had different structure of the walls. In the settlements of Botnikovskoe-1a, lake Chencher-6, and the hillfort of Bolshoy Imbiryay-3, the frame-and-pillar buildings dug into the solid ground have been recorded, similar in construction to the above-ground buildings. For the dwelling in the settlement of Karluga-1, due to the absence of bearing post holes, the researcher suggests a cribbed structure of the dwelling, whose roof was insulated with clay [Habdulina, 1994: 30].

Therefore, three types of dwellings have been recorded for the Baitovo Culture housebuilding. The principal type is above-ground carcass buildings.

The Gorokhovo Culture spanned the period of the 7th–2nd cc. BC. There are data on 38 buildings investigated in 10 settlements. Housebuilding traditions of the Gogokhovo

population have been characterised mainly from the materials of the hillforts of Chudaki and Pavlinovo [Sal'nikov, 1947, 1951; Koryakova et al., 2009]. The Gorokhovo housebuilding features a wide variety of the forms and types of dwellings. Most dwellings (28) are single-chamber, whereas the rest (10) are double-chamber. The second compartment, typically a workroom, is smaller and connected with the main room by a passageway. The compartments are aligned on one axis. The dual-chamber dwellings were possibly more abundant, but because the work chamber had a light carcass of bearing posts and was less imbedded in the ground, it might have not been recorded due to specifics of archaeologisation.

The foundation ditches of the dwellings are rectangular or trapezoid. The irregular shape has been recorded for the dwellings in the unfortified settlements of Rechkino-1, Khripunovskoe-1, and for some of the building of the early period of the Pavlinovo hillfort. By the depth of the ground imbedding, low sunk buildings stand out — 11 units (no more than 20 cm, not penetrating the solid ground). The mjority of the buildings are dug 20–30 cm into the solid ground, and only four have considerable depth in the solid ground — 60–90 cm (dwelling 8 of the Chudaki hillfort, dwellings 1, 10a, and 11 of the Pavlinovo hillfort).

Traces of the structures in the area of the dwellings are marked by the holes from the vertical bearing posts; some buildings feature shallow ditches connecting them, as the strips of a carbon-bearing loam. Such traces allowed suggesting a hypothesis on the existence of two types of the buildings — those of the frame-and-pillar structure and the others with the 'zaplot' walls (i.e., built using vertical wooden posts with a lengthwise recess in which timber logs or panels are inserted). The dwellings built in the frame-and-pillar technique are dominant — 35 out of 48 studied chambers of the dwellings were built up in this technique, and only 5 in the 'zaplot' wall technique.

There are five buildings known with the walls in the 'zaplot' technique from the hillfort of Chudaki (double-chamber dwelling 4, dwelling 6/chamber 1, dwelling 10/chamber 1, tentatively, dwelling 11/chamber 1). In terms of the traces of the structure of the dwellings, holes from the vertical bearing posts have been recorded, connected by depression ditches remaining from the horizontal logs whose ends were fitted into slots in the bearing posts. When the living chamber with the 'zaplot' walls was built up at the hillfort of Chudaki, the work room of the dual-chamber dwellings was always constructed in the frame-and-pillar technique (with the exception of dwelling 4). The work chamber was either not imbedded in the ground or sunk less than the main chamber, and it was connected to the living chamber by a passageway aligned with the axis of the dwelling. The passageway was deeply penetrating the work chamber. Small ditches noted at the end of the passageway are related to the structure of the doors (folding doors) [Sal'nikov, 1947; Koryakova et al., 2009]. In the latter period of inhabitation of the hillfort of Pavlinovo, there were larger area buildings with the 'zaplot' walls, which combined features of both Sargat and Gorokhovo housebuilding traditions (Fig. 3).

The cribbing technique of housebuilding was also used by the Gorokhovo population. At the hillfort of Vorobievskoe there were recorded carbon-filled stripes along the walls of the foundation ditch of the digs nos. 4 and 7 in the almost complete absence of the post holes. Similar nature of the building walls has been reconstructed for the dwelling of the dig no. 8. The walls of the dwelling, built up in the cribbing technique, were supported and strengthened by bearing posts from the inside and outside (as well as along the ridge beam).

The dwelling had a substantial size of 8.0×9.0 m, and it was divided by separation walls into three compartments, from one of which a separate exit was arranged. Presumably, dwellings of the settlement site of Kataiskoe were built up in the cribbing technique [Berlina, 2019] (Fig. 4).

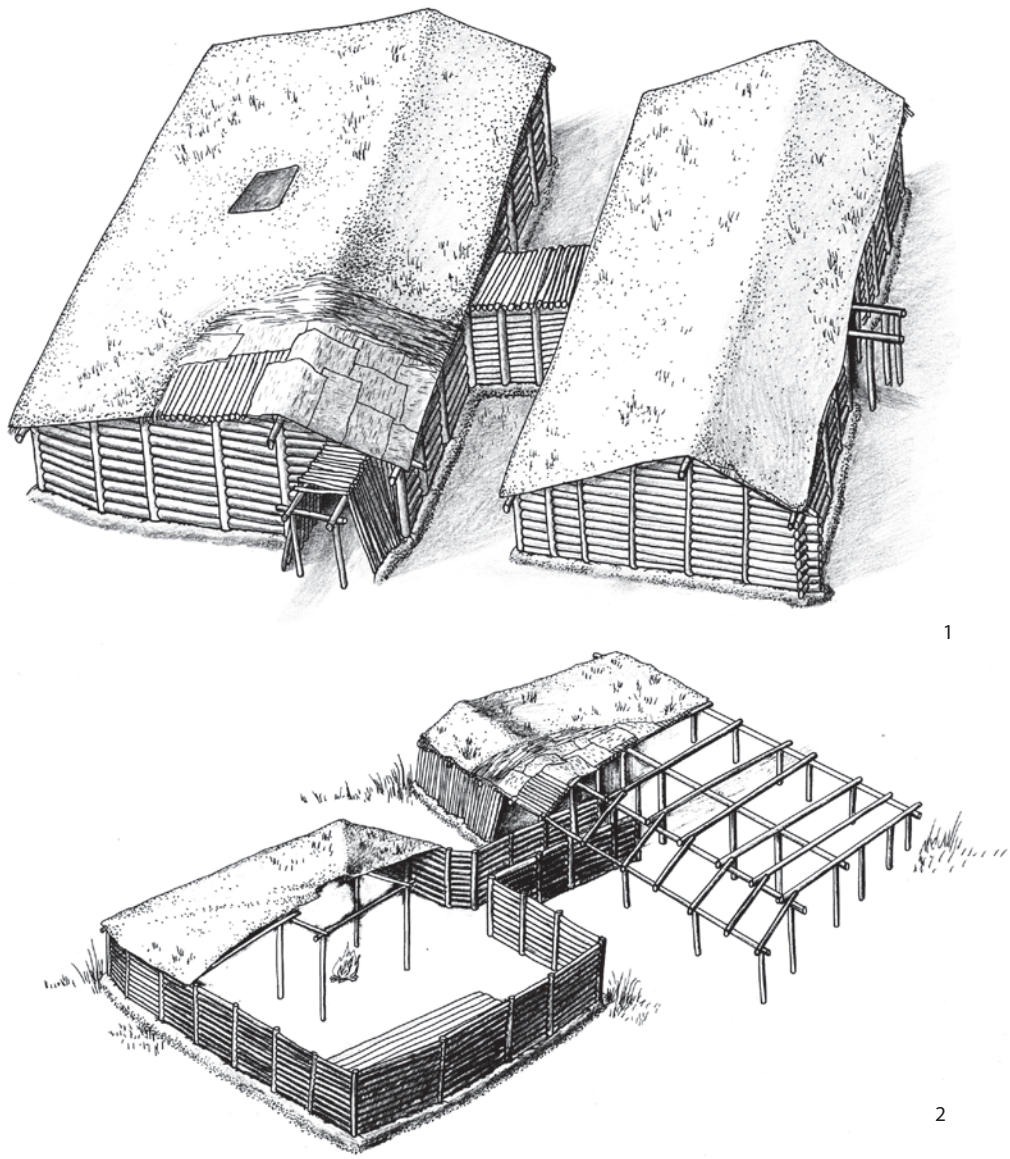

Fig. 3. Dwellings of the Gorokhovo culture. 'Zaplot' technique
(1 – dwelling 4; 2 – dwelling. 6 hillfort of Chudaki)
Рис. 3. Жилища гороховской культуры. Техника заплот
(1 – жил. 4; 2 – жил. 6 гор. Чудаки)

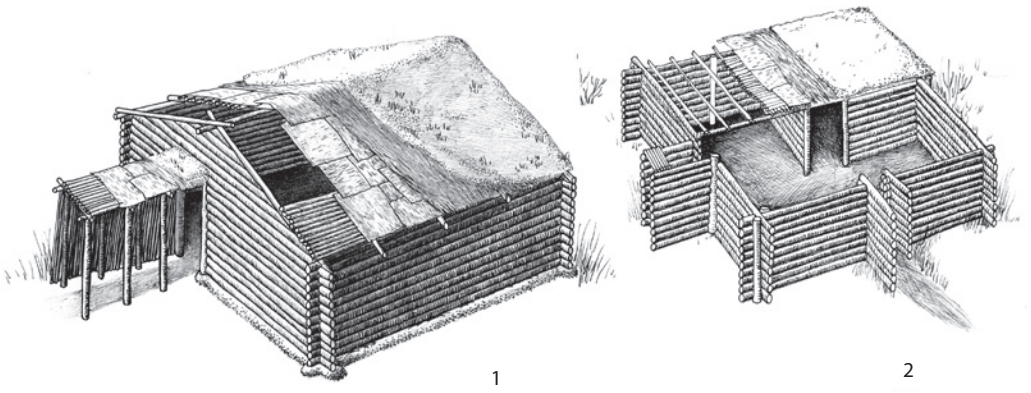

Fig. 4. Dwellings of the Gorokhovo culture. Cribbing technique of housebuilding (1 — settlement of Kataiskoe, 2 — hillfort of Vorobievskoe)
Рис. 4. Жилища гороховской культуры. Срубная техника (1 — Катайское сел., 2 — Воробъевское гор.)

The roofs of the dwellings had four and two sloping surfaces, and, in the latter variant, its ridge was often displaced either towards the entrance or towards the wall opposite to the entrance; the ridge beam aligned with the wall of the entrance has also been recorded. At the hillfort of Chudaki, a case of interconnecting several buildings into one complex by means of arranging additional passages at a corner of the living chamber was observed; the same convention has been observed at the Botnikovskoe 1a settlement. Amongst the elements of the dwelling layout, noteworthy is alignment of one of the walls of some work chambers with the main chamber, thus creating a rectangular compartment closed on three sides.

The presence of large area buildings with the 'zaplot' walls, which is quite a labour-intensive process, compared with the other techniques, as well as the one requiring more resources (i.e., more of quality timber of the same diameter and length), confirms that they belonged to the social elite of the population. Their large numbers, also at the sites of the Sargat Culture, are recorded in the late archaeological horizons of the dwellings and indicates, apparently, the flourishing of the material culture of the population and, concurrently, social stratification (hillforts of Chudaki, Pavlinovo, Kolovskoe, and Dikaya Yama).

Therefore, we identify the presence of the standards and sustained architectural traditions in the Gorokhovo housebuilding. The dwellings were built up in square and subrectangular (trapezoid) shapes. The frame-and-pillar technique was dominant in the housebuilding (Fig. 5).

Traditions of building up 'zaplot' and cribbed walls have been recorded. The dwellings were less imbedded in the solid ground, as compared with, e.g., Sargat houses. Only the topsoil was cut off for building many houses and sometimes the dwellings were not imbedded into the solid ground. A characteristic feature is the mutual arrangement of the chambers along one axis connected by a long passageway.

In general, one should note the presence amongst the Gorokhovo buildings of groups not only by the principle of the wall structure ('zaplot', frame-and-pillar, and cribbed), but also

by the workmanship. Tentatively, three groups can be distinguished: (i) large rectangular elite buildings, often with 'zaplot' walls; (ii) medium size rectangular buildings, with extensions and work chamber; and (iii) buildings of irregular shape, light and carcass-based. It should be reiterated that as of today the main complex of the studied dwellings is derived from fortified settlements. The dwellings from unfortified settlements have different characteristics — they are smaller in area and have foundation ditches of irregular forms.

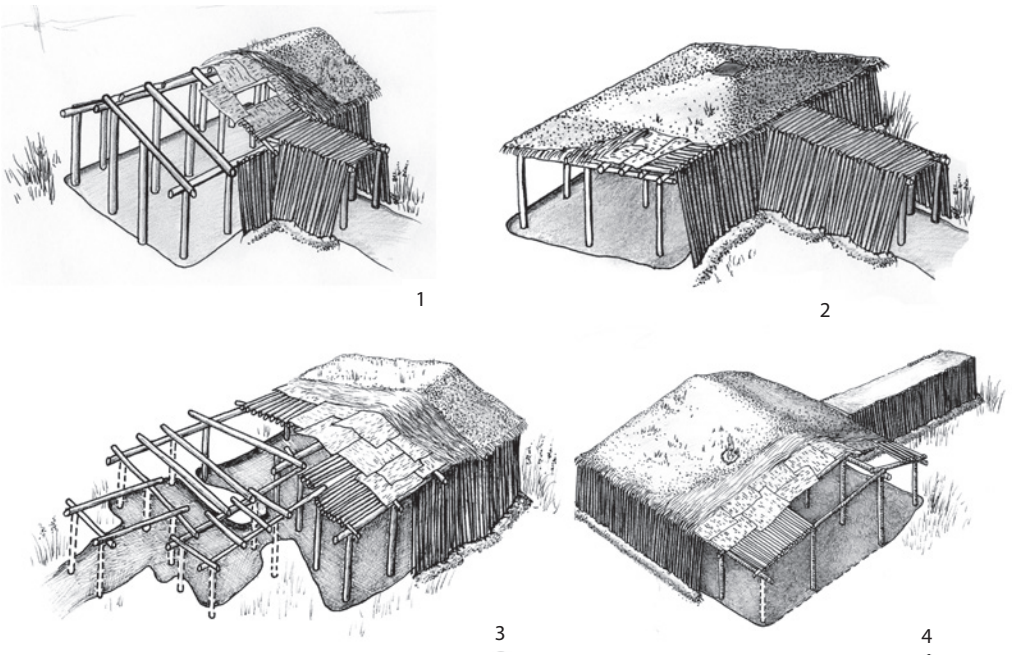

Fig. 5. Dwellings of the Gorokhovo culture. Frame-and-pillar structure
(1 — dwelling. 1 hillfort of Chudaki; 2 — dwelling. 3 hillfort of Chudaki; 3 — dwelling. 1 settlement of Botnikovskoe-1a; 4 — dwelling. 8 hillfort of Chudaki)
Рис. 5. Жилища гороховской культуры. Каркасная техника
(1 — жил. 1 гор. Чудаки; 2 — жил. 3 гор. Чудаки; 3 — жил. 1 Ботниковского-1а пос.; 4 — жил. 8 гор. Чудаки)

The derived types of buildings suggest social stratification — the presence of elite and ordinary buildings, as well as the presence of stationary dwellings and those temporary or seasonal.

The Sargat Culture was present in the Tobol-Ishim forest-steppe in 5th c. BC — 3rd c. AD. Due to the extensive research on the settlements of the Sargat Culture, more than 140 buildings have been studied. Sargat Culture dwellings differ on a number of features: the positioning with respect to the ground surface; the number, size and shape of the chambers; traces of the roof and wall structure; specifics of positioning of the hearth and its decoration, etc. Classification of the dwellings based on these and other characteristics allowed the researchers to distinguish

and describe the housebuilding traits of the Sargat tribes and to reconstruct selected buildings [Habdulina, 1993: 112–143; Koryakova, 1984: 77–78; Matveeva, 1993: 124–125; 2000: 38–41].

The Sargat buildings (138 units) are divided into single- and multi-chamber in the proportion of 87 to 51 units, respectively (~63% and 37%). There are buildings with a rectangular foundation ditch — 62 units (71.2%), a square one — 5 units (5.7%), and with a trapezoid ditch — 7 units (8.0%). There have been noted the buildings of sub-circular — 7 units (8%) and irregular forms — 5 units (5.7%).

Amongst the single-chamber buildings, the half-dugouts — 66 units (75.9%), above-ground dwellings — 12 units (13.8%), and dugouts — 4 units (4.6%) are dominant.

Analysis of the sources — layouts of the dwellings, traces of their construction or the lack of those, different combination of a set of characteristics either for the materials of one site, or within the structure of one dwelling, allowed drawing a hypothesis on the presence in the tradition of the Sargat housebuilding of several types of buildings different by their structure. They varied in decoration of the walls and roof, as well as the manner of insulation of the latter, and upon connection of several premises they comprised one multi-chamber dwelling [Berlina, 2009].

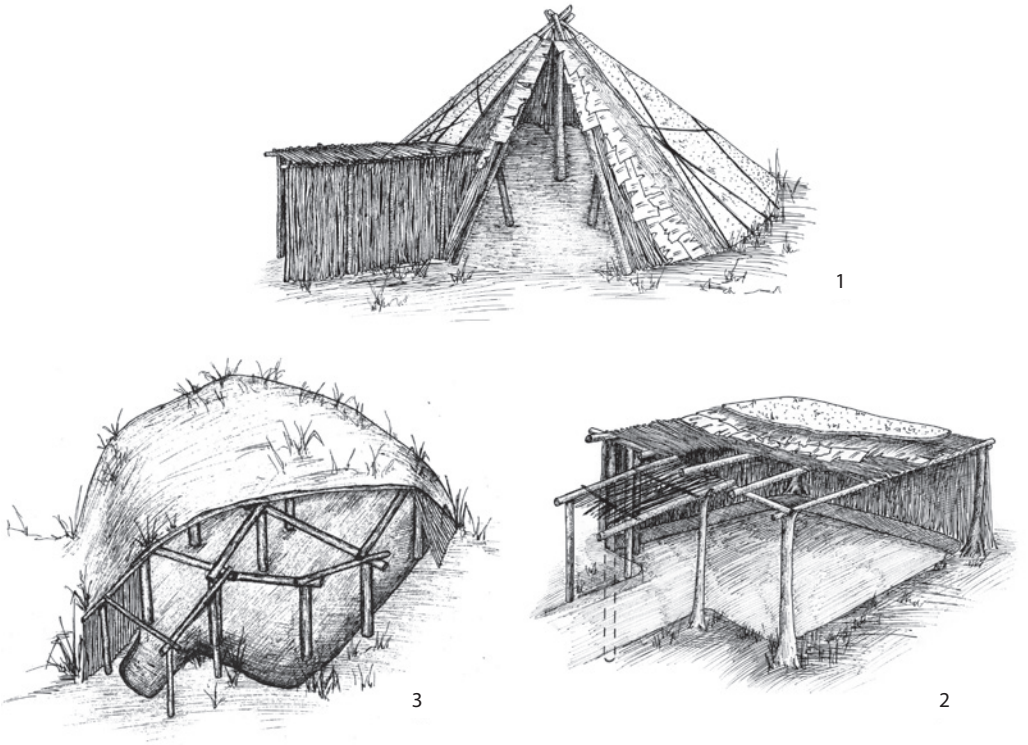

Fig. 6. Dwellings of the Sargat culture: 1 — light cone-shaped dwellings; 2 — Frame-and-pillar structure (1 — settlement of Loghka; dwelling. 5 settlement of Uk-III; 3 — settlement of SBAO)
Рис. 6. Жилища саргатской культуры: 1 — конические жилища; 2 — каркасная техника (1 — пос. Ложка; 2 — жил. 5 пос. Ук-III; 3 — пос. СБАО)

Above-ground cone-shaped dwellings — of the type of a light tepee, and of a ground-insulated tepee have been identified, although these are very rare, recorded for the early stage of the Sargat Culture, when such dwellings were present in the Baitovo Culture [Berlina, 2009] (Fig. 6.-*1*).

The most common were carcass dwellings of rather small area, insulated by poles with topsoil and grass above. The premises might have been connected by 2–3 units in a single system of a multi-chamber dwelling (Fig. 6.-*2, 3*). They have been recorded at the hillforts and small unfortified settlements. Apparently, their construction was economically advantageous and less laborious. Such dwellings were common later amongst the Siberian ethnic groups — Nganasans, Evenks, Selkups, Khanty, Kets etc. [Essays culture genesis…, 1994].

There are dwellings built in the 'zaplot'-wall technique, with roofs of two or four slopping surfaces. Among these are dwellings of the hillfort and the settlement site of Rafailovskoe, settlement of Rafailovsky Ostrov, hillfort and settlement site 3 and 4 of Kolovsky, settlement of Duvanskoe-2, settlement of Ingalinka, dwellings of the hillfort of Pavlinovo and others. That the walls were built in the 'zaplot' technique is evidenced by the presence of holes and grooves connecting them. The Sargat dwellings feature interconnection of several premises by passageways into one double, triple, and, occasionally, even five-chamber dwelling. This suggests division of a large patriarchal family into smaller families which lived in separate chambers [Matveeva, 2000]. Buildings of different types would be joined together in one complex, forming the whole homesteads. The presence of buildings in the 'zaplot'-wall technique makes the housebuilding traditions of the Sargat and Gorokhovo Cultures closer to each other (Fig. 7.-*1, 2, 4*).

The frame-and-pillar dwellings are manifested by sub-rectangular foundation ditches of different depth, with the holes located around the edge of the ditch and without grooves. Such dwellings have been recorded at the settlement of Inberen-4, the hillfort and the settlement site of Rafailovskoe, settlements of Uzlovskoe and Rechkino, SBAO, the hillfort of Kolovskoe, settlement site of Duvanskoe-VI, settlements of UAO-6, Uk-3, Ingalinka-1, Pavlinovo, at the settlement sites of Kolovskoe-1 and 2, as well as in the majority of the buildings of the Duvanskoe-2 settlement site and the Ak-Tau hillfort, settlements of Nizhneingalskoe-3 and Bochantsevo.

The structure of the buildings is reconstructed as a frame-and-pillar type, whereby four or more vertical bearing posts support a frame, or the roof carcass, with thinner logs split in halves, and whole timber beams leaning upon them at a small tilt. From the above, the structure was insulated with grass and topsoil. In contrast to the dwellings of the Baitovo and Itkul Cultures, where polygonal-circular buildings were widespread, the Sargat housebuilding features mostly rectangular shapes.

The carcass buildings are widely present in the Sargat housebuilding and constitute one of the dominant types in the Early Iron Age. The main advantages of such dwellings are their constructional simplicity, economic feasibility in terms of materials, and a high building rate. Apparently, these characteristics determined its wide spread amongst the Siberian populations in the ancient and medieval times.

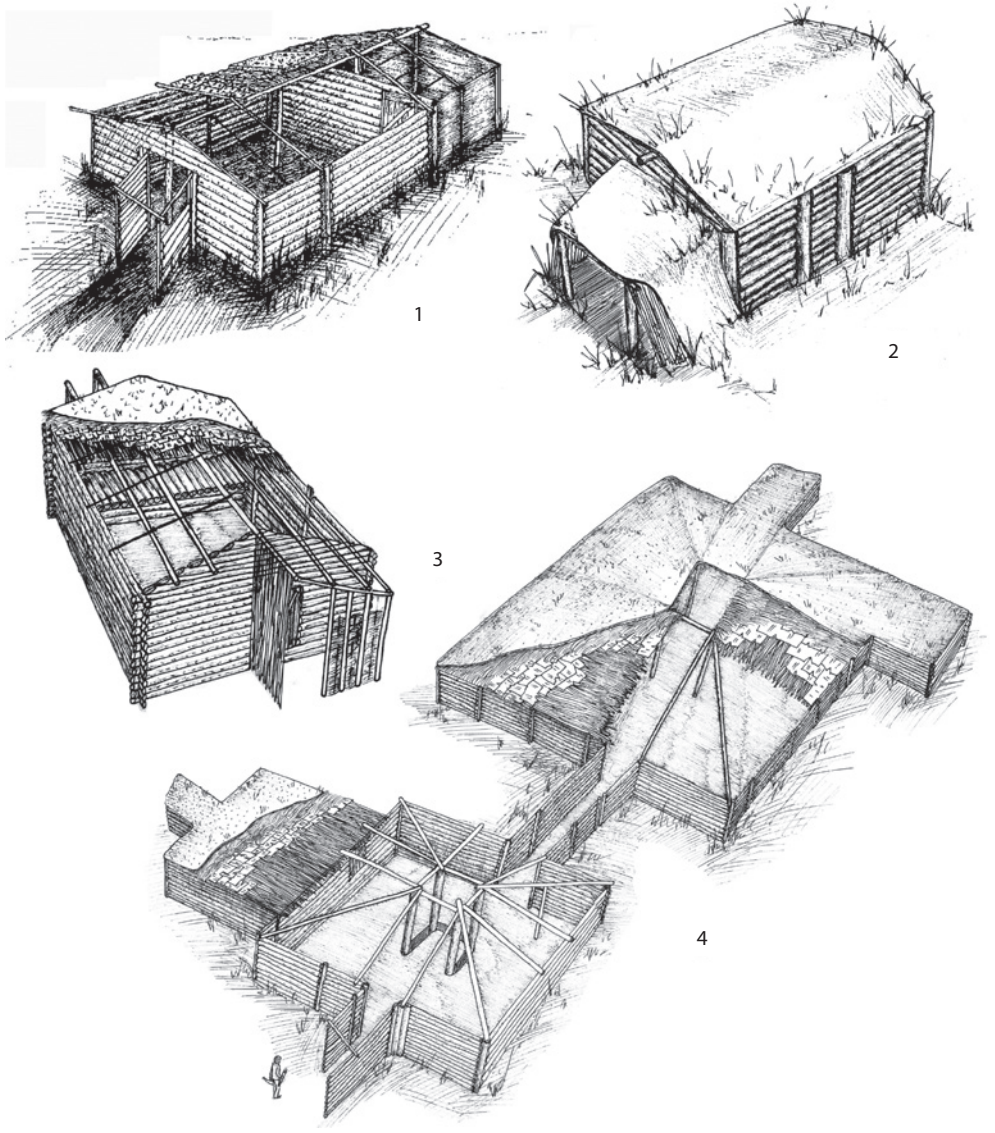

Fig. 7. Dwellings of the Sargat culture: 1, 2, 4 – 'zaplot' technique; 3 – Cribbing technique of housebuilding (1 – dwelling. 14 hillfort of Kolovskoe; 2 – dwell. 6 hillfort of Rafailovskoe; 3 – dwell. 2 settlement of Uzlovskoe; 4 – dwelling. 7 hillfort of Kolovskoe)
Рис. 7. Жилища саргатской культуры: 1, 2, 4 – техника заплот; 3 – срубная техника (1 – жил. 14 Коловского городища; 2 – жил. 6 Рафайловского гор.; 3 – жил. 2 пос. Узловское; 4 – жил. 7 Коловского гор.)

Cribbed dwellings constitute the smallest group of the Sargat dwellings (Fig. 7.-*3*). Building of cribbed dwellings was very labour-intensive. At the Sargat sites, they are represented by chamber 1 of dwelling 2 of the Rafailovskoe hillfort, dwelling 2 of the Uzlovskoe settlement, dwelling 1 of the Beloyarskoe settlement, dwelling 2 of the Chupino settlement, dwelling 22

of the Rozanovo hillfort, and dwelling 2 of the Kolovskoe hillfort. The dwellings that left such traces have two variants of the construction. The first variant are those with the walls built in the cribbing technique up to the necessary height, supporting the roof with one, two or four sloping surfaces. The second variant is the buildings in the cribbing techniques built up to the height of two or three timber sets which supported the carcass roof in the form of a truncated pyramid.

Another group is represented by buildings with foundation ditches and without traces of wooden structures. Among these are dwellings 3 and 4 of the Rafailovskoe hillfort, dwelling 9 of the Rafailovskoe settlement, dwelling 7 of the Inberen-6 hillfort, dwellings 1 and 10 of the Ak-Tau hillfort, chamber 1 of dwelling 1 of the Kolovskoe hillfort, dwelling 3 of the Karaguzhevskoe settlement, dwellings of the Bogdanovskoe and Kokonovskoe hillforts. Their reconstruction is quite difficult. Presumably, their above-ground part stood upon the foundation ditch, at the level of the daylight surface, and might have been of a cribbed or carcass type.

Therefore, the Sargat housebuilding features several types of structures. The identified types of the dwellings differ significantly from each other: a large earthen tepee, smaller light tepees, dwellings with the 'zaplot' walls, cribbed dwellings, and carcass dwellings — booths. In the meantime, it should be noted that sometimes buildings of different types were blended within the ensemble of one homestead. Two different timberwork techniques might have been occasionally combined within the structure of one premises, e.g., a 'zaplot' wall from one side and a wall cut 'v lapu' (i.e., the ends of the logs are cut off square with the wall) from the other. Dwellings built using different techniques are often found within the area of one settlement, and even within one building horizon, and they were used in the same period, e.g., dwellings of the Kolovskoe and Rafailovskoe archaeological complexes, settlement of Uzlovskoe, the hillfort and the settlement of Pavlinovo. The development of the living space was carried out by building additional chambers integrated within a section of the wall and connected by a passageway. The passageways were built in a corner of the main chamber, or in the centre of the premises, along a straight line or at a straight angle.

The variety of the Sargat building traditions can be explained, firstly, by the complex character of the economy, which necessitated utility premises for economic activities, secondly, by the presence of settlements different by the duration of their use and their functions, and, thirdly, by the nature of the raw material supplies. Besides, the proportion of buildings of different types in the complex of settlements might have been influenced by the economic welfare of the population — the established social inequality and stratification within the Sargat community [Matveeva, 2000, p. 258] might have had different proportions depending on the climatic changes, wars, plagues, etc.

Therefore, in the Sargat Culture, just as in any other actively developing culture, the changes taking place were manifested in the structure and shape of the dwellings. The housebuilding traditions of the Sargat Culture exhibit specific features determined, partly, by the nature and conditions of the emergence and development of the culture, and, partly, inherited from the preceding cultures: multi-chamber layout of the dwellings, different connection of the chambers into the common system making a homestead, presence of long passageways, blending different building techniques during the house building, and the wide use of the topsoil for house insulation.

Results and discussion

Considering the development of the housebuilding traditions during the transition from the Bronze to Iron Age in the forest-steppe Trans-Urals, one can note the following trends. Although during the transitional period, represented by the Itkul Culture, the buildings were mainly of the carcass type, small in area, and above ground, already during the existence of the Early Iron Age Baitovo Culture there were at least two types of the buildings: carcass type, notably, with dug-in buildings appearing alongside the above-ground structures, and the dwellings with cribbed walls. With the emergence of the Gorokhovo Culture, buildings with 'zaplot' walls and cribbed buildings appeared in the Trans-Urals forest-steppe. Alongside with them, the frame-and-pillar buildings were also widespread, although all of them are distinguished by the chastity of style and presence of certain architectural standards and traditions. This is entirely relevant in respect to the buildings at the hillforts — the small number of the dwellings in the settlement sites indicate that, although the building technique (frame-and-pillar principle) was carried on, the building contours have lost their preciseness, so that their deepened section often has irregular, amorphous character, which may indicate that some of these dwellings were temporary, or they were workshops.

During the period of the Gorokhovo and Baitovo Cultures, alongside with building of the above-ground dwellings, the tradition of half-dugouts, imbedded 20–50 cm in the ground, emerges and develops.

The Sargat Culture population used to build at least five types of dwellings: insulated and light cone-shaped, those built in the frame-and-pillar technique, dwellings with 'zaplot' walls, and cribbed dwellings. Noteworthy is the connection of several chambers, which had different structure and functions, into one homestead complex — a feature clearly manifested in the Sargat housebuilding.

In the beginning of the Early Iron Age, the transition from carcass above-ground dwellings to imbedded ones, and emergence of new building techniques — 'zaplot' and cribbing, was recorded. As a new phenomenon, the tradition of multi-chamber buildings creating an architectural ensemble should be noted. This tradition re-appeared in the Trans-Urals only with the advent of the Russian settlers. It is also probable that some types of the structures cannot be recorded, such as dens, corrals, sheds, and cone-shaped buildings, although they might have existed.

The processes of social stratification took place during the entire period of the Early Iron Age and reached their peak towards the end of the period. This manifested in the existence of "royal" mounds containing rich implements and articles made of gold, ordinary mounds, and ground burials. These processes were fully evidenced in the designs and types of the Sargat dwellings. Whereas only one type of the dwellings has been recorded for the Itkul Culture population, two for the Baitovo Culture, and three for the Gorokhovo Culture, the Sargat Culture population had five types of dwellings.

Therefore, the Early Iron Age population developed new housebuilding techniques in response to the climatic changes and changes in their social structure, as the result of the economic transformations, which heralded new architectural epoch in the wooden housebuilding of the forest-steppe Trans-Urals.

REFERENCES

Berlina S. V. K voprosu o tipah zhilishch naseleniya rannego zheleznogo veka zapadnosibirskoj lesostepi (po materialam sargatskoj kul'tury) [On the Question of the Types of Dwellings of the Population of the Early Iron Age of the West Siberian Forest-Steppe (based on the materials of the Sargat culture)]. Rossijskaya arheologiya [Russian Archaeology]. 2009. № 2. Pp. 44–56. *(In Russ.)*.

Berlina S. V. Zhilishyha gorohovskoj kul'tury Zaural'ya [Dwellings of Gorokhov Culture of Trans-Urals]. Vestnik arheologii, antropologii i etnografii [Bulletin of Archaeology, Anthropology and Ethnography]. 2019. № 3 (46). Pp. 62–74. *(In Russ.)*. DOI: 10.20874/2071-0437-2019-46-3-062-074

Berlina S. V., Zimina O. Y. Domostroitel'stvo naseleniya itkul'skoj kul'tury v podtaezhnom-lesostepnom Zaural'e [Housing Construction of the Population of the Itkul Culture in the Subtaiga-forest-steppe Trans-Urals]. Vestnik arheologii, antropologii i etnografii [Bulletin of Archaeology, Anthropology and Ethnography]. 2020. № 3 (50). Pp. 61–73. *(In Russ.)*. DOI.10.20874/2071-0437-2020-50-3-5

Habdulina M. K. Gorodishhe Ak-Tau kak arhitekturnyj kompleks [Ak-Tau Settlement as an Architectural Complex]. Znaniya i navyki ural'skogo naseleniya v drevnosti i srednevekov'e [Knowledge and Skills of the Ural Population in Antiquity and the Middle Ages]. Ekaterinburg: Nauka, 1993. Pp. 112–143. *(In Russ.)*

Habdulina M. K. Stepnoe Priishim'e v epohu rannego zheleza [Steppe Priishimye in the Early Iron Age]. Alma-Ata: Rakurs, 1994. 170 p. *(In Russ.)*

Koryakova L. N. Poseleniya sargatskoj kul'tury [Settlements of the Sargat Culture]. Vestnik arheologii Urala [Bulletin of the Archaeology of the Urals]. 1984. № 17. Pp. 61–79. *(In Russ.)*

Koryakova L. N., Dyer M. I., Kovrigin A. A., Sharapova S. V., Berseneva N. A., Panteleeva S. E., Razhev D. I., Kurto P., Hanks B., Efimova E. G., Kazdym A. A., Mikryukova O. V. Sreda, kul'tura i obshchestvo lesostepnogo Zaural'ya vo vtoroj polovine I tys. do n.e. (po materialam Pavlinovskogo arheologicheskogo kompleksa) [Environment, Culture and Society of the Forest-steppe Trans-Urals in the Second Half of the 1st Millennium BC (based on the materials of the Pavlinovsky archaeological complex)]. Ekaterinburg ; Surgut : Magellan, 2009. 298 p. *(In Russ.)*

Matveeva N. P. Sargatskaya kul'tura na Crednem Tobole. [Sargat Culture on the Middle Tobol]. Novosibirsk : Nauka, 1993. 175 p. *(In Russ.)*

Matveeva N. P. Social'no-ekonomicheskie struktury naseleniya Zapadnoj Sibiri v rannem zheleznom veke (lesostepnaja i podtaezhnaja zony) [Socio-economic Structures of the Population of Western Siberia in the Early Iron Age (forest-steppe and subtaiga zones)]. Novosibirsk : Nauka, 2000. 299 p. *(In Russ.)*

Molodin V. I. Ekologicheskij "stress" na rubezhe II–I tys. do n.e. i ego vliyanie na etnokul'turnye i social'no-ekonomicheskie processy u narodov Zapadnoi Sibiri [Ecological «Stress» at the Turn of the 2nd–1st Millennium BC and Its Impact on Ethnocultural and Socio-Economic Processes among the Peoples of Western Siberia]. Kul'tura kak sistema v istoricheskom kontekste: opyt zapadno-sibirskih arheologo-etnograficheskih soveshchanij [Culture as a System in a Historical Context: the Experience of West Siberian Archaeological and Ethnographic Meetings]. Tomsk : Agraf-Press, 2010. Pp. 22–24. *(In Russ.)*

Ocherki kul'turogeneza narodov Zapadnoj Sibiri [Essays on the Cultural Genesis of the Peoples of Western Siberia]. Volume 1. Book 2. Tomsk : Izd-vo Tomskogo gosudarstvennogo universiteta, 1994. 286 p. *(In Russ.)*

Sal'nikov K. V. Arheologicheskie issledovaniya v Kurganskoj i Chelyabinskoj oblastyah [Archaeological Research in the Kurgan and Chelyabinsk Regions]. Kratkie soobshcheniya o dokladah i polevyh issledovaniyah Instituta istorii material'noj kul'tury [Brief Reports on the Reports and Field Studies of the Institute of the History of Material Culture]. 1951. Issue XXXVII. Pp. 88–96. *(In Russ.)*

Sal'nikov K. V. Gorodishhe Chudaki Chelyabinskoj oblasti po raskopkam 1947 g. [The Ancient Settlement of the Chudaks of the Chelyabinsk Region according to the Excavations of 1947]. Sovetskaya arheologiya [Soviet Archaeology]. 1947. Volume IX. Pp. 221–238. *(In Russ.)*

Tsembalyuk S. I. Harakteristika poselenij i zhilishch baitovskoj kul'tury [Characteristics of Settlements and Dwellings of the Baitovo Culture]. Vestnik arheologii, antropologii i etnografii [Bulletin of Archaeology, Anthropology and Ethnography]. 2009. №10. Pp. 57–65 *(In Russ.)*

Tsembalyuk S. I., Berlina S. V. Kompleks rannego zheleznogo veka gorodishcha Lihachevskoe v Priishim'e [The Complex of the Early Iron Age Settlement of Likhachevskoye in Priishimye]. Vestnik arheologii, antropologii i jetnografii [Bulletin of Archaeology, Anthropology and Ethnography]. 2014. №3(26). Pp. 55–65 *(In Russ.)*.

Zah V. A., Tsembalyuk S. I. Baitovskij kompleks poseleniya Chepkul' 8b [Baitovsky Complex of the Settlement of Chepkul 8b]. Vestnik arheologii, antropologii i etnografii [Bulletin of Archaeology, Anthropology and Ethnography]. 2009. №10. Pp. 65–74. *(In Russ.)*

Zimina O. Y., Zah V. A. Nizhnee Pritobol'e na rubezhe bronzovogo i zheleznogo vekov [The Lower Tributary Region at the Turn of the Bronze and Iron Ages]. Novosibirsk : Nauka, 2009. 232 p. *(In Russ.)*

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Берлина С. В. К вопросу о типах жилищ населения раннего железного века западносибирской лесостепи (по материалам саргатской культуры) // Российская археология. 2009. № 2. С. 44–56.

Берлина С. В. Жилища гороховской культуры Зауралья // Вестник археологии, антропологии и этнографии. 2019. №3(46). С. 62–74. DOI: 10.20874/2071-0437-2019-46-3-062-074

Берлина С. В., Зимина О. Ю. Домостроительство населения иткульской культуры в подтаежном-лесостепном Зауралье // Вестник археологии, антропологии и этнографии. 2020. №3(50). С. 61–73. DOI.10.20874/2071-0437-2020-50-3-5

Зах В. А., Цембалюк С. И. Баитовской комплекс поселения Чепкуль 8б // Вестник археологии, антропологии и этнографии. 2009. № 10. С. 65–74.

Зимина О. Ю., Зах В. А. Нижнее Притоболье на рубеже бронзового и железного веков. Новосибирск : Наука, 2009. 232 с.

Корякова Л. Н. Поселения саргатской культуры // Вестник археологии Урала. 1984. Вып. 17. С. 61–79.

Корякова Л. Н., Дэйер М. И., Ковригин А. А., Шарапова С. В., Берсенева Н. А, Пантелеева С. Е., Ражев Д. И., Курто П., Хэнкс Б., Ефимова Е. Г., Каздым А. А., Микрюкова О. В. Среда, культура и общество лесостепного Зауралья во второй половине I тыс.

до н.э. (по материалам Павлиновского археологического комплекса). Екатеринбург ; Сургут : Магеллан, 2009. 298 с.

Матвеева Н. П. Саргатская культура на Среднем Тоболе. Новосибирск : Наука, 1993. 175 с.

Матвеева Н. П. Социально-экономические структуры населения Западной Сибири в раннем железном веке (лесостепная и подтаежная зоны). Новосибирск : Наука, 2000. 399 с.

Молодин В. И. Экологический «стресс» на рубеже II–I тыс. до н.э. и его влияние на этнокультурные и социально-экономические процессы у народов Западной Сибири // Культура как система в историческом контексте: опыт западносибирских археолого-этнографических совещаний. Томск : Аграф-Пресс, 2010. С. 22–24.

Очерки культурогенеза народов Западной Сибири. Т. 1. Кн. 2. Поселения и жилища. Томск : Изд-во Томск. ун-та, 1994. 286 с.

Сальников К. В. Городище Чудаки Челябинской области по раскопкам 1947 г. // Советская археология. 1947. Т. IX. С. 221–238.

Сальников К. В. Археологические исследования в Курганской и Челябинской областях // Краткие сообщения о докладах и полевых исследованиях Института истории материальной культуры. 1951. Вып. XXXVII. С. 88–96.

Хабдулина М. К. Городище Ак-Тау как архитектурный комплекс // Знания и навыки уральского населения в древности и средневековье. Екатеринбург : Наука, 1993. С. 112–143.

Хабдулина М. К. Степное Приишимье в эпоху раннего железа. Алма-Ата : Ракурс, 1994. 170 с.

Цембалюк С. И. Характеристика поселений и жилищ баитовской культуры // Вестник археологии, антропологии и этнографии. Тюмень : Изд-во ИПОС СО РАН, 2009. № 10. С. 57–65.

Цембалюк С. И., Берлина С. В. Комплекс раннего железного века городища Лихачевское в Приишимье // Вестник археологии, антропологии и этнографии. 2014. №3(26). С. 55–65.

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HISTORIC AND CULTURAL SITUATION AT THE TURN OF THE BRONZE AND IRON AGES IN THE TRANS-URALS

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Abstract: The article is devoted to the generalization and systematization of archaeological materials obtained during the excavations of sites of the late Bronze and early Early Iron Ages on the territory of the Trans-Urals. Comparative characteristics of the main life-supporting elements (settlement system, settlement planning, house-building, economy, ceramic production) of the carriers of the Mezhovka, Barkhatovo, Gamayun, Itkul (Iset) and Baitovo cultures made it possible for the authors to present one of the options for the development of the cultural-historical situation in the Trans-Urals forest-steppe and subtaiga zones at the turn of the Bronze and Iron epochs. Qualitative and quantitative data indicate dynamic transformation processes during this period, confirm the synchronicity of the Mezhovka and Barkhatovo cultures, the alien character of the Gamayun and Itkul (Iset) groups at the end of the Bronze Age and the continuity of the Barkhatovo-Baitovo antiquities. At the initial stage of the early Iron Age, representatives of the Itkul culture shared the space of the forest-steppe — subtaiga with the Baitovo communities. The alien traditions are becoming obsolete and there is a complete replacement of the local "standard" — Baitovo before the spread of the Sargat-Gorokhov influence.

Keywords: Trans-Urals, complexes with cross ornamentation pottery, Barkhatovo Culture, Gamayun Culture, Itkul Culture, Baitovo Culture

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ИСТОРИКО-КУЛЬТУРНАЯ СИТУАЦИЯ НА РУБЕЖЕ БРОНЗЫ И ЖЕЛЕЗА В ЗАУРАЛЬЕ

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Резюме: Статья посвящена обобщению и систематизации археологических материалов, полученных при раскопках памятников конца бронзового и начала раннего железного века на территории Зауралья. Сопоставительная характеристика основных жизнеобеспечивающих элементов (система расселения, планировка поселков, домостроительство, хозяйство, керамическое производство) носителей межовской, бархатовской, гамаюнской, иткульской (исетской) и баитовской культур дала возможность представить авторам один из вариантов развития культурно-исторической ситуации в лесостепной и подтаежной зонах Зауралья на рубе-

же эпох — бронзы и железа. Качественные и количественные данные свидетельствуют о динамичных трансформационных процессах в этот период, подтверждают синхронность межовской и бархатовской культур, пришлый характер гамаюнских и иткульских (исетских) коллективов в конце бронзового века и преемственность бархатово-баитовских древностей. На начальном этапе раннего железного века представители иткульской культуры делят пространство лесостепи — подтайги с баитовскими общинами. Пришлые традиции изживают себя и происходит полное замещение местным «стандартом» — баитовским до распространения саргатско-гороховского влияния.

Ключевые слова: Зауралье, комплексы с крестовой орнаментацией керамики, бархатовская культура, гамаюнская культура, иткульская культура, баитовская культура

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Introduction

The turn of the Bronze Age and the Early Iron Age (ca. 9th–6th c. BC) in Western Siberia was marked by the wide presence of sites containing pottery with cross ornamentation (Atlym, Krasnoozerka, Molchanovo, Zavyalovo and other cultures). Their ceramic complexes show clear signs of contacts of the local and migrant populations. Pottery with a pattern of crossed impressions is a specific indicator of infiltration of the taiga groups into the forest-steppe of Western Siberia. Processes of assimilation of the newcomers into these cultures are reflected in dynamics — crossed ornaments get woven into the Late Bronze Age ornamental scheme, replacing particular patterns without disrupting them, and over time disappear during the Early Iron Age, giving way to the autochthonous ornamental tradition [Abramov, Stefanov, 1985].

Unlike other regions of Western Siberia, the presence of representatives of the cultures with cross ornamentation of ceramics in the eastern part of the Trans-Urals in the valley of the Tobol River, was minimal. Only three fortified settlements — Andreevskoye 5 and 7, and Ust-Utyak 1 hillforts — can be reliably attributed to the complexes of ceramics with cross ornamentation; in other cases, the sites contain isolated fragments of vessels with cross pattern. However, the territory was not vacant — it was inhabited by groups that also suffered the influence of general cultural processes of this period. At the end of the Bronze Age, the Trans-Urals communities were not culturally homogenous. Indeed, each cultural formation occupied its ecological and landscape niche in the region; in the border areas, the distribution areas of the cultures occasionally overlapped, contacts of various intensity levels have been recorded among their representatives. To understand the specifics of the formation of cultures in the Early Iron Age, one needs to analyse the historical situation in the Trans-Urals at the final stage of the Bronze Age, and in the transitional time. As such, we aim to present one of the possible pathways of cultural and historical development in the Trans-Ural forest-steppe at the turn of the Bronze and Early Iron Ages. The lack of burials and the paucity of anthropological data make the ethnogenetic reconstructions impossible. The cultures of the final Bronze — Early Iron Age of the Trans-Urals are represented only by settlement complexes.

Different perspectives on the cultural genesis of the Trans-Ural forest-steppe and sub-taiga regions are outlined in V.A. Zakh [2007] and V.A. Borzunov [2019].

Materials and Methods

For the forest-steppe and sub-taiga territories of the Trans-Urals — a natural region bordering Urals on the east and comprising western areas of the West Siberian Plain in the Tobol River basin — several cultures have been identified for the considered period, partly being interrelated, yet carrying a number of differentiating features (Fig. 1).

Barkhatovo Culture was localized in the Trans-Urals, in the valley of the Tobol River and its tributaries. The Culture is dated to the 2nd mill. BC — 10th–9th c. BC [Korochkova, 1987; Matveyev, Anoshko, 2009] (Fig. 2). Among the settlements, there are unfortified and fortified villages. At present, 48 Barkhatovo sites are known; a third of them have been excavated (the villages of Zavodoukovskoye-9 and 10, Novo-Shadrino-2 and 7 (excavation 2), Palatki-2, Shchetkovo 2, Mostovoye, as well as Krasnogorskoye, Kolovskoye, Miasskoye and Ust-Utyakskoye-1 hillforts). Characteristic for the Barkhatovo groups was a riverside type of settling. Housebuilding represented single-chambered frame-and-pillar dwellings of 12 to 210 m^2 in area. Residential structures had a simple hearth in the centre, a portal, a ramp; the entrance was in the form of a long narrow corridor. There were utility structures among the buildings — they were small, slightly deepened into ground, without a hearth. Trenches, ramparts, additional wooden and earthen structures have been found in the Barkhatovo hillforts. Population of the Barkhatovo Culture had diverse economy with predominance of the home-pasture stockbreeding. The proportion of appropriating activities — hunting (14.3–28.1% in settlements and 5.9–9% in hillforts) and fishing was quite high. In the unfortified Barkhatovo settlements, cattle bones (31.7–50%) prevail, followed by horse bones 18.7–31.6%, and small cattle — 3.9–32.3%. In hillforts, horse bones (48.1–64.6%) prevail. Pottery of the Barkhatovo sites is represented by vessels made of clay with the inclusion of sand and chamotte. Morphologically, the pottery appears as vessels with low neck bent outwards or vertical, with a thickening in the lower part of the neck in 45% of the vessels. The pattern consists of simple figures in the form of inclined and horizontal lines, mesh, vertical and horizontal chevrons, less often complex motifs of dashed triangles, diamonds and ribbons, "flags". The essential element of the pattern on the necks of the vessels are pearls (9.4–72%), round pits (8.1–19.8%), drop-shaped dents (3.5–30.2%). Characteristic is a pattern of two parallel lines, breaking vertically all ornamental space of the vessel. In the end of the 2nd mill. BC, which includes the initial stage of the development of Barkhatovo Culture, the settlements were not fortified; the pottery complexes of these settlements include items of foreign cultures with a pattern of cross impressions.

In the 10th–9th c. BC, during the developed stage of the culture, defensive structures appear within the settlements, and items of foreign *Gamayun Culture* have been recorded in the pottery complexes, with cross ornaments and the inclusion of talc in the clay. In the centre of the distribution area of the Barkhatovo Culture (in the Krasnogorsk hillfort), the Gamayun shards have only been found as single fragments. In the south and south-west of the area, in the Miass and Ust-Utyak hillforts of the Barkhatovo Culture, the vessels of the Gamayun Culture comprise no more than 30%; vessels with mixed Barkhatovo-Gamayun features have

also been identified [Zimina, Zakh, 2009: 144, Fig. 88]. Settlements of the Gamayun Culture (10th/9th–4th c. BC) (Fig. 2), which was formed on Konda, Tavda and Lozva in the process of migrations of the Altym Culture population of the Ob River region and its interaction with the population of the Lozva Culture of the Konda River, which began around the 12th c. BC [Borzunov, 1992: 130], have been found not only in the Trans-Urals, but also in the Cis-Urals though the majority of them are located along the eastern slope of the Ural Range [Borzunov, 1992: 160, Fig. 1]. During the preceding period, the *Mezhovka Culture* (12th–7th c. BC) was spread across both sides of the Ural Range — in the Cis-Urals in the Kama River basin to the west, in the areas of the Middle and Southern Trans-Urals to the east, no further than the middle reaches of the Iset River [Obydennov, Shorin, 1995: 97] (Fig. 2).

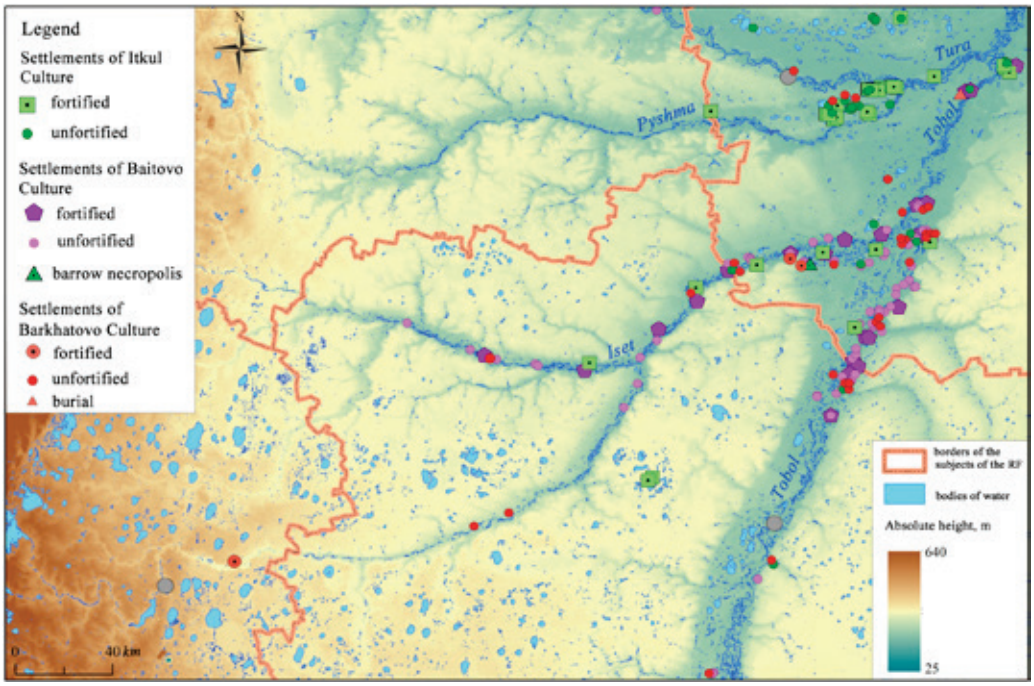

Fig. 1. Map of the settlements of the Barkhatovo, Itkul and Baitovo cultures in the Trans-Urals
Рис. 1. Карта памятников бархатовской, иткульской и баитовской культур в Зауралье

During the transitional time from the Bronze to the Iron Age, settlements of the *Itkul Culture* (7th–3rd/2nd c. BC) appeared in the Trans-Urals, with two types of pottery. The settlements with the type I of the Itkul pottery are localized along the eastern slopes of the Urals, on the basis of which the Itkul centre of metallurgy developed [Beltikova, 2005]. In the plain regions of the Trans-Urals, in the valley of the Tobol River, in the 8th–7th c. BC, according to radiocarbon data, weakly fortified circular settlements appeared, which were termed the *eastern variant of the Itkul Culture*, as the pottery complex of these fortifications was identical to the Itkul type II pottery [Zimina, Zakh, 2009] (Fig. 3).

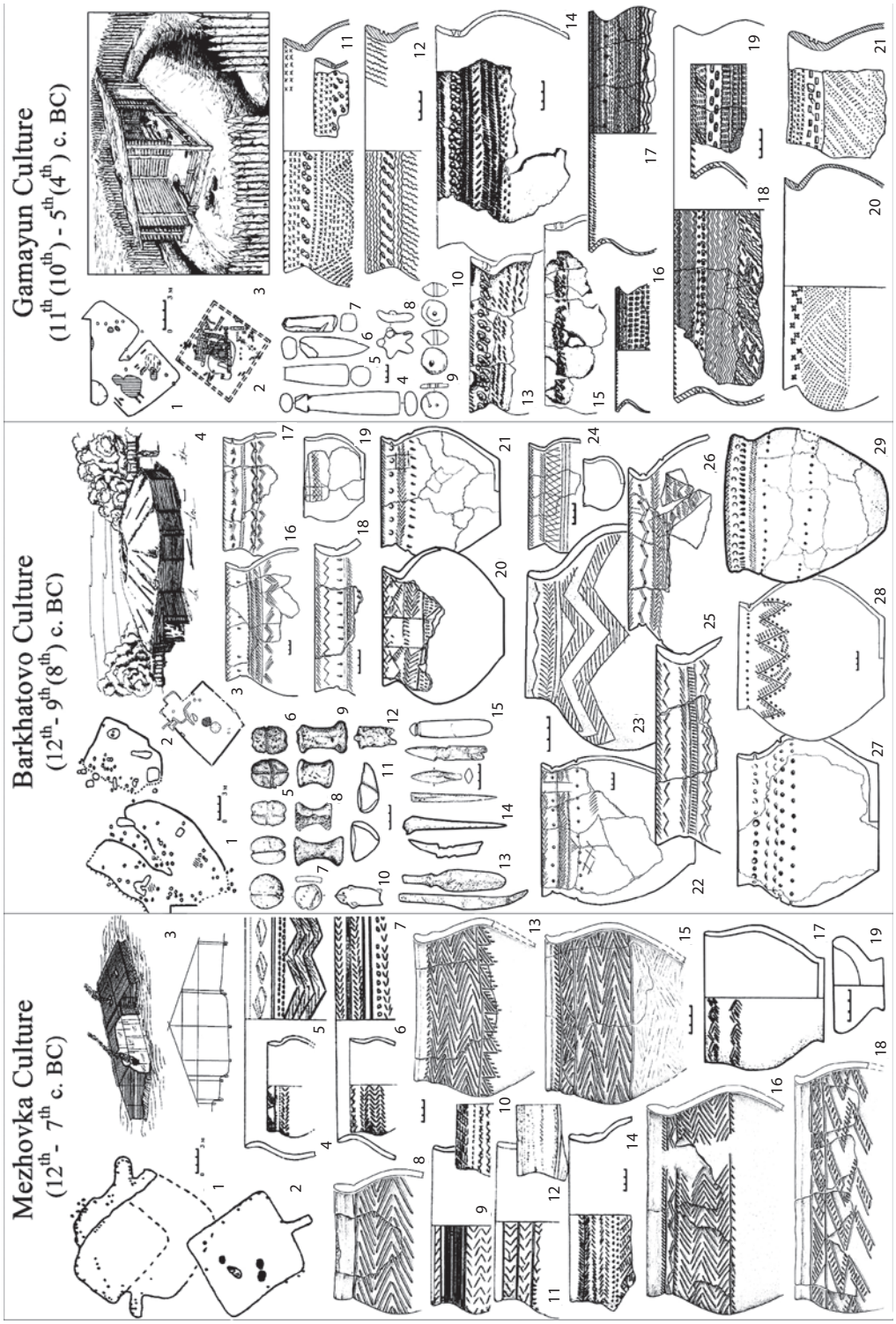
Mezhovka Culture
(12th - 7th c. BC)
Barkhatovo Culture
(12th- 9th(8th) c. BC)
Gamayun Culture
(11th(10th) - 5th(4th) c. BC)

Fig. 2. Archaeological cultures of the final stage of the Bronze Age in the Trans-Urals. Mezhovka Culture (after [M. F. Obydennov, 1997; V. T. Petrin, T. I. Nokhrina, A. F. Shorin, 1993; L. Y. Petrova, 2018]): 1 — Yukalikulevo-4; 2 — Kumlekul; 3 — Staro-Kabanovskoe; 4–7, 9–12, 14, 17 — Berezki-5; 8, 13, 15, 16, 18 — Arkhangelsk Mine-2; 19 — Maly Linden-9. Barkhatovo Culture (after [A. V. Matveev, O. M. Anoshko, 2009]): 1, 2, 10, 11, 14, 19 — Krasnogorskoe; 3, 6, 9, 20, 21 — Kolovskoe; 4, 5, 7, 8, 12, 13, 15, 24, 27 — Shchetkovo-2; 16, 17, 23, 26 — Novo-Shadrino-7; 18, 22, 25 — Novo-Shadrino-2; 28 — Zavodoukovskoe-9; 29 — Miass. Gamayun Culture (after [V. A. Borzunov, 1992, 2019; O. Y. Zimina, V. A. Zakh, 2009]): 1, 6, 7 — Kamenogorskoe; 2 — Palkinskoe; 3 — Tumanskoe; 4, 5, 9 — Zotinskoe-4; 8 — Elovskoe; 10 — Oskinskoe-1; 11, 12, 20, 21 — Andreevskoe-5, 7; 13–15 — Ust-Utyak; 16–19 — Shallow Lake

Рис. 2. Археологические культуры заключительного этапа бронзового века в Зауралье. Межовская культура (по: [Обыденнов, 1997; Петрин, Нохрина, Шорин, 1993; Петрова, 2018]): 1 — Юкаликулево-4; 2 — Кумлекуль; 3 — Старо-Кабановское; 4–7, 9–12, 14, 17 — Березки-5; 8, 13, 15, 16, 18 — Архангельский Прииск-2; 19 — Малый Липовый-9. Бархатовская культура (по: [Матвеев, Аношко, 2009]): 1, 2, 10, 11, 14, 19 — Красногорское; 3, 6, 9, 20, 21 — Коловское; 4, 5, 7, 8, 12, 13, 15, 24, 27 — Щетково-2; 16, 17, 23, 26 — Ново-Шадрино-7; 18, 22, 25 — Ново-Шадрино-2; 28 — Заводоуковское-9; 29 — Миасское. Гамаюнская культура (по: [Борзунов, 1992, 2019; Зимина, Зах, 2009]): 1, 6, 7 — Каменогорское; 2 — Палкинское; 3 — Туманское; 4, 5, 9 — Зотинское-4; 8 — Еловское; 10 — Оськинское-1; 11, 12, 20, 21 — Андреевское-5, 7; 13–15 — Усть-Утякское; 16–19 — Мелкое Озеро

Currently, V.A. Borzunov proposes to name this pottery and, accordingly, the culture, Iset, and he dates it to ca. 9th/8th–4th c. BC [Borzunov, 2019]. In the sub-taiga and forest-steppe areas, in the Tobol River valley, more than 70 sites with the type II pottery of the Itkul Culture have been identified, of which 46 villages are surrounded with sand ramparts up to 3–4 m wide and up to 0.5 m high, and trenches up to 1 m wide and up to 0.35–0.6 m deep, with a closed circular outline. The tendency of arrangement of the Itkul settlements closer to areas of large flow-through lakes and lake systems has been noted. The remains of above-ground buildings in the form of elevated platforms are located along the perimeter of the fortifications [Berlina, Zimina, 2020]. The cultural layer of the settlements is poor in finds; osteological material in cultural deposits formed on sandy soils does not preserve, the main category of finds — fragments of pottery. The economy of the Itkul (Iset) tribes in the Tobol River region can be described as complex, combining pastoralism, hunting, fishing and domestic production, and metalworking. The ornamentation of the Itkul pottery of type II (Iset) features horizontal lines on the neck, a double row of notches on the junction with the shoulder, interpenetrating figures or variously shaded areas on the shoulders; the pattern is completed with horizontal lines, horizontal chevrons or inclined impressions of a short stamp, etc. The necks of the vessels have thickening at the base. In the Tobol River region complexes, such vessels comprise from 45% in the sub-taiga areas to 90% in the forest-steppe. In the ornamentation technique for vessels of the Tobol River region complexes, comb stamp prevail (70–100%). For the pottery clay of Itkul ware in the Urals, the inclusion of talc and mica has been recorded [Beltikova, 2005]. In the Tobol River region complexes, the percentage of vessels with this type of admixture can vary from 25% in the sub-taiga zone [Zimina, Zakh, 2009: 181], to 46–85% in the forest-steppe complexes [Zimina, Ilyushina, 2016: 37].

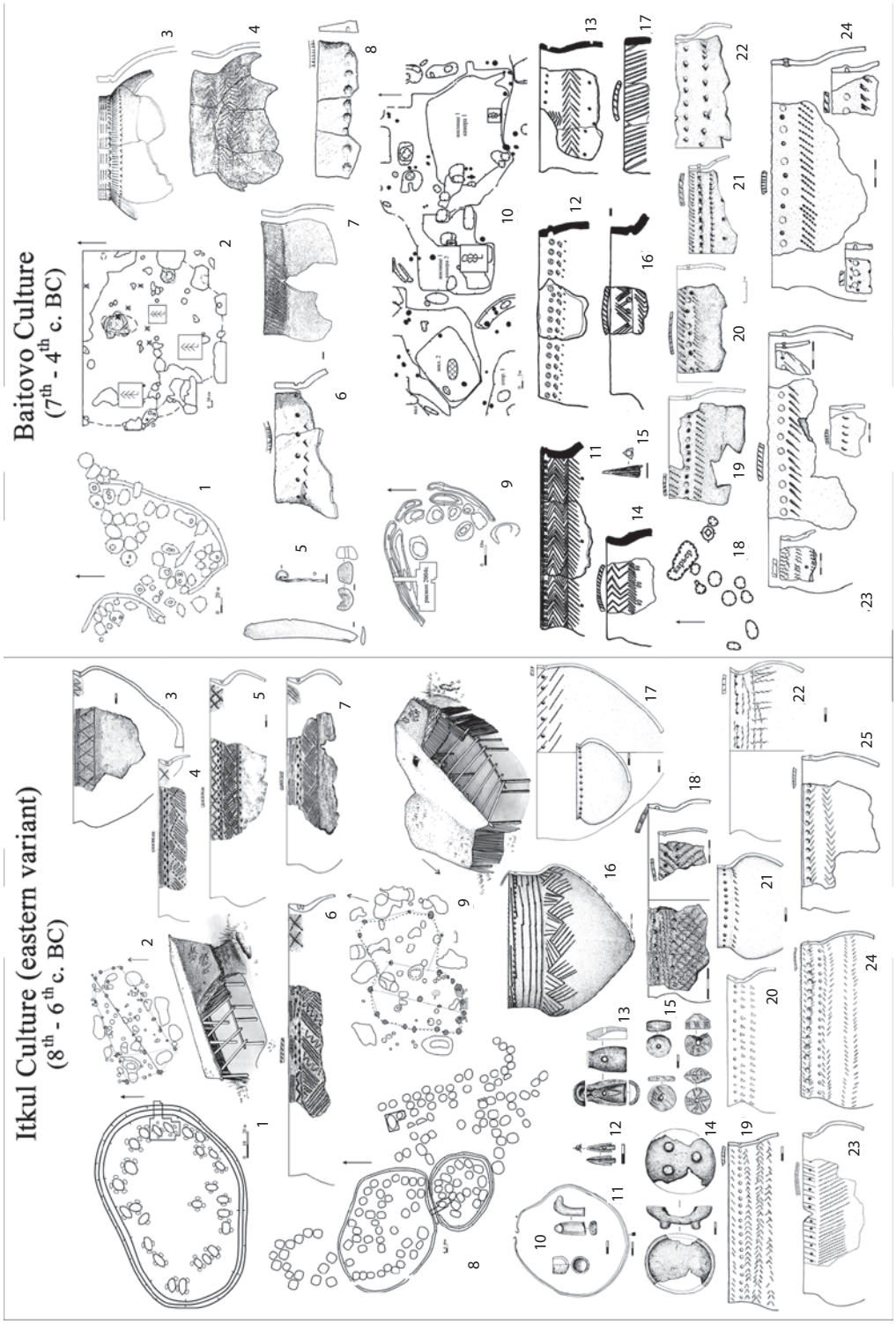
Baitovo Culture
(7th - 4th c. BC)
Itkul Culture (eastern variant)
(8th - 6th c. BC)

Fig. 3. Archaeological cultures of the transition period from the Bronze Age to the Early Iron Age in the Tobol region. Itkul culture (after [Zimina, Zakh, 2009]): 1–7 — Karagai Aul-4; 8–25 — Vak-Kur-2; Baitovskaya culture (after [Tsembalyuk et al., 2011; Matveeva, Tsembalyuk, 2010; Zimina, Tsembalyuk, 2012]): 1–8 — Borovushka-2; 9–17 — Bolshoy Imbiryai-3; 18–22 — Cheganovo-2; 23–24 — Cheganovo-3
Рис. 3. Археологические культуры переходного периода от бронзового века к раннему железному веку в Притоболье. Иткульская культура (по [Зимина, Зах, 2009]): 1–7 — Карагай Аул-4; 8–25 — Вак-Кур-2; Баитовская культура (по [Цембалюк и др., 2011; Матвеева, Цембалюк, 2010; Зимина, Цембалюк, 2012]): 1–8 — Боровушка-2; 9–17 — Большой Имбиряй-3; 18–22 — Чеганово-2; 23–24 — Чеганово-3

The Baitovo Culture (7th — 4th c. BC) highlights the initial stage of the Early Iron Age in the Trans-Ural forest-steppe and sub-taiga [Stoyanov, 1970: 252]. The core of its distribution area is located in the forest-steppe zone in the Tobol and Iset Rivers interfluve. About 200 fortified and unfortified settlements with the Baitovo materials are known [Matveeva, Tsembalyuk, 2004, p. 230]. In many multi-layered sites, the Baitovo complexes are not abundant, and they distinguish typologically. More than ten objects have been investigated by excavations [Tsembalyuk, 2017] (Fig. 3). For the Baitovo population, characteristic was the riverside type of settling, in single occasions they also settled along lake shores (Bochanetskoye, Chepkul 86). The defensive structures of the Baitovo weakly fortified hillforts have the layout of open ramparts and ditches of various shapes — broken arcs, straight lines, etc. Well fortified hillforts are hilltop or circular, with single defensive line of moat and rampart, reinforced with wooden structures (fence, palisade, wall) [Tsembalyuk, 2009]. Housebuilding of the Baitovo population features two types of frame-and-pillar buildings — above-ground ones, surrounded along the perimeter by pits-quarries or ditches, and half-dugouts — single- or two-chambered ones, 6.5 to 108 m^2 in area [Tsembalyuk, 2017: 10–11]. The analysis of palaeozoological complexes confirms, that the Baitovo population was engaged in pastoralism. The proportions of horses and cattle in the herd were almost equal, while small cattle only constituted its third. Considering the short-term residence periods of the Baitovo groups in many of the settlements, it has been assumed that the distant-pasture type of pastoralism was practiced [Tsembalyuk, 2017: 11–12]. The role of hunting and fishing in the economy of the Baitovo population was not significant. From the associated artefacts, it can be stated that the inhabitants of the Baitovo villages were also engaged in production of pottery, metal- and woodwork, leather, weaving, and other goods [Zimina, Kostomarov, Tsembalyuk, 2012]. Baitovo ware represents round-bottomed pots with an abundant inclusion of sand in the clay, poorly decorated at the top with pearls, round pits, angles, inclined and horizontal lines, horizontal "herringbone", vertical chevrons, less often — mesh, "combs", rocking, scallops. Ornaments are usually made in combing or, more rarely, drawing technique. A distinctive feature of the Baitovo pottery is decoration of the upper section of the neck with a "mesh", rows of inclined lines. To the early stage of the Baitovo Culture, dated to the end of the 7th — 6th c. BC, poorly fortified hillforts and unfortified settlements with above-ground buildings have been attributed; their pottery complexes are dominated by mildly profiled thin-walled egg-shaped vessels with short neck, simplified decoration, mainly made by the combed stamp [Tsembalyuk, 2017: 13]. The later stage (5th — beginning of the 4th c. BC) was marked by well-fortified

hillforts with one- or two-chambered half-dugouts, with pottery represented by well-profiled thick-walled ball-shaped vessels with high necks. The ornamentation of the ware shows larger proportion of carved and drawn elements, the compositional structure of the pattern becomes more complex. Furthermore, in the sub-taiga areas of the Tobol River region, a group of sites features pottery with particular characteristics which are considered to be a specific "taiga" type of the Baitovo pottery [Zimina, 2006]. It is represented by mildly profiled vessels, rather thin-walled, with less inclusion of sand, and with a specific wavy ornament.

The synthesis and systematization of materials from the Late Bronze Age sites (Mezhovka, Barkhatovo, Gamayun) of the Trans-Urals, as well as the reconstruction of the historical and cultural processes based on them, suggest that during the short period of transition to the Early Iron Age, with deteriorating natural and climatic conditions in the area, there was an intensive transformation of traditional features of the Late Bronze Age complexes of various cultures and the emergence of new single- (Baitovo) and multi-component (Itkul) cultural formations, which occupied different ecological niches. The modern source base provides a justification for the concept of historical and cultural environment at the turn of the Bronze and Iron Ages in the Trans-Urals.

The findings are based on statistical data (quantitative indicators of the pottery complexes) and qualitative indicators (type-defining characteristics of settlements, buildings, etc.) of the cultures, spatial analysis and radiocarbon dates for the settlements.

Results and discussion

Comparison on the main parameters of the discussed cultures allows outlining the basic cultural and genetic links, and mutual influence of the cultures reflected in their spatial distribution and in the material culture (outline of settlement, housebuilding, pottery production, economy).

Spatial analysis of overlapping/divergence of the distribution areas of the Trans-Ural cultures has shown, that populations of the Mezhovka and Barkhatovo Cultures were only neighbouring each other along the eastern slope of the Ural Ridge — in the outskirts of their regions. The main settlement area of the Barkhatovo Culture was the Tobol-Iset interfluve. The one of the Gamayun Culture, on the contrary, covered entirely the distribution region of the eastern Mezhovka sites [Borzunov, 1992: 26, 27, Fig. 1]. However, Gamayun pottery has not been found in the latter complexes [Obydennov, Shorin, 1995: 116]. Apparently, the Mezhovka Culture had finished its existence before the arrival of the Gamayun communities [Borzunov, 1992: 130], and, by the time of arrival of the Gamayun groups, complexes of the Itkul Culture were formed on its basis in the Urals with the type I pottery; its representatives created the Trans-Ural metallurgy centre [Beltikova, 2005]. Eastern slopes of the Urals and forest-steppe and sub-taiga areas of the Trans-Urals in the valley of the Tobol River were the main area of settlements with the Itkul ceramics of type II (Iset). The area of the Baitovo Culture overlapped with that of the Barkhatovo Culture, and it is located in the Tobol River and largely in the Tobol-Iset interfluve.

Unlike the settlements of the Mezhovka Culture, the Barkhatovo contains pottery with crossed ornaments. In the sites of the early stage of the Barkhatovo Culture (settlement sites of Schetkovo-2, Novo-Shadrino-7, Pospelovo-1) it only comprises several (no more than 50) fragments. In our view, this is indicative of only sporadic contacts between the Barkhatovo

and foreign groups. The settlements of the later stage of the Culture clearly show the presence of an external factor manifested in the presence of the Gamayun pottery, decorated with impressions of a stamped cross, conical pits and horizontal belts of "snakes" in cultural layers of the Barkhatovo hillforts. In the Krasnogorsk settlement it is not numerous (one collapsed vessel on the floor of a dwelling and 43 fragments from vessels) [Matveev, Anosko, 2009: 39–80]. In the Miassk and Ust-Utyak hillforts, Gamayun ware constitutes about 30% of the pottery complex, present are also items with mixed features [Borzunov, 1992; Epimakhov, Epimakhova, 2009: 66–70; Zimina, Zakh, 2009]. We hypothesise the coexistence of representatives of the Barkhatovo and Gamayun Cultures in these villages. The Miass settlement represents the southwestern periphery of the Barkhatovo area and it tends to be closer towards the territory of the compact location of the Gamayun groups (the Miass-Argazin variant) [Borzunov, 1992]. The hillfort of Ust-Utyak-1 is located at the southern edge of the main distribution area of the Barkhatovo Culture. Certain Gamayun groups (Andreevskoye 5 and 9 fortified settlement) were penetrating into the northern area of the Barkhatovo Culture in the sub-taiga zone of the Tobol River region. Interaction with the Gamayun communities was apparently forced for the Barkhatovo population, as it was during this time when they began to build fortified settlements on the points of high terraces of the Iset and Tobol Rivers.

The core of the Bronze Age Barkhatovo Culture area in the Tobol-Iset forest-steppe completely overlaps with the territory of the Early Iron Age Baitovo Culture sites. At the same time, in the lower reaches of Tobol, mainly in the sub-taiga zone in the interfluve of Tura and Pyshma, objects of the eastern local variant of the Itkul (Iset) Culture are concentrated. Yet, Itkul (Iset) poorly fortified settlements are also present in the zone of influence of the Baitovo Culture — in the forest-steppe of the Tobol-Iset region, where they are found in ribbon forests. As such, the inter-lane existence of the Itkul and Baitovo groups, occupying different ecological niches, has been recorded. Settlements of the Itkul Culture are arranged along the shores of large lakes and lake systems, located on sandy ridges, hills, often at a distance of watercourses. On the contrary, Baitovo sites are connected to large rivers and their tributaries. In this case, there is a direct overlapping with the Late Bronze settlement pattern of the Barkhatovo Culture, when a certain settling system most convenient for the existence was developed, clearly reflecting the tendency of building the villages in rather narrow areas along the river valleys.

Depending on the settlement pattern, the protective properties of the landscape were also considered. All the elements common for the prehistoric fortification systems have been identified in the Barkhatovo fortified settlements (Miass and Krasnogorsk hillforts): earthen ramparts and ditches [Matveev, Anoshko, 2009: 204–205]. Their small size indicates the unlikeliness of formidable barriers. Nevertheless, the fortified settlements of the final stage of the Bronze Age occupied areas of high steep shores, with further reinforcing of the rampart with a log wall on the mainland side of the cape, which enhanced their defensive ability. The appearance of fortifications in this period has been recorded not only among representatives of the Barkhatovo Culture, but also among their northern neighbours — the Gamayun population (hillforts of Andreevskoye-5 and 7, Palkinskoye, Funtusovskoye, etc.) [Borzunov, 1992: 33–41]. The differences between the Gamayun hillforts from the Barkhatovo sites are only limited to the presence on the former ones of circular defence lines on small hills and fortified isolated dwellings with double walls, a moat and a palisade, as well as the cape layout

with transverse, arc-shaped shafts-ditches. The majority of researchers link the appearance of fortresses during this period with climate change — the increase in the water level in the rivers, which resulted in movement of groups of various cultures, and subsequently the emergence of social tensions and the construction of fortifications [Kosarev, 1984: 42; and etc.].

The planning solutions for the weakly fortified settlements of the Itkul Culture differ considerably from those of the Gamayun and Barkhatovo. They are 50 to 300 m in diameter, have circular layout of defensive systems, comprising in prehistoric times a wall, only preserved as low sandy shafts, and a shallow perimeter trench. At the early stage of the Baitovo Culture, fortified settlements were surrounded with fences-palisades, installed in a shallow ditch, the soil from which was used for the mound of the rampart (Borovushka, Bochanetskoye). Already at the beginning of the Early Iron Age, at the late stage of existence of the Culture, the strength of the defence lines increased dramatically; gate towers appeared (Likhachevskoye, Bolshoy Imbiryai-3) [Tsembaluk, 2009: 58].

The comparison of the housebuilding traditions allows drawing the following succession lines. For the Late Bronze Age period, characteristic were frame-and-pillar sub-rectangular buildings, with foundation pits slightly deepened into soil, and corridor-shaped entrances of the Mezhovka (70–150 m^2 in area [Obydennov, Shorin, 1995]) and Barkhatovo (mostly 34–50 m^2 in area) Cultures. Baitovo frame-and-pillar buildings of the half-dugout type are most similar to the dwellings of the Barkhatovo Culture. Similarities between the Mezhovka and Gamayun housebuilding traditions have been recorded in the construction of above-ground dwellings. The construction of such objects became widespread in the succeeding period. Above-ground buildings in the form of raised platforms, contoured by pits-quarries or ditches along the perimeter, absolutely prevail in the Itkul settlements of the Tobol River region [Berlina, Zimina, 2020], and they are also present in the Baitovo sites [Tsembalyuk, 2017: 10–11]. Spatially, Baitovo settlements with above-ground buildings have been recorded to be more frequent in the sub-taiga areas of the lower Tobol River region; half-dugouts are more common in the forest-steppe belt.

The appearance of settlements with circular layout and above-ground buildings in the sub-taiga and forest-steppe Trans-Urals can only be related to the general tendency of the spread of weakly fortified settlements and above-ground structures. Somewhat earlier, these had already been common among the Middle Ob River region cultures — the Late Bronze Age Atlym and Barsova (12^{th}–8^{th} c. BC), and later Beloyarka and Kalinkina Cultures of the 7^{th}–4^{th} c. BC [Chemyakin, Karacharov, 2002], but there is no evidence for the migration of representatives of these cultures from the Ob River region to the Tobol River valley. In general, the comparative analysis of the Trans-Urals sites of the turn of the Bronze and Iron Ages suggests that the defensive complexes in the forest-steppe zone of the region played the role not only of residential settlements, but also of outposts, and in the sub-taiga they were most likely related to the specifics of the economy and lifestyle, or with some ideological aspects.

The analysis of the economic patterns of the communities suggests clear similarities between the Barkhatovo and Baitovo sites on the one hand, and Gamayun and Itkul on the other. Based on the materials of palaeozoological collections, the role of stockbreeding in the life-sustaining system of the Late Bronze (Barkhatovo) and succeeding Baitovo groups in the Trans-Ural forest-steppes was more important than for the Gamayun and Itkul communities.

The economy of the Barkhatovo population was based on the local-pasture meat and dairy stock farming. In the final stage of the Bronze Age, the number of small cattle in the Barkhatovo herd significantly reduced, but the proportion of horses sharply increased. This fact suggests an emerging tendency towards the increased mobility of the herd, which resulted in a change in the form and type of pastoralism at the beginning of the Early Iron Age. Researchers consider it highly probable that, in the forested areas of the Tobol River valley, the population of the Baitovo Culture practiced distant-pasture stockbreeding [Tsembalyuk, 2017: 11–13]. In the economy of the Gamayun and eastern Itkul communities, the proportion of the appropriating activities — hunting and fishing — was much higher compared to that of the Barkhatovo and Baitovo groups. It cannot be ruled out that the Gamayun population became acquainted with the farming of domesticated animals only as a result of interaction with local, Barkhatovo tribes. Representatives of the eastern local variant of the Itkul Culture, living mainly in woodlands, continued to actively use the appropriating sectors of economy, along with their supposed engagement into pastoralism [Zimina, Zakh, 2009].

Comparison of the statistical indicators for morphological and ornamental features of ceramic complexes of the turn of the Bronze and Iron Ages shows the continuity of the pottery production traditions of the earlier and later populations of the forest-steppe and sub-taiga Tans-Urals.

The Late Bronze Age cultures demonstrate close proximity of the Barkhatovo and Mezhovka pottery traditions, reflecting the period-specific originality in the ornamentation of the ware of cultures of the end of the Bronze Age. Those include the following elements of the decor: inclined lines, vertical and horizontal chevrons, mesh, shaded ribbons, triangles, diamonds, notches, knolls and grooves. The presence of "flags and pearls", as well as drop-shaped depressions and round pits, absent in the ornamentation of the Trans-Ural Mezhovka vessels, determines the originality of the Barkhatovo ceramics. At the same time, the decoration of the Mezhovka ware is defined by knolls and "collars" (14.1–27.5%), located in the mouth area of the vessel, and grooves (3–51.1%) [Stokolos, 1972, Tables 21b, 28a; Petrin, Nokhrina, Shorin, 1993, Table 15], not typical for the Barkhatovo ornamentation. The percentage of pearls on necks of the pots from the Barkhatovo hillforts constitutes 51.2–72% [Matveev, Anoshko, 2009: 312–315]. The ornaments are made in carved technique. The proportion of comb stamp patterns in the sites of the early stage of the Barkhatovo Culture does not exceed 13%, and in those of the late stage it is less than 5%. For the Mezhovka ornaments in general, carved patterns are also more characteristic, but in the northern local (Koksharovo) variant of the Mezhovka, the comb technique of ornamentation is prevailing [Shorin, 1996]. In the Mezhovka complexes, the patterns made by the comb stamp constitute 4 to 15.2% [Stokolos, 1972, Tables 21b and 28a; Petrin, Nokhrina, Shorin, 1993, Table 15].

The ornamental standards of the Mezhovka and Barkhatovo pottery complexes were formed the basis of new ornamentation traditions of cultures of the transitional time from the Bronze to the Iron Age. Mezhovka pottery traditions can be somewhat seen in ceramic materials of type I of the Itkul Culture, spread only in the mountain regions of the Southern Urals, and Barkhatovo traditions are featured in ornamental compositions of the Baitovo Culture vessels in the Tobol River region. Compared to the ornamental scheme of the Barkhatovo pottery, the Baitovo decorative compositions appear more routine, as the proportion of vertical and

horizontal chevrons is significantly reduced, and geometric patterns are virtually absent. The most common rapports of the Baitovo pottery are sloping lines, mesh, mainly made in combing technique (up to 53.1%), pearls and pits [Tsembalyuk, 2017: 13].

The comparative analysis revealed the differentiation of the Baitovo ceramic complexes of the Trans-Urals on, tentatively speaking, sub-taiga complexes of the lower Tobol River region and forest-steppe ones of the Tobol-Iset interfluve. There is less inclusion of sand in the clay of the vessels from the sub-taiga sites, while the concentration of sand in ceramics of the forest-steppe complexes is high; in the lower Tobol River region, the Baitovo ware is more thin-walled — 0.3–0.5 cm, and in the middle Tobol region — 0.5–0.7 cm; in the lower Tobol region complexes, there is a large number of weakly profiled vessels (up to 26.2%), the majority of vessels are wide-neck, the designs of the necks are variable (low straight vertical, or with a slight inclination inwards, less often slightly arched or bent); in the ornamentation of the Baitovo pottery from the lower Tobol region, a motif of alternating pits and pearls is quite common, occasionally there are wavy stamp patterns. The features of the Baitovo pottery from the lower Tobol region have direct similarities with the ornamentation of the Vak-Kur-type pottery, which developed in the lower Tobol region on the basis of the type II pottery of the Itkul (Iset) Culture, and they are absolutely not typical for the Baitovo ornamental complex [Zimina, Tsembalyuk, 2012: 34].

Ceramic materials of the eastern variant of the Itkul Culture demonstrate the result of interaction between the representatives of the Gamayun and Barkhatovo Cultures. In the Itkul pottery of type II represented by wide-neck low vessels with convex shoulders and round/small flattened bottom, the overall composition and zonality of the pattern trace back to the Gamayun ornamentation, the way of creating of the pattern is different: on the Gamayun vessels by the crossed/wavy rolled stamp, on Itkul by the combed stamp (70–100% of vessels). The ornamentation of the Itkul pottery of type II (Iset) is characterized by horizontal lines on the neck, double row of holes on the transition to the shoulder, interpenetrating figures or variously shaded areas on the shoulder; the pattern is completed with horizontal lines, horizontal chevrons or inclined impressions of a short stamp, etc. In the clay of the Itkul ware in the Urals, a mixture of talc and mica has been recorded [Beltikova, 2005]. In the Tobol region complexes, the percentage of vessels with this admixture can range from 25% in the sub-taiga zone [Zimina, Zakh, 2009: 181], to 46–85% in the forest-steppe complexes [Zimina, Ilyushina, 2016: 37]. Necks of the Itkul vessels of type II are characterized by thickening at the base — this is one of the type-defining features [Beltikova, 2005]. In the Tobol River region complexes, such vessels constitute from 45% in the sub-taiga zone to 90% in the forest-steppe [Zimina, Ilyushina, 2016]. The origin of this element is most likely related to the Barkhatovo traditions of the design of pot necks, 45% of which have similar thickening.

In the eastern variant of the Itkul (Iset) Culture, a ceramic complex of the Vak-Kur type (6th c. BC) has been identified. Its appearance is closely related to the Baitovo ware, but carries a number of characteristic decorative elements, which originate from the Itkul ornamentation of the Tobol River region (pattern in the form of impressions of wavy small-trickle stamp, several rows of horizontal lines on the neck, rows of staggered notches in the transition zone from neck to shoulder, interpenetrating figures), as well as a number of features associated with the local line of development of the pottery traditions, adopted from the Baitovo communities but originating from the Late Bronze Age traditions (elongated proportions, mild profile of

vessels, predominance of pearls in some complexes (up to 70% in the Karagai Aul 1/B fortified settlement), vertical and horizontal chevrons made by impressions of a smooth stamp, brackets and moon-shaped notches).

In general, the origins of the pottery complex of type II of the Itkul (Iset) Culture and the foreign nature of its representatives in the valley of the Tobol River has been established from a number of characteristics, which allow assuming that the region of its formation was in the eastern slopes of the Urals. A certain feature indicating the Ural origin is the inclusion of talc into the clay. This is a specific element of the Ural cultures, including both the Mezhovka and Gamayun traditions [Obydennov, Shorin, 1995: 68; Borzunov, 1992: 54]. At the same time, the principal ornamentation technique of the Itkul Culture (combed stamp) is not typical for the Barkhatovo and Gamayun pottery. For the Barkhatovo, the main ornamentation is carved [Matveev, Anosko, 2009: 249–250], and for the Gamayun — pit-crossed and pit-waved [Borzunov, 1992]. For the Mezhovka ornaments, carved patterns are also more characteristic in general, though in the northern variant of the Culture combed technique is dominant [Shorin, 1996]. The double row of pits and some elements in the form of shaded area indicate a distinct influence of the Gamayun ornamental tradition [Beltikova, 2005].

The comparative characteristics of the distribution areas, housebuilding, economy and pottery traditions of the Trans-Ural Mezhovka, Barkhatovo, Gamayun, Itkul and Baitovo Cultures show the synchronicity of the former two in the Late Bronze Age, the foreign nature of the third one in the final stage of the Bronze Age, and their transformation in the latter ones at the turn of the periods. However, the synchronicity of the stages does not imply complete coinciding of the periods during which the development of the related cultures was happening. Thus, the Mezhovka Culture ended its existence in the Trans-Urals slightly earlier than the Barkhatovo. The absence of radiocarbon dates of the Mezhovka sites and of any Gamayun ware in their ceramic complexes suggest that all of them belong to the pre-Gamayun period in the Trans-Urals. Unlike in the Cis-Urals, in this territory, the Mezhovka Culture could have ceised its existence before the end of the 9th c. BC, when the area was apparently already occupied by the Gamayun population. Radiocarbon dates, obtained from the materials of a building of the Krasnogorsk hillfort of the Barkhatovo Culture, in the foundation pit of which the fragments of both the Barkhatovo and Gamayun vessels were found, definitely indicate that the Gamayun groups appeared in the Tobol-Iset region in the late 9th — early 8th c. BC.

Materials and absolute dating of the Baitovo sites define the chronological framework of the Culture within the 7th to early 4th c. BC [Tsembalyuk, 2017: 14]. The literature has repeatedly suggested its formation on the basis of the Barkhatovo Culture. The settlement sites of Zavodoukovskoye-9 and Uk 3 can be attributed to the transitional Barkhatovo-Baitovo complexes [Matveev, Anosko, 2009: 341–342]. The pottery complex, identified in the materials of the Zavodoukovskoye-9 settlement, demonstrates the tendency towards the more poor and simple ornamental scheme of the Barkhatovo Culture, and shows the features characteristic to the pottery traditions of the Baitovo Culture: reduction of the proportion of carved ornaments (up to 48%), increase in number of notches (up to 45.2%) and elements made by a combed stamp (up to 5.5%). The provisional dating of this complex is 8th c. BC.

In the lower Tobol River region, which was the northern area of distribution of the Barkhatovo Culture, Gamayun and Itkul (Iset) groups appear in the 9th–8th c. BC. Further

development of the Itkul (Iset) Culture in the Tobol region occurred in the way of fading of its northern and Ural components and more powerful influence of the local traditions, already formed in the Late Bronze Age. This trend is reflected in the materials of the Vak-Kur stage of the Itkul (Iset) Culture (Vak-Kur-2, Karaulniy Yar-4, Yurtobor-6 and others [Zimina, Zakh, 2009]), dated to the 6th c. BC. From approximately the 5th c. BC, in the sub-taiga zone of the Tobol River region, in the area of the eastern variant of the Itkul Culture, sites with the so-called "forest Baitovo" ceramics spread, namely Kalachik-1, Yurtobor-3, 20, Cheganovo-1–4 [Zimina, Tsembalyuk, 2012: 35]. In general, the periodization of the eastern variant of the Culture reflects the dynamics of the Itkul (Iset) cultural stereotype, its gradual transformation and its replacement by the Baitovo [Zimina, Zakh, 2009: 213, Fig. 111].

Conclusions

The qualitative and quantitative data show rather dynamic transformational processes at the turn of the Bronze and Early Iron Ages, and confirm the minor presence of the taiga migrants — representative of ceramic traditions with crossed ornamentation — in the area of the Barkhatovo Culture in the forest-steppe of the Tobol River region. The chronological hiatus of the 8th and 7th c. BC is also filled by the presence of migrants, but from the eastern slopes of the Urals, who experienced the influence of the taiga cultures — the representatives of the Itkul (Iset) Culture. They shared the space of the forest-steppe — the sub-taiga zones of the Tobol River region — with the "Baitovo" communities: the Itkul dominated in the interfluve of the Tura and Pyshma Rivers (left tributaries of the Tobol River, sub-taiga), the Baitovo — in the interfluve of the Iset and Tobol Rivers (forest-steppe). In the 6th c. BC, the foreign traditions become obsolete, and a complete substitution by the local "standard" — the Baitovo — occurs for a short time before the spread of the Sargat-Gorokhov influence in the area in the 5th c. BC.

REFERENCES

Abramova M. B., Stefanov V. I. Krasnoozerskaya kul'tura na Irtyshe [Krasnoozerskaya Culture on the Irtysh]. Arheologicheskie issledovaniya v rajone novostroek Sibiri [Archaeological Research in the Area of New Buildings in Siberia]. Novosibirsk : Nauka, 1985. Pp. 103–130. *(In Russ.)*

Bel'tikova G. V. Sreda formirovaniya i pamyatniki Zaural'skogo (itkul'skogo) ochaga metallurgii [The Environment of Formation and Sites of the Trans-Ural (Itkul) Center of Metallurgy]. Arheologiia Urala i Zapadnoj Sibiri [Archaeology of the Urals and Western Siberia]. Ekaterinburg : Izd-vo Ural. un-ta, 2005. Pp. 162–186. *(In Russ.)*

Berlina S. V., Zimina O. Yu. Domostroitel'stvo naseleniya itkul'skoj kul'tury v podtaezhnom — lesostepnom Zaural'e [House-building of the Population of the Itkul Culture in the Subtaiga — Forest-Steppe Trans-Urals]. Vestnik arheologii, antropologii i etnografii [Bulletin of Archaeology, Anthropology and Ethnography]. 2020. №3. Pp. 61–73. *(In Russ.)*

Borzunov V. A. Zaural'e na rubezhe bronzovogo i zheleznogo vekov (gamayunskaya kul'tura) [Trans-Urals at the Turn of the Bronze and Iron Ages (Gamayun culture)]. Ekaterinburg : UrGU, 1992. 189 p. *(In Russ.)*

Borzunov V. A. O kul'turnoj prinadlezhnosti itkul'skih i gamayuno-itkul'skih drevnostey Zaural'ia [About the Cultural Affiliation of the Itkul and Gamayun-Itkul Antiquities of

the Trans-Urals]. Rossijskaya arheologiya [Russian Archaeology]. 2019. №3. Pp. 131–146. *(In Russ.)*

Chemyakin Yu. P., Karacharov K. G. Drevnyaya istoriya Surgutskogo Priob'ya [The Ancient History of the Surgut Ob Region]. Ocherki istorii tradicionnogo zemlepol'zovaniya hantov (materialy k atlasu) [Essays on the History of Traditional Land Use of the Khanty (materials for the atlas)]. Ekaterinburg : Tezis, 2002. 224 p. *(In Russ.)*

Epimakhov A. V., Epimakhova M. G. Miasskoe gorodishche: k voprosu o iuzhnoj granice barhatovskih i gamayunskih drevnostej [Miass Settlement: on the Question of the Southern Border of Barkhatovo and Gamayun Antiquities]. Etnicheskie vzaimodejstviya na Iuzhnom Urale [Ethnic Interactions in the South Urals]. Chelyabinsk : Izd-vo YuUrGU, 2009. Pp. 66–70. *(In Russ.)*

Korochkova O. N. Predtaezhnoe i yuzhnotaezhnoe Tobolo-Irtysh'e v epohu pozdnej bronzy: Avtoreferat dissertacii kandidata istoricheskih nauk [Tobol-Irtysh Pre- Taiga and Southern Taiga in the Late Bronze Age: Abstract of the Dissertation of the Candidate of Historical Sciences]. Leningrad : LOIA AN SSSR, 1987. 27 p. *(In Russ.)*

Kosarev M. F. Zapadnaya Sibir' v drevnosti [Western Siberia in Ancient Times]. Moskva : Nauka, 1984. 248 p. *(In Russ.)*

Matveev A. V., Anoshko O. M. Zaural'e posle andronovcev: Barhatovskaya kul'tura [Trans-Urals after the Andronovites: Barkhatovo Culture]. Tiumen' : Tiumenskii dom pechati, 2009. 416 p. *(In Russ.)*

Matveeva N. P., Tsembalyuk S. I. Novyj pamyatnik baitovskoj kul'tury [A New Site of the Baitovo Culture]. Kompleksnye issledovaniya drevnih i tradicionnyh obshchestv Evrazii [Comprehensive Studies of Ancient and Traditional Societies of Eurasia]. Barnaul : Izd-vo Alt. un-ta, 2004. Pp. 230–235. *(In Russ.)*

Obydennov M. F. U istokov ural'skih narodov: ekonomika, kul'tura, iskusstvo, etnogenez [At the Origins of the Ural Peoples: Economy, Culture, Art, Ethnogenesis]. Ufa : Vost. un-t, 1997. 202 p. (*In Russ.)*

Obydennov M. F., Shorin A. F. Arheologicheskie kul'tury bronzovogo veka drevnih ugrov (cherkaskul'skaya i mezhovskaya kul'tury) [Archaeological Cultures of the Bronze Age of the Ancient Ugrians (Cherkaskul and Mezhovskaya cultures)]. Ekaterinburg : Izd-vo Ural. un-ta, 1995. 196 p. *(In Russ.)*

Petrin V. T., Nokhrina T. I., Shorin A. F. Arheologicheskie pamyatniki Argazinskogo vodohranilishcha (epohi kamnya i bronzy) [Archaeological Sites of the Argazinsky Reservoir (Stone and Bronze Age)]. Novosibirsk : Nauka, 1993. 212 p. *(In Russ.)*

Petrova L. Yu. Novye mezhovskie kompleksy Iuzhnogo Zaural'ya [New Mezhovka Complexes of the South Trans-Urals]. XXI Ural'skoe arheologicheskoe soveshchanie [XXI Ural Archaeological Meeting]. Samara : Samarskij gosudarstvennyj social'no-pedagogicheskij un-t, 2018. Pp. 153–155. *(In Russ.)*

Shorin A. F. O roli mezhovskoj kul'tury Srednego Zaural'ya v formirovanii ural'skih kul'tur rannego zheleznogo veka [On the Role of the Mezhovskaya Culture of the Middle Trans-Urals in the Formation of the Ural Cultures of the Early Iron Age]. Aktual'nye problemy drevnei istorii i arheologii Iuzhnogo Urala [Actual Problems of Ancient History and Archaeology of the Southern Urals]. Ufa : Vostochnyj universitet, 1996. Pp. 20–32. (*In Russ.)*

Stokolos V. S. Kul'tura naseleniya bronzovogo veka Iuzhnogo Zaural'ya (hronologiya i periodizaciya) [The Culture of the Population of the Bronze Age of the Southern Trans-Urals (chronology and periodization)]. Moskva : Nauka, 1972. 168 p. *(In Russ.)*

Stoyanov V. E. Klassifikaciya i periodizaciya zapadnosibirskih lesostepnyh pamyatnikov rannego zheleznogo veka [Classification and Periodization of West Siberian Forest-Steppe Sites of the Early Iron Age]. Problemy hronologii i kul'turnoj prinadlezhnosti arheologicheskih pamyatnikov Zapadnoj Sibiri [Problems of Chronology and Cultural Affiliation of Archaeological Sites in Western Siberia]. Tomsk : Tomsk. un-t, 1970. Pp. 238–253. *(In Russ.)*

Tsembalyuk S. I. Harakteristika poselenij i zhilishch baitovskoj kul'tury [Characteristics of Settlements and Dwellings of the Baitovo Culture]. Vestnik arheologii, antropologii i etnografii [Bulletin of Archaeology, Anthropology and Ethnography]. 2009. №10. Pp. 57–65. *(In Russ.)*

Tsembalyuk S. I., Ilyushina V. V., Ryabogina N. E., Ivanov S. N. Kompleksnoe issledovanie baitovskogo gorodishcha Borovushka 2 (lesostepnoe Pritobol'e) [Comprehensive Study of the Baitovo Settlement Borovushka 2 (the forest-steppe of the Tobol River region)]. Vestnik arheologii, antropologii i etnografii [Bulletin of Archaeology, Anthropology and Ethnography]. 2011. №2(15). Pp. 103–113 (*In Russ.*).

Tsembalyuk S. I. Baitovskaya kul'tura nachala rannego zheleznogo veka v lesostepnom i podtaezhnom Pritobol'e [The Baitovo Culture of the Beginning of the Early Iron Age in the Forest-Steppe and Subtaiga Tobol Region]: Avtoreferat dissertacii kandidata istoricheskih nauk [Synopsis of the Dissertation of the Candidate of Historical Sciences]. Tyumen' : IPOS SO RAN, 2017. 21 p. *(In Russ.)*

Zakh V. A. K voprosu formirovaniya baitovskih kompleksov v Pritobol'e [On the Issue of the Formation of Baitovo Complexes in the Tobol Region]. Vestnik arheologii, antropologii i etnografii [Bulletin of Archaeology, Anthropology and Ethnography]. 2007. №8. Pp. 55–63. *(In Russ.)*

Zimina O. Yu. Itkul'skaya kul'tura v Nizhnem Pritobol'e (vostochnyj lokal'nyj variant) [Itkul Culture in the Lower Tobol Region (eastern local version)]: Avtoreferat dissertacii kandidata istoricheskih nauk [Synopsis of the Dissertation of the Candidate of Historical Sciences]. Tyumen' : IPOS SO RAN, 2006. 23 p. *(In Russ.)*

Zimina O. Yu., Ilyushina V. V. Ukreplennye poseleniya s krugovoj planirovkoj itkul'skoj kul'tury v lesostepnom Zaural'e [Fortified Settlements with a Circular Layout of the Itkul Culture in the Forest-Steppe Trans-Urals]. Arheologiya Srednego Pritobol'ya i sopredel'nyh territorij [Archaeology of the Middle Tobol Region and Adjacent territories]. Kurgan : Izd-vo Kurganskogo un-ta, 2016. Pp. 29–39. *(In Russ.)*

Zimina O. Yu., Kostomarov V. M., Tsembalyuk S. I. Paleoekonomika naseleniya Tobolo-Ishim'ya na rubezhe bronzovogo i zheleznogo vekov [Paleoeconomics of the Tobolo-Ishimya Population at the Turn of the Bronze and Iron Ages]. Vestnik arheologii, antropologii i etnografii [Bulletin of Archaeology, Anthropology and Ethnography]. 2012. №3 (18). Pp. 73–81. (In Russ.)

Zimina O. Yu., Tsembalyuk S. I. Pamyatniki baitovskoj kul'tury podtaezhnoj zony Pritobol'ya [Sites of the Baitovo Culture of the Subtaiga Zone of the Tobol Region]. AB ORIGINE. Tyumen' : Izd-vo TyumGU, 2012. Issue 4. Pp. 22–37. *(In Russ.)*

Zimina O. Yu., Zakh V. A. Nizhnee Pritobol'e na rubezhe bronzovogo i zheleznogo vekov [The Lower Tobol Region at the Turn of the Bronze and Iron Ages]. Novosibirsk : Nauka, 2009. 232 p. *(In Russ.)*

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Абрамова М. Б., Стефанов В. И. Красноозерская культура на Иртыше // Археологические исследования в районе новостроек Сибири. Новосибирск : Наука, 1985. С. 103–130.

Бельтикова Г. В. Среда формирования и памятники Зауральского (иткульского) очага металлургии // Археология Урала и Западной Сибири. Екатеринбург : Изд-во Урал. ун-та, 2005. С. 162–186.

Берлина С. В., Зимина О. Ю. Домостроительство населения иткульской культуры в подтаежном — лесостепном Зауралье // Вестник археологии, антропологии и этнографии. 2020. № 3. С. 61–73.

Борзунов В. А. Зауралье на рубеже бронзового и железного веков (гамаюнская культура). Екатеринбург : УрГУ, 1992. 189 с.

Борзунов В. А. О культурной принадлежности иткульских и гамаюно-иткульских древностей Зауралья // Российская археология. 2019. № 3. С. 131–146.

Епимахов А. В., Епимахова М. Г. Миасское городище: к вопросу о южной границе бархатовских и гамаюнских древностей // Этнические взаимодействия на Южном Урале. Челябинск : Изд-во ЮУрГУ, 2009. С. 66–70.

Зах В. А. К вопросу формирования баитовских комплексов в Притоболье // Вестник археологии, антропологии и этнографии. 2007. № 8. С. 55–63.

Зимина О. Ю. Иткульская культура в Нижнем Притоболье (восточный локальный вариант): автореф. дис. … канд. ист. наук. Тюмень : ИПОС СО РАН, 2006. 23 с.

Зимина О. Ю., Зах В. А. Нижнее Притоболье на рубеже бронзового и железного веков. Новосибирск : Наука, 2009. 232 с.

Зимина О. Ю., Костомаров В. М., Цембалюк С. И. Палеоэкономика населения Тоболо-Ишимья на рубеже бронзового и железного веков // Вестник археологии, антропологии и этнографии. 2012. № 3(18). С. 73— 81.

Зимина О. Ю., Илюшина В. В. Укрепленные поселения с круговой планировкой иткульской культуры в лесостепном Зауралье // Археология Среднего Притоболья и сопредельных территорий. Курган : Изд-во Курганского ун-та, 2016. С. 29–39.

Зимина О. Ю., Цембалюк С. И. Памятники баитовской культуры подтаежной зоны Притоболья // AB ORIGINE. Тюмень : Изд-во ТюмГУ, 2012. Вып. 4. С. 22–37.

Корочкова О. Н. Предтаежное и южнотаежное Тоболо-Иртышье в эпоху поздней бронзы : автореф. дис… канд. ист. наук. Л. : ЛОИА АН СССР, 1987. 27 с.

Косарев М. Ф. Западная Сибирь в древности. М. : Наука, 1984. 248 с.

Матвеев А. В., Аношко О. М. Зауралье после андроновцев: Бархатовская культура. Тюмень : Тюменский дом печати, 2009. 416 с.

Матвеева Н. П., Цембалюк С. И. Новый памятник баитовской культуры // Комплексные исследования древних и традиционных обществ Евразии. Барнаул : Изд-во Алт. ун-та, 2004. С. 230–235.

Обыденнов М. Ф. У истоков уральских народов: экономика, культура, искусство, этногенез. Уфа : Вост. ун-т, 1997. 202 с.

Обыденнов М. Ф., Шорин А. Ф. Археологические культуры бронзового века древних угров (черкаскульская и межовская культуры). Екатеринбург : Изд-во Урал. ун-та, 1995. 196 с.

Петрин В. Т., Нохрина Т. И., Шорин А. Ф. Археологические памятники Аргазинского водохранилища (эпохи камня и бронзы). Новосибирск : Наука, 1993. 212 с.

Петрова Л. Ю. Новые межовские комплексы Южного Зауралья // XXI Уральское археологическое совещание. Самара : Самарский государственный социально-педагогический ун-т, 2018. С. 153–155.

Стоколос В. С. Культура населения бронзового века Южного Зауралья (хронология и периодизация). М. : Наука, 1972. 168 с.

Стоянов В. Е. Классификация и периодизация западносибирских лесостепных памятников раннего железного века // Проблемы хронологии и культурной принадлежности археологических памятников Западной Сибири. Томск : Томск. ун-т, 1970. С. 238–253.

Цембалюк С. И. Характеристика поселений и жилищ баитовской культуры // Вестник археологии, антропологии и этнографии. 2009. № 10. С. 57–65.

Цембалюк С. И. Баитовская культура начала раннего железного века в лесостепном и подтаежном Притоболье : автореф. дис. … канд. ист. наук. Тюмень : ИПОС СО РАН, 2017. 21 с.

Цембалюк С. И., Илюшина В. В., Рябогина Н. Е., Иванов С. Н. Комплексное исследование баитовского городища Боровушка 2 (лесостепное Притоболье) // Вестник археологии, антропологии и этнографии. 2011. № 2(15). С. 103–113.

Чемякин Ю. П., Карачаров К. Г. Древняя история Сургутского Приобья // Очерки истории традиционного землепользования хантов (материалы к атласу). Екатеринбург : Тезис, 2002. 224 с.

Шорин А. Ф. О роли межовской культуры Среднего Зауралья в формировании уральских культур раннего железного века // Актуальные проблемы древней истории и археологии Южного Урала. Уфа : Восточный университет, 1996. С. 20–32.

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SINTASHTA AS A CULTURAL AND HISTORICAL PHENOMENON OF THE BRONZE AGE

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Abstract: The Sintashta culture is the most controversial ethno-cultural formation of the Bronze Age, formed in the Ural-Kazakhstan steppes. It appears suddenly and is located on the territory of the Southern Trans-Urals. Fortified settlements and burial grounds of this culture spread in a wide strip along the eastern slopes of the Ural Range. The specificity of fortified urban-type settlements, uncharacteristic for the steppe zone of Eurasia, allowed researchers to conclude that they were imported from other regions where they had been originally developed and canonized. In this regard, the most probable is the gradual migration of the population from the territory of Asia Minor, the architectural and planning standards of which demonstrate features of detailed similarity. The alleged migration took place through the Trans-Asian corridor connecting the Middle East and Central Asia to South Kazakhstan, from where paramilitary groups appear in the South Trans-Urals and create the Sintashta culture. Fortified settlements are accompanied by the appearance of burials with chariot attributes, presented in the form of an already established complex of objects and technologies. In archaeological sources, the chariot complex is represented by the remains of chariots, skeletons of draft horses, cheekpieces, as well as weapons of distance and close combat. In the steppes of Eurasia, the war chariot becomes the most formidable and powerful weapon of the Bronze Age.

Keywords: Sintashta, migration, chariot, Southern Trans-Urals, Middle East

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СИНТАШТА КАК КУЛЬТУРНО-ИСТОРИЧЕСКИЙ ФЕНОМЕН БРОНЗОВОГО ВЕКА

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Резюме: Синташтинская культура является одним из наиболее дискуссионных этнокультурных образований бронзового века, сформировавшимся в Урало-Казахстанских степях. Она появляется внезапно и локализуется на территории Южного Зауралья. Укрепленные поселения и могильники этой культуры распространяются широкой полосой вдоль восточных склонов Уральского хребта. Специфика укрепленных поселений городского типа, нехарактерных для степной полосы Евразии, позволила исследователям сделать выводы о том, что они импор-

тированы из других регионов, где были первоначально разработаны и канонизированы. В этом плане наиболее вероятной представляется поэтапная миграция населения с территории Малой Азии, архитектурно-планировочные стандарты которой демонстрируют черты детального сходства. Предполагаемая миграция проходила через трансазиатский коридор, соединяющий Ближний Восток и Центральную Азию, в Южный Казахстан, откуда военизированные группы проникают в Южное Зауралье и создают синташтинскую культуру. Укрепленные поселения сопровождаются появлением захоронений с колесничной атрибутикой, представленной в виде уже сложившегося комплекса предметов и технологий. В археологических источниках колесничный комплекс представлен остатками колесниц, костяками упряжных лошадей, псалиями, а также оружием дистанционного и ближнего боя. В степях Евразии боевая колесница становится наиболее грозным и мощным оружием бронзового века.

Ключевые слова: Синташта, миграция, колесница, Южное Зауралье, Ближний Восток

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Introduction

The brightest and the most mysterious phenomenon of the Ural-Kazakhstan steppes during the Bronze Age is the occurrence in the end of III thousand BC Sintashta culture which the first researchers immediately associated with the early Aryan ethnic group [Gening V.F., Zdanovich, Gening V.V., 1992: 9, 376]. It appears suddenly and is located in territory of Southern Zauralye. The strengthened settlements and burial grounds of this culture extend along the east slopes of the Ural ridge. Discovery of compactly grouped fortifications, more characteristic for the settled-agricultural centers of city type and their extremely militarized inhabitants who are absolutely beyond traditional representations about development of steppe cattle breeding cultures, became the big surprise for researchers.

Statement of a Question

Significant diversity of opinions on an origin Sintashta antiquities is caused both by eccentricity of the phenomenon, and an individual approach of the experts who are engaged in this problematics. Most researchers unequivocally point to the alien character of the Sintashta culture, which is not contradicted by paleoanthropological data [Kitov, 2011: 23–24]. A powerful foreign cultural impulse is recorded according to the multicomponent composition of culture-determining characters, where the Abashev, Late Catacomb, "Lot-of-rolls", Late Pit, Poltavka cultures as the initial ones. Participation of these cultures in formation of Sintashta type sites is marked almost by all researchers, with a difference only in preference of one or several of them [Vinogradov, 2011: 82; Gorbunov, 1992: 144; Epimahov, 2002: 72–73; Zdanovich G.B., Zdanovich D.G., 1995: 51; Kuz'mina, 2008: 191–192; 1992: 74–76; Otroshhenko, 2003: 75; Prjahin, 2003: 41; Tkachev, 2007: 310].

There is no consensus about the future of Sintashta culture. According to one hypothesis, it is assumed that at the final stage of the culture's existence, the population began to shift in a western direction; according to another, it dissolved among the local tribes, giving rise to

new cultural entities. According to the third point of view, the carriers of the Sintashta cultural traditions leave the territory of the Southern Trans-Urals to East Asia, and then to India [Vinogradov, 2011: 92–93; Zdanovich, 1995: 42].

Specificity of the strengthened settlements of city type, uncharacteristic for a steppe strip of Eurasia, has allowed researchers to draw conclusions that Sintashta architecturally-layout standards and building technics, including wide application of the clay, presented by shaft, ditches, features of the inhabited building subordinated planography of fortification constructions, have been imported from other regions with deep traditions of long settled way of life where they had been originally developed and canonized [Vinogradov, 2011: 31; 2007: 20; Grigor'ev, 2015: 110, 120, 130]. Hence, the so-called "the Country of cities" is some kind of "splinter" of a larger and developed civilization. In foreseeable territories of the west in Ural-Volga region, in the east to Ob-Irtysh interfluve, especially in the north of the taiga zone, mothing similar is observed. The unique direction where something similar took place, the type of sites of the Baktria-Margiana archaeological complex (BMAC), is recorded only in the south. Probably, the occurrence of a series of the strengthened settlements in Southern Zauralye and Northern Kazakhstan relates to moving of a considerable part of the militarized population with cattle breeding traditions, in the north in a forest-steppe border zone from the administrative-political and craft-economic centers of that time the located to the south [Kukushkin, 2011a: 105].

It is also necessary to notice that the strengthened settlements are accompanied by occurrence of burial places with the chariot attributes presented in the form of already developed complex of objects and technologies. In historical sense the chariot complex is a chariot harnessed with horses and a set of arms of the warrior-chariot. In archaeological sources it is presented by the rests of chariots, skeletons of team horses, cheek-pieces, and also the weapon of remote and near fight [Chechushkov, 2011: 58].

In the framework of the question under discussion, of special interest is the hypothesis about Asia Minorian origin of Sintashta culture where direct analogies to Sintashta architecturally-layout standards [Merpert, 1995: 116–117] have been noted. It allowed putting forward the assumption of migration of the solid and well organized militarized group from Anatolia through Caucasus, the Volga-Ural steppes with an exit to Southern Zauralye. Prompt migration could be caused by the internal social and economic reasons and foreign policy factors [Grigor'ev, 2015: 110, 120, 438]. This hypothesis has not received wide recognition. Well-founded objections were caused by huge extent of the passed route, considerable complexities of such distant transition, necessity of numerous change of a direction, moving to the alien and severe nature-climatic environment, and a number of other serious reasons making such migration a difficult enterprise. However, the fact of sudden occurrence of Sintashta type sites in Southern Zauralye needs the logical explanation and cannot be limited to the general reasoning about "the Volga-Ural culture-genesis center" [Tkachev, 2007: 260; Bochkarev, 2010: 52], which has already been considered [Grigor'ev, 2010: 40; Prjahin, 1995: 156] or on evolutionary self-development of local Late Chalcolithic or Early Bronze Age cultures [Zdanovich G.B., Zdanovich D.G., 1995: 51; Kalieva, Logvin, 1997: 159–161], obviously not ready to such sharp transformation, even from certain western impulses.

If despite everything we can accept Anatolian antiquities for a basis of primary signs of formation of future Sintashta sites between which lines of detailed similarity are observed [Grigor'ev, 2015: 44; Krizhevskaja, 1993], it is possible to admit that prospective migration nevertheless took place, but was not expressed-rectilinear. It could pass stage by stage and on more southern latitudes through Transcaucasia, Northern Iran and the Central Asian Entre Rios. It is proved that almost similar way was chosen by the population which has created the Baktria-Margiana civilization in territory of Central Asia, having migrated from areas of northern Mesopotamia [Sarianidi, 2001: 11]. Anatolian migrants should obtain preliminary data on the territory with similar environmental conditions for which their cultural-economic type has been adapted. It excludes purposeful transition in an alien landscape-geographical zone with a severe sharply continental climate. Similar with the Asia Minorian one, nature-climatic environment is marked in Central Asia oases. However, if we consider that in this territory Baktria-Margiana archaeological complex (BMAC) sites were situated, it is necessary to consider another nearby region which is out of the zone of BMAC influence. As required region Southern Kazakhstan having favorable nature-climatic characteristics could be: the branched out hydro-network with large forests in foothills of Karatau [Bajtanaev, 2010: 33], with hot summer and soft winter, that is with conditions optimum suitable for irrigation agriculture and cattle breeding activity.

Discussion

These assumptions are based on the factual material, according to which, in the era of the paleo metal, all the regions convenient for managing a complex production enterprise of the ancient oriental type had been already fully mastered. The exception is the north-eastern outskirts of the traditional settled agricultural world — South Kazakhstan, where the traditional sites which were characteristic of the early stages of urbanization have not yet been discovered. It is not excluded that the trans-Asiatic corridor connecting the Near East and the Central Asia, remained opened and functioned for a long time. Not only migration flows could move along it, but also the accompanying things, ideas, technologies, innovative developments affecting, first of all, the military sphere.

Probably, the development of Southern Kazakhstan by migrants began in last centuries of the 3rd thousand BC, simultaneously with closely related population BMAC occupying territory of Central Asia and Northern Afghanistan which may be reflected in certain elements of material and spiritual culture. Judging by a long history of development of wheel transport in the regions of Western Asia [Novozhenov, 2012: 123–130, 185–192], it is assumed immigrants already owned skills of rung wheels manufacturing and, probably, limited quantity of the tamed horses. It is significant that the first mention of the horse in the Near-Asian written sources dates back to the end of the 3rd millennium BC [Kuz'mina, 2010a: 71]. Indirect acknowledgement are finds of individual skeletons of horses and their images recorded in Baktria-Margiana sites [Sarianidi, 2001: 41–42; Sataev, 2008: 139; Shhetenko, 2008: 232]. However, in the burial complexes of the BMAK, the wheeled transport itself is so far represented only by finds of heavy composite wheels, sawn along circular markings from several boards joined together [Sarianidi, 2006: 160, 177, 179]. The already well-known burial of Zardch Khalifa, accidentally discovered near the city of Penjikent in Tajikistan, may become one of the markers of Anatolian migration. In the burial at a depth of 3.5 m, a knife, a dagger,

metal and ceramic dishes were found, including those with an oblique at the bottom, typical for BMAC, a pin with a picture of a horse, as well as two bridle sets indicating a pair of harness [Bobomulloev, 1999: 309].

Each of the sets consisted of two horny disc-shaped cheekpieces with thorns, similar to the Sintashta specimens, and one-piece bronze bit, unambiguously indicating a Middle Eastern impulse.

For example, analogies to one-piece bits combined with crampon round procarved cheekpieces made of bronze are known in Ugarit, Gaza, Palestine [Potratz, 1966: 103–116, taf. 106–109, 115] in Tel-Amarna, Tel-al-Adjul [Muller-Karpe, 1980, taf. 37, 115].

Ringed single-piece bits, similar in shape, were also found at settlement 9 in Kairak-Kum [Litvinskij, Okladnikov, Ranov, 1962: Tab. 8.-1], while the study of the temple part of the Dzharkutan settlement and the burial in the old river Sazagansai revealed characteristic disc-shaped cheekpieces made of a horn with monolithic spikes and rollers around the bit holes [Huff, Shajdullaev, 1999: 25; Avanesova, 2002: 20–21]. At present, on the territory of Central Asia, seven ancient cheekpieces of this type are known, associated by their origin with the Zaravshan and Amudarya oases.

It is assumed that they are based on the Persian samples [Avanesova, 2005: 11, 12]. Their archaism is also indicated by the absence of a bar that appears later.

Apparently, metal single-piece ringed bits with studded cheekpieces adapted to control donkeys were not suitable for full-fledged control of horses that required tighter control. The static rod bit, when the reins were pulled, rested against the insensitive teeth of the animals and did not give the desired effect, especially if two horses were harnessed to the cart at once, which required significant physical efforts of the charioteer.

It seems that the rejection of the metal elements of the headband and the transition in the future to the use of horn cheekpieces and leather bits is also associated with their greater practicality and less trauma for poorly trained semi-wild horses, which was provoked by a high speed of movement, the need for sharp turns and stops. The rounded central holes on the cheekpiece shields suggest a bit rounded in cross section, tightly woven from thin rawhide leather straps, similar in manufacture to modern stone whip or worked by bending the outer ends of the belt to the middle and longitudinal sewing of the edges with tendon threads, in which the belt acquired a rounded section .To give greater strength, a leather rod could be additionally inserted into the inner part. This technology of stitching, necessary to strengthen the horse's headband belts, was later noted among the early nomads [Shul'ga, 2016: 96].

For rectangular holes, apparently, strong belts made of thick leather or narrow leather straps stitched together in several layers, forming a rectangle in cross-section, could have been used, although a similar shape could have been obtained using weaving. It is characteristic that the tradition of making a woven leather bridle survives to ethnographic modernity and was known, for example, among the Kazakhs.

Obviously, unlike rod-shaped one-piece metal bits, elastic and rather rigid leather bits, possibly with an interception or even a looped connection in the central part, when pulling the reins (braking), bent and pressed more strongly with the edges on the horse's sensitive lips, the process partially included and cheekpieces spikes, which in general contributed to better

crew control. The principle of operation of such bits later formed the basis for the transition to two-part metal bits, which act in a similar way and make it possible to do without studded cheekpieces.

This may be indicated by the finds of the skulls of chariot horses, bridled with cast two-piece bits with disc-shaped slotted cheekpieces in the Lchashensky mounds of the South Caucasus, dating from the middle of the 2nd millennium BC. The materials of the site testify to a significant expansion of the area of distribution of the chariot traditions of the Ancient [Mnacakanjan, 1961: 71, Fig. 25.-4–6; Pogrebova, 2014: 420].

It was found that a belt headband with metal crampon cheekpieces and fixed single-piece ringed bits was originally tested on donkeys [Kuz'mina, 2010a: 71]. The next logical step was the use of horses as a traction force for horse-drawn transport, as they are stronger and more frisky animals. Most likely, the natural shortness of tamed horses, with parameters not much different, for example, from large Syrian donkeys, ensured the success of these domestication experiments, which were carried out for a long time with equids in the territory of Western Asia [Kuz'mina, 2010б: 8–11].

It is no coincidence that Middle Eastern sources call horses "donkeys of the mountains", which indirectly indicates the original habitat of the ancestral species.

The compact constitution of domestic horses is confirmed by paleozoological definitions of the osteological material of Sintashta settlements and burial grounds [Gajduchenko, 2002, Tab. 4; Kosincev, 2010: 30–31, Tab. 3]. Their size is well illustrated in the rock carvings, where at a realistic scale of the depictions of chariots and horses harnessed to them, the latter look clearly short. For example, camels harnessed to a cart, as a rule, are depicted much larger than the wheeled transport itself.

It is believed that the tarpan, which is widespread in the steppe zone of Eurasia, has become a wild horse species suitable for domestication. Its external appearance is usually associated with numerous images of horses, made in the so-called Seima-Turbino style, known in rock art, on the tops of cutting-piercing weapons and ornaments. The animals have a massive head with overhanging bangs, a characteristic erect mane, a well-defined belly, and relatively short legs. However, in petroglyphic drawings, these signs are often absent in horses harnessed to chariot carts [Slobodzjan, 2002: 117, Fig. 1.-1–10]. Chariot horses generally have slightly different morphological characters, which suggests at an early stage the use of other ancestral forms in the process of domestication. Further domestication experiments, probably involving local species of wild horses in them, eventually made it possible to obtain sufficiently large herds of domesticated horses and begin the mass production of an innovative vehicle, where horses were used as a draft force in a spoke two-wheeled carriage. Moreover, individuals with the necessary characteristics were purposefully selected, which were then taught the necessary skills according to the system of special training [Kosincev, 2010: 32].

It is possible that these processes proceeded in parallel to each other. It is indicative that only on the eastern slopes of the Karatau Mountains of South Kazakhstan were recorded about fifty locations of petroglyphs with chariot themes [Kadyrbaev, Mar'jashev, 2007: 44], which in a number of cases show images of the chariot warriors themselves, shooting from a bow or harnessing horses. Probably, the initial phase of the operation of single chariots was closely related to herding and hunting functions, which created the necessary conditions for

identifying and eliminating defects, improving the quality characteristics of a new vehicle. For example, in the Central Asian urban centers, with the dominant role of agriculture in the economic sector, cattle breeding and hunting were of no small importance. This is confirmed by the osteological collections of the Sapallitepa and Dzharkutan settlements, where the bones of domestic animals accounted for 70% and 90%, and of the wild fauna, 30% and 10%, respectively. The inhabitants of the settlements bred large and small cattle, camels, donkeys, pigs, dogs. The bones of a horse were also recorded in the materials of Jarkutan. The objects of the hunt were kulan, gazelle, deer, wild boar, wolf, etc. [Avanesova, 2005: 21].

The increase in the "wheel park" was a kind of impetus for the first military experiments. The combat use of chariots, apparently, began with attacks on small Late Neolithic hunting communities widely spread across the steppe territory of Kazakhstan, with which conflict situations could periodically arise. This, for example, can be evidenced by the emergence of a whole series of fortified settlements explored on the cliffs of the Ustyurt plateau. Obviously, the construction of stone defenses reflects the real threat of total extermination faced by the local population. Teams of hunters, psychologically suppressed by the very sight of racing chariots, simply did not have the opportunity to counteract the attack of chariots in open areas, and they themselves became easy prey for the attackers. The only salvation was only the stone walls of the settlements, which were located on high and steep outliers. The materials of the studied sites record traces of fires in dwellings and the presence of numerous flint arrowheads [Samashev, Loshakova, 2011: 349–350, Fig. 1.-1–10], some of which may well be attributed to the Sintashta arsenal. Interesting are the finds of two Peter-type cheekpieces at the fortified settlement Toksanbay, the lower layers of which, according to calibrated radiocarbon dates, date back to the 22nd — 21st centuries. BC NS [Samashev, Ermolaeva, Loshakova, 2007: 88, 91]. The reasons for the appearance of cheekpieces in a settlement can be very different, but in no way connected with the local chariot tradition, since it never existed among the population with an appropriating economic and cultural type of economy. At the same time, cheekpieces were kept in the altar of the sacred room, acting as a relic or even an object of worship, symbolizing the chariot attributes of a new formidable deity.

Finally, the number of war chariots reaches the required number to become the most advanced weapon of its time, which made it possible to move from the practice of episodic predatory raids to the conduct of much larger and more promising military enterprises. This is how a truly war chariot was created, which in the steppes of Eurasia became the most formidable and powerful weapon of the Bronze Age. The emerging monopoly on the priority possession of the fastest and most maneuverable wheeled vehicles, incredibly increasing combat power and significantly expanding military horizons, led to the militarization of society and an aggressive foreign policy, which resulted in long northern campaigns, recorded in the form of the Sintashta phenomenon. Obviously, they were carried out under a clear centralized leadership, as may be indicated by the burial of one of the high-status leaders, for whom the Great Sintashta burial mound was built, many times exceeding all other known Sintashta burials in terms of volume of work [Abaev, 1972: 342–374].

Sintashtians appear in Southern Zauralye on the easy two-wheeled carts having rung wheels, the developed complete set belt bridle with crampon cheek-pieces and horses as draught animals — differently on already invented fighting chariots with a characteristic set

of various arms. However, they brought with them not only versatile military experience, but also professional skills in the field of architectural and construction works characteristic of the population of ancient urban centers.Most likely, the penetration of the Sintashta people into the Southern Trans-Urals cannot be called migration in the full sense of the word.

First, the distribution vector of Sintashta fortified settlements is clearly expressed, directed in a rather wide strip from south to north, along the eastern slopes of the Ural Mountains, indirectly indicating the opposite southern sources of this impulse.

Secondly, such a localization of monumental "military bases" or "forts" with regular standardized residential buildings of a virtual barracks type, as well as the militarized appearance of their inhabitants, strongly resemble the well-known tactics of conquering and gradual colonization of new territories. It is curious that this direction corresponds to one of the famous medieval routes of the Great Silk Road, which began in China, went through East Turkestan, Semirechye, South Kazakhstan and further along the Syr Darya in the Aral Sea region with access to the South Urals [Bajpakov, Vojakin, Usmanova, 2012: 40].

However, it is assumed that the earliest routes of the future Silk Road, connecting the south and north, were laid as early as the beginning of the 2nd millennium BC. [Kuz'mina, 2010a: 69].

The presence of connections with the southern territories is also confirmed by the few bones of camels noted in the osteological collections of fortified settlements (Arkaim, Alandskoe). Apparently, their findings are associated with the episodic death or slaughter of caravan individuals [Gajduchenko, 2010: 107].

Later, from these "military bases" campaigns were made to the east, in the Tobol region and, to a large extent, to the west, in the Middle Volga region.

The configuration of the Sintashta fortified settlements indicates repeated military expeditions stretching over time.

Sometimes they block each other, specifying in chronological sequence of their construction [Zdanovich G. B., Zdanovich D. G., 1995: 50].

Apparently, chronological differences reflect the dynamics of military engineering concepts associated with changes in architectural and planning decisions during the construction of fortifications that took place in the metropolis itself.

It is indicative that the distribution of fortified Sintashta settlements is increasing from earlier to relatively later in a ratio of 7–9–12 [Zdanovich, Batanina, 2007]. The short-term exploitation of fortified settlement camps is indicated by a thin and poor cultural layer with few osteological and ceramic collections, as well as small necropolises located near settlements, incomparable with the estimated number of inhabitants of residential buildings [Vinogradov, 2011: 88; Epimahov, 2005: 167] which according to various estimates for individual settlements could reach from 1000–1800 to 3500–4000 people [Grigor'ev, 2015: 132, 133]. Leaving the fortified settlements, their inhabitants preliminarily destroyed and set fire to residential and household buildings, which is documented by traces of fires in the absence of signs of military clashes [Maljutina, 1999: 119].]. For example, according to A. V. Epimakhova, at least 1000 people lived in the fortified settlement of Olgino (Kamenny Ambar). It is assumed that the village functioned for 50–60 years and with a natural decline in the population, the sample at the disposal of the researchers would be at least 1000 deaths [Zdanovich G. B., Zdanovich D. G., 1995: 167], that is, about 20 people died a year, including children. However, in the study of

3 kurgans of the "suburban" burial ground Kamenny Ambar 5, about 100 burials were revealed, although with a complete study of the sites, which consisted of 6 kurgans, the number of buried people may increase to 200 individuals [Zdanovich G. B., Zdanovich D. G., 1995: 149].

According to the researcher, Kamenny Ambar 5 is an elite necropolis in which only the burials of persons with a high social status or those close to this privileged layer were carried out, while the rest of the predominant part of the population was buried by some other archaeologically unrecognizable means [Zdanovich G. B., Zdanovich D. G., 1995: 167–168]. It is hardly possible to agree with the proposed selective selection, since such groups are not distinguished at the burial ground by age or gender characteristics. Consequently, even according to the most optimistic forecasts, the settlement existed within 10 years, which was directly reflected in the quantitative composition of those buried in the necropolis, which, in fact, became a kind of chronometer that determines the life of this settlement. Obviously, this pattern also applies to other Sintashta sites. Paleoanthropological data indicate a pronounced heterogeneity of the Sintashta society and clearly distinguish the numerically dominant male population from the female population [Kitov, 2011: 23, 24; Hohlov, 2010: 146].]. According to paleoanthropological definitions, the male series of skulls belong to the steppe Caucasian type, while the female ones, in turn, have local autochthonous uraloid characteristics.

Such contrasting craniological differences indicate the mechanical mixing and origin of male populations and the female part of the population not only from an alien ethnocultural environment, but also from different natural landscape zones [Kitov, 2011: 19, 23–24; Hohlov, 2010: 114].

The newcomers initially consisted of male groups, not burdened by the rest of society, so the mixing of a heterogeneous population could hardly happen peacefully and deliberately. This could happen only due to the physical and social superiority of the male anthropological component [Hohlov, 2010: 129].

Taking into account the control of the Sintashta people over the vast territory of the Middle Volga region, the Urals and the Tobol region, carried out with the aim of compulsory withdrawal of livestock [Drevnjaja istorija…, 2000: 280] and, apparently, other products, it is assumed that the female part of the Sintashta enclave was formed in a similar way. A significant variety of ceramic collections, on which the system of culture-defining features in the Bronze Age is based, captures a number of cultures participating in the formation of Sintashta-type monuments and, first of all, Abashevskaya [Tkachev, Havanskij, 2006: 122]. However, given that, as a rule, only women participated in ceramic production [Loman, 2003: 150], then this fact is a marker exclusively of certain cultures or ethnic groups to which women who made dishes belonged. Thus, the formed female conglomerate, concretizing the direction of Sintashta contacts, accordingly reflected on the variety of ceramic collections, where the appearance of culture depended to a greater extent on the prevalence of the female population of a particular ethnocultural group, which brought its traditional features into the appearance of Sintashta (Potapov) ceramic ware. If we take the Abashev culture as a basis, the population of which is characterized by uraloid anthropological characteristics [Hohlov, 2010: 114], then, accordingly, the "Abashevo veil" or "Abashoid" of Sintashta ceramics gets its logical explanation. In this case, the identity of the male population remains outside the scope of cultural attribution, and the "native" ceramic complex could radically differ from the Sintashta one, both in form and in the

complete absence of ornamentation. It is possible that a small series of so-called proto-Fedor's dishes with a smooth profile and a base, which was recorded in elite burials, including in the Bolshoi Sintashta burial mound, may be close to it [Grigor'ev, 2015: 90]. A similar situation, apparently, is observed when trying to correlate the Seima-Turbino phenomenon with any specific cultural formation of the Bronze Age. Most likely, the nature of these phenomena has common roots, but so far lies beyond our knowledge. It seems that the Sintashta fortified settlements are evidence of quite real military expeditions organized with the aim of creating controlled territories for the development of the mineral and biological resources of the region, the subordination of the local population, necessary from the point of view of the socio-economic and military-political needs of society. After completing the assigned tasks, part of the paramilitary group returned, and another part of the "military settlers", entering into close contacts with the autochthonous population and spreading over the adjacent territory, later became the nucleus of new cultural formations. These processes are recorded due to the emergence of elite, often necropolis-forming structures of the post-Sintashta time in the form of early cut and early Alakul burial monuments, demonstrating elements of the chariot complex, the traditions of which survive to the classical alakul, which is recorded, for example, in the Maitan burial ground [Tkachev, 2014: 658].

Attention is drawn to the apparent "wastefulness" of the funeral rite, unknown neither before, nor after, nor outside the monuments of the Sintashta circle. The burial rite was accompanied by "magnificent" ceremonies, which involved placing "rich" implements and chariot paraphernalia in the burial chamber, as well as numerous sacrifices of domestic animals, which in material form optimally reflects the worldview of the Sintashta population about the afterlife. Obviously, when the deceased was sent off to the "last journey", the verbal part of the funeral rite contained traditional wishes, suggesting the possession of a victorious weapon, a fast chariot with frisky horses, "numerous cattle of different types" began to actually duplicate in kind, transferring in a number of cases a significant part of oral wishes from the virtual sphere to the material plane. Apparently, this is how the bright and distinctive tradition of Sintashta military burials, previously unknown in other regions of steppe Eurasia, developed. This could only be possible as a result of the presence of an excess of livestock and, probably, metal obtained through the forcible seizure from the controlled communities. Under other circumstances, in the burial practice of the population of the same metropolis, such hecatombs could simply be absent, like the general militaristic background of most burials, and ritual actions were limited to verbal formulations and the real possibilities of society itself. In the post-Sintashta period, due to the stabilization of the situation in the steppe, the hypertrophied forms of this tradition "die off" rather quickly and are never reanimated in the Bronze Age.

The absence of direct written sources of this period creates a simplified view of events of a military, political, social, economic nature that took place in the territory of Kazakhstan in the Bronze Age. These illusions are based on the specifics of "silent" archaeological material and significant difficulties in the reconstruction of regional historical processes of the Bronze Age.

Now the considerable periods of ancient history of Kazakhstan remain poorly understood, in particular, the Bronze Age of Southern Kazakhstan. This region is more presented by destroyed medieval settlements in the form of hundreds of large earthen hills of a various configuration.

Their parameters can be estimated in hundreds meters, and the height to exceed 20-meter mark [Svod pamjatnikov…, 1994]. It is not excluded that under thick medieval cultural layers more ancient layers disappear with which riddles of Sintashta and Sejma-Turbino cultural phenomena are connected.

Serious argument for localization of the craft-economic centers in territory of Southern Kazakhstan and, probably areas of the Central Kazakhstan corresponding to present desert Betpakdala adjoining from the north, are finds of unique metal vessels in early Andronov burial grounds of Ashchisu and Nurataldy I, located in the Central Kazakhstan region [Kukushkin, 2011б: 106; Kukushkin it all., 2016].

Each of metal vessels had a well expressed neck, characteristic early Alakul ledge-edge and separately made ring pallet that more corresponds to Fedorovo processing methods of manufacturing of ceramics with capacitor beginning [Loman, 1995: 97]. Thus, mixture of cultural traditions for early Alakul development stages that assumes the uniform center of formation of sources of these cultures, connected with functioning of the large craft-economic centers is observed.

It is supposed that vessels are created by the skilled craftsmen possessing manufacturing techniques of thin-walled metal ware. Absence on products of connecting seams or rivets, testifies to ware moulding on wax model [Degtyareva et al., 2019]. High quality of vessels, absence of traces of a spoilage in production, technical crafting details and standardization of forms, definitely specify that there were usual, serial products. Additional argument for this statement is the conditions of their detection. If on a burial ground of Ashchisu the vessel has been fixed in the large central burial blocked by a earth mound, Nurataldy 1 it is found in a small extension to the basic fencing which had modest parameters.

Obviously, standard metal utensils of characteristic Andronovo shapes penetrated far beyond the limits of handicraft and economic centers and are noted both in the elite and ordinary burials of the early Andronov time. It is possible that traditional Andronov metal jewelry was mass-produced in urban centers, which then went to the steppe in exchange for livestock products, otherwise it is difficult to explain the detailed standardization of women's clothing sets, at least in the area of distribution of Alakul cultural sites. In this regard, interesting results were obtained in the study of the chemical composition of Alakul paste (faience) beads, on the basis of which a reasoned assumption was made about their import from Ancient Egypt, where local craft workshops produced faience beads in large quantities. It is noted that the manufacture of earthenware is a complex chemical technology, surpassing the level of complexity of the technological processes associated with melting copper and obtaining bronze [Lihter, Usmanova, 2017: 42–43].

It is extremely indicative of the finding in 2017 of a large solid-molded bronze vessel at the Sintashta Karatomar burial in northern Kazakhstan, proving that the production of metal utensils already took place during this period [Logvin, Shevnina, 2018: 125, Fig. 19]. The use of unique technologies in its manufacture may indicate a high level of development of the metalworking industry concentrated, as a rule, in the ancient urban centers of the time.

Metal vessels are well known in the materials of the Bactrian-Margian archaeological complex in Central Asia. High technologies associated with the manufacture of solid-molded thin-walled metal dishes, judging by the Margian finds, were concentrated exclusively in large

sedentary agricultural centers of urban type. For example, gold, silver and copper-bronze vessels duplicating traditional ceramic standards were found in significant quantities only in rich "royal" burials located near the palace and temple complex of Gonur-Depe in Eastern Turkmenistan [Sarianidi, 2006: 171–177].

Currently, the existence of the Sintashta culture is determined within 200–250 years or by the end of 3rd — the first quarter of the 2nd millennium BC [Vinogradov, 2011: 78; Epimahov, 2004: 206]. At the end of this period, the accents of military priorities under the influence of the "militaristic syndrome", stimulated by successful northern campaigns, obviously, are shifting. The direction of military expansion is changing, involving richer and more prosperous countries. These processes are probably associated with a significant irrevocable outflow of the population from the southern regions of Kazakhstan and, possibly, Central Asia. With the departure of the Sintashta population, the "rich" military burials disappear. Part of this tradition is preserved in the early Alakul sites, but soon it also disappears.

At the same time, in the east, in China, the appearance of horses, chariot fighting tactics and the art of making thin-walled metal vessels are recorded, based on a sophisticated casting technology using a wax model previously unknown there [Chechushkov, 2011: 63; Beh et al., 1997]. In the southeast, the fighting teams of charioteers conquer North-West India. In the hymns of the Rig Veda, the brilliant victories of the Indo-Aryans are declared, destroying the fortresses of the aboriginal population and capturing rich booty [Elizarenkova, 1989: 427]. Vague memories of a distant homeland are preserved only in the "Northern cycle" of Aryan mythology, where, for example, metamorphoses occurring in water during the cold season are vividly described [Bongard-Levin, Granatovskij, 1983: 7–8, 141]. In the south-west, in the states of Front and Asia Minor, whole dynasties of the ruling elite are formed, whose representatives bear Aryan names. Marriage treaties are concluded between royal houses, where the supreme deities of the Aryan pantheon act as guarantors of the terms of the agreement. In Mitanni, Kikkuli's famous treatise on the training of chariot horses is compiled, saturated with Aryan horse-breeding terminology, which is then repeated in Hittite and Assyrian sources [Bongard-Levin, Granatovskij, 1983: 430; Kuz'mina, 1994: 5, 189]. The chariots of war are becoming the striking force of many states and peoples, but their appearance is marked much later than the Sintashta counterparts.

It is assumed that all these events document the disintegration of the Indo-Iranian linguistic community, which many researchers in general attribute to the first half of the 2nd millennium BC [Abaev, 1972: 32–36; Gindin, 1992: 55; Granatovskij, 2007: 410; Zdanovich, 1995: 42; Kovtun, 2013: 35–41; Lelekov, 1990: 123; Steblin-Kamenskij, 2009: 18; Helimskij, 2000; Anthony, 2007: 408; Lamberg-Karlovsky, 2002: 72]. In fact, there is a division of community into two large ethnocultural array — the ancient Iranians, who remained in the original habitat, and the actual Aryans, who are actively settling in the new territories. The war becomes the main ideology of society, and the symbol of victories is the thunder-god Indra, in whom the arias carried away the faith.

Conclusions

If our assumptions are true, the Andronov genesis model looks as follows. In territory Southern and, probably, Central Kazakhstan, during the Bronze Age, the powerful settled-agricultural culture which has reached of enough high level of development which it is possible to name prior to-Andronov was generated. Its formation resulted from migratory motions

of considerable weights of the Indo-Iranian population probably provoked by social and economic processes or military-political events, which took place early in the territory of the Near East. The carriers of these cultural traditions became pioneers in the use of mounted horse chariots in the military sphere and contributed to the wide spread of the chariot complex throughout the ancient world.

The part of the population participating in northern campaigns, left the Sintashta type sites which were the base of the Alakul culture, therefore Sintashta is as a matter of fact proto-Andronov or is proto-Alakul formation. Of course, it also influenced the formation of the Srubnaya culture, where, however, the closely related Potapov culture of the Middle Volga region played a leading role. The cattle breeding collectives which had separated from the prospective settled-agricultural centers generated Fedorovo culture. In particular, it confirms the Fedorovo settlement Pavlovka (Shagalaly II) layers in Northern Kazakhstan, containing wheel ceramics, characteristic for ancient agriculturist pottery traditions and imitations its forms [Maljutina, 1991: 155–157; Sakenov, 2014: 562–563; Habdulina et al., 2017: 173–174].

The common roots of these ethnocultural formations later formed the basis for the formation of the Andronovo cultural and historical unity, as evidenced by the absence of visible antagonistic contradictions in the interaction of cultures with each other. This can be indicated by joint burial grounds consisting of Alakul and Fedorov burials, as well as a significant number of syncretic monuments. Subsequently, the Alakul culture is absorbed by the Fedorov culture, which later participates in the formation of the monuments of the final bronze. Research on the purposeful identification and fixation of objects correlated with the early civilization stages of the development of the Bronze Age society on the territory of Kazakhstan are still at the initial stage of development. The known difficulties are undoubtedly connected with the traditions of centuries-old settled life in local settlements with a high concentration of the population, which led to the formation of large multi-layered settlements, some of which existed until the late Middle Ages. The search for isolated sites of the Bronze Age requires the involvement of additional technical means and, first of all, aerospace survey data. It is also pertinent to draw attention to the fact that 18 out of 21 Sintashta settlements were discovered only as a result of decryption of aerial photography data carried out in the 50–60s. of the 20th century [Zdanovich, Batanina, 2007: 24].

REFERENCES

Abaev V. I. K voprosu o prarodine i drevnejshih migraciyah indoiranskih narodov [On the Question of the Ancestral Home and the Most Ancient Migrations of Indo-Iranian Aeoples]. Drevnij Vostok i antichnyj mir [Ancient East and ancient World]. Moscow : MGU, 1972. Pp. 26–37. *(In Russ.)*

Avanesova N. A. Mezhkul'turnye vzaimodejstviya stepnogo naseleniya Evrazii i urbanizirovannyh zemledel'cev Srednej Azii [Intercultural Interactions of the Steppe Population of Eurasia and Urbanized Farmers of Central Asia]. Civilizacii Central'noj Azii: zemledel'cy i skotovody. Tradicii i sovremennost' [Civilizations of Central Asia: Farmers and Pastoralists. Tradition and Modernity]. Samarkand : FAN, 2002. Pp. 16–18. *(In Russ.)*

Avanesova N. A. O kul'turnoj atribucii kolesnogo transporta doistoricheskoj Baktrii (po materialam sapallinskoj kul'tury) [On the Cultural Attribution of Wheeled Vehicles of

Prehistoric Bactria (Based on the Materials of the Sapalli Culture)]. Istorija Uzbekistana v arheologicheskih i pis'mennyh istochnikah [History of Uzbekistan in Archaeological and Written Sources]. Tashkent : FAN, 2005. Pp. 7–25. *(In Russ.)*

Bajpakov K. M., Vojakin D. A., Usmanova E. R. Predislovie [Foreword]. Svod pamyatnikov istorii i kul'tury Zhambyl'skoj oblasti. Chujskij rajon [A Collection of Monuments of History and Culture of the Zhambyl Region. Shu District]. Almaty : Arheologicheskaya ekspertiza, 2012. Pp. 11–56. *(In Russ.)*

Bajtanaev B. A. Poselenie epohi pozdnej bronzy urochishcha Burgulyuk i keramika karzhantauskogo tipa [The Settlement of the Late Bronze Age of the Burgulyuk Tract and Pottery of the Karzhantau Type]. Izvestiya NAN RK. Seriya obshchestvennyh nauk [Bulletin of the National Academy of Sciences of the Republic of Kazakhstan. Social Science Series]. 2010. No. 1(274). Pp. 32–39. *(In Russ.)*

Beh N. I., Vasil'ev V. A., Gini E. Ch., Petrichenko A. M. Mir hudozhestvennogo lit'ya. Istoriya tehnologii [The World of Art Casting. History of Technology]. Moscow : URSS, 1997. 272 p. *(In Russ.)*

Bobomulloev S. Raskopki grobnicy bronzovogo veka na Verhnem Zeravshane [Excavation of a Bronze Age Tomb on the Upper Zeravshan]. Stratum plus. Arheologiya i kul'turnaya antropologiya. 1999. Vol. 2. Pp. 301–313. *(In Russ.)*

Bongard-Levin G. M., Granatovskij E. A. Ot Skifii do Indii. Drevnie arii: mify i istoriya [From Scythia to India. Ancient Aryans: Myths and History]. Moscow : Mysl', 1983. 206 p. *(In Russ.)*

Bochkarev V. S. Kul'turogenez i drevnee metalloproizvodstvo Vostochnoj Evropy [Cultural Genesis and Ancient Metal Production in Eastern Europe]. Sankt-Petersburg : Info-ol, 2010. 231 p. *(In Russ.)*

Vinogradov N. B. Kul'turno-istoricheskie processy v stepyah Yuzhnogo Urala i Kazahstana v nachale II tys. do n.e. (pamyatniki sintashtinskogo i petrovskogo tipov) [Cultural and Historical Processes in the Steppes of the South Urals and Kazakhstan at the Beginning of the 2nd Millennium BC (Monuments of Sintashta and Petrovsky Types)]: avtoref. diss. … kand. ist. nauk. Moscow, 2007. 50 p. *(In Russ.)*

Vinogradov N. B. Stepi Yuzhnogo Urala i Kazahstana v pervye veka II tys. do n.e. (pamyatniki sintashtinskogo i petrovskogo tipa) [Steppes of the Southern Urals and Kazakhstan in the First Centuries of the 2nd Millennium BC (The Sites of Sintashta and Petrovsky Type)]. Chelyabinsk : Abris, 2011. 175 p. *(In Russ.)*

Gajduchenko L. L. Nekotorye biologicheskie harakteristiki zhivotnyh iz zhertvennyh kompleksov kurgana 25 Bol'shekaraganskogo mogil'nika [Some Biological Characteristics of Animals from the Sacrificial Complexes of Mound 25 of the Bolshekaragan Burial Ground]. Arkaim: nekropol' (po materialam kurgana 25 Bol'shekaraganskogo mogil'nika) [Arkaim: Necropolis (Based on Materials from Mound 25 of the Bolshekaragan Burial Ground)]. Chelyabinsk : Yuzhno-Ural'skoe knizhnoe izdatel'stvo, 2002. Vol. 1. Pp. 189–195. *(In Russ.)*

Gajduchenko L. L. Biologicheskie ostatki iz ukreplennyh poselenij "strany gorodov" Yuzhnogo Zaural'ya [Biological Remains from Fortified Settlements of the "Country of Cities" of the Southern Trans-Urals]. Arkaim — Sintashta: drevnee nasledie Yuzhnogo Urala [Arkaim — Sintashta: the Ancient Heritage of the South Urals]. Chelyabinsk : Chelyabinskij gosudarstvennyj universitet, 2010. Vol. 1. Pp. 96–108. *(In Russ.)*

Gening V. F., Zdanovich G. B., Gening V. V. Sintashta. Arheologicheskie pamyatniki arijskih plemen Uralo-Kazahstanskih stepej [Sintashta. Archaeological Sites of the Aryan Tribes of the Ural-Kazakhstan Steppes]. Chelyabinsk : Yuzhno-Ural'skoe knizhnoe izdatel'stvo, 1992. Vol. 1. 408 p. *(In Russ.)*

Gindin L. A. Prostranstvenno-hronologicheskie aspekty indoevropejskoj problemy i "Karta predpolagaemyh prarodin shesti inostrannyh yazykov" V. M. Illich-Svitycha [Spatial and Chronological Aspects of the Indo-European Problem and "Map of the Alleged Ancestral Homelands of Six Foreign Languages" V. M. Illich-Svitych]. Voprosy yazykoznaniya [Linguistic Issues]. 1992. No. 6. Pp. 54–65. *(In Russ.)*

Gorbunov V. S. Bronzovyj vek Volgo-Ural'skoj lesostepi [Bronze Age of the Volga-Ural Forest-steppe]. Ufa : Bashkirskij gosudarstvennyj pedagogicheskij universitet im. M. Akmully, 1992. 223 p. *(In Russ.)*

Grantovskij E. A. Rannyaya istoriya iranskih plemen Perednej Azii [Early History of the Iranian Tribes of Western Asia]. Moscow : Vostochnaya literatura, 2007. 510 p. *(In Russ.)*

Grigor'ev S. A. Blizhnevostochnye komponenty v formirovanii sintashtinskoj kul'tury i ee hronologii [Middle Eastern Components in the Formation of Sintashta Culture and its Chronology]. Arkaim — Sintashta: drevnee nasledie Yuzhnogo Urala [Arkaim — Sintashta: the Ancient Heritage of the Southern Urals]. Chelyabinsk : Izd-vo Chelyab. gos. un-ta, 2010. Vol. 2. Pp. 32–48. *(In Russ.)*

Grigor'ev S. A. Drevnie indoevropejcy [Ancient Indo-Europeans]. Chelyabinsk : Rifej, 2015. 496 p. *(In Russ.)*

Drevnyaya istoriya Yuzhnogo Zaural'ya [Ancient History of the Southern Trans-Urals]. Chelyabinsk : Izd-vo YuUrGU, 2000. Vol. 1. 538 p. *(In Russ.)*

Elizarenkova T. Ya. "Rigveda" — velikoe nachalo indijskoj literatury i kul'tury ["Rig Veda" — the Great Beginning of Indian Literature and Culture]. Rigveda. Mandaly I–IV. Prilozheniya [Rig Veda. Mandalas I–IV. Applications]. Moscow : Nauka, 1989. Pp. 426–543. *(In Russ.)*

Epimahov A. V. Yuzhnoe Zaural'e v epohu srednej bronzy [Southern Trans-Urals in the Middle Bronze Age]. Chelyabinsk : Biblioteka A. Millera, 2002. 170 p. *(In Russ.)*

Epimahov A. V. Absolyutnaya i otnositel'naya hronologiya bronzovogo veka Urala v svete novyh radiokarbonnyh dat [Absolute and Relative Chronology of the Bronze Age of the Urals in the Light of New Radiocarbon Dates]. Kompleksnye issledovaniya drevnih i tradicionnyh obshchestv Evrazii [Comprehensive Studies of Ancient and Traditional Societies of Eurasia]. Barnaul: Izd-vo Alt un-ta, 2004. Pp. 204–208. *(In Russ.)*

Epimahov A. V. Rannie kompleksnye obshchestva severa Central'noj Azii (po materialam mogil'nika Kamennyj Ambar-5) [Early Complex Societies of the North of Central Asia (Based on Materials from the Kamenny Ambar-5 Burial Ground)]. Chelyabinsk : Chelyabinskij Dom pechati, 2005. Vol. 1. 192 p. *(In Russ.)*

Zdanovich G. B. Arkaim: arii na Urale, ili Nesostoyavshayasya civilizaciya [Arkaim: Aryans in the Urals or a Failed Civilization]. Arkaim: Issledovaniya. Poiski. Otkrytiya [Arkaim: Research. Search. Discoveries]. Chelyabinsk : Kamennyj poyas, 1995. Pp. 21–42. *(In Russ.)*

Zdanovich G. B., Batanina I. M. Arkaim — Strana gorodov: Prostranstvo i obrazy (Arkaim: gorizonty issledovanij) [Arkaim — Country of cities: Space and Images (Arkaim: Research Horizons)]. Chelyabinsk : Krokus, 2007. 260 p. *(In Russ.)*

Zdanovich G. B., Zdanovich D. G. Protogorodskaya civilizaciya "Strany gorodov" Yuzhnogo Zaural'ya (opyt modeliruyushchego otnosheniya k drevnosti) [Proto-urban Civilization "Country of Cities" of the Southern Trans-Urals (an Experience of Modeling Attitude to Antiquity)]. Kul'tury drevnih narodov stepnoj Evrazii i fenomen protogorodskoj civilizacii Yuzhnogo Urala. Rossiya i Vostok [Cultures of the Ancient Peoples of the Steppe Eurasia and the Phenomenon of the Proto-urban Civilization of the South Urals. Russia and the East]. Chelyabinsk: Chelyabinskij gosudarstvennyj universitet, 1995. Ch. V. Vol. 1. Pp. 48–62. *(In Russ.)*

Kadyrbaev M. K., Mar'yashev A. N. Petroglify hrebta Karatau [Petroglyphs of the Karatau Ridge]. Almaty : Nauka, 2007. 147 p. *(In Russ.)*

Kalieva S. S., Logvin V. N. Skotovody Turgaya v tret'em tysyacheletii do nashej ery [Turgai Pastoralists in the Third Millennium BC]. Kustanaj : IA MNAN RK, 1997. 176 s. *(In Russ.)*

Kitov E. P. Paleoantropologiya naseleniya Yuzhnogo Urala epohi bronzy [Paleoanthropology of the Population of the Southern Urals of the Bronze Age]: avtoref. dis. … kand. ist. nauk. Moscow, 2011. 26 s. *(In Russ.)*

Kovtun I. V. Predystoriya arijskoj mifologii [Prehistory of Aryan Mythology]. Kemerovo : Aziya-Print, 2013. 702 p. *(In Russ.)*

Kosincev P. A. "Kolesnichnye" loshadi ["Chariot" Horses]. Koni, kolesnicy i kolesnichie stepej Evrazii [Horses, Chariots and Charioters of the Steppes of Eurasia]. Ekaterinburg ; Samara ; Doneck : Rifej, 2010. Pp. 21–79. *(In Russ.)*

Krizhevskaja L. Ya. Znachenie kul'turnyh svyazej dlya organizacii poselenij i domostroitel'stva epohi rannej bronzy v Yuzhnom Zaural'e [The Importance of Cultural Ties for the Organization of Settlements and House-building of the Early Bronze Age in the Southern Trans-Urals]. Arheologicheskie kul'tury i kul'turno-istoricheskie obshchnosti Bol'shogo Urala [Archaeological Cultures and Cultural-Historical Communities of the Greater Urals]. Ekaterinburg : Ural'skij federal'nyj universitet im. B.N. El'cina, 1993. Pp. 107–108. *(In Russ.)*

Kuz'mina O. V. Abashevskaya kul'tura v lesostepnom Volgo-Ural'e [Abashev Culture in the Forest-steppe Volga-Urals]. Samara : Izd-vo Samarskogo GPI, 1992. 128 p. *(In Russ.)*

Kuz'mina E. E. Otkuda prishli indoarii? Material'naya kul'tura plemen andronovskoj obshchnosti i proishozhdenie indoirancev [Where did the Indo-Aryans Come From? Material Culture of the Tribes of the Andronov Community and the Origin of the Indo-Iranians]. Moscow : Kalina, 1994. 464 p. *(In Russ.)*

Kuz'mina E. E. Arii — put' na yug [Arias — the Way to the South]. Moscow-Sankt Petersburg : Letnij sad, 2008. 558 p. *(In Russ.)*

Kuz'mina E. E. Sintashtinskij tip pamyatnikov i ih etnicheskaya atribuciya [Sintashta Type of Monuments and Their Ethnic Attribution]. Arkaim — Sintashta: drevnee nasledie Yuzhnogo Urala [Arkaim — Sintashta: the Ancient Heritage of the South Urals]. Chelyabinsk : Izdatel'stvo ChelGU, 2010a. Vol. 2. Pp. 66–77. *(In Russ.)*

Kuz'mina E. E. Koni stepej v epohu eneolita i bronzy [Horses of the Steppes in the Eneolithic and Bronze Age]. Koni, kolesnicy i kolesnichie stepej Evrazii [Horses, Chariots and Charioters of the Steppes of Eurasia]. Ekaterinburg ; Samara ; Doneck : Rifej, 2010b. Pp. 5–20. *(In Russ.)*

Kukushkin I. A. Arheologicheskie kompleksy Kazahstana s kolesnichnoj atributikoj. Novyj aspekt v arheologii bronzy Kazahstana [Archaeological Complexes of Kazakhstan with Chariot Attributes. A New Aspect in the Archeology of Bronze in Kazakhstan]. Svideteli Tysyacheletij: Arheologicheskaya nauka Kazahstana za 20 let (1991–2011) [Witnesses of the Millennium: Archaeological Science of Kazakhstan for 20 Years (1991–2011)]. Almaty : Institut arheologii im. A.H. Margulana, 2011a. Pp. 97–113. *(In Russ.)*

Kukushkin I. A. Metallicheskie izdeliya ranneandronovskogo mogil'nika Ashchisu (Central'nyj Kazahstan) [Metal Products from the Early Andronovo Burial Ground Ashisu (Central Kazakhstan)]. Rossijskaya arheologiya [Russian Archeology]. 2011b. No. 2. Pp. 103–109. *(In Russ.)*

Kukushkin I. A., Loman V. G., Kukushkin A. I., Dmitriev E. A. Pogrebenie s metallicheskim sosudom v mogil'nike Nurataldy I (epoha bronzy) [Burial with a Metal Vessel in the Burial Ground of Nurataldy I (Bronze Age)]. Ural'skij istoricheskij vestnik [Ural Historical Bulletin]. 2016. No. 4 (53). Pp. 85–92. *(In Russ.)*

Lelekov L. A. Problema indoiranskih analogij k yavleniyam skifskoj kul'tury [The Problem of Indo-Iranian Analogies to the Phenomena of Scythian Culture]. Skifo-sibirskoe kul'turno-istoricheskoe edinstvo [Scythian-Siberian Cultural and Historical Unity]. Kemerovo : KemGU, 1980. Pp. 118–125. *(In Russ.)*

Litvinskij B. A., Okladnikov A. P., Ranov V. A. Drevnosti Kajrak-Kumov [Antiquities of Kairak-Kumy]. Dushanbe : Izdatel'stvo Akademii nauk Tadzhikskoj SSR, 1962. 402 p. *(In Russ.)*

Lihter Ju. A., Usmanova E. R. Busy iz egipetskogo fayansa iz kazahstanskih pamyatnikov andronovskoj obshchnosti [Beads from Egyptian Faience from Kazakhstan Sites of the Andronov Community]. Istoriya i arheologiya Semirech'ya [History and Archeology of Semirechye]. Almaty : Institut arheologii im. A.H. Margulana, 2017. Vol. 5. Pp. 40–54. *(In Russ.)*

Logvin A. V., Shevnina I. V. Issledovanie sintashtinskogo mogil'nika Karatomar, kurgan 1 (predvaritel'noe soobshchenie) [Exploration of the Sintashta Burial Ground Karatomar, Mound 1 (Preliminary Report)]. XXI Ural'skoe arheologicheskoe soveshchanie, posvyashchennoe 85-letiyu so dnya rozhdeniya G.I. Matveevoj i 70-letiyu so dnya rozhdeniya I.B. Vasil'eva [XXI Ural Archaeological Meeting Dedicated to the 85th Anniversary of the Birth of G.I. Matveeva and the 70th Birthday of I.B. Vasiliev]. Samara : Samarskij gosudarstvennyj social'no-pedagogicheskij universitet, 2018. Pp. 123–125. *(In Russ.)*

Loman V. G. Andronovskoe goncharstvo: obshchie priemy izgotovleniya sosudov [Andronovo Pottery: General Techniques for Making Vessels]. Kul'tury drevnih narodov stepnoj Evrazii i fenomen protogorodskoj civilizacii Yuzhnogo Urala. Rossiya i Vostok [Cultures of the Ancient Peoples of the Steppe Eurasia and the Phenomenon of the Proto-urban Civilization of the South Urals. Russia and the East]. Chelyabinsk : Chelyabinskij gosudarstvennyj universitet, 1995. Ch. V. Vol. 1. Pp. 96–100. *(In Russ.)*

Loman V. G. Obshchie principy vydeleniya istoriko-kul'turnoj informacii po dannym goncharnoj tehnologii [General Principles of Allocation of Historical and Cultural Information According to the Data of Pottery Technology]. Stepnaya civilizaciya Vostochnoj Evrazii [Steppe Civilization of Eastern Eurasia]. Astana : Kyltegin, 2003. Vol. 1. Drevnie epohi. Pp. 146–151. *(In Russ.)*

Maljutina T. S. Stratigraficheskaya poziciya materialov fedorovskoj kul'tury na mnogoslojnyh poseleniyah kazahstanskih stepej [Stratigraphic Position of the Materials of the Fedorov Culture on the Multilayer Settlements of the Kazakh Steppes]. Drevnosti Vostochno-Evropejskoj lesostepi [Antiquities of the East European Forest-steppe]. Samara : SGPI, 1991. Pp. 141–162. *(In Russ.)*

Malyutina T. S. "Kvazigoroda" epohi bronzy Yuzhnogo Urala i drevnij Horezm ["Quasi-cities" of the Bronze Age of the Southern Urals and Ancient Khorezm]. Kompleksnye obshchestva Central'noj Evrazii v III–I tys. do n.e.: Regional'nye osobennosti v svete universal'nyh modelej [Complex Societies of Central Eurasia in the 3rd — 1st Millennium BC: Regional Features in the Light of Universal Models]. Chelyabinsk : Chelyabinskij gosudarstvennyj universitet, 1999. Pp. 119–121. *(In Russ.)*

Merpert N. Ya. K voprosu o drevnejshih krugloplanovyh ukreplennyh poseleniyah Evrazii [On the Question of the Oldest Circular Fortified Settlements in Eurasia]. Rossiya i Vostok: problemy vzaimodejstviya [Russia and the East: Problems of Interaction]. Chelyabinsk : Chelyabinskij gosudarstvennyj universitet, 1995. Ch. V, vol. 1. Pp. 116–119. *(In Russ.)*

Mnacakanjan A. O. Lchashenskie kurgany (raskopki 1956 goda) [Lchashen Burial Mounds (Excavations in 1956)]. Kratkie soobshcheniya Instituta arheologii [Brief Reports of the Institute of Archeology]. 1961. Vol. 85. Pp. 66–72. *(In Russ.)*

Novozhenov V. A. Chudo kommunikacii i drevnejshij kolesnyj transport Evrazii [The Miracle of Communication and the Oldest Wheeled Transport of Eurasia]. Moscow : Taus, 2012. 500 p. *(In Russ.)*

Otroshhenko V. V. K istorii plemen srubnoj obshchnosti [To the History of the Tribes of the Timber Community]. Arheologiya vostochnoevropejskoj lesostepi [Archeology of the Eastern European Forest-steppe]. Voronezh : Penzenskij gosudarstvennyj pedagogicheskij universitet im. V.G. Belinskogo, 2003. Vol. 17: Dono-Doneckij region v epohu bronzy. Pp. 68–96. *(In Russ.)*

Pogrebova M. N. O konyah, olenyah i kolesnicah Yuzhnogo Kavkaza [About Horses, Deers and Chariots of the South Caucasus]. Arii stepej Evrazii: epoha bronzy i rannego zheleza v stepyah Evrazii i na sopredel'nyh territoriyah [Arias of the Eurasian Steppes: the Bronze and Early Iron Age in the Eurasian Steppes and Adjacent Territories]. Barnaul : Izd-vo Alt. un-ta, 2014. Pp. 418–424. *(In Russ.)*

Prjahin A. D. Dono-Volzhsko-Ural'skaya lesostep' na styke srednej i pozdnej bronzy [Don-Volga-Ural Forest-steppe at the Junction of the Middle and Late Bronze Age]. Kul'tury drevnih narodov stepnoj Evrazii i fenomen protogorodskoj civilizacii Yuzhnogo Urala. Rossiya i Vostok [Cultures of the Ancient Peoples of the Steppe Eurasia and the Phenomenon of the Proto-urban Civilization of the South Urals. Russia and the East]. Chelyabinsk : Chelyabinskij gosudarstvennyj universitet, 1995. Ch. V, vol. 1. Pp. 154–156. *(In Russ.)*

Prjahin A. D. Izuchenie epohi bronzy Dono-Doneckogo regiona i vyhod na novuyu paradigmu osmysleniya problematiki epohi bronzy Evrazijskoj stepi i lesostepi (vtoray polovina XX stoletiya) [Study of the Bronze Age of the Don-Donetsk Region and Access to a New Paradigm of Understanding the Problems of the Bronze Age of the Eurasian Steppe and Forest-steppe (Second Half of the 20th Century)]. Arheologiya vostochnoevropejskoj lesostepi [Archaeology of the Eastern European Forest-steppe]. Voronezh : Penzenskij gosudarstvennyj pedagogicheskij universitet im. V.G. Belinskogo, 2003. Vol. 17: Dono-Doneckij region v epohu bronzy. Pp. 36–43. *(In Russ.)*

Sakenov S. K. Stankovaya keramika iz poseleniya Shagalaly II (k voprosu o kul'turnyh svyazyah plemen epohi bronzy Severnogo Kazahstana i Srednej Azii) [Potter-wheel Ceramics from the Shagalaly II Settlement (on the Issue of Cultural Ties Between the Bronze Age Tribes of Northern Kazakhstan and Central Asia)]. Dialog kul'tur Evrazii v arheologii Kazahstana [Dialogue of the Cultures of Eurasia in the Archeology of Kazakhstan]. Astana : Saryarka, 2014. Pp. 557–567. *(In Russ.)*

Samashev Z. S., Ermolaeva A. S., Loshakova T. N. Kostyanye psalii s poseleniya Toksanbaj. K voprosu o komplekse kolesnichih naseleniya Ustyurta v epohu bronzy [Bone Cheekpieces from the Toksanbai Settlement. On the Question of the Chariot Complex of the Population of Ustyurt in the Bronze Age]. Voprosy istorii i arheologii Zapadnogo Kazahstana [Questions of History and Archeology of Western Kazakhstan]. 2007. No. 1. Pp. 87–102. *(In Russ.)*

Samashev Z. S., Loshakova T. N. Issledovanie Aralo-Kaspijskogo regiona v gody nezavisimosti Kazahstana [Exploration of the Aral-Caspian Region During the Years of Independence of Kazakhstan]. Svideteli tysyacheletij: arheologicheskaya nauka Kazahstana za 20 let (1991–2011) [Witnesses of the Millennium: Archaeological Science of Kazakhstan for 20 Years (1991–2011)]. Almaty : Institut arheologii im. A.H. Margulana, 2011. Pp. 348–368. *(In Russ.)*

Sarianidi V. I. Nekropol' Gonura i iranskoe yazychestvo [Necropolis of Gonur and Iranian Paganism]. Moscow : Mir-media, 2001. 246 p. *(In Russ.)*

Sarianidi V. I. Carskij nekropol' na Severnom Gonure [King Necropolis in Northern Gonur]. Vestnik drevnej istorii [Ancient History Herald]. 2006. No. 2 (257). Pp. 155–192. *(In Russ.)*

Sataev R. M. Zhivotnye iz raskopok Gonur-Depe [Animals from the Excavations of Gonur-Depe]. Trudy Margianskoj arheologicheskoj ekspedicii [Proceedings of the Margian Archaeological Expedition]. Moscow : Staryj sad, 2008. Vol. 2. Pp. 138–142. *(In Russ.)*

Svod pamyatnikov istorii i kul'tury Kazahstana. Yuzhno-Kazahstanskaya oblast' [Collection of Monuments of History and Culture of Kazakhstan. South Kazakhstan Region]. Alma-Ata : Akademiya nauk Respubliki Kazahstan, 1994. Vol. 1. 368 p. *(In Russ.)*

Slobodzjan M. B. Izobrazhenie kolesnic v petroglifah Altaya (mestonahozhdeniya Elangash i Kalbak-Tash-1) [Image of Chariots in Altai Petroglyphs (Elangash and Kalbak-Tash-1 Locations)]. Severnaya Evraziya v epohu bronzy: prostranstvo, vremya, kul'tura [Northern Eurasia in the Bronze Age: Space, Time, Culture]. Barnaul : Izd-vo Alt. un-ta, 2002. Pp. 116–119. *(In Russ.)*

Steblin-Kamenskij I. M. Vstupitel'nye stat'i [Introductory Articles]. Gaty Zaratushtry [Ghats of Zarathushtra]. Sankt-Petersburg : Peterburgskoe Vostokovedenie, 2009. Pp. 4–32. *(In Russ.)*

Tkachev A. A. K voprosu o formirovanii i razvitii pogrebal'noj obryadnosti atasuskoj kul'tury [On the Formation and Development of the Funeral Rituals of the Atasu Culture]. Dialog kul'tur Evrazii v arheologii Kazahstana [Dialogue of Eurasian Cultures in the Archeology of Kazakhstan]. Astana : Saryarka, 2014. Pp. 653–664. *(In Russ.)*

Tkachev V. V. Stepi Yuzhnogo Priural'ya i Zapadnogo Kazahstana na rubezhe epoh srednej i pozdnej bronzy [Steppes of the Southern Urals and Western Kazakhstan at the Turn of the Middle and Late Bronze Age]. Aktobe : Aktyubinskij oblastnoj centr istorii, etnografii i arheologii, 2007. 384 p. *(In Russ.)*

Tkachjov V. V., Havanskij A. I. Keramika sintashtinskoj kul'tury [Ceramics of the Sintashta Culture]. Orsk ; Samara : Izdatel'stvo OGTI, 2006. 180 p. *(In Russ.)*

Habdulina M. K., Tleugabulov D. T., Brynza T. V., Biljalova G. D., Kucherov P. Yu. Issledovanie pamyatnikov bronzovogo veka v Akmolinskom Priishim'e (poselenie Shagalaly II) [Investigation of Bronze Age Monuments in Akmola Priishimye (Shagalaly II Settlement)]. Astana : Globus, 2017. 192 p. *(In Russ.)*

Helimskij E. A. Samodijskaya lingvisticheskaya rekonstrukciya i praistoriya samodijcev [Samoyed Linguistic Reconstruction and Prehistory of the Samoyedians]. Komparativistika, uralistika [Comparative Studies, Uralistics]. Moscow : Yazyki russkoj kul'tury, 2000. Pp. 13–25. *(In Russ.)*

Hohlov A. A. O proishozhdenii i dal'nejshem razvitii fizicheskogo tipa nositelej sintashtinsko-potapovskogo kruga kul'tur [On the Origin and Further Development of the Physical Type of Carriers of the Sintashta-Potapov Circle of Cultures]. Arkaim — Sintashta: nasledie Yuzhnogo Urala [Arkaim — Sintashta: the Heritage of the Southern Urals]. Chelyabinsk : Izd-vo ChelGU, 2010. Vol. 2. Pp. 112–132. *(In Russ.)*

Huff D., Shajdullaev Sh. B. Nekotorye rezul'taty rabot uzbeksko-germanskoj ekspedicii na gorodishche Dzharkutan [Some Results of the Work of the Uzbek-German Expedition to the Settlement of Dzharkutan]. Istoriya material'noj kul'tury Uzbekistana. Samarkand : Institut arheologii AN RUz, 1999. Vol. 30. Pp. 19–26. *(In Russ.)*

Chechushkov I. V. Kolesnicy Evrazijskih stepej epohi bronzy [Chariots of the European Steppes of the Bronze Age]. Vestnik arheologii, antropologii i etnografii [Bulletin of Archeology, Anthropology and Ethnography]. 2011. Vol. 2 (15). Pp. 57–65. *(In Russ.)*

Shul'ga P. I. Mogil'nik ranneskifskogo vremeni Gilyovo-10 [Early Scythian Burial Ground Gilevo-10]. Novosibirsk : RIC NGU, 2016. 258 p. *(In Russ.)*

Shhetenko A. Ja. Vremya poyavleniya domashnej loshadi na territorii Srednej Azii [The Time of the Appearance of the Domestic Horse in the Territory of Central Asia]. Proishozhdenie i razvitie kolesnichestva [Origin and Development of Chariots]. Lugansk : Globus, 2008. Pp. 218–232. *(In Russ.)*

Anthony D. W. The Horse, the Wheel, and Language: How Bronze-Age Riders from the Eurasian Steppes Shaped the Modern World. Princeton : Princeton University Press, 2007. 553 p.

Degtyareva A. D., Kuzminykh S. V., Loman V. G., Kukushkin I. A., Kukushkin A.I. Metal vessels of the Bronze Age in Kazakhstan. Journal of Archaeological Science: Reports. 2019. No. 28. P. 102024.

Lamberg-Karlovsky C. C. Archaeology and Language. The Indo-Iranians. Current Anthropology. 2002. Volum 43. Number 1. Pp. 63–88.

Muller-Karpe H. Handbuch der Vorgeschichte. Munchen: C. H. Beck'sche Verlagsbuchhandlung, 1980. Band IV/3. 996 s.

Potratz J. A. H. Die Pferdetrensen des alten Orient. Roma : Pontificum Institutum Biblicum, 1966. 364 p.

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Абаев В. И. К вопросу о прародине и древнейших миграциях индоиранских народов // Древний Восток и античный мир. М. : МГУ, 1972. С. 26–37.

Аванесова Н. А. Межкультурные взаимодействия степного населения Евразии и урбанизированных земледельцев Средней Азии // Цивилизации Центральной Азии: земледельцы и скотоводы. Традиции и современность. Самарканд : ФАН, 2002. С. 16–18.

Аванесова Н. А. О культурной атрибуции колесного транспорта доисторической Бактрии (по материалам сапаллинской культуры) // История Узбекистана в археологических и письменных источниках. Ташкент : ФАН, 2005. С. 7–25.

Байпаков К. М., Воякин Д. А., Усманова Э. Р. Предисловие // Свод памятников истории и культуры Жамбыльской области. Чуйский район. Алматы : Археологическая экспертиза, 2012. С. 11–56.

Байтанаев Б. А. Поселение эпохи поздней бронзы урочища Бургулюк и керамика каржантауского типа // Известия НАН РК. Серия общественных наук. 2010. № 1 (274). С. 32–39.

Бех Н. И., Васильев В. А., Гини Э. Ч., Петриченко А. М. Мир художественного литья. История технологии. М. : УРСС, 1997. 272 с.

Бобомуллоев С. Раскопки гробницы бронзового века на Верхнем Зеравшане // Stratum plus. Археология и культурная антропология. 1999. Вып. 2. С. 301–313.

Бонгард-Левин Г. М., Гранатовский Э. А. От Скифии до Индии. Древние арии: мифы и история. М. : Мысль, 1983. 206 с.

Бочкарев В. С. Культурогенез и древнее металлопроизводство Восточной Европы. СПб. : Инфо-ол, 2010. 231 с.

Виноградов Н. Б. Культурно-исторические процессы в степях Южного Урала и Казахстана в начале II тыс. до н.э. (памятники синташтинского и петровского типов): автореф. дис. … д-ра ист. наук. М., 2007. 50 с.

Виноградов Н. Б. Степи Южного Урала и Казахстана в первые века II тыс. до н.э. (памятники синташтинского и петровского типа). Челябинск : Абрис, 2011. 175 с.

Гайдученко Л. Л. Некоторые биологические характеристики животных из жертвенных комплексов кургана 25 Большекараганского могильника // Аркаим: некрополь (по материалам кургана 25 Большекараганского могильника). Челябинск : Южно-Уральское книжное издательство, 2002. Кн. 1. С. 189–195.

Гайдученко Л. Л. Биологические остатки из укрепленных поселений «страны городов» Южного Зауралья // Аркаим — Синташта: древнее наследие Южного Урала. Челябинск : Челябинский государственный университет, 2010. Ч. 1. С. 96–108.

Генинг В. Ф., Зданович Г. Б., Генинг В. В. Синташта. Археологические памятники арийских племен Урало-Казахстанских степей. Челябинск : Южно-Уральское книжное издательство, 1992. Ч. 1. 408 с.

Гиндин Л. А. Пространственно-хронологические аспекты индоевропейской проблемы и «Карта предполагаемых прародин шести иностранных языков» В. М. Иллич-Свитыча // Вопросы языкознания. 1992. №6. С. 54–65.

Горбунов В. С. Бронзовый век Волго-Уральской лесостепи. Уфа : Башкирский государственный педагогический университет им. М. Акмуллы, 1992. 223 с.

Грантовский Э. А. Ранняя история иранских племен Передней Азии. М. : Восточная литература, 2007. 510 с.

Григорьев С. А. Ближневосточные компоненты в формировании синташтинской культуры и ее хронологии // Аркаим — Синташта: древнее наследие Южного Урала. Челябинск : Изд-во Челяб. гос. ун-та, 2010. Ч. 2. С. 32–48.

Григорьев С. А. Древние индоевропейцы. Челябинск : Рифей, 2015. 496 с.

Древняя история Южного Зауралья. Челябинск : Изд-во ЮУрГУ, 2000. Т. 1. 538 с.

Елизаренкова Т. Я. «Ригведа» — великое начало индийской литературы и культуры // Ригведа. Мандалы I–IV. Приложения. М. : Наука, 1989. С. 426–543.

Епимахов А. В. Южное Зауралье в эпоху средней бронзы. Челябинск : Библиотека А. Миллера, 2002. 170 с.

Епимахов А. В. Абсолютная и относительная хронология бронзового века Урала в свете новых радиокарбонных дат // Комплексные исследования древних и традиционных обществ Евразии. Барнаул : Изд-во Алт. ун-та, 2004. С. 204–208.

Епимахов А. В. Ранние комплексные общества севера Центральной Азии (по материалам могильника Каменный Амбар-5). Челябинск : Челябинский Дом печати, 2005. Кн. 1. 192 с.

Зданович Г. Б. Аркаим: арии на Урале, или Несостоявшаяся цивилизация // Аркаим: Исследования. Поиски. Открытия. Челябинск : Каменный пояс, 1995. С. 21–42.

Зданович Г. Б., Батанина И. М. Аркаим — Страна городов: Пространство и образы (Аркаим: горизонты исследований). Челябинск : Крокус, 2007. 260 с.

Зданович Г. Б., Зданович Д. Г. Протогородская цивилизация «Страны городов» Южного Зауралья (опыт моделирующего отношения к древности) // Культуры древних народов степной Евразии и феномен протогородской цивилизации Южного Урала. Россия и Восток. Челябинск : Челябинский государственный университет, 1995. Ч. V, кн. 1. С. 48–62.

Кадырбаев М. К., Марьяшев А. Н. Петроглифы хребта Каратау. Алматы : Наука, 2007. 147 с.

Калиева С. С., Логвин В. Н. Скотоводы Тургая в третьем тысячелетии до нашей эры. Кустанай : ИА МНАН РК, 1997. 176 с.

Китов Е. П. Палеоантропология населения Южного Урала эпохи бронзы: автореф. дис. … канд. ист. наук. М., 2011. 26 с.

Ковтун И. В. Предыстория арийской мифологии. Кемерово : Азия-Принт, 2013. 702 с.

Косинцев П. А. «Колесничные» лошади // Кони, колесницы и колесничие степей Евразии. Екатеринбург ; Самара ; Донецк : Рифей, 2010. С. 21–79.

Крижевская Л. Я. Значение культурных связей для организации поселений и домостроительства эпохи ранней бронзы в Южном Зауралье // Археологические культуры и культурно-исторические общности Большого Урала. Екатеринбург : Уральский федеральный университет им. Б.Н. Ельцина, 1993. С. 107–108.

Кузьмина О. В. Абашевская культура в лесостепном Волго-Уралье. Самара : Изд-во Самарского ГПИ, 1992. 128 с.

Кузьмина Е. Е. Откуда пришли индоарии? Материальная культура племен андроновской общности и происхождение индоиранцев. М. : Калина, 1994. 464 с.

Кузьмина Е. Е. Арии — путь на юг. М. ; СПб. : Летний сад, 2008. 558 с.

Кузьмина Е. Е. Синташтинский тип памятников и их этническая атрибуция // Аркаим — Синташта: древнее наследие Южного Урала. Челябинск : Издательство ЧелГУ, 2010а. Ч. 2. С. 66–77.

Кузьмина Е. Е. Кони степей в эпоху энеолита и бронзы // Кони, колесницы и колесничие степей Евразии. Екатеринбург ; Самара ; Донецк : Рифей, 2010б. С. 5–20.

Кукушкин И. А. Археологические комплексы Казахстана с колесничной атрибутикой. Новый аспект в археологии бронзы Казахстана // Свидетели Тысячелетий: Археологическая наука Казахстана за 20 лет (1991–2011). Алматы : Институт археологии им. А.Х. Маргулана, 2011а. С. 97–113.

Кукушкин И. А. Металлические изделия раннеандроновского могильника Ащису (Центральный Казахстан) // Российская археология. 2011б. №2. С. 103–109.

Кукушкин И. А., Ломан В. Г., Кукушкин А. И., Дмитриев Е. А. Погребение с металлическим сосудом в могильнике Нураталды I (эпоха бронзы) // Уральский исторический вестник. 2016. № 4 (53). С. 85–92.

Лелеков Л. А. Проблема индоиранских аналогий к явлениям скифской культуры // Скифо-сибирское культурно-историческое единство. Кемерово : КемГУ, 1980. С. 118–125.

Литвинский Б. А., Окладников А. П., Ранов В. А. Древности Кайрак-Кумов. Душанбе : Издательство Академии наук Таджикской ССР, 1962. 402 с.

Лихтер Ю. А., Усманова Э. Р. Бусы из египетского фаянса из казахстанских памятников андроновской общности // История и археология Семиречья. Алматы : Институт археологии им. А.Х. Маргулана, 2017. Вып. 5. С. 40–54.

Логвин А. В., Шевнина И. В. Исследование синташтинского могильника Каратомар, курган 1 (предварительное сообщение) // XXI Уральское археологическое совещание, посвященное 85-летию со дня рождения Г. И. Матвеевой и 70-летию со дня рождения И. Б. Васильева. Самара : Самарский государственный социально-педагогический университет, 2018. С. 123–125.

Ломан В. Г. Андроновское гончарство: общие приемы изготовления сосудов // Культуры древних народов степной Евразии и феномен протогородской цивилизации Южного Урала. Россия и Восток. Челябинск : Челябинский государственный университет, 1995. Ч. V, кн. 1. С. 96–100.

Ломан В. Г. Общие принципы выделения историко-культурной информации по данным гончарной технологии // Степная цивилизация Восточной Евразии. Астана : Күлтегін, 2003. Т. 1. Древние эпохи. С. 146–151.

Малютина Т. С. Стратиграфическая позиция материалов федоровской культуры на многослойных поселениях казахстанских степей // Древности Восточно-Европейской лесостепи. Самара : СГПИ, 1991. С. 141–162.

Малютина Т. С. «Квазигорода» эпохи бронзы Южного Урала и древний Хорезм // Комплексные общества Центральной Евразии в III–I тыс. до н.э.: Региональные особенности в свете универсальных моделей. Челябинск : Челябинский государственный университет, 1999. С. 119–121.

Мерперт Н. Я. К вопросу о древнейших круглоплановых укрепленных поселениях Евразии // Россия и Восток: проблемы взаимодействия. Челябинск : Челябинский государственный университет, 1995. Ч. V, кн. 1. С. 116–119.

Мнацаканян А. О. Лчашенские курганы (раскопки 1956 года) // Краткие сообщения Института археологии. 1961. Вып. 85. С. 66–72.

Новоженов В. А. Чудо коммуникации и древнейший колесный транспорт Евразии. М. : Таус, 2012. 500 с.

Отрощенко В. В. К истории племен срубной общности // Археология восточноевропейской лесостепи. Воронеж : Пензенский государственный педагогический университет им. В. Г. Белинского, 2003. Вып. 17: Доно-Донецкий регион в эпоху бронзы. С. 68–96.

Погребова М. Н. О конях, оленях и колесницах Южного Кавказа // Арии степей Евразии: эпоха бронзы и раннего железа в степях Евразии и на сопредельных территориях. Барнаул : Изд-во Алт. ун-та, 2014. С. 418–424.

Пряхин А. Д. Доно-Волжско-Уральская лесостепь на стыке средней и поздней бронзы // Культуры древних народов степной Евразии и феномен протогородской цивилизации Южного Урала. Россия и Восток. Челябинск : Челябинский государственный университет, 1995. Ч. V, кн. 1. С. 154–156.

Пряхин А. Д. Изучение эпохи бронзы Доно-Донецкого региона и выход на новую парадигму осмысления проблематики эпохи бронзы Евразийской степи и лесостепи (вторая половина XX столетия) // Археология восточноевропейской лесостепи. Воронеж : Пензенский государственный педагогический университет им. В. Г. Белинского, 2003. Вып. 17: Доно-Донецкий регион в эпоху бронзы. С. 36–43.

Сакенов С. К. Станковая керамика из поселения Шагалалы II (к вопросу о культурных связях племен эпохи бронзы Северного Казахстана и Средней Азии) // Диалог культур Евразии в археологии Казахстана. Астана : Сарыарка, 2014. С. 557–567.

Самашев З. С., Ермолаева А. С., Лошакова Т. Н. Костяные псалии с поселения Токсанбай. К вопросу о комплексе колесничих населения Устюрта в эпоху бронзы // Вопросы истории и археологии Западного Казахстана. 2007. № 1. С. 87–102.

Самашев З. С., Лошакова Т. Н. Исследование Арало-Каспийского региона в годы независимости Казахстана // Свидетели тысячелетий: археологическая наука Казахстана за 20 лет (1991–2011). Алматы : Институт археологии им. А. Х. Маргулана, 2011. С. 348–368.

Сарианиди В. И. Некрополь Гонура и иранское язычество. М. : Мир-медиа, 2001. 246 с.

Сарианиди В. И. Царский некрополь на Северном Гонуре // Вестник древней истории. 2006. № 2 (257). С. 155–192.

Сатаев Р. М. Животные из раскопок Гонур-Депе // Труды Маргианской археологической экспедиции. М. : Старый сад, 2008. Т. 2. С. 138–142.

Свод памятников истории и культуры Казахстана. Южно-Казахстанская область. Алма-Ата : Академия наук Республики Казахстан, 1994. Том 1. 368 с.

Слободзян М. Б. Изображение колесниц в петроглифах Алтая (местонахождения Елангаш и Калбак-Таш-1) // Северная Евразия в эпоху бронзы: пространство, время, культура. Барнаул : Изд-во Алт. ун-та, 2002. С. 116–119.

Стеблин-Каменский И. М. Вступительные статьи // Гаты Заратуштры. СПб. : Петербургское Востоковедение, 2009. С. 4–32.

Ткачев А. А. К вопросу о формировании и развитии погребальной обрядности атасуской культуры // Диалог культур Евразии в археологии Казахстана. Астана : Сарыарка, 2014. С. 653–664.

Ткачев В. В. Степи Южного Приуралья и Западного Казахстана на рубеже эпох средней и поздней бронзы. Актобе : Актюбинский областной центр истории, этнографии и археологии, 2007. 384 с.

Ткачёв В. В., Хаванский А. И. Керамика синташтинской культуры. Орск ; Самара : Издательство ОГТИ, 2006. 180 с.

Хабдулина М. К., Тлеугабулов Д. Т., Брынза Т. В., Билялова Г. Д., Кучеров П. Ю. Исследование памятников бронзового века в Акмолинском Приишимье (поселение Шагалалы II). Астана : Глобус, 2017. 192 с.

Хелимский Е. А. Самодийская лингвистическая реконструкция и праистория самодийцев // Компаративистика, уралистика. М. : Языки русской культуры, 2000. С. 13–25.

Хохлов А. А. О происхождении и дальнейшем развитии физического типа носителей синташтинско-потаповского круга культур // Аркаим — Синташта: наследие Южного Урала. Челябинск : Изд-во ЧелГУ, 2010. Ч. 2. С. 112–132.

Хуфф Д., Шайдуллаев Ш. Б. Некоторые результаты работ узбекско-германской экспедиции на городище Джаркутан // История материальной культуры Узбекистана. Самарканд : Институт археологии АН РУз, 1999. Вып. 30. С. 19–26.

Чечушков И. В. Колесницы евразийских степей эпохи бронзы // Вестник археологии, антропологии и этнографии. 2011. Вып. 2 (15). С. 57–65.

Шульга П. И. Могильник раннескифского времени Гилёво-10. Новосибирск : РИЦ НГУ, 2016. 258 с.

Щетенко А. Я. Время появления домашней лошади на территории Средней Азии // Происхождение и развитие колесничества. Луганск : Глобус, 2008. С. 218–232.

Anthony D. W. The horse, the wheel, and language: how Bronze-Age riders from the Eurasian steppes shaped the modern world. Princeton : Princeton University Press, 2007. 553 p.

Degtyareva A. D., Kuzminykh S. V., Loman V. G., Kukushkin I. A., Kukushkin A. I. Metal vessels of the Bronze Age in Kazakhstan // Journal of Archaeological Science: Reports. 2019. No. 28. P. 102024.

Lamberg-Karlovsky C. C. Archaeology and Language. The Indo-Iranians // Current Anthropology. 2002. Volum 43. Number 1. Pp. 63–88.

Muller-Karpe H. Handbuch der Vorgeschichte. Munchen : C. H. Beck'sche Verlagsbuchhandlung, 1980. Band IV/3. 996 s.

Potratz J. A. H. Die Pferdetrensen des alten Orient. Roma : Pontificum Institutum Biblicum, 1966. 364 p.

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ADVANTAGES OF SCAR-PATTERN ANALYSIS IN THE STUDY OF PALEOLITHIC CORES

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Abstract: Scar-pattern or working step analysis is one of the main components of technological analysis. This analysis is usually applied to reconstruct the technological sequence of Middle and Upper Palaeolithic bifacial tools. In addition to bifacial implements, the scar-pattern analysis is applied to geometric microliths and to macro-implements made on large flakes, such as Quina scrapers. However, the potential of this analysis is much wider. Here we present the basic approaches and algorithm for the application of scar-pattern analysis to core analysis.

The analysis algorithm includes five main research activities: determining the directions of all negatives, determining the mutual sequence of adjacent negatives, combining negatives into "technological units", determining the mutual consistency of the groups of combined negatives and complicating of scheme. As an example, two carinated technological sequences in the Kulbulakian from Western Central Asia are provided. Scar-pattern analysis applied to reconstruct the technological sequences of the cores is devoid of the disadvantages inherent in this analysis applied to bifacial tools. We believe that scar-pattern analysis is the most promising in Paleolithic technological reconstructions.

Keywords: scar-pattern analysis, working step analysis, cores, technology, knapping

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ПРЕИМУЩЕСТВА АНАЛИЗА ПОСЛЕДОВАТЕЛЬНОСТИ СКОЛОВ ПРИ ИЗУЧЕНИИ ПАЛЕОЛИТИЧЕСКИХ НУКЛЕУСОВ

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Резюме: Анализ последовательности сколов является одним из основных компонентов технологического анализа. Этот анализ обычно применяется для реконструкции технологической

последовательности бифасиальных орудий среднего и верхнего палеолита. Помимо бифасиальных орудий, анализ последовательности сколов применялся к геометрическим микролитам и макроорудиям, изготовленным на крупных отщепах, таким как скребки кина. Однако потенциал этого анализа гораздо шире. В предлагаемой вниманию читателей статье мы представляем основные подходы и алгоритм применения анализа последовательности сколов для анализа палеолитических нуклеусов.

Алгоритм анализа включает пять основных шагов: определение направлений всех негативов сколов на артефакте, определение взаимной последовательности соседних негативов сколов, объединение негативов в «технологические единицы», определение взаимной последовательности групп объединенных негативов и создание финальной схемы. В качестве примера приведен анализ последовательности сколов на двух кареноидных нуклеусах из комплексов кульбулакской культуры (западная часть Центральной Азии). Анализ последовательности сколов, примененный для реконструкции технологических последовательностей нуклеусов, лишен недостатков, присущих этому анализу применительно к бифасиальным орудиям. Авторы считают, что анализ последовательности сколов является наиболее перспективным в реконструкции палеолитических технологий первичного расщепления.

Ключевые слова: анализ последовательности сколов, анализ технологических этапов, нуклеусы, технология, первичное расщепление

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Introduction

The application of the "chaîne opératoire" [Boeda et al., 1990; Pelegrin, 1990; Pigeot, 1991; Inizan et al., 1999] and all its components have in recent years become an integral part of Palaeolithic research. The approach from the French research practice, aimed at a comprehensive reconstruction of the technological sequence is now actively used in Russian [Girya, 1997; Nekhoroshev, 1999; Pavlenok, Belousova, Rybin, 2011; Kolobova, 2006] and English-speaking [Bar-Yosef, Van Peer, 2009] research literature. One element of this procedure is scar-pattern analysis, along with attributive analysis, experimental and use-wear, refitting, and the method of raw material units.

The idea of a scar-pattern analysis is to reconstruct the knapping process of a lithic implement by examining all the negatives and ridges on its surface and determining their mutual consistency. As an independent research tool, this method was first applied by J. Richter and A. Pastoors in their study of Middle Palaeolithic bifacial tools. The basic principles of the method have been formulated and substantiated in the research works of A. Pastors [Pastoors, Schafer, 1999; Pastoors, 2000], J. Richter [2001], E. Boeda [2001], M. Kot [2013].

The applicative method is considered to be the most reliable method for identifying the main stages of stone artefact manufacture. However, the application of this method is not possible in all Paleolithic complexes. In such a situation, the use of scar-pattern analysis becomes particularly important, as a set of negatives on the surface of a stone artefact provides direct evidence in identifying methods and ordering the procedures used in its manufacture.

One of the most widespread categories of artefacts that can provide important information about knapping technology in the absence of refitting is cores. The advantages of using scar-pattern analysis in the study of cores are the subject of this article.

Historiographical review

The basic principles of scar-pattern analysis were originally developed and used extensively in the study of bifacial tools. This is because the application of the refitting, as the most reliable method for reduction process reconstructing, is not possible in the case of bifacial tools, with a few exceptions [Veselsky, 2008; Nerudova, Neruda, 2017; Wiśniewski et al., 2020]. Bifacial implements were often used as multi-purpose tools and were used as mobile raw materials [Uthmeier, 2004], which were brought to the site being shaped [Chabai, 2004]. In the research literature there are many successful examples of reconstruction of bifacial tool production through scar-pattern analysis [Richter, 2004; Uthmeier, 2012; Joris, 2006; Kot, 2013; Shalagina et al., 2020].

Today, scar-pattern analysis is used to reconstruct the technological sequences of different lithic artefacts, including various types of tools made of blanks. In particular, the use of scar-pattern analysis made it possible to reconstruct the technological sequence of the production of truncated faceted tools in the complexes of Obi-Rakhmat rock shelter (Uzbekistan), and to determine that the purpose of the these tools production was to create a working edge, and not to obtain blanks [Shalagina, Krivoshapkin, Kolobova, 2015; Shalagina, Kolobova, Krivoshapkin, 2019].

This analysis has no limitations in terms of the tool size and the intensity of their design. The analysis proves effective both in the study of microliths and various macro-tools. The study of early geometric microliths in Central Asia, allowed the authors to identify general patterns in the design of microliths by analyzing the chronological sequence of retouch facets [Kolobova, Krivoshapkin, Shnaider, 2018]. A successful example of the application of scar pattern analysis to macro-tools produced on blanks is the study of the earliest "Quina" and "semi-Quina" type scrapers in the Qesem Cave, in the Middle East. Using scar pattern analysis in conjunction with use-wear analysis allowed the researchers to identify several cycles of processing and use of scrapers [Lemorini et al., 2015].

Application of scar-pattern analysis to the study of cores

Recently, scar-pattern analysis has increasingly been used to reconstruct the knapping process. It is not always used as an independent research tool, however, the study of negatives from removals are actively used in the analysis of cores.

Detailed examination of the negatives on the surface of the cores allows information to be extracted on the size of the withdrawals, the impact force and type of indenter, the procedures used to shape the nucleus and the way the impact pad was designed. Detailed examination of the negatives on the core surface provides information on the size of the removed flakes, the impact force and type of the hammer, the procedures used to core shaping and the way the striking platform was designed. In general, the negatives on the cores are highly informative regarding the reconstruction of knapping patterns. The morphology and size of the negatives can be analysed either manually or with special equipment and software that automates the process [Clarkson, Vinicius, Lahr, 2006; Kolobova et al., 2020]. First and foremost, scar-pattern analysis is used to reconstruct the main stages of core knapping, as well as the patterns

associated with the design of striking platforms and the core front [Soriano et al., 2015; Pavlenok, Kozlikin, Shunkov, 2021]. Often, reduction schemes based on a detailed study of the negatives are a good illustration of the technological process and the conclusions reached through technological analysis [Zwins, 2012]. Analysis of the morphology of the negatives on the cores also makes it possible to reconstruct the length of the pre-form during the previous reduction stages, as well as the volume of the material chunk. The cores contain both the complete negatives of the impact point and their distal or medial fragments. Nevertheless, even examining fragments of the negatives provides information about the initial size of the obtained flakes. Counting method was proposed by P. Neruda for analyzing Middle Paleolithic and Upper Paleolithic cores. This method is based on calculating the initial length of the removed flake by measuring the wave of the impact on its negative. The effectiveness of this method has been confirmed on both experimental and archaeological assemblages [Neruda, 2015].

In Russian Palaeolithic studies, the ideas of analysis of removal negatives began to be developed from the middle of the 20th century within the framework of morphological [Lyubin, 1965], and then the concept of dynamic technological [Doronichev, 1986] analysis of cores. In contemporary science, scar-pattern analysis is applied in the definition of "flaking systems" in the process of reconstructing knapping technology [Nekhoroshev, 1999]. In this case, the "flaking system" refers to a set of negatives reflecting a particular stage in the design of a stone artefact (cores, core fragments and bifacial tools). One "flaking systems" is a combination of an striking platform and its corresponding core surface [Ocherednoy, 2014, p. 215–221].

Research procedure for scar-pattern analysis

Regardless of the artefacts being studied, the research procedure for scar-pattern analysis is unified and is a process consisting of several steps, each of which is depicted in graphic schemes 3. combining negatives into " technological units" [Pastoors, 2000] or "blank sequences" [Kot, 2013].

1. Determining the directions of all negatives, on the surfaces of the artefact (Fig. 1.-*a*);

2. Determining the mutual sequence of adjacent negatives (Fig. 1.-*b*);

3. Combining negatives into "technological units" [Pastoors, 2000] or "blank sequences" [Kot, 2013]. Here, a "technological unit" refers to a group of negatives with similar morphological characteristics (from the same striking platform, in the same direction, etc.) and aimed at the same technological task. o simplify visual perception, each such technological unit is indicated by a separate color and letter in the graphic illustration of the artefact (Fig. 1.-*c*).

4. Determining the mutual consistency of the groups of combined negatives, and its graphical representation (Fig. 1.-*d*). Determines the interdependence and sequence of the design of the different surfaces (parts) of the artefact. At this stage, the chronological scheme of the artefact's design is reconstructed.

Different ways of representing the results of analysis exist [Richter, 2001; Jöris, 1994; Kot, 2014]. In our paper, in a simplified, adapted version, we use the event chain process diagram (EPC diagram) adopted for modelling economic phenomena [Scheer, 1998]. It is a type of flowchart that is an ordered combination of events, where each event is defined by a different time frame and mutual influence.

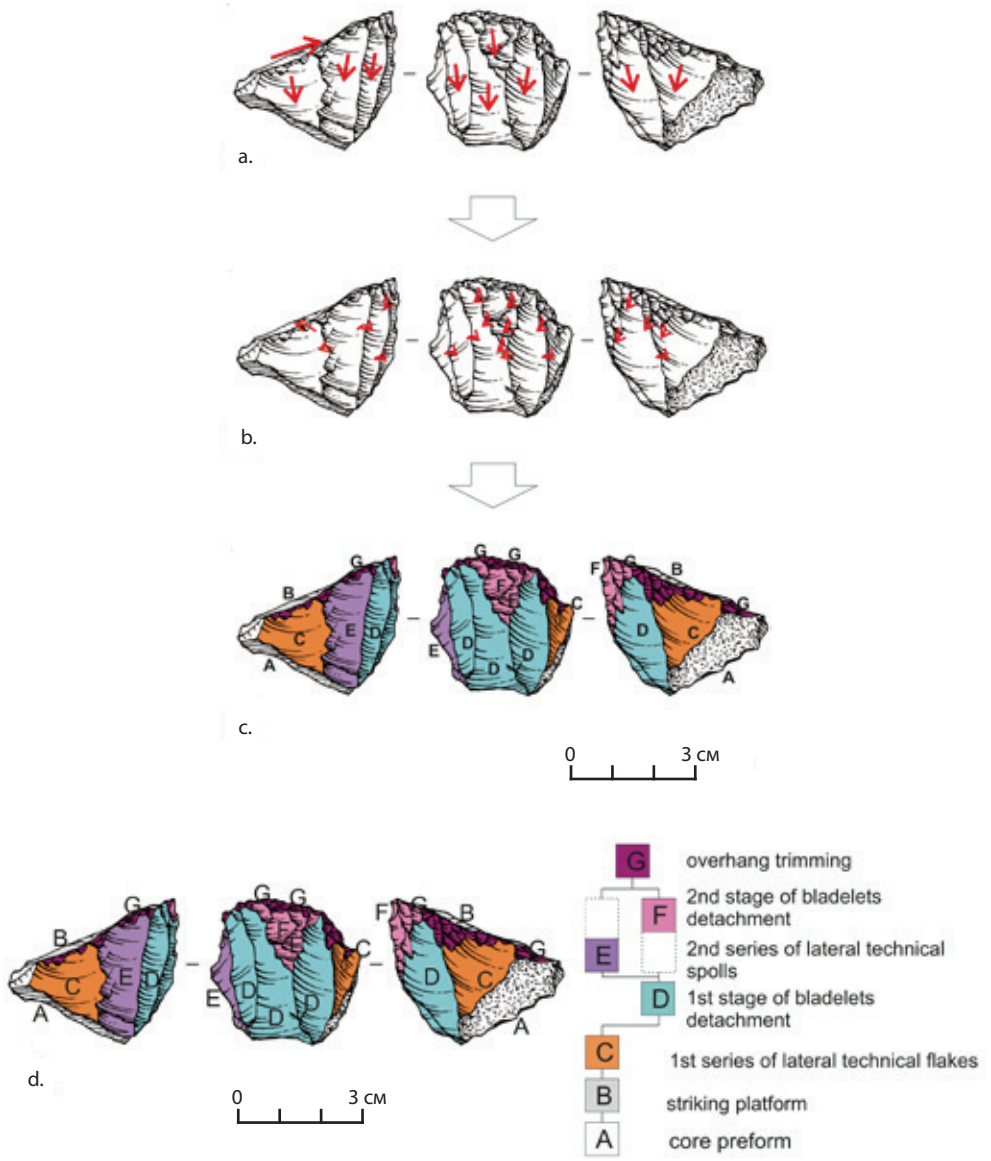

Fig. 1. Procedure of scar-pattern analysis: a — determining the directions of negatives on artifact; b — determining the mutual sequence of adjacent negatives; c — combining negatives into "technological units"; d — completed scheme of scar-pattern analysis

Рис. 1. Процедура анализа последовательности сколов: a — определение направлений негативов на артефакте; b — определение взаимной последовательности соседних негативов; c — объединение негативов в «технологические единицы»; d — завершенная схема анализа последовательности сколов

5. At the final stage of analysis, the entire production process is divided into phases based on the compiled scheme. As a result of the analysis of all the negatives on the surface of the

artefact, a scheme of its design is constructed, highlighting the main technological steps (Fig. 1.-*d*). Thus, by systematising the negatives in chronological order, visible on the surface of the artefact, the place of the individual technological steps in the reduction process is determined.

The example of the application of scar-pattern analysis to the study of cores

To illustrate the application of scar-pattern analysis in the reconstruction of primary reduction process we give an example of carinated cores from the Kulbulakian Upper Paleolithic complexes of Central Asia. The use of scar-pattern analysis in this case makes it possible to demonstrate the technological differences between the two different concepts within a carinated technology.

The following technological sequence is reconstructed within the framework of the concept of carinated end-scrapers. As a rule, massive flakes were used as blanks for such cores.

The first stage in the reduction of the carinated end-scrapers was to select the striking platform (in the case of the ventral surface), or to create one (Fig. 2). The next step was to prepare the main flaking surface by removing a series of flakes from the striking platform, creating a convex front surface (Fig. 2). This was followed by the realization of the target blanks - bladelets with a curved profile. The reduction sequence involves recurrent removal of the bladelets without the realization of technical spalls at the core processing stage.

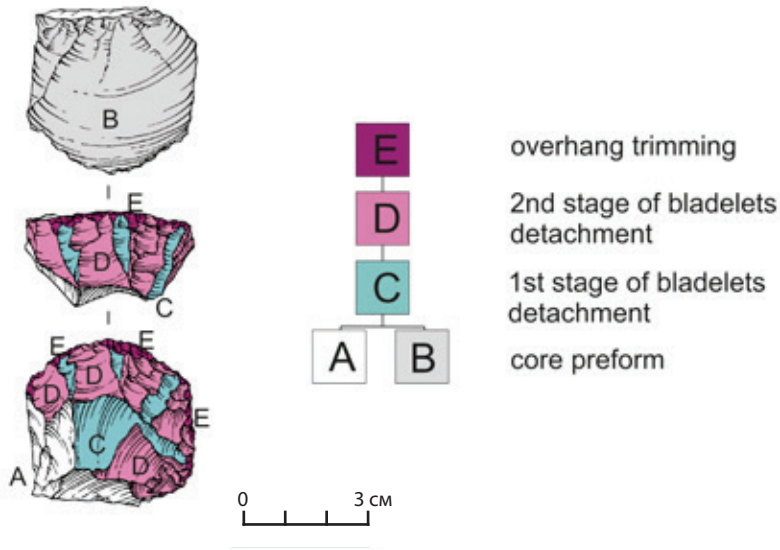

Fig. 2. The example of scar-pattern analysis on carinated (end-scraper) core from Kulbulakian Upper Paleolithic assemblage

Рис. 2. Пример анализа последовательности сколов на кареноидном нуклеусе (кареноидном концевом скребке) из Кульбулакского верхнепалеолитического комплекса

The second technological sequence is based on the processing of small chunks, or blanks, oriented so that the ventral and dorsal surfaces act as left and right laterals of the core. As part of the main core reduction, a series of targeted bladelets was removed from a small area of the front bounded by the negatives of the lateral removals (Fig. 3).

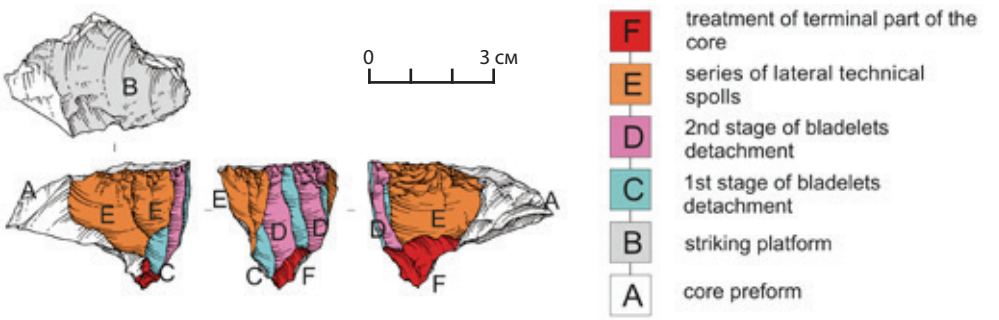

Fig. 3. The example of scar-pattern analysis on carinated (lateral) core from Kulbulakian Upper Paleolithic assemblage

Рис. 3. Пример анализа последовательности сколов на кареноидном нуклеусе (латеральном кареноидном нуклеусе) керне из Кульбулакского верхнепалеолитического комплекса

In this case, the use of scar-pattern analysis made it possible to reconstruct the different technological sequences of core reduction within a single carinated technique, which could not be done on the basis of technical-typological analysis.

Conclusion

Scar-pattern analysis is a versatile tool for the most accurate reconstruction of different technological sequences. Typically used to analyze bifacial tools, this can seem overly complicated and time-consuming to inexperienced researchers. However, this perception is solely a consequence of complex reductionist patterns of production and further biface rejuvenation.

The application of the scar-pattern to core analysis is able to provide new, previously inaccessible technological data. The hierarchical flaking inherent in the Levallois technology has enabled one of the earliest manifestations of this technology in the Lower Paleolithic of Europe to be justified [Soriano, Villa, 2017].

Scar-pattern analysis of the cores from layer 23 of the Kulbulak site provided evidence of a much larger portion of Levallois technology in the Middle Paleolithic of western Central Asia than previously assumed. Scar-pattern analysis of the bladelet cores demonstrated technological similarity with Levallois cores [Pavlenok G., Pavlenok K., 2019].

As our practice shows, the use of scar-pattern analysis has substantial prospect because the cores usually have simpler reduction patterns that even a non-experienced researcher can read. An undoubted advantage of using scar-pattern for core analysis is that it provides more accurate technological data than the widespread technological or attribute analysis.

REFERENCES

Bar-Yosef O., Van Peer P. The Chaine Operatoire Approach in Middle Paleolithic Archaeology. Current Anthropology. 2009. № 1 (50). Pp. 103–131.

Boëda E. Determination des unités techno-fonctionnelles des pièces bifaciales provenant de la couche acheuléenne C'3 base du site de Barbas I // Les industries à outils bifaciaux du

Paléolithique moyen d'Europe occidentale. Liège : Editions de l'Université de Liège 2001. Pp. 51–75.

Boëda E., Geneste J. M., Meignen L. Identification de chaîne opératoires lithiques du Paléolithique ancien et moyen // Paléo. 1990. № 2. Pp. 43–80.

Chabai V. P. Srednij paleolit Kryma [Middle Paleolithic of Crimea]. Simferopol : Shlyah, 2004. 324 p. (*In Russ.*)

Clarkson C., Vinicius L., Lahr M. M. Quantifying Flake Scar Patterning on Cores Using 3D Recording Techniques // Journal of Archaeological Science. 2006. № 33. Pp. 132–142.

Girya E. Yu. Tehnologicheskij analiz kamennyh industrij: Metodika mikro-makroanaliza drevnih orudij truda. Ch. 2 [Technological Analysis of Stone Industries (Methodology of micro-macroanalysis of Ancient Tools, Part 2). Sankt-Peterburg : Izd-vo IIMK RAN, 1997. C. 199 (*In Russ.*)

Doronichev V. B. Izuchenie tehniki rasshchepleniya nukleusov kak sistemy vzaimosvyazannyh teknologicheskih processov (po materialam Abadzehskogo mestonahozhdeniya v Majkopskom rajone) [Studying the Technique of Splitting Cores as a System of Interrelated Technological Processes (based on materials from the Abadzekh site in the Maikop region)]. Voprosy arheologii Adygei. [Questions of Archaeology of Adygea]. Majkop : Adygejskoe knizhnoe izdatel'stvo, 1986. Pp. 79–92 (*In Russ.*)

Inizan M. L., Reduron-Ballinger M., Roche G., Tixier J. Technology and Terminology of Knapped Stone. Translated by J. Féblot-Augustins. Préhistoire de la Pierre Taillée T. 5. Nanterre : CREP, 1999. P. 189

Jöris O. Neue Untersuchungen zum Mittelpaläolithikum von Buhlen, Hessen. Technologische Studien zur Pradniktechnik in Horizont IIIb des Oberen Fundplatzes // Ethnographisch Archäologische Zeitschrift. 1994. № 35. Pp. 88–97.

Jöris O. Bifacially backed knives (Keilmesser) in the Central European Middle Palaeolithic // Axe age: Acheulian Tool-Making from Quarry to Discard / eds. by N. Goren-Inbar, G. Sharon. London, 2006. Pp. 287–310.

Kolobova K. A. Priemy oformleniya kamennyh orudij v paleoliticheskih industriyah Gornogo Altaya [Techniques for the Formation of Stone Tools in the Paleolithic Industries of Gorny Altai]. Novosibirsk : Izd-vo In-ta arheologii i etnografii SO RAN, 2006. (*In Russ.*)

Kolobova K. A., Krivoshapkin A. I., Shnaider S. V. Early Geometric Microlith Technology In Central Asia // Archaeological and Anthropological Sciences. 2018. №1. DOI: 10.1007/s12520-018-0613-y

Kolobova K. A., Shalagina A. V., Chistyakov P. V., Bocharova E. N., Krivoshapkin A. I. Three-dimensional Modelling Application for Studying Stone Age Assemblages // Siberian Historical Research. 2020. № 4. Pp. 240–260. DOI: 10.17223/2312461X/30/12

Kot M. A. The Earliest Middle Palaeolithic Bifacial Leafpoints in Central and Southern Europe. Technological Approach. PhD Thesis. Warsaw. 2013. P. 374

Kot M. A. The Earliest Middle Palaeolithic Bifacial Leafpoints in Central and Southern Europe: Technological Approach // Quaternary International. 2014. № 326–327. P. 381–397. DOI: 10.1016/j.quaint.2013.10.030

Lemorini C., Bourguignon L., Zupancich A., Gopher A., Barkai R. A Scraper's Life History: Morpho-Techno-Functional and Use-Wear Analysis of Quina and Demi-Quina Scrapers from Qesem Cave, Israel // Quaternary International. 2015. № 398. Pp. 1–8.

Lyubin V. P. K voprosu o metodike izucheniya nizhnepaleoliticheskih kamennyh orudij [On the Question of the Method of Studying the Lower Paleolithic Stone Tools]. Paleolit i neolit SSSR [Paleolithic and Neolithic of the USSR]. Vol. V. Moscow; Leningrad : Nauka, 1965. Pp. 7–75 (*In Russ.*)

Nehoroshev P. E. Tehnologicheskij metod izucheniya pervichnogo rasshchepleniya kamnya srednego paleolita [Technological Method for Studying the Primary Cleavage of the Middle Paleolithic Stone]. Sankt-Peterburg : Evropeiskij dom, 1999. P. 172. (*In Russ.*)

Neruda P. Blank Length Reconstruction on the Base of Circular Segment Method -Core Refitting Case Study // Anthropologie (Brno). 2015. № 53 (3). Pp. 531–545.

Nerudova Z., Neruda P. Technology of Moravian Early Szeletian Leaf Point Shaping: A Case Study of Refittings from Moravský Krumlov IV Open-Air Site (Czech Republic) // Quaternary International. 2017. № 428. Pp. 91–108. DOI: 10.1016/j.quaint.2015.09.065

Ocherednoj A. K. Sistemy skalyvaniya v analize izgotovleniya dvustoronneobrabotannyh orudij [Chipping Systems in the Analysis of the Manufacture of Double-Sided Tools]. Trudy istoricheskogo fakul'teta Sankt-Peterburgskogo universiteta [Proceedings of the Faculty of History of St. Petersburg University]. 2014. № 18. Pp. 215–224. (*In Russ.*)

Pastoors A. Standardization and Individuality in the Production Process of Bifacial Tools — Leaf-Shaped Scrapers from the Middle Paleolithic Open Air Site Sare Kaya I (Crimea). In Neanderthals and Modern Humans — Discussing the Transition. Central and Eastern Europe from 50.000–30.000 B. P. Mettmann : Neanderthal Museum, 2000. Pp. 243–255.

Pastoors A., Schafer J. Analyse des états techniques de transformation, d'utilisation et états post dépositionnels. Illustrée par un outil bifacial de Salzgitter-Lebenstedt (FRG) // Préhistoire Européenne. 1999. № 14. Pp. 33–47.

Pavlenok G. D., Kozlikin M. B., Shunkov M. V. Small Blade Technology in the Early Upper Paleolithic Industries from Denisova Cave: Data from Analysis of a Lithic Reduction Sequence // Ural'skij Istoriceskij Vestnik. 2021. № 70 (1). Pp. 123–128

Pavlenok K. K., Belousova N. E., Rybin E. P. Atributivnyj podhod k rekonstrukcii "operacionnyh cepochek" rasshchepleniya kamnya [An Attributive Approach to the Reconstruction of "Operational Chains" of Stone Splitting]. Vestnik Novosibirskogo gosudarstvennogo universiteta. Ser.: Istoriya, filologiya [Bulletin of Novosibirsk State University Series: History, Philology]. 2011. Vol. 10. Issue 3. 2011. P. 35–46. (*In Russ.*)

Pavlenok G., Pavlenok K. Scar-Pattern Analysis of the Bladelet Cores from Layer 23 of Kulbulak Site // The Past has a Future! Conference to Mark the Centenary of Archaeology at the Institute of Archaeology, University of Warsaw (9–3.12.2019). Warsaw, 2019. Pp. 61–62.

Pelegrin J. Prehistoric Lithic Technology: Some Aspects of Research // Archaeological Review from Cambridge. 1990. № 9. Pp. 116–125.

Pigeot N. Reflexions sur l'histoire technique de l'homme: De l'evolution cognitive a l'evolution culturelle // Paleo 1991. № 3. Pp. 167–200.

Richter J. Une analyse standarisée des chaines opératoires sur les pièces foliacées du Paleolithique moyen tardif // L. Bourgignon, I. Ortega and M.-C. Frèresautot (eds). Préhistoire et approche expérimentale. 2001. Pp. 77–78.

Richter J. Copies of flakes: Operational Sequences of Foliate Pieces from Buran-Kaya III Level B1 // V. P. Chabai, K. Monigal and A. E. Marks (eds.). The Middle Paleolithic and Early Upper Paleolithic of Eastern Crimea 3. Liege : ERAUL 104, 2004. Pp. 233–247.

Shalagina A. V., Kharevich V. M., Maury S., Baumann M., Krivoshapkin A. I., Kolobova K. A. Reconstruction of the Bifacial Technological Sequence in Chagyrskaya Cave Assemblage // Siberian Historical Research. 2020. № 3. Pp. 130–151. DOI: 10.17223/2312461X/29/9

Shalagina, A., Kolobova, K., Krivoshapkin, A. Scar Pattern Analysis as a Method for the Rreconstruction of Lithic Artifacts Production Sequence // Stratum Plus. 2019. № 1. Pp. 145–154.

Shalagina A. V., Krivoshapkin A. I., Kolobova K. A. Truncated-Faceted Pieces in the Paleolithic of Nothern Asia. Archaeology, Ethnology & Anthropology of Eurasia. 2015. № 4(44). P. 33–45. DOI: 10.17746/1563-0102.2015.43.4.033-045

Soriano S., Villa P. Early Levallois and the Beginning of the Middle Paleolithic in Central Italy // PLoS One. 2017. № 12(10). e0186082. DOI:10.1371/journal.pone.0186082.

Scheer A.-W. ARIS — Modellierungsmethoden, Metamodelle, Anwendungen. Berlin Heidelberg : Springer-Verlag. 1998. DOI 10.1007/978-3-642-97731-2

Soriano S., Villa P., Delagnes A., Degano I., Pollarolo L., Lucejko J. J., Henshilwood Ch., Wadley L. The Still Bay and Howiesons Poort at Sibudu and Blombos: Understanding Middle Stone Age Technologies // PloS ONE. 2015. № 10 (7). P. 1–46.

Uthmeier Th. The Transition from Middle- to Upper Palaeolithic at Buran Kaya III, Crimea (Ukraine): a Case of Conceptual Continuity of Lithic Artefact Manufacture?» // A. Pastoors and M. Peresani (eds.). Flakes not Blades: The Role of Flake Production at the Onset of the Upper Palaeolithic. Mettmann: Wissenschaftliche Schriften des Neanderthal Museums 5, 2012. Pp. 239–260.

Uthmeier Th. Transformation Analysis and the Reconstruction of On-Site and Off-Site Activities: Methodological Remarks // V.P. Chabai, K. Monigal and A.E. Marks (eds.): The Middle Paleolithic and Early Upper Paleolithic of Eastern Crimea: The Paleolithic of Crimea III. Liege : ERAUL 104, 2004. Pp. 175–191.

Veselsky A. P. Kabazi V: Production and Rejuvenation of Bifacial Tools // Kabazi V: Interstratification of Micoquian & Levallois-Mousterian Camp Sites. Palaeolithic Sites of Crimea. Vol. 3, Part 2. Simferopol; Cologne : Shlyakh, 2008. Pp. 455–479.

Wiśniewski A., Chłoń M., Weiss M., Pyżewicz K. Migal W. On Making of Micoquian Bifacial Backed Tools at Pietraszyn 49a, SW Poland // Journal of Paleolithic Archaeology. 2020. №3. Pp. 856–888.

Zwyns N. Laminar Technology and the Onset of the Upper Paleolithic in the Altai, Siberia (Studies in Human Evolution). Doctoral Thesis, Leiden : University Press. 2012. P. 414.

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Гиря Е. Ю. Технологический анализ каменных индустрий: Методика микро-макроанализа древних орудий труда. Ч. 2. СПб. : Изд-во ИИМК РАН, 1997. С. 199.

Дороничев В. Б. Изучение техники расщепления нуклеусов как системы взаимосвязанных технологических процессов (по материалам Абадзехского местонахождения в Майкопском районе) // Вопросы археологии Адыгеи. Майкоп : Адыгейское книжное издательство, 1986. С. 79–92.

Колобова К. А. Приемы оформления каменных орудий в палеолитических индустриях Горного Алтая. Новосибирск : Изд-во Ин-та археологии и этнографии СО РАН, 2006. 136 с.

Любин В. П. К вопросу о методике изучения нижнепалеолитических каменных орудий // Палеолит и неолит СССР. Т. V. М.; Л. : Наука, 1965. С. 7–75.

Нехорошев П. Е. Технологический метод изучения первичного расщепления камня среднего палеолита. СПб. : Европейский дом, 1999. С. 172.

Очередной А. К. Системы скалывания в анализе изготовления двустороннеобработанных орудий // Труды исторического факультета Санкт-Петербургского университета. 2014. № 18. С. 215–224.

Павленок К. К., Белоусова Н. Е., Рыбин Е. П. Атрибутивный подход к реконструкции «операционных цепочек» расщепления камня // Вестник Новосибирского государственного университета. Сер.: История, филология. 2011. Т. 10. Вып. 3. С. 35–46.

Чабай В. П. Средний палеолит Крыма. Симферополь : Шлях, 2004. 324 с.

Bar-Yosef O., Van Peer P. The Chaine Operatoire Approach in Middle Paleolithic Archaeology // Current Anthropology. 2009. №1 (50). P. 103–131.

Boëda E. Determination des unités techno-fonctionnelles des pièces bifaciales provenant de la couche acheuléenne C'3 base du site de Barbas I // Les industries à outils bifaciaux du Paléolithique moyen d'Europe occidentale. Liège : Editions de l'Université de Liège, 2001. P. 51–75.

Boëda E., Geneste J. M., Meignen L. Identification de chaîne opératoires lithiques du Paléolithique ancien et moyen // Paléo. 1990. №2. P. 43–80.

Clarkson C., Vinicius L., Lahr M. M. Quantifying flake scar patterning on cores using 3D recording techniques // Journal of Archaeological Science. 2006. №33. P. 132–142.

Inizan M. L., Reduron-Ballinger M., Roche G., Tixier J. Technology and Terminology of Knapped Stone. Translated by J. Féblot-Augustins. Préhistoire de la Pierre Taillée T. 5. Nanterre : CREP, 1999. P. 189

Jöris O. Neue Untersuchungen zum Mittelpaläolithikum von Buhlen, Hessen. Technologische Studien zur Pradniktechnik in Horizont IIIb des Oberen Fundplatzes // Ethnographisch Archäologische Zeitschrift. 1994. №35. P. 88–97.

Jöris O. Bifacially backed knives (Keilmesser) in the Central European Middle Palaeolithic // Axe age: Acheulian tool-making from quarry to discard / eds. by N. Goren-Inbar, G. Sharon. London : Equinox Publishing, 2006. P. 287–310.

Kolobova K. A., Krivoshapkin A. I., Shnaider S. V. Early Geometric Microlith Technology In Central Asia // Archaeological and Anthropological Sciences. 2018. №1. DOI: 10.1007/s12520-018-0613-y

Kolobova K. A., Shalagina A. V., Chistyakov P. V., Bocharova E. N., Krivoshapkin A. I. Three-dimensional modelling application for studying stone age assemblages // Siberian Historical Research. 2020. № 4. С. 240–260. DOI: 10.17223/2312461X/30/12

Kot M. A. The Earliest Middle Palaeolithic Bifacial Leafpoints in Central and Southern Europe. Technological Approach. PhD Thesis. Warsaw. 2013. P. 374.

Kot M. A. The Earliest Middle Palaeolithic Bifacial Leafpoints in Central and Southern Europe: Technological Approach // Quaternary International. 2014. №326–327. P. 381–397. DOI: 10.1016/j.quaint.2013.10.030

Lemorini C., Bourguignon L., Zupancich A., Gopher A., Barkai R. A Scraper's life history: Morpho-techno-functional and use-wear analysis of Quina and demi-Quina scrapers from Qesem Cave, Israel // Quaternary International. 2015. №398. P. 1–8.

Neruda P. Blank length reconstruction on the base of circular segment method – core refitting case study // Anthropologie (Brno). 2015. №53 (3). P. 531–545.

Nerudova Z., Neruda P. Technology of Moravian Early Szeletian leaf point shaping: A case study of refittings from Moravský Krumlov IV open-air site (Czech Republic) // Quaternary International. 2017. №428. P. 91–108. DOI: 10.1016/j.quaint.2015.09.065

Pastoors A. Standardization and individuality in the production process of bifacial tools — leaf-shaped scrapers from the middle Paleolithic open air site Sare Kaya I (Crimea). In Neanderthals and Modern Humans — Discussing the Transition. Central and Eastern Europe from 50.000–30.000 B. P. Mettmann : Neanderthal Museum, 2000. P. 243–255.

Pastoors A., Schafer J. Analyse des états techniques de transformation, d'utilisation et états post dépositionnels. Illustrée par un outil bifacial de Salzgitter-Lebenstedt (FRG) // Préhistoire Européenne. 1999. №14. P. 33–47.

Pavlenok G., Pavlenok K. Scar-Pattern Analysis of the Bladelet Cores from Layer 23 of Kulbulak Site // The past has a future! Conference to Mark the Centenary of Archaeology at the Institute of Archaeology, University of Warsaw (9-3.12.2019). Warsaw, 2019. P. 61–62.

Pavlenok G. D., Kozlikin M. B., Shunkov M. V. Small blade technology in the early upper paleolithic industries from denisova cave: Data from analysis of a lithic reduction sequence // Ural'skij Istoriceskij Vestnik. 2021. № 70(1). P. 123–128.

Pelegrin J. Prehistoric lithic technology: Some aspects of research // Archaeological Review from Cambridge. 1990. №9. P. 116–125.

Pigeot N. Reflexions sur l'histoire technique de l'homme: De l'evolution cognitive a l'evolution culturelle // Paleo 1991. №3. P. 167–200.

Richter J. Une analyse standarisée des chaines opératoires sur les pièces foliacées du Paleolithique moyen tardif // L. Bourgignon, I. Ortega and M.-C. Frèresautot (eds). Préhistoire et approche expérimentale. 2001. P. 77–78.

Richter J. Copies of flakes: Operational Sequences of Foliate Pieces from Buran-Kaya III Level B1 // V. P. Chabai, K. Monigal and A. E. Marks (eds.). The Middle Paleolithic and Early Upper Paleolithic of Eastern Crimea 3. Liege : ERAUL 104, 2004. P. 233–247.

Shalagina A. V., Kharevich V. M., Maury S., Baumann M., Krivoshapkin A. I., Kolobova K. A. Reconstruction of the bifacial technological sequence in Chagyrskaya cave assemblage // Siberian Historical Research. 2020. № 3. P. 130–151. DOI: 10.17223/2312461X/29/9

Shalagina A., Kolobova K., Krivoshapkin A. Scar pattern analysis as a method for the reconstruction of lithic artifacts production sequence // Stratum Plus. 2019. № 1. P. 145–154.

Shalagina A. V., Krivoshapkin A. I., Kolobova K. A. Truncated-faceted pieces in the Paleolithic of Nothern Asia. Archaeology, Ethnology & Anthropology of Eurasia. 2015. № 4 (44). P. 33–45. DOI: 10.17746/1563-0102.2015.43.4.033-045

Scheer A.-W. ARIS — Modellierungsmethoden, Metamodelle, Anwendungen. Berlin Heidelberg : Springer-Verlag, 1998. DOI 10.1007/978-3-642-97731-2

Soriano S., Villa P., Delagnes A., Degano I., Pollarolo L., Lucejko J. J., Henshilwood Ch., Wadley L. The Still Bay and Howiesons Poort at Sibudu and Blombos: understanding Middle stone age technologies // PloS ONE. 2015. №10 (7). P. 1–46.

Soriano S., Villa P. Early Levallois and the beginning of the Middle Paleolithic in central Italy // PLoS One. 2017. № 12 (10). e0186082. DOI:10.1371/journal.pone.0186082.

Uthmeier Th. The Transition from Middle- to Upper Palaeolithic at Buran Kaya III, Crimea (Ukraine): a case of conceptual continuity of lithic artefact manufacture?" // A. Pastoors and M. Peresani (eds.). Flakes not Blades: The Role of Flake Production at the Onset of the Upper Palaeolithic. Mettmann : Wissenschaftliche Schriften des Neanderthal Museums 5, 2012. P. 239–260.

Uthmeier Th. Transformation Analysis and the Reconstruction of On-Site and Off-Site Activities: Methodological Remarks // V. P. Chabai, K. Monigal and A. E. Marks (eds.): The Middle Paleolithic and Early Upper Paleolithic of Eastern Crimea: The Paleolithic of Crimea III. Liege : ERAUL 104, 2004. P. 175–191.

Veselsky A. P. Kabazi V: Production and Rejuvenation of Bifacial Tools // Kabazi V: Interstratification of Micoquian & Levallois-Mousterian Camp Sites. Palaeolithic Sites of Crimea. Vol. 3, Part 2. Simferopol; Cologne : Shlyakh, 2008. P. 455–479.

Wiśniewski A., Chłoń M., Weiss M., Pyżewicz K. Migal W. On Making of Micoquian Bifacial Backed Tools at Pietraszyn 49a, SW Poland // Journal of Paleolithic Archaeology. 2020. №3. P. 856–888.

Zwyns N. Laminar Technology and the Onset of the Upper Paleolithic in the Altai, Siberia (Studies in Human Evolution). Doctoral Thesis. Leiden : University Press. 2012. P. 414.

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PRESERVATION AND USE OF ARCHAEOLOGICAL HERITAGE IN WEST SIBERIA

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Abstract: Archaeological sites are the only source of information on the preliterate period in the history. In West Siberia and further to the east of the Ural mountains written sources appear only after arrival of Russians at the end of the 26th century. Therefore, the value of archaeological materials in studying of pre-Russian Siberia cannot be overestimated. Therefore, the effective system of protection and using of archaeological heritage of natives of Siberia is necessary. The special federal law is directed on it. However, in practice of archeologists there are nuances which the legislation does not regulate. This situation is analyzed by the author of article. First of all, this is due to the fact that it is advisable to excavate archaeological sites in those regions that have been most developed. This is due to both the significance of the sites, its accessibility, and the cost of archaeological work. Hundreds of interesting objects have been excavated, but the materials of many are unpublished, which hinders the growth of the available source base. However, the obligation to introduce the materials into scientific circulation in a timely manner is not imposed on researchers. I particularly note the inattention to the publications of organizations that conduct rescue and new-build archaeological work. The second aspect is related to the increasing attention of Russian citizens to antiquities, which they often find during trips. It is impossible to say how many such finds are eventually lost. The situation could be corrected by the interaction of the sites protection bodies, museum institutions and citizens. However, it happens that it is easier for citizen to throw away a find than to carry it to a cultural institution. This situation requires a legislative solution.

Keywords: archaeological heritage, research, using, preservation, source

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СОХРАНЕНИЕ И ИСПОЛЬЗОВАНИЕ АРХЕОЛОГИЧЕСКОГО НАСЛЕДИЯ В ЗАПАДНОЙ СИБИРИ

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Резюме: Археологические памятники — единственный источник информации о дописьменном периоде в истории. В Западной Сибири и далее к востоку от Уральских гор письменные источники появляются только после прихода русских в конце XVI в. Поэтому значение археологических материалов в изучении дорусской Сибири невозможно переоценить, и необходима эффективная система охраны и использования археологического наследия аборигенов Сибири. На это направлен специальный федеральный закон. Но в практике археологов есть нюансы, которые законодательство пока никак не регламентирует. В первую очередь раскопки археологических памятников целесообразно вести в наиболее освоенных регионах. Это связано со зна-

чимостью памятника, его доступностью и стоимостью археологических работ. Интересных памятников раскопаны сотни, но материалы многих не опубликованы, что препятствует росту доступной источниковой базы. Однако обязанность своевременно вводить материалы в научный оборот на исследователей не возложена. Особо отмечу невнимание к публикациям организаций, ведущих спасательные и новостроечные археологические работы. Второй аспект связан с усиливающимся вниманием граждан России к древностям, которые они часто находят во время выездов на природу. Невозможно учесть, какое количество таких находок в конце концов теряется. Ситуацию могло бы исправить взаимодействие органов охраны памятников, музейных учреждений и граждан. Но бывает так, что простому гражданину легче находку выбросить, чем нести в учреждение культуры. Эта ситуация требует законодательного решения.

Ключевые слова: археологическое наследие, исследование, использование, сохранение

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Problem

I believe, that completeness and reliability of archaeological researches in many respects depends on qualification of the scientist, on methodology applied by it and a technique of works, and a condition of source's base. Eventually the scientists can gather experience and increase qualification, improve the methodology and a technique. However, the sources require special attitude as:

— it is impossible to excavate the dug-out archaeological sites for the second time second time;
— the quantity of archaeological sites is great, but not boundless and with increase of economic activity their number is steadily reduced.

Therefore, preservation of archaeological sites, their careful research and careful using are a very important task. In this work I will consider two problems connected with use of materials of archeological excavations in scientific activity, and safety of archaeological monuments.

Sources are the data which I collected during archaeological expeditions and ethnoarchaeological work carried out by me for the last twenty five years in Omsk, Kemerovo, Tyumen areas, the Altai and Krasnoyarsk Krai.

Other part of the materials concerning the problem under research, was obtained in the process of work in the museums of the state and pedagogical universities of Barnaul, Kemerovo, Novosibirsk, Omsk, Surgut, Tomsk, the state museums of Omsk, Tobolsk, Khanty-Mansiysk, the museums which are parts of the system of the Russian Academy of Sciences in Tyumen and Novosibirsk.

Similar data were received during the visit to the university and state museums in the Republic of Kazakhstan in the cities of Alma-Ata, Karaganda, Kokchetav, Petropavlovsk. Therefore, I will assume that the situation with the use of archaeological materials in Western Siberia and Kazakhstan is nearly identical.

Unfortunately, I am unaware of the research conducted by Russian researches in this field of study, so I cannot provide the exhaustive bibliographic list of works on this subject.

Preliminary remarks

Before passing to a statement of an essence of a problem, I will make some explanations. The first of them concerns ***the legislation of Russia*** on protection of sites of history and culture,

including archaeology, and practice of its application. In the Federal law No. 73-FZ "About the objects of a cultural heritage (history and culture monuments) of the people of the Russian Federation", the following definitions are given:

- **the object of archaeological heritage:** "… partially or completely hidden in the ground or under water traces of human existence in past eras (including all archaeological objects and cultural layers associated with such traces), the main or one of the main sources of information about which are archaeological excavations or finds. The objects of archaeological heritage are, among other things, fortifications, mounds, earthen burial grounds, ancient burials, settlements, sites, stone statues, steles, rock carvings, remains of ancient fortifications, industries, canals, ships, roads, places of ancient religious rites cultural layers classified as objects of archaeological heritage";
- **the subject of archaeology:** "… movable things, the main or one of the main sources of information about which irrespective of circumstances of their detection are archeological excavations or finds, including the objects found as the result of such excavation or finds";
- **occupation layer:** "… the layer in the earth or under the water, containing traces of existence of the person, which time of emergence exceeds hundred years, including archaeological objects".

All of them — object, a subject, a layer — can have the federal, regional or municipal status, and around them there is a security zone. Further the law determines the order of carrying out archeological excavations, procedures of the use of objects of cultural heritage, their protection and property. Provisions of the law assume that carrying out the specified actions guarantees the safety of the site.

This law is more perfect, than the laws on protection of monuments of history and culture of times of the USSR, and is widely applied. However, in life there are situations which the legislator cannot foresee.

The second explanations is devoted to a ***natural and geographical situation in West Siberia and the related system of an arrangement of archaeological sites***. I will remind that West Siberia is a vast plain between the Ural mountains and the Yenisei River. Its area is about 3 million square kilometers. The northern part of the plain adjoins to the Arctic ocean, where the tundra is situated. The central part of the plain is presented by coniferous forests which in Siberia are called "taiga". The southern areas adjoining to Kazakhstan is the steppe. West Siberia from the South to North is crossed by the river Ob, and its large tributaries — Tobol, Irtysh, Tom. The tributaries falling into these rivers most often flow in the width direction. In the territory of West Siberia are a large number of swamps. The biggest one, the Vasyugan Swamp, is comparable to a selva of the Amazon.

As in West Siberia there are no mountains, and absolute marks of heights are close to 120–160 m, the width zonation of natural and geographical zones here is well expressed. Lack of mountains facilitates to penetration of cold Arctic air into West Siberia which makes the climate sharply continental, with long cold winters, and short warm summers. Natural-geographical conditions formed the system of moving of inhabitants of West Siberia in the ancient time and the Middle Ages, and respectively and system of an arrangement of archaeological sites.

By my calculations, based on the lists of the settlements of 1857–1927, the materials of maps created in 1745–2000 the most part of the population of the Western Siberia lives on the banks of the large rivers — Ob, Irtysh, Tobol, Tom and in lower reaches of their large tributaries. A large number of the population lives along the Trans-Siberian railway line. These are the places most convenient for living. These are the same places on the first terrace of the rivers, and in their flood plains, where up to 70% of known archaeological sites are situated [Tikhonov, 2006, p. 265–294].

Now in the territory which I describe, lives about 12,6 million people. Among them 9.5 million (75%) are city dwellers, and 3.1 million people live in rural areas. Population density in the middle and upper part of the taiga's rivers, in deep areas of the steppe and in the tundra makes 1–1,5 people per square kilometer and less. At the beginning of 1990 many villagers moved from villages to the cities therefore big territories became without population.

Thirdly, *industrial development of the region* considerably influences intensity of archaeological work. It is known that over the past 60 years Western Siberia has become a region where oil and gas production is developing rapidly, pipelines are being built for pumping them, and giant hydroelectric power plants are being built. Naturally, this requires the construction of roads, bridges, and so on. In accordance with the legislation, all these measures are possible only after carrying out archaeological work, which, as a rule, is carried out.

The fourth: *the tourism organization* including scientific one, in the locations of sites is complicated as they are not always accessible and it is not always possible to reconstruct a monument as timber, the main construction material of inhabitants of Siberia, is poorly stored. Therefore, after excavating a site, information about it can be obtained in the report, in field diaries and drawings, and when working with collections.

Current situation

To the middle of the 20th century archeologists studied the sites mainly in southeast part of West Siberia which is sometimes called South Siberia. This is the upper course of the Yenisei in the Sayan Mountains, and the upper course of the Ob in the Altai Mountains and the steppe adjacent to them from the north. The excavations were carried out by archaeologists from the Institute for the History of Material Culture in Moscow and the Leningrad Branch of the Institute for the History of Material Culture (now St. Petersburg). Archaeologists who constantly lived and worked in Western Siberia — V. I. Matyushchenko, A. I. Martynov, T. N. Troitskaya — began their excavations in the early — mid-1950s. However, since they had little experience, and the beginning of industrial construction was supposed to start exploration of large territories, these large territories were studied by other archaeologists.

I will show it at by the example of the works of M. P. Gryaznov, a famous Soviet archaeologist from Leningrad. At that time in 1952 he was an experienced fifty-year-old archaeologist who excavated the sites in Altai, in the Sayan Mountains, in Kazakhstan. Therefore, he was instructed to carry out excavations in the flood zone of the Novosibirsk hydroelectric power station on the Ob River south of Novosibirsk. After filling the reservoir bed, a water mirror was formed from Novosibirsk to Kamen-on-Ob, about 175 km long and up to 18 km wide. For three years of work, several hundred archaeological sites of different eras were found, excavations were carried out at some of the most scientifically significant ones. The expedition

fulfilled its the task, since at that time it was not supposed to fully study the territory, but to excavate only the most typical, and the collections were added to the depositories of museums. Everything else disappeared under water, and is now inaccessible to archaeologists, which is very bad.

However what could be even worse is that M. P. Gryaznov did not publish materials of the excavations, except for a small work written by him with several colleagues only 20 years after the completion of the work [Gryaznov et al., 1973]. However, let us not blame the scientist. He did not have time to process the materials, since he continued to lead the same large-scale work in other places: in the construction zone of hydroelectric power plants on the Angara and Yenisei rivers, as well as on Lake Baikal from 1955 to the mid-1970s. This means that he excavated large areas 3–4 months a year, and sometimes more. The rest of the time he was preparing a report on them. Therefore, he, and other leaders of the excavation, physically did not have enough time to prepare the materials for publication. For example, during excavations on the Yenisei, when the Krasnoyarsk hydroelectric power plant was being built, M. P. Gryaznov's expedition comprised several groups. However, as a result of excavations during his lifetime, only one book was published [Complex of archaeological monuments…, 1979]. Other materials were prepared for publication by his colleagues, but after the death of the scientist [Antiquities Baikala, 1992; Burial ground Kürgenner…, 2010]. The situation is very clear. In a remote region, it is necessary to develop industry, and there is a plan for commissioning facilities. This plan cannot be violated. But according to the law, it is necessary to excavate archeological sites beforehand. Therefore, archaeologists (and there are few of them) were on the expedition for the maximum possible time, as long as the weather permits, and the rest of the time they wrote a report on the work. The museums accumulate collections, field documentation, inventories, photographs, etc. The cycle repeats the next year and so it was during all the years of the existence of the Soviet Union: a gigantic volume of archaeological work, and a lack of time to process materials.

After 1970, universities were organized in Western Siberia in large cities (in Barnaul, Kemerovo, Kurgan, Omsk, Tyumen), and archaeologists began to work in them. They were constantly excavating, since most of the territory of Western Siberia in the archeological respect had not been studied, and were engaged in surveying the places of future construction. The number of excavated sites and archaeological materials increased significantly. And again, some of them lay on the shelves of museum depositories.

It turns out a paradoxical situation: the materials of the regions most studied by archaeologists are practically not published. I would like to point out to the credit of archaeologists that as soon as they have time, they publish their materials. For example, in the 1970s, under the Council of Ministers of the USSR, an archaeological expedition was organized to excavate the sites at the bottom of the future reservoir of the Sayano-Shushenskaya hydroelectric power station. Funding and supplies for the expedition were on the top level. However, generalizing monographs began to appear 15 or more years after the end of excavations. As an example, I will cite the books by D. G. Savinov [2009], who excavated sites in 1970 and later, and published them not so long ago.

So, the results of not all excavations have been introduced into scientific circulation, and this does not always allow taking into account all the nuances in the study. What way out I

see from this situation, which is not yet regulated by any section of Law No. 73-FZ? This is, at a minimum, a mandatory posting on the Internet of the following materials:

— field reports of researchers, or at least their brief versions;
— lists of field reports and field documentation kept in the museum;
— lists of collections available in museums.

Probably, it is necessary to consider some provisions of the copyright law, and think over amendments that, in the event of a long period of non-use, (the period can be determined based on the prevailing practice), of the excavation materials by the author, would allow making them open for any research. In Russia, this is a big problem, since ethical standards do not allow using materials without the author's permission. However, it happens that an archeologist is going to publish something all his life, and does not have time to do it. For example, Professor V. I. Matyushchenko did not manage to publish the materials of the excavations of the Late Bronze Age settlements Krasnoozerka on the Irtysh in the Omsk region and Elovka on the Ob in the Tomsk region, although he was going to do it all the time. These two sites became the main ones in the identification of archaeological cultures, but there is no complete publication of them, and, most likely, they will never be. That is precisely why I consider the timely and complete introduction of archeological materials into scientific circulation an extremely important task, and even the direct duty of an archaeologist, although the legislation does not regulate this in any way.

The second issue of using and protection of archaeological heritage is connected with activity of nonspecialists. I do not mean the people who in Russia are called by "black archeologists". Actually, they are not archaeologists, but criminals plundering archaeological sites for replenishment of private collections or for sale. They can use metal detectors forbidden in Russia, small bulldozers, or work of illegal guest workers for search of antiquities. Their activity is the prerogative of law enforcement agencies.

However, there are many people who find ancient and medieval things from the settlements washed away by the rivers and burial grounds during rest, fishing, or hunting. I will remind that terraces of the rivers are formed with sedimentary rocks, and they are easily washed away by the rivers. Some people hand over the finds to the museums. For example, *I studied a bone dagger of an era of a late Paleolithic which is stored in the funds of Omsk State Museum of History and Regional Studies* [Tikhonov, 2012; 2013]. It was brought to the museum by a fisherman. It is a very rare find for Western Siberia as there are only six such things.

Other people store things for some years, and then transfer them to experts, but by that time they forget the circumstances and the location of the find. Some people having kept the finds for many years, throw them away, but in some cases report about them to archeologists if they appear in their village.

My colleague S. F. Tataurov and I since 2009 have been excavating cultural layers of the end of 16th — the beginning of the 18th centuries in the town Tara. It is the first Russian town on the Irtysh. For a long time it was the main fortress protecting the southern boundaries of Russian lands in Siberia. The locations of the Tobolsk gate, Prince tower, the Voevoda estate, a cemetery about church have been found and studied. During the work on studying of the Tara fortress, thousands of Tara residents and neighboring villagers visited the excavation. After that many of them informed about the antiquities once found, demonstrated interest in

rules of conducting excavation and search of antiquities; some people gave to archeologists some found ancient objects.

General impression from conversations with people is as following: when on picnic, many people found ancient objects, some brought them home, but they did not hurry to hand over them to the museum as they did not think that the ceramics, or rusty iron things can be interesting to science.

Therefore, in this case it is necessary to raise level of culture of people (lecture, demonstration of films, excursions in places of excavation and so on). Then the archaeologists will have many assistants who know the area of the living very well. The administration of governor generals in the Russian Empire in the second half of the 19th century had experience of such work when when helping archeologists was a point of honor of educated people,

Here are two situations which are not reflected in the legislation but are quite common in practice of archeologists.

REFERENCES

Gryaznov M. P., Troickaya T. N., Umanskij A. P., Sevast'yanova E. A. Arheologicheskaya karta poberezh'ya Novosibirskogo vodohranilishcha [Archaeological Map of the Coast of the Novosibirsk Reservoir]. Nauchnye trudy Novosibirskogo gosudarstvennogo pedagogicheskogo instituta [Scientific works of the Novosibirsk State Pedagogical Institute]. Novosibirsk : NGPI, 1973. Issue 85. Pp. 3–44. (*In Russ.*)

Drevnosti Bajkala [Antiquities of Baikal]. Irkutsk : Izd-vo Irkut. gos. un-ta, 1992. 252 p. (*In Russ.*)

Kompleks arheologicheskih pamyatnikov u gory Tepsej na Enisee [A Complex of Archaeological Sites near Mount Tepsei on the Yenisei] / Gryaznov M. P., Zavituhina M. P., Komarova M. N., Minyaev S. S., Pshenicyna M. N., Hudyakov Ju. S. Novosibirsk : Nauka, 1979. 167 p. (*In Russ.*)

Mogil'nik Kyurgenner epohi pozdnej bronzy Srednego Eniseya. [The Kürgenner Burial Ground of the Late Bronze Age of the Middle Yenisei] / Gryaznov M. P., Komarova M. N., Lazaretova I. P., Polyakov A. V., Pshenicyna M. N. Sankt-Peterburg : Peterburgskoe Vostokovedenie, 2010. 196 p. (*In Russ.*)

Savinov D. G. Minusinskaya provinciya Hunnu (po materialam arheologicheskih issledovanij 1984–1989 gg.) [The Minusinsk Province of the Xiongnu (based on archaeological research materials 1984–1989)]. Sankt-Peterburg : IIMK RAN, 2009. 226 p. (*In Russ.*)

Tihonov S. S. Ottok naseleniya iz taezhnyh rajonov Sibiri v tret'ej chetverti XX veka [The Outflow of the Population from the Taiga Regions of Siberia in the Third Quarter of the 20th century]. Etnografo-arheologicheskie kompleksy: problemy kul'tury i sociuma [Ethnographic and Archaeological Complexes: Problems of Culture and Society]. Omsk : Nauka, 2006. Vol. 9. Pp. 265–294. (*In Russ.*)

Tihonov S. S. Kostyanoj vkladyshevyj kinzhal iz Setkulovki [Bone Dagger from the Middle Irtysh Region]. Izvestiya OGIK-Muzeya [Bullitin of OGIK Museum]. Omsk : OGIK muzej, 2012. Issue 17. Pp. 133–138. (*In Russ.*)

Tihonov S. S. Kostyanoj kinzhal iz Srednego Priirtysh'ya [Bone dagger from the Middle Irtysh region]. Voennoe delo srednevekovogo naseleniya narodov Juzhnoj Sibiri i Central'noj

Azii [Military Affairs of the Medieval Population of the Peoples of South Siberia and Central Asia]. Novosibirsk : Izd-vo In-ta arheologii i etnografii SO RAN, 2013. Pp. 11–13. (*In Russ.*)

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Грязнов М. П., Троицкая Т. Н., Уманский А. П., Севастьянова Э. А. Археологическая карта побережья Новосибирского водохранилища // Научные труды Новосибирского государственного педагогического института. Новосибирск : НГПИ, 1973. Вып. 85. С. 3–44.

Древности Байкала. Иркутск : Изд-во Иркут. гос. ун-та, 1992. 252 с.

Комплекс археологических памятников у горы Тепсей на Енисее / Грязнов М. П., Завитухина М. П., Комарова М. Н., Миняев С. С., Пшеницына М. Н., Худяков Ю. С. Новосибирск : Наука, 1979. 167 с.

Могильник Кюргеннер эпохи поздней бронзы Среднего Енисея / Грязнов М. П., Комарова М. Н., Лазаретова И. П., Поляков А. В., Пшеницына М. Н. СПб. : Петербургское Востоковедение, 2010. 196 с.

Савинов Д. Г. Минусинская провинция Хунну (по материалам археологических исследований 1984–1989 гг.). СПб. : ИИМК РАН, 2009. 226 с.

Тихонов С. С. Отток населения из таежных районов Сибири в третьей четверти XX века // Этнографо-археологические комплексы: проблемы культуры и социума. Омск : Наука, 2006. Т. 9. С. 265–294.

Тихонов С. С. Костяной вкладышевый кинжал из Сеткуловки // Известия ОГИК-Музея. Омск : ОГИК музей, 2012. Вып. 17. С. 133–138.

Тихонов С. С. Костяной кинжал из Среднего Прииртышья // Военное дело средневекового населения народов Южной Сибири и Центральной Азии. Новосибирск : Изд-во Ин-та археологии и этнографии СО РАН, 2013. С. 11–13.

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RESULTS OF STUDYING OF MATERIALS OF ARCHAEOLOGICAL RESEARCH

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THE CHAINE OPERATOIRE OF BRONZE AGE MINING: TOOLS FROM THE NOVOTEMIRSKY COPPER MINE (SOUTHERN TRANS-URALS)

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Abstract: The paper is devoted to the problem of the development level and organization models of mining within the Eurasian metallurgical province of the Late Bronze Age in the 2nd millennium BC. The main research aim is to determine the chain of technological processes taking place at the Novotemirsky ancient mine in the Southern Trans-Urals. The sources of raw materials, traces of use, and functional identification of stone (n=58) and bone tools (n=1) were determined using traceological, petrographic, X-ray fluorescence, and X-ray diffraction analysis. All tools were divided into three groups depending on their use: mining (a casting mould for a pick), ore crushing (hammers, small hammers), supporting devices ("bases", counterweights for lifting ore).

The absence of mining and processing (grinding pestles, grinding stones) and metal-working (blacksmith hammers) tools at the Novotemirsky mine indicates a narrow range of technical operations associated only with direct mining of copper ore and ore-preparing (crushing large blocks). It is assumed that there is a partial specialization of mining, which consists in the formation of temporary miners' collectives, who are seasonally involved in these operations.

Keywords: stone tools, ancient mine, Late Bronze Age, Southern Trans-Urals, Alakul culture, traceological analysis, X-ray fluorescence analysis, X-ray diffraction analysis

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ОПЕРАЦИОННАЯ ЦЕПЬ ГОРНОГО ДЕЛА В БРОНЗОВОМ ВЕКЕ: ОРУДИЯ НОВОТЕМИРСКОГО РУДНИКА (ЮЖНОЕ ЗАУРАЛЬЕ)

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Резюме: В статье обсуждается проблема оценки уровня развития и моделей организации горного дела в пределах Евразийской металлургической провинции позднего бронзового века. Основная цель работы — определение цепи технологических процессов, происходящих на древнем руднике Новотемирский в Южном Зауралье. Основным источником являются каменные (58 экз.) и костяные орудия (1 экз.) позднего бронзового века, обнаруженные в ходе раскопок на памятнике. Их функциональное назначение и следы использования, состав и источники сырья были определены при помощи трасологического, петрографического, рентгенофлуоресцентного и рентгенофазового анализов. В коллекции памятника выделено три группы орудий: горнопроходческие (литейная форма для отливки кайла), рудодробительные (молоты, молотки), вспомогательные приспособления (подставки, противовесы для подъема руды).

Отсутствие в материалах Новотемирского рудника орудий горно-обогатительного (песты, терочники) и металлообрабатывающего (кузнечные молотки) циклов указывает на узкий спектр технических операций, практиковавшихся на Новотемирском руднике, связанных только с непосредственной добычей медной руды и первичным обогащением (дроблением крупных форм). Предполагается существование частичной специализации горного дела, которая заключается в образовании временных коллективов рудокопов, сезонно задействованных на горных работах.

Ключевые слова: каменные орудия, поздний бронзовый век, Южное Зауралье, алакульская культура, трасологический анализ, рентгенофлуоресцентный анализ, рентгенофазовый анализ

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Introduction

The development of a large number of copper and tin deposits in the Late Bronze Age is associated with the functioning of the Eurasian metallurgical province [Chernykh, 2008: 46–47]. Nowadays, several centers of mining and metallurgical activity are known within its boundaries. In the western part of the province there are some complexes (copper mines and settlements) of the Srubnaya culture were investigated: the Kartamysh complex in Eastern Ukraine (Donetsk region) [Tatarinov, 1977: 193; Brovender, 2008: 184]; the Mikhailo-Ovsyanka complex on the Middle Volga (Samara region) [Matveeva, Kolev, Korolev, 2004: 78; Kolev, 2010]; Kargaly in the Cis-Urals (Orenburg region) [Chernykh, 2008]. The deposits of the eastern part of the province were developed by the Andronovo populations, in particular, Ural-Mugodzhary mining and metallurgical center [Tkachev, 2011; Yuminov et al., 2013], deposits of Central and Eastern Kazakhstan [Chernikov, 1960; Zhauymbaev, 1984; Margulan, 1973]. The Zarafshan tin deposits were used by the Srubnaya, Andronovo, and Tazabagyab metallurgists [Avanesova, 2012].

Determining the degree of specialization of Bronze Age mining is an actual task for paleometallurgists. Its solution is facilitated by the assessment of the spectrum of technological operations presented at the mining and metallurgical complexes. In general, the list of processes at the mines of the 2nd millennium BC in Northern Eurasia can be represented in the following sequence:

1. Overburden works and ore mining (mattocks, mining picks made of copper, stone, wedges made of bone.
2. Ore crushing (hammers, small hammers).
3. Enrichment and preparation of the ore for smelting (pestles, grinding stones).
4. Pre-roasting for sulphide ores in burn pits.
5. Ore smelting, ingots production (metallurgical furnace, slags, ingots).
6. Metalworking (blacksmith's hammers, metal polisher, casting moulds for a series of tools-sickles, knives, shafts).

The list of processes identified at a mine may indicate a mining model. The identification of a set of tools and items with functionality associated with the entire spectrum of processes indicates a far-reaching process of specialization. The achievement of ingots production and the manufacture of serial items for trade and exchange operations are indicated a sufficiently high level of specialization in mining.

The Kartamysh microdistrict mines demonstrate the presence of tools and evidence of all stages of metal production: mining, ore-preparing, and metallurgy [Brovender, 2008: 198; Brovender, Zagorodnyaya, 2009]. The Mikhailo-Ovsyanka materials reflect a similar situation [Gorashchuk, Kolev, 2004; Kolev, 2010]. Localization next to the ancient quarries of

manufacturing and living buildings determines the type of Srubnaya miners' specialization. The Karagaly mines, in addition to the full range of the tool complex, also have evidence of the serial production of tools (fragments of foundry molds with multiple negatives of tools) for possible trade and exchange operations [Kargaly, 2004].

The Andronovo (Alakul, Kozhumberdy) mines of the Ural-Mugodzhar region, Kazakhstan, and Uzbekistan are less studied. The overwhelming numbers of toolsets come from collections from the modern surface of mines and are devoid of a stratigraphic context and accurate cultural and chronological attribution. Most of these tools were used in mining and ore crushing processes; evidence of the identification of other stages of metal production is limited [Zhauymbaev, 1984: 52; Tkachev, 2011: 50, 52; Avanesova, 2012: 27, 29].

In this regard, the Southern Trans-Urals region is represented by significant metal-producing assemblages of the Sintashta and Alakul Late Bronze Age cultures [Koryakova, Epimakhov, 2007; Grigoriev, 2015] remains studied not enough. The cultural layer dating to the second millennium BC is known here in three mines of the steppe zone of the modern Chelyabinsk region: Vorovskaya Yama, Novonikolaevsky, and Novotemirsky [Zaykov et al., 2005; Ankushev et al., 2018], but large-scale excavations were carried out only on the last one [Ankusheva et al., 2021a, b]. In the course of these activities, a representative collection of tools was found, the analysis of which makes it possible to raise the problem of defining a model of mining activity. The research aim is to determine the chain of technological processes taking place at the Novotemirsky mine. The tasks include determining the functionality of tools, use-wear of traces on them, composition and source of raw materials. The identification of technological operations contributes to the determination of the specialization level and possible social actions in the mining industry in the Bronze Age of the Southern Trans-Urals.

Materials and Methods

The Novotemirsky mine is located in the Chesma district of the Chelyabinsk region (Russia, South Urals) (Fig. 1). It was discovered as a geoarchaeological site in 2014. The deposit is confined to the Kulikovsky ultrabasic massif, the primary copper ores are chalcopyrite and bornite. Chrysocolla, malachite, azurite, less often delafossite, covellite, chalcocite, and native copper are represented in the supergene zone [Blinov et al., 2018]. The mine is a system of mine workings (shafts, hollows, and small pits) and adjacent waste rock dumps, the central object of which is a quarry measuring 20×30 m 2.5 m in deep. Archaeological excavations were carried out at the border of the quarry in 2017–2019, the investigated area was 400 m^2. Sectror A (240 m^2) covered the space above the shaft No.1 located on the southeastern side of the central quarry, while Sector B (160 m^2) was located in the area with the dumps of the south-western boundary of the quarry (Fig. 2). The site identifies three stages of the deposit development during the Bronze Age: the Sintashta period (the 21st — 20th centuries BC), Alakul period (the 17th — 16th centuries BC), and the period of the Final Bronze Age (the 15th — 13th centuries BC) [Ankusheva et al., 2021a].

The inventory of the mine includes 58 tools made of stone and one tool made of the long bone of cattle. The tools were found in different layers of the dumps, in the filling mine workings, which may indicate their use throughout the entire life of the mine in the Late Bronze Age. Some of these artifacts were precisely linked to the dated layers of the Alakul culture: the shutters of the casting mould for the pick, tool and devices from the shaft filling and the space next to it [Ankusheva et al., 2021a].

Fig. 1. Location of the Novotemirsky copper mine
Рис. 1. Местонахождение Новотемирского медного рудника

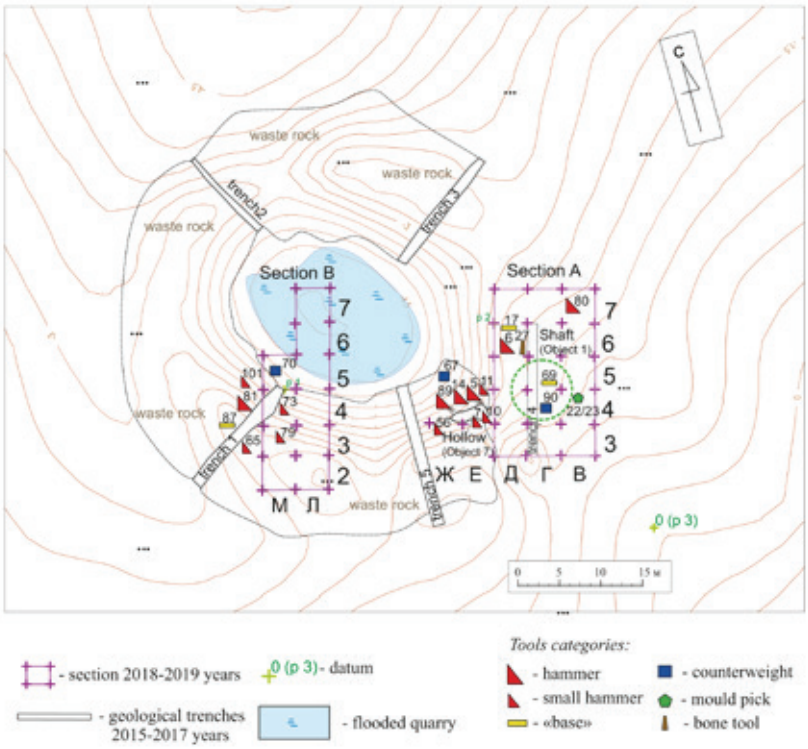

Fig. 2. The Novotemirsky copper mine. Plan. Excavation area 2018–2019
Рис. 2. Новотемирский медный рудник. План. Раскопы 2018–2019 гг.

The traseological analysis of stone tools was carried out in the archaeological laboratory of the South Ural State Humanitarian Pedagogical University using an MBS-2 optical microscope (oblique illumination, magnification up to 40 times, analyst Ivan V. Molchanov). Photographing of micro traces on the artifact's surface was carried out using an MC-2-Zoom TD-2 stereomicroscope with a TOUPCAM 10M video ocular. Petrographic analysis of 6 thin sections of tools (hammers, counterweights) was carried out on Olympus BX 51 microscope (SU FRC MG UB RAS, analysts Maksim N. Ankushev, Larisa Ya. Kabanova). X-ray fluorescence analysis of the mould surface was carried out on a portable device INNOV-X α 400, Soil mode, exposure time 30 s (SU FRC MG UB RAS, analyst Maksim N. Ankushev). X-ray diffraction analysis of the mould was carried out on a SHIMADZU XRD 6000 diffractometer, Cu anode, graphite monochromator; the content was calculated by the Rietveld method in the SIROQUANT V4 program (SU FRC MG UB RAS, analyst Pavel V. Khvorov).

Results

The sample from the excavations 2017–2019 amounted to 59 items. 22 of them are classified as tools; the remaining 37 items are represented by stone fragments and boulders without evidences of work or use. Morphological features made it possible to divide the tools into five categories:

1. **Percussion** tools (n=14)
1a. Hammers (n=6)
1b — Small hammers (n=8)
2. "Bases" (n=3)
3. Counterweights (n=3)
4. The casting mould of the pick (n=1)
5. Bone tool (n=1)

The characteristics of the tools are presented in table 1.

Tab. 1

Tools from the excavations of the Novotemirsky ancient mine (2017–2019)

Таблица 1

Орудия из раскопок древнего рудника Новотемирский (2017–2019)

№	Code of tool	Location / depth from conditional 0	Whole or fragment	Weight, kg	Size, cm	Material	Functionality	Labor operations
1	*5*	4Е, hollow,—270	whole	3.6	22.5*15.5 *11.2	sandstone	sledgehammer	**percussion**
2	*6*	6Д,—195	whole	6	21*18.3 *14.5	sandstone	sledgehammer	**percussion**, crushing
3	*14*	4Е, hollow,—346	fragment	2.1	20.5*13.2 *7.5	sandstone	sledgehammer	**Percussion,** crushing
4	*80*	7В,—178	whole	8.2	27.5*18 *14.5	sandstone	sledgehammer	**percussion**, crushing
5	*81*	Dumps of the trench 1	fragment	5	20*21.8*11	sandstone	sledgehammer	**percussion**, crushing?
6	*89*	4Е	whole	3.5	27.4*11.5 *11	sandstone	sledgehammer	**percussion**?
7	*7*	4Е, hollow,—270		1	13*11.2 *7.5	sandstone	hammer	**percussion**?

Окончание таблицы 1

№	Code of tool	Location / depth from conditional 0	Whole or fragment	Weight, kg	Size, cm	Material	Functionality	Labor operations
8	*10*	4E, hollow,—518	fragment	1	16.7*11.9*7.3	sandstone	hammer	**percussion**
9	*11*	4E	fragment	0.6	15*10*4	sandstone	hammer	**percussion**
10	*56*	4E	fragment	0.6	10*11*8.7	sandstone	hammer	**percussion**
11	*65*	Dumps of the trench 1	whole	0.5	13*8.1*5.5	sandstone	hammer	**percussion**?
12	*73*	Section B	whole	1.9	17.5*12.4 *10	sandstone	hammer	**percussion**, crushing
13	*79*	3M,—233	whole	0.5	14.3*7*4.4	sandstone	hammer	**percussion**
14	*101*	Dumps of the trench 1	whole	1.4	15.7*13.7*6.5	sandstone	hammer	**percussion**
15	*17*	6D,—196	fragment	1.9	15*13*8.5	sandstone	base	?
16	*69*	Shaft 1	whole	4.1	27.2*14.5 *10.2	sandstone	base	?
17	*87*	Dumps of the trench 1	fragment	6.7	23.5*21 *14.5	sandstone	base	grinding a soft materials, touching up metal artifacts
18	*67*	4E	whole	8.2	22.5*17 *15.5	rodingite	counterweight	lifting rock
19	*70*	5M	fragment	3.5	21.8*15.5 *11.2	rodingite	counterweight	lifting rock
20	*90*	Shaft 1	whole	16	40*18*21.5	serpentinite	counterweight	lifting rock
21	*22–23*	4B,—171	whole, two parts		22.9*11.3 *6 23.3*12*5.6	micaceous-epidote-chlorite metasomatite	the casting mould of the pick	mining
22	*27K*	6Д,—205	fragment	0.1	13*1.5–2	bone of cattle	tool	?

Stone tools (Fig. 3–7).

1. Percussion tools (n=13).

1a. *Hammers* (n=6) (*Fig. 3–4*). Large, massive tools, main function of them are percussion (codes 5, 6, 14, 80, 81, 89). Almost all of them were found in the waste rock: three tools come from filling heap of the boundary of quarry (object 7), two from heap planned around of the mine (object 1), one of them was found on surface of heap of the geological trenches.

The tools are represented by whole forms, only one by a fragment. The weight of the whole hammers is from 3.5 to 8.2 kg. Their measures are from 20 to 27.5 cm in length, from 11.5 to 21.8 cm in width, from 11.5 to 14 cm in thickness. The tools are subrectangular, elongated in form, wedge-shaped or trapezoidal with flattened edges in section. In most cases the working surface is located on the wedge-shaped end.

The wide grooves on the side edges are fixed on tools. It is a characteristic feature of this type of tool. In four cases, depressions for the groove were made in the center of the side edges (code 6, 80, 81, 89). In one case — in the upper part of the tool (code 5). The measures of the

grooves are 4.5 to 8 cm in length, 4.5–6.5 cm in width, and 1–1.2 cm in depth. The design of the grooves is perfunctory. In some cases natural grooves are decorated with rough chips, debitage.

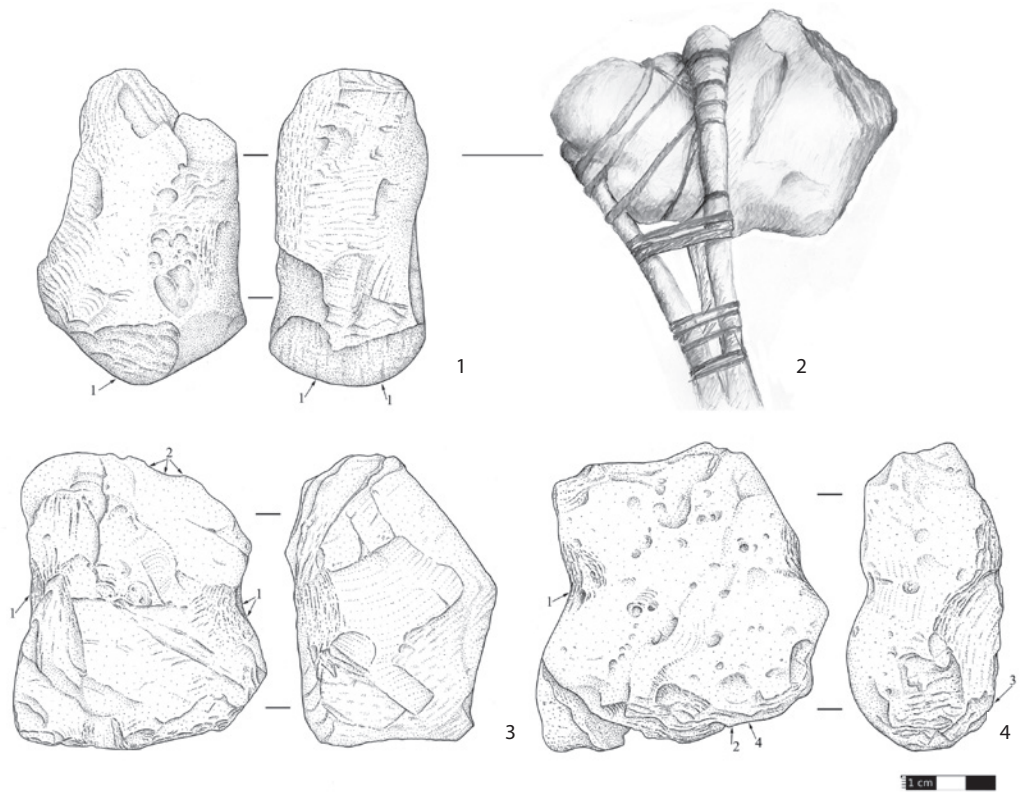

Fig. 3. Percussion tools. Hammers:
1. Hammer (code 369H/5): 1 – chipping. 2. Reconstruction of percussion tool (369H/5) by Sergey V. Kozhevnikov. 3. Hammer (code 369H/6): 1 – grinding, weakly observed linear traces, 2 – grinding, multidirectional linear traces. 4. Hammer (code 369H/81): 1 – grinding, close to polishing, multidirectional linear traces, 2 – grinding with thin linear marks, 3 – rolled edge of the hole, 4 – rolled edge of the hole
Рис. 3. Ударные орудия. Молоты:
1. Молот (шифр 369H/5): 1 – скалывание. 2. Реконструкция ударного орудия (369H/5), выполнена С. В. Кожевниковым. 3. Молот (шифр (369H/6): 1 – пришлифовка, слабо выраженные линейные следы, 2 – пришлифовка, разнонаправленные линейные следы. 4. Молоток (шифр 369H/81): 1 – пришлифовка, близкая к заполировке, разнонаправленные линейные следы, 2 – пришлифовка с тонкими линейными следами, 3 – завальцованый край ямки, 4 – скругленный край ямки

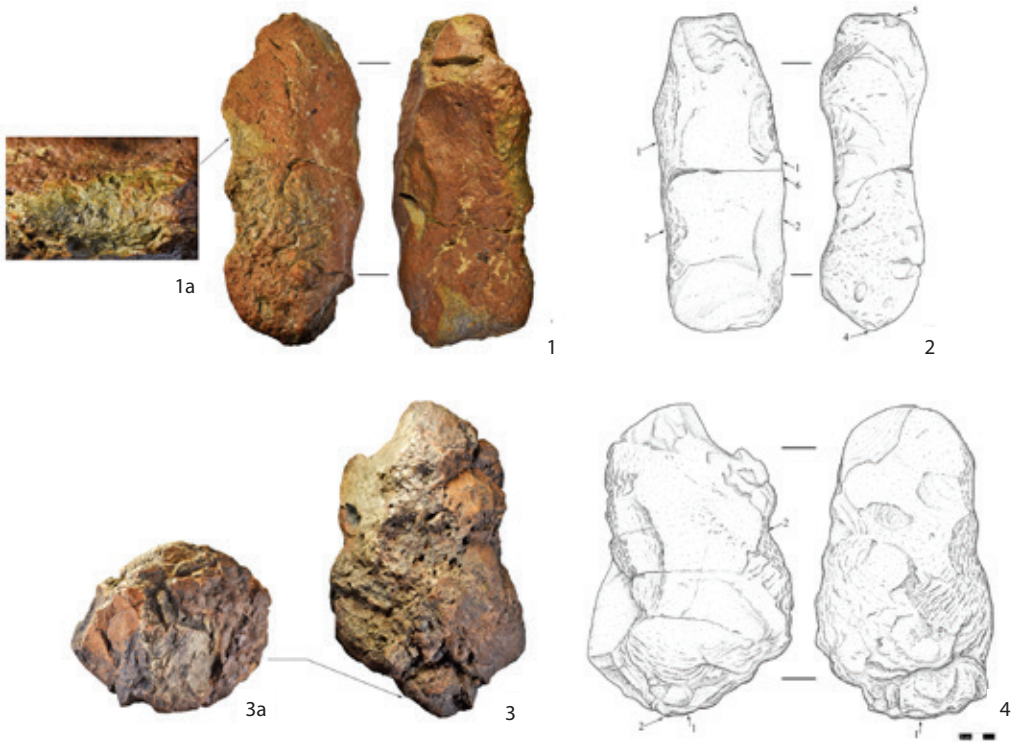

Fig. 4. Percussion tools. Hammer:
1 – Hammer (code 369H/89). Photo of tool. 1a – photo of groove surface with chipping traces, x40; 2 – Hammer (code 369H/89). Drawing of tool: 1, 2 – grooves, smoothness surface, 3 – smoothed edge, 4 – chipping, 5 – chipping, grinded area, 6 – copper fractions; 3, 3a – Hammer (code 369H/80). Photo of tool; 4 – Drawing of hammer (code 369H/80): 1 – rare, shortly linear traces, 2 – smoothness, deformation of rock grain
Рис. 4. Ударные орудия. Молоты:
1 – Молот (шифр369Н/89). Фотография. 1а – фотография поверхности выемки со следами сколов, х40; 2 – Молот (шифр 369Н/89). Рисунок: 1, 2 – выемки, сглаженность поверхности, 3 – сглаженная грань, 4 – скалывание, 5 – скалывание, пришлифованный участок, 6 – медные фракции; 3, 3а – Молот (шифр 369Н/80). Фотографии; 4 – прорисовка молота (шифр 369Н/80): 1 – редкие короткие линейные следы, 2 – сглаженность, деформация зерен породы

1b. *Small hammers* (n=8) *(Fig. 5)* elongated-sub-rectangular shape stones with a percussion function (codes: 10, 11, 56, 101, 65, 73, 79, 7). Five of them were found within the limits of the excavation: in waste rock and in the filling heap of the boundary of quarry (object 7). Two collected from the surface of waste rock, which formed during the laying of geological trenches. The weight of whole small hammers is from 0.5 to 1.5 kg. Their measures are from 13 to 17.5 cm in length, from 7 to 12.4 cm width, from 3.6 to 10 cm thickness.

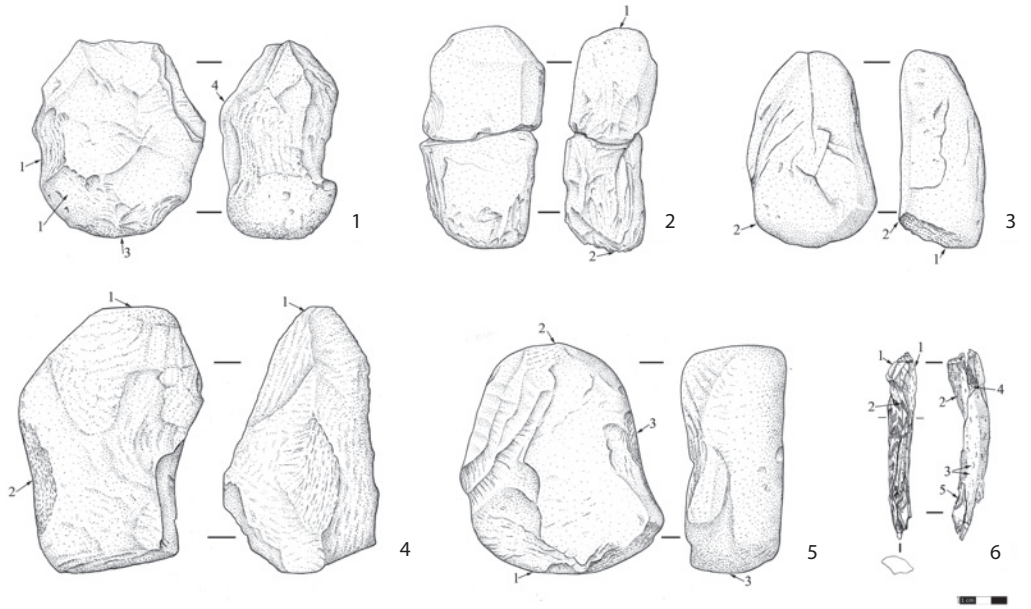

Fig. 5. Percussion tools. Small hammers, bone:
1 – Small hammer (code 369H/7): 1 – gloss of surface, 2 – chipping of the plaque,
3 – multidirectional linear traces, 4 – smoothed grains with linear traces;
2 – Small hammer (code 369H/79): 1 – grinded area with short linear marks,
2 – grinded area with short linear marks: 3 – Small hammer (code 369H/65):
1 – chipping wear area, 2 – ground area with linear marks; 4 – Small hammer (code 369H/73):
1 – clogging and short linear traces, 2 – grinded; 5 – Small hammer (code 369H / 101):
1 – flattening of the edge by chipping, 2 – clogging areas with deep, short linear traces,
3 – thin short traces; 6 – Bone tool (code 369H / 27K): 1 – working with a metal blade,
2 – cutting, 3 – groups of thin linear traces, 4 – thin linear traces, 5 – drop of metal (?)
Рис. 5. Ударные орудия. Молотки, костяное орудие:
1 – Молоток (шифр 369H/7): 1 – блеск поверхности, 2 – скалывание желвачной корки,
3 – разнонаправленные линейные следы, 4 – сглаженные зерна породы с линейными следами; 2 – Молоток (шифр 369H/79): 1 – слабая пришлифовка с короткими линейными следами, 2 – пришлифованный участок с короткими линейными следами;
3 – Молоток (шифр 369H/65): 1 – выкрошенный участок, скалывания,
2 – пришлифованный участок с линейными следами; 4 – Молоток (шифр 369H/73):
1 – небольшая забитость и короткие линейные следы, 2 – пришлифовка; 5 – Молоток (шифр 369H/101): 1 – уплощение края скалыванием, 2 – выкрошенные участки с глубокими, короткими линейными следами, 3 – тонкие короткие царапинки; 6 – костяное орудие (шифр 369H/27K): 1 – подработка металлическим лезвием, 2 – резка, 3 – группы тонких линейных следов, 4 – тонкие линейные следы, 5 – воздействие капли металла (?)

The general outline of the tools has a sub-rectangular shape, but the parameters of the products are not standardized. The tools have subrectangular, square and wedge-shaped section. Some of the edges of the tools undefined, not specially flattened. Fragmented objects

are transverse splits. They are represented by either the upper or lower part of the tool. Usually, the working surface is located on the lower end of item. The shape of the working surface is different — round, flattened, wedge.

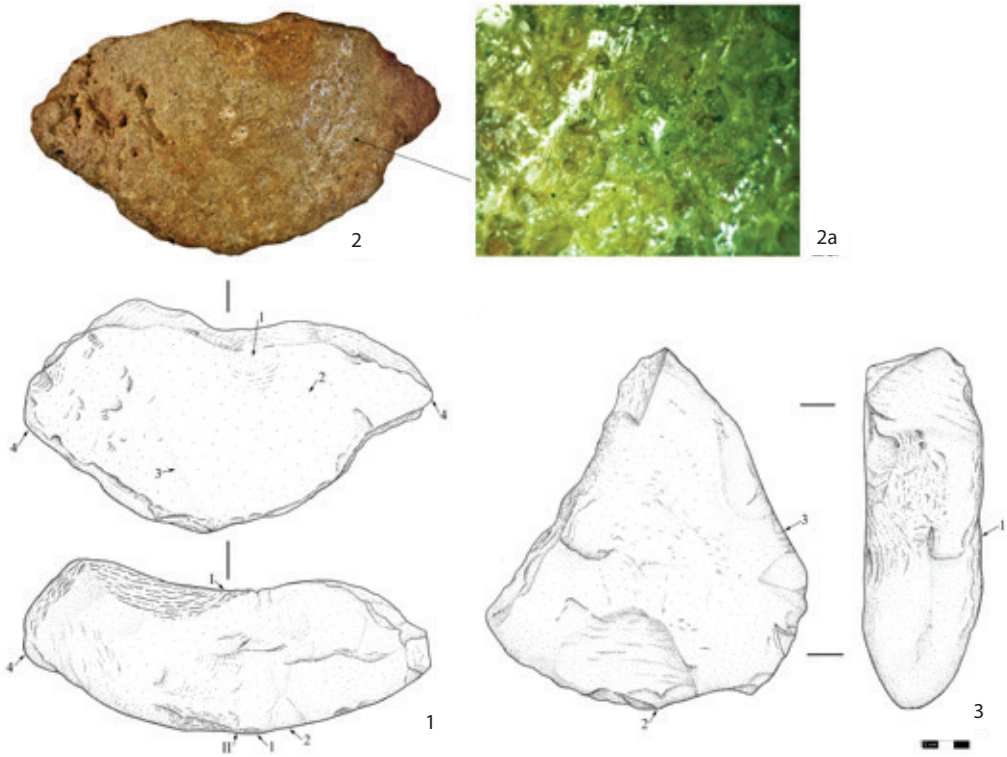

Fig. 6. "Bases":
1 — Drawing of "base" (code 369H/69): I — concave plane, II — convex plane;
1 — grinding around the chipped area, 2 — polished area with a group of thin linear traces,
3 — clogging areas with smoothed grains, 4 — rounded edge between the plane and the end;
2 — Photo of "base" (code 369H/69); 2a — Photo of gloss surface with linear traces x40;
3 — Drawing of "base" (code 369H/87): 1 — deep, multidirectional and crossing linear traces,
2 — flattening of the surface by chipping, 3 — chipping along the edge
Рис. 6. «Подставки»:
1 — Прорисовка «подставки» (шифр 369H/69): I — вогнутая плоскость, II — выпуклая плоскость; 1 — пришлифовка вокруг сколотой площадки, 2 — заполированный участок с группой тонких линейных следов, 3 — выкрошенные участки со сглаженными зернами породы, 4 — скругленная грань между плоскостью и торцом; 2 — Фотография «подставки» (шифр 369H/69); 2а — Фотография заполированной поверхности с линейными следами, x40; 3 — Прорисовка «подставки» (шифр 369H/87): 1 — глубокие разнонаправленные и перекрещивающиеся линейные следы, 2 — уплощение поверхности скалыванием, 3 — скалывание по краю

The working surface of hammers and small hammers was located on one of the ends, or on one of the flatness side of the tool. Multidirectional, different sizes linear traces are marked on

crumbled and a little clogged contact surfaces. The morphology and use-wear traces on whole objects are correlated with medium-size hammers. Large tools have a wedge-shaped edge in section, formed as a result of flattening of the planes adjacent to it, in addition to percussion zones. Wear was represented by rare, thin traces distinguished on grains on the flattened areas. The edge has no visible deformation. On the surface of several objects the areas with the copper fractions are preserved.

2. *"Bases"*[1] (n=3) *(Fig. 6)* are objects with a flattened surface for some material processing. Two of them are whole, one is fragmented. Localization of "bases" is associated with the functioning of Object 1 (mine). The tool with the code 17 was found in the waste rocks near the mine, with code 69 — in the filling of the mine, at the level –715, one meter from the bottom, with code 87 — from the waste. The tools are close to sub-triangular in plane, sub-rectangular in section. The working surface is flattened and located on wide surfaces of the stone. The weight of the whole product ranges from 4.1 to 6.7 kg. Measures: 23.5×21×14.5 cm (87), 27.2×14.5×10.2 cm (69).

Shiny plaque on the surface of "bases" is the problem for functional analysis and determine the material processed on them. The objects have one or two smoothed, grinded working surfaces, on which thin, multidirectional, different traces are recorded. Short, multidirectional traces are recorded on the slightly crashed grains of the contact zones. An interesting artifact seems to have a curved shape in the plane (code 69). Most of its convex surface is well grinded and polished; the "top" is flattened by chipping. Close to "top" is a smoothed area with a metallic sheen, slightly different from the shiny plaque of surface. On the flattened area, deformation of the rock grains is noted, on which short, multidirectional scratches are recorded. Groups of thin, parallel to each other, longitudinal and diagonal linear traces are visible on a smoothed surface with a metallic sheen. They are located to elongated axis of the stone. Probably, this item could be used to soft material processing; also it can be used as an abrasive for metal objects.

All stone hammer tools and "bases" are made of sandstone, as well as a series of boulders and fragments without traces of work. According to the petrographic analysis, the clastic material is represented by quartz, rare grains of feldspar, rutile, and muscovite and makes up 80% of the sample. Quartz grains are rounded and corroded with cement in some areas. Opal cement makes up 20% of the sample volume and is colored with iron oxides and hydroxides. The mineral composition and textural features of the rock (content of quartz grains in the opal cement), provides high hardness and strength of the tools. This makes it possible to successfully reuse a heavy piece of sandstone as a hand-held beating tool [Kozhevnikov, Ankushev, 2018]. Minimal processing to give the tool shape and unexpressed traces of work indicate a quick replacement of tools, their consumability. Numerous pieces of sandstone with no trace of work are likely a byproduct of the hammer-making process right at the mine.

The sandstone can be safely considered specially brought to the mine. The Novotemirsky deposit is confined to the Kulikovsky massif ultramafic rocks, composed of serpentinites with blocks of dolerites and gabbroids. Sandstones are developed at some distance, on the Sukhtelinskaya and Berezinskaya strata located to the north and east of the Novotemirsky

[1] For flat stones, which have surfaces with some kind of processing wear we are use the term "base".

deposit [Tevelev et al., 2018]. The field survey of the nearby area revealed a deluvial spread of rounded sandstone boulders of small and medium-size (from 5*5 to 20*25 cm), which were found at the site of modern arable land 1.5 km east of the mine.

3. *Counterweights* (n=3) *(Fig. 7)* — represented by massive stones with grooves (codes 67, 70, 90). Two whole and one fragmented tools of this category were found.

The first large tool has measurement 40×18×21.5 cm and weight of 16 kg (code 90). It was found at the bottom of the mine. The product was made of a large fragment of serpentinite, practically without modification. It is trapezoidal, triangular in section. One of the edges is concave, other are flattened. Two wide grooves are grinded on the side edges (8.2×3.6×1.2 cm; 7.8×4.9×2.1 cm). The grooves are chipped and with debitage modified, there are abrasion traces visible. The second whole stone (code 67) was found in a waste of mine (Object 7). It is presented in a more compact version and has cubic shape measure is 22.5×17×15.5 cm and weigh 8.2 kg. 4 grooves are sharpened on each side edge. A fragment of the third item was found in waste at the bottom of a quarry (code 70). A wide groove for the fastening was marked on one of the surfaces of it.

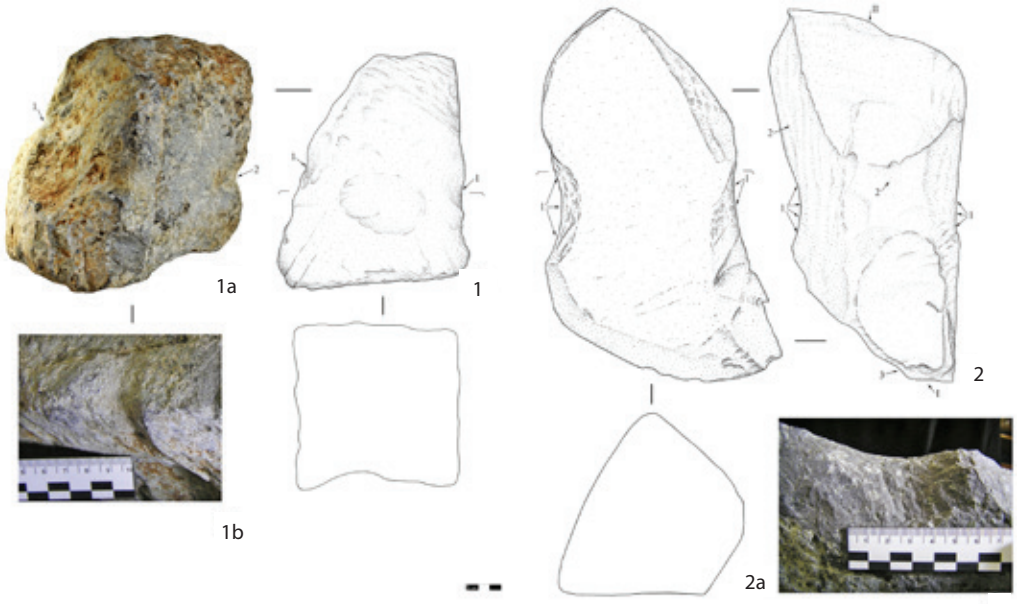

Fig. 7 Counterweights:
1 — Counterweight (code 369H/67), 1 — drawing, 1a — photo, 1b — photo of groove surface x40: 1 — grooves, smoothed surface; 2 — Counterweight (code 369H/90): I — trapezoidal section, II — triangular section; 1 — smoothed surface with linear traces from the strapping, 2 — chipped plane, 3 — chipping of the end surface; 2a — photo of groove surface x40
Рис. 7. Противовесы:
1 — Противовес (шифр 369H/67), 1 — рисунок, 1а — фотография, 1б — фотография поверхности выемки, x40; 1 — выемка, сглаженная поверхность; 2 — Противовес (шифр 369H/90): I — трапециевидное сечение, II — треугольное сечение; 1 — сглаженная поверхность с линейными следами от обвязки, 2 — сколотая плоскость, 3 — скалывание поверхности торца; 2а — фотография поверхности выемки, x40

The grooves located on all or several elongated lateral edges in line are characteristic feature of this type of objects. It used for fixing with a belt or rope. Only one fragment of the counterweight has a depression in plane, which slightly overhang the edges (code 70). A same depression of one of the planes is marked on other massive counterweight. It is wide, transverse, slightly deepen curved strip, which connecting two opposite grooves to each other. It is formed by knapping of the white plaque (code 90). On the surface of the grooves, traces of abrasion are visible. It is poorly distinguishable, rare traces, which are transverse to the edges. On the border of the abrasion area and natural surface are observed smoothed grains with multidirectional scratches on it. These traces could be formed after contact of the stone with transverse strapping rope, probably made of plant material. Perhaps, this mount had a slight backlash, which sometimes allowed the stone to vertically move in a horizontal axis.

Local rocks were used for manufacture of counterweights: codes 67, 70 — rodingite, code 90 — serpentinite. These rocks do not have sufficient hardness and strength. It is not very suitable for performing basic labor operations (percussion, abrasive). The general signs of counterweights are absence of traces of work, the presence of special grooves and heavy weight.

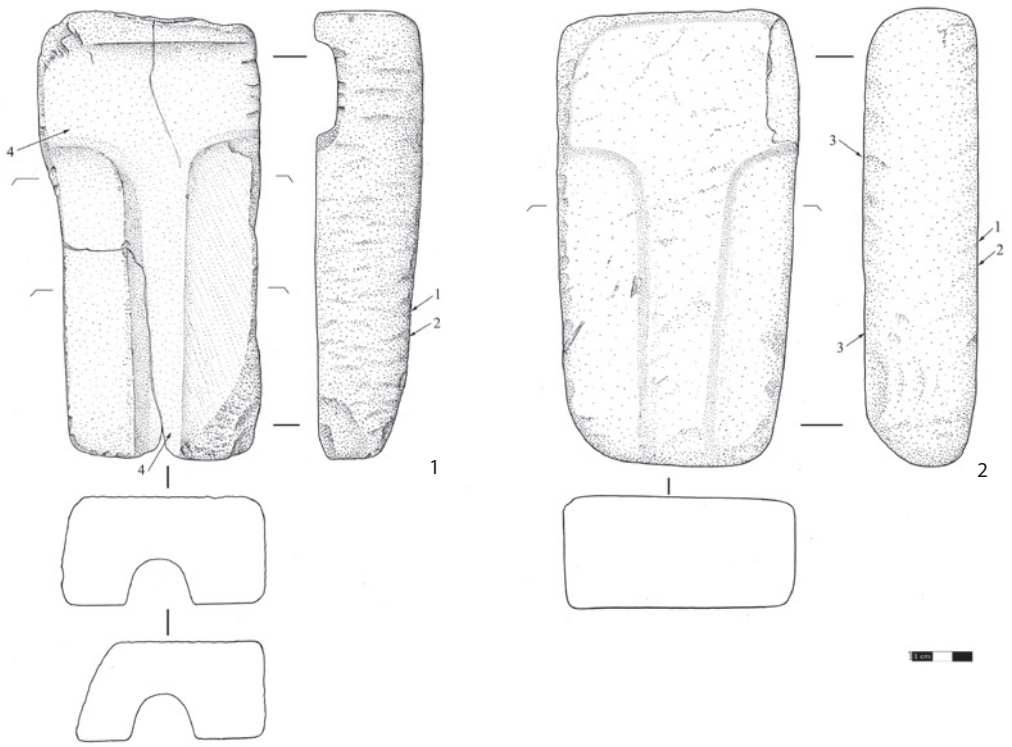

Fig. 8. Mould, drawing (codes 369H/22–23):
1 – Matrix: 1 – grinding, 2 – debitage, 4 – grinding surface of negative; 2 – cover:
1 – grinding, 2 – debitage, 3 – areas with a metallic gloss
Рис. 8. Рисунок литейной формы (шифр 369H/22–23):
1 – Матрица: 1 – шлифование, 2 – пикетаж, 4 – пришлифовка поверхности негатива;
2 – крышка: 1 – шлифование, 2 – пикетаж, 3 – участки с металлическим блеском

4. *A bivalve casting mould* (code 22–23) *(Fig. 8–9)* for casting a mining tool was found in 3 meters south-east of the mine in the waste rock field. The mould consists of two parts: a matrix and a cover. The matrix has a rectangular shape, measure is 22.9×11.3×6 cm and at the location of the negative of the fixing part of the tool are expands. A T-shaped negative of the pick is cut out on the matrix. It consisted of a spearhead (measure is 15.5×2–4×2 cm) and a plate for forming an open sleeve (measure 11.3×5x1–2 cm). Along the edges of the negative are distinguished traces of high-temperature exposure, which are presented by black calcined edging penetrating to a depth of 0.3–0.5 cm. The measure of the cover is 23.3×12×5.6 cm. Small fragment was chipped in ancient from one of the corners was found near mould. Close to the negative were visible wear traces, which were presented by black outline of blank of tool with reddish calcined filling. The width of outline is -0.5–1 cm.

Fig. 9 Mould, photo (codes 369H/22–23):
1 – Set of matrix and cover, 2 – view from the end of the mold,
3 – view from the opposite end, 4 – view from the side
Рис. 9. Фотография литейной формы (шифр 369H/22–23):
1 – набор литейной формы из крышки и матрицы; 2 – вид с одного торца;
3 – вид с противоположного торца; 4 – вид сбоку

Tab. 2

Evidence of copper and tin on the casting mould surface (code 22–23) from the Novotemirsky mine according to X-ray fluorescence analysis

Таблица 2

Следы меди и олова на поверхности литейной формы (код 22–23) с Новотемирского рудника по данным рентгенофлюоресцентного анализа

Part of the mould	Concentration, ppm	
	Cu	Sn
cover, an inner surface	5505	1165
cover, an outer surface	545	–
matrix, an inner surface	3624	387
matrix, an outer surface	1650	–

Note: dash — below the detection limit.

On the outer surfaces of both pieces wear grinding, presented by small- and medium-grained abrasives areas with characteristic for this operation traces was preserved. After that, all surfaces, except flat plane of matrix and the cover, were processed by debitage. This is evidenced by rather large, rounded, in places overlapping each other potholes, which cover almost all the outer surfaces of the mould. On the longitudinal edges of the cover, areas with metallic gloss are noted, a similar gloss is noted on the rounded end of the matrix. The surface of the matrix is well smoothed; traces of grinding with a small-grained abrasive are noted on it. The inner surface of the upper part of matrix is chipped, probably as a result of casting.

The results of X-ray fluorescence analysis of the casting mould surfaces indicate the bronze composition of the metal (copper + tin) from which the pick was cast; it is noteworthy that evidences of tin were recorded only on the inner (working) surface of the mould parts (Table 2).

According to X-ray diffraction analysis, the casting mould was made of mica-epidote-chlorite metasomatite (Table 3). This rock has not been found in the mine and the surrounding area, which makes it possible to attribute the casting mould to the brought artifacts.

Tab. 3

Mineral composition of the casting mould of a pick found at the Novotemirsky mine

Таблица 3

Минеральный состав литейной формы кирки, найденной на Новотемирском руднике

Code of analysis	Mineral composition (approx. weight %)					
	Chlorite	Epidote	Mica	Plagioclase	Talc	Amphibole
LF-1	38	27	26	9	trace	trace

5. *The bone tool* (Fig. 5.-*6*) is a fragmented item made from the diaphysis of the tibia of cattle (code 27K). It was found in the humus layer under the waste rock of the Alakul time. The tool is badly preserved, 13 cm in length, 1.5 to 2 cm in width. The safety of the tool fragment does not allow us to clearly defined function of it.

The same gloss as on stone objects is noted on the surface of this bone. The surface of the epiphysis is worked. Several areas are marked on it with wide lines, reminiscent of outlines. Directly (1) on the end, they are located at the edges opposite each other. On a small chip (4) adjacent to the end (epiphysis), a porous bone structure is noted. On its surface, thin, parallel to each other traces are fixed. They are located transversely to the elongated axis of the object. On the curved metaphysis (2), there are traces of cutting with a metal blade, probably by warmed bone. Traces formed small ledges placed in a cascade. Linear traces are not distinguished here. The outer edges of this section of the cut are straight. Closer to the broken end of the fragment (3), on the outer surface of the bone, two diagonal elongated axes of the object depressions are visible. One of them is deep, triangular in shape. Probably, it is result of direct percussion by metal object. Another observed as shallow, wide, curving trace. Inside of them parallel to each other traces are fixed, which repeating the outer contour of the depressions. Groups of thin, different-sized, transverse traces can be seen close to outside of them. A small, round brown drop is noted in a small depression on the inner surface of bone. Probably, it can be a drop of metal (5).

Thus, the distinguished evidence of wear allows classifying this fragment of bone as a tool. Tools made of animal bones are widely presented in the materials of the miners settlements: Kargaly [Kargaly, 2004], Michailo-Ovsyanka [Goraschuk, Kolev, 2004], Kartamysh ore occurrence [Brovender, Zagorodnyaya, 2009], but there are not enough data to relate this bone from Novotemirsky mine with a specific tool's type.

Discussion

According to results of the study of the tool complex of the Novotemirsky mine, we can noted that only two types of technical processes of the mining and metallurgical production are presented here: mining (casting mould for a bronze pick, counterweights) and crushing ore (hammers). There are no tools of the enrichment process (pestles, ore grinders) and metalworking (blacksmith hammers), as well as evidence of the serial production of tools in the artifact complex of the site, found during the excavations in 2017–2019.

Mining processes. This kind of work is represented by a bronze mining pick (pickaxe) cast in a bivalve casting mould. Finding a forged bushing pick mould with traces of use near the mine may indicate the production of these tools (picks) right at the mine.

There are few analogies of of this kind of tools from the surface collection of the Middle and Southern Trans-Urals sites [Avanesova, 2012], the Volga region [Tikhonov, 1960: 13], in old collections at Kargaly [Kargaly, 2004: 77; Kargaly, 2007: 101, Fig. 7.-2]. Nona Avanesova defines a similar category of tools as wedge-shaped socket chisels. The author notes that they could have been used for mining operations [Avanesova, 1991: 35].

Analogies of the pick from the Sintashta and Petrovka fortified settlements of the Southern Trans-Urals have a more reliable stratigraphic context. A tin-arsenic bronze tool (15 cm long) was found in the cultural layers of the Ustye I [Drevnee Ustye, 2013: 444, Fig. 15, 18.-1] and Kamenny Ambar settlements [Molchanov, Molchanova, in print].

At the same time, casting moulds for same tools in a fairly large series are presented in the materials of the Gorny I settlement at the Kargaly deposit [Kargaly, 2004: 134]. It is necessary to note the morphological difference between the Novotemirsky negative of the pick and the chlorite metasomatite form itself and sandstone forms from the Gorny I. The negative of the

Novotemirsky pick is strictly T-shaped, whereas the Gorny I pick negatives is wedge-shaped. Perhaps this difference is due to cultural and chronological specifics. The Novotemirsky casting mould is confined to the Alakul layers (the 17th — 16th centuries BC), whereas Gorny moulds are mostly associated with the B-3 subphase, with the end of the Bronze Age (the 15th — 13th centuries BC) [Kargaly, 2004: 134].

Auxiliaries for mining operations include heavy (16 kg and 8.2 kg) counterweights with grooves for tying. Analogies of similar items are also known in Kargaly [Kargaly, 2004: 179, Fig. 6.-17].

According to ethnographic evidence, the lifting of ore from vertical shaft could be carried out simply: in baskets, on ropes or slings [Agricola, 1962: 212]. However, the finding of counterweights suggests the presence of a more complex lifting mechanism. The rectangular shape of the Novotemirsky shaft 1 [Ankusheva et al., 2021a: 32–33, Fig. 2, 3] makes it possible and convenient to erect scaffolding inside it and a support site in the adjacent territory.

The manufacture of mining tools at the mine, as well as the possible use of complex lifting mechanisms in vertical workings, indicates a pronounced specialization of mining processes in the Bronze Age of the Southern Trans-Urals.

Ore crushing. These processes include the main set of the tool complex (sledgehammers and hammers). Numerous fragments of sandstone indicate that there were many such tools and, possibly, they were used throughout the Late Bronze Age. Typologically Novotemirsky hammer tools are distinguished by several characteristic features: wide grooves on the side edges of the tools, heavyweight, strong hard rock, and percussion marks on the working surface.

Reconstruction of the stone tools attached to the handle is a significant problem since the grooves suggest a handle method of attachment. An additional groove on the upper platform, difference on Kargaly hammers [Kargaly, 2004: 162, Fig. 6, 5.-1] is on the Novotemirsky tools. Nevertheless, special flattening chips on the upper platform were made on sledgehammers, probably for a better fit of the handle. According to ethnographic parallels, hammer handles are made of twigs, wood, ropes, and leather belts [Craddock et al., 2003: 57, Fig. 4.-6]. A possible reconstruction of a hafted stone mining hammer from the Novotemirsky mine is shown in the figure (Fig. 3.-*2*).

Ore crushing hammers are known at all Eurasian metallurgical province mines: at the Kartamysh ore occurrence [Brovender, 2008: 196, Fig. 8; Brovender, Zagorodnyaya, 2009: 254], at the Mikhailo-Ovsyanka mine [Gorashchuk, Kolev, 2004: 95, Fig. 1–4], at the Kargaly complex [Kargaly, 2004: 158–161], at the Ural-Mugodzhary [Tkachev, 2011: 50, Fig. 4, 6], Central and East Kazakhstan [Margulan, 2001; Chernikov, 1960], and Zarafshan mining and metallurgical centers [Avanesova, 2012: 27, Fig. 13, 16]. At the same time, this tools category is represented unevenly on household sites. These tools are spread on settlements located near mines. In particular, hammers were found in the settlements of the Ural-Mugodzhary mining and metallurgical center [Fomichev, 2015] and Central Kazakhstan: Zhezkazgan, Atasu I, Taldysai [Kuznetsova, Teplovodskaya, 1994: 57, Fig. 21, 23]. But such heavy ore-crushing tools are absent on the Sintashta and Alakul settlements in the Southern Trans-Urals. On the fortified settlement of Ustye I hammers are not founded [Drevnee Ustye, 2013: 288–289]; they have also not been found in the Alakul unfortified settlements [Zdanovich and Korobkova, 1988; Alaeva, 2015: Tab. 27].

The organization of mining at different stages of the Late Bronze Age in the Southern Trans-Urals could have a significant difference: the Sintashta fortified settlements with bright evidence of metal production (furnaces, slags, ingots, mining tools) in every house demonstrate the employment of their entire population in these processes. Mining tools and massive ore crushing hammers are absent in the unfortified settlements of the Alakul culture. At the same time, these categories of tools are represented at the mine which suggests a different model of labor organization — the presence of a specialized group of miners who perform work only at the mine.

We assume the existence of various models for organizing mining and metallurgical production at mines in Northern Eurasia in the Bronze Age:

— export, all-season, specialized model;
— pastoral, seasonal, non-specialized model;
— seasonal, partly specialized model.

Evgeny N. Chernykh defines the form of organization of Kargaly mining production as an "export model" that combines all production cycles: from mining, crushing and enrichment, ore smelting to the production of ingots and casting serial tools for trade and exchange operations. The export model assumes the existence of a specialized group of miners and metallurgists employed only in this production [Kargaly, 2007: 120].

Following to the materials of the Ural-Mugodzhary mining and metallurgical center Vitaly V. Tkachev reconstructs the pastoral model of metal production, which combines distant-pasture cattle breeding and ore mining during the warm season. Non-specialized groups of pastoralists are seasonally involved in mining as well [Tkachev, 2020]. A similar model associated with summer work at the mine and combination with a seasonal livestock system was proposed for the Mikhailo-Ovsyanka mine in the Volga region [Shishlina et al., 2020: 22].

It is still difficult for us to agree with the non-specialized model of mining in the Srubnaya and Alakul culture. This model is contradicted both by the difficulty of combining mining with cattle grazing and by evidence of specialization: the absence of mining tools in settlements and the availability of such tools only in mines, the existence of mining settlements near copper deposits (Mikhailo-Ovsyanka mine, Ural-Mugodzhary mines). In addition, to date, the exploration degree of the mines (fragmented data, insignificant excavation areas) do not allow to unambiguously interpreting the results of the herd composition analysis based on the bones of livestock at the mines.

The main stumbling block in attribution of a specialized or non-specialized model is the herd composition from mines. At the Kargalinsky mine, the herd composition is non-standard for settlements (up to 80% of cattle with a small proportion of small cattle and horses) [Kargaly, 2004: 187, 222]. At the Mikhaylo-Ovsyanka and Ural-Mugodzhar mines, the composition of the herd is identical to that of the settlement. However, the similarity of the parameters of the herd composition at mines and at household monuments can only indicate the use of the food base of settlements [Ankusheva et al., 2021b], and not the practice of developing mines by pastoralists combining these types of activities.

Most likely, we can talk about partial specialization, which consists of the formation of temporary collectives of miners who are seasonally involved in mining operations.

Boris Tikhonov argues in favor of working in mines during the cool season (spring, autumn and even winter). At this time, the population is freed from the economic affairs of the summer season. As evidence, the author points to the finds of winter clothes (fur coats, fur mittens) in old workings Gumeshevskie mines [Tikhonov, 1960: 14]. The slaughter season of the cattle on the Novotemirsky mine does not contradict the possible exploitation of deposits in the cold time of year, although the investigated sample of teeth (n=2) is too small to draw firm conclusions [Ankusheva et al., 2021b]. The presence of deepened buildings and thick deposits of the cultural layer at another Alakul mine (Vorovskaya Yama) also testifies in favor of mining in the cold season [Zaykov et al., 2005; the results of the author's field research in 2021].

The model of seasonal work in the cool (spring, autumn) and even cold (winter) seasons with partially specialized groups of metallurgical miners is in good agreement with the settled model of cattle breeding reconstructed for the population of the Bronze Age of the Southern Trans-Urals stall keeping livestock in the cold season [Rassadnikov, 2017].

Thus, the seasonal model of partially specialized mining could function at the Novotemirsky mine, as indicated by the set of tools, reconstruction of production stages, as well as the absence of buildings and a small number of artifacts and other evidence of human activity in the cultural layer of the site.

Conclusion

The complex of artifact's analysis from the Novotemirsky mine excavations made it possible to distinguish three groups of tools, depending on their functionality: mining (casting mould of a bronze pick), ore crushing (sledgehammers and hammers), auxiliary devices ("bases", counterweights for lifting ore).

The absence of enrichment (pestles, grinding stones) and metal-working (blacksmith hammers) tools in the Novotemirsky mine indicates a narrow range of technical operations, associated only with the direct extraction of copper ore and primary enrichment (crushing of large blocks).

The incomplete chain of operations at the Novotemirsky mine may be related to the peculiarities of this deposit. The laboriousness of mining due to the need to crush solid ore-hosting rocks, the poverty of copper deposits made it unprofitable to organize a specialized village of miners at this deposit.

REFERENCES

Agrikola G. O gornom dele i metallurgii v dvenadcati knigah [On Mining and Metallurgy in Twelve Books]. Moscow : Izdatel'stvo Akademii nauk SSSR, 1962. 598 p. *(In Russ.)*

Avanesova N. A. Kul'tura pastusheskih plemen epohi bronzy Aziatskoj chasti SSSR (po metallicheskim izdeliyam) [The Culture of the Bronze Age Pastoral Tribes of the Asian Part of the USSR (for metal products)]. Tashkent : Fan, 1991. 200 p. *(In Russ.)*

Avanesova N. A. Drevniye gornyaki Zarafshana [The Ancient Miners of Zarafshan]. Arheologiya Uzbekistana [Archaeology of Uzbekistan]. 2012. №1. Pp. 3–35. *(In Russ.)*

Alaeva I. P. Kul'turnaya specifika pamyatnikov pozdnego bronzovogo veka stepnoj zony Yuzhnogo Zaural'ya [Cultural Specificity of the Late Bronze Age Sites of the Southern Trans-Urals Steppe Zone]: Dis. … Cand. Hist. Sciences. Moscow, 2015. 539 p. *(In Russ.)*

Ankushev M. N., Yuminov A. M., Zajkov V. V., Noskevich V. V. Mednye rudniki bronzovogo veka v Yuzhnom Zaural'e [Copper Mines of the Bronze Age in the South Trans-Urals]. Izvestiya Irkutskogo gosudarstvennogo universiteta. Ser.: Geoarheologiya. Etnologiya. Antropologiya [Bulletin of the Irkutsk State University. Series Geoarchaeology. Ethnology. Anthropology]. 2018. Vol. 23. Pp. 87–110. DOI: 10.26516/2227-2380.2018.23.87. *(In Russ.)*

Ankusheva P. S., Alaeva I. P., Ankushev M. N., Fomichev A. V., Zazovskaya E. P., Blinov I. A. From Ore to Metal: Exploitation of the Novotemirsky Mine, Southern Trans-Urals, in the Second Millennium BC // Archaeology, Ethnology & Anthropology of Eurasia. 2021a. Vol. 49. № 1. Pp. 30–38. DOI: 10.17746/1563-0110.2021.49.1.030-038.

Ankusheva P. S., Kiseleva D. V., Bachura O. P., Alaeva I. P., Ankushev M. N., Okuneva T. G. Trud i pitanie gornyakov bronzovogo veka Yuzhnogo Zaural'ya (po dannym izotopnogo sostava stronciya v osteologicheskih ostatkah rudnika Novotemirskij [Labor and Food of Bronze Age Miners in the Southern Trans-Urals (based on the strontium isotopic composition in the Novotemirsky mine osteological remains]. Stratum Plus. 2021b. № 2. Pp. 69–83. *(In Russ.)*

Blinov I. A., Ankushev M. N., Rassomahin M. A., Medvedeva P. S. Mineraly medi, nikelja i mysh'jaka v rudah Novotemirskogo projavlenija zheleza (Juzhnyj Ural) [Minerals of Copper, Nickel and Arsenic in the Ores of the Novotemir Iron Occurrence (South Urals)] // Mineralogija [Mineralogy]. 2018. Vol. 4, № 3. Pp. 36–45. *(In Russ.)*

Brovender Yu. M. Itogi raskopok tehnogennogo uchastka na Kartamyshskom rudoproyavlenii [Results of Excavations of a Technogenic Site at the Kartamysh Ore Occurrence]. Drevnosti [Antiquities]. 2006–2008. Har'kov : NTMT. 2008. Pp. 184–203. *(In Russ.)*

Brovender Yu. M., Zagorodnyaya O. N. Orudiya metalloproizvodstva poseleniya Chervone Ozero-3 Kartamyshskogo kompleksa gorno-metallurgicheskyh pamyatnykov epohy bronzy [Tools of Metal Production of the Settlement Chervone Ozero-3 of the Kartamysh complex of mining and metallurgical Bronze Age Sites]. Materialy ta doslidzhennya z arheologii Skhidnoi Ukrainy [Materials and Researches on Archeology of Eastern Ukraine]. Lugansk : Naw. akad. nauk Ukrayiny, Skhidnoukr. nac. un-t im. Volodymyra Dalya, In-t arheologii. 2009. Pp. 251–262.

Chernikov S. S. Vostochnyj Kazakhstan v epohu bronzy [East Kazakhstan in the Bronze Age]. Materialy i issledovaniya po arheologii [Materials and Research on Archaeology]. №88. Moscow; Leningrad : Izdatel'stvo Akademii nauk SSSR, 1960. 270 p. *(In Russ.)*

Chernykh E. N. Formation of the Eurasian "Steppe Belt" of Stockbreeding Cultures: Viewed through the Prism of Archaeometallurgy and Radiocarbon Dating // Archaeology, Ethnology & Anthropology of Eurasia. 2008. 3(35). Pp. 36–53 DOI: 10.1016/j.aeae.2008.11.003

Craddock B. R., Cartwright C. R., Craddock P. T., Wray W. B. Hafted Stone Mining Hammer from Chuquicamata, Chile // Mining and Metal Production. Through the Ages. Edited by Paul Craddock and Janet Lang. London : The British Museum Press, 2003. Pp. 52–68.

Drevnee Ust'e: ukreplennoe poselenie bronzovogo veka v Yuzhnom Zaural'e. Red. N. B. Vinogradov; A. V. Epimahov [Ancient Ustye: Fortified Settlement of the Bronze Age in the Southern Trans-Urals. Eds. N. B. Vinogradov; A. V. Epimakhov]. Chelyabinsk : ABRIS, 2013. 482 p. (*In Russ.*)

Fomichev A. V. Orudiya gornogo dela i metallurgii poseleniy pozdnego bronzovogo veka na severe Ural'sko-Mugodzharskogo gorno-metallurgicheskogo centra [Mining and Metallurgy Tools of the Late Bronze Age Settlements in the North of the Ural-Mugodzhary Mining and Metallurgical Center]. Vestnik Chelyabinskogo gosudarstvennogo universiteta [Bulletin of the Chelyabinsk State University]. 2015. № 24. History. Issue 66. Pp. 9–16. *(In Russ.)*

Gorashchuk I. V., Kolev Yu. I. Kamennye i kostyanye orudiya s rudnika bronzovogo veka Mihajlo-Ovsyanka v Samarskoj oblasti [Stone and Bone Tools from the Bronze Age Mine Mikhailo-Ovsyanka in the Samara Region]. Voprosy arheologii Urala i Povolzh'ya [The Questions of Archaeology of the Urals and the Volga Region]. Vol. 2. Samara : Izd-vo "Samarskij universitet", 2004. Pp. 89–104. *(In Russ.)*

Grigoriev S. Metallurgical Production in Northern Eurasia in the Bronze Age. Oxford : Archaeopress Publishing Ltd., 2015. 831 p.

Kargaly. T. III: Selishche Gornyj: Arheologicheskie materialy: Tehnologiya gorno-metallurgicheskogo proizvodstva: Arheobiologicheskie issledovaniya. Sost. i nauch. red. Ye.N. Chernyh [Kargaly. Vol. III: Gorny Settlement: Archaeological Materials: Technology of Mining and Metallurgical Production: Archaeobiological Research. Compiled and scientific by ed. E.N. Chernykh]. Moscow : Yazyki slavyanskoj kul'tury, 2004. 320 p. *(In Russ.)*

Kargaly. T. V: Fenomen i paradoksy razvitiya: Kargaly v sisteme metallurgicheskikh provintsiy: Potayennaya (sakral'naya) zhizn' arkhaiyeskikh gornyakov i metallurgov. Sost. i nauch. red. Ye.N. Chernyh [Kargaly. Vol. V: Phenomenon and Paradoxes of Development: Kargaly in the System of Metallurgical Provinces: Hidden (Sacred) Life of Archaic Miners and Metallurgists. Compiled and scientific by ed. E.N. Chernykh]. M. : Yazyki slavyanskoj kul'tury, 2007. 200 p. (*In Russ.*)

Kolev J. I. Das Bergbau- und Verhüttungszentrumder Bronzezeit in Michael-Ovsânka an dermittleren Wolfgang // Der Anschnitt 62. 2010. 1–12. Pp. 2–19.

Koryakova L. N. Epimakhov A. V. The Urals and Western Siberia in the Bronze and Iron Ages. Cambridge : Cambridge University Press, 2007. 383 p. DOI: 10.1017/CBO9780511618451

Kozhevnikov S. V., Ankushev M. N. Kamennye orudiya iz otvala drevnego rudnika Novotemirskij (Yuzhnoe Zaural'e) [Stone Tools from the Dump of the Ancient Novotemirsky mine (South Trans-Urals)]. Geoarheologiya i arkeologicheskaya mineralogiya [Geoarchaeology and Archaeological Mineralogy]. Miass : Institute of Mineralogy, Ural Branch of the Russian Academy of Sciences. 2018. Pp. 80–82. *(In Russ.)*

Kuznecova E. F., Teplovodskaya T. M. Drevnyaya metallurgiya i goncharstvo Central'nogo Kazahstana [Ancient Metallurgy and Pottery of Central Kazakhstan]. Almaty : Gylym, 1994. 207 p. *(In Russ.)*

Margulan A. H. Dzhezkazgan — drevnij metallurgicheskij centr (Gorodishche Milykuduk) [Dzhezkazgan — an Ancient Metallurgical Center (Milikuduk fortified settlement)]. Arheologicheskie issledovaniya v Kazahstane [Archaeological Research in Kazakhstan]. Alma-Ata : Nauka, 1973. Pp. 3–42. (*In Russ.*)

Margulan A. H. Sochineniya: v 14 t. T. 2. Saryarka. Gornoe delo i metallurgiya v epohu bronzy. Dzhezkazgan — drevnij i srednevekovyj metallurgicheskij centr (gorodishche Milykuduk) [Essays: In 14 Volumes. V. 2. Saryarka. Mining and Metallurgy in the Bronze Age.

Dzhezkazgan is an Ancient and Medieval Metallurgical Center (settlement of Milykuduk)]. Almaty : Dajk-Press, 2001. 144 p. *(In Russ.)*

Matveeva G. I., Kolev Yu. I., Korolev A. I. Gorno-metallurgicheskij kompleks bronzovogo veka u s. Mihaylo-Ovsyanka na yuge Samarskoj oblasti [Mining and Metallurgical Complex of the Bronze Age near the Village Mikhailo-Ovsyanka in the South of the Samara region]. Voprosy arheologii Urala i Povolzh'ya [The Questions of Archaeology of the Urals and the Volga Region]. Vol. 2. Samara : Izd-vo "Samarskij universitet", 2004. Pp. 69–88. *(In Russ.)*

Molchanov V. Ivan. and Molchanova V. Vlada. Catalogue of Inventory from the Kamennyi Ambar Settlement (excavation unit 6) // in R. Krause and L.Koryakova (ed.). Culture, Environment and Economy of the Bronze Age in the Karagaily-Ayat microregion (South Urals, Russia) (в печати).

Rassadnikov A. Y. Rezul'taty arheozoologicheskih issledovanij na poseleniyah Bol'shaya Berezovaya-2, Malaya Berezovaya-4 i Aleksandro-Nevskoe-II v Yuzhnom Zaural'e [Results of Archaeozoological Studies at the Settlements Bolshaya Berezovaya-2, Malaya Berezovaya-4 and Aleksandro-Nevskoye-II in the South Trans-Urals]. Vestnik arheologii, antropologii i etnografii [Bulletin of Archaeology, Anthropology and Ethnography]. 2017. 3(38). Pp. 176–185. *(In Russ.)*. DOI: 10.20874/2071-0437-2017-38-3-176-185.

Shishlina N., Roslyakova N., Kolev Y., Bachura O., Kuznetsova O., Kiseleva D., Retivov V., Tereschenko E. Animals, Metal and Isotopes: Mikhailo-Ovsyanka I, the Late Bronze Age Mining Site of the Steppe Volga Region. Archaeological Research in Asia. 2020. 24. 100229. DOI: 10.1016/j.ara.2020.100229.

Tatarinov S. I. O gorno-metallurgicheskom centre epohi bronzy v Donbasse [About the Mining and Metallurgical Center of the Bronze Age in Donbass]. Sovetskaya arheologiya [Soviet Archaeology]. 1977. № 4. Pp. 192–207. *(In Russ.)*

Tevelev Al. V., Kosheleva I. A., Burshtejn E. F., Tevelev Ark. V., Kuznecov I. E., Popov V. S. Gosudarstvennaya geologicheskaya karta Rossijskoj Federacii. Masshtab 1 : 200 000. Izdanie vtoroe. Seriya Yuzhno-Ural'skaya. List N-41-XIX (Varna). Ob'yasnitel'naya zapiska [State Geological Map of the Russian Federation. Scale 1: 200 000. Second edition. South Ural series. Sheet N-41-XIX (Varna). Explanatory letter]. Moskow : Moscow Branch of FSBI VSEGEI, 2018. 236 p. *(In Russ.)*

Tihonov B. G. Metallicheskie izdeliya epohi bronzy na Severnom Urale i Priural'ye [Metal Products of the Bronze Age in the Northern Urals and the Cis-Urals]. Materialy i issledovaniya po arheologii [Materials and Research on Archaeology]. №90. Moscow; Leningrad : Izdatel'stvo Akademii nauk SSSR, 1960. 208 p. *(In Russ.)*

Tkachev V. V. Ural'sko-Mugodzharskij gorno-metallurgicheskij centr epohi pozdnej bronzy [Ural-Mugodzhary Mining and Metallurgical Center of the Late Bronze Age]. Rossijskaya arheologiya [Russian Archaeology]. 2011. № 2. Pp. 43–55. *(In Russ.)*

Tkachev V. V. Vozmozhnosti landshaftnoj arheologii v izuchenii lokal'noj mobil'nosti stepnyh skotovodcheskih kul'tur epohi paleometalla [Possibilities of Landscape Archaeology in the Study of Local Mobility of Steppe Cattle-Breeding Cultures of the Paleometal Era]. Ural'skij istoricheskij vestnik [Ural Historical Bulletin]. 2020. 4(69). Pp. 32–41. *(In Russ.)*

Zaykov V. V., Yuminov A. M., Dunaev A. Yu., Zdanovich G. B., Grigoriev S. A. Geologo-mineralogicheskie issledovaniya drevnih mednyh rudnikov na Yuzhnom Urale [Geological and Mineralogical Studies of Ancient Copper Mines in the Southern Urals]. Arheologiya,

etnografiya i antropologiya Yevrazii [Archaeology, Ethnology & Anthropology of Eurasia]. 2005. 4 (24). Pp. 101–115. *(In Russ.)*

Zdanovich S. Ya., Korobkova G. F. Novye dannye o hozyajstvennoj deyatel'nosti naseleniya epohi bronzy (po dannym trasologicheskogo izucheniya orudij s poseleniya Petrovka II) [New Data on the Economic Activity of the Population of the Bronze Age (according to the tracological study of tools from the settlement of Petrovka II]. Problemy arheologii Uralo-Kazahstanskih stepej [Problems of Archaeology of the Ural-Kazakhstani steppes]. Chelyabinsk : Chelyabinskij gosudarstvennyj universitet, 1988. Pp. 60–80. *(In Russ.)*

Zhauymbayev S. U. Drevnie mednye rudniki Central'nogo Kazahstana [Ancient Copper Mines of Central Kazakhstan]. Bronzovyy vek Uralo-Irtyshskogo mezhdurech'ya [Bronze Age of the Ural-Irtysh Interfluve]. Chelyabinsk : Izdatel'stvo BGU, 1984. Pp. 113–121. *(In Russ.)*

Yuminov A. M., Zaykov V. V., Korobkov V. F., Tkachev V. V. Bronze Age copper mining in the Mugodzhary // Archaeology, Ethnology & Anthropology of Eurasia. 2013. 3/41. Pp. 87–96. DOI: 10.1016/j.aeae.2012.08.004

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Аванесова Н. А. Культура пастушеских племен эпохи бронзы Азиатской части СССР (по металлическим изделиям). Ташкент : ФАН, 1991. 200 с.

Аванесова Н. А. Древние горняки Зарафшана // Археология Узбекистана. 2012. № 1. С. 3–35.

Агрикола Г. О горном деле и металлургии в двенадцати книгах. М. : Изд-во АН СССР, 1962. 598 с.

Алаева И. П. Культурная специфика памятников позднего бронзового века степной зоны Южного Зауралья: дис. … канд. ист. наук. М., 2015. 539 с.

Анкушев М. Н., Юминов А. М., Зайков В. В., Носкевич В. В. Медные рудники бронзового века в Южном Зауралье // Известия Иркутского государственного университета. Сер.: Геоархеология. Этнология. Антропология. 2018. Т. 23. С. 87–110. DOI: 10.26516/2227-2380.2018.23.87.

Ankusheva P. S., Alaeva I. P., Ankushev M. N., Fomichev A. V., Zazovskaya E. P., Blinov I. A. From Ore to Metal: Exploitation of the Novotemirsky Mine, Southern Trans-Urals, in the Second Millennium BC // Archaeology, Ethnology & Anthropology of Eurasia. 2021a. Vol. 49. № 1. Pp. 30–38. DOI: 10.17746/1563-0110.2021.49.1.030-038.

Анкушева П. С., Киселева Д. В., Бачура О. П., Алаева И. П., Анкушев М. Н., Окунева Т. Г. Труд и питание горняков бронзового века Южного Зауралья (по данным изотопного состава стронция в остеологических остатках рудника Новотемирский) // Stratum plus. Археология и культурная антропология. 2021б. № 2. С. 69–83.

Блинов И. А., Анкушев М. Н., Рассомахин М. А., Медведева П. С. Минералы меди, никеля и мышьяка в рудах Новотемирского проявления железа (Южный Урал) // Минералогия. 2018. Т. 4, № 3. С. 36–45.

Бровендер Ю. М. Итоги раскопок техногенного участка на Картамышском рудопроявлении // Древности. 2006–2008. Харьков : НТМТ, 2008. С. 184–203.

Бровендер Ю. М., Загородняя О. Н. Орудия металлопроизводства поселения Червонэ Озеро-3 Картамышского комплекса горно-металлургических памятников эпохи брон-

зы // Матеріали та дослідження з археології Східної України. Луганск : Нац. акад. наук України, Східноукр. нац. ун-т ім. Володимира Даля, Ін-т археології. 2009. С. 251–262.

Горащук И. В., Колев Ю. И. Каменные и костяные орудия с рудника бронзового века Михайло-Овсянка в Самарской области // Вопросы археологии Урала и Поволжья. Самара : Изд-во «Самарский университет», 2004. Вып. 2. С. 89–104.

Древнее Устье: укрепленное поселение бронзового века в Южном Зауралье / ред. Н. Б. Виноградов, А. В. Епимахов. Челябинск : АБРИС, 2013. 482 с.

Жауымбаев С. У. Древние медные рудники Центрального Казахстана // Бронзовый век Урало-Иртышского междуречья. Челябинск : Издательство БГУ, 1984. С. 113–121.

Зайков В. В., Юминов А. М., Дунаев А. Ю., Зданович Г. Б., Григорьев С. А. Геолого-минералогические исследования древних медных рудников на Южном Урале // Археология, этнография и антропология Евразии. 2005. № 4 (24). С. 101–114.

Зданович С. Я., Коробкова Г. Ф. Новые данные о хозяйственной деятельности населения эпохи бронзы (по данным трасологического изучения орудий с поселения Петровка II // Проблемы археологии Урало-Казахстанских степей. Челябинск : Челябинский государственный университет, 1988. С. 60–80.

Каргалы. Т. III: Селище Горный: Технология горно-металлургического производства: Археобиологические исследования / сост. и науч. ред. Е. Н. Черных. М. : Языки славянской культуры, 2004. 320 с.

Каргалы. Т. V: Феномен и парадоксы развития: Каргалы в системе металлургических провинций: Потаенная (сакральная) жизнь архаических горняков и металлургов / сост. и науч. ред. Е. Н. Черных. М. : Языки славянской культуры, 2007. 200 с.

Кожевников С. В., Анкушев М. Н. Каменные орудия из отвала древнего рудника Новотемирский (Южное Зауралье) // Геоархеология и археологическая минералогия. Миасс : ИМин УрО РАН, 2018. С. 80–82.

Кузнецова Э. Ф., Тепловодская Т. М. Древняя металлургия и гончарство Центрального Казахстана. Алматы : Гылым, 1994. 207 с.

Маргулан А. Х. Джезказган — древний металлургический центр (городище Милыкудук) // Археологические исследования в Казахстане. Алма-Ата : Наука, 1973. С. 3–42.

Маргулан А. Х. Сочинения: в 14 т. Т. 2. Сарыарка. Горное дело и металлургия в эпоху бронзы. Джезазган — древний и средневековый металлургический центр (городище Милыкудук). Алматы : Дайк-Пресс. 2001. 144 с.

Матвеева Г. И., Колев Ю. И., Королев А. И. Горно-металлургический комплекс бронзового века у с. Михайло-Овсянка на юге Самарской области // Вопросы археологии Урала и Поволжья: сборник научных трудов. Самара : Издательство «Самарский университет», 2004. Вып. 2. С. 69–88.

Рассадников А. Ю. Результаты археозоологических исследований на поселениях Большая Березовая-2, Малая Березовая-4 и Александро-Невское-II в Южном Зауралье // Вестник археологии, антропологии и этнографии. 2017. № 3 (38). С. 176–185. DOI: 10.20874/2071-0437-2017-38-3-176-185

Татаринов С. И. О горно-металлургическом центре эпохи бронзы в Донбассе // Советская археология. 1977. №4. С. 192–207.

Тевелев Ал. В., Кошелева И. А., Бурштейн Е. Ф., Тевелев Арк. В., Кузнецов И. Е., Попов В. С. Государственная геологическая карта Российской Федерации. Масштаб 1:200 000. Издание второе. Серия Южно-Уральская. Лист N-41-XIX (Варна). Объяснительная записка. М.: Московский филиал ФГБУ ВСЕГЕИ, 2018. 236 с.

Тихонов Б. Г. Металлические изделия эпохи бронзы на Северном Урале и Приуралье. МИА № 90. М.; Л. : Изд-во АН СССР, 1960. 208 с.

Ткачев В. В. Уральско-Мугоджарский горно-металлургический центр эпохи поздней бронзы // Российская Археология. 2011. № 2. С. 43–55.

Ткачев В. В. Возможности ландшафтной археологии в изучении локальной мобильности степных скотоводческих культур эпохи палеометалла // Уральский исторический вестник. 2020. № 4 (69). С. 32–41. DOI: 10.30759/1728-9718-2020-4(69)-32-41

Черников С. С. Восточный Казахстан в эпоху бронзы. МИА № 88. М.; Л. : Изд-во АН СССР, 1960. 270 с.

Фомичев А. В. Орудия горного дела и металлургии поселений позднего бронзового века на севере Уральско-Мугоджарского горно-металлургического центра // Вестник Челябинского государственного университета. 2015. № 24. История. Выпуск 66. С. 9–16.

Ankusheva P. S., Alaeva I. P., Ankushev M. N., Fomichev A. V., Zazovskaya E. P., Blinov I. A. From Ore to Metal: Exploitation of the Novotemirsky Mine, Southern Trans-Urals, in the Second Millennium BC // Archaeology, Ethnology & Anthropology of Eurasia. 2021a. 49/1. Pp. 30–38. DOI: 10.17746/1563-0110.2021.49.1.030-038.

Chernykh E. N. Formation of the Eurasian "Steppe Belt" of Stockbreeding Cultures: Viewed through the Prism of Archaeometallurgy and Radiocarbon Dating // Archaeology, Ethnology & Anthropology of Eurasia. 35/3. 2008. Pp. 36–53 DOI: 10.1016/j.aeae.2008.11.003

Craddock B. R., Cartwright C. R., Craddock P. T., Wray W. B. Hafted stone mining hammer from Chuquicamata, Chile // Mining and metal production. Through the ages. Edited by Paul Craddock and Janet Lang. London : The British Museum Press, 2003. Pp. 52–68.

Grigoriev S. Metallurgical Production in Northern Eurasia in the Bronze Age. Oxford : Archaeopress Publishing Ltd, 2015. 831 p.

Kolev J. I. Das Bergbau- und Verhüttungszentrumder Bronzezeit in Michael-Ovsânka an dermittleren Wolfgang // Der Anschnitt 62. 2010. 1–12. P. 2–19.

Koryakova L. N., Epimakhov A. V. The Urals and western Siberia in the Bronze and Iron Ages. Cambridge : Cambridge University Press, 2007. 383 p. DOI: 10.1017/CBO9780511618451

Molchanov V. Ivan. and Molchanova V. Vlada. Catalogue of inventory from the Kamennyi Ambar settlement (excavation unit 6) // in R. Krause and L.Koryakova (ed.). Culture, Environment and Economy of the Bronze Age in the Karagaily-Ayat microregion (South Urals, Russia) (в печати).

Shishlina N., Roslyakova N., Kolev Y., Bachura O., Kuznetsova O., Kiseleva D., Retivov V., Tereschenko E. Animals, metal and isotopes: Mikhailo-Ovsyanka I, the Late Bronze Age mining site of the steppe Volga region. Archaeological Research in Asia. 24. 2020. 100229. DOI: 10.1016/j.ara.2020.100229.

Yuminov A. M., Zaykov V. V., Korobkov V. F., Tkachev V. V. Bronze Age copper mining in the Mugodzhary // Archaeology, Ethnology & Anthropology of Eurasia. 2013. 3/41. Pp. 87–96. DOI: 10.1016/j.aeae.2012.08.004

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PINCHUGA-6 BURIAL GROUND — A NEW SITE OF THE FINALE OF THE IRON AGE IN THE LOWER ANGARA REGION

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Abstract: The article presents the preliminary results of studying of the Pinchuga-6 burial ground in the Lower Angara region. This site is the first large necropolis of the late Iron Age to be explored in the region. 16 cremated burials on the side were recorded at the necropolis. Eventually 30 individuals of different ages were identified. The research revealed single children's and adults' burials, collective and paired complexes. In the collective complexes the remains of three or five people are buried. Based on the results the main features of the funeral ceremony were identified. Among the finds from the burial ground and the inter-burial ground space are weapons, tools, ceramic vessels, objects of Western Siberian cult casting and adornments. According to the analogy, the burial ground dates back to the second quarter of the 1st millennium AD. In addition materials of the Tashtyk and Late Kulai guises have been collected at the site along with local elements of the Lower Angara region.

Keywords: Lower Angara region, finale of the Iron Age, burial ground, burial ceremony, funeral equipment, ceramics, dating, cultural connection

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МОГИЛЬНИК ПИНЧУГА-6 — НОВЫЙ ПАМЯТНИК ФИНАЛА ЭПОХИ ЖЕЛЕЗА В НИЖНЕМ ПРИАНГАРЬЕ

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Резюме: В статье представлены предварительные результаты исследования могильника Пинчуга-6, расположенного в нижнем течении Ангары. Памятник стал первым изученным крупным некрополем финала эпохи железа для этого региона. На нем зафиксировано 16 погребений, выполненных по обряду трупосожжения на стороне. Идентифицировано погребение останков 30 индивидов разных возрастов. В ходе исследований выявлены одиночные детские и взрослые погребения, парные и коллективные комплексы. По итогам работ выделены основные черты погребального обряда. Среди находок из могил и межмогильного пространства отмечены предметы вооружения, орудия труда, керамические сосуды, предметы западносибирского культового литья, украшения. Многочисленные аналогии позволяют датировать могильник в рамках

2-й четверти I тыс. н.э. На памятнике вместе с местными нижнеангарскими элементами присутствуют материалы таштыкского и позднекулайского облика.

Ключевые слова: Нижнее Приангарье, финал эпохи железа, могильник, погребальный обряд, инвентарь, керамика, хронология, культурные связи

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Introduction

Archaeological study of the sites of the Lower Angara region at the finale of the Iron Age is at an early stage. Burial complexes of the second quarter of the 1st millennium AD are not known on this territory. Isolated random finds attributed to this period did not allow a detailed description of the culture of the region's population.

The first large studied necropolis of the finale of the Iron Age in the region is the Pinchuga-6 burial ground, discovered by an archaeological expedition of the Siberian Federal University. During field research in 2018–2019 on an exposed area of about 700 m^2, 16 burials were identified. The received finds began to be processed recently. Anthropological research has already been made for the sites. In addition the funeral equipment allowed preliminarily determining its cultural and dating affiliation.

The Pinchuga-6 burial ground is located on the right bank of the Angara River, 180 km above its mouth, opposite the settlement of Pinchuga in the Boguchan District of the Krasnoyarsk Territory. The burials were arranged in rows along a low sandy ridge on the surface of the terrace. Five burials were desecrated by hoardfinders of the 16 studied burials. The hoardfinders were interested only in bronze toreutics. The metalware, the fragments of horn finds, the glass and stone beads were left by them in the robbed graves. All disrupted holes were fixed and plotted on the plan before excavations. Further, a correlation was made between abandoned things and discovered burials.

The burial ceremony

Every burial was made according to the ceremony of cremation on the side. Some variability in the methods of placement of remains and funeral equipment was identified.

The first group contains most of the burials (13 out of 16). The burials were situated in earthen pits of oval, rectangular or irregular geometric shapes. The size of the pits varies from 30×27 cm to 70×90 cm, but medium-sized graves predominate. In most cases, the walls of the pits are vertical, the bottom is even. Cremated human bones were located in the pits in compact sets. The sets were most often in one of the sectors of the burial pit, less often they are located in center. The remains were placed in the burial in two compact sets in two cases.

The gravestones of these burials have not been reliably identified. It was difficult to characterize the tombstones due to their poor preservation. The presence of charred birch bark leaves at the bottom of the burial pit and above the cremated remains was noted only in three cases. Also, there were three thin wide charred wooden billets in one burial at the bottom of the pit. Furthermore some pieces of coal were recorded in the infill of ten graves and the soil in the infill was calcined in three cases.

The second group contains three burials which consist of a surface and an underground part. The finds with fragments of cremated human remains are scattered at the level of the original surface in the surface part. The scatter of artifacts is significant and ranges from 1.3×0.6 m to 2.2×1.8 m. One, two or three ground pits are recorded under the surface sets of finds and the human remains. Fragments of the cremated human bones, the funeral equipment, the pieces of coal and the fragments of organic materials were also placed in these pits. The finds from the upper and lower levels of such complexes are typologically uniform. For instance, some parts of the broken horn finds found in them are glued together. These complexes contain the largest number of the finds. For example, 115 specimens were found in burial №8 and about 170 specimens were found in burial №16. In addition, to the second group contains conditionally burial № 1. This burial was the most desecrated by hoardfinders. As a result, only 25 finds and small part of the cremated human remains have survived.

Also, the second group of objects is characterized by the presence of all categories of funeral equipment. Moreover, the breakdown of ceramic vessels with thin-rolled decor and blacksmith's tools were found only in these burials. Probably, people buried in these complexes possessed specific knowledge and skills of metallurgy and could occupy a special place in the structure of society. In addition, finds and fragments of cremated human bones were found scattered over the grave at the level of the ancient surface. This fact may indicate the presence in antiquity of some terrestrial objects, for example gravestone structures or a "gravestone" tree. Some human remains and some finds could be placed on them during a funeral or during funeral repast.

Every burial of the Pinchuga-6 burial ground contains a large number of funeral equipment. Moreover their placement in the planigraphy of the complexes is different. It was noted that large objects were found both at the bottom of the burial pit with cremated bones, and in the filling of the graves above the main set of remains. Traces of pyrogenic effects are recorded on some finds. At the burial ground weapons were found (including arrowheads, bow lining, dagger), tools (namely knives, adzes, hammer, chisels, fishhooks, scraper, needles), ceramic vessels, objects of Western Siberian cult casting, adornments (for example, appliques, plates, beads, combs, chains, hairpins), and fragments of things made of organic materials were also fixed at the burial ground. Non-inventory complexes have not yet been identified.

The remains of at least 30 individuals have been identified in the 16 burials. 14 individuals are children of different ages and 16 are adults (Fig. 1). The burial ground is dominated by single burials. Also, two paired and five collective burials were identified. In these burials there were remains from three, four or five people. Among children's burials, single ones predominate (№ 9, № 12, № 13), one collective burial (№ 4) with the remains of three children of different ages was noted. There are also single (№ 5–7, № 10, № 14) and collective burials (№ 3) among the adult burials. The rest of the burials are paired and collective with the remains of children and adults. The weight of the bones from each set is different and varies from 0.007 to 4.4 kg. The total weight of all cremated remains at the burial ground of 30 people is about 14 kg.

Analysis of anthropological remains showed that fragments of the skull were found in 87.5% of burials, teeth — in 81.3%, fragments of long bones — 100.0%, ribs — in 43.8%, vertebrae — in 43.8%. pelvic bones — in 25.0%. Thus, the identified remains contain bones from all parts of the skeleton. This indicates that various parts of the skeleton fell into the burial after the cremating. This means that there was no certain selectivity connected with any ritual.

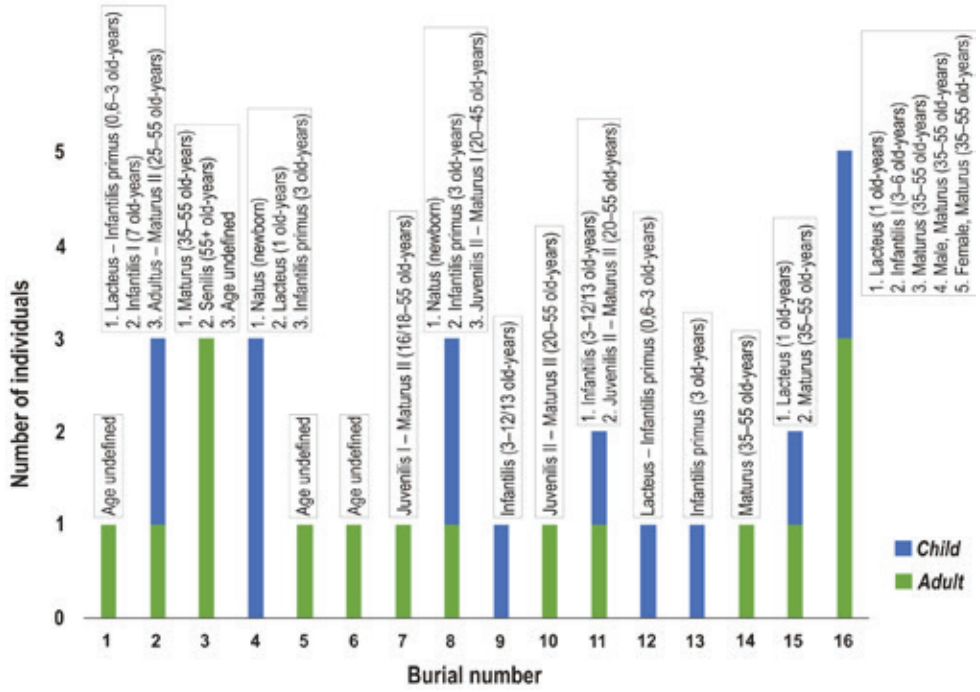

Fig. 1. Distribution of children and adults in burials
Рис. 1. Распределение детей и взрослых в погребениях

Different colors and sizes of cremated remains indicate different degrees of firing. Moreover, the difference is observed both between burials and between the fragments within the same burial.

The correlation between the age and gender groups and the characteristic features of the funeral ceremony did not give stable connections. The design features of children's and adults' burials are the same (including the shape, size of the grave pits, and the location of human remains). Children's burials are located with adults' ones and do not occupy a special place in the necropolis. At the same time, it should be noted that only in children's burials finds of bronze cult West Siberian casting were found. One of the characteristic features of single children's burials is the presence of a small number of related items, mainly adornments.

The dating and cultural characteristics

The funeral equipment of the Pinchuga-6 burial ground has numerous analogies among the materials of archaeological cultures of adjacent territories. Most of the tools, arrowheads, some adornments and ceramics are compared with the funeral equipment of the Bohr type burials. These inhumation burials were discovered in the forest-steppe Krasnoyarsk region [Mandryka, Makarov, 1994]. In addition some of the finds correlate with the materials of the Tashtyk culture (Fig. 2.-*5, 9*), including a belt clip with volute-like decor, an openwork fastener (applique?), fragments of horn pins with a globular head. The decor with volutes is often found in the belt sets of the Tashtyk culture and serves as a cultural and dating indicator. The wares find analogies in the Tashtyk burial complexes of the middle of the 1st millennium AD [Senotrusova, 2021].

Fig. 2. Finds from the Pinchuga-6 burial ground: 1–6, 8–10 – bronze; 11, 12 – bone; 21 – ceramics; the rest is iron. 1 – from burial № 9; 5, 11, 12, 21 – from burial № 1; 6 – from burial № 12; 13 – from burial № 7; 15 – from burial № 3; the rest is from the inter-burial ground space

Рис. 2. Находки из могильника Пинчуга-6. 1–6, 8–10 – бронза; 11, 12 – кость; 21 – керамика; остальное – железо. 1 – из погребения № 9; 5, 11, 12, 21 – из погребения № 1; 6 – из погребения № 12; 13 – из погребения № 7; 15 – из погребения № 3; остальное – из межмогильного пространства

Another group of finds is associated with the Late Kulay complexes of Western Siberia. Among them are ornithomorphic images of diurnal birds of prey (Fig. 2. -*2*). Two such items were discovered at the Pinchuga-6 burial ground. The images are realistic and haut-relief, with wealthy decor. Also a guise is schematically marked on the chest of one bird. These wares find analogies in many Late Kulai complexes namely in the Tomsk burial ground, Ishim, Kholmogorsk hoards etc. [Ermolaev, 1914; Zykov, Fedorova, 2001: 104; Shirin, Khavrin, 2012: 7].

Furthermore at the Pinchuga-6 burial ground six flat white bronze discs with a circular ornament and hollow volumetric bronze head of a fish (pike?) were found (Fig. 2. -*8, 6*). Similar finds are known in Western Siberia in many hoard collections, they are also found in the Tomsk burial ground [Zykov, Fedorova, 2001: 112; Shirin, Khavrin, 2012: 5; Yakovlev, 2001: 189]. These West Siberian analogies date of the second quarter of the 1st millennium A.D. [Shirin, 1993].

The dating of the site within the second quarter of the 1st millennium AD other materials is also confirmed. Eight-shaped white bronze appliques with imitation of granulation along the edge (Fig. 2. -*3, 4*) find analogies among the adornments from the burials of the Fominsk culture of the 2nd–4th centuries AD [Shirin, 2003: 73, 105]. A heavily corroded knife with a humped back finds analogies in Altai complexes of the 3rd–5th centuries AD [Tishkin, Matrenin, Schmidt, 2018: 59]. The same knives are also found in the Kuznetsk Basin in the sites of the Kok-Pash type in the 5th century [Bobrov, Vasyutin, Vasyutin, 2003: Fig. 46].

The most numerous categories of finds at the Pinchuga-6 burial ground were round convex hemispherical iron appliques of various diameters. They were located in two rows closely adjacent to each other in two burials (Fig. 2. -*13*). The appliques were scattered in the rest of the complexes. The similar decorations date back to the finale of the 2nd–3rd centuries in the Barnaul Ob region AD and in the Novosibirsk Ob region are dated to the finale of the 4th–5th century AD. The earliest copies of such appliques from the sites of the Tomsk Ob region belong to the 5th — first half of the 6th century AD [Belikova, Pletneva, 1983: Fig. 10.-4; Troitskaya, 1996]. Also such finds appear not earlier than the 3rd century AD in the foothills of the Kuznetsk Alatau [Shirin, 2003: tab. LXIII.-4, 6; LXVII.-1, 2].

In addition to hemispherical appliques on the Angara, single flat rectangular and square belt appliques of iron were found. The transition from bronze to iron belt sets took place in the 1st–2nd centuries AD on the territory of the Sayano-Altai Uplands. Such iron plates were most spread in the period of the 2nd–5th centuries AD [Tishkin, Matrenin, Schmidt, 2018: 8].

Analysis of the funeral equipment of the Pinchuga-6 burial ground assumes the site to be dated to the second quarter of the 1st millennium AD. The presence on the site of beads made of bronze spiral-twisted wire, flat triangular and three-bladed arrowheads and knives with a looped pommel, socketed adzes, and blacksmith's tools does not contradict the proposed dating. Probably, further research of this site will clarify the dating.

Today it is difficult to define the position of the Pinchuga-6 burial ground among other complexes of the Lower Angara region of the first half — the middle of the 1st millennium AD due to limited sources. The only synchronous objects are the burials of the third group of the Ust-Zelinda-2 burial ground. These are six burials in the form of scattered cremated human remains on an original surface. These burials contain iron arrowheads, pierced beads, beads, fragments of ceramics with thin rollers. Researchers associate the finds of objects of Western

Siberian cult casting with the same complexes [Marchenko et al., 2012: 457]. Anthropological researches of these remains have not yet been studied.

In the territories adjacent to the Lower Angara region, at the finale of the Iron Age, the ceremony of cremated is known in the Krasnoyarsk forest-steppe and characteristic of the burials of the Borovoe type [Mandryka, Makarov, 1994]. The cremated remains were buried in ground pits along with funeral equipment and a ceramic vessel was placed next to it in these burials. There are similar arrowheads, adornments and similar ceramics with an ornament of thin rollers and fingertips in the Krasnoyarsk and Angarsk burials. All these facts testify to the dating and probably cultural closeness of the Angara complexes and the burials of the Bohr type.

Conclusion

The Pinchuga-6 burial ground is the largest studied necropolis of the second quarter of the 1st millennium AD. The finds make it possible to characterize the burial ceremony of the population in the Lower Angara region. The materials also allow tracing the directions of cultural connection and highlighting the main markers of the complexes of this period. New materials demonstrate that the population of the lower reaches of the Angara at the finale of the Iron Age participated in a complex system of cultural communications that existed at that time between different regions of Siberia. Moreover, the materials of the second quarter of the 1st millennium AD stand out in a separate dating complex, which is synchronous with the sites of the Borovsk type, the Tashtyk culture and the late stage of the Kulai culture/community.

REFERENCES

Belikova O. B., Pletnyova L. M. Pamyatniki Tomskogo Priob'ya v V–VIII vv. n.e. [The Sites of the Tomsk Ob Region in the 5th — 8th Centuries A. D.]. Tomsk : Izdatel'stvo Tomskogo universiteta, 1983. 244 p. (*In Russ.*)

Bobrov V. V., Vasyutin A. S., Vasyutin S. A. Vostochnyj Altaj v epohu Velikogo pereseleniya narodov (III–VII vv.) [Altai in the Era of the Great Nations Migration (the 3rd — 7th Centuries)]. Novosibirsk : Izd-vo In-ta arheologii i etnografii SO RAN, 2003. 224 p. (*In Russ.*)

Ermolaev A. P. Opisanie kollekcij Krasnoyarskogo muzeya. Ishimskaya kollekciya [Description of the Collections of the Krasnoyarsk Museum. Ishim Collection]. Krasnoyarsk : Tipografiya b. M. I. Abalakova, 1914. 19 p. (*In Russ.*)

Zykov A. P., Fedorova N. V. Holmogorskij klad: kollekciya III–IV vv. iz sobraniya Surgutskogo hudozhestvennogo muzeya [Kholmogorsk Hoard: the Collection of the 3rd — 4th Centuries from the Collection of the Surgut Art Museum]. Ekaterinburg : Sokrat, 2001. 176 p. (*In Russ.*)

Mandryka P. V., Makarov N. P. Pogrebeniya s truposozhzheniyami v okrestnostyah Krasnoyarska (k voprosu o vydelenii pamyatnikov novogo kul'turnogo tipa) [Cremated Burial Grounds in the Vicinity of Krasnoyarsk (on the issue of identifying of the sites of a new cultural type)]. Etnokul'turnye processy v Yuzhnoj Sibiri i Central'noj Azii v I–II tysyacheletii n.e. [Ethnocultural Processes in Southern Siberia and Central Asia in the 1st — 2nd Millennium A. D.]. Kemerovo : Kuzbassvuzizdat, 1994. Pp. 68–84. (*In Russ.*)

Marchenko Zh. V., Garkusha Yu. N., Grishin A. E., Kazakova E. A. Issledovaniya na mogil'nike Ust'-Zelinda-2 v 2012 godu [Research at the Ust-Tselinda-2 Burial Ground in 2012]. Problemy arheologii, etnografii, antropologii Sibiri i sopredel'nyh territorij [Problems

of Archaeology, Ethnography, Anthropology of Siberia and Adjacent Territories]. Novosibirsk : Izd-vo In-ta arheologii i etnografii SO RAN, 2012. Vol. 18. Pp. 453–458. (*In Russ.*)

Senotrusova P. O. Tashtykskie veshchi v kompleksah finala rannego zheleznogo veka v nizhnem techenii Angary [Tashtyk Things in the Complexes of the Final of the Early Iron Age in the Lower Reaches of the Angara Regoin]. Arheologicheskie pamyatniki Yuzhnoj Sibiri i Central'noj Azii: ot poyavleniya pervyh skotovodov do epohi slozheniya gosudarstvennyh obrazovanij [Archaeological Sites of Southern Siberia and Central Asia: from the Appearance of the First Herders to the Epoch of the Establishment of State Formations]. Sankt-Peterburg : Izdatel'stvo IIMK, 2021. Pp. 118–119. (*In Russ.*)

Tishkin A. A., Matryonin S. S., Shmidt A. V. Altaj v syan'bijsko-zhuzhanskoe vremya (po materialam pamyatnika Stepushka) [Altai in the Xianbei-Zhuzhan Time (based on materials from the Stepushka site)]. Barnaul : Izd-vo Alt. un-ta, 2018. 368 p. (*In Russ.*)

Troickaya T. N. Mestnye poyasa naseleniya verhneobskoj kul'tury [Local Belts of the Population of the Upper Ob Culture]. Arheologiya, antropologiya i etnografiya Sibiri [Archeaology, Anthropology and Ethnography of Siberia]. Barnaul : Izd-vo Alt. un-ta, 1996. Pp. 154–162. (*In Russ.*)

Shirin Yu. V. Verhnee Priob'e i predgor'ya Kuzneckogo Alatau v nachale I tysyacheletiya n.e. (Pogrebal'nye pamyatniki fominskoj kul'tury) [The Upper Ob Region and Foothills of the Kuznetsk Alatay at the Beginning of the 1st Millennium A.D. (Burial monuments of the Fominsk culture)]. Novokuzneck : Kuzbass. gos. ped. akad., 2003. 288 p. (*In Russ.*)

Shirin Yu. V. K istorii "kul'tovyh mest" Zapadnoj Sibiri [On the History of "Places of Worship" in Western Siberia]. Arheologicheskie issledovaniya v Srednem Priob'e [Archaeological Research in the Middle Ob Region]. Tomsk : Izdatel'stvo Tomskogo universiteta, 1993. Pp. 152–162. (*In Russ.*)

Shirin Yu. V., Havrin S. V. Kompleksy vtoroj chetverti I tysyacheletiya iz Tomskogo mogil'nika [Complexes of the Second Quarter of the 1st Millenium from the Tomsk Burial Ground]. Stratum Plus. 2012. № 4. Pp. 1–15. (*In Russ.*)

Yakovlev Ya. A. Illyustracii k nenapisannym knigam: Sarovskoe kul'tovoe mesto [Illustrations for Unwritten Books: the Cult Site of Sarov]. Tomsk : Izdatel'stvo Tomskogo universiteta, 2001. 274 p. (*In Russ.*)

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Беликова О. Б., Плетнёва Л. М. Памятники Томского Приобья в V–VIII вв. н.э. Томск : Изд-во Томск. ун-та, 1983. 244 с.

Бобров В. В., Васютин А. С., Васютин С. А. Восточный Алтай в эпоху Великого переселения народов (III–VII вв.). Новосибирск : Изд-во Ин-та археологии и этнографии СО РАН, 2003. 224 с.

Ермолаев А. П. Описание коллекций Красноярского музея. Ишимская коллекция. Красноярск : Типография б. М. И. Абалакова, 1914. 19 с.

Зыков А. П., Федорова Н. В. Холмогорский клад: коллекция III–IV вв. из собрания Сургутского художественного музея. Екатеринбург : Сократ, 2001. 176 с.

Мандрыка П. В., Макаров Н. П. Погребения с трупосожжениями в окрестностях Красноярска (к вопросу о выделении памятников нового культурного типа) // Этно-

культурные процессы в Южной Сибири и Центральной Азии в I–II тысячелетии н.э. Кемерово : Кузбассвузиздат, 1994. С. 68–84.

Марченко Ж. В., Гаркуша Ю. Н., Гришин А. Е., Казакова Е. А. Исследования на могильнике Усть-Зелинда-2 в 2012 году // Проблемы археологии, этнографии, антропологии Сибири и сопредельных территорий. Новосибирск : Изд-во Ин-та археологии и этнографии СО РАН, 2012. Т. 18. С. 453–458.

Сенотрусова П. О. Таштыкские вещи в комплексах финала раннего железного века в нижнем течении Ангары // Археологические памятники Южной Сибири и Центральной Азии: от появления первых скотоводов до эпохи сложения государственных образований. СПб. : Изд-во ИИМК, 2021. С. 118–119.

Тишкин А. А., Матрёнин С. С., Шмидт А. В. Алтай в сяньбийско-жужанское время (по материалам памятника Степушка). Барнаул : Изд-во Алт. ун-та, 2018. 368 с.

Троицкая Т. Н. Местные пояса населения верхнеобской культуры // Археология, антропология и этнография Сибири. Барнаул : Изд-во Алт. ун-та, 1996. С. 154–162.

Ширин Ю. В. Верхнее Приобье и предгорья Кузнецкого Алатау в начале I тысячелетия н.э. (Погребальные памятники фоминской культуры). Новокузнецк : Кузбасс. гос. пед. акад., 2003. 288 с.

Ширин Ю. В. К истории «культовых мест» Западной Сибири // Археологические исследования в Среднем Приобье. Томск : Изд-во Том. ун-та, 1993. С. 152–162.

Ширин Ю. В., Хаврин С. В. Комплексы второй четверти I тыс. из Томского могильника // Stratum Plus. 2012. № 4. С. 1–15.

Яковлев Я. А. Иллюстрации к ненаписанным книгам: Саровское культовое место. Томск : Изд-во Томск. ун-та, 2001. 274 с.

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NIZHNYAYA SOORU SETTLEMENT IN CENTRAL ALTAI: SOME OUTCOMES OF THE STUDY AND PROSPECTS FOR FURTHER RESEARCH

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Abstract: More than 150 years have passed since V.V Radlov began the first excavations to study the Afanasievo culture in the Altai. To date, mortuary complexes have provided the majority of cultural and biological material for the Afanasievo culture and have served as the basis for robust analyses and interpretations, even though their potential has not been fully exhausted. Critically, Afanasievo settlements have been very poorly studied. One of the most important reasons for this gap in our knowledge is the lack of surveys for occupational sites of communities in the Altai dating to the end of the 4th to the beginning of the 3rd millennium BCE. The available information on the Afanasievo culture gives hope that this research agenda will be eventually implemented. At the same time, it is important to bring existing results into the scientific literature and analyze available materials with modern methods. This article provides information about the Afanasievo settlement Nizhnyaya Sooru, which was discovered in the Karakol River Valley of the central Altai. In spite of the small scale of previous excavations, the findings attracted archaeological attention and have been described in several publications. Inspection of this settlement in 2019 and 2020 revealed that the cultural deposits were actively being destroyed by erosion. Here, we present our observations, photographs, and a topographic plan of the site, while outlining the prospects of future research at Nizhnyaya Sooru.

Keywords: Altai, Afanasievo culture, Nizhnyaya Sooru, settlement, animal bones, ceramics, stone tools, radiocarbon dating, topographic plan

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ПОСЕЛЕНИЕ НИЖНЯЯ СООРУ В ЦЕНТРАЛЬНОМ АЛТАЕ: НЕКОТОРЫЕ ИТОГИ ИЗУЧЕНИЯ И ПЕРСПЕКТИВЫ ДАЛЬНЕЙШИХ ИССЛЕДОВАНИЙ

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Резюме: Изучение археологических памятников на Алтае, относимых к афанасьевской культуре, насчитывает более 150 лет. Начало этого процесса было заложено раскопками под руководством В. В. Радлова. К настоящему времени при исследовании погребальных комплексов получены существенные по объему научные материалы, которые уже стали предметами всесторонних анализов и интерпретаций, хотя их потенциал до конца не исчерпан. Совсем слабо изученными оказались поселения. Это связано с несколькими факторами, среди которых главный — неосуществленные обследования для специальной фиксации мест проживания населения Алтая в конце IV — начале III тыс. до н.э. Имеющиеся сведения позволяют надеяться на перспективность такого направления работ. При этом важно ввести в научный оборот ранее полученные результаты и на современном уровне проанализировать имеющиеся материалы. В данной статье представлена информация о поселении Нижняя Соору, которое было обнаружено в одной из горных долин Центрального Алтая. Несмотря на незначительные по объему раскопки, были получены находки, которые привлекли внимание исследователей, что нашло отражение в нескольких публикациях. Осмотр указанного поселения в 2019 и 2020 гг. обозначил проблему дальнейшего разрушения культурного слоя. Зафиксированные наблюдения, полученные фотоснимки и тахеометрический план памятника представлены в данной статье. Обозначены перспективы дальнейших исследований.

Ключевые слова: Алтай, афанасьевская культура, Нижняя Соору, поселение, кости животных, керамика, каменные орудия, радиоуглеродное датирование, тахеометрический план

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Introduction

For several decades in Eurasian archaeology much attention has been paid to the so-called Afanasievo culture, the sites of which have been studied over a large region — not only in Russia (Altai, Khakasia, Tuva), but also in Eastern Kazakhstan, China (Xinjiang) and Mongolia [Tsyb, 1984; Pogozheva et al., 2006; Burial and settlement complexes…, 2006; Afanasiev Collection, 2010; Afanasiev Collection 2, 2012; Vadetskaya, Polyakov, Stepanova, 2014; Kovalev, 2019; Merz, 2021; Honeychurch et al., 2021; et al.]. Of course, expansion and refinement of the delineated range of the Afanasievo culture is not excluded. In this situation, there is a need to align the accumulated information with the concepts that characterize the archaeological materials at various taxonomic levels. It is absolutely clear, that the available volume of data raises the question on designation of a cultural-historical community, for which there may be sense in abandoning the name "Afanasievo". Regional manifestations of this phenomenon should be considered as separate archaeological cultures, not excluding the identification of local variants [Masson, 1976, fig. 1] and consideration should be made to special types of sites. Therefore, one of us has already expressed the idea of designating the Saldyar culture of the Afanasievo period in the Altai [Surazakov and Tishkin, 2007, p. 86; Tishkin and Seregin, 2012, p. 202; Tishkin, 2018, p. 30], based on the materials of Saldyar-I monument, published as a monograph [Larin, 2005].

The possibility of revised designations for the Afanasievo culture requires additional discussions, although the cultural specificity of the studied sites is clearly observed in the known cultural areas, among which the Altai Mountains are paramount. The peculiarities of the Afanasievo culture are mainly based on the results of research on human burials. Such excavations in 1865 were carried out by V. V. Radlov [Kiryushin, 1985], and later under the leadership of S. I. Rudenko in 1924, 1925 and 1929 [Rudenko, 1926; Vadetskaya, Polyakov, and Stepanova, 2014, pp. 34–35; Konstantinov et al., 2018, p. 19]. In the 1930s, they were continued by G. P. Sergeev, G. P. Sosnovsky, and S. V. Kiselev [Sosnovsky, 1941; Kiselev, 1951, pp. 55–59; Vadetskaya, Polyakov, Stepanova, 2014, p. 3; et al.]. The results of this work and later studies were reflected in two dissertations [Tsyb, 1984; Fribus, 1998]. A brief history of the study of the Afanasievo culture of the Altai was published by O. V. Larin [1988]. By the present time there has been published a summary of the sites of the Altai Afanasievo culture [Vadetskaya, Polyakov and Stepanova, 2014, pp. 5–120]. Most of the materials from the mortuary complexes have been analyzed in different aspects [Ancient cultures…, 1994; Larin, 2005; Pogozheva et al., 2006; Grushin et al., 2006; Stepanova, 2019; etc.]. Unfortunately, targeted excavations of settlements were seldom carried out. The obtained materials were put into scientific circulation [Abdulganeev, Kiryushin, and Kadikov, 1982; Pogozheva et al., 2006, pp. 18–26; Mamadakov and Stepanova, 1998; Shulga, 2012; Vadetskaya, Polyakov and Stepanova, 2014, pp. 6–7, 9, 15–16, 23–24, 26–31, 33–34, 36–37, 40–41], but their impact was small. It is the study of the settlements that is worth paying close attention to at present. Such monuments are important for gaining a complete picture when reconstructing the subsistence of the Altai population at the end of the 4th and beginning of the 3rd millennium BCE. Therefore, the purpose of this article is to present small but important results of the study of the Nizhnyaya Sooru settlement located in the Central Altai (Fig. 1.-*1*). On this basis, it is worth considering the prospects of its excavation.

The Nizhnyaya Sooru settlement is situated about 2 km south-eastward from Kulada village in the Ongudai region of the Altai Republic (Russia) on the first terrace of the Karakol river near to the modern cattle farms (Fig. 1.-*2*). The geographic coordinates of its location, fixed by GPS-receiver (WGS-84), are as follows: N — 50° 40.069', E — 085° 48.483' (± 4 m). The altitude above sea level, demonstrated by the same instrument, was about 1110 m, indicating a mid-mountain zone, which covers the largest area of the Central Altai and has its own geographical features [Kiryushin and Tishkin, 1997, p. 94–97]. The characteristic intermountain valley in the Nizhnyaya Sooru valley, gradually descends and widens closer to the flood plain. According to the local residents of the valley, this lower section is not covered by snowpack in winter because the winds prevent snow accumulation. This circumstance allows cattle to feed on the remaining dry grass in winter, in addition to the use of cultivated fodder. Most likely, the setting of the local valley was an important factor in selecting the area for ancient and modern cattle husbandry.

History of the study of the settlement and the recovered materials

In the Nizhnyaya Sooru valley, many mortuary and memorial sites have been recorded, which belong to the Afanasievo period, Pazyryk culture, Turkic communities, and modern times. Early Turkic fences were partially investigated by A. S. Vasyutin [Seregin, Vasyutin, 2021]. The results of the excavations of sites attributed to the Eneolithic [Seregin, Vasyutin, 2020], which can be correlated with the Nizhnyaya Sooru settlement, should be mentioned.

Ancient and modern cult places [Ilyushin, 2011], as well as the results of pictorial activity [Mukhareva, Miklashevich and Seregin, 2021], were identified.

Fig. 1. The location of the settlement of Nizhnyaya Sooru:
1 — on the schematic map; 2 — on a picture from space
Рис. 1. Место расположения поселения Нижняя Соору:
1 — на карте-схеме; 2 — на снимке из космоса

The Nizhnyaya Sooru settlement was revealed in 1994 by the Altai archaeologist O. V. Larin, while inspecting the growth of an erosional ravine into the site's boundary. In prevent destruction of the cultural layer, an excavation with an area of only 2.4 square meters was made at the same time [Yelin and Larin, 1998, pp. 66–67]. Information about the findings has been published in detail [Larin, Kungurova and Stepanova, 1998; Kosintsev, 2005]. In 1997 another researcher from Gorno-Altaisk V.A. Kocheev again examined the site and collected surface material [Larin, Kungurova, Stepanova, 1998, p. 67], which is probably stored in the A. V. Anokhin National Museum of the Altai Republic (Gorno-Altaysk). In autumn 1998, the cultural layer of the settlement was examined by Yu.T. Mamadakov and A.A. Tishkin during the Altai excursion with their German colleagues from Dresden (Germany). Very small collections of pottery and bone fragments were obtained, and stone products from the Middle Paleolithic site of the Mousterian industry were found at a nearby quarry [Kungurov and Tishkin, 2000]. At the end of July 2019 (during a planned expedition to Mongolia) further erosion of the settlement was noted and geographical coordinates were recorded by an archaeological detachment of Altai State University led by A. A. Tishkin.

Small excavations at the Nizhnyaya Sooru settlement were planned in 2020. However, due to the pandemic, the expedition did not take place, although S. P. Grushin received an excavation permit. When visiting the monument, it was possible to photograph the extent of the archaeological site and the nature of its erosion (Fig. 2.-*1*). In particular, it was observed that the cultural deposits were overlaid by a dense layer of coarse gravel, as well as subsequent alluvial deposits, which over time had formed a layer about 0.6 m thick and was already well sodded (Fig. 2.-*2, 3*). In some places, a carbonaceous layer was observed (Fig. 2.-*4*), as well as in the precipice of the ravine there was a visible firepit (Fig. 2.-*2*).

The thickness of the cultural layer of the Nizhnyaya Soru settlement excavated in 1994 was about 0.16 m. Cultural material (pottery, stone items, animal bones) was rather densely accumulated. The excavation exposed a rectangular feature, embedded in the C horizon (materik) and consisted of four stone slabs (32×25×3–4 cm in size). The bottom of the feature also appeared to be lined with slabs. Soot on the inner walls of the feature suggested it was a hearth. The excavation yielded 33 lithic artifacts, which were analyzed in detail and wear-trace determinations were made [Larin, Kungurova, Stepanova, 1998]. The main lithic finds were chips and splinters. Three blades of irregular outlines were found, which were made with a rather simple technique of cleavage. During the use wear analysis, N. Yu. Kungurova identified three splinted pieces, saws, and burins, indicating that they were used in the manufacture of wooden products. Three grinding tools, which could be used for processing metal objects and a so-called "iron" for smoothing seams on leather items were also found. Two fragments of clay spindle whirls were found. One of them was made from a fragment of a vessel. The recovered ceramic assemblage represents about 25 vessels, including a censer. It was not possible to restore the vessels completely. It was noted that some fragments stylistically differ from the typical Afanasievo pottery [Larin, Kungurova and Stepanova, 1998, p. 72].

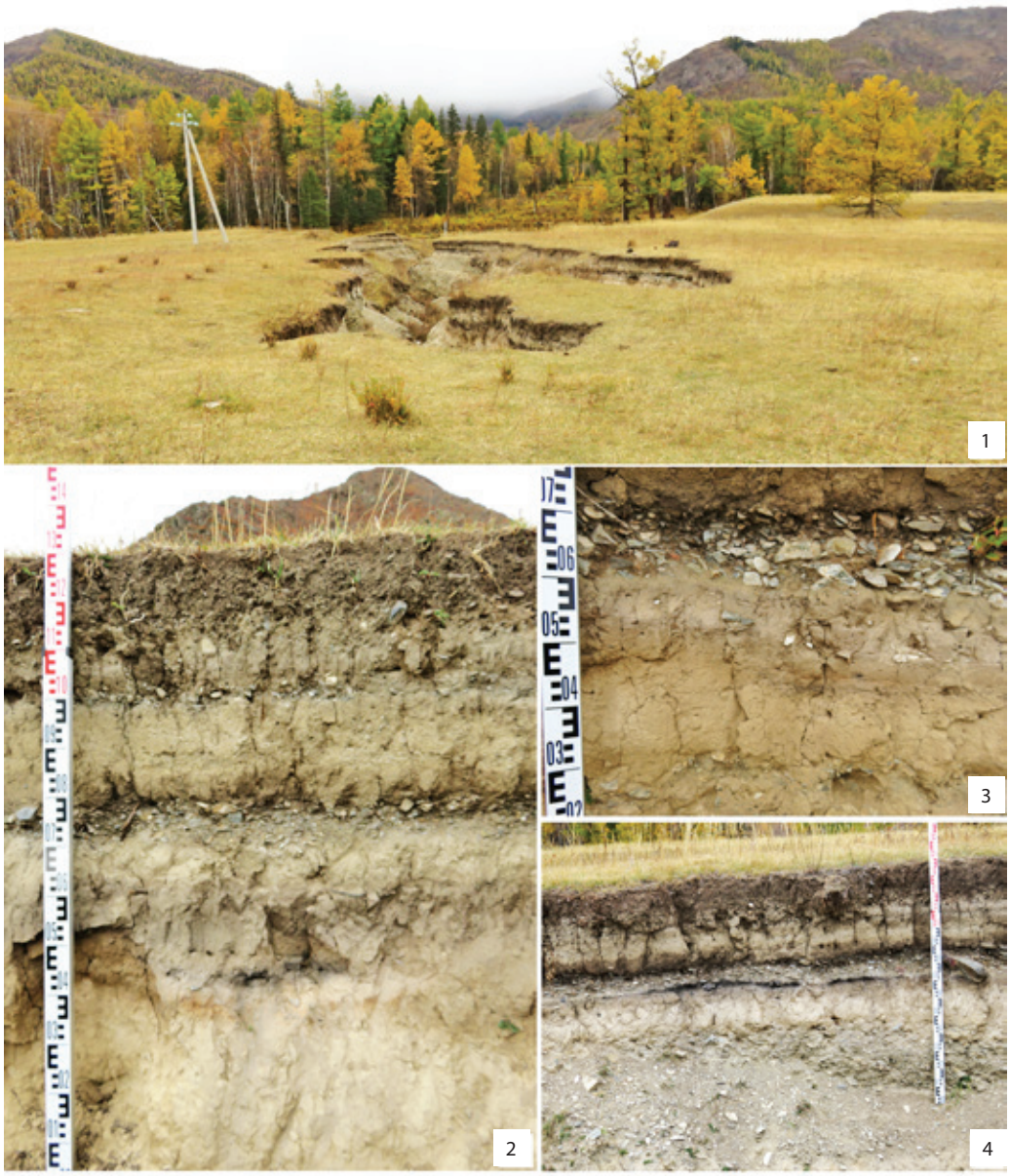

Fig. 2. Nizhnyaya Sooru: 1 — the modern type of destruction; 2 — the wall of the broken ground; 3 — the cultural layer; 4 — the carbonaceous layer
Рис. 2. Нижняя Соору: 1 — современный вид разрушений; 2 — стенка оврага; 3 — культурный слой; 4 — углистая прослойка

The excavation recovered bones of cattle (41 specimens), caprines (229 specimens), horse (4 specimens), wild animals (separate specimens from deer, fox, badger) and indeterminate remains, of which 198 specimens are closer to mammals. All skeletal elements attributed to caprine belonged to sheep (probably from 19 individuals). According to the wear stages of faunal teeth, P. A. Kosintsev distinguished the following age groups: 6–12 months, seven individuals; 12–24 months, five individuals; over 24 months, seven individuals. This age composition allowed him to point to the meat productive strategy of sheep husbandry. It was also noted that the sheep of the Afanasievo culture were smaller than the sheep of the Early Bronze Age in southwestern Siberia and Northern Kazakhstan, as well as the Sintashta community [Kosintsev, 2005].

On the basis of the analyzed materials the Nizhnyaya Sooru settlement was attributed to the Afanasievo culture, but absolute dating was not performed. The importance of studying the site as one of the most "pure" of the Afanasievo culture was noted [Larin, Kungurov and Stepanova, 1998, p. 72].

Problems and their discussion

Selected sheep teeth from the excavations of the Nizhnyaya settlement became the basis for paleogenetic analysis and AMS dating [Hermes et al., 2020]. But before proceeding to a brief overview of these results, it is worth paying attention to some relevant points related to the origin of the Afanasievo culture, the interest in which is recently "heated" by paleogenomic research, during which close genetic affinity between individuals of the Yamnaya cultural community and individuals of the Afanasievo culture (community) was established. On this basis, an unambiguous conclusion is made about the migration of the eastern "Yamnaya" to the region of South Siberia and a corresponding arrow is prominently drawn on the map of the Eurasian steppes representing the early Bronze Age [Allentoft et al., 2015, p. 169, fig. 1]. It makes sense to discuss this situation, as the fact of the alleged mass migration is not so obvious archaeologically and is very problematic. More probable, in our opinion, should be considered the migration of closely related ("pre-Yamnaya") people from one center but in different directions to the Volga and farther east, but not through Northern Kazakhstan, where a completely different (Botai) community prevailed, but possibly through the region of present-day central Kazakhstan. This hypothesis requires testing. However, at the present stage such a point of view does not contradict the available archaeological materials and has already been expressed in a relatively similar form [Fribus, 2006]. The migrants who arrived in Altai, within a narrow time window and nearly across the whole region, found the mountain-valleys suitable for pastoralist herding. In this way, they reconfigured their subsistence strategies that differed sharply from local strategies, which were based on Neolithic foraging and hunting. It is possible that earlier Afanasievo people (before the Altai was reached) lived in similar montane ecosystems. Otherwise they may have stopped in the resource-rich Ob-Irtysh interfluve, as the bearers of the Elunino culture did at the end of the 3rd millennium BCE [Kiryushin, 2002, p. 82–91]. But, it seems, a choice was made in favor of familiar mountain landscapes for pastoralist production. Here, it is worth mentioning that the population of the Andronovo culture did not occupy the Altai Mountains but instead they densely occupied the surrounding foothills in the middle of the 2nd millennium BCE. This pattern is well evidenced by the results of archaeological research. The famous Russian archaeologist M. P. Gryaznov [1955, 1957]

directly connected the cause of the absence of Bronze Age sites in the Altai Mountains with the economic system of the Andronovo culture (community) being better suited to the lower plains.

The chronological designation the Afanasievo community in the Altai requires clarification. In some publications it is indicated as Eneolithic [for example: Seregin, Vasyutin, 2020], in others as Early Bronze Age [for example: Dashkovsky, Stepanova, 2018], as well as the Bronze Age [for example: Burial and settlement complexes…, 2006] or the Paleometallic era [for example: Dashkovsky, 2019]. The chronological framework of the sites of Afanasievo cultural community studied using radiocarbon dating is defined in a broad chronological framework: from the 2nd half of 4th to the 1st half of 3rd millennium BCE [Poliakov and Svyatko, 2009, pp. 25–27, fig. 3; Kiryushin et al., 2010, p. 61], which nicely corresponds to the Eneolithic period. This conclusion is also supported by the fact that no bronze artifacts were found in any of the Altai sites of that time. It is clear that Afanasievo metallurgy was limited to copper working [Grushin et al., 2009, pp. 7–23].

The AMS dating of sheep teeth from the Nizhnyaya Sooru settlement and materials from other sites in the Altai (Maly Dugan, Pervy Mezhelik-I) not only marked a chronological interval of 3300–2900 BCE [Hermes et al., 2020], but also pointed to the need for further work on this topic. These dates partially confirmed the previously obtained radiocarbon determinations for the Afanasievo culture. However, the solution of the chronological issues for the sites of the Altai Eneolithic period is still far from reach. No less important were the results of the initial stage of the paleogenetic study of domestic sheep [Hermes et al., 2020]. In our opinion, studies of the osteological materials of these animals together with other data will allow for the determination of the origins of the Afanasievo phenomenon, while also isolating the waves of community movements to the region.

Conclusion

There is significant prospect for further research at the Nizhnyaya Sooru settlement. By the present time a topographic plan (Fig. 3) has been obtained, which reflects the erosional situation with the site and highlights the Importance of excavations. In addition, geophysical surveys of one of the sites have been conducted. The results of electrotomography are still in progress. The surveys indicate the spread of the cultural layer to the north of the ravine. It is not fixed in the southern wall.

The Nizhnyaya Sooru settlement is a rescue site, which raises the urgency of thorough archeological excavation. The experience of previous works allows us to count on obtaining large amounts faunal skeletal remains for traditional zooarchaeological analysis, proteomics (Zooarchaeology by Mass Spectrometry — ZooMS), paleogenomics, and AMS dating. A separate problem is the determination of the importance of domesticated horses in Afanasievo subsistence. For this, the available finds are still scarce. A separate project remains to be done to further study pottery and stone artifacts, as well as to establish their geographic sources. It makes sense to carry out palynological and phytolithic analyses for environmental reconstructions. Observations of the geomorphological plan are important to understand the processes that took place before and after the formation of the cultural layer. It is crucial to understand the cause of formation of the massive gravel layer, which overlapped and partially disturbed the cultural layer. Thus, future excavations will significantly complement

and implement the modern program of multidisciplinary research, which will provide critical new information about the still poorly understood Afanasievo culture.

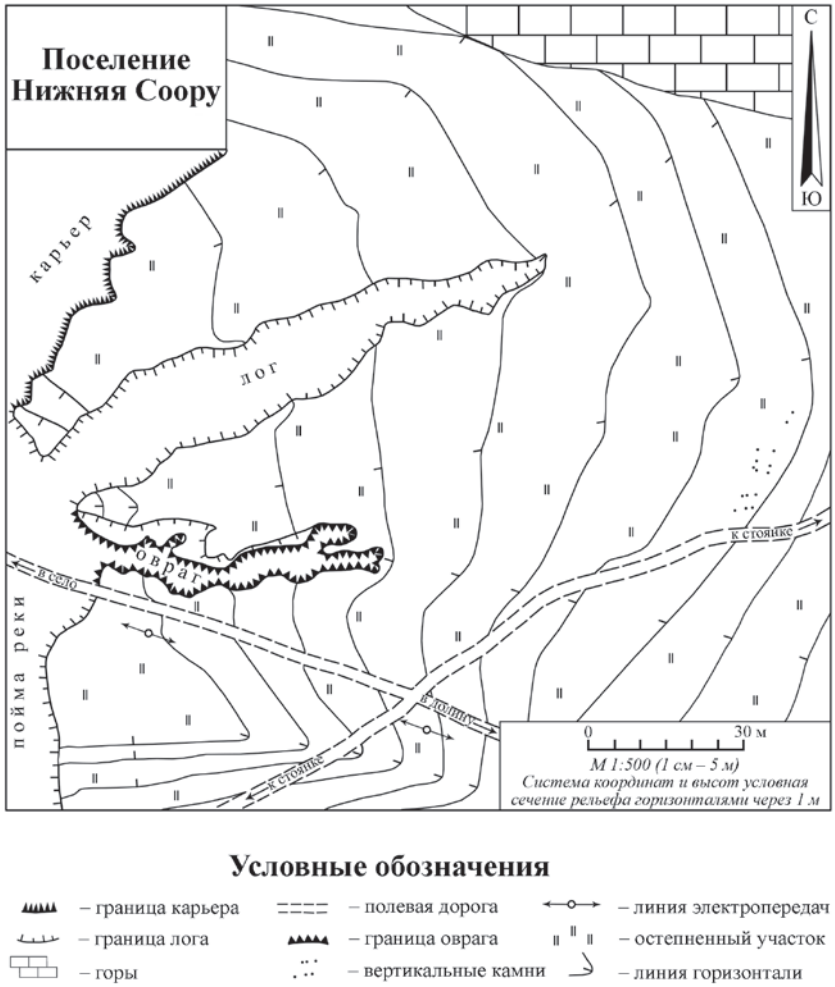

Fig. 3. Nizhnyaya Sooru. Topographic plan
Рис. 3. Нижняя Соору. Тахеометрический план

REFERENCES

Abdulganeev M. T., Kiryushin Yu. F., Kadikov B. H. Materialy epohi bronzy iz Gornogo Altaya [Materials of the Bronze Age from Gorny Altai]. Arheologiya i etnografiya Altaya [Archaeology and Ethnography of Altai]. Barnaul: Izd-vo Alt. un-ta, 1982. Pp. 52–77. *(In Russ.)*

Afanas'evskij sbornik [Afanasyevsky Collection]. Otv. red. N. F. Stepanova, A. V. Polyakov. Barnaul : Azbuka, 2010. 293 p. *(In Russ.)*

Afanas'evskij sbornik 2 [Afanasyevsky Collection 2] otv. red. N. F. Stepanova. Barnaul : Azbuka, 2012. 226 p. *(In Russ.)*

Vadeckaya E. B., Polyakov A. V., Stepanova N. F. Svod pamyatnikov afanas'evskoj kul'tury [The Collection of Sites of Afanasyevo Culture] Barnaul : AZBUKA, 2014. 380 p. *(In Russ.)*

Grushin S. P., Papin D. V., Pozdnyakova O. A., Tyurina E. A., Fedoruk A. S., Havrin S. V. Altaj v sisteme metallurgicheskih provincij eneolita i bronzovogo veka [Altai in the System of Metallurgical Provinces of the Eneolithic and Bronze Age]. Barnaul : Izd-vo Alt. un-ta, 2006. 160 p.

Gryaznov M. P. Nekotorye voprosy istorii slozheniya i razvitiya rannih kochevyh obshchestv Kazahstana i Yuzhnoj Sibiri [Some Questions of the History of the Formation and Development of the Early Nomadic Societies of Kazakhstan and Southern Siberia]. Kratkie soobshcheniya Instituta etnografii [Brief Reports of the Institute of Ethnography]. M. : Izd-vo Akademii nauk SSSR, 1955. Vyp. XXIV. Pp. 19–29. *(In Russ.)*

Gryaznov M. P. Etapy razvitiya hozyajstva skotovodcheskih plemen Kazahstana i Yuzhnoj Sibiri v epohu bronzy [Stages of Development of the Economy of Pastoralist Tribes of Kazakhstan and southern Siberia in the Bronze Age]. Kratkie soobshcheniya Instituta etnografii [Brief Reports of the Institute of Ethnography]. M.: Izd-vo Akademii nauk SSSR, 1957. Vyp. XXVI. P. 21–28. *(In Russ.)*

Drevnie kul'tury Bertekskoj doliny (Gornyj Altaj, ploskogor'e Ukok) [Ancient Cultures of the Bertek Valley (Gorny Altai, Ukok Plateau)]. A. P. Derevyanko, V. I. Molodin, D. G. Savinov i dr. Novosibirsk: Nauka, 1994. 224 P. *(In Russ.)*

Dashkovskij P. K., Stepanova N. F. Inskoj Dol — pamyatnik epohi rannej bronzy v Zapadnom Altae [Inskoy Dol — a Site of the Early Bronze Age in Western Altai]. Arheologiya, etnografiya i antropologiya Evrazii [Archaeology, Ethnography and Anthropology of Eurasia]. 2018. T. 46, № 1. Pp. 41–50.*(In Russ.)* DOI: https://doi.org/10.17746/1563-0102.2018.46.1.041-050

Dashkovskij P. K. Kurgan epohi paleometalla iz mogil'nika Hankarinskij dol (Gornyj Altaj) [A Burial Mound of the Paleometal Era from the Khankarinsky Dol Burial Ground (Gorny Altai)]. Narody i religii Evrazii [Peoples and Religions of Eurasia]. 2019. №3 (20). Pp. 19–33. *(In Russ.)*

Elin V. N., Larin O. V. Obsledovanie avarijnyh pamyatnikov v Gornom Altae [Survey of Emergency Sites in Gorny Altai]. Sohranenie i izuchenie kul'turnogo naslediya Altajskogo kraya [Preservation and Study of the Cultural Heritage of the Altai Territory]. Barnaul : Izd-vo Alt. un-ta, 1998. Vyp. IX. Pp. 64–67. *(In Russ.)*

Ilyushin A. M. Drevnie i sovremennye kul'tovye mesta Altaya (dannye iz polevogo dnevnika avtora ob arheologicheskih issledovaniyah na Nizhnem Sooru v 1982 g.) [Ancient and Modern Places of Worship in Altai (Data from the Author's Field Diary on Archaeological Research on the Lower Soor in 1982)] Drevnie i sovremennye kul'tovye mesta Altaya [Ancient and Modern Places of Worship in Altai]. Barnaul : OOO "Pechatnaya kompaniya ARTIKA",2011. Pp. 11–13. *(In Russ.)*

Kiryushin Yu. F. Itogi i perspektivy izucheniya pamyatnikov eneolita i bronzy Altaya [Results and Prospects of Studying the Sites of the Eneolithic and Bronze of Altai]. Problemy drevnih kul'tur Sibiri [Problems of Ancient Cultures of Siberia]. Novosibirsk : [Bez izd-va], 1985. Pp. 46–53. *(In Russ.)*

Kiryushin Yu. F. Eneolit i rannyaya bronza yuga Zapadnoj Sibiri [Eneolithic and Early Bronze Age of the South of Western Siberia]. Barnaul : Izd-vo Alt. un-ta, 2002. 294 p. *(In Russ.)*

Kiryushin Yu. F., Grushin S. P., Semibratov V. P., Tyurina E. A. Afanas'evskie pogrebal'nye kompleksy Srednej Katuni (rezul'taty issledovanij Katunskoj arheologicheskoj ekspedicii v zone stroitel'stva i zatopleniya Altajskoj GES v 2006–2007 gg.) [Afanasyevskaya Burial Complexes of the Middle Katun (Results of the Research of the Katunskaya Archaeological Expedition in the Zone of Construction and Flooding of the Altai Hydroelectric Power Station in 2006-2007)]. Barnaul: Izd-vo Alt. un-ta, 2010. 80 p. *(In Russ.)*

Kiryushin Yu. F., Tishkin A. A. Skifskaya epoha Gornogo Altaya. Ch. I: Kul'tura naseleniya v ranneskifskoe vremya [Scythian Era of Gorny Altai. Part I: Culture of the Population in the Early Scythian Time]. Barnaul : Izd-vo Alt. u-ta, 1997. 232 p. *(In Russ.)*

Kiselev S. V. Drevnyaya istoriya Yuzhnoj Sibiri. 2-e izd. [Ancient History of Southern Siberia. 2nd ed]. M. : Izd-vo AN SSSR, 1951. 644 p. *(In Russ.)*

Kovalev A. A. Rasprostranenie afanas'evskoj kul'tury na territorii Sin'czyana: hronologicheskie ramki i tipologicheskie osobennosti [The Spread of Afanasyevo Culture in Xinjiang: Chronological Framework and Typological Features]. Fenomeny kul'tur rannego bronzovogo veka stepnoj i lesostepnoj polosy Evrazii: puti kul'turnogo vzaimodejstviya v V–III tys. do n.e. [Phenomena of the Cultures of the Early Bronze Age of the Steppe and Forest-steppe Zone of Eurasia: the Ways of Cultural Interaction in the 5-3 Millennium BC]. Orenburg : Orenburgskij gosudarstvennyj pedagogicheskij universitet, 2019. Pp. 188–209. *(In Russ.)*

Konstantinov N. A., Vavulin M. V, Zajceva O. V., Urbyshev A. U. Obsledovanie arheologicheskih pamyatnikov doliny reki Bol'shoj Ulagan (Vostochnyj Altaj) [Survey of Archaeological Sites in the Valley of the Bolshoi Ulagan River (Eastern Altai)]. Drevnosti Sibiri i Central'noj Azii: Elektronnoe izdanie [Antiquities of Siberia and Central Asia: Electronic Edition]. Gorno-Altajsk : GAGU, 2018. Pp. 17–33. *(In Russ.)*

Kosincev P. A. Fauna poseleniya Nizhnyaya Sooru [Fauna of the Settlement of Nizhnaya Sooru]. Larin O. V. Afanas'evskaya kul'tura Gornogo Altaya: mogil'nik Sal'dyar-1 [Larin O. V. Afanasyevskaya Culture of Gorny Altai: Burial Ground Saldiar-1]. Barnaul : Azbuka, 2005. Pp. 160–167. *(In Russ.)*

Kungurov A. L., Tishkin A. A. Eshche odin must'erskij pamyatnik v Gornom Altae [Another Mousterian Site in Gorny Altai] Drevnosti Altaya: Izvestiya laboratorii arheologii [Altai Antiquities: Proceedings of the Laboratory of Archaeology]. Gorno-Altajsk : Gorno-Altajskij gos. un-t, 2000. №5. Pp. 4–7. *(In Russ.)*

Larin O. V. K istorii izucheniya afanas'evskoj kul'tury Gornogo Altaya [On the History of the Study of the Afanasyev Culture of Gorny Altai]. Arheologiya Gornogo Altaya [Archaeology of Altai Mountains]. Gorno-Altajsk : GANIIIYaL, 1988. Pp. 82–91. *(In Russ.)*

Larin O. V. Afanas'evskaya kul'tura Gornogo Altaya: mogil'nik Sal'dyar-I [Afanasyevskaya Culture of Gorny Altai: Saldiar-I Burial Ground]. Barnaul : Izd-vo Alt. un-ta, 2005. 208 p. *(In Russ.)*

Larin O. V., Kungurova N. Yu., Stepanova N. F. Poselenie afanas'evskoj kul'tury Nizhnyaya Sooru [Settlement of Afanasyevsk Culture Nizhnaya Sooru]. Sohranenie i izuchenie kul'turnogo naslediya Altajskogo kraya [Preservation and Study of the Cultural Heritage of the Altai Territory]. Barnaul : Izd-vo Alt. un-ta, 1998. Vyp. IX. Pp. 67–73. *(In Russ.)*

Mamadakov Yu. T., Stepanova N. F. Afanas'evskie poseleniya Lamah-2 i Bichiktu-Bom [Afanasyevsk Settlements Laman-2 and Bichiktu-Bom]. Sohranenie i izuchenie kul'turnogo

nasledіya Altajskogo kraya [Preservation and Study of the Cultural Heritage of the Altai Territory]. Barnaul : Izd-vo Alt. un-ta, 1998. Vyp. IX. Pp. 73–77. *(In Russ.)*

Masson V. M. Kul'tura v ponyatijnom apparate arheologii [Culture in the Conceptual Apparatus of Archaeology] Yuzhnaya Sibir' v skifo-sarmatskuyu epohu [Southern Siberia in the Scythian-Sarmatian Era]. Kemerovo : KemGU, 1976. Pp. 3–7. *(In Russ.)*

Merc I. V. Afanas'evskie pamyatniki Vostochnogo Kazahstana [Afanasyevsky Sites of East Kazakhstan]. Arheologicheskie pamyatniki Yuzhnoj Sibiri i Central'noj Azii: ot poyavleniya pervyh skotovodov do epohi slozheniya gosudarstvennyh obrazovanij [Archaeological Sites of Southern Siberia and Central Asia: from the Appearance of the First Pastoralists to the Era of the Formation of state Formations]. SPb. : IIMK RAN, 2021. Pp. 39–42. *(In Russ.)*

Muhareva A. N., Miklashevich E. A., Seregin N. N. Izobrazheniya na stele iz pogrebal'no-pominal'nogo kompleksa Nizhnyaya Sooru (Gornyj Altaj) [Images on a Stele from the Burial and Memorial Complex of Nizhnaya Sooru (Gorny Altai)]. Problemy istorii, filologii, kul'tury [Problems of History, Philology, Culture]. 2021. №2 (72). Pp. 188–210. *(In Russ.)*

Polyakov A. V., Svyatko S. V. Radiouglerodnoe datirovanie arheologicheskih pamyatnikov neolita — nachala zheleznogo veka Srednego Eniseya: obzor rezul'tatov i novye dannye [Radiocarbon Dating of Archaeological Sites of the Neolithic — Early Iron Age of the Middle Yenisei: a Review of the Results and New Data]. Teoriya i praktika arheologicheskih issledovanij [Theory and Practice of Archaeological Research]. Barnaul : Izd-vo Alt. un-ta, 2009. Vyp. 5. Pp. 20–56. *(In Russ.)*

Pogozheva A. P., Rykun M. P., Stepanova N. F., Tur S. S. Epoha eneolita i bronzy Gornogo Altaya. Ch. 1 [The Eneolithic and Bronze Age of Gorny Altai. Part 1]. Barnaul : [bez izd-va], 2006. 233 p. *(In Russ.)*

Pogrebal'nye i poselencheskie kompleksy epohi bronzy Gornogo Altaya [Burial and Settlement Complexes of the Bronze Age in Gorny Altai]. Otv. red. N. F. Stepanova. Barnaul : Izd-vo Alt. un-ta, 2006. 154 p. *(In Russ.)*

Rudenko S. I. Pogrebenie cheloveka kamennogo veka v Vostochnom Altae [Burial of a Stone Age Man in Eastern Altai]. Priroda [Nature]. 1926. № 5–6. Pp. 108–109. *(In Russ.)*

Seregin N. N., Vasyutin S. A. Ritual'nye ob»ekty perioda eneolita v urochishche Nizhnyaya Sooru (Central'nyj Altaj): po materialam raskopok A. S. Vasyutina [Ritual Objects of the Eneolithic Period in the Lower Sooru Tract (Central Altai): Based on Materials from the Excavations of A. S. Vasyutin]. Teoriya i praktika arheologicheskih issledovanij [Theory and Practice of Archaeological Research]. 2020. T. 31, № 3. Pp. 90–98. *(In Russ.)* DOI: https://doi.org/10.14258/tpai(2020)3(31).-08

Seregin N. N., Vasyutin S. A. Rannetyurkskie arheologicheskie kompleksy Central'nogo i Vostochnogo Altaya (po materialam issledovanij A. S. Vasyutina) [Early Turkic Archaeological Complexes of Central and Eastern Altai (Based on Research by A. S. Vasyutin)]. Barnaul : Izd-vo Alt. un-ta, 2021. 296 p. *(In Russ.)*

Sosnovskij G. P. Ojrotskaya Avtonomnaya oblast', 1936 g. [Oirot Autonomous Region, 1936]. Arheologicheskie issledovaniya v RSFSR 1934–36 gg. Kratkie otchety i svedeniya [Archaeological Research in the RSFSR 1934–36. Brief Reports and Details]. M.; L. : Izd-vo Akad. nauk SSSR, 1941. Pp. 304–306. *(In Russ.)*

Stepanova N. F. Afanas'evskaya kul'tura [Afanasyevskaya Culture] Istoriya Altaya: v 3 t. T. 1: Drevnejshaya epoha, drevnost' i srednevekov'e [History of Altai: in 3 Vol. Vol. 1: The Most Ancient Era, Antiquity and the Middle Ages]. Barnaul : Izd-vo Alt. un-ta ; Belgorod : Konstanta, 2019. Pp. 114–124. *(In Russ.)*

Surazakov A. S., Tishkin A. A. Arheologicheskij kompleks Kyzyk-Telan' — I v Gornom Altae i rezul'taty ego izucheniya [Archaeological Complex Kyzyk-Telan-I in Gorny Altai and the Results of its Study]. Barnaul : Azbuka, 2007. 232 p. *(In Russ.)*

Tishkin A. A. Arheologicheskie mikrorajony na Altae kak osnova dlya sozdaniya osobo ohranyaemyh territorij (na primere vyyavlennyh i izuchennyh pamyatnikov v doline r. Bol'shoj Yaloman) [Archaeological Microdistricts in Altai as a Basis for the Creation of Specially Protected Areas (on the Example of Identified and Studied Sites in the Valley of the Bolshoy Yaloman River)]. Znachenie prirodnogo i kul'turnogo naslediya v sovremennom obshchestve [The Importance of Natural and Cultural Heritage in Modern Society]. Gorno-Altajsk : OOO "Gorno-Altajskaya tipografiya", 2018. Pp. 29–33. *(In Russ.)*

Tishkin A. A., Seregin N. N. Eneoliticheskie ob'ekty Urkoshskogo i Kur-Kechuskogo arheologicheskih mikrorajonov (Central'nyj Altaj) [Eneolithic Objects of the Urkos and Kur-Kechu Archaeological Microdistricts (Central Altai)]. Afanas'evskij sbornik 2 [Afanasyevsky Collection 2]. Barnaul : Azbuka, 2012. Pp. 196–203. *(In Russ.)*

Fribus A. V. Proiskhozhdenie afanas'evskoj kul'tury : avtoreferat dis. ... kand. ist. nauk [The Origin of Afanasyev Culture: Abstract of dis. ... Cand. Hist. Sciences]. Kemerovo, 1998. 26 p. *(In Russ.)*

Fribus A. V. K diskussii o proiskhozhdenii afanas'evskoj kul'tury [To a Discussion about the Origin of the Afanasyev Culture]. Sovremennye problemy arheologii Rossii [Modern Problems of Archaeology in Russia]. Novosibirsk : Izd-vo In-ta arheologii i etnografii, 2006. T. I. Pp. 478–480. *(In Russ.)*

Cyb S. V. Afanas'evskaya kul'tura Altaya : avtoreferat dis. ... kand. ist. nauk [Afanasyev Altai Culture: Abstract of dis. ... Cand. Hist. Sciences]. Kemerovo, 1984. 19 p. *(In Russ.)*

Shul'ga P. I. O hozyajstve afanas'evcev Gornogo Altaya [About the Economy of Afanasyevites in Gorny Altai]. Afanas'evskij sbornik 2 [Afanasyevsky Collection 2]. Barnaul : Azbuka, 2012. Pp. 204–209. *(In Russ.)*

Allentoft M. E., Sikora M., Sjogren K.-G., Rasmussen S., Rasmussen M., Stenderup J., Damgaard P. B., Schroeder H., Ahlstrom T., Vinner L., Malaspinas A.-S., Margaryan A., Higham T., Chivall D., Lynnerup N., Harvig L., Baron J., Casa P. D., Dąbrowski P., Duffy P. R., Ebel A. V., Epimakhov A., Frei K., Furmanek M., Gralak T., Gromov A., Gronkiewicz S., Grupe G., Hajdu T., Jarysz R., Khartanovich V., Khokhlov A., Kiss V., Kolař J., Kriiska A., Lasak I., Longhi C., McGlynn G., Merkevicius A., Merkyte I., Metspalu M., Mkrtchyan R., Moiseyev V., Paja L., Palfi G., Pokutta D., Pospieszny Ł., Price T. D., Saag L., Sablin M., Shishlina N., Smrčka V., Soenov V. I., Szeverenyi V., Toth G., Trifanova S. V., Varul L., Vicze M., Yepiskoposyan L., Zhitenev V., Orlando L., Sicheritz-Ponten T., Brunak S., Nielsen R., Kristiansen K., Willerslev E. Population genomics of Bronze Age Eurasia Nature. 2015. Vol. 522. Pp. 167–172. DOI: https://doi.org/10.1038/nature14507

Hermes T. R., Tishkin A. A., Kosintsev P. A., Stepanova N. F., Krause-Kyora B., Makarewicz C. A. Mitochondrial DNA of Domesticated Sheep Confirms Pastoralist

Component of Afanasievo Subsistence Economy in the Altai Mountains (3300–2900 cal BC). Archaeological Research in Asia. 2020. 24, 100232. DOI: https://doi.org/10.1016/j.ara.2020.100232

Honeychurch W., Rogers L., Amartuvshin Ch., Diimaajav E., Erdene-Ochir N-O., Hall M. E., and M. Hrivnyak. The Earliest Herders of East Asia: Examining Afanasievo Entry to Central Mongolia. Archaeological Research in Asia. 2021. DOI: https://doi.org/10.1016/j.ara.2021.100264.

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Абдулганеев М. Т., Кирюшин Ю. Ф., Кадиков Б. Х. Материалы эпохи бронзы из Горного Алтая // Археология и этнография Алтая. Барнаул : Изд-во Алт. ун-та, 1982. С. 52–77.

Афанасьевский сборник / отв. ред. Н. Ф. Степанова, А. В. Поляков. Барнаул : Азбука, 2010. 293 с.

Афанасьевский сборник 2 / отв. ред. Н. Ф. Степанова. Барнаул : Азбука, 2012. 226 с.

Вадецкая Э. Б., Поляков А. В., Степанова Н. Ф. Свод памятников афанасьевской культуры. Барнаул : АЗБУКА, 2014. 380 с.

Грушин С. П., Папин Д. В., Позднякова О. А., Тюрина Е. А., Федорук А. С., Хаврин С. В. Алтай в системе металлургических провинций энеолита и бронзового века. Барнаул : Изд-во Алт. ун-та, 2009. 160 с.

Грязнов М. П. Некоторые вопросы истории сложения и развития ранних кочевых обществ Казахстана и Южной Сибири // Краткие сообщения Института этнографии. М. : Изд-во Академии наук СССР, 1955. Вып. XXIV. С. 19–29.

Грязнов М. П. Этапы развития хозяйства скотоводческих племен Казахстана и Южной Сибири в эпоху бронзы // Краткие сообщения Института этнографии. М. : Изд-во Академии наук СССР, 1957. Вып. XXVI. С. 21–28.

Древние культуры Бертекской долины (Горный Алтай, плоскогорье Укок) / А. П. Деревянко, В. И. Молодин, Д. Г. Савинов и др. Новосибирск : Наука, 1994. 224 с.

Дашковский П. К., Степанова Н. Ф. Инской Дол — памятник эпохи ранней бронзы в Западном Алтае // Археология, этнография и антропология Евразии. 2018. Т. 46, № 1. С. 41–50. DOI: https://doi.org/10.17746/1563-0102.2018.46.1.041-050

Дашковский П. К. Курган эпохи палеометалла из могильника Ханкаринский дол (Горный Алтай) // Народы и религии Евразии. 2019. № 3 (20). С. 19–33.

Елин В. Н., Ларин О. В. Обследование аварийных памятников в Горном Алтае // Сохранение и изучение культурного наследия Алтайского края. Барнаул : Изд-во Алт. ун-та, 1998. Вып. IX. С. 64–67.

Илюшин А. М. Древние и современные культовые места Алтая (данные из полевого дневника автора об археологических исследованиях на Нижнем Соору в 1982 г.) // Древние и современные культовые места Алтая. Барнаул : ООО «Печатная компания АРТИКА», 2011. С. 11–13.

Кирюшин Ю. Ф. Итоги и перспективы изучения памятников энеолита и бронзы Алтая // Проблемы древних культур Сибири. Новосибирск : [Без изд-ва], 1985. С. 46–53.

Кирюшин Ю. Ф. Энеолит и ранняя бронза юга Западной Сибири. Барнаул : Изд-во Алт. ун-та, 2002. 294 с.

Кирюшин Ю. Ф., Грушин С. П., Семибратов В. П., Тюрина Е. А. Афанасьевские погребальные комплексы Средней Катуни (результаты исследований Катунской археологической экспедиции в зоне строительства и затопления Алтайской ГЭС в 2006–2007 гг.). Барнаул: Изд-во Алт. ун-та, 2010. 80 с.

Кирюшин Ю. Ф., Тишкин А. А. Скифская эпоха Горного Алтая. Ч. I: Культура населения в раннескифское время. Барнаул : Изд-во Алт. у-та, 1997. 232 с.

Киселев С. В. Древняя история Южной Сибири. 2-е изд. М. : Изд-во АН СССР, 1951. 644 с.

Ковалев А. А. Распространение афанасьевской культуры на территории Синьцзяна: хронологические рамки и типологические особенности // Феномены культур раннего бронзового века степной и лесостепной полосы Евразии: пути культурного взаимодействия в V–III тыс. до н.э. Оренбург : Оренбургский государственный педагогический университет, 2019. С. 188–209.

Константинов Н. А., Вавулин М. В, Зайцева О. В., Урбышев А. У. Обследование археологических памятников долины реки Большой Улаган (Восточный Алтай) // Древности Сибири и Центральной Азии: Электронное издание. Горно-Алтайск : ГАГУ, 2018. С. 17–33.

Косинцев П. А. Фауна поселения Нижняя Соору // Ларин О. В. Афанасьевская культура Горного Алтая: могильник Сальдяр-1. Барнаул : Азбука, 2005. С. 160–167.

Кунгуров А. Л., Тишкин А. А. Еще один мустьерский памятник в Горном Алтае // Древности Алтая: Известия лаборатории археологии. Горно-Алтайск : Горно-Алтайский гос. ун-т, 2000. № 5. С. 4–7.

Ларин О. В. К истории изучения афанасьевской культуры Горного Алтая // Археология Горного Алтая. Горно-Алтайск : ГАНИИИЯЛ, 1988. С. 82–91.

Ларин О. В. Афанасьевская культура Горного Алтая: могильник Сальдяр-I. Барнаул : Изд-во Алт. ун-та, 2005. 208 с.

Ларин О. В., Кунгурова Н. Ю., Степанова Н. Ф. Поселение афанасьевской культуры Нижняя Соору // Сохранение и изучение культурного наследия Алтайского края. Барнаул : Изд-во Алт. ун-та, 1998. Вып. IX. С. 67–73.

Мамадаков Ю. Т., Степанова Н. Ф. Афанасьевские поселения Ламах-2 и Бичикту-Бом // Сохранение и изучение культурного наследия Алтайского края. Барнаул : Изд-во Алт. ун-та, 1998. Вып. IX. С. 73–77.

Массон В. М. Культура в понятийном аппарате археологии // Южная Сибирь в скифо-сарматскую эпоху. Кемерово : КемГУ, 1976. С. 3–7.

Мерц И. В. Афанасьевские памятники Восточного Казахстана // Археологические памятники Южной Сибири и Центральной Азии: от появления первых скотоводов до эпохи сложения государственных образований. СПб. : ИИМК РАН, 2021. С. 39–42.

Мухарева А. Н., Миклашевич Е. А., Серегин Н. Н. Изображения на стеле из погребально-поминального комплекса Нижняя Соору (Горный Алтай) // Проблемы истории, филологии, культуры. 2021. № 2 (72). С. 188–210.

Поляков А. В., Святко С. В. Радиоуглеродное датирование археологических памятников неолита — начала железного века Среднего Енисея: обзор результатов и новые дан-

ные // Теория и практика археологических исследований. Барнаул : Изд-во Алт. ун-та, 2009. Вып. 5. С. 20–56.

Погожева А. П., Рыкун М. П., Степанова Н. Ф., Тур С. С. Эпоха энеолита и бронзы Горного Алтая. Ч. 1. Барнаул : [без изд-ва], 2006. 233 с.

Погребальные и поселенческие комплексы эпохи бронзы Горного Алтая / отв. ред. Н. Ф. Степанова. Барнаул : Изд-во Алт. ун-та, 2006. 154 с.

Руденко С. И. Погребение человека каменного века в Восточном Алтае // Природа. 1926. №5–6. С. 108–109.

Серегин Н. Н., Васютин С. А. Ритуальные объекты периода энеолита в урочище Нижняя Соору (Центральный Алтай): по материалам раскопок А. С. Васютина // Теория и практика археологических исследований. 2020. Т. 31, № 3. С. 90–98. DOI:https://doi.org/10.14258/tpai(2020)3(31).-08

Серегин Н. Н., Васютин С. А. Раннетюркские археологические комплексы Центрального и Восточного Алтая (по материалам исследований А. С. Васютина). Барнаул : Изд-во Алт. ун-та, 2021. 296 с.

Сосновский Г. П. Ойротская Автономная область, 1936 г. // Археологические исследования в РСФСР 1934–36 гг. Краткие отчеты и сведения. М.; Л. : Изд-во Акад. наук СССР, 1941. С. 304–306.

Степанова Н.Ф. Афанасьевская культура // История Алтая : в 3 т. Т. 1 : Древнейшая эпоха, древность и средневековье. Барнаул : Изд-во Алт. ун-та ; Белгород : Константа, 2019. С. 114–124.

Суразаков А. С., Тишкин А. А. Археологический комплекс Кызык-Телань-I в Горном Алтае и результаты его изучения. Барнаул : Азбука, 2007. 232 с.

Тишкин А. А. Археологические микрорайоны на Алтае как основа для создания особо охраняемых территорий (на примере выявленных и изученных памятников в долине р. Большой Яломан) // Значение природного и культурного наследия в современном обществе. Горно-Алтайск : ООО «Горно-Алтайская типография», 2018. С. 29–33.

Тишкин А. А., Серегин Н. Н. Энеолитические объекты Уркошского и Кур-Кечуского археологических микрорайонов (Центральный Алтай) // Афанасьевский сборник 2. Барнаул : Азбука, 2012. С. 196–203.

Фрибус А. В. Происхождение афанасьевской культуры : автореф. дис. ... канд. ист. наук. Кемерово, 1998. 26 с.

Фрибус А. В. К дискуссии о происхождении афанасьевской культуры // Современные проблемы археологии России. Новосибирск : Изд-во Ин-та археологии и этнографии, 2006. Т. I. С. 478–480.

Цыб С. В. Афанасьевская культура Алтая : автореферат дис. … канд. ист. наук. Кемерово, 1984. 19 с.

Шульга П. И. О хозяйстве афанасьевцев Горного Алтая // Афанасьевский сборник 2. Барнаул : Азбука, 2012. С. 204–209.

Allentoft M. E., Sikora M., Sjogren K.-G., Rasmussen S., Rasmussen M., Stenderup J., Damgaard P. B., Schroeder H., Ahlstrom T., Vinner L., Malaspinas A.-S., Margaryan A., Higham T., Chivall D., Lynnerup N., Harvig L., Baron J., Casa P. D., Dąbrowski P., Duffy P. R., Ebel A. V., Epimakhov A., Frei K., Furmanek M., Gralak T., Gromov A., Gronkiewicz S.,

Grupe G., Hajdu T., Jarysz R., Khartanovich V., Khokhlov A., Kiss V., Kolař J., Kriiska A., Lasak I., Longhi C., McGlynn G., Merkevicius A., Merkyte I., Metspalu M., Mkrtchyan R., Moiseyev V., Paja L., Palfi G., Pokutta D., Pospieszny Ł., Price T. D., Saag L., Sablin M., Shishlina N., Smrčka V., Soenov V. I., Szeverenyi V., Toth G., Trifanova S. V., Varul L., Vicze M., Yepiskoposyan L., Zhitenev V., Orlando L., Sicheritz-Ponten T., Brunak S., Nielsen R., Kristiansen K., Willerslev E. Population genomics of Bronze Age Eurasia // Nature. 2015. Vol. 522. Pp. 167–172. DOI: https://doi.org/10.1038/nature14507

Hermes T. R., Tishkin A. A., Kosintsev P. A., Stepanova N. F., Krause-Kyora B., Makarewicz C. A. Mitochondrial DNA of domesticated sheep confirms pastoralist component of Afanasievo subsistence economy in the Altai Mountains (3300–2900 cal BC) // Archaeological Research in Asia. 2020. 24, 100232. DOI: https://doi.org/10.1016/j.ara.2020.100232

Honeychurch W., Rogers L., Amartuvshin Ch., Diimaajav E., Erdene-Ochir N-O., Hall M. E., and M. Hrivnyak. The earliest herders of East Asia: Examining Afanasievo entry to central Mongolia // Archaeological Research in Asia. 2021. DOI: https://doi.org/10.1016/j.ara.2021.100264.

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DISC BARROWS (HENDGES) OF THE LOWER DON

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Abstract: The disc barrows of Eurasia attract the attention of researchers due to the bright discoveries during the study of the famous Stonehenge. This paper is the first to publish data on the presence, location and features of disc barrows on the Lower Don. Several sites have been partially or completely excavated. The poverty or lack of finds showed that the disc barrows should be preserved for future generations of researchers. For the Semikarakorsk complex of four objects, their location is close to the latitudinal and meridional. This indicates with a high degree of probability, that they are used to determine the key dates of the annual cycle. The wide distribution of ring ditch-sanctuaries of the Early Iron Age in the steppe territory of Eastern Europe is described.

Keywords: the Lower Don, disc barrows, henge, sanctuary, archeoastronomy, relief, steppe

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КОЛЬЦЕВЫЕ КУРГАНЫ (ХЕНДЖИ) НИЖНЕГО ПОДОНЬЯ

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Резюме: Кольцевые курганы Евразии привлекают к себе пристальное внимание исследователей благодаря ярким открытиям при исследовании знаменитого Стоунхенджа. Данный тип объектов широко распространен в Западной и Центральной Европе. В работе впервые публикуются данные о наличии, расположении и особенностях кольцевых курганов на Нижнем Дону. Несколько объектов были частично или полностью раскопаны. Бедность или отсутствие находок показали, что кольцевые курганы должны быть сохранены для будущих поколений исследователей. Для Семикаракорского комплекса из четырех объектов установлено их расположение, близкое к широтному и меридиональному. Это с высокой степенью вероятности говорит об их использовании для определения ключевых дат годового солнечного цикла. Описано широкое распространение кольцевых валов-святилищ раннего железного века на степной территории Восточной Европы.

Ключевые слова: Нижнее Подонье, кольцевой курган, хендж, святилище, археоастрономия, рельеф, степь

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Introduction

The territory of the Rostov region holds at least 100,000 burial mounds – burial structures erected from the end of the 5th millennium BC until the 14th century AD. They are domed earthen structures with a diameter of 2 to 140 m and a height of up to 16 m. At present, an extensive source base has been created for the mounds which makes it possible to distinguish among them other mounds of earth.

After the discovery of disc structures in the Stavropol Territory [Belinsky, Fassbinder, Reinhold, 2012], the question arose about their distribution in other territories. Purposeful field and archival research allowed the author to identify a series of similar objects in the Lower Don. Some of them were excavated, but the excavation was carried out without taking into account their specificity and uniqueness. The results of the work showed that the disc barrows had not been intended for burials; excavations "for demolition" of such objects should be excluded.

The History of Research

Central Asia and Western Europe hold large series of interesting archaeological sites. They are ring ditches and non-defensive earthworks. In Germany they are known as "ringwall, kreisgrabenanlagen"; in France: "rondela, cromlech". The most famous and numerous structures of this type are found in the British Isles. Accordingly, the UK holds the record for both the number of objects and their names: "henge, circular enclosures, ringditch, roundbarrow, discbarrow, pondbarrow, timber circles, ring monuments, ring enclosures, ring structure, circular rampart". Several typologies have been proposed for the British Archipelago [Gibson, 2012]. The famous Stonehenge consists of a megalithic structure of the Middle Bronze Age and disc ditches and earthworks of the Early Bronze Age [Agafonova et al., 2017: 14].

In Russian science there is no generally accepted name for such structures because they were discovered recently. The following cartographic and folk names were used: round redoubt, settlement, town, Tatar fortress, ground table, fortification, ground rampart, ring ditch, ring rampart, mound-trizna, sanctuary, restalishche, disc barrow. The latter term is used during the excavations of similar objects in the Crimea (Kulikov, 2017: 108). And although in this study the structures turned out to be reservoirs for water, the term seems to be successful, since they are structurally very similar. He describes their main features: a non-defensive, probably ritual purpose, an ground embankment, clearly visible on the ground, the ring shape of ditches and ramparts.

A similar structure in Moldova near the village of Ungheni has not yet been put into scientific circulation yet. It is called the "The Ground Table of Peter the Great" and has a diameter of 150 m. On the territory of Russia, they were found in the vicinity of the city of Pyatigorsk [Belinsky, Fassbinder, Reinhold, 2012]. The total number of such objects in the area of the Caucasian Mineral Waters can reach 30. The largest of the detected objects — Tamlyk — has a diameter of 200 m. Magnetometric survey [Fassbinder, 2019] made it possible to establish the initial depth of the ditches, to find out the presence of stone structures inside. The excavations of the disc structure (Maryinskaya-1, diameter 145 m) damaged by the bank washout showed that it was built by the bearers of the Maikop culture in the Early Bronze Age (the 4th millennium BC).

As for the for European disc barrows and henges, it has long been established that at least some of them were used as near-horizon observatories to determine the main stages of the solar annual cycle. Observation of the sun and determination of the date requires minimal skills and tools. Their calendar purpose is especially clearly reflected in the construction of the Neolithic Goseck circle in Germany, where the entrances are precisely directed along the lines of sunrise and sunset on the day of the winter solstice [Bertemes, Northe, 2007: 145]. The same purpose is assumed for the North Caucasian disc barrows [Belinsky, Fassbinder, Reinhold, 2012: 30].

On the territory of the Volgograd region, a similar object called the "Sanctuary at the Trehostrovskaya Village" (Fig. 1.-*6*) was investigated [Demkin et al., 2001]. It is a ditch with a diameter of 200 m, 2.5 m deep and 20 m wide (Fig. 2). The outer part of the ditch is surrounded by low earthworks, increasing the diameter of the structure up to 210 m. The soil from the ditch is piled inside the formed site, forming a mound of earth of 1 m height (Fig. 3). The section from center to edge showed that the mound of earth consists of a mixture of charcoal and overheated stone weighing up to 2.5 thousand tons. The dating of coal gave the interval of the 16th – 14th centuries BC in calibrated values. It is assumed that it was a place of the conditional "temple of fire" where a large wooden structure was covered with a layer of stone and burned.

Fig. 1. Map of the location of the discbarrows: 1 – Sidorov II; 2 – Nikolaevsky III; 3 – Sambek settlement (Round Redoubt); 4 – Cheryumkin discbarrow; 5 – Semikarakorsky complex; 6 – Trekhostrovskoye sanctuary

Рис. 1. Карта расположения кольцевых курганов: 1 – Сидоров II; 2 – Николаевский III; 3 – Самбекское городище (Круглый редут); 4 – Кольцевой курган Черюмкин; 5 – Семикаракорский комплекс; 6 – Трехостровское святилище

Fig. 2. Photo of the discbarrow Trekhostrovskoye sanctuary. View from the west. Author: Sergey Fomin
Рис. 2. Фото кольцевого кургана Трехостровское святилище. Вид с запада. Автор: Сергей Фомин

Fig. 3. Photo of the discbarrow Trekhostrovskoe sanctuary. View from the west. Author: Oleg Dimitrov
Рис. 3. Фото кольцевого кургана Трехостровское святилище. Вид с запада. Автор: Олег Димитров

Research Methods

All objects were examined by the author, lifting material was collected or its absence was established. The survey was carried out using a DJI Mavic 2 Pro drone from a height of 35 m, the processing of the survey and the creation of digital terrain models were made in the Agisoft Metashape software. The models are presented only for objects well expressed in the relief. The dense vegetation covering the surface of the objects was not excluded from the relief picture and is given "as it is". The mapping of the objects made it possible to establish their special geographic relationship. Some of the objects were investigated by stationary excavations in previous years. The data obtained did not make it possible to reliably date the disc barrows.

Description of Sites

The Sidorov II Burial mound, mound 2 (Fig. 4) was identified by P. A. Larenok during the inventory in the early 1990s. It is located on the middle part of the slope of the watershed upland formed from by the Sarmatskaya river in the east, the Nosov balka in the west, by the Sidorov balka in the west of the headwaters. At the same time, it remains completely unclear what brought the researcher to this area of the terrain, since neither mounds nor settlements are found on such slopes. It is ring earthwork with a modern diameter of 45 m, 10–14 m wide, 0.15 m high. In the center there is a flat area without earthworks badly damaged by plowing. Some fragments of ceramics from the Saltov-Mayatskaya culture (the 8th — 10th centuries AD) were found around the object.

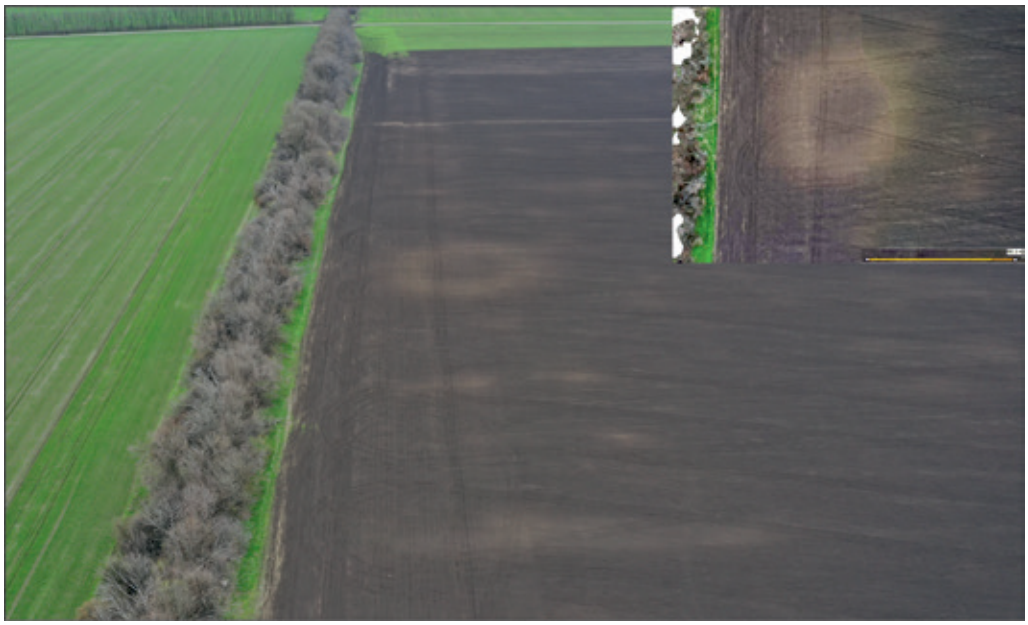

Fig. 4. Photo of the discbarrow Sidorov II. View from the south
Рис. 4. Фото кольцевого кургана Сидоров II. Вид с юга

The Sambek settlement (Round redoubt) is located on an elevated section of the rock terrace of the Sambek river, half destroyed by the collapse of the coast of the Taganrog Bay

of the Azov Sea (Fig. 5). The settlement was discovered in 1926 by A. A. Miller. In 1961 I. S. Kamenetsky laid a pit on the site which did not allow reliable dating of the object. The 1975–1979 expedition led by P. A. Larenok carried out excavations along the brink of the coast (Fig. 6). "The fortifications of the 1st settlement are made up of earthworks (ridge diameter 84 m, height 1 m), with a wide passage of 2 m left in the northeastern part. Behind the earthworks there is a ditch, which is separated from the earthworks by an circular platform 9 m wide. The ditch is 15,4 m wide, 1–1.4 m deep. The ditch encircles the "citadel" — a platform with a diameter of 28.6 m. The citadel is connected to a circular earthen bridge left in the northern part of the ditch. The southern part of the settlement (about a third) was destroyed by the rocks of the cliff" [Larenok, 1983: 125–126]. The area of 540 sq. m. has been investigated. The research was done into an extensive dugout of the 18th century located in the center of the ring structure which actually destroyed the entire central part of the object. The author of the excavations dated the upper horizon of the cultural layer of the settlement, the ditch and the earthworks to the second half of the 18th century. The lower cultural layer is represented by ceramics of the Saltovo-Mayatskaya culture and a significant number of flint flakes, blades and tools of the Upper Paleolithic and Eneolithic appearance. 2 medieval dugouts have been investigated. Such a chronological attribution cannot but raise objections, since the use of a structure from the outer earthworks and the inner ditch as a defensive one is impossible. There is no documentary evidence of the construction of this structure in the 18th century. Large-scale destruction and digging (Fig. 7), the lack of information about the disc barrows of Europe at that time did not allow classifying this site as a ritual one. In the center of the structure one can see squares of an excavation and a dump (Fig. 6), a ditch around the dump, and at a distance of 15 m from the edge of the ditch, earthwork up to 0.8 m high, extending into the dacha development. A large pavilion is installed on the eastern part of the earthworks.

Fig. 5. Photo of the discbarrow Sidorov II. View from the east
Рис. 5. Фото кольцевого кургана Сидоров II. Вид с востока

Fig. 6. Photo of the discbarrow Sambek settlement. View from the southwest
Рис. 6. Фото кольцевого кургана Самбекское городище. Вид с юго-запада

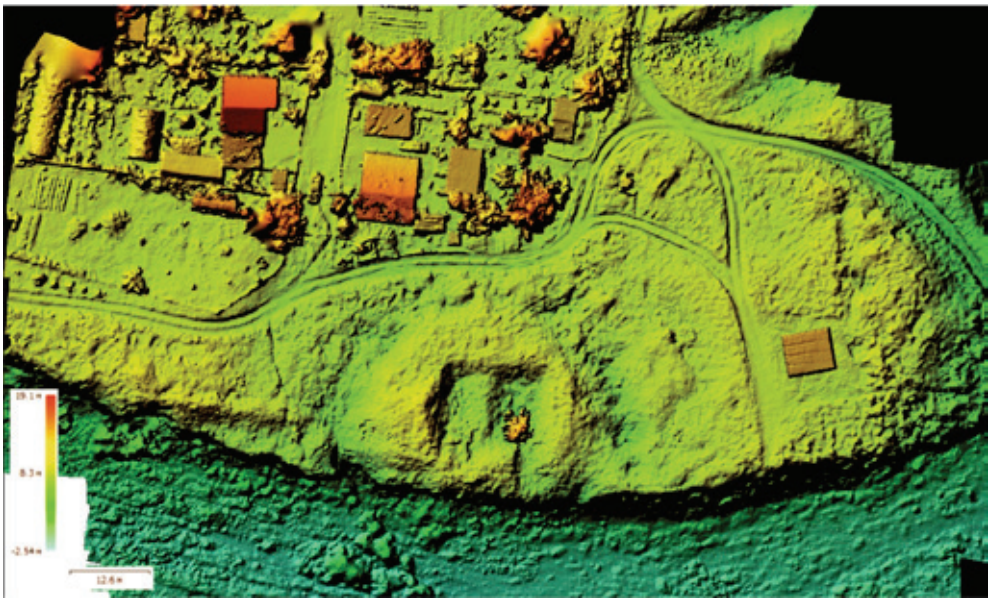

Fig. 7. Digital relief model of the discbarrow Sambek settlement
Рис. 7. Цифровая модель рельефа кольцевого кургана Самбекское городище

The Nikolaevsky III burial mound, mound 14 is located at the top of the watershed of the Mius River and the Volovaya balka, as part of a long chain of mounds of different times

(Fig. 9). Available for ploughing, it was discovered by I.N. Parusimov. It is circular earthwork with a modern diameter of 70 m, 12 m wide, 0.25 m high. In the center there is a flat area without earthworks.

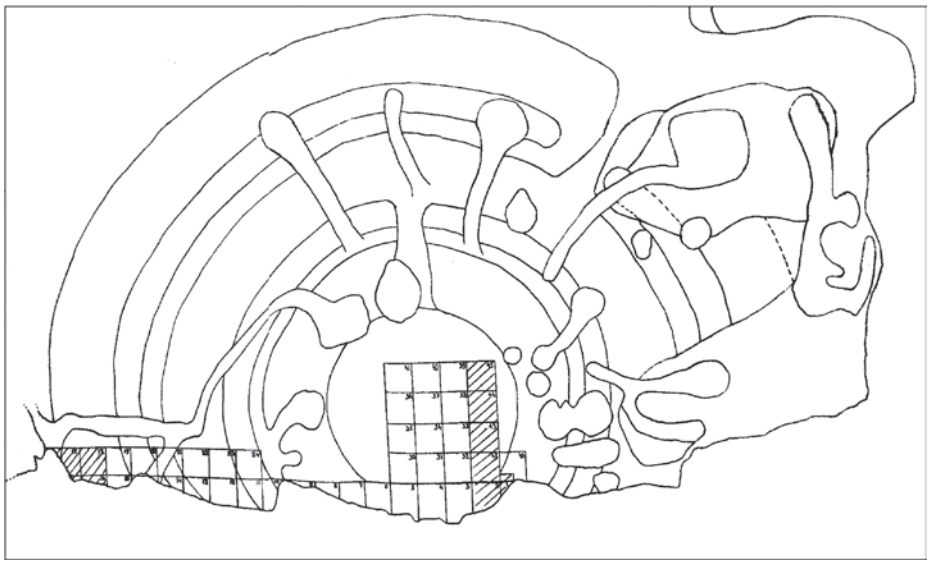

Fig. 8. Excavation plan of the Sambek settlement of P.A. Larenka
Рис. 8. План раскопок Самбекского городища П.А. Ларенка

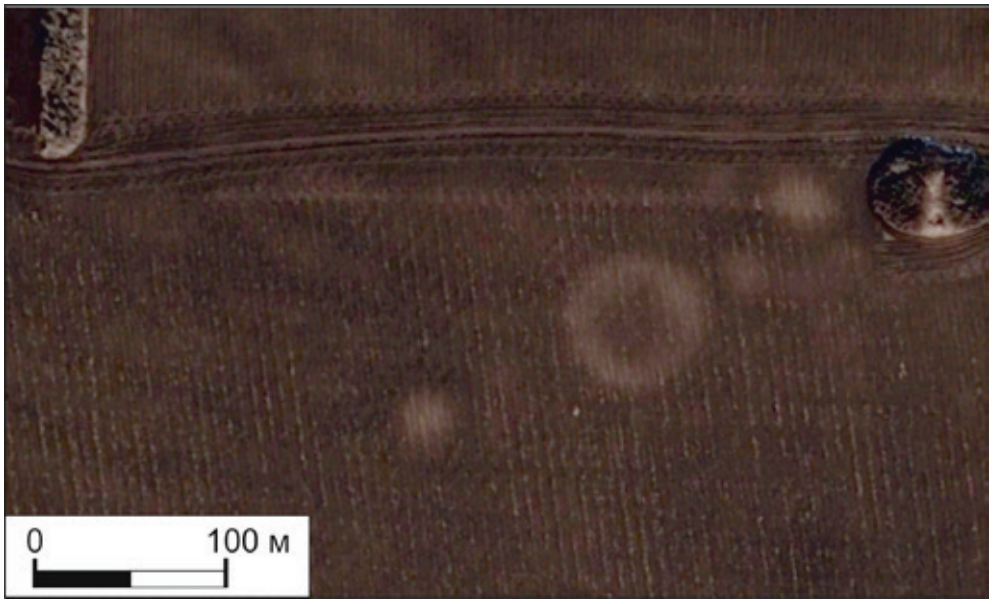

Fig. 9. Satellite image of the discbarrow Nikolaevsky III
Рис. 9. Космоснимок кольцевого кургана Николаевский III

The Cheryumkin disc barrow is a revealed object, located on the first terrace above the Podpolnaya river, an arm of the Don river, discovered by G.E. Bespaly. It is plowed up, damaged from the north and west by irrigation canals (Fig. 10). It is annular earthwork with a modern diameter of 110×100 m, 15 m wide. Inside the earthwork one can see a flooded ditch with a diameter of up to 58 m. The difference in height between the top of the earthworks and the bottom of the ditch is about 1 m. In the center there is a convex area formed as a result of soil displacement into the ditch.

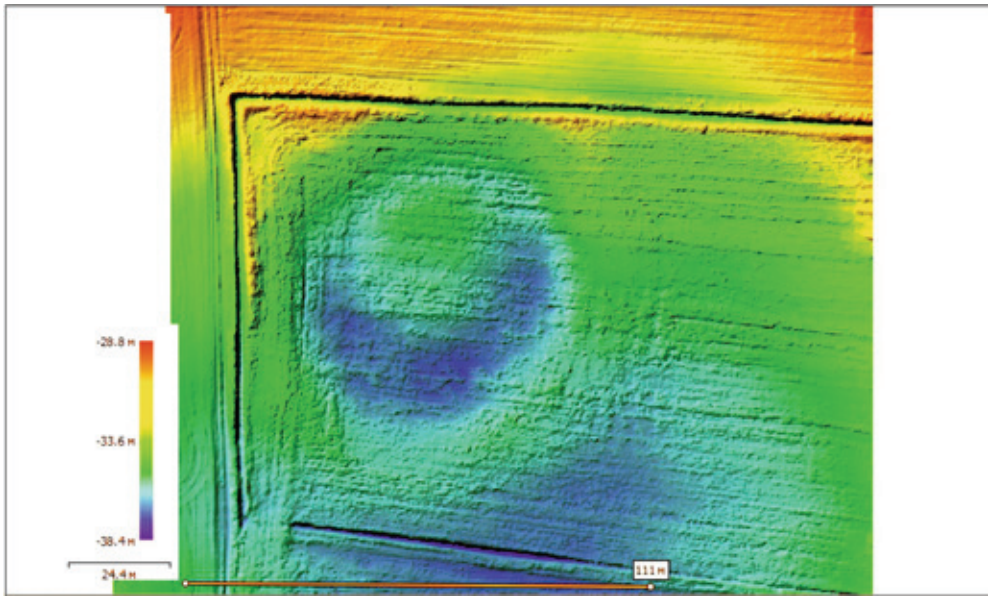

Fig. 10. Digital relief model of the discbarrow Cheryumkin
Рис. 10. Цифровая модель рельефа кольцевого кургана Черюмкин

The Semikarakorsky Complex

The Melikhovsky disc barrow is a revealed object discovered by I.N. Parusimov. It is located on the terrace of the high rocky right bank of the Don river (Fig. 11). Previously it had been plaughed. It is annular earthwork with a modern diameter of 98 m, 18 m wide. Around the rampart, one can see take out of soil for the structure, increasing the diameter of the structure to 110 m. In the earthworks one can see a flooded ditch with a diameter of 65 m and in the ditch there are bushes (Fig. 12), the northern and western parts of the earthworks are heavily plowed up. The difference in height between the top of the earthworks and the bottom of the ditch is about 2.5 m. In the center there is an almost flat platform.

The Semikarakorsky disc barrow is a part of the Semikarakorsk settlement ensemble and was opened together with it. For a long time, it was considered the remains of a defensive structure, such as a tower. As in the case of the Sambek settlement, the meaning of the location of the ditch inside the earthworks remained unclear from a defensive point of view. It is located on the highest floodplain island of the left-bank part of the river Don valley which rises above the surrounding flooded areas by 10 m. It is annular earthwork with a modern diameter of 90

m and 10 m wide (Fig. 13). A flooded ditch with a diameter of 67 m is clearly visible inside the earthworks (Fig. 14). The difference in height between the top of the earthworks and the bottom of the ditch is about 1.3 m. There is a flat area in the center. In the northern part of the rampart, a 4×4 m excavation was laid, however, the time of the object's creation remained unclear [Flerov, 2002, p. 60].

Fig. 11. Photo of the discbarrow Melikhovsky. View from the southeast
Рис. 11. Фото кольцевого кургана Мелиховский. Вид с юго-востока

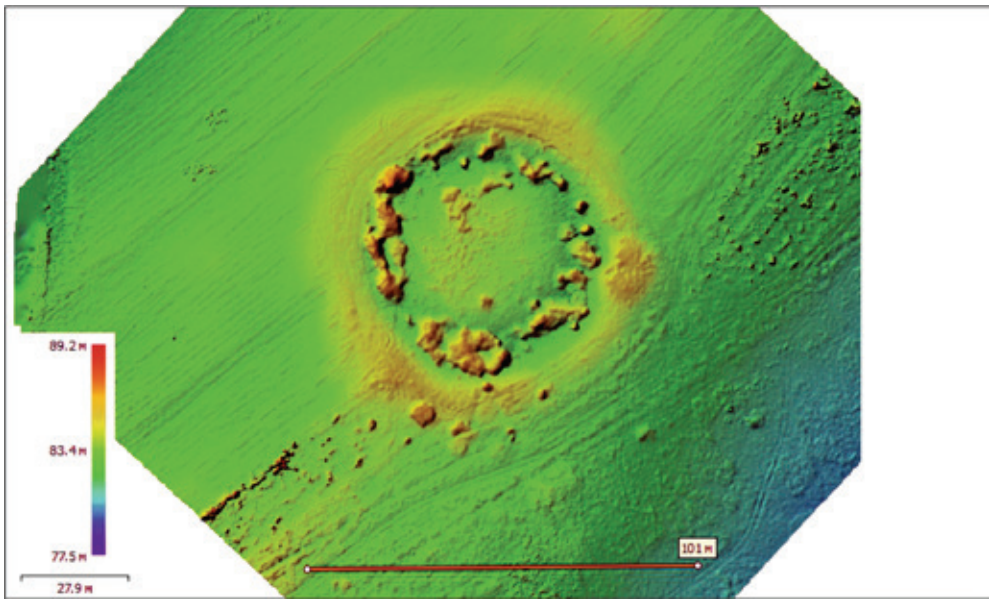

Fig. 12. Digital model of the relief of the discbarrow Melikhovsky
Рис. 12. Цифровая модель рельефа кольцевого кургана Мелиховский

Fig. 13. Photo of the Semikarakorsky discbarrow. View from the north-west
Рис. 13. Фото кольцевого кургана Семикаракорский. Вид с северо-запада

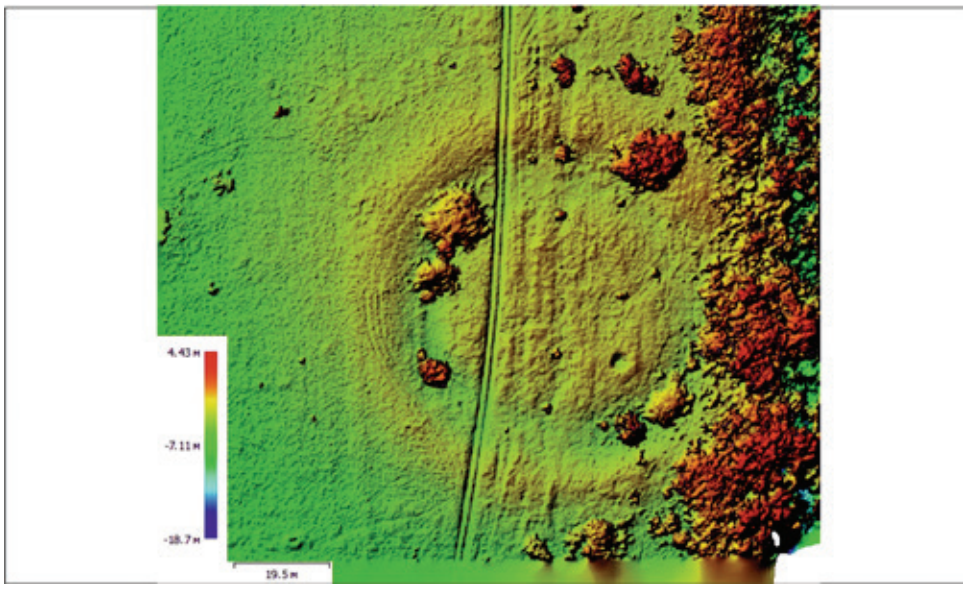

Fig. 14. Digital relief model of the discbarrow Semikarakorsky
Рис. 14. Цифровая модель рельефа кольцевого кургана Семикаракорский

The Atamansky IV burial mound, mound 1 is located on an elevated promontory of the high rocky right bank of the Don river. The mound was discovered by I.N. Parusimov and was registered as a destroyed mound of earth of a large barrow. It is heavily plowed and leveled. The northern third of the structure has survived, the southern part was first damaged in the 19th century when planning the gardens of the Razdorskaya village (Fig. 15). In the 20th century, it was leveled by machines, since it prevented the plowing of the field, and from the north there

was a very buried road made of paving stones. It represents a sector of annular earthworks with a reconstructed diameter of 90 m, and 12 m wide (Fig. 16). A small flooded ditch is visible inside the earthworks. The difference in height between the top of the earthworks and the bottom of the ditch is about 2.0 m. In the center there is an almost level platform.

Fig. 15. Photo of the discbarrow Atamansky IV. View from the southwest
Рис. 15. Фото кольцевого кургана Атаманский IV. Вид с юго-запада

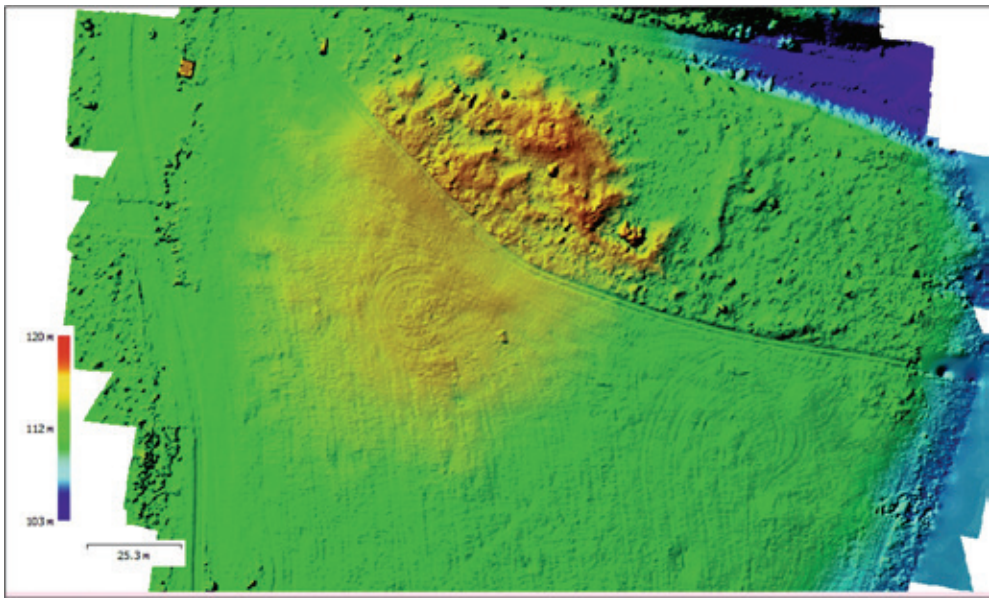

Fig. 16. Digital relief model of the discbarrow Atamansky IV
Рис. 16. Цифровая модель рельефа кольцевого кургана Атаманский IV

The Karpovka II mound is located on an elevated platform of the high rocky left bank of the Don river. It was discovered and partially excavated by E.I. Bespaly and I.N. Parusimov under the name «Fortification "Excavated Barrow"» (Fig. 17). During the work it was perceived as mound of earth which was a completely leveled and laid out in ridges. Before excavations, the earthwork was not ploughed out and had the following dimensions (Fig. 18): diameter from the base — 76 m, height up to 2.5 m. From the northeastern side, the earthworks had a gap of 2 m wide. Around the earthwork, a flooded circular takeout was traced, which had a gap (elevation) at the earthwok's disruption. It was investigated by the scraper trenches with the leaving 1 m wide edge. The rabotage of the front showed that earthworks had been made of clay (Fig. 19), take- out of from the inner ditch. On the inner slope of the earthworks, in the upper horizon of the sliding soil, there were fragments of ram and horse bones, and a large amount of amphora pottery from the Scythian time of the 4th century BC. A nomadic burial of the 13th — 14th centuries with a saber was discovered in the eastern part of the rampart.

Unfortunately, the authors of the excavations did not know what type of objects they had encountered and how unique it was. Therefore, the work was carried out according to the usual kurgan method. The excavations were carried out in the autumn of 1984 and were suspended after snowfall. The builders of the irrigation pipeline (Fig. 17), having seen the departure of the expedition, flattened the unexplored parts of the object. Thus, they conserved the remains of the rampart and the ditch, which can be further investigated in the future.

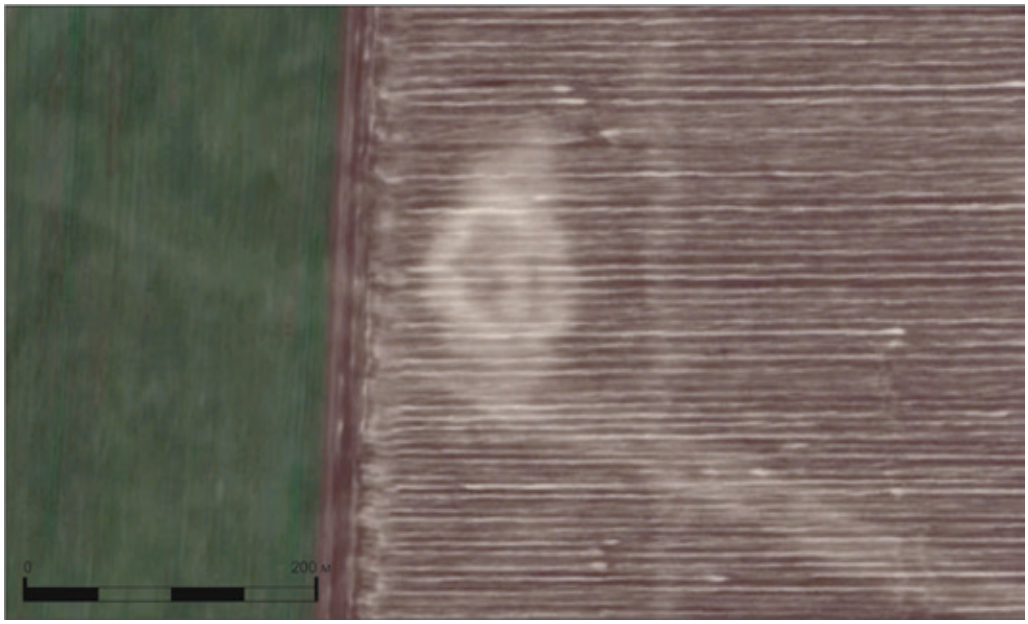

Fig. 17. Satellite image of the discbarrow Karpovka II
Рис. 17. Космоснимок кольцевого кургана Карповка II

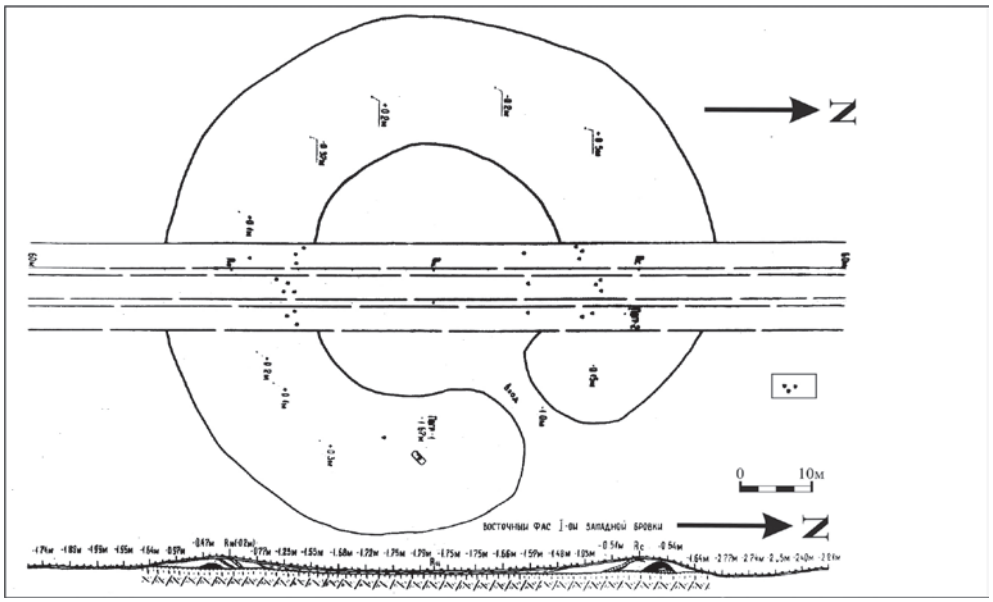

Fig. 18. The discbarrow Karpovka II. The excavation plan and the section in the center
Рис. 18. Кольцевой курган Карповка II. План раскопок и разрез по центру

Fig. 19. Photo of the section of the shaft of the discbarrow Karpovka II
Рис. 19. Фото разреза вала кольцевого кургана Карповка II. Вид с юго-востока

The mapping of the disc barrows made it possible for the first time to reveal the geographic interconnection of objects with each other. Thus, the centers of the Melikhovsky and

Semikarakorsky disc barrows are located almost ideally on the same parallel (47 ° 29'28 "N — 47 ° 29'30" N), the coordinates of their centers differ by only 2 arc seconds (!) (Fig. 20). The highest section is located exactly on this line on the eastern part of the Melikhovsky earthworks (Fig. 12). Then it became obvious that the two indicated objects form on the map an almost regular isosceles triangle with the sides 10845 m long and 11291 m long with the excavated Karpovka II disc barrow. After that, it was logical to try to find the fourth symmetrical vertex of the outlined geometric figure. Near the point located to the north of the center of Karpovka II was the Atamansky IV mound, a visual inspection of which led to the conclusion that it is a destroyed disc barrow. Thus, a complex of four almost identical interconnected objects was outlined. For the entire complex, the name Semikarakorsky was proposed, since the locations of all other objects could allow displacement in the meridional and latitudinal directions for kilometers, and only the top of the high floodplain island, on which the Semikarakorsky disc barrow is located, allows an interval of location of no more than 300 m.

The relative position of the ring disc barrows on one parallel can be explained by their destination to observe the movement of the Sun or other celestial bodies. To test this hypothesis, an Internet resource suncalc.net. was used to determine the direction of sunrise for any date. According to the data obtained, the Melikhovsky and Semikarakorsky disc barrows are located exactly on the line of sunrise and sunset on the days of the spring and autumn equinoxes.

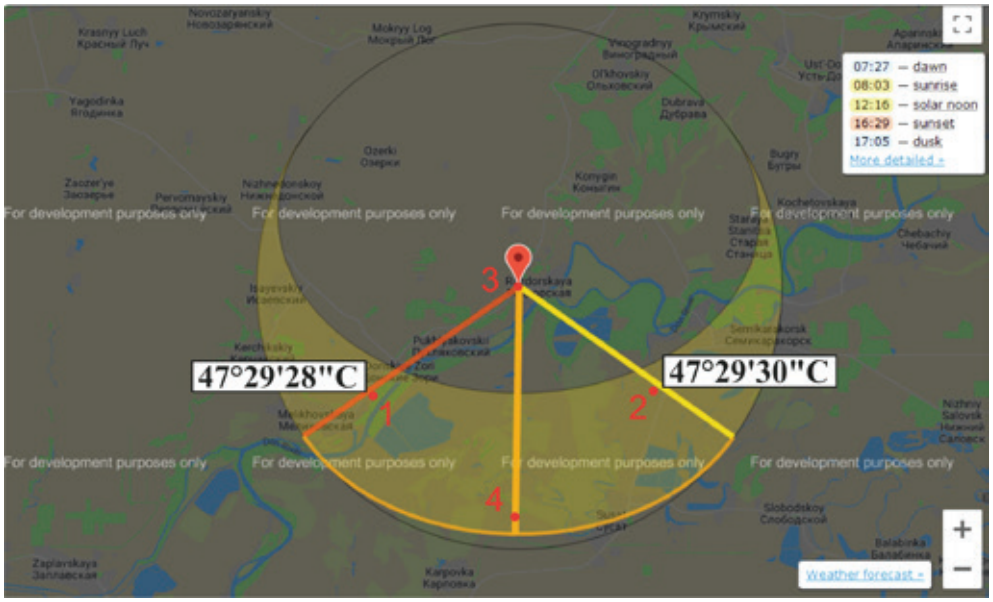

Fig. 20. The location of the discbarrows of the Semikarakor complex relative to the sunrise and sunset lines on December 22, according to the site suncalc.net
Рис. 20. Расположение кольцевых курганов Семикаракорского комплекса относительно линий восхода и захода Солнца 22 декабря по данным сайта suncalc.net

The lines of sunrise and sunset on the day of the winter solstice (December 22) almost exactly coincide with the relative positions of Atamansky IV, Semikarakorsky and Melikhovsky

(Fig. 20) mounds. The existing symmetric deviation can be explained both by the difference in the mathematical model of the suncalc.net resource from the observed situation, and by the orientation of objects not to the sunrise point of the Sun's edge, but to the sunrise of the entire solar disk above the horizon.

We can assume the following motivation for the construction of structures. The simplest instruments for observing the movement of the Sun decayed over time. To renew the marks on objects on a clear night, it was possible to make fires in the centers of the disc structures and set up the necessary anchor marks again. Thus, for many generations the exact date could be determined by observers of rather low qualifications. Due to the location of all four objects in the elevated areas, the floodplain of the Don river valley could not limit the visibility between the disc barrows. However, it can be argued that direct optical communication between the Semikarakorsky and Atamansky IV mounds is impossible due to the presence of a 20 m elevated section between them.

The hypothesis about the possibility of using disc barrows as benchmarks to adjust the observational instruments does not contradict the author's observations: from the Melikhovsky disc barrow using binoculars, one can easily distinguish the locations of the Karpovka II and Semikarakorsky mounds. This does not contradict the practice of the past, since the distance between semaphores of the optical telegraph of the 19th century was more than 15 km, and the theoretically possible limit was considered 65 km.

However, the astronomically exact coincidence of the coordinates of the centers of the Semikarakorsky and Melikhovsky disc barrows is perplexing, since because of the precessional displacement of the earth's axis with a period of 26 thousand years, the objects that were at the same latitude in the past cannot remain on it to the present time. It also remains unclear whether the deviation of the coordinates of Karpovka II (longitude: 40 ° 37'36.55 "E) and Atamansky IV (longitude: 40 ° 38'2.71" E) from the meridian can be explained by precession. The listed problems require further development by competent specialists. However, given the rarity of the ring mounds, their geographical binding can be considered an established fact. For the henge of the British archipelago and the ring structures of the North Caucasus, such patterns of location have not yet been established.

Excavation Results and Dating

In total, five disc barrows have been excavated in the Lower Don: two have been fully explored, and a limited area has been opened on three of them. As described above, the excavations of the sites at the Semikarakorsk and Sambek ring structures did not allow establishing the time of their construction. The finds of flint objects of the Eneolithic appearance at the Sambek settlement allow us to make a careful assumption about its dating to the boundary of the Eneolithic and Early Bronze Age, since otherwise it is difficult to explain the presence of such material on the watershed far from settlements and burial mounds. The excavations of the Sanctuary at the Tryokostrovskaya station allowed dating it to the Late Bronze Age. The Karpovka II mound has been excavated almost completely, however the absence of burial structures dating back to the time of the construction of the object prevented its dating. Mound 20 of the Vysochino V burial ground has been fully investigated and reliably dated to the 1st century AD.

Disc Barrows of the Sarmatian Time

The excavations of K. F. Smirnov in 1966 near the Lipovka village of the Orenburg region initiate the history of the study of the Sarmatian ring sanctuaries, which comprise several dozen in the Urals and Kazakhstan. An investigation was done of rather large annular earthwork (mound 6 of the Perevolotsky I burial ground on the Samara River) with a diameter of 46–48 m and a height of 1.2 m, surrounded by a ditch 6 m wide and up to 3 m deep [Morgunova, Kuptsov, 2018: 23]. Like other disc barrows, Perevolotsky I did not contain any burials.

Such sanctuaries are known in the basin of the Ingul river on the territory of Ukraine, e.g. Kurgan 9 of the burial ground Ryadovy mogily. Ordinary graves are circular mounds of earth with a diameter of 44–46 m and a height of up to 0.8 m [Melnik, Steblina: 170]. Many fragments of amphorae of the 3rd — early 2nd century BC were found inside the structure.

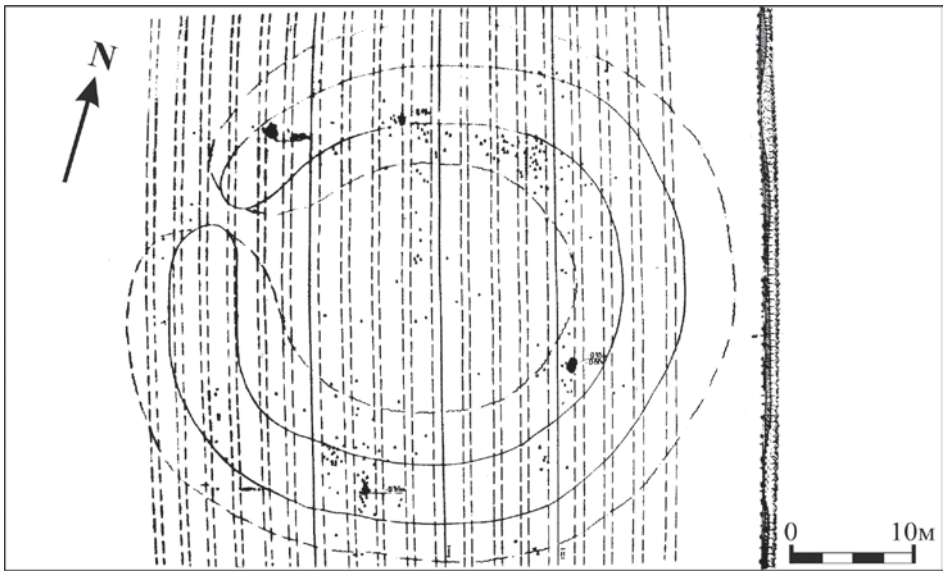

Fig. 21. Kurgan 20 of the Vysochino V burial mound, discbarrow. The excavation plan and the section in the center
Рис. 21. Курган 20 могильника Высочино V, кольцевой курган. План раскопок и разрез по центру

Large annular earthwork was investigated in the Lower Don by E. I. Bespaly and I. N. Parusimov in 1986 — mound 20 of the Vysochino V burial ground (Fig. 21). It was located at the top of the watershed between the Don and the Kagalnik rivers, among the vast Sarmatian mound necropolis. "The excavated object is heavily plowed earthworks of a circular shape, visually on the surface it was poorly visible. In the NW sector, the earthworks had a barely noticeable gap. The object was dug out with a scraper leaving the edges. The edges were oriented N — S, the soil was cut in thin layers (1–2 cm each), all findings were recorded and plotted on the plan. In total, 20 strips were uncovered, between which 19 edges were left 1–1.5 m wide. All the fronts were cleaned (in total, 4 linear kilometers of the edges were cleaned), the most informative faces were graphically recorded. The rabotage showed

that annular earthworks of 8–10 m wide (along the bottom), represented in the plan an almost regular circle with a diameter (in the center of the earthworks) of 70 m, in the NW sector the earthworks had a gap of 4 m wide. The soil for the construction of the earthworks was taken from the adjacent areas inside and outside the earthworks. As a result of soil take-out, two annular hollows 8–10 m wide were formed, the depth of the hollows from the level of the buried soil was 0.4–0.7 m. In the northwestern sector, where the earthworks had a gap, there were no hollows. The earthwork is up to 0.4 m high" [Bespaly, Lukyashko, 2008: 88]. On the inner slopes of the earthworks and in the inner ring takeout, fragments of amphorae, gray-clay circular vessels, stucco vessels, small fragments of sandstone, an accumulation of animal skulls (two skulls of horses, one of a large predator (bear?), two skulls of rams) were found. According to the amphorae, the object dates back to the 1st century A. D and was created by the bearers of the Sarmatian culture.

Thus, the wide distribution of disc barrows of the Early Iron Age on the territory of the Eurasian steppes is beyond any doubt. Excavations of several of them have presented very modest results. The level of development of excavation techniques today does not allow obtaining valuable information from excavations "for demolition". These objects should be carefully preserved for future research.

Conclusion

Disc barrows of Eurasia, except for the territory of the British Archipelago, are at the beginning of their research. To date, it has been established that they are common throughout Europe and date back to the period from the 5th millennium BC up to the 1st millennium AD. They are direct analogs of British henge and contain a lot of valuable historical information.

The Semikarakorsk complex, highlighted by the author, for the first time for similar structures, presents the geographical relationship of location which unequivocally testifies to their use to determine the most important dates of the year: the spring and autumn equinoxes, the days of the summer and winter solstices.

The dating and cultural attribution of most of the disc barrows and, in particular, the Semikarakorsk complex, urgently requires further research. The archaeoastronomical aspects of the location of the Semikarakor complex by ancient people also need careful study.

REFERENCES

Agafonova T. E., Vasil'eva A. V., Kashirina S. S., Polyakov E. N. Megaliticheskij kompleks Stounhendzh — astronomicheskaya legenda Drevnego Mira [The Stonehenge Megalithic Complex — Astronomical Legend of the Ancient World]. Gaudeamus Igitur. 2017. № 1. Pp. 13–20. *(In Russ.)*

Belinskij A. B., Fassbinder I., Rajnhold S. Magnitometriya i 3D modeli severokavkazskix kol'cevyh sooruzhenij [Magnetometry and 3D Models of North Caucasian Ring Structures]. Novejshie otkrytiya v arheologii Severnogo Kavkaza: Issledovaniya i interpretacii. XXVII Krupnovskie chteniya [Latest Discoveries in the Archaeology of the North Caucasus: Research and Interpretation. The XXVII Krupnovsky Conference]. Mahachkala : Mavraev, 2012. Pp. 29–31. *(In Russ.)*

Bespalyj E. I., Luk'yashko S. I. Drevnee naselenie mezhdurech'ya Dona i Kagal'nika. Kurgannyj mogil'nik u s. Vysochino [The Ancient Population of the Interfluve of the Don and

Kagalnik. Kurgan Burial Ground in the Village of Vysochino]. Rostov-on-Don : Izdatel'stvo Yuzhnogo nauchnogo centra RAN, 2008. 224 p. *(In Russ.)*

Demkin V. A., Alekseeva T. A., Sergackov I. V., Alekseev A. O., Demkina T. S. Itogi estestvenno-nauchnogo izucheniya arheologicheskogo pamyatnika u stanicy Trehostrovskaya v Volgogradskom Zadon'e [Results of Natural and Scientific Study of an Archaeological Site at the Village of Trekhostrovskaya in the Volgograd Zadonye]. Nizhnevolzhskij arheologicheskij vestnik [Nizhnevolzhsky Archaeological Bulletin]. 2001. № 4. Pp. 78–91. *(In Russ.)*

Kulikov A. V., Smekalov S. L., Yanishevskij B. E., Mokroborodov V. V., Plehanov Yu. V. Pozdnesrednevekovye zemlyanye gidrotehnicheskie sooruzheniya v Vostochnom Krymu (Respublika Krym) [Late Middle Ages Earth Hydrotechnical Structures in the Eastern Crimea (Republic of Crimea)]. Goroda, poseleniya, nekropoli. Raskopki 2016. Materialy spasatel'nyh arheologicheskih issledovanij. T. 19 [Cities, Settlements, Necropolises. Excavations 2016. Materials of Rescue Archaeological Research. Volume 19]. Moscow : Institut Archeologii RAN, 2017. Pp. 108–119. *(In Russ.)*

Larenok P. A. Hronologiya srednevekovogo sloya gorodishcha Sambek [Chronology of the Middle-century Layer of the Sambek Settlement]. Problemy hronologii arheologicheskih pamyatnikov stepnoj zony Severnogo Kavkaza [Problems of Chronology of Archaeological Sites of the Steppe Zone of the Northern Caucasus]. Rostov-on-Don : Izdatel'stvo Rostovskogo universiteta, 1983. Pp. 124–129. *(In Russ.)*

Morgunova N. L., Kupcov E. A. Kol'cevoe svyatilishche sarmatskoj kul'tury u poselka Perevolockij [Ring Sanctuary of Sarmatian Culture near the Village of Perevolotsky]. "Evrazijskij perekrestok" ["Eurasian crossroads"]. Issue 9. Orenburg : Universitet, 2018. Pp. 19–29. *(In Russ.)*

Fassbinder J. V. E. Magnitometriya v arheologii — ot teorii k praktike [Magnetometry in Archaeology — from Theory to Practice]. Rossijskaya arheologiya [Russian Archaeology]. 2019. № 3. Pp. 75–91. *(In Russ.)*

Flerov V. S. "Semikarakory" — krepost" Hazarskogo kaganata na Nizhnem Donu ["Semikarakory" — fortress of the Khazar Khaganate on the Lower Don]. Rossijskaya arheologiya [Russian archaeology]. 2002. № 2. P. 56–70. *(In Russ.)*

Melnik O. O., Steblina I. O. Mounds of Kryvyi Rih. Kryvyi Rih : Publishing house, 2012. 474 p.

Bertemes F., Northe A. Der Kreisgraben von Goseck. Ein Beitrag zum Verständnis früher Monumentaler Kultbauten Mitteleuropas. In: Karl Schmotz (Hrsg.): Vorträge des 25. Niederbayerischen Archäologentages. Leidorf, Rahden/Westf. 2007. Pp. 137–168.

Gibson A. An Introduction to the Study of Henges: Time for a Change? In: Gibson A (Ed.) Enclosing the Neolithic: Recent studies in Britain and Europe. Oxford : Archaeopress. BAR International Series 2440, 2012. P. 1–20.

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Агафонова Т. Е., Васильева А. В., Каширина С. С., Поляков Е. Н. Мегалитический комплекс Стоунхендж — астрономическая легенда Древнего Мира // Gaudeamus Igitur. 2017. № 1. С. 13–20.

Белинский А. Б., Фассбиндер И., Райнхольд С. Магнитометрия и 3D модели северокавказских кольцевых сооружений // Новейшие открытия в археологии Северно-

го Кавказа: исследования и интерпретации. XXVII Крупновские чтения. Махачкала : Мавраев, 2012. С. 29–31.

Беспалый Е. И., Лукьяшко С. И. Древнее население междуречья Дона и Кагальника. Курганный могильник у с. Высочино. Ростов-на-Дону : Издательство Южного научного центра РАН, 2008. 224 с.

Демкин В. А., Алексеева Т. А., Сергацков И. В., Алексеев А. О., Демкина Т. С. Итоги естественно-научного изучения археологического памятника у станицы Трехостровская в Волгоградском Задонье // Нижневолжский археологический вестник. 2001. № 4. С. 78–91.

Куликов А. В., Смекалов С. Л., Янишевский Б. Е., Мокробородов В. В., Плеханов Ю. В. Позднесредневековые земляные гидротехнические сооружения в Восточном Крыму (Республика Крым) // Города, поселения, некрополи. Раскопки 2016. Материалы спасательных археологических исследований. Т. 19. М. : Институт археологии РАН, 2017. С. 108–119.

Ларенок П. А. Хронология средневекового слоя городища Самбек // Проблемы хронологии археологических памятников степной зоны Северного Кавказа. Ростов-на-Дону : Издательство Ростовского университета, 1983. С. 124–129.

Моргунова Н. Л., Купцов Е. А. Кольцевое святилище сарматской культуры у поселка Переволоцкий // «Евразийский перекресток». Вып. 9. Оренбург : Университет, 2018. С. 19–29.

Фассбиндер Й. В. Е. Магнитометрия в археологии — от теории к практике // Российская археология. 2019. № 3. С. 75–91.

Флеров В. С. «Семикаракоры» — крепость Хазарского каганата на Нижнем Дону // Российская археология. 2002. № 2. С. 56–70.

Мельник О. О., Стеблина І. О. Кургани Криворіжжя. Кривий Ріг: Видавничий дім, 2012. 474 с.

Bertemes F., Northe A. Der Kreisgraben von Goseck. Ein Beitrag zum Verständnis früher Monumentaler Kultbauten Mitteleuropas. In: Karl Schmotz (Hrsg.): Vorträge des 25. Niederbayerischen Archäologentages. Leidorf, Rahden/Westf, 2007. Pp. 137–168.

Gibson A. An Introduction to the Study of Henges: Time for a Change? In: Gibson A. (Ed.). Enclosing the Neolithic: Recent studies in Britain and Europe. Oxford : Archaeopress. BAR International Series 2440, 2012. P. 1–20.

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USE OF NATURAL-SCIENTIFIC METHODS IN ARCHAEOLOGICAL RESEARCH

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GEOPHYSICAL AND ARCHAEOLOGICAL SURVEY OF THE HILLFORT OF ZILGI AND THE BARROW CEMETERY OF BESLAN (NORTH OSSETIA)

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Abstract: The article is devoted to new methodological techniques in the study of widely known sites of the early stage of Alanic culture of the Central Ciscaucasia — Zilgi hillfort and Beslan kurgan catacomb burial ground (RNO — Alania). The use of satellite images, low-altitude aerial photography, photogrammetry and magnetometric survey made it possible to obtain fundamentally new information about these well-studied sites and to specify their topographic and planigraphic features in the shortest time with minimal destructions. The excavations carried out in two areas of the Beslan necropolis helped to considerably refine its chronological framework, trace the development of the necropolis from the Zilgi hillfort to the southeastern periphery and identify the area of the most recent graves dating from the middle of the 7th century AD, which were made near the eastern border of unfortified settlement of Zilgi. The non-destructive survey methodology tested by the team has wide prospects for the study of Alanic culture sites of the Central Caucasus, especially at its early stage.

Keywords: North Caucasus, Alanic culture, "earthen hillforts", barrow catacomb burials, photogrammetry, Remote Sensing data, magnetometric survey

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АРХЕОЛОГО-ГЕОФИЗИЧЕСКОЕ ИССЛЕДОВАНИЕ ЗИЛЬГИНСКОГО ГОРОДИЩА И БЕСЛАНСКОГО КУРГАННОГО КАТАКОМБНОГО МОГИЛЬНИКА В СЕВЕРНОЙ ОСЕТИИ

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Резюме: Статья посвящена новым методическим приемам в исследовании широко известных памятников раннего этапа аланской культуры Центрального Предкавказья — Зильгинского городища и Бесланского курганного катакомбного могильника, расположенных в Республике Северная Осетия — Алания. Использование космоснимков, низковысотной аэрофотосъемки, фотограмметрии и магнитометрического обследования дало возможность в кратчайшие сроки с минимальными площадными вскрытиями получить принципиально новую информацию об этих хорошо исследованных археологических памятниках и существенно уточнить их топографические и планиграфические особенности. Небольшие по площади раскопки на Бесланском некрополе позволили существенно расширить прежние (с 1-й половины III по финал IV в. н.э.) представления о времени его использования, проследить тенденцию развития некрополя от городища в восточном и юго-восточном направлении, а также выявить свидетельства повторного использования его могильного пространства рядом с городищем в середине VII в. н.э. Нам представляется, что аналогичные в методическом отношении работы имеют широкие перспективы при исследовании поселенческих и погребальных памятников северокавказских алан, особенно на раннем этапе их существования в Центральном Предкавказье.

Ключевые слова: Северный Кавказ, аланская культура, «земляные городища», курганные катакомбные могильники, фотограмметрия, данные дистанционного зондирования, магнитометрическое обследование

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Introduction

This article is devoted to some results of our comprehensive study of the largest early Alanic sites of the 2nd — 4th centuries AD in the Central Ciscaucasia — the hillfort of Zilgi and adjoining barrow catacomb cemetery of Beslan. The history of the study of these sites [Kravtsova, 2020] spans several decades, and large-scale excavations have made them a reference point for the study of antiquities associated with the Alanic tribes of the North Caucasus in the 1st millennium AD.

The Zilgi fortified settlement is one of the largest so-called "earthen hillforts" in the region. According to present views, the area occupied by several "residential hills" arranged in semicircles around the so-called "citadel" is 1.5 square kilometers [Arzhantseva, Deopik, 1989: 76]. It is difficult to estimate the size of the unfortified settlement with our knowledge. According to V. A. Kuznetsov's observations, it spreads across the area of the fortified settlement at least 100–150 m to the east and south-east of the settlement [Kuznetsov, 1986: 79]. Our collection of surface material showed its distribution about 400 m to the south-east of the extreme boundary of fortified hills, which was visible on the surface (Hill II according to the plan drawn up in 1981 by V. A. Kuznetsov [1986: Fig. 2]). V. A. Kuznetsov [1986: 88] suggested the existence of non-fortified settlement also in the south side of the hillfort, the dimensions of which are presently unknown, because the area is completely destroyed with buildings. Reconnaissance by N. I. Gidzhrati during protection and rescue work in the area of the highway

reconstruction to Mozdok in autumn 2020, revealed the existence of an open settlement in the north-western side of the Zilgi hillfort (personal information of N. I. Gidzhrati). This area is now completely built up by the farmsteads of Zilgi village, and special field surveys are required to determine its extent. However, even at a very rough estimate, the surface material can be found in the northwest direction, at a distance of more than 200 meters from the bottom of the fortified slope of the settlement.

The Beslan kurgan catacomb cemetery has been studied for over thirty years. From 1988 to 2012, the Beslan team of the Institute of History and Archaeology of RNO — Alania, headed by F.S. Dzutsev, has carried out archaeological field investigations. The protection and rescue work was connected with the clay quarry that served two brickyards and destroyed the site, which required the clearing of an area of about 1 hectare annually for archaeological excavations [Dzutsev, Malashev, 2015: 9]. Every year, for 25 seasons, the expedition excavated dozens of burial mounds containing catacomb graves of the early stage of the Alanic culture.

Excavations of the Beslan catacomb burial mound were also carried out in 2011 during the reconstruction of the federal road M-29 "Kavkaz" [Dzhanaev, 2012; Malashev et al., 2015]. The North Ossetia expedition of the IA RAS excavated a one-hectare burial area, where 66 burial complexes were studied, as well as a number of ritual objects. Most of the tombs belong to the early stage of the Alanic culture, and might be dated to the 1st half of the 3rd century AD. There are 20 kurgan graves marked with ditches, 22 burials without traces of any mound of earth, and two ditches containing no burials. The group of complexes dating from the 2nd century BC to the 1st century AD includes eight inlet burials in Bronze Age barrows. One burial belongs to the Early Scythian period, 15 burials belong to the Middle Bronze Age and are connected with the Catacomb culture.

More than 870 burial complexes of the Alanic culture of the 3rd century through the end of the 4th century AD, more than 20 tombs of the Late Catacomb Culture, a complex of the Early Scythian time and about 10 tombs of the 2nd century BC — 1st century AD have been studied so far [Dzutsev, Malashev, 2015: 10]. However, as it was said above, most of the studied burials of the necropolis originate from a single site and are dated narrowly around the middle of the 3rd century AD.

Analysis of Remote Sensing Data

It should be noted that the fortified size of the hillfort considered by the researchers is not limited to the area currently visible on the surface. Analysis of satellite images and aerial photographs of the Zilgi hillfort made in different years provides a similar conclusion. Thus, the archival aerial photo of 1980s clearly shows a semicircular ditch outlining the residential hillfort V from the south-eastern and southern sides (Fig. 1.-*1*). The southeastern sector of the ditch is completely leveled by modern plowing and can be traced on some open source satellite images, for example, Bing-Maps. An image taken on 3 April 2017 by the WorldView-3 Earth observation satellite with a spatial resolution of 35 cm per image pixel gives a good idea of the structure (Fig. 2).

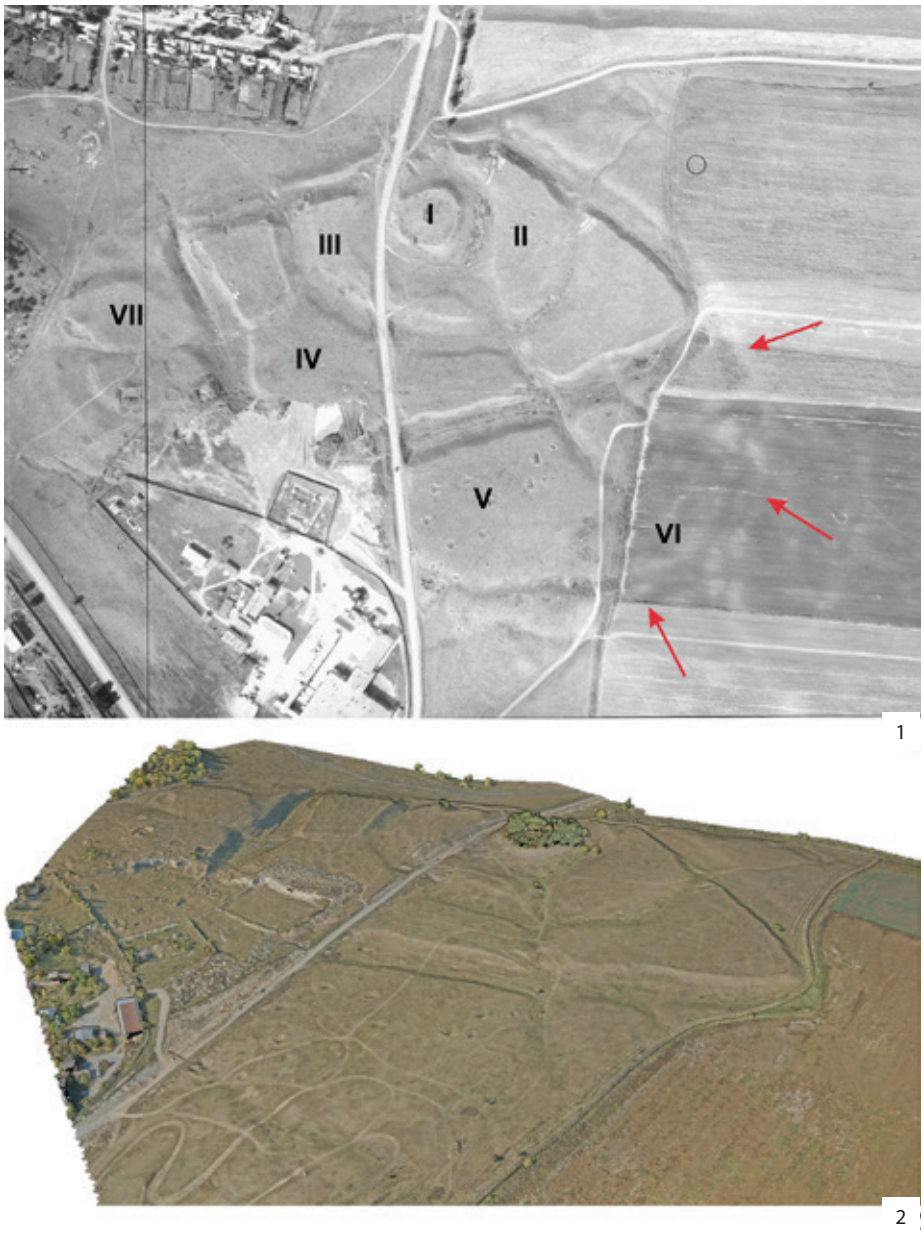

Fig. 1. 1 — view of Zilgi hillfort on the aerial photo of 1980-ties. Plowed outer ditch of the settlement is shown with red arrows; 2 — photogrammetric 3D-model of the hillfort of Zilgi based on the low-altitude aerial survey of 2020. View from the south

Рис. 1. 1 — вид Зильгинского городища на аэрофотоснимке 1980-х гг. Красными стрелками показан распаханный внешний ров городища; 2 — трехмерная модель Зильгинского городища, построенная методом фотограмметрии по результатам низковысотной аэрофотосъемки 2020 г. Вид с юга

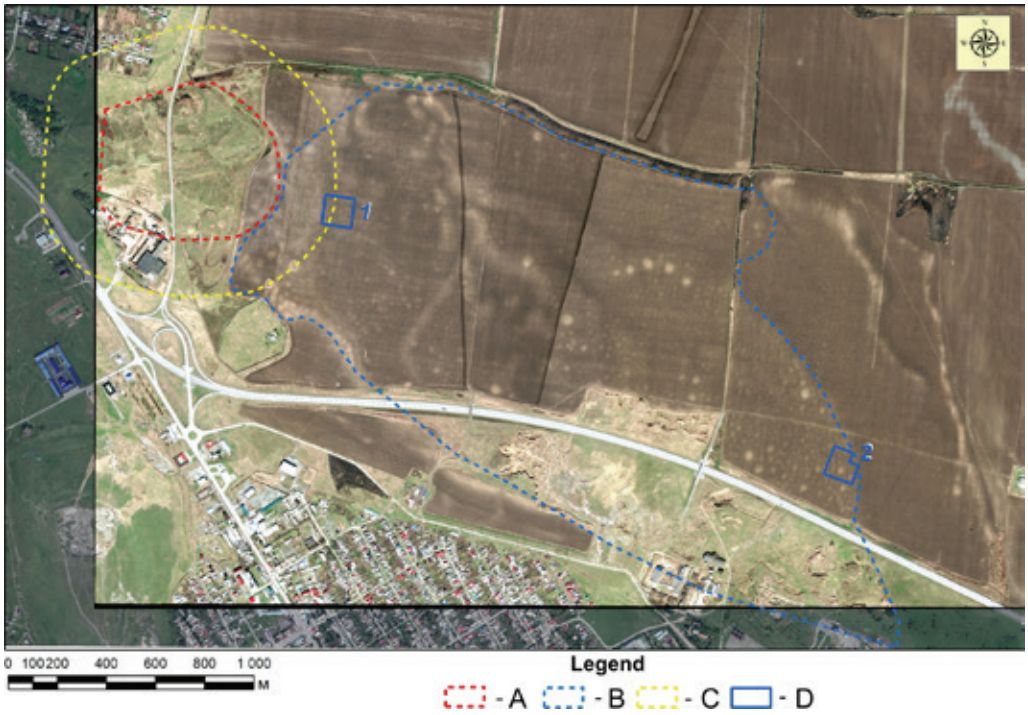

Fig. 2. Hillfort of Zilgi and the Beslan catacomb burial mound cemetery on the WorldView-3 satellite image (April 3, 2017). Symbols: A — boundaries of the hillfort; B — boundaries of the burial mound; C — assumed boundaries of the settlement; D — areas of geophysical survey

Рис. 2. Зильгинское городище и Бесланский курганный катакомбный могильник на космоснимке космического аппарата WorldView-3 (снимок 3 апреля 2017 г.). Условные обозначения: A — границы городища; B — границы могильника; C — предполагаемые границы посада; D — участки геофизического обследования

Different quantitative assessments of the Zilgi hillfort area can be found in the publications. For example, V. A. Kuznetsov defined its area as 1 sq. km [Kuznetsov, 1986: 74]. I. A. Arzhantseva's publication estimates the area of the fortified part of the settlement as 1.5 sq. km [Arzhantseva, Deopik, 1989: 76]. Analysis of remote sensing data, which we performed with the help of GIS, helps to understand how far these ideas are consistent with reality (Fig. 2). The calculation of the area of the fortified settlement gives much more modest results than it is usually assumed. Thus, the area of the fortified part of the hillfort in the ArcGIS 10.5 program based on the external contour of the ditch visible in the above-mentioned WorldView-3 image shows an approximate estimate of 38.5 ha, which is 0.385 sq. km. The visible area of the fortified hills of the hillfort, including the south-western part destroyed by the brickyard pit, is about 19 hectares (0.19 square kilometers). If we assume that the unfortified settlement was at a distance of 230 meters from outermost ditches of the fortified settlement (the distance of the settlement's border was traced in the course of our works, which will be described below), then the total area of the settlement is about one square kilometer (Fig. 2). Of course, we cannot say

that, on the one hand, all this vast area was developed by the inhabitants of Zilgi settlement in ancient times, and, on the other hand, that the area of the settlement did not extend further than the indicated distance of 230 m.

However, the fortified settlement of Zilgi is one of the largest earthworks of the early Alanic culture, comparable in fortified area to the Staro-Lesken (0.4 sq km), Brut (0.38 sq km) and Alkhan-Kala (0.3 sq km). Most of the "earthen hillforts" of that time are vastly inferior to those of Zilgi. For example, the Kievskoe hillfort near Mozdok, which is rather large, covers about 6 ha [Korobov, 2020: 23–28]. We would point out that these conclusions are preliminary, and a more detailed study of topographical and planning features of early Alanic "earthen hillforts" has yet to be made.

The Zilgi hillfort is of particular importance also because of the huge catacomb burial mound cemetery of Beslan, which is adjacent to it from the east and southeast. The area of this necropolis was estimated by its researchers at 7 sq. km, assuming that the number of mounds there could be as many as 35,000 [Dzutsev, Malashev, 2015: 56, 58]. The analysis of the WorldView-3 satellite image allows us to correct these assumptions as well (Fig. 2). This image is unique, as it was made at a time when virtually the entire territory of the Beslan cemetery was under ploughing, with no agricultural crops, which makes it impossible to recognize mounds reduced in the course of agrarian activities. As a result, we have a unique opportunity to estimate the boundaries of this site, at least to the north and east, and to calculate the maximum density of barrows per unit area. The spatial ultra-high resolution of the satellite image (35 cm per image pixel) allows us to do this (Fig. 2).

The clay quarry of the Beslan brickworks has heavily damaged the southern edge of the catacomb burial ground, but no barrow mounds can be traced in the ploughed areas south of the highway on the northwestern edge of Beslan town. They are also absent in the fields to the north of the country roads running eastwards along the edge of the promontory on which the settlement and the burial ground are located (Fig. 2). The eastern edge of the burial ground can be read perfectly by the high concentration of barrow mounds, which run in a semicircle along the ancient stream bed (?), now completely levelled by agricultural work. The most difficult is the definition of the western boundary of the burial ground, which adjoins closely the unfortified settlement of the Zilgi hillfort and, as our work in 2020 has shown, partially overlaps it. Here the barrow accumulations are bounded by a natural gully on the southwestern edge of the burial ground (now also leveled), which adjoins the tracking station of Beslan airport. The western edge of the necropolis, on the other hand, has no clear boundaries. There are several large mounds, adjoining the ploughed ditch from the southeastern side of the settlement. Two of them can be easily seen on the modern surface north of the tracking station. The small fully ploughed mounds of the Beslan catacomb cemetery adjoin these large mounds closely on the eastern side (Fig. 2).

An assessment of the Beslan cemetery area from the WorldView-3 satellite image yielded the following results. The total area of the necropolis within the boundaries outlined in Fig. 2 was about 324 ha (3.24 sq km). This is half as much as the calculations of the area of the site given in the literature [Dzutsev, Malashev, 2015: 58]. Nevertheless, the necropolis does not cease to look grandiose: its maximum length along the axis from northwest to southeast is 3 km, and its width in the middle part reaches 1.4 km.

We can try to calculate the maximum number of barrows that can be located in this area, based on the visually estimated number on the satellite image. If we take as a basis the place of their highest concentration in the eastern part of the necropolis, then according to the analysis of the satellite image there are from 15 to 25 mounds per hectare. Thus, taking as an estimated area of the burial ground about 300 hectares, we receive from 4500 to 7500 mounds in their maximum concentration. The results of excavations in 2011 [Dzhanaev, 2012; Malashev et al., 2015] allow us to estimate the density of burials in the necropolis more accurately. Calculations show that, on average, there are approximately 45 burial mounds and moundless burial complexes per hectare. At the same time, the density of burials near the settlement and in the greater part of the burial ground is higher than in its periphery. On the whole, the necropolis is one of the foremost necropolises of the early Alanic culture and could contain at least 13500 burials. A large burial mound cemetery of Kievskiy-I, adjacent to the above mentioned hillfort from the south, according to the recently conducted topographic survey, has an area of 2.4 sq. km and counts 1050 mounds, visible on the surface and on the space images [Kim, 2017: Fig. 232]. The results of the 2019 excavations [Malashev et al., 2020] at its periphery give a density of about 10 mounds per ha. Areas closer to the settlement should give a markedly higher density.

3D-modelling with help of photogrammetry

Modern approaches in the field survey provide a detailed overview of the topography of the Zilgi hillfort, especially the creation of its three-dimensional image by photogrammetry (Fig. 1.-*2*). This technology widespread in recent years has become an excellent tool in non-destructive archaeological survey [Zaitseva, 2014; Shubert, 2016]. The work to create a detailed three-dimensional photogrammetric model of the Zilgi fortress was carried out by the staff of the Laboratory of Digital Archaeology of the Centre for Ancient and Oriental Archaeology of the National Research University Higher School of Economics and the Laboratory of Remote Sensing and Spatial Data Analysis (RSSDA[1]) under the supervision of Yu. Svoysky in autumn 2020. The aerial survey was was made on 10–11 October 2020. A total of 12 operational flights were carried out (11 for the planned survey and one for the perspective survey). The flights were substantially complicated by the proximity of the Beslan airport glide path, due to which the flight altitude in the area of the ancient settlement was limited to 60 m, while the central and eastern parts of the Beslan burial ground were in the glide path area, completely closed for UAV flights. The low altitude considerably slowed down the survey and hindered further data processing.

A DJI Phantom 4 PRO unmanned aerial vehicle (UAV) was used with a DJI FC6310 camera with a full-frame 5464×3640 pixels (19.89 Mpix) sensor and lens with a focal length of 8.8 mm (24 mm equivalent), equipped with a non-standard onboard Emlid Reach M+ single-frequency GNSS receiver. The survey was performed in automatic piloting mode with parallel flight lines set in the meridional direction. The permanent operating altitude with terrain contouring was 56 m, the estimated image resolution was 1.45 cm/pixel, and the flight speed was 5 m/s. In order to create three-dimensional model of the fortress we used 2619 images with longitudinal overlap of 70% and cross-overlap of 60%.

[1] https://rssda.su/

As a result of this large-scale work we got a detailed topographical model of the whole area of the ancient settlement of Zilgi with very high spatial resolution (Fig. 1.-*2*), which is still to be analyzed.

Results of geophysical prospection

The field research of the Beslan kurgan catacomb burial ground in the 2020 season took place at two areas located in the immediate vicinity of the outermost ditches of the Zilgi hillfort (Survey Area 1) and at the maximum distance from them, on the eastern edge of the necropolis (Survey Area 2) (Fig. 2). The choice of the section was made to test the hypothesis repeatedly expressed by one of the authors about the expansion of the kurgan area of the early Alanic culture from the hillforts over the time. Furthermore, we want to test the consequent reuse of the areas adjacent to the hillforts during the Early Middle Ages [Gabuev, Malashev, 2009: 143; Korobov, Malashev, Fassbinder, 2020: 456]. We assumed that in Survey Area 1 we could excavate both the earliest and the latest catacomb burials of the Beslan burial ground, whereas Survey Area 2 would contain the catacombs marking the end of its planned development.

The team developed a number of methodological techniques for identifying and locating barrow catacombs using archival aerial photography and free-access satellite imagery, as well as subsequent magnetometer surveys of the areas to be excavated. The burial mounds, almost completely ploughed in Soviet times, are nevertheless revealed as lightened spots on aerial images (Fig. 2). Subsequent geophysical survey of clusters of these spots allows the identification of burial ditches, as well as catacomb graves, due to magnetic enhancement and magnetic enrichment of humus filled recessed ditch structures and the flowing soil in robbing manholes in the entrance pits of catacombs [Fassbinder, Stanjek, Vali, 1990; Fassbinder, 2015]. This technique was used in the study of the burial mound cemetery of Levopodkumsky 1 in the northern part of the Kislovodsk Basin [Korobov, Malashev, Fassbinder, 2014] and the section of the kurgan cemetery of Kievskiy I [Korobov, Malashev, Fassbinder, 2020].

Based on the results of interpretation of the super-resolution satellite image from the WorldView-3 satellite, two areas of this vast necropolis were outlined — in the immediate vicinity of the Zilgi fortified settlement and at a distance of 2.7 km east-southeast of it (Fig. 2). The next step in the complex work was a magnetometer survey carried out in May 2019 in a cooperation with the Ludwig Maximilians-University of Munich (J. Fassbinder) at the areas to be excavated. Magnetic Survey Area 1 had dimensions of 120×120 m (nine geophysical survey squares with dimensions of 40×40 m) (Fig. 3.-*1*). To achieve the highest possible sensitivity combined with the maximum speed of prospection, we set up our Geometrics G858 cesium magnetometer in a so-called "duo-sensor" configuration. The profile spacing was 0.5 m and the sampling rate was 10 measurements per second. This helps us to obtain the best and most exact interpolation of data to 25×25 cm spacing. At that time, we correct the slight linear diurnal variations of the geomagnetic field by means of a reduction filter, calculate a mean value of a profile, respectively of all data from the 40×40 m grid and subtract this value from the survey data. This survey technique and the instrument's characteristics make it possible to achieve both high sensitivity (up to ±10 pT) total field measurements and high speed and provides us with a clear picture of the underground features. The visualization as a grey-scale image (by 256 grey-scales) allows to trace even the smallest anomalies (< 0.1 nT). The application of

a high-pass filter removes (if necessary) the deeper, mainly geological features and provides supplementary information on the type of the anomalies. After this procedure, the results were displayed by a second magnetogram image [Fassbinder, 2017].

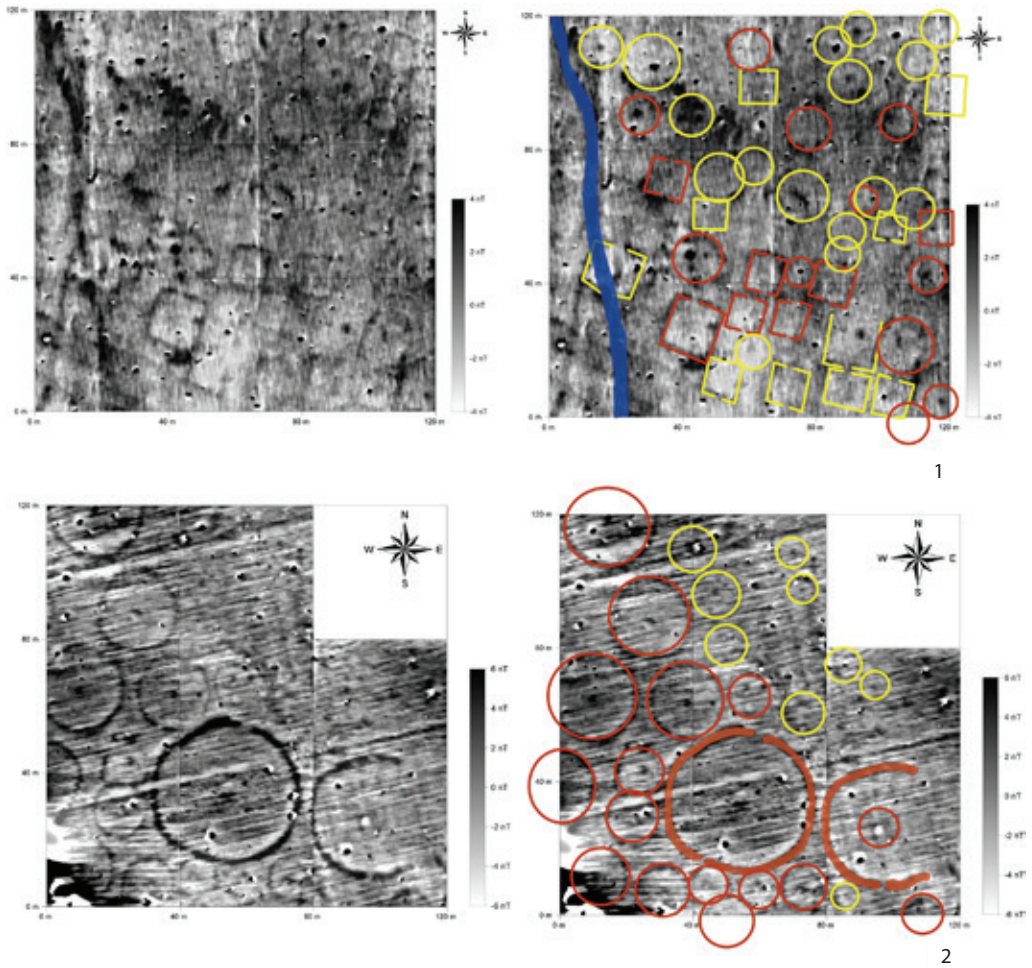

Fig. 3. Results of the magnetic survey of the Beslan catacomb burial mound cemetery (left) and their interpretation (right): 1 — Survey Area 1; 2 — Survey Area 2
Рис. 3. Результаты магнитометрического обследования Бесланского курганного катакомбного могильника (слева) и их интерпретация (справа): 1 — участок 1; 2 — участок 2

The magnetogram although dominated by deep ploughing furrows reveals a multitude of mounds surrounded by square and circular ditches. The mounds are virtually invisible on the surface because of years of ploughing, which has taken place annually to the present day. Some elevations of ploughed embankments can be seen in oblique low-altitude aerial photography under favorable illumination.

The boundaries of the barrow mounds appear on the magnetometer survey as linear, square and circular positive anomalies corresponding to the more humus-laden filling of the ditches surrounded the mounds. As a rule, the anomalies do not have sharp boundaries, their edges are blurred and the contrast is low. In the center of the square and rounded ditches, a brighter spot is usually present, corresponding to the humus-laden filling of robbing manholes let into the entrance pits of catacomb burials in ancient times (Fig. 3.-*1: left*). Some ditches have higher contrast and clearer boundaries on the cited magnetogram, while others are barely discernible. In total no fewer than eighteen mounds with clear boundaries were identified in Survey Area 1, all within the magnetometer survey area, of which seven were square in shape and eleven were circular (Fig. 3.-*1: right*; marked in red). A further ten square-shaped and sixteen circular ditches are only vague recognizable (Fig. 3.-*1: right*; marked in yellow). Two ploughed mounds surrounded by square ditches were selected for archaeological excavation, bearing the numbers 876 and 877; to the north of the square ditch of barrow 877 was a circular ditch of barrow 878, which was difficult to identify on the magnetogram (Fig. 3.-*1*). In the western part of the survey area we detected a ditch running from north to south. Obviously, this ditch marks the boundary to the Alanic settlement of Zilgi in the west and delimits the necropolis of Beslan in the east.

Survey Area 2, on the eastern periphery of the necropolis, is extremely in danger of erosion. On the other hand, it was characterized by a high contrast between the mainland soil and the filling of the mound ditches. As a result, embankments can be identified here with a high degree of probability. An area of 120×120 m sides we surveyed here, one of the nine geophysical survey squares was excluded from the work because it extended beyond the boundaries of the necropolis and across the road on the northeastern side (Fig. 2). In addition, the southwestern square was partially disturbed by a large magnetic anomaly due to the proximity of a gas pipeline (Fig. 3.-*2*). The remainder of the approximately 1.28 ha magnetometer survey area identifies at least 18 ploughed mounds bounded by circular ditches (Fig. 3.-*2: right*; marked in red), including two large mounds with ditches 35–40 m in diameter, located in the lower part of the survey area. One of these, the largest in size, can also be seen on the surface; the other mounds are completely ploughed up and show no external features.

Four of the 18 ditches extend beyond the Survey Area 2, the rest fall entirely within it. In addition, some nine other ditches, mostly in the northeastern part of the surveyed area (Fig. 3.-*2: right*; marked in yellow), are presumably recognizable. They are of small size, with diameters of about 10 m, and their contrast is weak. The two largest barrows are extraordinary not only because of their size. One of them is enclosed by a wide ditch, which show clearly two earthen bridges — oppositely one in the south, the other in the north. Only a semicircular ditch followed by an earthen bridge in the south and an appendix of ca 10 m encloses the other one. In the center of this semicircle, the barrow pit shows up as a negative (white) magnetic anomaly. Two barrows with circular ditches, 20–22 m in diameter, have been selected for excavation (874 and 875).

Beside all of the clearly detectable burials we find a multitude of further (burial) pits, indicating that they were made without any enclosure ditch and/or this enclosure was already eroded and therefore not anymore detectable by our measurements.

Results of archaeological excavations

At present, a complete publication of the results of the excavations of barrows 874–878 of Beslan catacomb cemetery is being prepared. In this paper we present these results in the briefest form.

The mounds of all investigated burials were completely ploughed up and were not traced on the surface. Their structure, recorded in the profiles, is homogeneous in all the cases: a layer of buried soil (grey-brown humus loam with carbonate inclusions, 50–75 cm thick) lies under an arable layer of black humus loam with a thickness of 30–40 cm. The lower profiles of ditch fillings, trapezoidal in cross-section, were recorded in the barrows of the mounds. Their depth from the level of arable layer was from 75 cm up to 1,3 m. The width of the upper part was 50 to 75 cm, and the width of the ditches at the bottom part was 20 to 40 cm. The ditches of all the mounds, apart from the kur. 878, were filled with black-brown humus loam with inclusions of mainland clay and carbonate inclusions. The ditch fill of kur. 878 was notable for the absence of these inclusions.

The diameter of the ditches varied as follows. Mounds 874 and 875 were surrounded by circular ditches, with diameters of 22–24 m along the outer edges. On the northeast and southwest sides, the ditches had bridges about 2.0 m width (Fig. 4.-*1*). Mounds 876 and 877 had square-shaped ditches, measuring 15.5–16.5 m and 12–12.5 m on the outer contour respectively. The bridges located on the north-northeast and south-southwest sides were significantly smaller in width, ranging from 0.5 m to 1.2 m. The ditch of kur. 878 circular in shape is only partially preserved. Its reconstructed diameter along the outer contour is 9.5 m, and the width of the bridge preserved on the south-west side is 1.5 m.

The barrow mounds mainly contained one central burial in T-shaped catacomb. The catacombs of barrows 874 and 875 had considerable depth of entrance pits (up to 4 m), which had been heavily destroyed by robberies in antiquity. The entrance pits were rectangular in shape, 2.95 m long and 1.4–1.6 m width at the clearing level; oriented in a northeast — southwest line. They had steps made along the long northern wall. The chamber entrances have not survived — looters had heavily widened them. The chambers situated on the northeastern side, and were rectangular, with dimensions of 2.2–2.4×1.0–1.5 m and about 2.0 m high. The vaults have not survived, but they appear to have been raised from the entrance and were lancet-shaped (Fig. 4.-*2*).

The funerary inventory preserved after the robbery was found mainly in the chamber fill, in a displaced state. In the catacomb of kur. 874 bronze buckles (Fig. 5.-*3*), a belt tip, fragments of an iron knife and an iron object were found. Inventory of the chamber 875 consists of numerous fragments of an iron sword or dagger, a silver buckle with a shield (Fig. 5.-*8*), an iron buckle, a knife, as well as a bronze and silver ring with clips (Figs. 5.-*4–5*). There were also the finds of pottery from this catacomb — a grey clay bowl with a bent inside rim, as well as a thin-walled narrow-necked light clay jug with a broken handle, the chipped point of which has been ground away for further use (Fig. 5.-*1*). This jug is of Transcaucasian origin and was probably of great value to its owners. The upper profiling of this vessel is similar to that of a vessel found in the Zilgi hillfort [Arzhantseva, Deopik, Malashev, 2000: 242, Fig. 18], and also finds analogies in materials from the Georgian Zhinvali cemetery dated from the 3rd — beginning the 4th cc. AD [Ramishvili, 1983: table LXIII; LXV.-283]. The silver and

bronze buckles and rings with clips, found here, are characteristic of the third quarter of the 4th century AD.

Fig. 4. 1 — Kur. 874, view from the north to the circular ditch and entrance pit of the catacomb; 2 — axonometric view of catacombs 874, based on the results of three-dimensional photogrammetric modeling

Рис. 4. 1 — вид с севера на пятно кольцевого ровика и входной ямы катакомбы кургана 874 Бесланского могильника; 2 — аксонометрия катакомбы 874, построенная по результатам трехмерного моделирования методом фотограмметрии

Fig. 5. Findings from the Beslan catacomb burials: 1, 4, 5, 8 – kur. 875; 2, 7, 9 – kur. 876, grave 1; 3 – kur. 874; 6 – kur. 876, grave 2. 1, 2 – pottery; 3, 4, 6 – bronze; 5, 7, 8 – silver; 9 – bronze, gilding

Рис. 5. Находки из захоронений Бесланского курганного катакомбного могильника: 1, 4, 5, 8 – кур. 875; 2, 7, 9 – кур. 876, п. 1; 3 – кур. 874; 6 – кур. 876, п. 2. 1, 2 – керамика; 3, 4, 6 – бронза; 5, 7, 8 – серебро; 9 – бронза, позолота

Catacombs of kur. 876 and 877 excavated at Survey Area 1 near Zilgi settlement were very different from the above-mentioned ones. Their entrance pits, oriented from north-northeast to south-southwest, were longer and narrower. Their shape was trapezoidal, extending to the north-northeast wall; they measured 2.3–2.7 m long and 0.5–0.7 m width at the clearing level. At the south-southwest (opposite) wall of the entrance pits, steps were made half of its width, arranged in a staggered pattern. The depth of the entrance pits was up to 2.5 m in front of the chamber. The chambers themselves were oval, with a hemispherical vault at the top, 2.2–2.3 m × 1.6 m, and 1.0–1.1 m high.

The inventory left by the robbers was also found among the filling in the chambers. In cat. 876, it included a large black-lined jug with a closed spout and an ornament in the form of shaded triangles, made by narrow broken lines, as well as a belt of impressions of Z-shaped stamps (Fig. 5.-*2*), a mug with zoomorphic decoration on the upper edge of the handle, an iron knife, small glass beads, a cornelian bead, fragments of stamped bronze and silver plaques (Fig. 5.-*7*) and a fragmented gilded pseudo-buckle (Fig. 5.-*9*). In cat. 877 fragments of an iron buckle and a bronze earring with gilding were found.

Mound 876 also contained a peripheral burial of a 4–5 years old girl (?), made in a podboj grave. The dimensions at the level of the cleanup of the entrance pit were trapezoidal, 1.4 m × 0.5–0.6 m, and 0.5 m deep. The western wall contained the entrance of 0.9m width and 12 cm high to oval-shaped chamber measuring 1.2 m × 0.4 m and 0.3 m high. The entrance was closed with large pieces of clay. At the bottom of the niche the skeleton of a child lay in an elongated position on its back, with its head facing north-north-east. Its head was turned to the right side. The skull was artificially deformed, in S. Yu. Friesen's opinion, a deformation typical of the Early Alanic craniological series, with a roll in the region of the *bregma* and a postbregma depression. A small pot was on the left side of the head and a large bronze chain was on the neck (Fig. 5.-*6*), apparently connected with the outermost links by a leather cord, which has decayed.

This burial has no precisely dated material. However, it is synchronous with the central burial in the catacomb 876 and is made under the same mound, surrounded by a square ditch. All these burials can be dated about to the middle of the 7th century AD according to the remains of a belt set with pseudo-buckle and stamped plaques in heraldic style, found in cat. 876. The black-clad jug from the main burial of kur. 876 has an analogy among the finds from the Kur. 18 of the burial mound cemetery of Brut 2, the complex of which dates to the end of the 6th or the first third of the 7th cc. [Gabuev, Malashev, 2009: 120–121, 127–129, 141, Fig. 93.-14].

Thus, the burials studied at Survey Area 1, in barrows with square ditches, are the latest of all burials known to date in the Beslan catacomb burial ground. Our excavations confirm the existence of life in the Zilgi hillfort in the 7th century AD, which had been suggested earlier due to the finds of pottery and fibulae in the stratum of the settlement [Arzhantseva, Deopik, Malashev, 2000: 244, Fig. 16] discussed by I.O. Gavritukhin [2007].

A square ditch of kur. 877 cut a circular ditch of an earlier catacomb burial made in kur. 878. Sections of its outline in the southern and western part were preserved; the northeastern sector could not be traced. The central part of the space enclosed by a ditch was occupied by a catacomb burial. Its entrance pit had a pronounced trapezoidal shape. It was oriented from north-east to south-west, 2.05 m long and 1.6 m width at the northeast wall of the chamber,

and 0.7 m width at the south-west opposite wall. The depth of the entrance pit at the chamber entrance from the level of the sweep was 1.25 m. Several steps were made in the south-western corner and along the width of the back wall. The chamber had an oval shape, with dimensions of 2.0 m × 1.15 m and a height of 0.9 m. The vault was hemispherical, descending from the entrance to the front wall.

Some bones of a buried adult were preserved in the chamber, which had been robbed in antiquity. Judging by the position of the long leg bones preserved *in situ*, the deceased lay stretched out on his back with his head to the south-east, to the right of the chamber entrance. Extant funerary equipment included an iron awl, a buckle and a knife, as well as a grey-clay bowl with a curved rim. Unfortunately, the found inventory does not allow to establish the precise date of this burial. However, judging by the construction of the catacomb, it is dated no later than the beginning of the 3rd century AD and belongs to the earliest catacomb burials of Beslan necropolis known to date.

A rather interesting detail revealed in the course of our work at Survey Area 1 of the Beslan burial ground during the 2020 season. It was the discovery of household pits belonging to the unfortified settlement of the Zilgi hillfort. Three of the pits were found in the inner space of the burial area, enclosed by a ditch of kur. 876 and next to it. Pit 1 was excavated in the south-southwest corner of the barrow area, pit 2 was located near the eastern edge of the ditch from the inner side; pit 3 was located northwest of the northern bridge, on the outer side of the ditch. Preserved depth of pits 1 and 2 from clearing level was 0,7–0,9 m, diameter at clearing level was 1,6–1,7 m, bottom diameter was 1,9–2,0 m. They were filled with loose grey-brown ashy loam, which was denser and darker in colour towards the bottom and near the walls. Numerous fragments of pottery vessels (about 500), burned clay and animal bones were found in the pits. Pit 3 was preserved only in the bottom part, to a depth of no more than 15 cm; there were large fragments of a tare vessel (pithos) at the bottom.

It is interesting to note the rather sparse arrangement of the pits described, and also the fact that no similar objects were found in the area surrounded by the ditch of the neighbouring northeastern kur. 877. The cultural layer was not stratigraphically recorded in the profiles of the excavated barrows, although materials such as fragments of pottery and animal bones were present in the arable layer. Therefore, we can state that our work has established the periphery of the open settlement of the Zilgi hillfort on the east side at the time of its maximum expansion. This boundary was approximately 230 m to the east of the ditch line fencing off Hill V from the east and 400 m to the southeast of southeastern corner of Hill II according to the plan of V.A. Kuznetsov dating to 1981 (Fig. 1.-*1*; 2).

Conclusions

To sum up, the use of non-destructive methods based on remote sensing data analysis, three-dimensional modelling by photogrammetry, magnetometric survey and limited area excavations allow us to obtain fundamentally new information even about such well-known archaeological site as the Zilgi hillfort and the Beslan burial ground in the shortest time. For the first time, we have been able to specify the area of these sites and their boundaries, and trace their spatial features. Small-scale excavations at the Beslan necropolis allowed to expand considerably the ideas about the time of its use (from the first half of the 3rd century AD to the end of the 4th century AD), trace the tendency of its development from the ancient

settlement towards the east and southeast, and find evidence that its burial space near the open settlement was used again in the middle of the 7th century AD. We believe that works similar in methodological respects have broad prospects for the study of the settlements and burial sites of North Caucasian Alans, especially at the early stage of their existence in the Central Caucasus.

REFERENCES

Arzhantseva I. A., Deopik D. V. Zilgi — gorodishche nachala I-go tysyacheletiya n. e. na styke stepi i predgorij v Severnoj Osetii [Zilgi is a Settlement at the Beginning of the 1st Millennium A.D. e. at the Junction of the Steppe and Foothills in North Ossetia]. Uchenye zapiski Komissii po izucheniyu pamyatnikov civilizacij drevnego i srednego Vostoka Vsesoyuznoj associacii vostokovedov [Scientific Notes of the Board for the Study of the Sites of Civilizations of the Ancient and Middle East of the All-Union Association of Orientalists]. M. : Nauka, 1989. Pp. 75–107. (*In Russ.*)

Arzhantseva I. A., Deopik D. V., Malashev V. Y. Zilgi — Early Alan Proto-City of the First Millenium AD on the Boundary between Steppe and Hill Country // Les Sites archéologiques en Crimée et au Caucase durant l'Antiquité tardive et le haut Moyen-Age. Leiden; Boston; Köln : Brill, 2000. Pp. 211–250.

Dzhanaev E. G. Otchet ob issledovanii Beslanskogo kurgannogo katakombnogo mogil'nika v Pravoberezhnom rajone Respubliki Severnaya Osetiya — Alaniya v 2011 g. (v zone stroitel'stva avtomagistrali M-29 «Kavkaz» na uchastke obhoda g. Beslan). Vladikavkaz, 2012 [Report on the Study of the Beslan Kurgan Catacomb Burial Ground in the Pravoberezhny District of the Republic of North Ossetia-Alania in 2011 (in the construction zone of the M-29 "Kavkaz" highway at the bypass section of the city of Beslan)]. Arhiv IA RAN. R. 1. №29675–29693. (*In Russ.*)

Dzutsev F. S., Malashev V. Yu. Beslanskij arheologicheskij kompleks rannealanskoj epohi (nekotorye itogi issledovanij 1988–2014 gg.) [The Beslan Archaeological Complex of the Early Alanian Time (some results of research in 1988–2014)]. Vladikavkaz : Proekt-Press, 2015. 112 p. (*In Russ.*)

Fassbinder J. W. E. Seeing Beneath the Farmland, Steppe and Desert Soil: Magnetic Prospecting and Soil Magnetism // Journal of Archaeological Science. 2015. Vol. 56. Pp. 85–95. DOI: 10.1016/j.jas.2015.02.023.

Fassbinder J. W. E. Magnetometry for Archaeology // Encyclopedia of Geoarchaeology, Encyclopedia of Earth Sciences Series. 2017. Pp. 499–514. DOI: 10.1007/978-1-4020-4409-0.

Fassbinder J. W. E., Stanjek H., Vali H. Occurrence of Magnetic Bacteria in Soil // Nature. 1990. Vol. 343 (6254). Pp. 161–163. DOI: 10.1038/343161a0.

Gabuev T. A., Malashev V. Yu. Pamyatniki rannih alan central'nyh rajonov Severnogo Kavkaza [The Sites of the Early Alanian Central Regions of the North Caucasus]. M. : TAUS, 2009. 468 p. (*In Russ.*)

Gavrituhin I. O. K voprosu o verhnej date gorodishcha Zilgi [On the Question of the Top Date of the Zilgi Settlement]. Tri chetverti veka. D. V. Deopiku — druz'ya i ucheniki [Three Quarters of a Century. D. V. Deopik — Friends and Students]. M. : Pamyatniki istoricheskoj mysli, 2007. Pp. 482–486. (*In Russ.*)

Kim M. G. Otchet o razvedkah v Respublike Severnaya Osetiya — Alaniya i v Chechenskoj Respublike v 2017 godu. T. V. Rostov-na-Donu, 2017 [Report in the Republic of North Ossetia-Alania and the Chechen Republic in 2017. Vol. V. Rostov-on-Don, 2017]. Arhiv IA RAN. R-1. № 56799 [Archive of the IA RAN. R-1. №56799]. (*In Russ.*)

Korobov D. S. Otchet ob arheologicheskoj razvedke na gorodishche Kievskoe v Mozdokskom rajone RSO — Alaniya v 2019 g. Moskva, 2020 [Report on Archaeological Exploration at the Kievskoe Settlement in the Mozdok District of the North Ossetia-Alania in 2019. Moscow, 2020]. Arhiv IA RAN. R-1, b/n. [Archive of the IA RAN. R-1]. (*In Russ.*)

Korobov D. S., Malashev V. Yu., Fassbinder J. Predvaritel'nye rezul'taty raskopok na kurgannom mogil'nike Levopodkumskij 1 bliz Kislovodska [Preliminary Results of the Excavations at the Levopodkumsky 1 Burial Mound near Kislovodsk]. KSIA. 2014. Issue 232. Pp. 120–135. (*In Russ.*)

Korobov D. S., Malashev V. Yu., Fassbinder J. Kompleksnoe issledovanie rannealanskih zahoronenij IV v. n.e. v Severnoj Osetii [A Comprehensive Study of the Early Alanian Burials of the 4th c. AD in North Ossetia]. KSIA. 2020. Issue 260. Pp. 441–458. DOI: 10.25681/IARAS.0130-2620.260.441-458 (*In Russ.*)

Kravtsova Yu. D. Istoriya izucheniya Zilginskogo gorodishcha v Respublike Severnaya Osetiya — Alaniya [History of the Study of the Zilgi Settlement in the Republic of North Ossetia — Alania]. XV Vserossijskaya arheologicheskaya konferenciya studentov i aspirantov «Problemy arheologii Vostochnoj Evropy» [XV All-Russian Archaeological Conference of Students and Postgraduates "Problems of Archaeology of Eastern Europe"]. Rostov-na-Donu ; Taganrog : Izd-vo Yuzhnogo federal'nogo universiteta, 2020. Pp. 200–205. (*In Russ.*)

Kuznetsov V. A. Zilginskoe gorodishche v Severnoj Osetii [The Zilgi Settlement in North Ossetia]. Novye materialy po arheologii Central'nogo Kavkaza [New Materials on the Archaeology of the Central Caucasus]. Ordzhonikidze : SONII IFE, 1986. Pp. 72–106. (*In Russ.*)

Malashev V. Yu., Albegova Z. H.-M., Men'shikova V. A., Gabuev T. A., Frizen (Kurinskih) O. I., Frizen S. Yu. Issledovaniya uchastka Beslanskogo mogil'nika v Respublike Severnaya Osetiya — Alaniya [Research into the site of the Beslan Burial Ground in the Republic of North Ossetia — Alania]. AO 2010–2013 gg. M. : IA RAN, 2015. Pp. 387–389. (*In Russ.*)

Malashev V. Yu., Magomedov R. G., Dzutsev F. S., Mamaev H. M., Kadzaeva Z. P. Ohranno-spasatel'nye issledovaniya mogil'nikov rannego etapa alanskoj kul'tury na Srednem Tereke Oktyabr'skij I i Kievskij I v Mozdokskom rajone Respubliki Severnaya Osetiya — Alaniya v 2019 g. [Rescue Research into the Burial Grounds of the Early Stage of the Alan Culture on the Middle Terek Oktyabrsky and Kievskiy in the Mozdok District of the Republic of North Ossetia — Alania in 2019]. Istoriya, arheologiya i etnografiya Kavkaza [History, Archaeology and Ethnography of the Caucasus]. 2020. Issue 16. №2. Pp. 439–460. (*In Russ.*) DOI: 10.32653/CH162439-460

Ramishvili R. M. Mogil'nik i poselenie v Ahali-Zhinvali po raskopkam 1971–1973 gg. [Burial Ground and Settlement in Akkhali-Zhinvali Based on the Excavations in 1971–1973]. Zhinvali. Arheologicheskie izyskaniya v Aragvskom ushchel'e [Zhinvali. Archaeological Research into the Aragvi Gorge]. Tbilisi : Mecniereba, 1983. Pp. 81–130. (*In Georgian*)

Shubert H. 3D-fotogrammetriya s primeneniem BPLA v processe arheologicheskogo issledovaniya [3D-photogrammetry using UAVs in the Process of Archaeological Research].

Vestnik Omskogo universiteta. Ser. Istoricheskie nauki [Bulletin of Omsk University. Series "Historical Sciences"]. 2016. №4 (12). Pp. 124–127. (*In Russ.*)

Zajtseva O. "3D revolyuciya" v arheologicheskoj fiksacii v rossijskoj perspective ["3D Revolution" in Archaeological Fixation in the Russian Perspective]. Sibirskie istoricheskie issledovaniya [Siberian Historical Research]. 2014. №4. Pp. 10–20. (*In Russ.*)

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Аржанцева И. А., Деопик Д. В. Зилги — городище начала I-го тысячелетия н. э. на стыке степи и предгорий в Северной Осетии // Ученые записки Комиссии по изучению памятников цивилизаций древнего и среднего Востока Всесоюзной ассоциации востоковедов. М. : Наука, 1989. С. 75–107.

Габуев Т. А., Малашев В. Ю. Памятники ранних алан центральных районов Северного Кавказа. М. : ТАУС, 2009. 468 с.

Гавритухин И. О. К вопросу о верхней дате городища Зилги // Три четверти века. Д. В. Деопику — друзья и ученики. М. : Памятники исторической мысли, 2007. С. 482–486.

Джанаев Э. Г. Отчет об исследовании Бесланского курганного катакомбного могильника в Правобережном районе Республики Северная Осетия — Алания в 2011 г. (в зоне строительства автомагистрали М-29 «Кавказ» на участке обхода г. Беслан). Владикавказ, 2012 // Архив ИА РАН. Р. 1. №29675–29693.

Дзуцев Ф. С., Малашев В. Ю. Бесланский археологический комплекс раннеаланской эпохи (некоторые итоги исследований 1988–2014 гг.). Владикавказ : Проект-Пресс, 2015. 112 с.

Зайцева О. «3D революция» в археологической фиксации в российской перспективе // Сибирские исторические исследования. 2014. № 4. С. 10–20.

Ким М. Г. Отчет о разведках в Республике Северная Осетия — Алания и в Чеченской Республике в 2017 году. Т. V. Ростов-на-Дону, 2017 // Архив ИА РАН. Р-1. №56799.

Коробов Д. С. Отчет об археологической разведке на городище Киевское в Моздокском районе РСО — Алания в 2019 г. М., 2020 // Архив ИА РАН. Р-1, б/н.

Коробов Д. С., Малашев В. Ю., Фассбиндер Й. Предварительные результаты раскопок на курганном могильнике Левоподкумский 1 близ Кисловодска // КСИА. 2014. Вып. 232. С. 120–135.

Коробов Д. С., Малашев В. Ю., Фассбиндер Й., Комплексное исследование раннеаланских захоронений IV в. н.э. в Северной Осетии // КСИА. 2020. Вып. 260. С. 441–458.

Кравцова Ю. Д. История изучения Зилгинского городища в республике Северная Осетия — Алания // XV Всероссийская археологическая конференция студентов и аспирантов «Проблемы археологии Восточной Европы». Ростов-на-Дону ; Таганрог : Изд-во Южного федерального университета, 2020. С. 200–205.

Кузнецов В. А. Зилгинское городище в Северной Осетии // Новые материалы по археологии Центрального Кавказа. Орджоникидзе : СОНИИ ИФЭ, 1986. С. 72–106.

Малашев В. Ю., Албегова З. Х.-М., Меньшикова В. А., Габуев Т. А., Фризен (Куринских) О. И., Фризен С. Ю. Исследования участка Бесланского могильника в Республике Северная Осетия — Алания // АО 2010–2013 гг. М. : ИА РАН, 2015. С. 387–389.

Малашев В. Ю., Магомедов Р. Г., Дзуцев Ф. С., Мамаев Х. М., Кадзаева З. П. Охранно-спасательные исследования могильников раннего этапа аланской культуры на Среднем Тереке Октябрьский I и Киевский I в Моздокском районе Республики Северная Осетия — Алания в 2019 г. // История, археология и этнография Кавказа. 2020. Т. 16. № 2. С. 439–460.

Рамишвили Р. М. Могильник и поселение в Ахали-Живнали по раскопкам 1971–1973 гг. // Живнали. Археологические изыскания в Арагвском ущелье. Тбилиси : Мецниереба, 1983. С. 81–130. (На груз. яз.).

Шуберт Х. 3Д-фотограмметрия с применением БПЛА в процессе археологического исследования // Вестник Омского университета. Сер. Исторические науки. 2016. № 4 (12). С. 124–127.

Arzhantseva I. A., Deopik D. V., Malashev V. Y. Zilgi — Early Alan Proto-City of the First Millenium AD on the boundary between Steppe and Hill Country // Les Sites archéologiques en Crimée et au Caucase durant l'Antiquité tardive et le haut Moyen-Age. Leiden; Boston; Köln : Brill, 2000. P. 211–250.

Fassbinder J. W. E. Magnetometry for Archaeology // Encyclopedia of Geoarchaeology, Encyclopedia of Earth Sciences Series. 2017. Pp. 499–514. DOI: 10.1007/978-1-4020-4409-0

Fassbinder J. W. E., Stanjek H., Vali H. Occurrence of Magnetic Bacteria in Soil // Nature. 1990. Vol. 343 (6254). Pp. 161–163. DOI: 10.1038/343161a0

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NEW DATA IN THE RESEARCH OF SETTLEMENTS OF THE SAKA TIME IN CENTRAL KAZAKHSTAN

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Abstract: The article is devoted to an overview of the results of new studies of the Saka era settlements discovered in the eastern regions of Central Kazakhstan. The source base of modern research was made up of over 70 settlements found over the past 20 years. The author attributes these settlements to the tasmola culture of Central Kazakhstan and dates them within the framework of the 8th — 5th centuries BC. Archaeozoological, traceological, and carpological analyzes are being carried out based on the materials from the excavations of the Kulzhan-1 and Abylai settlements and other sites carried out in recent years. According to the author, the settlements of Central Kazakhstan of the Saka era were the winter habitats of the tribes of the Tasmola culture. Materials from over 50 Kazakh wintering sites make it possible to draw ethnographic data. A comparative study of these sites has shown that the topography of the Kazakh wintering grounds and Saka settlements coincide.

Keywords: Central Kazakhstan, tasmola culture, Saka era, settlements, Kazakh wintering grounds, multidisciplinary research

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НОВЫЕ ДАННЫЕ В ИССЛЕДОВАНИИ ПОСЕЛЕНИЙ САКСКОГО ВРЕМЕНИ ЦЕНТРАЛЬНОГО КАЗАХСТАНА

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Резюме: Статья посвящена обзору результатов новых исследований поселений сакской эпохи, открытых в восточных районах Центрального Казахстана. Источниковую базу современных исследований составили свыше 70 поселений, найденных в течение последних 20 лет. Эти поселения автор относит к тасмолинской культуре Центрального Казахстана и датирует в рамках VIII–V вв. до н.э. По материалам раскопок поселений Кулжан-1 и Абылай и других памятников, проводимых в последние годы, выполняются археозоологический, трасологический, карпологический анализы. По мнению автора, поселения Центрального Казахстана сакской эпохи являлись местами зимнего обитания племен тасмолинской культуры. Материалы свыше 50 казахских зимовок позволяют привлечь данные по этнографии. Сравнительное изучение этих памятников показало, что топография казахских зимовок и сакских поселений совпадает.

Ключевые слова: Центральный Казахстан, тасмолинская культура, сакская эпоха, поселения, казахские зимовки, мультидисциплинарные исследования

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Introduction

Settlements of the Saka time in Kazakhstan are known in many regions, including Northern Kazakhstan, Zhetysu, Aral Sea region, Kazakh Altai [Levina, 1979; Khabdulina, 2003; Benecke, 2003; Chang et all., 2003; Merz, 2015; Beisenov, Shulga, Loman, 2017; Bazarbaeva, 2017; Duisenbai, Dzhumanazarov, Ahijarov, 2020; Samashev, 2020]. Also, the settlements on the territory of the Russian Federation: in Khakassia, the Southern Urals, in the steppe Altai are known [Amzarakov et al., 2015; Saveliev, 2015; Frolov, 2013; Stepanova, Frolov, 2017; Prishchepa, 2018]. Among the regions adjacent to Kazakhstan, materials on the settlements of the Saka time in Gorny Altai, collected and studied by the Siberian archaeologist P. I. Shulga, are of particular importance. In the monograph of this researcher, a large amount of data related to the existence of the Bike and Pazyryk cultures was analyzed and summarized [Shulga, 2015].

The proposed report provides an overview of new studies of Saka settlements in the eastern regions of Central Kazakhstan, as well as some of their results. In the region, the study of these sites is carried out almost continuously; in recent years, work has been focused on the settlements of Abylai and Kulzhan-1 (Fig. 1).

The first settlement of the Saka era in the eastern regions of Central Kazakhstan was found by the author in 2001. Thanks to intensive archaeological exploration, about 30 settlements were discovered in 2–3 years, and the first excavations began. At this time, a comprehensive study of excavation materials began, including ceramic and traceological analyzes [Beisenov, 2015], which continue up to this day. Recently begun archaeozoological studies bring important results. Grains of millet, barley, wheat, identified by flotation of

the cultural layer of the Abylai settlement, also open up certain prospects for studying the economy of the population (carpological analyzes are carried out by N. E. Ryabogina at the Tyumen Scientific Center of the Russian Academy of Sciences). A recent study of the diet of the Saka population of the era of Central Kazakhstan showed the presence of millet in their diet [Beisenov et al., 2020]. All these results characterize only the initial stage of a comprehensive study of settlements in Central Kazakhstan.

Fig. 1. Map of the location of the Kulzhan-1 and Abylai settlements
Рис. 1. Карта расположения поселений Кулжан-1 и Абылай

As of July 2021, over 70 Saka-era settlements are open in this region. The presence of a large number of settlements with absolutely identical features in topography and planigraphy makes it possible to study the issues of landscape placement of these sites. This task is posed for the first time in Central Kazakhstan. Data analysis and study of the problem of landscape placement are an important part of scientific work related to such a category of sites as settlements. These aspects have important points of contact with such scientific fields as landscape archaeology and ecological archaeology [Environmental Archeology, 2001; Reitz, Shackley, 2012; Handbook of Landscape…, 2016]. At the same time, these aspects are directly related to such a special direction as the Settlements archaeology, the recognized founder of which in Europe was the German archaeologist Werner Haarnagel [Behre K.-E., 1984; Haarnagel, 1961; 1979; 1983].

Speaking about the settlements of Saka of the era of Central Kazakhstan, we must proceed from the fact that we are dealing with both specific sites and specific tasks of their search and research. These settlements created human collectives, whose way of life was highly dependent on the natural and climatic conditions of each region.

For many decades, the settlement of the Saka era in Central Kazakhstan was completely unknown. In addition to some scientific skepticism, the problem was in the peculiarities of

the topography of these sites, located, as it turned out, on the banks of rivers, and the upper slopes of the mountains.

The importance of using ethnographic data in the search and study of Saka settlements should be noted [Shulga, 2015a; Beisenov, Shulga, Loman, 2017].

As of July 2021, a group led by the author found over 50 Kazakh winterings located in the same areas where the settlements are located. It turned out that the topography of the Kazakh winterings and Saka settlements coincides exactly, and this gives good opportunities for further searches.

Materials and Discussions

In recent years, the bulk of research has been focused on two sites — the settlements Abylai and Kulzhan-1. Excavations have been going on at Abylai for several years, while Kulzhan-1 is a new site that has been selected for new excavations. It is one of the settlements located around the Edirei Mountains. To date, 28 settlements have been discovered here, of which one, the settlement of Edirey-2, dates back to the Dongal period, and all the rest belong to the Saka era.

Fig. 2. Settlements on the slope of Keregetas mountain:1 — Kulzhan-1; 2 — Karpyk-1; 3 — Karpyk-2; 4 — Karpyk-3. The numbers show the elevation marks
Рис. 2. Поселения на склоне горы Керегетас: 1 — Кулжан-1; 2 — Карпык-1; 3 — Карпык-2; 4 — Карпык-3. Цифрами показаны отметки высот

The settlement of Kulzhan-1 is located 5.4 km southeast of the village of Edirey, on the eastern slope of Mount Keregetas. The location of the settlement is the upper slope (Fig. 2). There is a small natural depression oriented from the southwest to the northeast and formed by the micro-relief of the upper slope of the mountain. The depression is about 100 m long and 40–50 m wide. From the southern, southeastern, and northern sides, this depression is surrounded by small but visible hills. An ancient settlement was built in the area of this depression.

Thus, the people of Saka of time, when choosing a place for a settlement, paid attention to 3 very important conditions of topography:

1) the upper slope of the mountain;
2) east, south-east exposure;
3) comfortable micro-relief in the form of a slightly deepened depression surrounded by low hills.

This picture is clarified and expanded by the general nature of the "slope topography", the correct understanding of which facilitates the task of studying the problems of the landscape distribution of Saka settlements in the eastern part of the Kazakh Upland.

The fact is that the "upper slopes" of the mountains are not a narrow strip of land on which a settlement is located. As it is shown by numerous facts of the topography of Saka settlements, this type of landscape is a large area of slopes, which are divided into categories such as "upper", "middle" and "lower".

The entire eastern side of Mount Keregetas has such convenient slopes, on which the micro-relief, every 300–500 m, forms a system of small depressions, where settlements of ancient pastoralists are arranged. To the north of Kulzhan-1, at a short distance, there are three synchronous settlements — Karpyk-1, Karpyk-2, and Karpyk-3 (Fig. 2), to the south, there is another settlement — Kulzhan-2. Further north of Kulzhan-1 are the settlements of Keregetas-1, Keregetas-2 [Beisenov, Shulga, Loman, 2017], Keregetas-3.

If we count from the settlement of Kulzhan-1, after about 150 m to the east the relief passes to the "middle slope" and after another 200 m the "lower slopes" begin, which extend for hundreds of meters. At a distance of 1.1 km to the east from the settlement of Kulzhan-1, on the lower slope, there is the Zhake-Bulak spring.

The bottom of the depression, where the settlement of Kulzhan-1 is located, is flat but has a general depression from the southwest to the northeast. The height difference is about 10 m. For ancient people, this condition was also important, since the water flowing down from the mountain during the melting of snow and rains did not collect around the dwellings, but went down into the valley.

Ancient buildings in the form of dwellings and utility structures occupy an area over 80 m long and about 30 m wide. Thus, the settlement covers an area of more than 2000 m^2. The settlement area is heavily overgrown with grass and bushes. It turned out that dense grass up to 40 cm high hides ancient structures and does not allow us to find out the features of stone structures. Therefore, before the start of excavations, vegetation was removed on an area of about 3000 m^2.

After removing the vegetation, it turned out that the ancient settlement consists of two main sectors located in the southwest and northeast. The distance between them is 15 m.

For excavations, the first group of structures was selected, which occupies the southwestern part of the settlement. At the same time, attention was drawn to the central structure, which has a clear rectangular shape and dimensions of at least 7×8 m. Judging by the thick walls made up of large stones measuring from 0.3×0.4×0.2 m to 0.8×1.0×0.5 m, this structure looked like a residential building.

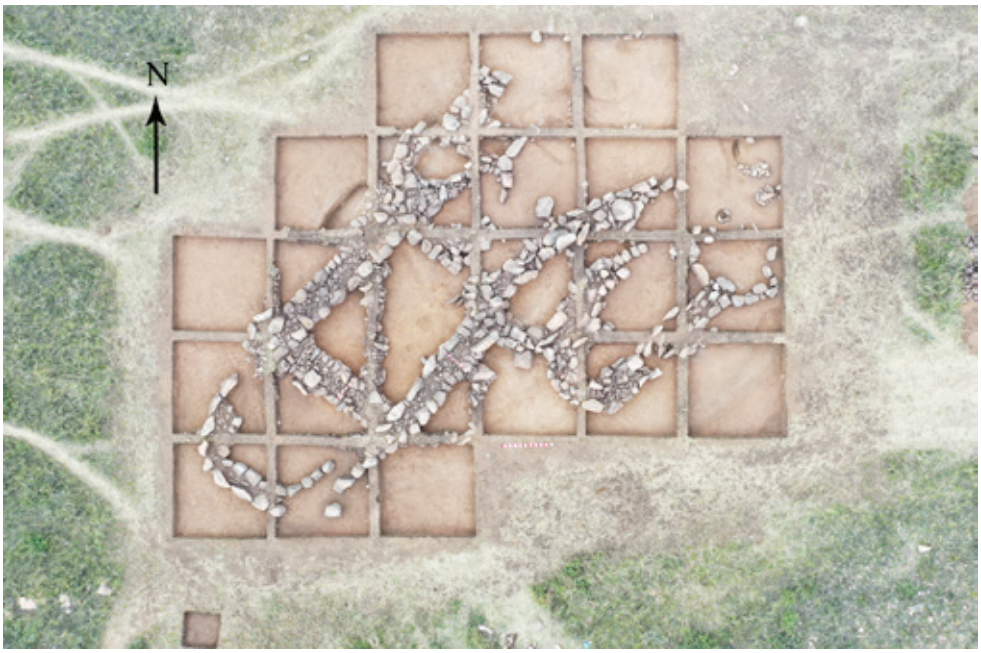

Fig. 3. Excavations on the settlements Kulzhan-1
Рис. 3. Раскопки на поселении Кулжан-1

It was on this group of structures that archaeological excavations were carried out in July 2021. An area of 368 m^2 was uncovered (Fig. 3). On the excavation area, 6 stone structures were revealed, animal bones, stone tools, and fragments of ceramics were found.

The two stone structures are located in a line from southwest to northeast and have the character of living quarters. Here is a rectangular structure with thick walls, which has a central position in relation to the entire excavated part of this settlement. The dimensions of this structure are 8×7.1 m. The internal space has dimensions of 5.4×4.2 m. The powerful walls are from 1.2–1.3 to 1.5 m wide. By the time of the excavation, the walls were preserved to a height of 0.7–0,8 m to 1 m. Judging by the numerous fallen stones, the wall was originally higher.

According to the materials of excavations of other settlements, the houses of the Saka tribes living in the eastern regions of the Kazakh Upland were squat, with thick walls. The interiors of such houses were not wide and had elongated and narrow proportions. This was due to the nature of the thick and massive roof, which consisted of wood and a layer of earth. It was difficult to cover large spaces of the interior with a heavy roof, which would require many supports, but narrow spans about 3–4 m long were easily covered with logs, the ends of which rested on the walls. The small size of the room was also dictated by the desire to save heat in the steppe regions, where there are no large reserves of wood fuel [Beisenov, Shulga, Loman, 2017]. The features of the dwelling space identified at Kulzhan-1 are close to previously obtained materials from the Saka settlements.

On the northeast side, this line of structures is adjoined by a second line, perpendicular to the first. Here, along a line from south-east to north-west, small rooms are located, which

played a secondary role in the rectangular living quarters. These are narrow, stretching from southwest to northeast and built parallel to each other. They all have common walls with each other. One of them is a narrow and small corridor for the entrance to the rectangular dwelling. The width of the corridor is about 1 m.

The stratigraphy is divided into 2 main layers. The first layer consists of sod, which is characterized by a large thickness. If in the southwestern part of the excavation the sod has a thickness of about 0.1–0.1 m, then in the southeast it reaches 0.15 m. Near the walls of the main structures, a sod thickness of up to 0.2 m is observed. Below the sod is the second layer of yellowish color, clay structure. The largest layer thickness is 0.25–0.28 m.

On the southeastern side of the excavation area, two fragments of a ditch were found, which has a width of 1.5–3 m and a depth of 0.2–0.25 m. Other parts of the ditch were outside the excavated area. The ditch was specially dug by the inhabitants of the settlement. It was oriented from the south-west to the north-east, that is, in the direction of the entire depression on which the ancient settlement is located. Apparently, this ditch completely bypasses this group of structures from the southern, southeastern, and eastern sides and served to drain melt and rainwater. Whether there is such a ditch on the northwest side of the structures remains unclear.

In the entire area of the excavation, a rectangular residential building occupies the highest position and the surface of the entire space around it has a decrease of 5–15 cm. Along with the natural features of this site, it is possible that the ancient inhabitants deliberately made such a decrease by removing the top layer of the earth. On the northeastern side of the excavation area, there are pits and elongated depressions, one of which is 0.45 m deep and 0.21 m wide. The end of this ditch is outside the excavated area. Two small hearths are also located in the northeastern part of the excavation site, from the side of the entrance.

Fig. 4. A pit with big stones
Рис. 4. Яма с большими камнями

On the outer side of the northwestern wall of the rectangular dwelling, there is a pit 3 m long, 1.1 m wide, and 0.7 m deep (Fig. 4). Stone tools, pottery fragments, and animal bones were found in the filling layer of the pit. The southeastern wall of the pit, which faces the wall of the dwelling, is filled with densely placed large stones. Perhaps this hole was specially dug to strengthen the wall of the dwelling, which began to sink in this area. In this case, large stones could serve as a support for the base of the wall of the dwelling. Hopefully, the purpose of these large stones will be clarified during the next excavations. The author plans to continue excavations of the Kulzhan-1 settlement and find answers to many more questions.

Fig. 5. Ceramics of the Kulzhan-1 settlement
Рис. 5. Керамика поселения Кулжан-1

Ceramic fragments (Fig. 5) from Kulzhan-1, as well as stone tools, are close to previously found materials from other settlements in the eastern regions of the Kazakh Upland. The flat-bottomed vessels were molded by hand; the ornament consists of pits and small rounded tubercles ("pearls"). Only a part of the vessels was decorated; some pots had plums in the upper part of the neck (Fig. 5.-*1*).

Fig. 6. Stone tools of Kulzhan-1 settlement
Рис. 6. Каменные орудия поселения Кулжан-1

The found over 200 stone tools (Fig. 6) are also close to the available materials. Among them, there are tools in the form of small hoes, cutting tools, graters, etc. Hoes from Kulzhan-1 have one interesting feature that was noticed in materials from other settlements. Trasologist I. V. Gorashchuk, as a result of a study of a group of stone tools from the Abylai settlement, noticed that along the longitudinal section, hoes are massive, with a triangular section, and thin. Hoes that have a triangular cross-section could be used on heavy soils, while hoes with plate cross-sections were intended for softer soils (materials in press). Among the hoes of Kulzhan-1, there are both of these types (Fig. 6.-*1, 2*).

In general, a preliminary study of the materials obtained from Kulzhan-1 shows the synchronicity of this site with the previously known settlements of the eastern regions of the Kazakh Upland. Excavations are to be continued, as well as a detailed study of new data, including multidisciplinary methods.

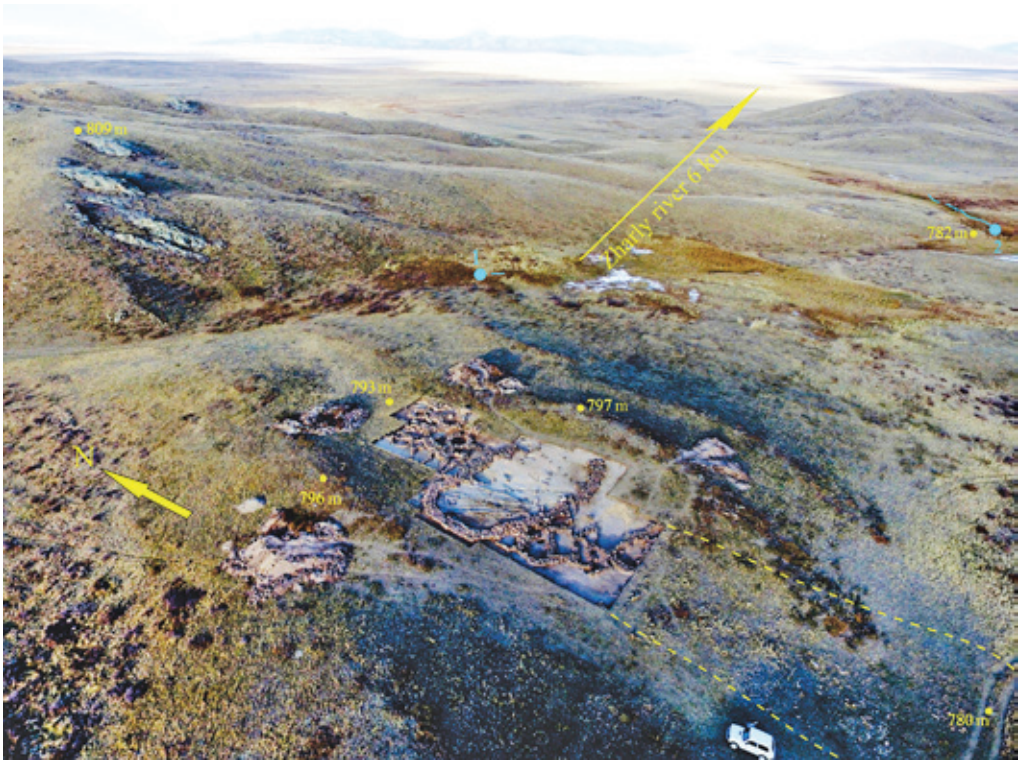

Fig. 7. Abylai settlement on the slope of Taskotan mountain. The numbers show the elevation marks
Рис. 7. Поселение Абылай на склоне горы Таскотан. Цифрами показаны отметки высот

The Abylai settlement was discovered by A. Z. Beisenov in 2004, excavations of the site began in 2016. Materials of previous years were partially introduced into scientific circulation in several publications, which considered the history of discovery, features of ceramics, the results of the first stage of archaeozoological research, and other data [Beisenov, 2021a; Beisenov et al., 2018; Beisenov et al., 2019; Kosintsev, Beisenov, 2020].

The Abylai settlement is located (Fig. 7) on the northeastern slope of Taskotan Mountain (absolute height 1005 m above sea level.). The settlement is located, like Kulzhan-1, on the upper slope, at the foot of the rocks. Here, too, a narrow and elongated from north to south depression, located between two low parallel ridges, was chosen for the development of housing and utility structures. This depression occupies a narrow and shallow pit, the bottom of which is soft and even, but has a general depression from north to south. The height difference is 13 m. There are two springs on the eastern side of the settlement. The first of them has dried up, the second, located below, has a current. On the eastern side of the settlement, we again see an extensive system of slopes, which gradually decrease and pass into the valley of the Zharly River.

To the north and northeast of the Tuskotan Mountain, a wide valley of the Zharly River opens. The distance from the settlement of Abylai to its channel is about 6 km. A detailed

survey of the banks of the Zharly River is still ahead, but the urgency of this task is obvious. On this river, there are two large irrigation ditches, built by the Kazakhs in the 19th century, with the help of which small arable lands for wheat and pasture meadows were irrigated. These ditches are mentioned in materials and archival documents of the 19th century, but they did not get into the works of historians and ethnographers. Valley of the Zharly River in the XX century intensively used for agricultural land. Nevertheless, the archaeological survey of the coasts remains relevant. The problem is that there can be found traces of the summer settlement sites of Saka time.

In 2016–2020. an area of over 1100 m^2 was excavated at the site. During five seasons of excavations at the Abylai settlement, numerous housing and economic structures have been identified, hundreds of fragments of ceramics, thousands of fragments of animal bones have been found. All materials are under research. In addition, excavations of this monument are planned to continue in 2021 and 2022.

In all regions where Saka settlements were discovered, these monuments are only partially studied. This circumstance affects the degree of the results obtained. We are dealing with specific settlements left by the steppe pastoralist tribes who led a semi-sedentary lifestyle. Important results can be achieved here with more complete studies of monuments of this category.

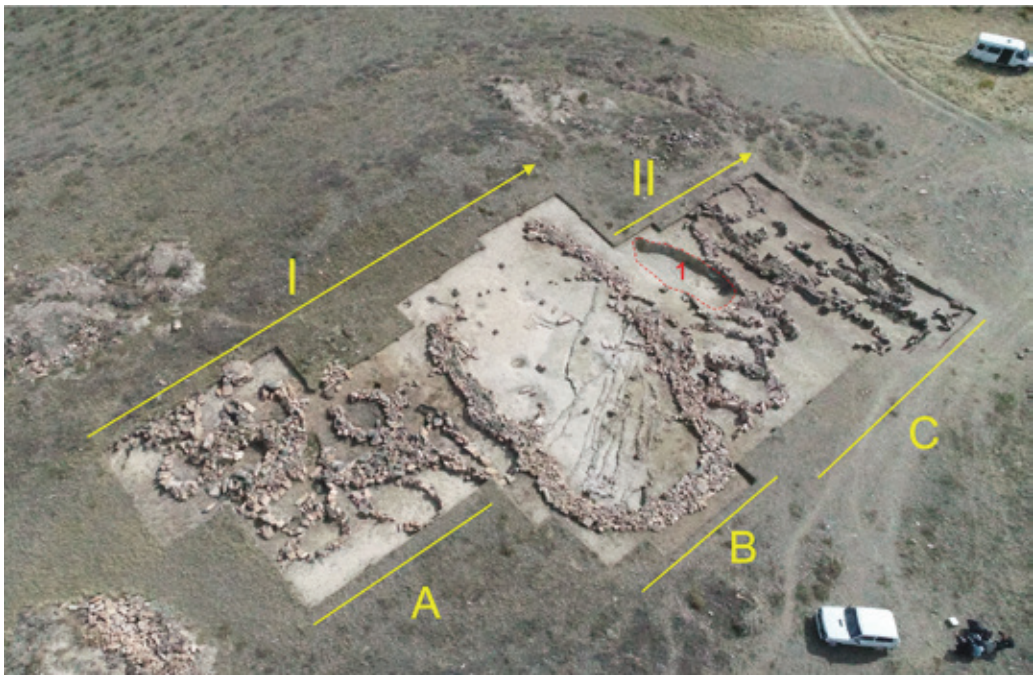

Fig. 8. Abylai settlement, excavations 2016–2019. I (A, B) – the first stage of development. II (C) – the second stage of development: 1 – a pit with animal bones
Рис. 8. Поселение Абылай, раскопки 2016–2019 гг. I (A, B) – первый этап застройки. II (C) – второй этап застройки: 1 – яма с костями животных

There are over 380 stone tools from the Abylai settlement. Of this number, 150 specimens were subjected to trace analysis (I. V. Gorashchuk, Samara, Russia). For 139 of them, functions were defined: it turned out that 130 guns were used in various types of work. According to the conclusion of the trasologist, tools for cultivating the land are in the first place — 57.3%, then tools for processing vegetation (24.5%), leatherworking (10.2%), for straightening metal products (whetstones, 8%). It is noteworthy that all whetstones bear traces of work with iron objects. At present, the results of the first stage of the traceological study of tools from Abylai are in print.

Excavations have shown that the Abylai settlement has two stages of development (Fig. 8). Judging by the excavation data, the development of the settlement proceeded from north to south. The first stage includes a group of small dwellings and outbuildings, an oval household structure, and a large pit with numerous animal bones (Fig. 8.-*1*). This pit was then backfilled and the second stage structures were built directly above it.

The excavation area 2016–2020 contained over 11,000 fragments of bones of domestic animals, which are now at the stage of archaeozoological research. In addition to such aspects as determining the composition of the herd, age categories, the most important were the results of determining the seasons of the slaughter of animals. Concerning the results of this work, 2 of the most interesting conclusions can be noted.

1) Over 5,000 bones have been found in the cultural layer of the settlement. Samples taken from these bones to determine the slaughter season showed that the animals were slaughtered during the period from late autumn to early spring. This conclusion proves that people lived in the settlement during the winter months. Thus, the previously expressed opinions about the winter character of the settlements [Beisenov, 2015] are confirmed by the results of archaeozoological studies.

2) In a large pit measuring 8×4 m, 0.7–0.9 m deep (Fig. 8.-*1*), over 6,000 bones of domestic animals were found. Samples taken from these bones showed that the animals died at the same time — during the early spring. According to the experts, this shows that in the settlement there was a fact of mass death of domestic animals due to hunger in the case of spring lack of food ("jute"in the ethnography of Kazakhs) or due to epizootics. These and other results carried out by a group of specialists led by P.A. Kosintsev are currently in print.

Pit No.4 from the excavations in 2019 is interesting. This pit is large (5.9×3.45×0.43–0.8 m) and is filled with ash soil. Only a small number of animal bones were found in it. It resembles the cesspools of ancient settlements. Along with this, it can be attributed to the type of catchment pits known from the ethnography of Kazakhs in the eastern regions of Central Kazakhstan. Such pits could be specially arranged in special areas of the settlement and serve for the drainage of rain and melt water. This was dictated by the conditions for the functioning of such settlements on the upper slopes, surrounded by rocky peaks. The streams of water flowing from them could create considerable problems for the inhabitants, as in ethnographic times. Similar pits filled with ash and ash-like soil, narrow ditches have already been encountered in previous excavations of the Edirei-3 settlements, excavation 2; Sarybuyrat; Abylai, excavation 1. Now you can add the settlement of Kulzhan-1 to them.

The burial of Korgantas time [Beisenov, 2017; Shulga, 2015b] discovered on the 2020 excavation area is already the second case for this settlement — the first was found in 2016

[Beisenov et al., 2018]. Such facts provide an additional and important basis for determining the upper date of settlements. The burials on the area of the Abylai settlement are not the first facts of identifying korgantas burials that cut through the layer of the Saka period. Earlier, one burial was opened at the areas of the settlements Kyzylsuir-2 and Shiderty-2. As it is stated above, these facts show that by the emergence of a new population group, by the 4th century. BC, the settlements of the tasmola culture were already abandoned. The new Korgantas burial once again brings the Abylai settlement closer to other previously studied sites of this category. If as the lower boundary of the date of the settlement of Abylai, like other settlements of Central Kazakhstan, take the period of the 8th — 7th centuries. BC, then the upper date should fit into the framework of the V century BC. Such a broad date for the settlement of the tasmola range is based on current evidence and clarification should be expected from future research.

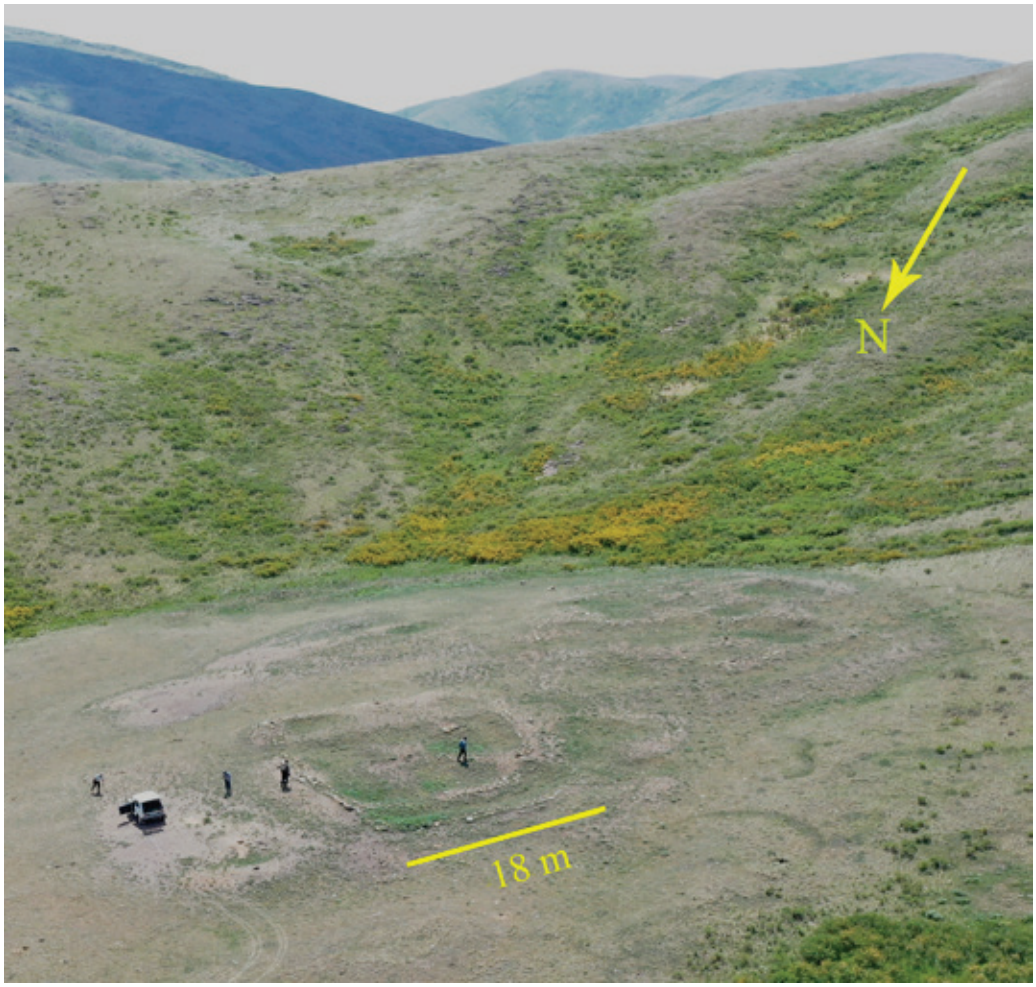

Fig. 9. Kazakh wintering Jibekschoky
Рис. 9. Казахская зимовка Жибекшокы

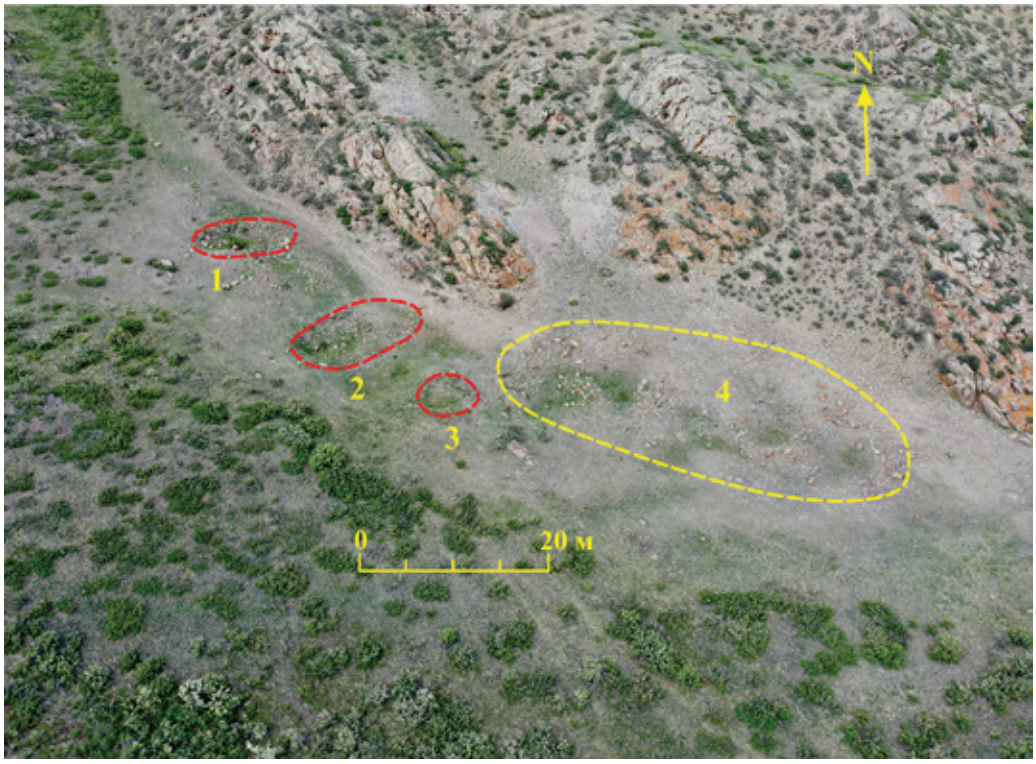

Fig. 10. Saka settlement and wintering of the Kazakh time on the slope of Ayrtas mountain: 1–3 — Kazakh dwellings; 4 — the area of the Saka settlement
Рис. 10. Сакское поселение и зимовка казахского времени на склоне горы Айыртас: 1–3 — казахские жилища; 4 — площадь сакского поселения

For ethnographic parallels, materials from 50 Kazakh wintering sites were used, which were found and examined by a group led by the author. All of them are located in the places where the Saka settlements are located. As already noted [Beisenov, 2021b], the topography of the Kazakh winterings and Saka settlements surprisingly coincide. Winterings are also located on the slopes of mountains and high hills (Fig. 9). It is well known from ethnography that Kazakh pastoralists chose winter places based on such practical considerations that there is not a lot of snow on the mountain slopes in winter, which is harmful especially for small livestock. On the slopes, which are blown by the wind, cattle graze in winter. In the spring, Kazakhs went to the plain, to the river banks.

In some cases, the wintering grounds of Kazakhs and Saka settlements are located in the same area, such as on the slope of Mount Ayrtas (Fig. 10). In addition, there are numerous facts of the discovery of stone tools from the Saka period in the areas of Kazakh wintering grounds (Fig. 11). Kazakhs of the eastern regions of Central Kazakhstan in the 19th century lived in cold and snowy winter, coupled, moreover, with frequent winds. The Saka tribes likely lived in the same natural and climatic conditions.

Fig. 11. Materials of Kazakh winterings: 1 — the remains of the walls of wintering Aznabai; 2–5 stone tools of the Saka era, wintering Aznabai; 6–11— stone tools of the Saka era, wintering Soltan
Рис. 11. Материалы казахских зимовок: 1 — остатки стен зимовки Азнабай; 2–5 — каменные орудия сакской эпохи на площади зимовки Азнабай; 6–11 — каменные орудия сакской эпохи на зимовке Солтан

Conclusion

Ceramics from the Saka settlements of Northern and Central Kazakhstan [Beisenov, Shulga, Loman, 2017] finds very close analogies in many adjacent regions. One of these regions is the Altai Territory (Russian Federation). First of all, we are talking about the ceramics of the Kulunda settlements [Frolov, 2013], which has important differences from the ceramics of the settlements of the Forest-Steppe Altai [Stepanova, Frolov, 2017] and Gorny Altai [Shulga, 2015a]. The early Saka appearance of the Kulunda sites does not raise any objections.

The author considers the settlements of the eastern regions of Central Kazakhstan studied at the present stage to be the wintering places of the population of the tasmola culture, which in the natural and climatic conditions of the eastern part of the Kazakh Uplands led a semi-settled way of life [Makhortykh, Ievlev, 1991]. This population had small winter camps assigned to individual communities, located in a system of hills.

One of the unexplored aspects is the lack of data on summer parking. Such places, according to some observations, should be expected at short distances from winter places, along river valleys.

Earlier, the author dated these settlements within the 7th–5th centuries BC. [Beisenov, 2015]. In any case, their date is within the entire period of the existence of the tasmola culture, within the 8th –5th centuries. BC [Arman Z Beisenov et all., 2016].

Fagan and DeCors wrote that "the settlements are not randomly distributed over the land" and "practical considerations lie behind their distribution" [Fagan, DeCors, 2007: 412]. Speaking about the "dynamic relationships" of settlements with the outside world, they also note that "some of them are almost impossible to discern without careful use of analogies with living communities" [Fagan, DeKors, 2007: 414]. In the study of Saka settlements, the use of ethnographic materials is a justified method. We do not know all the nuances of the natural and climatic conditions of Saka time [Frolov, 2016], except for general concepts. At the same time, the familiar conditions of life and everyday life of the Kazakh time can be used in scientific research on the Saka era.

The magnificent Saka gold of the Kazakh steppe cultures enchants archaeologists. Behind the glitter of this gold lies the life of an ancient people, many aspects of which remain little known to us [Beisenov, 2020].

REFERENCES

Amzarakov P. B., Kovaleva O. V., Lazaretov I. P., Polyakov A. V. Poselenie skifskogo vremeni Staraya Kop'-1 na vostochnoj okraine minusinskih stepej [Settlement of the Scythian Time Staraya Kop-1 on the Eastern Outskirts of the Minusinsk Steppes]. Zapiski Instituta istorii material'noj kul'tury [Notes of the Institute for the History of Material Culture]. 2015. № 12. S. 130–145. *(In Russ.)*

Arman Z. Beisenov, Svetlana V. Svyatko, Aibar E. Kassenalin, Kairat A. Zhambulatov, Daniyar Duisenbai and Paula J. Reimer. First Radiocarbon Chronology for the Early Iron Age Sites of Central Kazakhstan (Tasmola Culture and Korgantas Period). Radiocarbon. 58. 2016. Pp. 179–191. DOI:10.1017/RDC.2015.18.

Bazarbayeva G. A. Pamyatniki sakskogo vremeni Zhetysu [The Sites of the Saka Time Zhetysu]. Kazahstan v sakskuyu epohu [Kazakhstan in the Saka Era]. Almaty : Institut arheologii im. A.H. Margulana; NICIA «Begazy-Tasmola», 2017. S. 157–178 *(In Russ.)*

Beisenov A. Studies of the Saka Settlements in the East Part of Central Kazakhstan // Arheologiya Zapadnoj Sibiri i Altaya: opyt mezhdisciplinarnyh issledovanij [Archaeology of Western Siberia and Altai: Experience of Multi-Disciplinary Research]. Barnaul : Izd-vo Alt. un-ta, 2015. Pp. 289–293.

Beisenov A. Z. Korgantasskie pogrebeniya v Central'nom Kazahstane [Korgantas Burials in Central Kazakhstan]. Aktual'nye voprosi arheologii I etnologii Central'noj Azii [Actual Questions of Archaeology and Ethnology of Central Asia]. Ulan-Ude : Isd-vo BNC SO RAN, 2017. Pp. 103–108 *(In Russ.)*

Beisenov A. Z. Tasmola: A Ray of Gold, Glittering in the Steppe // Istoriya i arheologiya Turana [History and Archaeology of Turan]. 2020. №5. Pp. 138–162.

Beisenov A. Z. Raskopki poseleniya Abylaj (Rezul'taty issledovaniya "shlaka" iz kul'turnogo sloya) [Excavations of the Abylai Settlement (Results of the study of "slag" from the cultural layer)]. Drevnyaya i srednevekovaya kul'tura Central'noj Azii: preemstvennost' i transformaciya kul'tur [Ancient and Medieval Culture of Central Asia: Continuity and Transformation of Cultures]. Almaty : Kazak universiteti, 2021a. Pp. 63–68 *(In Russ.)*

Beisenov A. Z. Voprosy izucheniya i sohraneniya kazahskih zimovok [Issues of the Study and Preservation of Kazakh Winterings]. Sohraneniye i izucheniye kul'turnogo naslediya Altajskogo kraya [Preservation and Study of the Cultural Heritage of the Altai Territory]. Barnaul : Izd-vo Alt. un-ta, 2021b. Issue 27. Pp. 7–16. *(In Russ.)*

Beisenov A. Z., Gimranov D. O., Akhiyarov I. K., Duysenbay D. B. Poseleniye sakskogo vremeni Abylaj v Central'nom Kazahstane [Settlement of the Saka time Abylai in Central Kazakhstan]. Teoriya i praktika arheologicheskih issledovanij [Theory and Practice of Archaeological Research]. 2018. №2 (22). Pp. 150–171. *(In Russ.)*

Beisenov A. Z., Duysenbay D. B., Akhiyarov I. K., Dzhumanazarov N. Sh., Svyatko S. V. Issledovanie poseleniya i kurganov rannego zheleznogo veka v Central'nom Kazahstane [Study of the Settlement and Mounds of the Early Iron Age in Central Kazakhstan]. Polevye issledovaniya v Verhnem Priob'e, Priirtysh'e i na Altae (arheologiya, etnografiya, ustnaya istoriya i muzeevedenie) [Field Research in the Upper Ob, Irtysh and Altai (archaeology, ethnography, oral history and museology]. 2018 g. Issue 14. Barnaul : AltGPU, 2019. Pp. 4–17 *(In Russ.)*

Bejsenov A. Z., Shul'ga P. I., Loman V. G. Poseleniya sakskoj epohi [Settlements of the Saka Era]. Almaty : NICIA «Begazy-Tasmola», 2017. 208 p. *(In Russ.)*

Beisenov A. Z., Svyatko S. V., Duysenbay D. B., Akhiyarov I. K., Reimer P. J. New Isotopic Data on the Diet of the Saka Period Population from Central Kazakhstan. Povolzhskaya arheologiya [The Volga River Region Archaeology]. 2020. №3 (33). Pp. 208–218.

Benecke N. Iron Age Economy of the Inner Asian steppe. A Bioarchaeological Perspective from the Talgar Region in the Ili River Valley (Southeastern Kazakhstan). Eurasia Antiqua. 2003. №9. Pp. 63–84.

Behre K.-E. Abschied von Werner Haarnagel, dem Nestor der deutschen Marschen. Jahrbuch der Männer vom Morgenstern. 1984. 63. S. 259–263.

Benecke N. Iron Age Economy of the Inner Asian Steppe. A Bioarchaeological Perspective from the Talgar Region in the Ili River Valley (Southeastern Kazakhstan). Eurasia Antiqua. 2003. №9. Pp. 63–84.

Duysenbay D. B., Dzhumanazarov N. Sh., Akhiyarov I. K. Arheologicheskie issledovaniya na poselenii Balakungej-2 [Archaeological Research at the Balakungei-2 Settlement]. Margulanovskie chteniya — 2020: materialy Mezhdunarodnoj nauchno-prakticheskoj konferencii "Velikaya Step' v svete arheologicheskih i mezhdisciplinarnyh issledovanijy". Almaty, 17–18 sentyabrya 2020 g. T. 2 [Margulanovskie Readings-2020. Materials of the International Scientific-Practical Conference "The Great Steppe in the Light of Archaeological and Interdisciplinary Research". Almaty, September 17–18, 2020. Vol. 2]. Almaty : Institut arheologii im. A.H. Margulana, 2020. Pp. 223–232. *(In Russ.)*

Fagan B., DeKors K. Arkheologiya. V nachale. [Archaeology. At the Deginning]. M. : Tehnosfera, 2007. 592 p. *(In Russ.)*

Frolov Ya. V. Mesto kompleksov rannego zheleznogo veka Rublevskogo arheologicheskogo mikrorajona v krugu pamyatnikov ranneskifskogo i skifskogo vremeni Kulundy [The Place of the Complexes of the Early Iron Age of the Rublevsky Archaeological Microdistrict among the Sites of the Early Scythian and Scythian times of Kulunda]. Drevnosti Sibiri i Central'noj Azii [Antiquities of Siberia and Central Asia]. Gorno-Altajsk : GAGU, 2013. №5 (17). Pp. 45–57. *(In Russ.)*

Frolov Ya. V. Problemy izucheniya vliyaniya klimaticheskih izmenenij na dinamiku etnokul'turnyh processov na territorii yuga Ob'-Irtyshskogo mezhdurech'ya v I tys. do n.e. [Problems of Studying the Influence of Climatic Changes on the Dynamics of Ethnocultural Processes in the South of the Ob-Irtysh Interfluve in the 1st Millennium BC]. Izvestiya Altajskogo gosudarstvennogo universiteta [Bulletin of Altai State University]. 2016. № 4. Pp. 287–291. *(In Russ.)*

Chang C., Benecke N., Grigoriev F. P., Rosen A. M., Tourtellotte P. A. Iron Age Society and Chronology in South-east Kazakhstan. Antiquity. 2003. № 77. Pp. 298–312.

Environmental Archaeology: Meaning and Purpose. Albarella, U. (Ed.). Dordrecht, Boston; London : Kluwer Academic Publ., 2001. 336 p.

Handbook of Landscape Archaeology. Edited by David Bruno and Thomas Julian. Routledge, New York : Routledge, 2016. 719 p.

Haarnagel Werner. Die Marschen im deutschen Küstengebiet der Nordsee und ihre Besiedlung. In: Berichte zur deutschen Landeskunde, 1961. 27. S. 203–219.

Haarnagel Werner. Die Grabung Feddersen Wierde. Methode, Hausbau, Siedlungs und Wirtschaftsformen sowie Sozialstruktur. Wiesbaden. Nachrichten aus Niedersachsens Urgeschichte. 1979. 48. 364 s.

Haarnagel Werner. Das Handwerk im Verband der kaiserzeitlichen Marschensiedlung Feddersen Wierde. In: Herbert Jankuhn (Hrsg.), Das Handwerk in vor und frühgeschichtlicher Zeit, Abhandlungen der Akademie der Wissenschaften zu Göttingen, Phil.-Hist, Klasse. 1983. Folge 3, Nr. 123. S. 67–89.

Khabdulina M. K. Poseleniya rannesakskogo vremeni na r. Selety [Settlements of the Early Saka Time on the Seleti river]. Stepnaya civilizaciya Vostochnoj Evrazii. T. 1. Drevnie epohi [Steppe Civilization of Eastern Eurasia. Vol. 1. Ancient Epochs]. Astana : Kul Tegin, 2003. Pp. 189–214 *(In Russ.)*.

Kosintsev P. A., Beisenov A. Z. Loshad' iz poseleniya rannego zheleznogo veka Abylaj v Central'nom Kazahstane [A Horse from the Early Iron Age Settlement Abylai in Central

Kazakhstan]. Ekologiya drevnih i tradicionnyh obshchestv [Ecology of Ancient and Traditional Societies]. Tyumen' : Izd. TyumNC SO RAN, 2020. Issue 6. Pp. 179–182. *(In Russ.)*

Levina L. M. Poseleniya VII–V vv. do n.e. i "shlakovye" kurgany yuzhnyh rajonov Syrdar'inskoj del'ty [Settlements of the 7th — 5th Centuries BC. and "Slag" Mounds of the Southern Regions of the Syrdarya Delta]. Kochevniki na granicah Horezma [Nomads on the Borders of Khorezm]. M. : Nauka, 1979. THAEE. Vol. XI. Pp. 176–185. *(In Russ.)*

Makhortykh S. V., Iyevlev M. M. O putyah i vremeni formirovaniya rannekochevnicheskih obrazovanij na yuge Evropejskoj chasti SSSR v pozdnejshij predskifskij period [On the Ways and Time of Formation of Early Nomadic Formations in the South of the European Part of the USSR in the Late Pre-Scythian Period]. Drevnosti Severnogo Kavkaza i Prichernomor'ya [Antiquities of the North Caucasus and the Black Sea Region]. M. : Moskovskij arheologicheskij informacionnyj centr, 1991. Pp. 18–30. *(In Russ.)*

Merts V. K. Sistema adaptacii drevnih skotovodov v gornostepnoj zone Severnoj Evrazii i metody poiska ih poselenij [Adaptation System of Ancient Pastoralists in the Mountain-Steppe Zone of Northern Eurasia and Methods of Searching for their Settlements]. Arheologiya Zapadnoj Sibiri i Altaya: opyt mezhdisciplinarnyh issledovanij [Archaeology of Western Siberia and Altai: Experience of Interdisciplinary Research]. Barnaul : Izd-vo Alt. un-ta, 2015. Pp. 69–73. *(In Russ.)*

Prishchepa E. V. Problema rekonstrukcii zhilishch tagarskoj kul'tury hakassko-minusinskoj kotloviny [The Problem of Reconstruction of Dwellings of the Tagar Culture of the Khakass-Minusinsk Depression]. Vestnik Tomskogo gosudarstvennogo universiteta [Bulletin of the Tomsk State University]. 2018. №427. Pp. 153–163. *(In Russ.)*

Reitz E., Shackley M. Environmental Archaeology. New York : Springer US Publ., 2012. 554 s.

Samashev Z. Proizvodstvennyj centr rannih sakov v Kazahskom Altae (poselencheskij kompleks Akbauyr) [Early Sakov Production Center in the Kazakh Altai (settlement complex Akbauyre)]. Arheologiya Yuzhnoj Sibiri [Archeology of Southern Siberia]. 2020. Issue 28. Pp. 103–118. *(In Russ.)*

Savel'yev N. S. Rannesakskie poseleniya Yuzhnogo Zaural'ya [Early Saki Settlements of the Southern Trans-Urals] Sakskaya kul'tura Saryarki v kontekste izucheniya etnosociokul'turnyh processov Ctepnoj Evrazii [Saka Culture of Saryarka in the Context of Studying the Ethnosocial and Cultural Processes of the Eurasian Steppe]. Almaty : NICIA "Begazy-Tasmola", 2015. Pp. 246–254. *(In Russ.)*

Settlement Archaeology. Chang K. C. (ed.). Palo Alto, California : National Press Books, 1968. 229 p.

Stepanova N. F., Frolov Ya. V. Keramika s poselenij rannego zheleznogo veka Lesostepnogo Altaya [Ceramics from the Settlements of the Early Iron Age of the Forest-Steppe Altai]. Teoriya i praktika arheologicheskih issledovanij [Theory and Practice of Archaeological Research]. 2017. №1 (17). Pp. 71–85. *(In Russ.)*

Shul'ga P. I. Skotovody Gornogo Altaya v skifskoe vremya (po materialam poselenij) [Cattle Breeders of Gorny Altai in the Scythian Time (based on materials from settlements)]. Novosibirsk : NGU, 2015a. 336 p. *(In Russ.)*

Shul'ga P. I. O zahoroneniyah korgantasskogo tipa [About Burials of the Korgantas Type]. Sakskaya kul'tura Saryarki v kontekste izucheniya etnosociokul'turnyh processov stepnoj

Evrazii [Saka Culture of Saryarka in the Context of Studying the Ethnosocial and Cultural Processes of Eurasian Steppe]. Almaty : NICIA "Begazy-Tasmola", 2015b. Pp. 405–418. *(In Russ.)*

Wiseman James, Zachos Konstantinos. Landscape Archaeology in Southern Epirus, Greece. New York : American School of Classical Studies, 2003. 311 p.

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Амзараков П. Б., Ковалева О. В., Лазаретов И. П., Поляков А. В. Поселение скифского времени Старая Копь-1 на восточной окраине минусинских степей // Записки Института истории материальной культуры. 2015. № 12. С. 130–145.

Базарбаева Г. А. Памятники сакского времени Жетысу // Казахстан в сакскую эпоху. Алматы : Институт археологии им. А. Х. Маргулана; НИЦИА «Бегазы-Тасмола», 2017. С. 157–178.

Бейсенов А. З. Коргантасские погребения в Центральном Казахстане // Актуальные вопросы археологии и этнологии Центральной Азии. Улан-Удэ : Изд-во БНЦ СО РАН, 2017. С. 103–108.

Бейсенов А. З. Раскопки поселения Абылай (Результаты исследования «шлака» из культурного слоя) // Древняя и средневековая культура Центральной Азии: преемственность и трансформация культур. Алматы : Қазақ университеті, 2021a. С. 63–68.

Бейсенов А. З. Вопросы изучения и сохранения казахских зимовок // Сохранение и изучение культурного наследия Алтайского края. Барнаул : Изд-во Алт. ун-та, 2021b. Вып. XXVII. С. 7–16.

Бейсенов А. З., Гимранов Д. О., Ахияров И. К., Дуйсенбай Д. Б. Поселение сакского времени Абылай в Центральном Казахстане // Теория и практика археологических исследований. 2018. № 2 (22). С. 150–171.

Бейсенов А. З., Дуйсенбай Д. Б., Ахияров И. К., Джуманазаров Н. Ш., Святко С. В. Исследование поселения и курганов раннего железного века в Центральном Казахстане // Полевые исследования в Верхнем Приобье, Прииртышье и на Алтае (археология, этнография, устная история и музееведение). 2018 г. Вып. 14. Барнаул : АлтГПУ, 2019. С. 4–17.

Бейсенов А. З., Шульга П. И., Ломан В. Г. Поселения сакской эпохи. Алматы : НИЦИА «Бегазы-Тасмола», 2017. 208 с.

Дуйсенбай Д. Б., Джуманазаров Н. Ш., Ахияров И. К. Археологические исследования на поселении Балакунгей-2 // Маргулановские чтения — 2020: материалы Международной научно-практической конференции «Великая Степь в свете археологических и междисциплинарных исследований». Алматы, 17–18 сентября 2020 г. Т. 2. Алматы : Ин-т археологии им. А.Х. Маргулана, 2020. С. 223–232.

Косинцев П. А., Бейсенов А. З. Лошадь из поселения раннего железного века Абылай в Центральном Казахстане // Экология древних и традиционных обществ. Тюмень : Изд-во ТюмНЦ СО РАН, 2020. Вып. 6. С. 179–182.

Левина Л. М. Поселения VII–V вв. до н.э. и «шлаковые» курганы южных районов Сырдарьинской дельты // Кочевники на границах Хорезма. ТХАЭЭ. М. : Наука, 1979. Т. XI. С. 176–185.

Махортых С. В., Иевлев М. М. О путях и времени формирования раннекочевнических образований на юге Европейской части СССР в позднейший предскифский период // Древности Северного Кавказа и Причерноморья. М. : Московский археологический информационный центр, 1991. С. 18–30.

Мерц В. К. Система адаптации древних скотоводов в горностепной зоне Северной Евразии и методы поиска их поселений // Археология Западной Сибири и Алтая: опыт междисциплинарных исследований. Барнаул : Изд-во Алт. ун-та, 2015. С. 69–73.

Прищепа Е. В. Проблема реконструкции жилищ тагарской культуры хакасско-минусинской котловины // Вестник Томского государственного университета. 2018. № 427. С. 153–163.

Савельев Н. С. Раннесакские поселения Южного Зауралья // Сакская культура Сарыарки в контексте изучения этносоциокультурных процессов Степной Евразии. Алматы : НИЦИА «Бегазы-Тасмола», 2015. С. 246–254.

Самашев З. Производственный центр ранних саков в Казахском Алтае (поселенческий комплекс Акбауыр) // Археология Южной Сибири. 2020. Вып. 28. С. 103–118.

Степанова Н. Ф., Фролов Я. В. Керамика с поселений раннего железного века Лесостепного Алтая // Теория и практика археологических исследований. 2017. № 1 (17). С. 71–85.

Хабдулина М. К. Поселения раннесакского времени на р. Селеты // Степная цивилизация Восточной Евразии. Т. 1. Древние эпохи. Астана: Кул Тегин, 2003. С. 189–214.

Шульга П. И. Скотоводы Горного Алтая в скифское время (по материалам поселений). Новосибирск : НГУ, 2015a. 336 с.

Шульга П. И. О захоронениях коргантасского типа // Сакская культура Сарыарки в контексте изучения этносоциокультурных процессов степной Евразии. Алматы : НИЦИА «Бегазы-Тасмола», 2015b. С. 405–418.

Фаган Б., ДеКорс К. Археология. В начале. М. : Техносфера, 2007. 592 с.

Фролов Я. В. Место комплексов раннего железного века Рублевского археологического микрорайона в кругу памятников раннескифского и скифского времени Кулунды // Древности Сибири и Центральной Азии. Горно-Алтайск : ГАГУ, 2013. №5 (17). С. 45–57.

Фролов Я. В. Проблемы изучения влияния климатических изменений на динамику этнокультурных процессов на территории юга Обь-Иртышского междуречья в I тыс. до н.э. // Известия Алтайского государственного университета. 2016. №4. С. 287–291.

Arman Z. Beisenov, Svetlana V. Svyatko, Aibar E. Kassenalin, Kairat A. Zhambulatov, Daniyar Duisenbai and Paula J. Reimer. First Radiocarbon Chronology for the Early Iron Age Sites of Central Kazakhstan (Tasmola Culture and Korgantas Period). Radiocarbon. 58. 2016. Pp. 179–191. DOI:10.1017/RDC.2015.18.

Beisenov A. Studies of the Saka settlements in the East part of the Central Kazakhstan // Археология Западной Сибири и Алтая: опыт междисциплинарных исследований. Барнаул : Изд-во Алт. ун-та, 2015. Pp. 289–293.

Beisenov A. Z. Tasmola: A Ray of Gold, glittering in the Steppe // История и археология Турана. 2020. №5. С. 138–162.

Beisenov A. Z., Svyatko S. V., Duysenbay D. B., Akhiyarov I. K., Reimer P. J. New isotopic data on the diet of the Saka period population from Central Kazakhstan // Поволжская археология — The Volga River region archaeology. 2020. № 3 (33). Pp. 208–218.

Behre K.-E. Abschied von Werner Haarnagel, dem Nestor der deutschen Marschen. Jahrbuch der Männer vom Morgenstern. 1984. 63. S. 259–263.

Benecke N. Iron Age economy of the Inner Asian steppe. *A bioarchaeological perspective from the Talgar Region in the Ili River Valley* (Southeastern Kazakhstan) // Eurasia Antiqua. 2003. №9. Pp. 63–84.

Chang C., Benecke N., Grigoriev F. P., Rosen A. M., Tourtellotte P. A. Iron Age society and chronology in South-east Kazakhstan // Antiquity. 2003. №77. C. 298–312.

Environmental Archaeology: Meaning and Purpose. Albarella, U. (Ed.). Dordrecht, Boston; London : Kluwer Academic Publ., 2001. 336 p.

Handbook of Landscape Archaeology. Edited by David Bruno and Thomas Julian. Routledge, New York : Routledge, 2016. 719 p.

Haarnagel Werner. Die Marschen im deutschen Küstengebiet der Nordsee und ihre Besiedlung. In: Berichte zur deutschen Landeskunde, 1961. 27. S. 203–219.

Haarnagel Werner. Die Grabung Feddersen Wierde. Methode, Hausbau, Siedlungs und Wirtschaftsformen sowie Sozialstruktur. Wiesbaden: Nachrichten aus Niedersachsens Urgeschichte, 1979. 48. 364 s.

Haarnagel Werner. Das Handwerk im Verband der kaiserzeitlichen Marschensiedlung Feddersen Wierde. In: Herbert Jankuhn (Hrsg.), Das Handwerk in vor und frühgeschichtlicher Zeit, Abhandlungen der Akademie der Wissenschaften zu Göttingen, Phil.-Hist, Klasse. 1983. Folge 3, Nr. 123. S. 67–89.

Reitz E., Shackley M. Environmental Archaeology. New York : Springer US Publ., 2012. 554 s.

Settlement Archaeology. Chang K.C. (ed.). Palo Alto, California : National Press Books, 1968. 229 p.

Wiseman James, Zachos Konstantinos. Landscape Archaeology in Southern Epirus, Greece. New York : American School of Classical Studies, 2003. 311 p.

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EARLY METALLURGY OF EASTERN XINJIANG

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Abstract: This paper examines the form and chemical composition of metal artifacts of three successive cultures of the Hami region. The metal artifacts of the Tianshanbeilu culture are rather diverse in both type and material; body ornaments are dominant, whereas tools and weapons are quantitatively modest. The typological composition and the predominance of body ornaments made of tin bronze, pure copper, and arsenic copper are reminiscent of the Karasuk culture in the Minusinsk Basin and the Siba culture in the Hexi Corridor. Apart from the bulk metal types, there are gold, lead, and antimonial copper. The metal artifacts of the succeeding culture of Yanbulake are morphologically derived from Tianshanbeilu. In the subsequent Heigouliang culture, apart from old types of metal artifacts inherited from the Yanbulake culture, there are a number of new types of artifacts that are morphologically derived from nomadic cultures in the Eurasian steppe. In the cultures of Yanbulake and Heigouliang, the use of tin bronze, arsenic copper, and pure copper prevailed. The source of minerals, especially tin, which is used throughout the three successive cultures, awaits further investigation.

Keywords: Xinjiang, Bronze Age, Early Iron Age, metallurgy, Eurasia

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ДРЕВНЯЯ МЕТАЛЛУРГИЯ ВОСТОЧНОГО СИНЬЦЗЯНА

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Аннотация: В статье исследуются форма и химический состав металлических артефактов трех последовательных культур региона Хами. Металлические артефакты культуры Тяньшаньбэйлу весьма разнообразны как по типу, так и по материалу; украшения преобладают, а орудия труда и оружие немногочисленны. Такой типологический состав и преобладание украшений из оловянной бронзы, химически чистой меди и мышьяковистой меди напоминают Карасукскую культуру в Минусинской котловине и культуру Сыба в Ганьсуйском коридоре. Кроме основных металлов присутствуют золото, свинец и сурьмяная медь. Металлические артефакты последующей культуры Яньбулак морфологически происходят от Тяньшаньбэйлу. В последующей культуре Хэйгоулян, кроме старых типов металлических изделий, унаследованных от культуры Янбулак, существует ряд новых типов артефактов, которые морфологически происходят от кочевых культур евразийской степи. В культурах Янбулак и Хэйгоулян продолжается преобладание оловянной бронзы, мышьяковой меди и химически чистой меди. Источник минерального сырья, особенно олова, которое используется во всех трех последовательных культурах, еще ожидает исследования.

Ключевые слова: Синьцзян, бронзовый век, ранний железный век, металлургия, Евразия

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Introduction

Eastern Xinjiang, which is coterminous with the Hami region, is comprised of the eastern terminal of the Tianshan Mountains, flanked by the Hami Basin to the south and the Barkol Plain to the north. The limited moisture traveling far from the Atlantic Ocean is captured by the soaring peaks of Tianshan to produce lush forest and grassland in the northern foothill of the Tianshan Mountains and the Barkol plain. However, the Hami Basin, subject to scorching sunshine and meager precipitation, is a desert. Underground streams flowing from

the peaks of Tianshan give rise to a few oases in the Hami Basin, which become important stops on what is now known as the ancient Silk Road, connecting to the Turfan oasis to the west, and the Hexi Corridor to the east via a path through the Tianshan Mountains.

The curtain of modern archaeology in the Hami region was lifted in the 1920s when the Sino-Swedish Expedition investigated a number of prehistoric sites [Bergman, 1939; De Chardin and Young, 1933]. After 1949, archaeological survey was renewed in tandem with small-scale excavations [Chen and Zhang, 1999: 3]. For several decades, however, the excavation materials were dated within the chronological framework of Central China, thus, the painted pottery, characteristic of the prehistoric and early historic sites of this region, was erroneously taken to be contemporaneous with the Yangshao culture (4900–2900 BC) of the Neolithic Age. It is only since the 1980s when large-scale excavations were conducted at a number of prehistoric cemeteries and settlements that the painted pottery-producing sites were assigned to the Bronze Age and the Early Iron Age [Chen, 1987; Chen and Zhang, 1999: 5]. Although these sites have been excavated, the protracted publication of most of these excavated materials has significantly hindered research. Several scholars have reviewed the meager materials ever published [Han, 2007; Zhang, 2010; Guo, 2012: 42–57], but a preliminary chronology was established only recently [Zhang et al., 2016].

Between 1943 and 1256 BC, an assortment of exogenous metal artifacts, analogous to those of the Karasuk culture (1400–830 BC) in the Minusinsk Basin and the Machang (2250–1950 BC), Siba culture (2050–1530 BC) in the Hexi Corridor[1], emerged at the cemetery of Tianshanbeilu of the toponymic culture[2]. Painted pottery comparable with those of the Machang and Siba cultures was also found at the cemetery. It is surmised that a group of immigrants from the Hexi Corridor, who brought metallurgy and painted pottery to the Hami region, established this culture. What followed was the Yanbulake culture of 1300–900 BC with a collection of metal artifacts of largely the same types but stylistically altered and a type of painted pottery that is unprecedented in Hami or the surrounding regions. In the subsequent Heigouliang culture (900–200 BC), a new group of metal artifacts, mainly ornaments and horse harnesses of nomadic cultures from the Eurasian steppe, entered the Hami region to join the earlier repertoire. Once again, no stylistic precedents for the pottery wares have been found in Hami and the surrounding regions.

The form and composition of prehistoric metal artifacts of the Hami region have been examined by various scholars [Mei, 2000; Qian, 2006; Ling, 2008]. The origin and development of metallurgy during the three cultures have also been addressed [Zhang et al., 2016]. These studies, however, fail to provide an extensive study of the metal artifacts. In 2013, the authors examined a large portion of the metal artifacts stored in the Hami Museum and analyzed their composition with portable X-ray fluorescence. These artifacts were unearthed from several

[1] The dates of the Machang and Siba cultures are a combination of two AMS ^{14}C reports [Zhang, Zhang, Wang, Lu, Chen, Wang, 2015: 38–45; Yang, Zhang, Oldknow, Qiu, Chen, Li, Cui, Ren, Chen, Wang, Dong, 2019: 2045].

[2] In the recent years, 41 AMS ^{14}C dates were acquired to delineate the chronology of the Tianshanbeilu cemetery as 1943–931BC). Among the 706 tombs exposed at this cemetery, 490 were assigned with the aids of typological and stratigraphic data to four phases, 1943–1672BC, 1660–1408BC, 1385–1256BC, and 1214–1029BC [Tong et al., 2020: 8–9]. Phase IV, as indicated in a previous study of the authors, is assignable to the Yanbulake culture [Zhang et al., 2016: 7].

major cemeteries that are representative of the three cultures, but the study below is far from exhaustive. A good number of better-looking artifacts, however, had been taken to Urumqi to be displayed in the galleries of the Xinjiang Museum and the Xinjiang Institute of Cultural Relics and Archaeology, and were not available for study. The extant collection in the Hami Museum can still be considered, however, a good representation of the complete collection. This paper will characterize the metal artifacts of the Hami region diachronically based on the acquired morphological and compositional data.

The Tianshanbeilu Culture

To the Tianshanbeilu culture can be ascribed only the toponymic cemetery near the Hami city (Fig. 1). During the expansion of the city from 1987 to 1997, 706 graves were exposed at this cemetery. The graves are densely placed, occasionally cutting into each other. These are simple pit graves with single interments and comparatively rich funeral goods, including a ceramic pot and an array of metal artifacts, bone objects, pearls, and cowrie shells. Some of the graves are lined with mud bricks of 1–2 m long and 0.6–1 m wide. The painted pottery from this cemetery is extremely reminiscent of the Machang and Siba cultures in the western Hexi Corridor. An abundance of metal artifacts was uncovered; the majority is presently kept in the Hami Museum. There is no precise count so far but in 2013, the authors examined 1355 items. To this date, the excavation report of this important cemetery has not been published. Only two batches of them, 32 and 36 items respectively, have been published [Institute of History…, 2001: 80; Lü, Chang, Wang, 2001: 182–183]. The metal artifacts of the Tianshanbeilu cemetery, typologically speaking, are highly diverse.

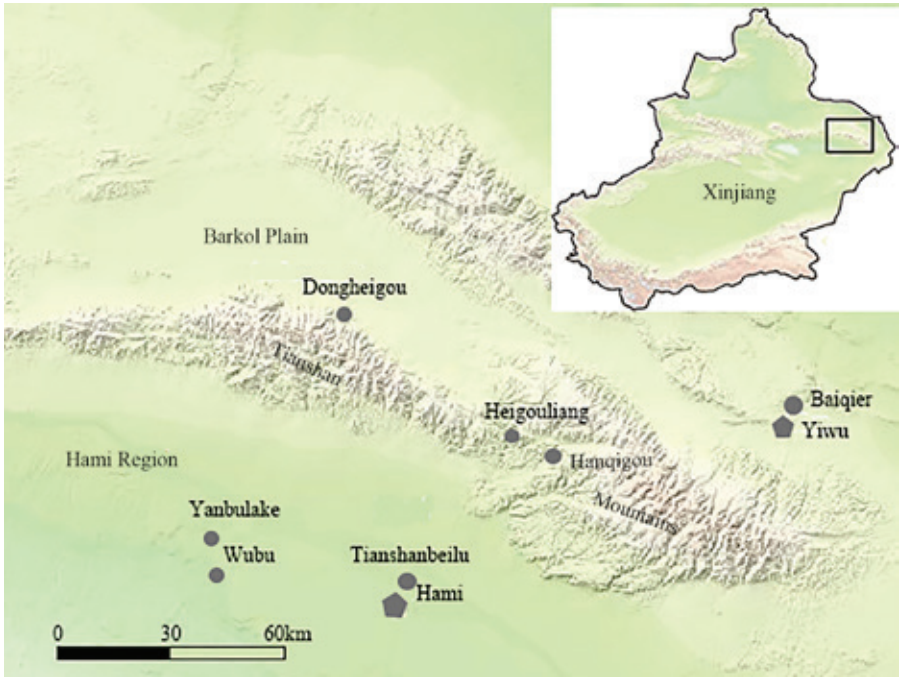

Fig. 1. Locations of the prehistoric sites
Рис. 1. Расположение доисторических памятников

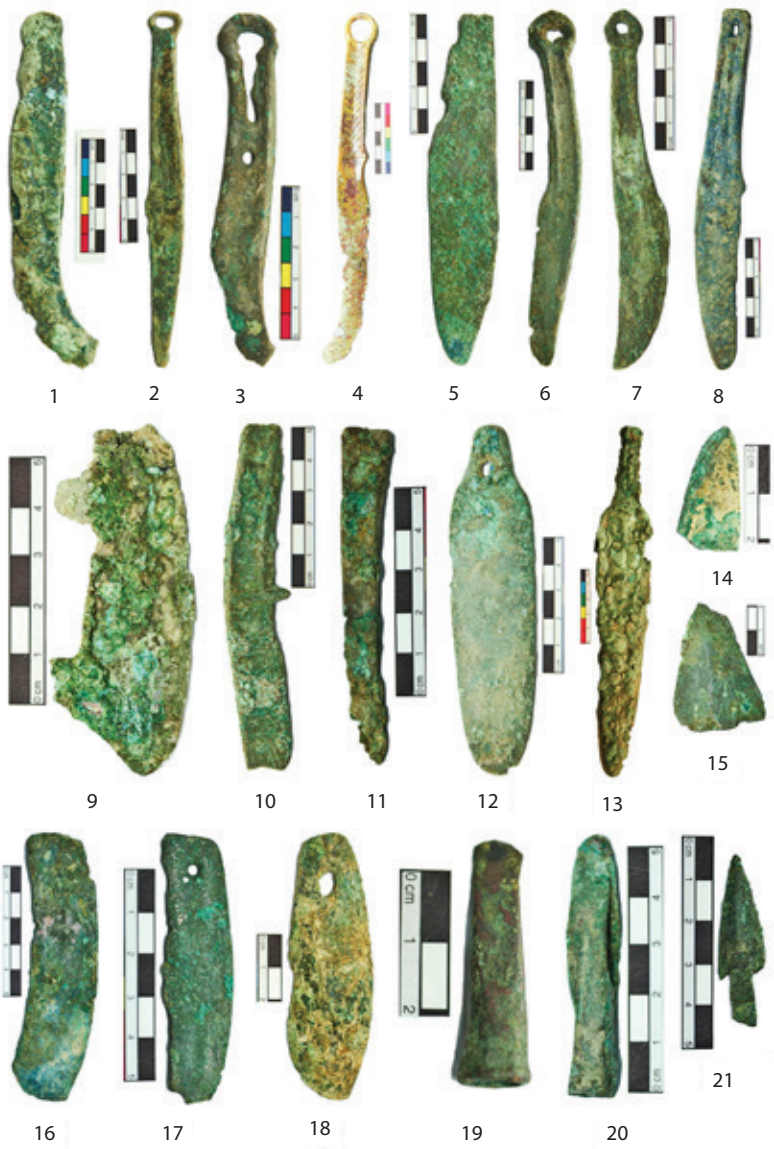

Fig. 2. Metal artifacts of the Tianshanbeilu culture (I): 1–11 – knives; 12–14, daggers; 15 – spearhead; 16–18 – sickles; 19 – chisel; 20–21 – arrowheads. 1. M14: 2; 2. M66; 3. M144: 3; 4. M146: 2; 5. M319: 1; 6. M341: 22; 7. M649: 2; 8. M383: 4; 9. M375: 9; 10. M635: 1; 11. M145: 10; 12. M384; 13. M626: 2b; 14. M43: 9; 15. M101: 5; 16. M270; 17. M287: 4; 18. M340: 5; 19. M341: 13; 20. M307: 15; 21. M71: 15

Рис. 2. Металлические изделия культуры Тяньшаньбэйлу (I): 1–11 – ножи; 12–14 – кинжалы; 15 – наконечник копья; 16–18 – серпы; 19 – долото; 20–21 – наконечники стрел. 1. M14: 2; 2. M66; 3. M144: 3; 4. M146: 2; 5. M319: 1; 6. M341: 22; 7. M649: 2; 8. M383: 4; 9. M375: 9; 10. M635: 1; 11. M145: 10; 12. M384; 13. M626: 2b; 14. M43: 9; 15. M101: 5; 16. M270; 17. M287: 4; 18. M340: 5; 19. M341: 13; 20. M307: 15; 21. M71: 15

Knives. 67 items. Only in one grave three items were found; in all other graves, only one item was uncovered. Most of these items are fragments; only a few pieces are intact. Of the intact ones, the smallest one is 11.5 cm long and 1.8 cm wide, and the largest one is 25.3 cm long and 2.1 cm wide. Only three items were uncovered from known context: at the right femur (M215: 5), at the pelvis (M312: 5), and at the waist (M441: 3)[1].

Long-blade knives. 49 items. They have long and thin blades but short hilts. All except for three are made of copper-based metals. The blades, as in the examples of M14:2, M319:1, and M145: 10, have a triangular cross section and are curved inward in the middle but bending outward at the tip (Fig. 2.-*1, 5, 11*).

Short-blade knives. 17 items. They have short and up-curving blades but long hilts with a center groove. As in the examples of M66, M144: 3, M341: 22, M649: 2, 383: 4 and M635: 1, they are sometimes equipped with cross bars and often topped with ring pommels (Fig. 2.-*2, 3, 6–8, 10*).

Double-hump knife. 1 item (M375: 9). It is a fragment of 7.1 cm long and 2.2 cm wide (Fig. 2.-*9*).

Celt. 1 item (stray find). It has a slender shaft extending toward a fan-like edge, with a half-moon-like opening. It measures 4.8 cm long (Fig. 8.-*4*).

Fig. 8. Metal artifacts of the Tianshanbeilu culture (VII): 1–3 — beads; 4 — celt. 1. M125: 35; 2. M125: 27/2; 3. M194: 4; 4 — stray find
Рис. 8. Металлические изделия культуры Тяньшаньбэйлу (VII): 1–3 — бусы; 4 — кельт. 1. M125: 35; 2. M125: 27/2; 3. M194: 4; 4 — случайная находка

[1] All the placements and quantities of metal artifacts in this paper are taken from the label tags written by the excavators.

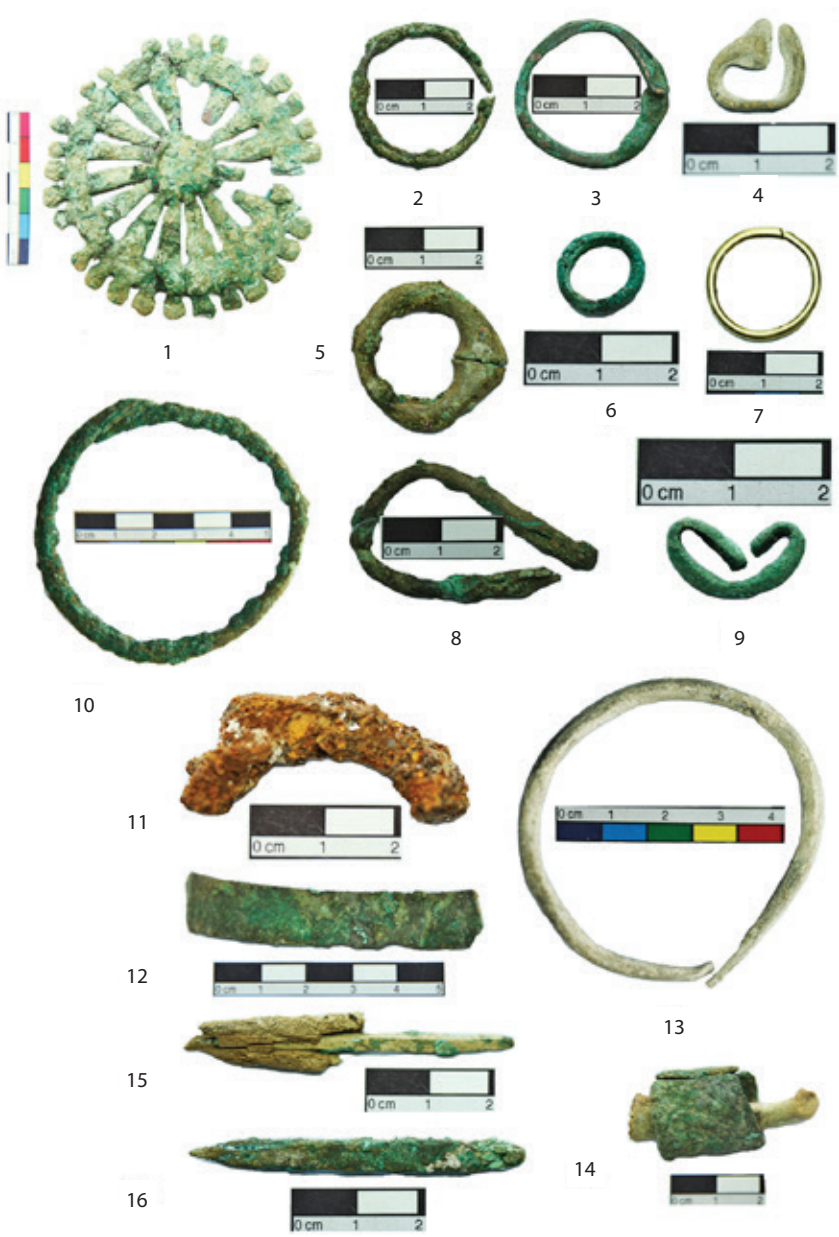

Fig. 6. Metal artifacts of the Tianshanbeilu culture (V): 1 – plaque; 2–9 – earrings; 10–13 – bracelets; 14 – fingering; 15–16 – awls. 1. M685: 1; 2. M2: 2; 3. M19: 1; 4. M261: 2; 5. M625: 1; 6. M7: 3; 7. M446: 2; 8. M670: 4; 9. M91: 2; 10. M5: 3; 11. M21: 3; 12. M298: 2; 13. M38: 3; 14. M542: 3; 15. M20: 13; 16. M92: 2

Рис. 6. Металлические изделия культуры Тяньшаньбэйлу (V): 1 – бляха; 2–9 – серьги; 10–13 – браслеты; 14 – кольцо (на палец); 15–16 – шилья. 1. M685: 1; 2. M2: 2; 3. M19: 1; 4. M261: 2; 5. M625: 1; 6. M7: 3; 7. M446: 2; 8. M670: 4; 9. M91: 2; 10. M5: 3; 11. M21: 3; 12. M298: 2; 13. M38: 3; 14. M542: 3; 15. M20: 13; 16. M92: 2

Sickles. 3 items. No handle. One (M270) is curved, 10.3 cm long and 2.6 cm wide (Fig. 2.-*16*). The other two (M287: 4, M340: 5) feature a curved blade and a hole at one end (Fig. 2.-*17, 18*).

Chisels. 2 items. The handle is absent on one (M330: 8), 6.1 cm long and 1.8 cm wide. The other (M341: 13), which was found at the right knee of the deceased, has a hollow shaft, 3.4 cm long and 1 cm in diameter (Fig. 2.-*19*).

Awls. 58 items. Made of iron, copper, or copper alloys, they are 1–16.3 cm long, 0.1–0.8 cm thick, and vary in quality (Fig. 6.-*15, 16*). They were found under the tibia, near the femur, the pelvis, the right face, and near the shoulder.

Daggers. 3 items. One (M43: 9) is the tip of a dagger (Fig. 2.-*14*). Another (M384) is an intact one that has a willow-shaped blade and a short hilt with a hole, 12.9 cm long and 3.1 cm wide (Fig. 2.-*12*). The third dagger (M626: 2b) also features a willow-shaped blade and three ribs, 23.6 cm long (Fig. 2.-*13*).

Spearhead. 1 item (M101: 5). Only the tip is preserved. With outstanding ribs in the middle, it is 5.2 cm long and 3.7 cm wide (Fig. 2.-*15*).

Arrowheads. 13 items. 12 of them are willow-leaf-shaped with hollow shafts. The longest one (M307: 15) is 5.3 cm long (Fig. 2.-*20*). A shorter one (M71: 15) has a hilt with a rectangular cross section, 4 cm long and 1.1 cm wide (Fig. 2.-*21*).

Bosses. 235 items. They are diverse in form and varied in size. In a given grave anywhere between 1 and 14 items could be found. Those discovered in context were found at the skull, shoulder, chest, arm, or leg. At times, they were used to cover the eyes of the occupants. For example, in Grave M53, it is placed on the left eye of the occupant. In Grave M311, it is on the right eye; the one placed on the left eye had slid off prior to excavation. In Grave M312, it is on the left eye. In Grave 483, they are on both eyes; and in Grave M552, on the right eye.

Disc bosses. Flat disc or semi-spherical, varying in thickness, sometimes with 1–4 holes for fastening, sometimes without them. 207 items. Their diameters vary from 1.6 cm to 9.2 cm. Some of them, as in the example of M40: 3, have a ring of holes or short lines on the perimeter (Fig. 3.-*1*).

Cocoon bosses. 2 items. As in the example of M400: 26, they are incomplete and small, varying from 1.2 cm to 1.5 cm (Fig. 3.-*7*).

Triangular bosses. 2 items. One (M17: 11) was originally placed upon a wooden object, 1.1 cm long. The other (M79: 6) has a hole at the center, 2 cm in diameter (Fig. 3.-*3*).

Fan boss. 1 item (M305: 5). It has a hole on the edge, 2.9 cm long and 2.3 cm wide (Fig. 3.-*5*).

Almond bosses. 10 items. Some of them, as in the example of M280: 7, have two or three holes for securing (Fig. 3.-*4*). One of them (M593: 6) is decorated with sunrays on the border. Their long diameter varies from 1.9 cm to 5 cm.

Irregular bosses. 5 items. Made of scrap bronze, finished with 1–2 holes. As in the example of M361: 9, they are 2.1–3.8 cm long (Fig. 3.-*6*).

Horn boss. 1 item (M683: 9). It has two horns and one hole at the center, 7.4 cm apart between the horns (Fig. 3.-*8*).

Semispherical boss. 1 item (M311: 14). It has two holes at the center and a diameter of 7.6 cm (Fig. 3.-*2*).

Conical boss. 1 item (M321: 3). It has a hole at the center and a diameter of 2 cm (Fig. 7.-*7*).

Fig. 3. Metal artifacts of the Tianshanbeilu culture (II): 1–8 — bosses; 9–11 — buttons. 1. M40: 3; 2. M311: 14; 3. M79: 6; 4. M280: 7; 5. M305: 5; 6. M361: 9; 7. M400: 26; 8. M683: 9; 9. M2: 6; 10. M15: 4; 11. M150: 3b

Рис. 3. Металлические изделия культуры Тяньшаньбэйлу (II): 1–8 — бляхи; 9–11 — пуговицы. 1. M40: 3; 2. M311: 14; 3. M79: 6; 4. M280: 7; 5. M305: 5; 6. M361: 9; 7. M400: 26; 8. M683: 9; 9. M2: 6; 10. M15: 4; 11. M150: 3b

Fig. 7. Metal artifacts of the Tianshanbeilu culture (VI): 1–2 – jingle bells; 3–7 – caps; 8 – imitation cowrie; 9 – clip; 10–12 – tubes; 13–14 – spiral tubes; 15 – spatula; 16 – beads. 1. M54: 5; 2. M10: 10; 3. M73: 10; 4. M78: 1; 5. M307: 14; 6. M460: 4; 7. M11: 6; 8. M363: 4; 9. M16: 5; 10. M1: 5; 11. M65: 4; 12. M349: 10; 13. M154: 2; 14. M597: 3; 15. M84: 4; 16. M48: 4

Рис. 7. Металлические изделия культуры Тяньшаньбэйлу (VI): 1–2 – колокольчики; 3–7 – колпачки; 8 – имитация каури; 9 – зажим; 10–12 – трубки; 13–14 – спиральные трубки; 15 – лопатка; 16 – бусы. 1. M54: 5; 2. M10: 10; 3. M73: 10; 4. M78: 1; 5. M307: 14; 6. M460: 4; 7. M11: 6; 8. M363: 4; 9. M16: 5; 10. M1: 5; 11. M65: 4; 12. M349: 10; 13. M154: 2; 14. M597: 3; 15. M84: 4; 16. M48: 4

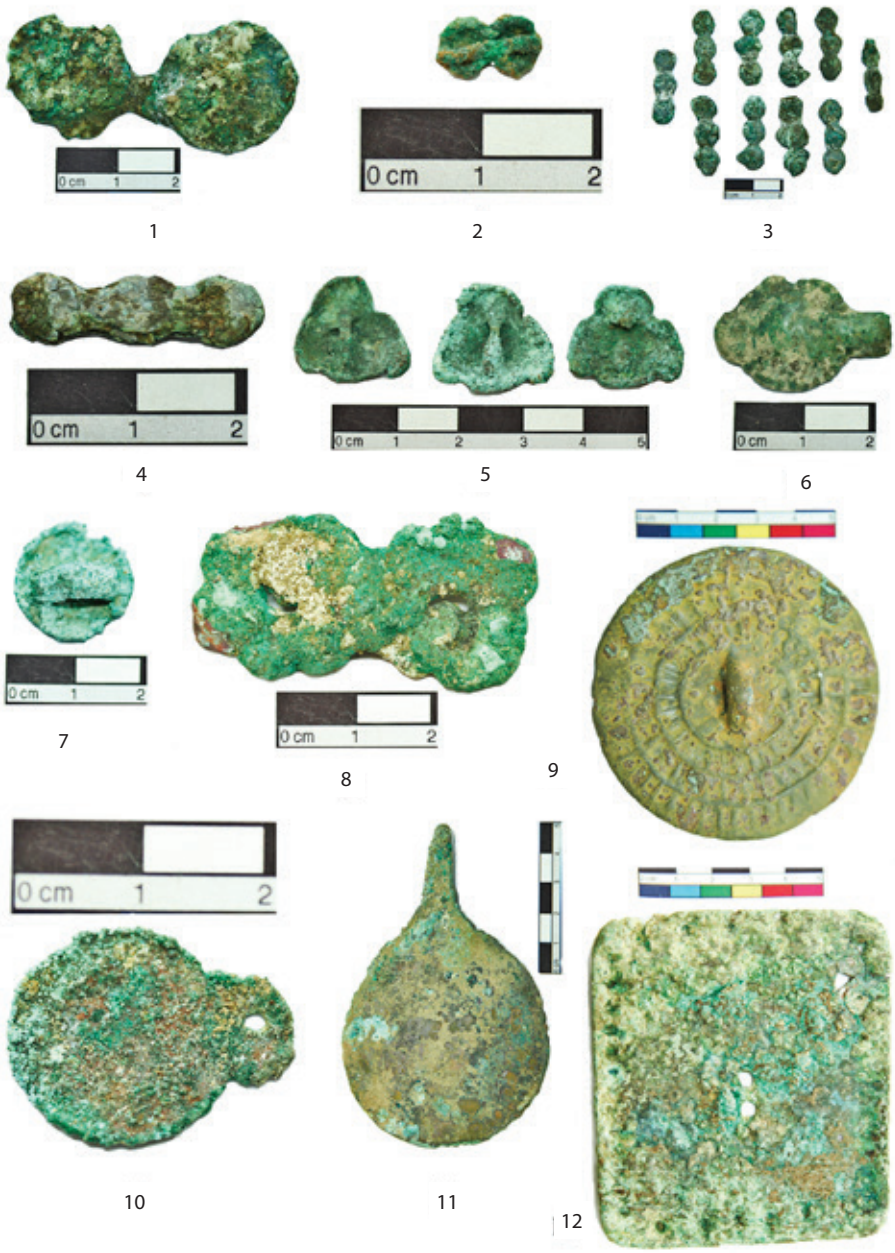

Fig. 4. Metal artifacts of the Tishanbeilu culture (III): 1–7 – buttons; 8, 12 – plaques; 9–11 – mirrors. 1. M15: 15; 2. M17: 16; 3. M126: 5; 4. M112: 3; 5. M50: 8; 6. M386: 1; 7. M25; 8. M3: 2; 9. M15: 13; 10. M91: 6; 11. M36: 2; 12. M400: 8

Рис. 4. Металлические изделия культуры Тяньшаньбэйлу (III): 1–7 – пуговицы; 8, 12 – бляшки; 9–11 – зеркала. 1. M15: 15; 2. M17: 16; 3. M126: 5; 4. M112: 3; 5. M50: 8; 6. M386: 1; 7. M25; 8. M3: 2; 9. M15: 13; 10. M91: 6; 11. M36: 2; 12. M400: 8

Plaques. 86 items. They are rather diverse in form, including S-shaped, rectangular, butterfly-shaped, and hoof-shaped. They are found in different quantities and in various positions, including the upper body, shoulder, waist, fibula, skull, under the elbow, hipbone, tibia, knee, right arm, and the leg of the occupants.

S plaque. 1 item (M3: 2). It is 4.3 cm long and 2.2 cm wide (Fig. 4.-*8*).

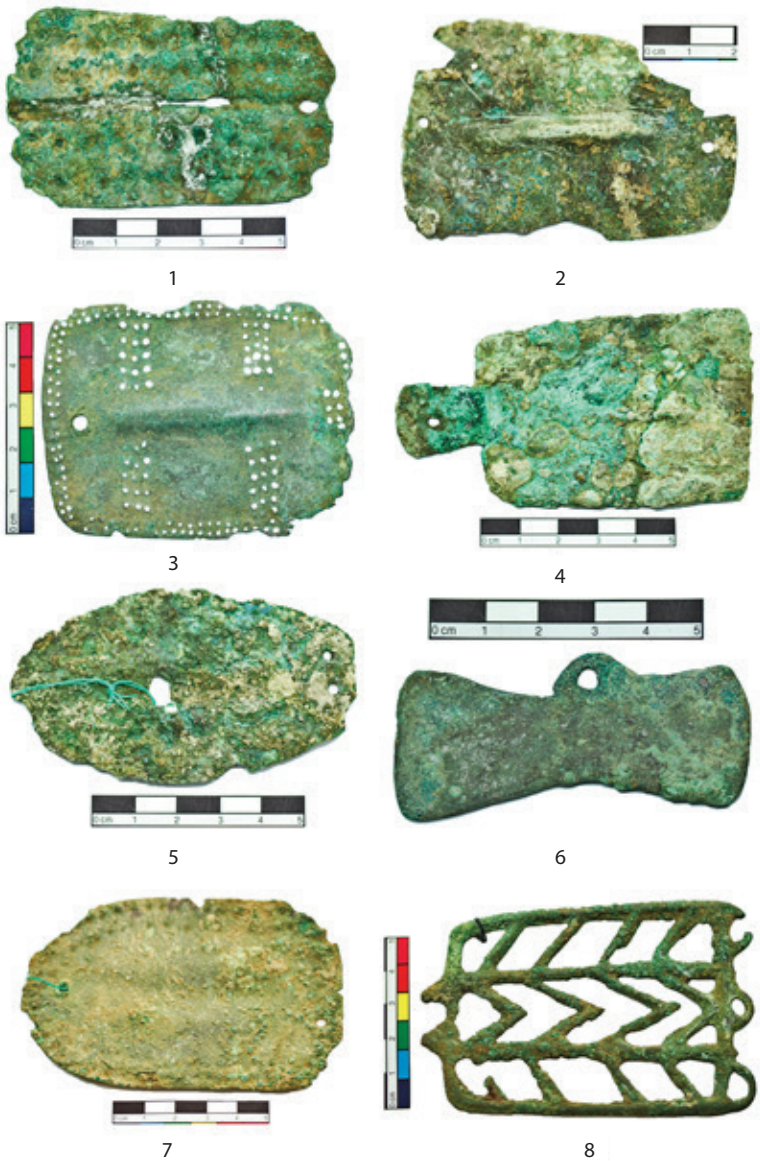

Fig. 5. Metal artifacts of the Tianshanbeilu culture (IV): 1–8 – plaques. 1. M16: 3; 2. M54: 4; 3. M80: 2; 4. M190; 5. M483: 24; 6. M536: 7. M589: 5; 8. M626: 2

Рис. 5. Металлические изделия культуры Тяньшаньбэйлу (IV): 1–8 – бляшки. 1. M16: 3; 2. M54: 4; 3. M80: 2; 4. M190; 5. M483: 24; 6. M536: 7. M589: 5; 8. M626: 2

Rectangular plaques. 58 items. More or less rectangular. Each of them, as in the examples of M16:3, M54:4, M80:2, has a longitudinal rib in the middle, a hole on each end, and one or two rings of indentation (Fig. 5.-*1, 2, 3*). Except for one grave (M16) yielding two items, all the other graves each offer one item. Most of them are 7.5 cm long and 4.7 cm wide, but there are a larger one that is 11.3 cm long and 4.2 cm wide, and a smaller one of 2.5 cm long and 1.6 cm wide.

Hoof plaques. 3 items. They have a rounded edge on one end and a straight edge on the other. One (M589: 5) has multiple indentations (Fig. 5.-*7*).

Butterfly plaques. 18 items. They occur either singly or in pairs. More or less rectangular, they are constricted in the middle, which gives them their butterfly shape, and have a loop at one side, as in the example of M536: 7 (Fig. 5.-*6*). Most are plain, except for one (M625: 3B), which has three grooves and a row of chevrons on either side, and another (M636: 1) is decorated with grids in relief.

Spade plaque. 1 item (M190). It has a rectangular handle, which has a hole for suspension, 8.2 cm long and 5 cm wide (Fig. 5.-*4*).

Square plaque. 1 item (M400: 8). It has two holes at the ends of one diagonal line, a row of punched indents along the four borders, 5.5 cm long and 4.9 cm wide (Fig. 4.-*12*).

Almond plaque. 1 item (M483: 24). It is in the form of fan, 8.7 cm long and 4.7 cm wide (Fig. 5.-*5*).

Openwork plaques. 2 items in nearly identical form. Rectangular in form, they have two columns of chevrons, one loop at one end, and three loops at the other. One (M626: 2) is 9.8 cm long and 6.2 cm wide (Fig. 5.-*8*); the other (unlabeled), partly damaged, is 7.6 cm long.

Wheel plaque. 1 item (M685: 1). Analogous to a wheel, it has centrifugal spikes, four of which are broken, 9.3 cm in diameter (Fig. 6.-*1*).

Buttons. They are commonly found in graves, and varied not only in form, but also in size. A string of buttons is found around the head.

Disc buttons. 4 items. As in the example of M2: 6, they are flat and equipped with arch grips like mirrors, but much smaller (Fig. 3.-*9*). They are 3.2–4.3 cm in diameter.

Small dome buttons. 208 items. Mostly 0.4–1.8 cm, but a few are up to 2.8 cm in diameter. Most are plain miniature buttons, but a good number of them, as in example of M112: 3, are decorated with a ring of sunrays (Fig. 4.-*7*). In addition, many bear the imprint of the stick core for casting the hole of arch grip. Apart from the common circular ones, there are also peach and pear ones. In Grave M267, they are found at the clavicle, jaw, hand, or under the head of the occupant; in Grave 266, they are found at the upper jaw, upon the eye, neck, left ear, under the skull, shoulder blade, or humerus of the occupant. In Grave M307, they are found at the waist and left shoulder. In Grave 317, they are found at left foot and forehead. In Grave M341, they are found under the neck, left wrist, left ankle, left and right ears of the occupant.

Large dome buttons. 117 items in total. Mostly 3–4.7 cm in diameter, but a few are 1.5–2.2 cm. But like the small dome buttons, they retain the imprint of the casting core for the hole of grip. Mostly plain; only a few, as in the example of M15: 4, are decorated with a ring of sunrays (Fig. 3.-*10*). They usually occur singly, but when they occur multiply, they are spread over many areas of the human body. In Grave M315, they are found on the right arm, chest,

the right shoulder, and the right eye of the occupant, a fact indicating that they are used to adorn various parts of human body.

Large double-piece buttons. 37 items in total. They are formed by joining two round buttons. Like the dome buttons, they have arch grips and imprints of the casting core for the hole of grip (Fig. 3.-*11*, Fig. 4.-*1*), as in the examples of M150: 3b and M15: 15. Mostly plain, some are decorated with a ring of sunrays. In most graves, they occur singly, but in Graves M190, M267, M311, M341, they are found at the femur, lower jaw, right elbow, right wrist, or forehead of the occupant, which means that they are used to adorn various parts of the human body. They are 2.1–4.9 cm long.

Small double-piece buttons. 19 items. These are the miniature version of the large double-piece buttons without arch grip on the back, as in the example of M17: 16 (Fig. 4.-*2*). They are normally 0.8–1.4 cm long, but some are 1.9–2.4 cm long. In a grave, they occur by the numbers of 1, 2, or 3.

Triple-piece buttons. 26 items. These are formed by joining three small round buttons in a row; very small in size, they are 2.4–2.9 cm long (Fig. 4.-*3, 4*), as in the examples of M126: 5 and M112: 3. Where the context is known, they occur at the head and waist (M126).

Triangular button. 1 item (M50: 8). It is 1.8 cm per side (Fig. 4.-*5*).

Tree-top button. 1 item (M386: 1). It is 2.6 cm long (Fig. 4.-*6*).

Mirrors. 65 items in total. They are roughly similar to bosses in form, but different in having larger sizes and flat surfaces. Most have an arch grip at the center of the back, whereas two items (M91: 6; M36: 2) stand out in having side handles (Fig. 4.-*10, 11*). While most are plain, a few items are decorated with three concentric rings of sunrays, as in the example of M15: 13 (Fig. 4.-*9*). They are 4.5–9.5 cm in diameter. The mirrors occur by 1 item, 3 items, and occasionally 11 items. They are found at the leg, upper body, on the face, at the head, or on the eye.

Tubes. 201 items in total. Rolled out of hammered tapes, they vary widely in size, and in workmanship. Most of them are thin and thoroughly corroded, as in the examples of M1: 5 and M349: 10 (Fig. 7.-*10, 12*). The long ones are 4.2–19.2 cm long, and 0.5–1 cm in diameter. They can be found at the hipbone, fibula, humerus, tibia, pelvis, knee, left arm, neck, leg, and waist. Mostly found singly, they sometimes occur in the groups of 2, 3, 4, 5, 7, 8, or 9. The short ones are comparatively short and thin, occurring singly in a grave, except for Grave M321, which yields 2 items. They are mostly 0.6–2.3 cm long, 0.4–1.4 cm in diameter. Only one is 13.3 cm (M349). Where the context is known, one (M137: 4–1) is located at the hip.

Spiral tubes. They are formed out of coiling tapes, the small sections of which are sometimes as components of bracelets, as in the example of M65: 4 (Fig. 7.-*11*). The intact ones are 4.4–7.5 cm long, and located at the femur, the leg, or on the chest, as in the example of M154: 2 (Fig. 7.-*13*). Altogether 58 items, they occur singly in most graves; only in M683 they occur by a set of 10 items.

Earrings. 308 items in total. They are made of bronze, lead, iron, or gold wires, which are uneven in thickness. Most are made of solid threads of 0.2–0.3 cm, but some are made of thin ones of 0.1 cm. Roughly in the shape of circles, they are fully closed or slightly open, sometimes stricken into fans at ends, as in the examples of M2: 2, M19: 1, M625:1, M7:3, M446:2, M91:2 (Fig. 6.-*2, 3, 5, 6, 7, 9*). Moreover, a few are triangular, as in the examples of M261: 2 and

M670: 4 (Fig. 6.-*4, 8*). They do not appear in all graves that are furnished with metal artifacts. However, when they appear, they often occur in pairs, near the two ears of the occupant, but in this case the two items are not necessarily identical in form. It is more common that they occur singly. Occasionally they occur in trio, or in 2 pairs, or 4 pairs. Their diameters vary from 0.9 cm to 5.3 cm. The single pair of gold earrings (M446: 2) found at this cemetery are nearly closed and 2.1–2.5 cm in diameter (Fig. 6.-*7*).

Bracelets. Altogether 107 items. A lot less in quantity than earrings, they are nevertheless more solid. Some are hammered flat, whereas the other items are round. One grave may yield 1 or even 3 or 4 items. They are mostly made of copper or copper alloy wire, as in the example of M5: 3 (Fig. 6.-*10*), but sometimes made of iron or lead wire, as in the examples of M21: 3 and M38: 3 (Fig. 6.-*11, 13*); yet one item (M298: 2) is made of copper or copper alloy tape (Fig. 6.-*12*). Their ends, which are usually crossed, are tapered yet in some cases flattened. These are generally made of one round of wire, but one item (M311: 20) is made of three rounds. In addition, some are made of small beads. In some graves, they are found at the wrist. Their sizes are located anywhere between 4.4 cm and 8 cm, thickness between 0.4 cm and 0.7 cm.

Clips. 41 items in total. Usually made of lead wires, as in the example of M16: 5 (Fig. 7.-*9*), they are sometimes made of copper or copper alloy wires, but all in the form of letter T with two parallel tongs. They occur usually singly in graves, but sometimes in pair. In three graves, they are found at the head, or the mastoid process. They vary from 2.5 cm to 5.2 cm in length, and 0.1–0.3 cm in thickness.

Fingerings. 2 items. It is bent of a copper or copper alloy wire. One is actually found on a finger, 2 cm in diameter, and 2.2 cm long, as in the example of M542: 3 (Fig. 6.-*14*).

Beads. Altogether 827 items. They are mostly used for making bracelets, but sometimes for headdresses. A grave may yield up to 9 bracelets. Some of the beads are cut out of the spiral tubes, and assembled together with spiral tubes. Some bracelets are made of a mix of round, spiral metal beads, and bone beads. When the context is known, beads are found near the neck, upper arm, and right wrist of the occupants. They occur in various forms: ball, ring, tube, and water-drop.

Ball beads. Altogether 351 items. Generally spherical in shape, they often carry casting seam, as in the example of M125: 27/2 (Fig. 8.-*2*). As components of bracelet, they have small holes for passing thread. All made of copper or copper-based alloys, they occur in the groups of 1, 2, 3, 7, 8, 9, 12, 13, 15, 16, 23, 27, or 32. In one grave, the occurrence of 1 bracelet is common, that of 2 bracelets less so, but in Grave M125, 9 bracelets occur. They also vary widely in size; the common ones are 0.5–0.7 cm in diameter, whereas the occasional large one is 1.7 cm.

Ring beads. 311 items. They are generally made of bent short wires or tapes, as in the example of M48: 4 (Fig. 7.-*16*). A bracelet may be comprised of 1, 2, 3, 4, 5, 6, 7, 9, 12, 14, 16, 17, 20, 21, 26, 31 or 32 beads. In a grave it may occur 1, 2, or 3 times. They are found at the skull or the right wrist. While the majority of them are circular, a few are pentagonal. Their diameters vary from 0.6 to 1.1 cm, and their lengths from 0.2 to 1.1 cm. In Grave M602, they are combined with 65 bone beads.

Tube beads. 105 items in total. These are short tubes, 0.3–2.3 cm in length, 0.4–1.2 cm in diameter, as in the example of M125: 35 (Fig. 8.-*1*). Normally they are rolled out of sheet, but

in a few cases coiled out of tape. Yet 1 item (M378: 3) is made in the form of tooth. Most often they occur singly, in pair, or in groups of 5, 8, 9, 13, and 14.

Water-drop beads. 60 items in total. They are rendered in the form of water drop, but some approximate the form of wheat grain with a vertical groove, as in the example of M194: 4 (Fig. 8.-*3*). They occur only in four graves, in the groups of 2, 4, 12, 20, or 21. Roughly produced, they retain casting seam. They are 0.6–0.8 cm in diameter, and 0.6–1 cm long.

Jingle bells. 5 items. One (M10: 10) is fragmentary; its stem is crushed flat, but three horizontal bulges are visible, 4 cm long (Fig. 7.-*2*). Another (M54: 5) is characterized by a rope stem and a cup, but it has two casting defects (Fig. 7.-*1*), 9.8 cm long. The third (M361: 7) is found at the right kneel.

Caps. 9 items. Often one end thicker than the other, they are possibly used for holding rope or stick (Fig. 7.-*3*–*6*), as in the examples of M73: 10, M78: 1, M307: 14, M460: 4. They are 1–2.4 cm long and 0.4–1.2 cm in diameter.

Imitation cowrie shell. 1 item (M363: 4). It is made in the form of almond with a long cut in the middle, 3.7 cm long, 1.4 cm wide (Fig. 7.-*8*). Not coincidentally, a real cowrie shell, a maritime good far away from Tianshanbeilu, is found in Grave M393.

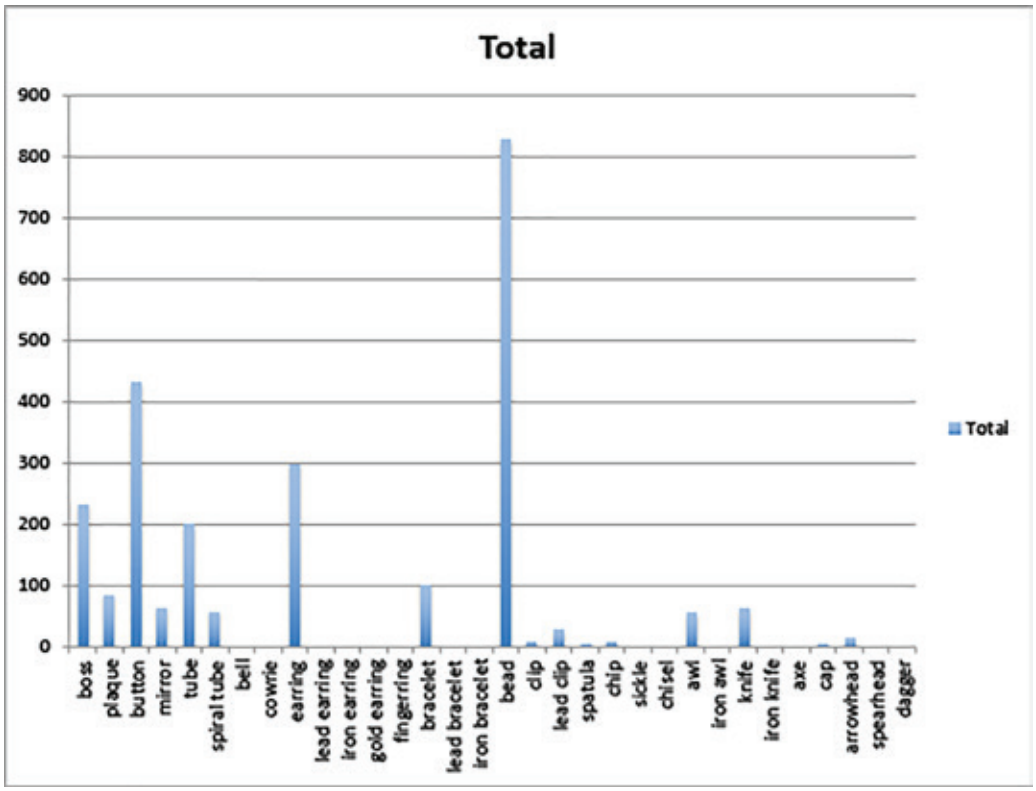

Fig. 9. Quantities of types of the Tianshanbeilu metal artifacts
Рис. 9. Количество типов металлических изделий культуры Тяньшаньбэйлу

Although the data set presented here is incomplete, it offers a good picture of the diverse types of metal artifacts at Tianshanbeilu (Fig. 9). The quantity of tools and weapons (knife, awl, chisel, sickle, arrowhead, spearhead, dagger) is rather modest, 146 in total. Knives and awls are the most numerous items, whereas the other types of tools and weapons are relatively few. By comparison, ornaments are abundant. There are a large number of beads, bosses, plaques, mirrors, tubes, spiral tubes, earrings, and bracelets, amounting to between 50 and 800 for each. This suggests that they might have been staple accessories. They are diverse not only in form, but also in material. Apart from copper and copper alloys, lead and iron are used to make these ornaments.

It has been argued that the metallurgy of the Hami region is derived directly from the Siba culture in western Hexi Corridor, but ultimately from the Karasuk culture in the Minusinsk Basin and Tuva, rather than locally born [Zhang, 2017: 107–108]. This is because to date no Neolithic sites have been found in the Hami region, and the metallurgy of this period is unambiguously exogenous. When we examine the Bronze Age cultures of the surrounding regions, the ensemble of the metal artifacts of the Tianshanbeilu culture showcases multiple sources of inspiration. There is an analogous dagger with three ribs (Fig. 2.-*13*) at the Andronovo culture site of Myrzhik in Kazakhstan [Kadyrbaev and Kurmankulov, 1992: 59]. Most of the ornaments, tools, and weapons are comparable with those of Siba and Karasuk. The striking predominance of body ornaments among the assemblage of Tianshanbeilu is likewise reminiscent of Siba and Karasuk. The popular assumption that the metallurgy of Tianshanbeilu is derived from the Andronovo culture in Kazakhstan is not grounded [Mei, 2000: 38]. The signature assemblage of Andronovo metal artifacts, consisting of willow-leafed dagger, shaft-hole axe, foil bracelet, and snail-shaped earring, is absent among the Tianshanbeilu metals. The metallurgy of Tianshanbeilu therefore has not much to do with Andronovo, but rather with the Karasuk culture.

The metal artifacts of Tianshanbeilu are, however, not imports of the Siba or Karasuk cultures. A great number of them exhibit local traits. The buttons bear the imprint of the casting core, which, together with the mold, are used for casting the small grip. Ring-topped knives and mirrors differ from the Siba and Karasuk counterparts in having very long blades. In addition, certain types of objects of the Karasuk culture such as triangular pendants do not occur at Tianshanbeilu, whereas other metal objects of the Tianshanbeilu culture such as rectangular plaques and butterfly plaques do not occur among the Siba and Karasuk metals. Artifacts such as sunray discs, chevron-shaped objects, humpbacked knives, and spiral tubes are unique to the Tianshanbeilu metals. While some traits of the Tianshanbeilu metals indicate that they derive their inspiration from Siba and Karasuk prototypes, others are suggestive of local innovations. These lines of evidence suggest that these metals are produced locally.

The Yanbulake Culture

Several cemeteries, as well as a few graves at the sites of Tianshanbeilu, Fuzhisuanchang [Zhang, Chang, 1998], Nanwan [Chang 1985; Xinjiang Institute of Archaeology, 1987], Wubu [Xinjiang Institute of Cultural Relics and Archaeology, 1992], Baiqier [Tulahun, 2005], Aisikexiaer [Xinjiang Institute of Cultural Relics and Archaeology, Hami Region Cultural Relics Administration, 2002], Lafuqiaoke [Xinjiang Institute of Cultural Relics and Archaeology 1984], Yaer [Hu, 2015], Sayituer [Xinjiang Institute of Cultural Relics and Archaeology, 2014;

Hu, 2015], and Hanqigou [Xinjiang Institute of Cultural Relics and Archaeology, Hami Region Cultural Relics Administration 1996, 1997] can be attributed to this culture. While the sites are dispersed in the ranges of Tianshan and the area to its north, they are mostly concentrated in the oases in the Hami Basin. In general, these cemeteries contain much lesser graves, and offer much lesser metal artifacts. The Yanbulake and Wubu collections in Hami Museum were likewise examined by the authors in 2013. As in the case of the Tianshanbeilu metals, a small number of fine pieces are dispersed in Xinjiang Institute of Cultural Relics and Archaeology, and Xinjiang Museum in Urumqi and unavailable for this study, which is admittedly not exhaustive.

The Yanbulake cemetery is located on a small terrace 60 km to the west of the Hami city. In conjunction with a small walled settlement nearby, it was discovered in the 1950s. It was excavated in 1958, when 14 graves were discovered. These graves, found below the gravel surface, are small pit graves, some of which are lined with mud-bricks. They produce a few funeral goods. In 1986, another 76 graves were excavated [Xinjiang Uighur Autonomy Region Cultural Ministry Cultural Relics Department, Xinjiang University History Department Cultural Relics and Museology Training Program, 1989]. The metal artifacts uncovered from the cemetery, however, are more limited in quantity and less diverse in form than those from Tianshanbeilu.

Buttons. 15 items. Morphologically identical to those of the Tianshanbeilu culture but smaller in size, as in the examples of M33: 3 and two unlabeled items (Fig. 10.-*2–4*). Most are 1.1–1.4 cm in diameter, but the largest ones are up to 1.9 cm. 4 of them are miniature buttons; they are thin and light. Yet 2 have the imprint of the core for casting the arch grips, as in the example of M33: 3 (Fig. 10.-*3*). Most of them are plain except for three that are decorated with a ring of sunrays, as in the example of an unlabeled item (Fig. 10.-*2*). The arch grips are soldered or pre-cast to the main bodies. Apart from circular ones, there are also triangular and pentagonal ones.

Bosses. 3 items, all thin and fine pieces. One (M48: 1) is partially preserved, over 4 cm in diameter (Fig. 10.-*6*). The other two are 1.3–1.9 cm long and 0.9–1.5 cm wide, as in the example of M68: 8 (Fig. 10.-*7*). They occur singly or in pairs.

Rectangular plaque. 1 item (M41: 1). It is thin and light, measuring 4.4 cm long and 1.6 cm wide (Fig. 10.-*8*).

Mirror. 1 item (unlabeled). It is a round flat disc with an arch loop on the back, measures 3.8 cm in diameter (Fig. 10.-*14*).

Earring. 15 items. Most are circular. They are made of copper or copper alloy thread, as in the example of M76: 6 and M18: 1 (Fig. 10.-*11, 13*). A few have flat hammered ends, as in the example of an unlabeled item (Fig. 10.-*12*). 3 of them are cast in a spiral. Apart from the regular ones, a pendant is attached to 2 of the earrings, as in the example of another unlabeled item (Fig. 10.-*15*). They are 1–3.9 cm across, and 0.2 cm thick.

Bracelets. 2 items. One (M37: 2) is partially preserved, measuring 0.2 cm thick (Fig. 10.-*16*); the other (unlabeled) is comprised of 3 tubular beads and 11 round beads, 8.1 cm long (Fig. 11.-*1*).

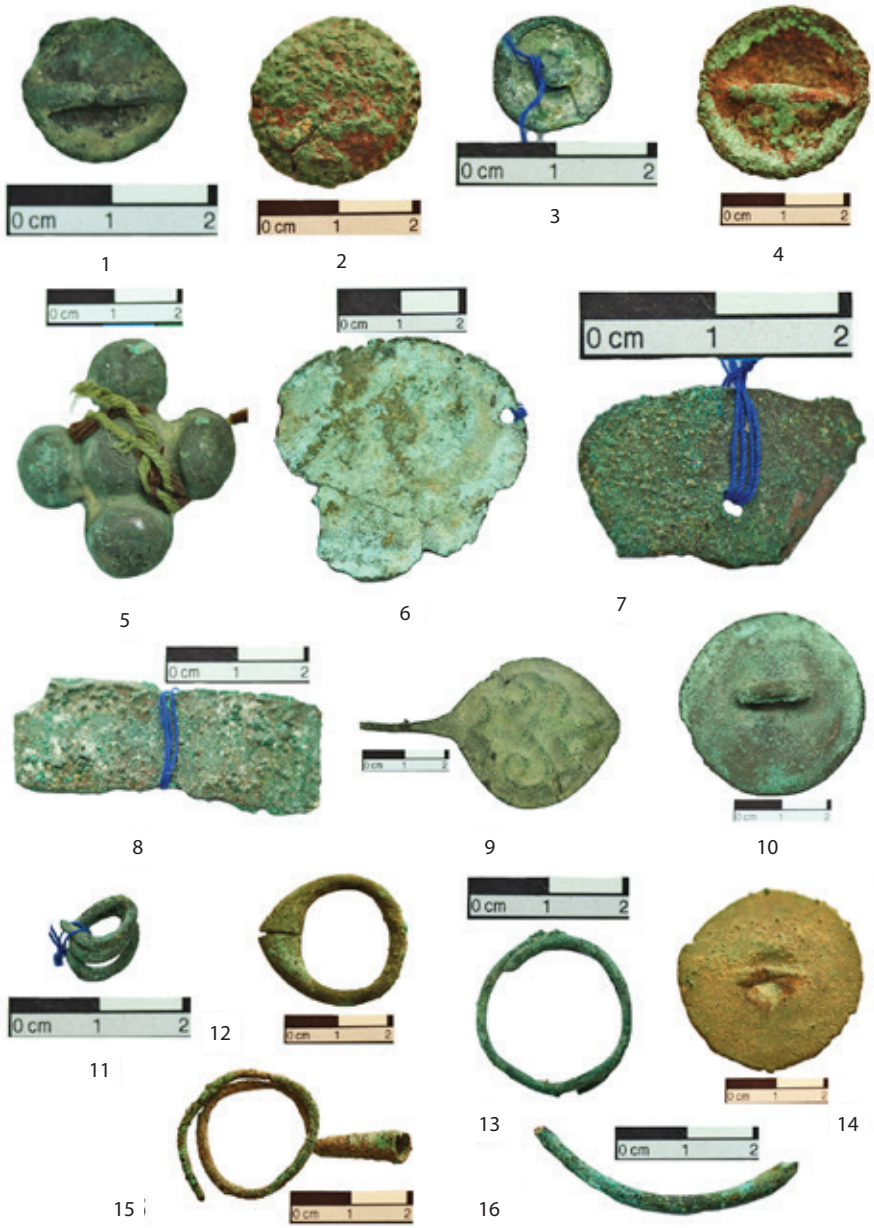

Fig. 10. Metal artifacts of the Yanbulake culture (I): 1–5 – buttons; 6–7 – bosses; 8–9 – plaques; 10, 14 – mirrors, 11–13, 15 – earrings; 16 – bracelet. 1, 5, 9, 10. Wubu; 2, 4, 12, 14, 15. Yanbulake; 3. Yanbulake M33: 3; 6. Yanbulake M48: 1; 7. Yanbulake M68: 8; 8. Yanbulake M41: 1; 11. Yanbulake M76: 6; 13. Yanbulake M18: 1; 16. Yanbulake M37: 2

Рис. 10. Металлические изделия культуры Яньбулак (I): 1–5 – пуговицы; 6–7 – бляхи; 8–9 – бляшки; 10, 14 – зеркала, 11–13, 15 – серьги; 16 – браслет. 1, 5, 9, 10. Убу; 2, 4, 12, 14, 15. Яньбулак; 3. Яньбулак M33: 3; 6. Яньбулак M48: 1; 7. Яньбулак M68: 8; 8. Яньбулак M41: 1; 11. Яньбулак M76: 6; 13. Яньбулак M18: 1; 16. Яньбулак M37: 2

Fig. 11. Metal artifacts of the Yanbulake culture (II): 1 – bracelet; 2 – tubes; 3 – bead; 4–5 – caps; 6 – knife; 7 – burin; 8–9 – jingle bells; 10 – celt; 11–13 – arrowheads. 1, 2. Yanbulake M3; 3. Yanbulake T12: 9; 4. Yanbulake T10: 11; 6. Yanbulake M47: 5; 1, 5, 7, 11–13. Yanbulake; 8–10, Wubu

Рис. 11. Металлические изделия культуры Яньбулак (II): 1 – браслет; 2 – трубки; 3 – бусина; 4–5 – колпачки; 6 – нож; 7 – резец; 8–9 – колокольчики; 10 – кельт; 11–13 – наконечники стрел. 1, 2. Яньбулак M3; 3. Яньбулак T12: 9; 4. Яньбулак T10: 11; 6. Яньбулак M47: 5; 1, 5, 7, 11–13. Яньбулак; 8–10. Убу

Tubular ornaments. 4 items. They are 2.2–4.7 cm long and 0.6–1.1 cm in diameter. They are found in pairs in two of the graves, as in the example of M3 (Fig. 11.-*2*).

Beads. 9 items, all tubular. They are 0.4–1.6 cm long, and 0.5–0.7 cm in diameter, and occur singly or in pairs, as in the example of T12: 9 (Fig. 11.-*3*).

Cap. 1 item (T10:11). It resembles those of the Tianshanbeilu culture in form, 1.6 cm long and 0.8 cm in diameter (Fig. 11.-*4*).

Knives. 4 items, all narrow and long. One of them (M47: 4, 5) is 2.5 cm long and 0.6 cm wide (Fig. 11.-*6*). Another one is partially preserved. Thin and light, it is finished with a small hole, 4.5 cm long and 1.8 cm wide. The third one, also thin and light, includes a ring-pommel. The fourth one is made of iron, 10.1 cm long.

Burin. 1 item (unlabeled). It is spade-shaped, topped with a wooden hilt, 7.8 cm long (Fig. 11.-*7*).

Arrowhead. 6 items. Three items (all unlabeled), unlike those of the Tianshanbeilu culture, are made in the form of spearhead with hollow shaft, 2.7–3.8 cm long (Fig. 11.-*11–13*). The shaft of one (M6: 2) contains remnants of wood, rendered in the form of hand, 2.7 cm long and 1 cm wide. Another two items (both unlabeled) are chisel-shaped and flanked with two wings, whose forms are unprecedented in the Tianshanbeilu culture (Fig. 11.-*11, 13*). They measure 2.3–2.4 cm long.

Unknown object. 1 item. It is round at one end, and drilled at the other; it is also flat on one side, possibly attached to another object, 6 cm long.

The Wubu cemetery is located to the south of Yanbulake in a small oasis. 114 graves were excavated in the 1980s, but only the materials of two graves (M151, M152) have been published [Xinjiang Cultural Relics Affairs Administration, Xinjiang Institute of Cultural Relics and Archaeology 1999; Lü, Chang, Wang, 2001]. The graves are pit graves, some of which are lined with mud bricks. Thanks to the dry environment, wooden logs, and needle grass (*Achnatherum splendens*) mats covering the opening have been found. The metal artifacts in the collection of Hami Museum are rather limited in quantity.

Five-piece button. 1 item (unlabeled). It has 5 semispherical bosses and a diameter of 3.3 cm long (Fig. 10.-*5*).

Button. 2 items. Dome-shaped, they have long arch grips, as in the example of an unlabeled item (Fig. 10.-*1*). They measure 1.5 cm and 2.4 cm in diameter respectively.

Peach-shaped plaque. 1 item (unlabeled). It is made into the peach shape, decorated with impressed motifs, and attached with a loop, 6.2 cm long (Fig. 10.-*9*).

Earrings. 2 items. One of them is made of copper or copper alloy thread into the shape of a droplet 1.9 cm long. The other has intersecting ends; it measures 1.6 cm long.

Mirror. 1 item (unlabeled). A flat round disc 4 cm in diameter (Fig. 10.-*10*).

Jingle bells. 5 items. Three of them have woolen yarn, 3.8–5.2 cm long, threaded through holes around its circumference, as in the case of an unlabeled item (Fig. 11.-9). The other two also have elongated perforations, measuring 4.2 cm in length, as in the example of another unlabeled item (Fig. 11.-*8*).

Shaft-hole axe. 1 item (unlabeled). Well preserved. It has a flared edge and a socket into which a wooden stick is inserted. It is 4.1 cm long (Fig. 11.-*10*).

The metal artifacts of the Yanbulake and Wubu cemeteries are representative of the Yanbulake culture. In comparison with those of the Tianshanbeilu culture, the diversity is significantly reduced, possibly related to the drastic drop in quantity (Fig. 12). On the one hand, there are fewer types of artifacts — the clip, chisel, sickle, spearhead, and dagger are

absent — on the other hand, the diversity of the types of staple objects such as buttons and earrings declines. There are no objects made of gold or lead.

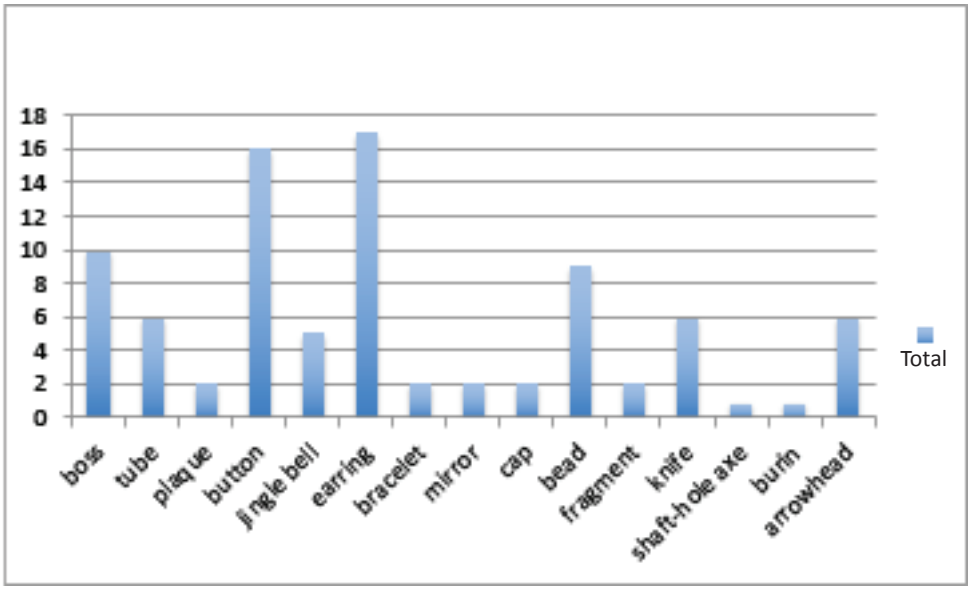

Fig. 12. Quantities of types of the Yanbulake metal artifacts
Рис. 12. Количество типов металлических изделий культуры Яньбулак

The majority of the ensemble of the Yanbulake metals shows continuity from the Tianshanbeilu culture, following its use of personal ornaments such as plaques, earrings, buttons, tubes, and beads. The predilection for body ornaments persists, but certain types of artifacts, such as the large plaques and spiral tubes of Tianshanbeilu disappear. Most types appear to evolve from the Tianshanbeilu prototypes. As a general trend, the artifacts, which include buttons, knives, bosses, and jingle bells, become smaller and cruder in quality; it may be considered a period of stylistic degeneration.

This, however, does not suggest that the Yanbulake metals do not exhibit traits of technical innovation. The buttons, for instance, have larger holes for passing threads; most of them are free of the casting defect, that is, the imprint of the casting core. The tubes and the unique rectangular plaques are still used during the time of Yanbulake, but they are much less prevalent. The workmanship of Yanbulake items declines significantly. The jingle bell from the Wubu cemetery is a later and simpler version of the Tianshanbeilu items, without the trumpet-like mouth and the linear ornament of the latter. In the meantime, a number of new types appear, which include the five-piece button, the pear-shaped plaque, the earring with pendant, and several types of arrowhead and burin. These ornament types are too unique for us to identify the origin of inspiration for their forms.

The Heigouliang Culture

The cemeteries of Heigouliang, Shangmiaoergou [Autonomy Region Cultural Relics Survey Office, Hami Region Cultural Relics Expedition, 1991; Hami Region Cultural Relics Administration, 1998], Dongheigou, Sheyuegou [Xinjiang Institute of Cultural Relics and

Archaeology, Northwest University Cultural Heritage Conservation and Archaeology Center, Hami Region Cultural Relics Bureau, 2014], Liushugou [Hu and Zhang, 2014], Xiagou [Xinjiang Institute of Cultural Relics and Archaeology, Northwest University Cultural Heritage Conservation and Archaeology Center, Hami Region Cultural Relics Bureau, 2014], and Tuobeiliang [Northwest University Cultural Heritage Conservation and Archaeology Center, Xinjiang Institute of Cultural Relics and Archaeology, Hami Region Cultural Relics Bureau, 2014] may be attributed to this culture. These sites are all located on the foothills of the Tianshan Mountains rather than in the oases of the Hami Basin, which suggests that its populations give up agriculture and practice pastoralism only. The Heigouliang cemetery is located on the ancient path cutting through the Tianshan Mountains from the Hami Basin to the Barkol Plain. A survey conducted in 1993 led to the discovery of four clusters of graves. Unlike the pit graves of the previous two periods, these graves are kurgans of the Eurasian steppe type, consisting of stone-piled mounds, measuring 2–7.5 m across, under which pit graves or catacomb graves are found. This type of grave structure has been found at the Hanqigou cemetery where funeral goods of the Yanbulake culture are also located. In 1993 and 1994, 64 graves were excavated at Heigouliang. A different set of funeral objects uncovered from this cemetery, including lacquerware, iron artifacts, show wide-range cultural interaction. Unfortunately these materials have not been fully published; only an informal preliminary report is available [Xinjiang Institute of Cultural Relics and Archaeology, Hami Region Cultural Relics Administration, 1991]. Most of these metal artifacts are stored in Hami Museum; some are published in the museum catalog [Hami Museum, 2013].

Bosses. 22 items. Made of copper, copper alloy or iron. They are mostly flat discs or trumpet-shaped, with a hole at the center, as in the examples of M31:11 and M10:5 (Fig. 13.-*1, 2*). They vary greatly in size: the largest one is 4.6 cm in diameter; the others are 1–2.1 cm in diameter. One of them is semispherical, made of iron, and 4.2 cm in diameter. A rectangular item (M28: 7), which has one hole at each end, is 3.9 cm long (Fig. 13.-*4*). A few items are made of scraps and holes are drilled for securing, as in the example of M4: 1b (Fig. 13.-*3*).

Buttons. 10 items. There are three types. The first is a round disc furnished with a high arch grip. There are two of these, 1.9 cm in diameter with grip of 0.9 cm high, as in the example of M9:21 (Fig. 13.-*8*). The second type is a deep round box decorated with a beak in the front, and a long and high grip on the back, as in the examples of two items under the same label of M4:3 (Fig. 13.-*9–10*). There are four of these, 2.6 cm in diameter. And the third is a semi-spherical top with a broad brim, as in the example of M10: 8 (Fig. 13.-*7*). There are three of these, 1.5–3.5 cm in diameter. The buttons come in pairs except in two graves.

Plaque. 1 item (M4: 1). It is a flat disc in the form of a bird, showing the beak, front claw and wing (Fig. 13.-*11*). It has six holes for securing, 38 cm long and 2.5 cm wide.

Mirrors. 8 items. Unlike those of the Tianshanbeilu and Yanbulake cultures, the mirrors of Heigouliang are characterized by the presence of a side handle. The handle is preserved on three of these items. As in the examples of M22: 6 and M12: 6, they are round with a hole in the middle and cast together with the main body (Fig. 13.-*15, 16*). The handle, which is broken off and lost, is attached to the main body by soldering or riveting, as in the example of M43: 11 (Fig. 13.-*14*). The intact mirrors are 5.6–6.5 cm in diameter. It should be noted that the abovementioned three mirrors are tinned.

Fig. 13. Metal artifacts of the Heigouliang culture (I): 1–6 – bosses; 7–10 – buttons; 11–13 – plaques; 14–16 – mirrors. 1. Heigouliang M31: 11; 2. Heigouliang M10: 5; 3. Heigouliang M4: 1b; 4. Heigouliang M28: 7; 5. Dongheigou M12: 8; 6. Dongheigou M12: 37; 7. Heigouliang M10: 8; 8. Heigouliang M9: 21; 9. Heigouliang M4: 3; 10. Heigouliang M4: 3; 11. Heigouliang M4: 1; 12. Dongheigou M13: 7; 13. Dongheigou M15: 3; 14. Heigouliang M43: 11; 15. Heigouliang M22: 6; 16. Dongheigou M12: 6

Рис. 13. Металлические изделия культуры Хэйгоулян (I): 1–6 – бляхи; 7–10 – пуговицы; 11–13 – бляшки; 14–16 зеркала. 1. Хэйгоулян M31: 11; 2. Хэйгоулян M10: 5; 3. Хэйгоулян M4: 1б; 4. Хэйгоулян M28: 7; 5. Дунхэйгоу M12: 8; 6. Дунхэйгоу M12: 37; 7. Хэйгоулян M10: 8; 8. Хэйгоулян M9: 21; 9. Хэйгоулян M4: 3; 10. Хэйгоулян M4: 3; 11. Хэйгоулян M4: 1; 12. Дунхэйгоу M13: 7; 13. Дунхэйгоу M15: 3; 14. Хэйгоулян M43: 11; 15. Хэйгоулян M22: 6; 16. Дунхэйгоу M12: 6

Fig. 14. Metal artifacts of the Heigouliang culture (II): 1 – mirror; 2–3, 5–6 – earrings; 4, 9–10 – pins; 7–9 – handles; 11 – belt hook; 12 – beads; 13–14 – caps; 15 – needle; 16–17 – awls; 18–21 – knives. 1. Dongheigou M54: 2; 2. Heigouliang; 3. Heigouliang M14; 4. Heigouliang M9; 5. Dongheigou M11: 11; 6. Dongheigou M1: 3; 7. Heigouliang M7: 10; 8. Heigouliang M10: 8; 9. Heigouliang M4: 4b; 10. Heigouliang M4: 27; 11. Heigouliang M25: 23; 12. Heigouliang M14: 11; 13. Heigouliang M3: 7; 14. Heigouliang M10: 12; 15. Heigouliang M37: 17; 16. Heigouliang M9: 20; 17. Heigouliang M9: 22; 18. Heigouliang M1: 7; 19. Heigouliang M8: 2; 20. Heigouliang M10: 4; 21. Heigouliang M15: 12

Рис. 14. Металлические изделия культуры Хэйгоулян (II): 1 – зеркало; 2–3, 5–6 – серьги; 4, 9–10 – шпильки; 7–9 – ручки; 11 – крючок для ремня; 12 – бусы; 13–14 – колпачки; 15 – игла; 16–17 – шилья; 18–21 – ножи. 1. Дунхэйгоу M54: 2; 2. Хэйгоулян; 3. Хэйгоулян M14; 4. Хэйгоулян M9; 5. Дунхэйгоу M11: 11; 6. Дунхэйгоу M1: 3; 7. Хэйгоулян M7: 10; 8. Хэйгоулян M10: 8; 9. Хэйгоулян M4: 4b; 10. Хэйгоулян M4: 27; 11. Хэйгоулян M25: 23; 12. Хэйгоулян M14: 11; 13. Хэйгоулян M3: 7; 14. Хэйгоулян M10: 12; 15. Хэйгоулян M37: 17; 16. Хэйгоулян M9: 20; 17. Хэйгоулян M9: 22; 18. Хэйгоулян M1: 7; 19. Хэйгоулян M8: 2; 20. Хэйгоулян M10: 4; 21. Хэйгоулян M15: 12

Fig. 15. Metal artifacts of the Heigouliang culture (III): 1–2 – knives; 3–6 – arrowheads; 7–8, 16 – daggers; 9 – bit; 10 – cheek-piece; 11 – jingle bell; 12–14 – buckles; 15 – necklace; 17 – ring. 1. Heigouliang M20: 8; 2. Dongheigou; 3. Heigouliang M4: 2; 4. Heigouliang M4: 11; 5. Heigouliang M17: 17; 6. Heigouliang M31: 8; 7. Heigouliang M25: 24; 8. Heigouliang M11: 12; 9. Heigouliang M10: 1; 10. Heigouliang M21: 5; 11. Heigouliang M11: 23; 12. Heigouliang; 13. Heigouliang M10: 2; 14. Heigouliang M40: 6; 15. Dongheigou M11: 10; 16. Heigouliang M28: 14; 17. Heigouliang M26: 7

Рис. 15. Металлические изделия культуры Хэйгоулян (III): 1–2 – ножи; 3–6 – наконечники стрел; 7–8, 16 – кинжалы; 9 – удила; 10 – псалий; 11 – колокольчик; 12–14 – пряжки; 15 – ожерелье; 17 – кольцо. 1. Хэйгоулян M20: 8; 2. Дунхэйгоу; 3. Хэйгоулян M4: 2; 4. Хэйгоулян M4: 11; 5. Хэйгоулян M17: 17; 6. Хэйгоулянь M31: 8; 7. Хэйгоулян M25: 24; 8. Хэйгоулян M11: 12; 9. Хэйгоулян M10: 1; 10. Хэйгоулян M21: 5; 11. Хэйгоулян M11: 23; 12. Хэйгоулян; 13. Хэйгоулян M10: 2; 14. Хэйгоулян M40: 6; 15. Дунхэйгоу M11: 10; 16. Хэйгоулян M28: 14; 17. Хэйгоулян M26: 7

Earrings. 5 items. All are assembled out of multiple components. One (unlabeled) is comprised of two bronze tubes, two large rings, and two small rings, all of which are strung up with a silver wire. It measures 5.3 cm in length (Fig. 14.-*2*). The other earrings are made of copper or copper alloy. One item (M14) is comprised of one band and two rings hung from it, 1.3 cm long (Fig. 14.-*3*). Another (unlabeled) has two rings, one bead, and a pendant 3.2 cm long. The third one (M14: 5) has three rings and a pendant 3.1 cm long; the last two (M9: 4, M38: 14) are comprised of one ring and one hook, 5.2 cm and 2.7 cm long respectively.

Necklace. 1 item (M11: 10). It is comprised of carnelian and gold foil tubes, and faience beads (Fig. 15.-*15*). The carnelian beads are bi-conical.

Pins. 6 items, their forms vary. One (M4: 4b) has a mushroom top at one end and a flat body, 5.5 cm long and 0.3 cm wide (Fig. 14.-*9*). Two (M9) have flat ends that measure 2.2 cm and 2.9 cm long respectively (Fig. 14.-*4*). The fourth (M6: 8d) has a thick end and a slender body, 8.8 cm long. The fifth (M14) is a partially preserved long bent wire of 3.1 cm in length. The sixth item (M4: 27) has a disc cap and a long thin pin, 6 cm long (Fig. 14.-*10*).

Handles. 2 items. One item (M7: 10) is a solid triangular loop, possibly broken off from a cauldron, 3.5 cm long each side, and 0.5 cm thick (Fig. 14.-*7*). The other one (M10: 8) is likewise originally a part of a larger object, 2.1 cm long and 1.9 cm wide (Fig. 14.-*8*).

Belt hooks. 2 items. One (M9: 7) is comprised of a flat plaque with a hole at the end for securing, and a beak-like hook extended from it. It is 3.6 cm long and 0.8 cm wide. The other item (M25: 23) is tinned, comprised of a flat body and a tapering hook and 2.2 cm long (Fig. 14.-*11*).

Beads. 6 items. Five of them are conical tubes, 0.7 cm in diameter and 1.2–1.5 cm long, as in the example of M14: 11 (Fig. 14.-*12*).

Clip. 1 item. Only a half is preserved, 3.1 cm long.

Caps. 12 items, they occur in two types. One (M3: 7) is a tube with a disc-like top, and the other (M10: 12) a conical tube (Fig. 14.-*13*–*14*). Both types could have been used for holding horse whips. Similar in size, they are 0.9–1.7 cm long, and 0.5–0.9 cm in diameter. In two graves they occur singly, and in two other (M3, M10) by the numbers of 3 and 5.

Awls. 8 items, made of copper/copper alloy or iron. One (M9: 22) is 5.1 cm long; the other (M9: 20), topped with a wooden handle, 5.5 cm long (Fig. 14.-*16*–*17*).

Needles. 3 items. Topped with holes, they are 3.8–6 cm long, as in the example of M37: 17 (Fig. 14.-*15*).

Knives. 25 items. 12 are made of copper/copper alloy. Thin and slender, much like the modern medical lancet for surgery, they are nevertheless rather diverse in form. One (M1: 7) has a long hilt (Fig. 14.-*18*), another (M10: 4) also long hilt but with a hole (Fig. 14.-20), the third (M15: 12) a broad hilt and a hole (Fig. 14.-*21*), and the fourth (M20: 8) a slender blade (Fig. 15.-*1*). Among them, 8 are found singly in 8 graves, 4 in pair in 2 graves. The intact ones are 4.8–12 cm long, and their blades are 0.8–1.1 cm wide. 13 items are made of iron, as in the example of M8: 2 (Fig. 14.-*19*). They occur in two types: one type, as in the example of M1: 7, is thick and broad, triangular (Fig. 14.-*18*); the other, as in the example of M10: 4 and M20: 8, are thin and slender, 9–13.6 cm long, 1–1.2 cm wide (Fig. 14.-*20*; Fig. 15.-*1*). In one grave they normally occur singly, but in Graves M8 and M14 they occur by the numbers of 3 and 4.

Arrowheads. 9 items. Also strikingly different from those of Periods I and II. Eight, as in the examples of M4: 2, M4: 11, M17: 17, have three lobes with hilt or hollow shaft hole, 3.5–5.4 cm long (Fig. 15.-*3*–*5*); together with stronger bows, they can shoot with greater power and accuracy than those having two lobes. One item (M31: 8) differs in having a thin body and a long hilt, and kept in a wooden case, 4.8 cm long (Fig. 15.-*6*). What is notable is that two items, as in the example of M17: 17, are tinned (Fig. 15.-*5*). They occur either singly or in pair.

Daggers. 3 items. Rather varied in style. One (M11: 12) is rather slender, 8.5 cm long, and 0.4 cm wide (Fig. 15.-*8*); another (M25: 24) is wider and thicker, featuring a prominent guard, 6.6 cm long (Fig. 15.-*7*); the third (M28: 14) differs in having a well-defined hilt and blade, 7.7 cm (Fig. 15.-*16*). The latter two are tinned.

Jingle bells. 4 items. As in the example of M11: 23, they are roughly cast and small, 1.7 cm long and 1.1 cm in diameter (Fig. 15.-*11*).

Cheek-piece. 1 item (M21: 5). It consists of two flat branches and a coiled section in the middle, with a hole at the center, 8.5 cm long and 0.4 cm wide (Fig. 15.-*10*).

Bit. 1 item (M10: 1). A wire has its two ends coiled into loops and its center bent, 0.4 cm thick and 15.7 cm long (Fig. 15.-*9*).

Buckles. 3 items. One (M40: 6) consists of two rectangular rings and a bent hook, 2.3 cm long, 1.7 cm wide (Fig. 15.-*14*). It is probably part of a belt. The second (M10: 2) is comprised of a circle and a triangle, but flat as a whole, 3.6 cm long and 2 cm wide (Fig. 15.-*13*). The third (unlabeled) is comprised of a dome cap and a five-hole column, 2.6 cm and 3.2 cm in diameter, 1.3 cm high (Fig. 15.-*12*).

Ring. 1 item (M26: 7). It is cast as one piece without any break, 2.6 cm in diameter and 0.2 cm thick (Fig. 15.-*17*).

At Dongheigou, a compound site consisting of a settlement and a cemetery, 5 stone structures and 12 graves have been excavated. The graves are also of the Eurasian kurgan type, featuring a stone-piled mound and a stone-lined pit grave underground, and sacrificial pits containing camels and horses around [Xinjiang Institute of Cultural Relics and Archaeology, Northwest University Cultural Heritage Conservation and Archaeology Center, 2007]. Metal artifacts that have been found from the site are not many.

Earrings. 5 items. All compound earrings, two items, as in the example of M11: 11, are each comprised of a gold wire, two turquoise tubes, and an agate bead, 6.1 cm and 5.8 cm long respectively (Fig. 14.-*5*). Another two items, as in the example of M1:3, made of copper or copper alloy thread, are comprised of a hook and an openwork case, 5–5.3 cm long(Fig. 14.-*6*).

Knife. 1 item (unlabeled). Topped with a ring pommel, the hilt and blade are well homogenized without distinction, 17.6 cm long (Fig. 15.-*2*).

Plaques. 7 items. One (M1: 5) is hexagonal, 2.5 cm long; another (M1: 8) is in the form of butterfly, 3.4 cm long; the third (M15: 3) is in the form of animal, the species of which is unknown, 5.5 cm long. Two are rectangular: one (M13: 7) is hammered out of gold foil, showing an animal in the form of tiger, 6.5 cm long (Fig. 13.-*12*); the other (M12: 30) of silver foil, showing a relief of deer, 6.5 cm long.

Mirror. 1 item (M54: 2). Oval in shape, it has a large arch grip, 6.2 cm long (Fig. 14.-*1*).

Bosses. 5 items. One is a quad-petal cut out of silver foil, 3 cm long. The second (M12: 1–5) is identical to M12: 37 in motif, but made of gold, 2.9 cm long. The third (M11: 6) is a gold

spiral horn of 1.1 cm in diameter. To this one may attribute a silver semispherical item (M12: 8) with embossed motifs of 2.3 cm in diameter (Fig. 13.-*5*), and a silver quad-petal item (M12: 37), 3.1 cm long (Fig. 13.-*6*).

Altogether, metal artifacts from 37 graves at Heigouliang and Dongheigou cemeteries are examined. Continuity and change are evident when they are compared with those of the Tianshanbeilu and Yanbulake cultures (Fig. 16). Several types of metal artifacts, including bracelet, tube, clip, chisel, sickle, tube, spearhead, and axe, disappear. In the meantime, ornaments such as boss, button, plaque, mirror, earring, jingle bell, and tools and weapons such as awl, knife, arrowhead and dagger remain in use. Some of these objects retain their forms, but others are significantly changed. For example, some bosses are crafted in semispherical form; they are large and furnished with one hole at the center. The buttons are mounted with bird motifs on the top. The mirrors have lateral handles that are either riveted to or cast with the mirror. The earrings inherit the compound type of Yanbulake, but carnelian beads are added. Knives are thin and slender, and reminiscent of modern medical lancets. The stylistic changes hint a new way of craftsmanship, which is better visible in new types of metal artifacts discussed below.

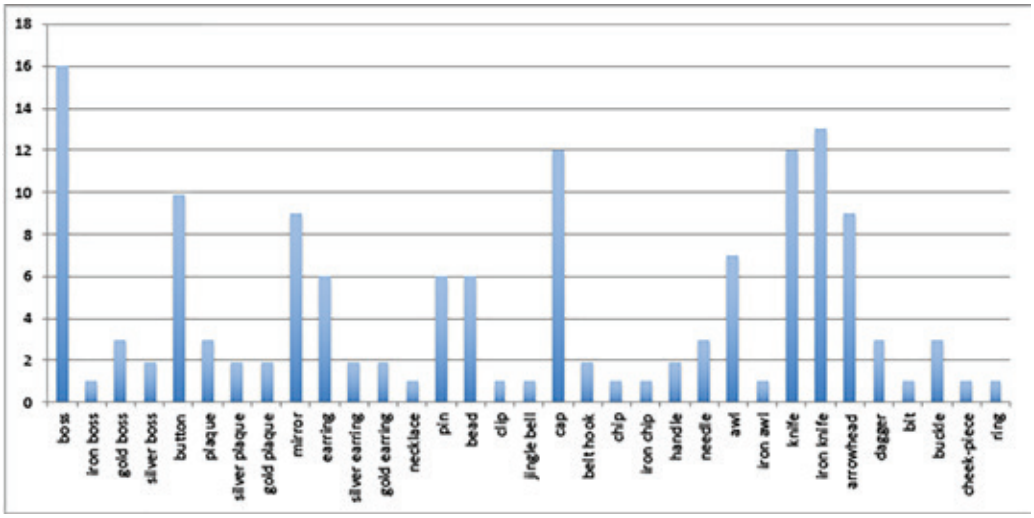

Fig. 16. Quantities of types of the Heigouliang metal artifacts
Рис. 16. Количество типов металлических изделий культуры Хэйгоулян

The new types of metal artifacts, including animal-style plaques, belt hooks, buckles, horse bit, jingle bells, long-handled daggers, and ring-handles are introduced. The animal-style plaques are made of gold and silver foils and decorated with animal motifs. A three-lobe arrowhead allows it to shoot for greater distance and with greater precision. The horse bit, cheek-piece, and buckles are used for harnessing, manifesting the emergence of horse-riding. The solid ring handles indicate the presence of metal vessels, which are the earliest ones found in Xinjiang. Iron artifacts become predominant and replace bronze as material for making daggers, knives, bosses, which are previously crafted solely in bronze during

the second period. Moreover, a new technology of tinning is employed for the making of mirrors and arrowheads.

Where are the new types of metal artifacts from? Contemporaneous nomadic cultures have been discovered in the adjacent regions, including the Altai Mountains, Minusinsk Basin, and Tuva. The ring-handle and rivet-handle mirrors have been discovered in the Altai Mountains [Rybakov, 1992: Fig. 63.-45, Fig. 64.-25]. The triangular belt hooks, bird-formed plaques, and five-holed round buckles have been discovered in the Tagar culture cemeteries in the Minusinsk Basin [Rybakov, 1992: Fig. 84.-34, Fig. 88.-12, Fig. 85.-23]. The bird buckles have been discovered in all the three regions, but the ones with double rectangular rings have only been found in Tuva [Rybakov, 1992: Fig. 77.-36]; The wire bit and round buckles have also been found there [Rybakov, 1992: Fig. 75.-82, Fig. 82.-18]. There are likely multiple incoming sources of inspiration; it is reasonable to surmise that the population of Heigouliang is receptive to the metallurgy and crafts traditions of nomads in these surrounding regions. This is further attested by the stone-piled kurgans and the catacomb grave structure. Physical anthropologist Wei Dong and his colleagues have discovered a horse rider, indicated by deformed femure, among 45 human skeletons from the cemetery of Heigouliang [Wei et all., 2012]. No pottery wares of these three regions have been found at Heigouliang, which indicates that the population of Heigouliang only adopts certain cultural elements of the Eurasian nomads.

Composition of the metal artifacts

Since the 1990s, a number of archaeometallurgists have analyzed metal artifacts from cemeteries of the three successive cultures of Tianshanbeilu, Yanbulake, and Heigouliang. Mei Jianjun and Qian Wei tested 108 samples from the Tianshanbeilu cemetery, and found tin bronze (79), pure copper (12), arsenic copper (9), and others [Mei, 2000: 39; Qian, 2006: 38; Institute of History of Metallurgy and Materials University of Science and Technology Beijing, Xinjiang Institute of Cultural Relics and Archaeology, Hami Region Cultural Heritage Administration, 2001]. Such an array of composition is analogous to that of the Karasuk culture, but the prominence of the tin bronze makes it distinct from the latter. Mei Jianjun and Qian Wei gathered 12 samples from the Yanbulake cemetery for compositional analysis, and found tin bronze (5), pure copper (4), and arsenic copper (3) [Mei, 2000: 40; Qian, 2006: 72]. In general, the chemical composition of the tin bronze and its prominence in the assemblage are similar to what is presented in the Tianshanbeilu cemetery. Metal artifacts from the Wubu cemetery are negligible; Mei Jianjun took only 2 samples, and both of them are pure copper [Mei, 2000: 40]. Lastly, Mei Jianjun, Qian Wei, and Ling Yong collected 16 samples from the Heigouliang Cemetery, and identified tin bronze (8), pure copper (6), and brass (cu-zinc alloy, 2), which is a new metal type [Mei, 2000: 40; Qian, 2006: 78; Ling, 2008: 67]. It is not known whether it is originated among the steppe nomads.

In 2013, the authors acquired 1754 portable XRF testing points of metal artifacts from several cemeteries of the three periods (Fig. 17). It should be noted that most of the metal artifacts found in the Hami region are corroded, and since the authors were not allowed to clean the surfaces of the objects, the XRF data are somewhat problematic. Given the research constraints, the authors could only assess the metal artifacts on a large scale. During the analysis, the authors found cases of discrepancy. As noted above, previous researchers, i.e. Mei

Jianjun, Qian Wei, and Ling Yong, have already analyzed a good number of samples from the cemeteries in question, for which they used the methods of scanning electron microscope (SEM) and Energy-dispersive X-ray fluorescence analyzer (EDXA). For the most part, our result match theirs, but for a number of samples, the data are varied. For instance, where our analysis identifies tin bronze, they recorded arsenic copper. For the moment, it is difficult to identify the reason for these discrepancies.

Cemetery	Portable XRF
Tianshanbeilu	1399
Yanbulake	85
Heigouliang	91
Sum	1575

Fig. 17. Quantities of metal objects subject to portable XRF analysis
Рис. 17. Количество металлических предметов, подвергнутых портативному XRF-анализу

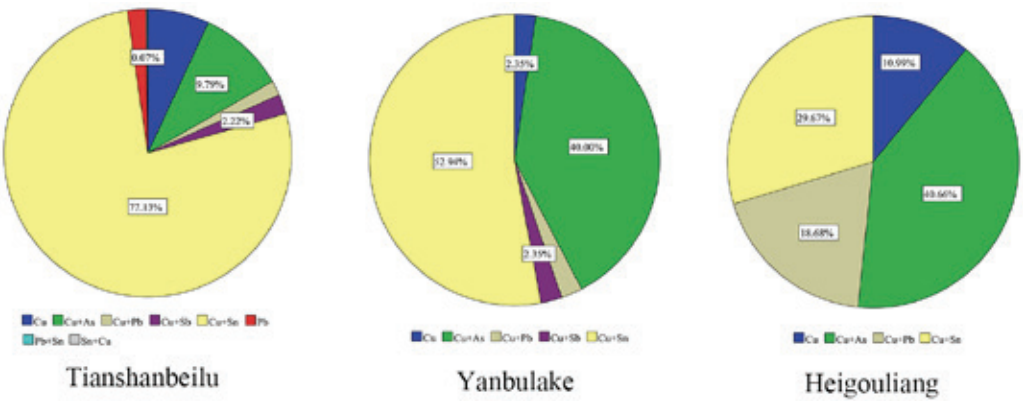

Fig. 18. Metal types of the Tianshanbeilu, Yanbulake, and Heigouliang cultures (based on the numbers of metal objects in Fig. 17)
Рис. 18. Типы состава металла культур Тяньшаньбэйлу, Яньбулак и Хэйгоулян (по количеству металлических предметов на рис. 17)

Nonetheless, the authors were able to extract some large patterns from the XRF data (Fig. 18). It is striking to see that the Tianshanbeilu metals are predominantly tin bronze, with a high percentage of 77. This is generally congruent with previous results obtained by Qian Wei, which was 68.5%. This ratio is a stark contrast with that of Karasuk metals, where arsenic copper is predominant. It supports the conjecture that Tianshanbeilu metals are locally produced. The metal artifacts of the Yanbulake and Heigouliang cultures are likewise characterized by the dominance of tin bronze and arsenic copper. If metal objects of Yanbulake and Heigouliang are also locally produced, they must have had access to stable sources of arsenic and tin. There is very limited chemically pure copper among the metal artifacts of all the three cultures. Lead copper alloy is prominent throughout the three periods.

The Tianshanbeilu metal artifacts are particularly diverse. Tin bronze is the primary type of metal, followed by arsenic copper and chemically pure copper. Apart from them, there are a few objects of gold (earrings), copper and antimony (beads), lead (clips), and lead tin alloy. The earrings are made of copper, copper alloy, lead and gold. The bracelets and pins from the Tianshanbeilu cemetery are made of lead. At the Yanbulake cemetery, tin bronze and arsenic copper are dominant, but antimonial copper, lead copper, and pure copper are present. At the Heigouliang cemetery, gold continues to be used for making earrings, necklace, and plaques, but arsenic copper, tin bronze, lead copper, and pure copper are the major metal types. Antimony is absent. It appears that tin bronze is the major type of metal throughout the three periods, although its use evidently declines over time.

Conclusion

Former research established a three-period chronology for the Bronze Age and early Iron Age of the Hami region, on the basis of which this paper provides a detailed analysis of the morphology and composition of the metal artifacts from cemeteries of the three successive cultures of Tianshanbeilu, Yanbulake, and Heigouliang. The result may be summarized as follows. The Tianshanbeilu cemetery of synonymous culture yields an extraordinary amount of metal artifacts that are extremely diverse in both form and composition. The striking predominance of body ornaments such as buttons and tubes among the metal artifacts from Tianshanbeilu is comparable with the Siba culture in western Hexi Corridor and the Karasuk culture in Tuva and the Minusinsk Basin. At the same time, however, they are characterized by some distinctive traits- the buttons have the imprint of core for casting the small grip. The ring-topped knives and mirrors do not seem to be direct imports from Siba or Karasuk either; they are different in form from their Siba and Karasuk counterparts. It appears that the forms of the Tianshanbeilu metal artifacts find inspiration among Karasuk prototypes, but they also embody local innovation. This suggests that these objects are produced locally. The PXRF data indicate a wide range of chemical composition. The predominance of tin bronze, pure copper, and arsenic copper resembles the composition of metal artifacts of the Siba and Karasuk cultures. There are, in addition, gold (earring), copper and antimony (beads), and lead copper products.

Nine cemeteries can be attributed to the Yanbulake culture. They are much smaller than Tianshanbeilu, and far fewer metal artifacts are found. The metal artifacts uncovered from the Yanbulake cemetery, however, showcase the continuous development of the Tianshanbeilu metallurgical tradition, albeit with new innovations. Personal ornaments such as plaques, earrings, and buttons and the predilection for body ornaments continue to be used but certain types of artifacts, such as butterfly plaques and spiral tubes of Tianshanbeilu disappear. As a general trend, the artifacts become smaller and cruder in quality. The Yanbulake metal artifacts, however, do not completely reflect inspiration from the contemporaneous Tagar culture of the Minusinsk Basin. Horse paraphernalia such as bit, cheek-piece, buckles, as well as animal style plaques and buttons are absent here. The PXRF data show two major types of metal: tin bronze and arsenic copper. There is a decline in the use of other metal types but iron becomes more popular.

The cemeteries of the Heigouliang culture also yield a limited number of metal artifacts. The materials used become increasingly diverse. Iron, which has already emerged in the

Tianshanbeilu and Heigouliang cultures, is particularly prominent in Heigouliang, although copper and copper alloy remain dominant. The object types change dramatically. Buttons are decorated with birds, and different from those of the Yanbulake culture. Knives approach the form of modern medical lancets. A few new types of objects, including animal-style plaques, belt hooks, buckles, horse bit, jingle bell, long-handled daggers, and ring-handles join the assemblage of this culture. It appears that the population of Heigouliang adopts new types from the nomads of the Eurasian steppe, although we cannot pinpoint a single region as the source of inspiration. As of the Yanbulake culture, the PXRF data continue to show two major types of metal: tin bronze and arsenic copper. The use of other types of metal declines, but iron becomes prominent.

The PXRF data show some large patterns. The Tianshanbeilu metals are predominantly made of tin bronze, and remarkably different from the Karasuk metals, lending support to the proposition of local production. The Yanbulake and Heigouliang metals are likewise mainly fabricated out of tin bronze and arsenic copper, which indicates staple supply of arsenic and tin. Lead copper alloy is also an important type of materials throughout the three periods; antimonial copper remains in use and during the second period. The origin of tin, lead, and antimony, therefore, becomes an outstanding question.

REFERENCES

Autonomy Region Cultural Relics Survey Office 自治区文物普查办公室, Hami Region Cultural Relics Expedition 哈密地区文物普查队. 1991. 哈密地区文物普查资料 Hami region cultural relics survey data. 新疆文物 *Xinjiang Cultural Relics* 4 (1991): 1–78.

Bergman, Folke. 1939. *Archaeological Researches in Sinkiang*, pp. 14–15. Stockholm: Bokvörlags Aktiebolaget Thule.

Chang, Xi'en 常喜恩. 1985. 巴里坤南湾墓地 66 号墓清理简报 A Brief Report on Grave 66 in the Nanwan Cemetery in Barkol. 新疆文物 *Xinjiang Cultural Relics* 1 (1985): 4, 16.

Chen, Ge陈戈. 1987. 关于新疆新石器时代文化的新认识 A New Understanding of the Neolithic Cultures of Xinjiang. 考古 *Archaeology* 4 (1987): 343–351, 322.

Chen, Ge陈戈 and Zhang, Yuzhong张玉忠. 1999. 世纪之交新疆考古学的回顾与展望 Retrospect and Prospect of Xinjiang Archaeology at the Turn of Centuries. 西域研究 *Studies of the Western Region* 1 (1999): 1–11.

De Chardin, Pierre Teihard and Young C.C. 1933. On Some Neolithic (and possibly Paleolithic) Finds in Mongolia, Sinkiang and West China, *Bulletin of the Geological Society of China* XII/1-2: 83–102.

Guo, Wu郭物. 2012. 新疆史前晚期社会的考古学研究 *An Archaeological Study of Late Prehistoric Societies of Xinjiang*. Shanghai: Shanghai Guji Chubanshe.

Hami Region Cultural Relics Administration哈密地区文管所. 1998. 哈密黄田庙尔沟墓地调查 A Survey at the Miaoergou Cemetery in Huangtian, Hami. 新疆文物 *Xinjiang Cultural Relics* 1(1998): 32–35, 10.

Hami Museum 哈密博物馆. 2013. 哈密文物精粹 *Selected CulturalRrelics of Hami*. Beijing: Kexue Chubanshe.

Han, Jianye 韩建业. 2007. 新疆的青铜时代和早期铁器时代文化 *Bronze Age and Early Iron Age Cultures of Xinjiang*. Beijing: Wenwu Chubanshe.

Hu, Wanglin 胡望林. 2015. 哈密市亚尔墓地考古发掘 An Archaeological Excavation at the Yaer Cemetery in Hami City, in *2013–2014* 文物考古年报 *Annual Report of Cultural Relics and Archaeology in 2013–2014*, pp. 15–16. Publication of the Xinjiang Institute of Cultural Relics and Archaeology.

Hu, Wanglin 胡望林, Zhang, Jie 张杰. 2014. 哈密市柳树沟遗址和墓地考古发掘 An Archaeological Excavation at the Liushugou Settlement and Cemetery in Hami city, in *2013–2014* 文物考古年报 *Annual Report of Cultural Relics and Archaeology in 2013–2014*, pp. 17–19. Publication of the Xinjiang Institute of Cultural Relics and Archaeology.

Institute of History of Metallurgy and Materials University of Science and Technology Beijing北京科技大学冶金与材料史研究所, Xinjiang Institute of Cultural Relics and Archaeology新疆文物考古研究所, Hami Region Cultural Heritage Administration哈密地区文物管理所. 2001. 新疆哈密天山北路墓地出土铜器的初步研究 A Preliminary Study of Bronze Artifacts Unearthed from the Tianshanbeilu Cemetery in the Hami Region, Xinjiang. 文物 *Cultural relics* 6 (2001): 79–89.

Kadyrbaev, M. K., Кадырбаев М. К., Kurmankulov, Zh. Ж. Курманкулов. 1992. Culture of Ancient Herders and Metallurgists of Sary-Arki *Культура древних скотоводов и металлургов Сары-Арки*. Alma-Ata: Gylym.

Ling, Yong凌勇. 2008. 新疆公元前第一千纪的金属技术研究 *A Study of Metallurgy of the First Millennium BC of Xinjiang*. PhD Dissertation, University of Science and Technology Beijing.

Lü, Enguo 吕恩国, Chang, Xi'en 常喜恩, and Wang, Binghua 王炳华. 2001. 新疆青铜时代考古文化浅论A Short Discussion of Bronze Age Archaeological Cultures of Xinjiang, in 宿白 Su, Bai ed., 苏秉琦与中国当代考古学 *Su Bingqi and Contemporary Archaeology of China*, 172-193. Beijing: Kexue Chubanshe.

Mei, Jianjun. 2000. *Copper and Bronze Metallurgy in Late Prehistoric Xinjiang*. Oxford: Archaeopress.

Northwest University Cultural Heritage Conservation and Archaeology Center 西北大学文化遗产保护与考古学研究中心, Xinjiang Institute of Cultural Relics and Archaeology 新疆文物考古研究所, Hami Region Cultural Relics Bureau 哈密地区文物局. 2014. 2008年伊吾县托背梁墓地考古发掘简报 A Brief Report of an Archaeological Excavation at the Tuobeiliang Cemetery in Yiwu County in 2008. 新疆文物 *Xinjiang Cultural Relics* 2 (2014): 45–59.

Qian, Wei潜伟. 2006. 新疆哈密地区史前时期铜器及其与邻近地区文化的关系 *Prehistoric Copper Artifacts of the Hami Region of Xinjiang and Their Connection with the Adjacent Regions*, p. 38. Beijing: Zhishi Chanquan Chubanshe.

Rybakov, B. A. Рыбаков Б. А. ed. 1992. *The Steppe Belt of the Asiatic Part of SSSR in the Scythian-Sarmatian Time Степная полоса Азиатской части СССР в скифо-сарматское время*. Moscow: Science Press.

Tong Tianyi, Ma Jian, Li Wenying, Chang Xi'en, Yu Jianjun, Wang Jianxin, Ma Yingxia, Tian Yiliang, Kuerban Reheman, Murati Simayi, Liu Ruiliang. 2020. Chronology of the Tianshanbeilu Cemetery in Xinjiang, Northwestern China. *Radiocarbon* 63/1 (2020): 343–356.

Tulahun, Tohti托乎提·吐拉洪. 2005. 新疆伊吾县拜契尔墓地进行抢救性考古发掘 A Rescue Excavation at the Baiqier Cemetery in Yiwu County, Xinjiang. 中国文物报 *China Cultural Relics Weekly*, February 4, 2005, page 1.

Wei, Dong 魏东, Zeng, Wen 曾雯, Chang, Xi'en 常喜恩, Zhu, Hong 朱泓. 2012. 新疆哈密黑沟梁墓地出土人骨的创伤、病理及异常形态研究 A Study of Trauma, Pathology, and Deformation of Unearthed Human Bones from the Heigouliang Cemetery in Hami, Xinjiang. 人类学学报 *Bulletin of Anthropology* 31/2 (2012): 176–186.

Xinjiang Institute of Archaeology新疆考古研究所. 1987. 巴里坤县南湾M95号墓试掘简报 A Brief Report on Grave 95 in the Nanwan Cemetery in Barkol County. 考古与文物 *Archaeology and Cultural Relics* 5 (1987): 7–8.

Xinjiang Institute of Cultural Relics and Archaeology 新疆文物考古研究所. 1984. 哈密拉甫乔克发现新石器时代晚期墓葬遗址 The Discovery of a Late Neolithic Mortuary Site at Lafuqiaoke in Hami. 考古与文物 *Archaeology and Cultural Relics* 4 (1984): 105–106.

Xinjiang Institute of Cultural Relics and Archaeology 新疆文物考古研究所, Northwest University Cultural Heritage Conservation and Archaeology Center 西北大学文化遗产保护与考古学研究中心, Hami Region Cultural Relics Bureau 哈密地区文物局. 2014. 2008年伊吾县峡沟墓地考古发掘简报 A Brief Report on an Archaeological Excavation at the Xiagou Cemetery in Yiwu County in 2008. 新疆文物 *Xinjiang Cultural Relics* 2 (2014): 9–17.

Xinjiang Institute of Cultural Relics and Archaeology 新疆文物考古研究所, Hami Region Cultural Relics Administration 哈密地区文管所. 1991. 哈密—巴里坤公路改线考古调查 An Archaeological Survey of the Rerouted Hami-Barkol Highway. 新疆文物 *Xinjiang Cultural Relics* 1 (1991): 9–10.

Xinjiang Institute of Cultural Relics and Archaeology 新疆文物考古研究所. 1992. 新疆哈密五堡墓地151、152号墓葬 Graves 151 and 152 in the Wubu Cemetery in Hami, Xinjiang. 新疆文物 *Xinjiang Cultural Relics* 3 (1992): 1–10.

Xinjiang Institute of Cultural Relics and Archaeology新疆文物考古研究所, Hami Region Cultural Relics Administration 哈密地区文物管理所. 2002. 新疆哈密市艾斯克霞尔墓地的发掘 An Excavation at the Aisikexiaer Cemetery in Hami City, Xinjiang. 考古*Archaeology* 6 (2002): 30–41.

Xinjiang Institute of Cultural Relics and Archaeology 新疆文物考古研究所. 2014. 哈密市花园乡萨伊吐尔墓地考古发掘报告 An Archaeological Excavation Report on the Sayituer Cemetery in Huayuan District, Hami City. 新疆文物 *Xinjiang Cultural Relics* 1 (2014): 65–75.

Xinjiang Institute of Cultural Relics and Archaeology 新疆文物考古研究所, Northwest University Cultural Heritage Conservation and Archaeology Center 西北大学文化遗产保护与考古学研究中心, Hami Region Cultural Relics Bureau 哈密地区文物局. 2014. 2008年哈密市射月沟墓地考古发掘简报A Brief Report on an Archaeological Excavation at the Sheyuegou Cemetery in Hami City in 2008. 新疆文物 *Xinjiang Cultural Relics* 2 (2014): 4–8.

Xinjiang Institute of Cultural Relics and Archaeology 新疆文物考古研究所, Hami Region Cultural Relics Administration 哈密地区文管所. 1996. 新疆哈密寒气沟墓地发掘简报 A Brief Report on the Hanqigou Cemetery in Hami, Xinjiang. 新疆文物 *Xinjiang Cultural Relics* 2 (1996): 23–30.

Xinjiang Institute of Cultural Relics and Archaeology 新疆文物考古研究所, Hami Region Cultural Relics Administration 哈密地区文管所. 1997. 新疆哈密市寒气沟墓地发掘简报A Brief Report on the Hanqigou Cemetery in Hami, Xinjiang. 考古*Archaeology* 9 (1997): 33–38.

Xinjiang Uighur Autonomy Region Cultural Ministry Cultural Relics Department 新疆维吾尔自治区文化厅文化处, Xinjiang University History Department Cultural Relics

and Museology Training Program 新疆大学历史系文博干部专修班, 1989. 新疆哈密焉布拉克古墓地 The Ancient Cemetery of Yanbulake in Hami, Xinjiang. 考古学报 *Bulletin of Archaeology* 3 (1989): 325–342.

Xinjiang Cultural Relics Affairs Administration 新疆文物事业管理局, Xinjiang Institute of Cultural Relics and Archaeology 新疆文物考古研究所. 1999. 新疆维吾尔自治区文物考古五十年 Fifty Years of Cultural Relics and Archaeology of Xinjiang Uighur Autonomy Region. In 新中国考古五十年 *Fifty Years of Archaeology of New China*, p. 482. Beijing: Wenwu Chubanshe.

Xinjiang Institute of Cultural Relics and Archaeology 新疆文物考古研究所, Northwest University Cultural Heritage Conservation and Archaeology Center 西北大学文化遗产保护与考古学研究中心. 2007. 2006年巴里坤东黑沟遗址发掘 An Excavation at the Dongheigou Settlement in Barkol in 2006. 新疆文物 *Xinjiang Cultural Relics* 2 (2007): 32–60.

Xinjiang Institute of Cultural Relics and Archaeology 新疆文物考古研究所, Northwest University Cultural Heritage Conservation and Archaeology Center 西北大学文化遗产保护与考古学研究中心. 2009. 新疆巴里坤县东黑沟遗址 2006～2007 年发掘简报 A Brief Report of the 2006-2007 Excavation at the Dongheigou Settlement in Barkol County, Xinjiang. 考古 *Archaeology* 11 (2009): 3–27.

Yang,Yishi, Shanjia Zhang, Chris Oldknow, Menghan Qiu, TIngting Chen, Haiming Li, Yifu Cui, Lele Ren, Guoke Chen, Hui Wang, Guanghui Dong.2019. Refined Chronology of Prehistoric Cultures and Its Implication for Re-Evaluating Human-Environment Relations in the Hexi Corridor, Northwest China. *Science China Earth Sciences* 62(2019): 1578–1590.

Zhang, Cheng'an 张成安, Chang, Xi'en常喜恩. 1998. 哈密腐殖酸厂墓地调查 A Survey of the Fuzhisuanchang Cemetery in Hami. 新疆文物 *Xinjiang Cultural Relics* 1 (1998): 36–40.

Zhang, Feng张凤. 2010. 新疆东部地区古文化探微 An Observation on Ancient Cultures of Eastern Xinjiang. 西域研究 *Studies of the Western Region* 2 (2010): 44–52.

Zhang, Liangren. 2017. The Transmission of the Karasuk Metallurgy to the Northern Zone of China, *Shidi Xuebao* 1 (2017): 100–124.

Zhang, Xuelian张雪莲, Liangren Zhang张良仁, Hui Wang王辉, Xuefeng Lu卢雪峰, Guoke Chen陈国科, Peng Wang王鹏. 2015. 张掖市西城驿遗址的碳十四测年及初步分析 C14 dates of the Xichengyi site in Zhangye City and preliminary analysis. 华夏考古 *Huaxia Archaeology* 4(2015):38–45.

Zhang, Liangren 张良仁, Ling, Yong 凌勇, Chen, Jianli 陈建立, Liu, Guorui 刘国瑞, Chang Xi'en 常喜恩, Kurban Rahman 库尔班. 热合曼 , Murat Esmayil 木拉提. 司马义, Ma Yingxia 马迎霞, Yan Feng 严枫. 2016. 哈密地区史前考古 Prehistoric Archaeology of the Hami Region. 欧亚学刊 *Journal of Eurasian Studies* 15(2016):1–18.

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MICROBLADE PERCUSSION IN THE UPPER PALEOLITHIC OF MONGOLIA: ON THE PROBLEM OF ORIGIN AND DISTRIBUTION WITHIN CENTRAL ASIA AND THE FAR EAST

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Abstract: The focus of this investigation is on the technology of micro-percussion in the Upper Paleolithic of Mongolia. Micro-percussion is defined as the entire assemblage of lithic artifacts associated with the production of microblades. The complexes analyzed here include microcores and microblades, but not tools made of them. Until recently, microblade percussion has never been considered a distinct trend emergent in the lithic technology of the Early Upper Paleolithic of Mongolia. In this paper, based upon lithic materials from northern Mongolia and the Gobi Altai, we prove the existence of microblade percussion at the early stages of the Upper Paleolithic (37–26 000 BP) and persisting until the very beginning of the Holocene (11–10 500 BP). In other words, this is crosscutting technology for the region. We conclude that in the Early Upper Paleolithic complexes of northern Mongolia, preferential reduction initially emphasized narrow-front and, later, wedge-shaped microcore production. Analysis of materials from the Final Paleolithic and the Early Holocene horizons at the Tolbor-15 site, along with representative surface collections and GIS modeling of site location patterns along tributaries of the Selenga River, allow us to formulate a series of hypotheses regarding the origin of the wedge-shaped flaking technique in northern Mongolia and the dynamics and directionality of its diffusion. The microblade technique observable in the Final Paleolithic of northern Mongolia exhibits more similarities with lithic complexes known archaeologically to the south (Inner Mongolia) and east (Russian Far East, Korean Peninsula, and Japanese Archipelago), not with the Russian Trans-Baikal region.

Keywords: Mongolia, Central Asia, Far East, Upper Paleolithic, microblade percussion

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МИКРОПЛАСТИНЧАТОЕ РАСЩЕПЛЕНИЕ В ВЕРХНЕМ ПАЛЕОЛИТЕ МОНГОЛИИ: К ВОПРОСУ О ПРОИСХОЖДЕНИИ И РАСПРОСТРАНЕНИИ В ЦЕНТРАЛЬНОЙ АЗИИ И НА ДАЛЬНЕМ ВОСТОКЕ

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Резюме: Предметом исследования является технология микрорасщепления в комплексах раннего верхнего палеолита Монголии. Под микрорасщеплением подразумевается вся совокупность каменных артефактов, связанная с операциями по изготовлению микропластин. В рассматриваемых комплексах обнаружены как микронуклеусы, так и микропластинки, но орудий из них не найдено. До сих пор микрорасщепление как самостоятельное направление развития технологии обработки камня в раннем верхнем палеолите Монголии не рассматривалось. В статье на примере материалов из северной Монголии и Гобийского Алтая доказывается существование микрорасщепления уже на ранних этапах верхнего палеолита (37–26 тыс. л.н.). Делается вывод, что в комплексах раннего верхнего палеолита северной Монголии предпочтение отдавалось торцовому, а затем клиновидному микрорасщеплению. Анализ материалов комплексов финального палеолита и раннего голоцена со стоянки Толбор-15 и представительных коллекций сборов с поверхности, а также ГИС модель распространения памятников вдоль притоков р. Селенги дают нам возможность сформулировать ряд гипотез о происхождении клиновидного микрорасщепления в северной Монголии, динамику и направление его распространения. Микропластинчатая техника финального палеолита северной Монголии демонстрирует большее сходство с комплексами, расположенными к югу (Внутренняя Монголия) и востоку (российский Дальний Восток, Корейский полуостров и Японский архипелаг), но не с Забайкальем.

Ключевые слова: Монголия, Центральная Азия, Дальний Восток, верхний палеолит, микропластинчатое расщепление

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Introduction

Materials of multi-level Paleolithic-Neolithic sites in Mongolia are of the highest importance for studies of the problem of the initial peopling by *Homo sapiens* of Northeast Asia in the Pleistocene. These data help correlating Mongolian artifacts with those of the

detailed-excavated Baikal and Trans-Baikal territories, and to construct a unified picture of the development of the Paleolithic in Central Asia and Eurasia in whole. Starting in the late 1990s a large series of stratified multilevel sites was discovered and studied in Gobi Altai and northern Mongolia. Of special interest are the cave sites Tsagaan Agui, Chikhen Agui, and the open-air Chikhen-2 site in the Gobi Altai, along with Tolbor-4 and Tolbor-15 open sites in Khangai Mountains of northern Mongolia (Fig. 1). The authors of this paper were directly involved in the investigations of all these sites.

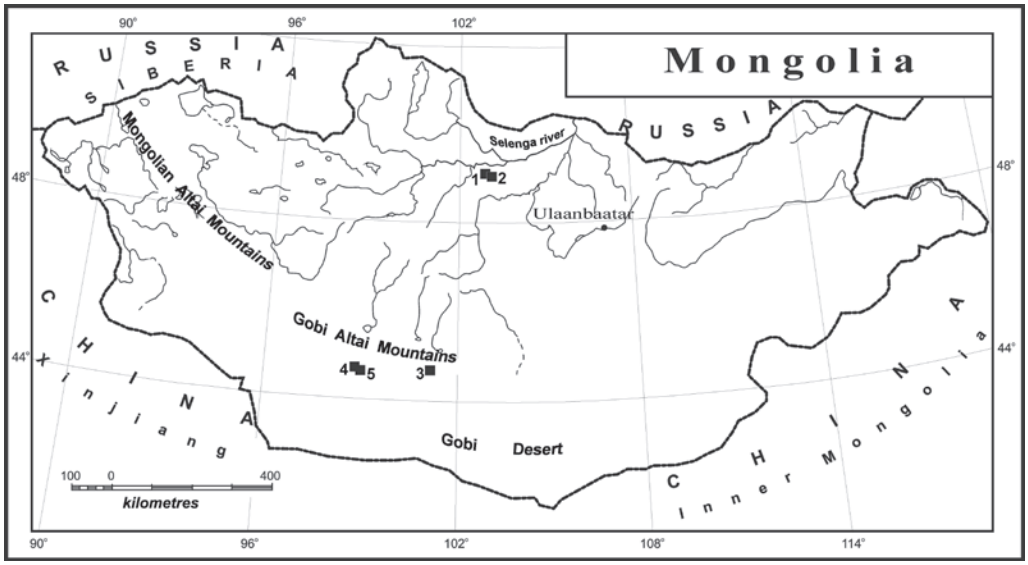

Fig. 1. Location of sites mentioned in the text: 1 — Tolbor-4; 2 — Tolbor-15; 3 — Tsagaan Agui Cave; 4 — Chikhen Agui Rockshelter; 5 — Chikhen-2
Рис. 1. Карта расположения стоянок, упомянутых в статье: 1 — Толбор-4; 2 — Толбор-15; 3 — пещера Цаган-Агуй; 4 — грот Чихэн-Агуй; 5 — Чихэн-2

Starting from 2014, excavations of the Early Upper Paleolithic in Northern Mongolia were led by the group of specialists from the Institute of Archaeology and Ethnography, Novosibirsk including Dr. Eugene P. Rybin and Dr. Arina M. Khatsenovich in permanent cooperation with specialists from Mongolia, Japan, USA etc. In fact they made important contribution to the quest of the origin and evolution of the Early Upper Paleolithic not only in Mongolia but in Central and Eastern Asia on the whole.

First of all, they re-organised previous periodization of the Early Upper Paleolithic of Mongolia by positioning "Initial" time of the Upper Paleolithic into the separate period on the basis of technological criteria [Rybin, 2014], and dividing the Early Upper Paleolithic into two periods with reasonable logic and arguments [Rybin et al., 2016a, 2016b].

The stratified Tolbor-21 (T-21) site is located in the same river valley as T-4 and T-15 (Ikh Tulberiin Gol), and Kharganyn Gol-5 located in the neighboring valley (Kharganyn Gol) sites plays central role in this concept. While in there researches were able to observe the archaeological horizons with the complexes of the Initial Upper Paleolithic and the Early

Upper Paleolithic along with some archaeological materials below them. They logically concluded that lower horizons could belong to the Middle Paleolithic [Khatsenovich et al., 2017; Rybin, Khatsenovich, Pavlenok, 2016c; Khatsenovich et al., 2015]. Among the materials of Kharganyn-Gol-5 site A.M. Khatsenovich described a new specific type of tool — geometric microliths which earlier have never been found at the known stratified Paleolithic complexes of Mongolia [Khatsenovich and Rybin, 2015].

Also Rybin and Khatsenovich described several scenarios for the origin of the Initial and Early Upper Paleolithic periods in Mongolia which are connected not only with the spreading from the territories of Altai around 45000–30000 BP, but also the influence of the possible local Mongolian, the Middle Paleolithic component [Khatsenovich et al., 2015, 2017]. They published the most complete list of all the dates for all known stratified Paleolithic complexes in Mongolia [Rybin et al., 2016a, 2016b].

In turn, in our article, we review all data connected with micro-percussion in the Early Upper Paleolithic (EUP), the Final Paleolithic (FP), complexes, and the Final Upper Paleolithic (FUP) at multi-level sites in Mongolia. In other words, the subjects of this research are microcores and microblades found in these levels. EUP is presented by archaeological materials from Hors. 6, 5, and 4 at T-4 and Hors. 7, 6 and 5 at T 15 (Northern Mongolia); as well as archaeological complexes of the third depositional cycle in Tsagaan Agui, materials from Level 3 in Chikhen Agui Rockshelter, and materials from Levels 3 and 2.8–2.5 at the Chikhen-2 open-air site (Gobi Altai).

Materials and Methods

Six archaeological horizons lying directly above each other, without sterile layers, were distinguished in the cross-section of the Tolbor 4 site (T-4). Upper horizons (2 and 3) belong to the final stage of the Upper Paleolithic, while horizons 4, 5 and 6 (Hors. 4, 5, 6) are connected with the Early and the beginning of the Early Upper Paleolithic.

In its turn, seven archaeological horizons were recognized for Tolbor-15 site (T-15). Upper horizons of T-15 illustrate the Final Paleolithic and are dates between 15000–14000 BP. The Early Upper Paleolithic complex was located in horizons 5–7 and is dated to 34000–28 000 BP.

Rich archaeological material, excavated during several seasons at T-4 and T-15 sites reasoned to judge about the technology of percussion and tools manufacture by the Upper Paleolithic habitants of this region [Derevianko et al., 2006, 2007, 2013; Rybin et al., 2006; Rybin, Gladyshev, Tsybankov, 2007; Gladyshev, Tsybankov, Kandyba, 2010; Gladyshev, Tabarev, Olsen, 2011].

In addition to archaeological material, a large series of ^{14}C dates covered the period from the Final Paleolithic to the limit possibilities of the method (the Early Upper Paleolithic) was received [Gladyshev et al., 2013]. In sum, the periodization of the Upper Paleolithic complexes of Mongolia, based on the radiocarbon dating and comparisons of the archaeological materials was proposed [Gladyshev et al., 2010, 2012].

However such important component of the stone industry as *micro-percussion* turned out to be unexplored. We understand micro-percussion as the specific part of ancient human activity, and direction lithic technology focused on the production of micro-preforms (microblades). It includes micro-cores of various types itself and micro-preforms removed from them. The

study of this topic will be realized in frames of the morphological, and technico-typological methods along with historical correlation method.

Archaeological Materials Associated with Micro-percussion from Early Upper Paleolithic Complexes of Northern Mongolia and the Gobi Altai

Sixty-six microcores were identified in the collection of Hors. 6 and 5 at T-4 site. The most numerous group consists of narrow-front microcores (48 items). They all have front on the narrow side of the core. They could be divided into two types according to the preform and technique of the percussion.

The first type is represented by narrow-front microcores made on edge spalls from big sub-prismatic cores — so called "core-burins" (15 items). New platform beveled to the back side of the spall usually was prepared by retouch on one or two margins of these spalls; microblades were removed from this platform along the lateral (Fig. 2.-*1–4*). The direct analogies of these cores occur in complex of Kara-Bom site (Russian Altai Region), where they were the subject of long-term discussion to be recognizes as "cores" or "burins". Finally researchers came to agreement that these artifacts are special-type microcores on technical spalls focused for the production of elongated bladelets and microblades [Slavinsky, Rybin, Belousova, 2016].

The second type is documented by narrow-front microcores made on various spalls of mid-range size (33 items). To remove the microblades and narrow bladelets ancient knappers used natural facets or laterals (Fig. 2.-*5, 6*). Six examples were made on small pebbles or pebble fragments, while for the rest, flakes were used. Maximal measurements for the cores are 56×37×18 mm, minimal — 40×17×14 mm. To initialize the percussion the removals were done along the lateral (in case of spall preform), or the natural facet of the stone. Slightly convex front demonstrates the negatives of single-directional removals of bladelets and microblades, platforms are beveled to the opposite side of the front which is prepared by punctual retouch.

One of the microcores morphologically is very similar with the conical microcores (Fig. 2.-*7*). It is made on the flake of the sub-rectangular configuration and oval cross-section with some cortex remnants. Its platform was prepared by the series of removals and canted to the ventral surface of the initial flake; front demonstrates traces of single-directional removals of bladelets and microblades.

The other narrow-front microcore is close to wedge-shaped modification. Being made on the elongated pebble it has cylindrical cross-section; traces of single-directional bladelets-like removals are located on the narrow side. Negatives cover about the half of it, and abut to the base of the core designed into the two-side retouched edge. It looks like the accommodation to tight the core into any portable device. From the other hand, this retouched edge is not opposed to the front of percussion, which is typical for classic wedge-shaped microcores, but in the same plane position (Fig. 2.-*8*).

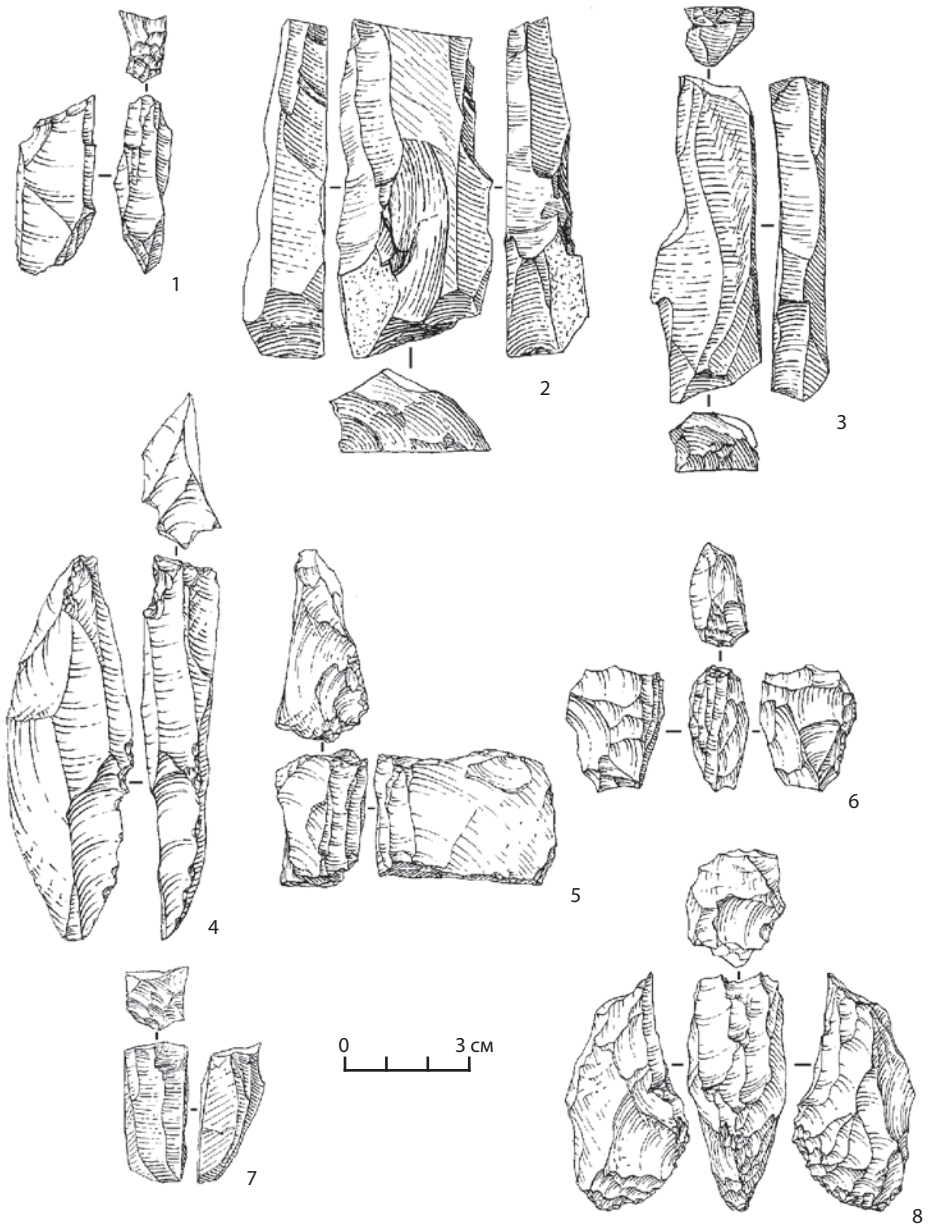

Fig. 2. Narrow-front microcores: 1–4 — microcores-burin type (1, 4 — Tolbor-4, Hor. 6; 2, 3 — Tolbor-4, Hor. 5); 5–7 — narrow-front microcores (5, 7 — Tolbor-4, Hor. 5; 6 — Tolbor-4, Hor. 6); 8 — proto-microcore (Tolbor-4, Hor. 5)

Рис. 2. Торцовые микронуклеусы: 1–4 — микронуклеусы-резцы (1, 4 — Толбор-4, гор. 6; 2, 3 — Толбор-4, гор. 5); 5–7 — торцовые микронуклеусы (5, 7 — Толбор-4, гор. 5; 6 — Толбор-4, гор. 6); 8 — прото-микронуклеус (Толбор-4, гор. 5)

Next type of microcores known in Hors. 6 and 5 at T-4 site is documented by monofrontal and two-platform flat microcores with parallel removal of microblades (22 items). This type has analogies in collections of some sites of the EUP in South Siberia. Usually they are of small size within compact measurements (max — 49×52×16 mm, min — 36×36×19 mm), rectangular in configuration, flat in cross-section. All of them were prepared on spalls or fragments of spalls, with just one exception of the core on the initial stage of exploration made on a single piece of raw material. The whole series of cores strongly confirms that this type is no the product of the bigger cores exhaustion, but belongs to the original chaîne opératoire. For example, one core retains cortex on part of the front and the opposite side; another is prepared on the small flake with the central ridge formed by vertical retouch on the dorsal surface. The third one, with the platform prepared on the spall with retouch on the narrow edge, showed the percussion which started with the elimination of one of the laterals, and subsequent removals of two microblades on the ventral face of the core.

Among the cores illustrating the next stage of the exploration there are three artifacts of double-platform type. All exhibit the negative scars of microblade removals with irregular shape (Fig. 3.-*1*). Usually one of the laterals was partly sharpened by retouch, while the other stayed wider. One of the cores of this type is presented in the picture (Fig. 3.-*2*). Another example (Fig. 3.-*3*) shows the process of transition of the percussion to the narrow side where the removals of microblades continued from the platform with the alternative orientation in comparison with the wide front. Flat retouch on the opposite side of the core is a common technical characteristic for this type of the cores.

The last,the forth type of the microcores, known in the EUP complexes at T-4 site is represented by one artifact. This is a very small sub-prismatic double-platform microcore (Fig. 3.-*4*). Each front of percussion was turned into the platform for the subsequent series of removals. The opposite side of the core is covered by natural cortex.

Analyzing these materials we could suggest that the preference in microblades production during the Initial Upper Paleolithic in northern Mongolia was given to the percussion of narrow-front cores. It should be underlined that "burin-cores" were in use only with the frames of this period, there are no technological signals about their presence in later times.

Later period of EUP in Northern Mongolia is characterized by the materials from Hors. 7-5 at T-15 site and Hor. 4 at T-4 site. It is dated by ^{14}C in chronological frames from 33000 to 26000 BP. The earliest materials are situated in Hors. 7-5 at T-15 site. Micro-percussion in these horizons is represented by three types of microcores.

The first type, microcores made of various preforms (13 items), are small flakes (9 items) and single briquettes (4 items). These microcores have minimal initial treatment by a series of removals to prepare striking platform, or even without it. After that several small microblades were removes from one of the preforms edges.

One of the microcores is presented by double-platform single-front modification on the briquette preform. Microblades were removed first from one platform, and then from the other in the opposite direction.

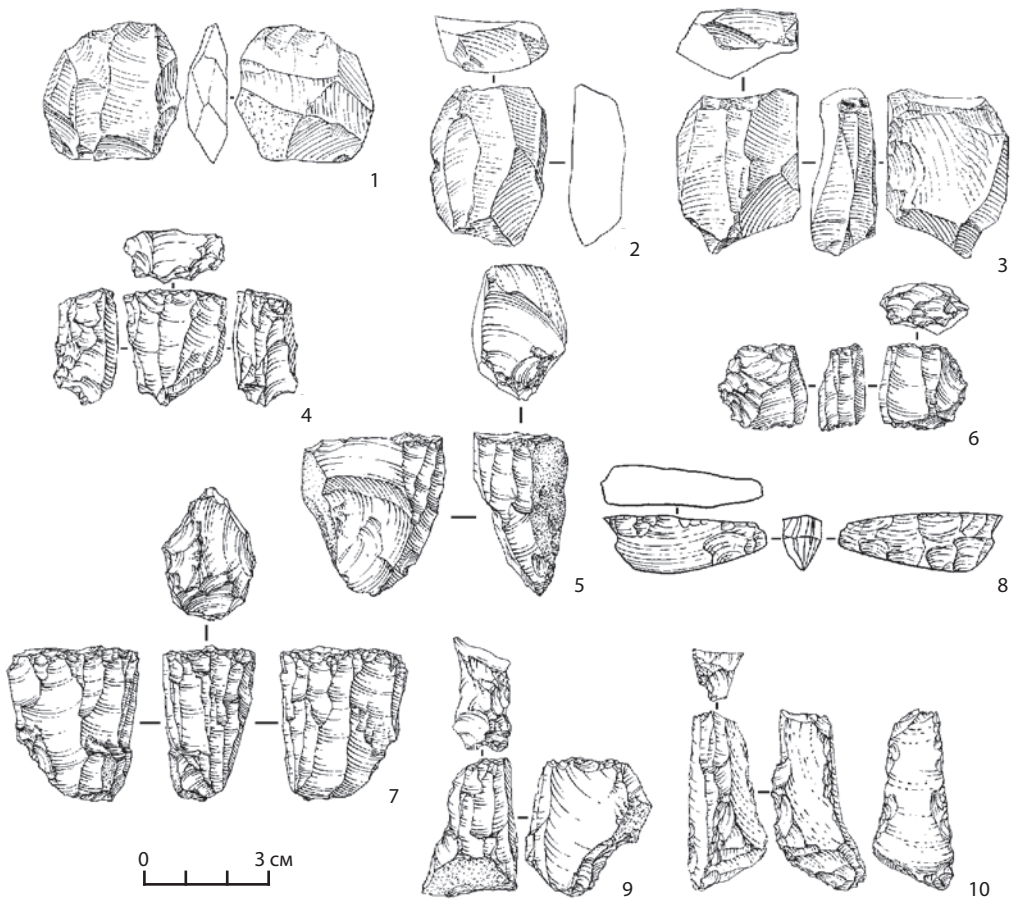

Fig. 3. Flat, volumetric, narrow-front, and wedge-shaped microcores: 1–3 — flat microcores (Tolbor-4, Hor. 5); 4, 9, 10 — volumetric sub-prismatic microcores (4 — Tolbor-4, Hor. 6; 9, 10 — Tolbor-4, Hor. 4); 5, 6 — narrow-front microcores (Tolbor-15, Hor. 6); 7, 8 — wedge-shaped microcores (Tolbor-15, Hor. 5)

Рис. 3. Плоскостные, объемные, торцовые и клиновидные микронуклеусы: 1–3 — плоскостные микронуклеусы (Толбор-4, гор. 5); 4, 9, 10 — объемные подпризматические микронуклеусы (4 — Толбор-4, гор. 6; 9, 10 — Толбор-4, гор. 4); 5, 6 — торцовые микронуклеусы (Толбор-15, гор. 6); 7, 8 — клиновидные микронуклеусы (Толбор-15, гор. 5)

The second type includes two artifacts of triangle configuration and flattened cross-section. They could be recognized as proto-wedge-shaped cores for microblades production. The shape of the microcore was determined by the shape of the initial preform: in one case it was the flake, in two others — possibly, very exhausted cores for bladelets. Platforms were prepared by the series of removals, while the opposite sides were shaped into the wedge by retouch. According to the negatives on the front the cores were used for microblades and small bladelets (Fig. 3.-*5, 6*).

The third type of microcore are wedge-shaped microcores for producing microblades (two items). One of the cores is made on a small pebble. Platform was prepared by several centripetal removals and oriented perpendicular to the front. The opposite support side was sharpen into wedge by retouch, on one of the laterals remained the portions of cortex (Fig. 3.-*7*). Another microcore was manufactured from the triangle edge spall; natural surface was used for the platform. One of the laterals has total surface retouching from the platform side, the other one was just slightly modified by retouch. The opposite side was carefully sharpened into wedge; the angle between front and platform is close to optimal — about 60°. According to the negatives (1, 2–1 cm length and 4 mm width), after several removals of the microblades the front was blocked by defects (breakage of microblades), and the exploration of the core was stopped on the early stage (Fig. 3.-*8*). We think that such problems in the core exploration are typical for pressure technique, and the core was reduced by pressure [Gladyshev and Tabarev, 2009]. This is confirmed, first of all, by the absence of any defects on the edge of the platform (they are common for percussion), and, secondly, by the equal width of the microblade across the length. In case of percussion, the width of the proximal end of the microblade, and accordingly, of its negative, will be bigger than at the distal end. And, finally, the core is so small (length — 5 cm, front height — 1,8 cm, and platform width — 1,4 cm) that is not possible to reduce it further by either direct or even indirect percussion.

The further development of the micro-technique is illustrated by the materials from Hor. 4 at the T-4 site, which are dated between 27000–26000 BP. It should be noted that in whole the system of percussion in this horizon differs from Hors. 6-5. Firstly, occasional percussion is dominating which is evident by the production of flakes with irregular configuration and orthogonal treatment. There are also a lot of debitage forms of different size. In spite of the same stone tool-kit as in previous period, the changes in the system of percussion could be explained by the exploration of alternative raw material sources of more fractional nature. Secondly, the dramatically decrease of blade production and the total absence of sub-prismatic cores focused on manufacturing large and medium blades which are typical of the lower horizons.

Volumetric sub-prismatic microcores for microblade manufacture are characteristic of the second, later period of EUP in Northern Mongolia. This type is presented in the collection of Hor. 4 at the T-4 site by eight items. All were made on small pebbles or spalls, three microcores have straight platforms (Fig. 3.-*9*), the rest ones — slanting platforms, all of the platforms were prepared by several removals and fixed by the edge with additional retouch. The front of percussion is covered by the negatives of bladelets; the opposite side is usually flat while the basal part of the core is slightly sharpened. One of the cores on the initial stage of percussion is of interest. It was made from end scraper which was possibly picked up somewhere and renewed later into the microcore. The difference in color and period of production between the negatives of microblades and prepared platform and the rest surface of the artifact with distinctive patina confirm it (Fig. 3.-*10*).

The second type of the microcores in the Hor. 4 at the T-4 site — wedge-shaped microcores for microblade production (four items). Medium spalls were used as preforms for three cores, and the rest one was made from the small flat piece of local stone. In all cases, preliminary

preparation started with the series of short removals for platform setting on one end of the preform. After that microblades were removed from the narrow side.

So, in materials belonging to second period of the EUP of northern Mongolia (Hors. 7–5 at T-15 the site, and Hor. 4 at the T-4 site) four types of microcores were identified: narrow-front, volumetric sub-prismatic, proto-wedge-shaped, and wedge-shaped cores.

Next categories of artifacts which characterize the micro-technology are microblades. They make up an insignificant part of all the removals.

We intentionally give the percentage neither for microcores nor for microblades of the total number of cores and removals of the other groups and types at the sites of northern Mongolia because this part is less than one percent. Analysis of the microblades demonstrates that unbroken artifacts are very few, the majority is fragmented. Most of the micro-spalls have pinpoint platforms; the margins are usually twisted, irregular, and convergent. There is no regularity in the dorsal treatment of the microblades, dihedral dorsal morphology is dominating. Single microblades with the trapezoidal cross-section and trihedral dorsal morphology are also known in the most ancient complexes (Hors. 6 and 5 at T-4 site), and in some later ones (Hors. 7–5 at T-15 site and Hor. 4 at T-4 site). No traces of secondary retouch on the microblades or on their fragments were found.

Next region of Mongolia where evidences of the micro-percussion is known at the multilevel sites is Gobi Altai. Today for this territory there are just three stratified sites which belong to the EUP: Chikhen Agui Rockshelter, the Chikhen-2 open-air site, and Tsagaan Agui Cave. All these sites are multicomponent [Derevianko et al., 2000, 2001, 2015].

In Tsagaan-Agui Cave, clear evidence of micro-percussion is associated with the third cycle of the sedimentation. First, collections of Levels 3–5 from the Main Chamber which the researchers attributed to the Late Mousterian — the beginning of the UP period [Derevianko et al., 2000]. They emphasize that: "Some core-like artifacts demonstrate the negatives of the micro-removals done without any preliminary platform and front preparations" [Ibid.: p. 31]. Also they wrote that the traces of proto-wedge-shaped technology and micro-preforms production were recorded earlier, in the materials of the second cycle of the sedimentation (levels 6–11 in the Main Chamber), and could belong to the Middle Paleolithic [Derevianko et al., 2000: 30, Fig. 6.-7]. The only proto-wedge-shaped core was manufactured on the piece of raw materials without any preparation of the laterals; elongated platform was designed by big flat flakes, and the micro-removals from this core had elongated and convergent configuration. The collection from the third cycle of the sedimentation has wide time-frames: Level 4 — from 66000 to 49000 BP, Level 3–33000–30000 BP [Derevianko et al., 2000: 27].

In Chikhen Agui Rockshelter, EUP materials were found in the third lithological horizon lying directly on the rock basement. The Paleolithic complex preserved on a small depression in the filling of the rocky base. On the rest of the territory of the cave it was destroyed [Derevianko et al., 2001]. In the collection there is one sub-prismatic core which typologically is the microcore for the microblade production [Derevianko et al., 2001: 30, Fig. 7.-7]. Its straight platform was neatly prepared with short flat removals; the edge of the platform was additionally fixed with micro-retouch; negatives of the microblade removals are visible on the front. Along with the microcore 24 microblades there are in the collection, their width is less

than 0.7 cm, and margins from the dorsal view are parallel. This lithic complex of the EUP is dated about 27000 BP [Derevianko et al., 2001: 34].

At the stratified Chikhen-2 open-air site, an EUP industry was discovered in Levels 3 and 2; at that level 2 is divided into 8 strata where 2.8–2.5 belong to the EUP, and the upper levels — to the later time [Derevianko et al., 2015]. Traces of the micro-percussion were found already in the collection of Level 3. The researchers point on the presence of microblades and bladelets with regular dorsal morphology [Derevianko et al., 2015: 21, Fig. 3.-9, 10] which in spite of the absence of the microcores could suggest the developed micro-percussion technology.

The next manifestation of the micro-percussion is known in the strata 2.6. There is a core in this strata demonstrating elements typical for the wedge-shaped cores [Derevianko et al., 2015: 32, Fig. 8.-4], and technical spall of so-called "ski-spall" modification [Derevianko et al., 2015: 33, Fig. 10.-18]. This artifact is a strong argument about the existence of the wedge-shaped technology in the industry of strata 2.6.

The most reliable example which confirms the fully developed technique of the manufacture and reduction of the microcores was found in strata 2.5. This is a microcore with scrupulous treatment of the laterals and prepared platform; microblades were removed from the narrow front and, partly, from one of the laterals [Derevianko et al., 2015: 34, Fig. 12.-5]. Furthermore, short narrow front microcore on the flake with the platform prepared by single removal was found in the same level [Derevianko et al., 2015: 34, Fig. 11.-3]. The lithic industry in stratum 2.5 dates to as early as 30000 BP [Derevianko et al., 2015: 37], so it is logical to assume that the materials in the lower strata of Level 2, and of Level 3 in particular, should be much older.

In the EUP materials of the Gobi Altai, two groups of the microcores were identified: sub-prismatic microcores (Chikhen Agui Rockshelter), and narrow-front modifications — wedge-shaped microcore (Chikhen-2 site), and short narrow-front microcores (Tsagaan Agui Cave, Chikhen-2 site).

The nearest complexes with synchronous industries of the EUP are the multilevel T-4 (Hor. 4), and T-15 sites (Hors. 7-5). Materials belonging to the period between 33000 and 30000 BP are known in Hors. 7–5 at the T-15 site [Gladyshev and Tabarev, 2017].

Microblade Technologies in the Final Pleistocene and Early Holocene Industries of Northern Mongolia

Materials associated with the Pleistocene — Holocene transition were also studied and analyzed, but not in all detail. They are known from the upper levels at T-4 (Hors. 1–3), T-15 (Hors. 1–4), and Kharganyn Gol-5 (Hor. 3). From the other side, the degree of the discussion about these complexes is much lower. In fact, they were studied in a "passing regime", just because of their presence at the multi-level sites, but never were the goal of the special research project or survey.

The manifestation of microblade technology in the Paleolithic of northern Mongolia is documented, first, with wedge-shaped microcores, which were manufactured by the *pressure technique*. As it was mentioned above, the pilot signal of this technique (microcore) is known at T-15 in Hor. 5 with an associated AMS date of 28460±310 (AA-84137) [Gladyshev, Tabarev, Olsen, 2011]. This early age was skeptically accepted by some specialists who pointed on possible infiltration of this artifact from the overlapping strata. Such approach would be compelling only if a series (or even a single case) of such microcores were ever found in the

upper horizons. However, while this was not fixed at T-15 or any other sites in the vicinity, we prefer to propose the early appearance of microblade pressure technique about 28000–27000 BP which is the earliest manifestation of this technology not only in northern Mongolia but in Central and East Asia as a whole.

Within the late period, at T-15, in Hors. 4, 3 (15000–14000 BP) and Hor. 2 (13000–11000 BP) wedge-shaped microcores are represented in more technically developed formats — on uni- and bifacial preforms. They all disappeared in Hor. 1 (the Early Holocene), while microblade technology continues to be in use in the form of micro-prismatic and micro-conical cores.

Interestingly to note that all the Final Paleolithic locations with microblade materials (microblade cores with negatives of removals, exhausted cores, microblades and their fragments, bi-facial and uni-facial preforms, boat-shaped and ski-spalls etc.) were located at different altitudes than locations yielding the Upper or Early Upper Paleolithic finds. From the other side, there are no wedge-shaped microblade cores (with pressure technique) in the upper horizons of such multi-component sites as T-4, 16 and 21 where micro-technology is represented by cores reduced only by percussion [Gillam et al., 2014].

In all known surface collections wedge-shaped microcores are usually accompanied by micro-conical and micro-prismatic modifications. So, the areas of habitation and activities of Final Paleolithic and Early Holocene groups in the Selenga River valley were identical.

This last point prompts returning to the question of the nature of the transition from the wedge-shaped to micro-prismatic technology. As it was emphasized above, these two technologies have not thus far been encountered in a single horizon in the Tolbor complex sites, which suggests the replacement of one by the other. This situation was encountered only at one site — T-15. Within special research wedge-shaped and micro-prismatic modifications could be traced, and their co-existence on the border of the Pleistocene and the Holocene would be prooved. This does not conflict with experimental data and strong evidence that to reduce wedge-shaped and micro-prismatic cores, portable devices of different constructions were used [Tabarev, 2012].

So far, only nine AMS dates are known for this period; they can be divided into two groups — the Final Pleistocene and the Holocene. Within the Final Paleolithic dates, five were obtained on *Struthio* eggshell and two on bone, while both Holocene dates were generated from charred remains on pottery. All the radiocarbon determinations in the first group fall within the range of 15700–12800 BP (18900–15200 cal BP), they completely match the Final Paleolithic. The second group — 7700–6700 BP (8600–7600 cal BP) corresponds with the Neolithic; possibly the Early Neolithic, because, for the present, they are the most ancient radiocarbon determinations not only the Selenga River basin but for the whole territory of Mongolia. Looks like in here we are facing gap between the two groups of dates — about 5000 — and it is possible that the degradation, the disappearance of wedge-shaped microblade technology, and its replacement by micro-prismatic technology occurred during this period.

It should be taken into consideration that chronological and regional subdivisions of microblade industries in the Trans-Baikal region often reflect the extent of archaeological knowledge,along with the clear intension of each scholar to contribute something original (personal) into this problem, or to critique previous models. Beginning in the 1990s, we observe the appearance of the so-called “Studenovskaya Culture” (18000–10800 BP); “Chikoiskaya

Culture" (15000–11000 BP); "Old Chikoiskaya Culture" (20000–18000 BP), "Selenginskaya Culture" (18000–8000 BP); "Ust' — Menza Phase" (18000–13000 BP); and "Final Paleolithic Selenginskaya Culture" (13000–11000 BP) among others. Both variants — that microblade wedge-shaped cores technology penetrated the Trans-Baikal region from northern Mongolia and vice versa — are discussed in these constructions. Almost all specialists regard the Selenga River as the principal route of these migrations and concomitant exchange of technologies.

During archaeological surveys conducted in the Ikh Tulberiin Gol, Kharganyn Gol and Altaatyn Gol river valleys in 2011–2014, it was figured out that the real mobility of groups was not limited only to the so-called "Selenga Corridor," but on the contrary people preferred to use low mountain passes to conveniently and comfortably pass from one river valley to the neighboring one. If so, tributaries of the Selenga River were functional transitional paths from the river's upstream reaches to its mouth.

Conclusions

Summing up, we may conclude that in Central Asia (specifically, in Mongolia) micro-percussion existed as an important element of material culture even during the early stage of the Upper Paleolithic. Technological approaches to microcore production and exploration appeared as early as 37000–35000 BP. Typology of microcore was not stable yet, there was a quest for optimal forms and shapes, while the morphology of small cores copies the morphology of large, flat and volume prismatic cores for blades and bladelets. The preference for narrow-front forms is obvious. The further development of the micro-technology continued until ca. 34000–33000 BP with the appearance of proto-wedge-shaped and wedge-shaped cores. The first evidence of the pressure technique also occurred at the same time or a little bit later.

We believe that the appearance of the micro-technique was not accidental, but reflected the necessity for smaller elements and microblades for composite tools which was manifest throughout Central Asia around 40000–35000 BP. Being spotted almost throughout the EUP, micro-percussion does not have an episodic but rather a *crosscutting* character.

Examples of the appearance and utilization of various micro-percussion techniques can be illustrated by *caréné*-type percussion in the Early Upper Paleolithic complexes of the Near East, Iran, and western Central Asia (Uzbekistan, Tajikistan) [Kolobova, Krivoshapkin, Pavlenok, 2014]; or narrow-front, flat-volume, and wedge-shaped percussion in the Russian Altai and Mongolia.

These facts confirm that the original technique of micro-percussion of narrow-front microcores came into practice in Mongolia as early as 40000–37000 BP. About 30000–28000 BP this approach transformed into the wedge-shaped technique based on the use of flakes, spalls, and bifacies as preforms. On the other hand, the same facts indicate the multi-linear and composite character of this process when several types of micro-percussion co-existed in the same territory simultaneously.

We contend that from morphological and typological points of view, the microblade technique in the Final Paleolithic of northern Mongolia illustrates interesting similarities with assemblages studied archaeologically to the south. For example, it is reasonable to mention the rich collections of Sven Hedin's Sino-Swedish Expeditions in Inner Mongolia; while to the east, the famous Here-Uul Mountain site is of special importance. Further east yet, we

find analogies in the Ustinovka Industry (Maritime Region, Russian Far East), on the Korean Peninsula, and in the Japanese Islands [Gladyshev, Tabarev, 2020; Sato, Izuho, Morisaki, 2011].

In fact, the majority of similarities (especially within the technical spalls and forms of exhausted microcores) could link northern Mongolia materials with the obsidian industry of Fukui Cave (Nagasaki Prefecture, Kyushu) [Kanomata et al., 2015].

This information proves the most likely spreading of pressure microblade technology in the Upper Paleolithic from Central Asia (northern Mongolia, in particular) to coastal and island territories of the East Asia. We believe that the alternative direction proposed recently by Buvit and colleagues [2016] this far lacks adequate archaeological substantiation. Also it would be extremely important to verify the hypothesis of the local center of the appearence of the microblade technology on the Korean Peninsula and the scale of its influence on the territories of the Maritime Region, Russian Far East and the Japanese Islands.

REFERENCES

Buvit I., Izuho M., Terry K., Konstantinov M. V., Konstantiniov A. V. Radiocarbon Dates, Microblades and Late Pleistocene Human Migrations in the Transbaikal, Russia and the Paleo-Sakhalin-Hokkaido-Kuril Peninsula // Quatenary International. 2016. Vol. 425. P. 100–119. DOI: 10.1016/j.quaint.2016.02.050

Derevianko A. P., Gladyshev S. A., Olsen J. W., Petrin V. T., Tserendagva Y. Characteristic Features of the Chikhen Agui Lithic Assemblage (Gobi Altai) // Archaeology, Ethnology & Anthropology of Eurasia. 2001. Vol. 5. P. 25–39.

Derevianko A. P., Zenin A. N., Rybin E. P., Gladyshev S. A., Tsybankov A. A. Razvitie kamennyh industrij verhnego paleolita Severnoj Mongolii (po dannym stoyanki Tolbor) [Evolution of Lithic Industries in the Upper Paleolithic of Mongolia (by the data of Tolbor 4 Site)] Chelovek i prostranstvo v kul'turah kamennogo veka Evrazii [Man and Space in the Stone Age Cultures of Eurasia]. Novosibirsk : Izd-vo In-ta arheologii i etnografii SO RAN, 2006. P. 17–42 (*In Russ*).

Derevianko A. P., Zenin A. N., Rybin E. P., Gladyshev S. A., Tsybankov A. A., Olsen D., Tseveendorj D., Gunchinsuren B. The Technology of Early Upper Paleolithic Lithic Reduction of Northern Mongolia: the Tolbor-4 Site // Archaeology, Ethnology & Anthropology of Eurasia. 2007. Vol. 29. P. 16–38.

Derevianko A. P., Markin S. V., Gladyshev S. A., Olsen D. The Early Upper Paleolithic of the Gobi Altai Region in Mongolia (Based on Materials from the Chikhen-2 Site) // Archaeology, Ethnology & Anthropology of Eurasia. 2015. Vol. 3 (43). P. 7–41. DOI: 10.1016/j.aeae.2015.11.004

Derevianko A. P., Olsen D., Tseveendorj D., Krivoshapkin A. I., Petrin V. T., Brantingham P. J. The Stratified Cave Site of Tsagaan Agui in the Gobi Altai (Mongolia) // Archaeology, Ethnology & Anthropology of Eurasia. 2000. Vol. 1. P. 23–36.

Derevianko A. P., Rybin E. P., Gladyshev S. A., Tsybankov A. A., Gunchinsuren B., Olsen D. 2013. Early Upper Paleolithic Stone Tool Technologies of Northern Mongolia: the Case of Tolbor-4 and Tolbor-15 // Archaeology, Ethnology & Anthropology of Eurasia. 2013. Vol. 4 (56). P. 21–37.

Gillam J. C., Gladyshev S. A., Gunchinsuren B., Olsen J. W., Tabarev A. V., Rybin E. P. Update on Paleolithic Research in Northern Mongolia // Legacy. 2014. Vol. 2. P. 22–23.

Gladyshev S. A., Gunchinsuren B., Jull A. J., Dogandzic T., Zwyns N., Olsen J. W., Richards M. P., Tabarev A. V., Talamo S. Radiouglerodnoe datirovanie paleoliticheskih stoyanok v doline r. Ih-Tulberijn-Gol v Severnoj Mongolii [Radiocarbon Dating of Paleolithic Sites in the Ikh Tulberiin Gol River Valley, Northern Mongolia]. Vestnik NGU. Seriya: Istoriya, filologiya [Newsletter of Novosibirsk State University, Series History, Philology]. 2013. Vol. 12. Pp. 44–48 *(In Russ)*.

Gladyshev S. A., Olsen J. W., Tabarev A. V., Kuzmin Y. V. Chronology and Periodization of Upper Paleolithic Sites in Mongolia // Archaeology, Ethnology & Anthropology of Eurasia. 2010. Vol. 3 (43). P. 33–40.

Gladyshev S. A., Olsen J. W., Tabarev A. V., Jull A. J. The Upper Paleolithic of Mongolia: Recent Finds and New Perspectives // Quatenary International. 2012. Vol. 281. P. 36–46. DOI: 10.1016/j.guaint.2012.01.032

Gladyshev S. A., Tabarev A. V. New Data on the Early Upper Paleolithic of Northern Mongolia // Current Research in the Pleistocene. 2009. Vol. 26. P. 17–18.

Gladyshev S. A., Tabarev A. V. Nekotorye problemy izucheniya mikroplastinchatogo rasshchepleniya v rannem verhnem paleolite Severnoj Mongolii [Some Problems of Studies of Microblade Percussion in the Early Upper Paleolithic of Northern Mongolia]. Teoriya i praktika arheologicheskih issledovanij [Theory and Practice of Archaeological Research]. 2017. Vol. 17. Pp. 154–166. DOI: 10.14258/tpai(2017)1(17).-11 *(In Russ)*

Gladyshev S. A., Tabarev A. V. Zaselenie Yaponskogo arhipelaga i osobennosti kamennyh industrij pozdnego paleolita sopredel'nyh territorij: obzor sovremennoj problematiki [Peopling of the Japanese Archipelago and Peculiarities of the Late Paleolithic Lithic Industries of the Neighboring Territories: Overview of the current problematic]. Stratum plus. 2020. Vol. 1. Pp. 117–136. *(In Russ)*.

Gladyshev S. A., Tabarev A. V., Olsen J. W. Itogi izucheniya verhnego paleolita Severnoj Mongolii [Results of the Study of the Upper Paleolithic of Northern Mongolia]. Vestnik NGU. Seriya: Istoriya, filologiya [Newsletter of Novosibirsk State University. Series: History, Philology]. 2011. Vol. 5. Pp. 28–43 *(In Russ)*.

Gladyshev S. A., Tsybankov A. A., Kandyba A. V. Verhnepaleoliticheskie kompleksy severnoj Mongolii: edinstvo i variabel'nost' [The Initial Upper Paleolithic Assemblages of Northern Mongolia: Cultural Unity and Variability]. Vestnik NGU. Seriya: Istoriya, filologiya [Newsletter of Novosibirsk State University. Series: History, Philology]. 2010. Vol. 5. Pp. 97–110 *(In Russ)*.

Kanomata Y., Murata H., Umekawa T., Hong H., Yanagida T., Akoshima K., Suzuki M., Inoue I., Hayase R., Ohara K. Study of Cave Sites in Kyushu Region: Report of the Third Term Excavation at the Fukui Cave // Bulletin of the Tohoku University Museum. 2015. Vol. 14. P. 5–200 (*In Japanese*).

Khatsenovich A. M., Rybin E. P. Geometricheskie izdeliya v pozdnem verhnem paleolite Mongolii [The Geometric Tools in the Late Upper Paleolithic of Mongolia]. Problemy arheologii, etnografii, antropologii Sibiri i sopredel'nyh territorij [Problems of Archaeology,

Ethnography, Anthropology of Siberia and Neighboring Territories]. Vol. 21. Novosibirsk : Izd-vo In-ta arheologii i etnografii SO RAN, 2015. Pp. 161–165 *(In Russ)*.

Khatsenovich A. M., Rybin E. P., Gunchinsuren B., Olsen J. W., Shelepaev R. A., Zotkina L. V., Bolorbat T., Popov A. Y., Odsuren D. New Evidence for Paleolithic Human Behavior in Mongolia: The Kharganyn Gol 5 site // Quatenary International. 2017. Vol. 442. P. 78–94. DOI: 10.1016/j.quaint.2016.10.013.

Khatsenovich A. M., Rybin E. P., Pavlenok G. D., Anojkin A. A., Kharevich V. M., Gunchinsuren B., Bolorbat T., Odsuren D., Kulik N. A., Popov A. Yu. Zaklyuchitel'nyj etap polevyh issledovanij mnogoslojnogo paleoliticheskogo pamyatnika Harganyn-Gol-5 v Severnoj Mongolii [The Final Field Research of Kharganyn Gol 5 the Multilayer Paleolithic Site in Northern Mongolia]. Problemy arheologii, etnografii, antropologii Sibiri i sopredel'nyh territorij [Problems of Archaeology, Ethnography, Anthropology of Siberia and Neighboring Territories]. Vol. 21. Novosibirsk : Izd-vo In-ta arheologii i etnografii SO RAN, 2015. Pp. 166–170 *(In Russ)*.

Kolobova K. A., Krivoshapkin A. I., Pavlenok K. K. Carinated Pieces in Paleolithic Assemblages of Central Asia // Archaeology, Ethnology & Anthropology of Eurasia. 2014. Vol. 4 (60). Pp. 13–29.

Rybin E. P. Tools, Beads, and Migrations: Specific Cultural Traits in the Initial Upper Paleolithic of Southern Siberia and Central Asia // Quatenary International. 2014. Vol. 347. P. 39–52. DOI: 10.1016/j.quaint.2014.04.031

Rybin E. P., Gladyshev S. A., Tsybankov A. A. Vozniknovenie i razvitie «otshchepovyh» industrij rannej pory verhnego paleolita Severnoj Mongolii [Origin and Evolution of "Flake" Industries of the Early Upper Paleolithic of Northern Mongolia]. Severnaya Evraziya v chetvertichnyj period: chelovek, paleotehnologii, geologiya, etnologiya i antropologiya [Northern Eurasia in the Quaternary Period: Man, Paleotechnologies, Geology, Ethnology, and Anthropology]. Irkutsk : Ottisk, 2007. Pp. 137–153. *(In Russ)*.

Rybin E. P., Khatsenovich A. M., Gunchinsuren B., Olsen J. W., Zwyns N. The Impact of the LGM on the Development of the Upper Paleolithic in Mongolia // Quatenary International. 2016a. Vol. 425. Pp. 69–87. DOI:10.1016/j.quaint.2016.05/001

Rybin E. P., Khatsenovich A. M., Kandyba A. V. Paleoliticheskoe zaselenie Mongolii po dannym absolyutnoj hronologii [Pleistocene Settling of Mongolia: according to the Data of Absolute Chronology]. Izvestiya Altajskogo gosuniversiteta. Istoriya i arheologiya [Bulletin of Altai State University. History and Archaeology]. 2016b. Vol. 2. P. 245–254. DOI: 10.14258/izvasu(2016)2-44 *(In Russ)*

Rybin E. P., Khatsenovich A. M., Pavlenok G. D. Posledovatel'nost' razvitiya industrij rannego — pozdnego verhnego paleolita Mongolii [The Sequence of Cultural Development of the Early-Late Paleolithic Industries in Mongolia]. Izvestiya Irkutskogo gosuniversiteta. Seriya: Geoarheologiya, etnologiya, antropologiya [Bulletin of Irkutsk State University. Series: Geoarchaeology, Ethnology, Anthropology]. 2016c. Vol. 16. Pp. 3–23 *(In Russ)*.

Rybin E. P., Zenin A. N., Gladyshev S. A., Tsybankov A. A., Chargynov T. T. Intensivnost' ktilizacii kamennogo syr'ya i proizvodstvennaya deyatel'nost' cheloveka v rannej pore verhnego paleolita Severnoj Mongolii (po materialam stoyanki Tolbor) [Lithic Raw Material Utilization Intensity and Human production Activity in the Early Upper Paleolithic of Northern Mongolia

(By the Materials of Tolbor 4 Site)]. Izvestiya laboratorii drevnih tehnologij [Newsletters of the Laboratory of Ancient Technologies]. Vol. 4. Irkutsk : Izd-vo Irkutskogo gosudarstvennogo tehnicheskogo universiteta, 2006. Pp. 201–218 *(In Russ).*

Sato H., Izuho M., Morisaki K. Human Cultures and Environmental Changes in the Pleistocene-Holocene Transition in the Japanese Archipelago // Quatenary International. 2011. Vol. 237. Pp. 93–102. DOI: 10.1016/j.quaint.2011.01.006

Slavinsky V. S., Rybin E. P., Belousova N. E. Variation in Middle and Upper Paleolithic Reduction Technology of Kara-Bom, the Altai Mountains: Refitting Studies // Archaeology, Ethnology & Anthropology of Eurasia. 2016. Vol. 1 (44). P. 39–50. DOI: 10.17746/1563-0102.2016.44.1.039-050

Tabarev A. V. Blades and Microblades, Percussion and Pressure: Towards the Evolution of Lithic Technologies of the Stone Age Period, Russian Far East // The Emergence of Pressure Blade Making: From Origin to Modern Experimentation. New York : Springer, 2012. Pp. 329–346.

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Гладышев С. А., Гунчинсурэн Б., Джалл Э. Д., Доганджич Т., Звинс Н. П., Олсен Д. В., Ричардс М. П., Табарев А. В., Таламо С. Радиоуглеродное датирование палеолитических стоянок в долине р. Их-Тулбэрийн-Гол в Северной Монголии // Вестник НГУ. Серия: История, филология. 2013. Т. 12. С. 44–48.

Гладышев С. А., Табарев А. В. Некоторые проблемы изучения микропластинчатого расщепления в раннем верхнем палеолите Северной Монголии // Теория и практика археологических исследований. 2017. Т. 17. С. 154–166. DOI: 10.14258/tpai(2017)1(17).-11

Гладышев С. А., Табарев А. В. Заселение Японского архипелага и особенности каменных индустрий позднего палеолита сопредельных территорий: обзор современной проблематики // Stratum plus. 2020. №1. С. 117–136.

Гладышев С. А., Табарев А. В., Олсен Д. В. Итоги изучения верхнего палеолита Северной Монголии // Вестник НГУ. Серия: История, филология. 2011. № 5. С. 28–43.

Гладышев С. А., Цыбанков А. А., Кандыба А. В. Верхнепалеолитические комплексы северной Монголии: единство и вариабельность // Вестник НГУ. Серия: история, филология. 2010. № 5. С. 97–110.

Деревянко А. П., Зенин А. Н., Рыбин Е. П., Гладышев С. А., Цыбанков А. А. Развитие каменных индустрий верхнего палеолита Северной Монголии (по данным стоянки Толбор) // Человек и пространство в культурах каменного века Евразии. Новосибирск : Изд-во Ин-та археологии и этнографии СО РАН, 2006. С. 17–42.

Рыбин Е. П., Гладышев С. А., Цыбанков А. А. Возникновение и развитие «отщеповых» индустрий ранней поры верхнего палеолита Северной Монголии // Северная Евразия в четвертичный период: человек, палеотехнологии, геология, этнология и антропология. Иркутск : Оттиск, 2007. С. 137–153.

Рыбин Е. П., Хаценович А. М., Кандыба А. В. Палеолитическое заселение Монголии по данным абсолютной хронологии // Известия Алтайского госуниверситета. История и археология. 2016б. № 2. С. 245–254. DOI: 10.14258/izvasu(2016)2-44

Рыбин Е. П., Хаценович А. М., Павленок Г. Д. Последовательность развития индустрий раннего — позднего верхнего палеолита Монголии // Известия Иркутского госуниверситета. Серия: Геоархеология, этнология, антропология. 2016 в. № 16. С. 3–23.

Рыбин Е. П., Зенин А. Н., Гладышев С. А., Цыбанков А. А., Чаргынов Т. Т. Интенсивность ктилизации каменного сырья и производственная деятельность человека в ранней поре верхнего палеолита Северной Монголии (по материалам стоянки Толбор) // Известия лаборатории древних технологий. Иркутск : Изд-во Иркутского государственного технического университета, 2006. Вып. 4. С. 201–218.

Хаценович А. М., Рыбин Е. П. Геометрические изделия в позднем верхнем палеолите Монголии // Проблемы археологии, этнографии, антропологии Сибири и сопредельных территорий. Новосибирск : Изд-во Ин-та археологии и этнографии СО РАН, 2015. Т. XXI. С. 161–165.

Хаценович А. М., Рыбин Е. П., Павленок Г. Д., Анойкин А. А., Харевич В. М., Гунчинсурэн Б., Болорбат Ц., Одсурэн Д., Кулик Н. А., Попов А. Ю. Заключительный этап полевых исследований многослойного палеолитического памятника Харганын-Гол-5 в Северной Монголии // Проблемы археологии, этнографии, антропологии Сибири и сопредельных территорий. Новосибирск : Изд-во Ин-та археологии и этнографии СО РАН, 2015. Т. XXI. С. 166–170.

Buvit I., Izuho M., Terry K., Konstantinov M. V., Konstantiniov A. V. Radiocarbon Dates, Microblades and Late Pleistocene Human Migrations in the Transbaikal, Russia and the Paleo-Sakhalin-Hokkaido-Kuril Peninsula // Quatenary International. 2016. Vol. 425. P. 100–119. DOI: 10.1016/j.quaint.2016.02.050

Derevianko A. P., Gladyshev S. A., Olsen J. W., Petrin V. T., Tserendagva Y. Characteristic Features of the Chikhen Agui Lithic Assemblage (Gobi Altai) // Archaeology, Ethnology & Anthropology of Eurasia. 2001. Vol. 5. P. 25–39.

Derevianko A. P., Zenin A. N., Rybin E. P., Gladyshev S. A., Tsybankov A. A., Olsen D., Tseveendorj D., Gunchinsuren B. The Technology of Early Upper Paleolithic Lithic Reduction of Northern Mongolia: the Tolbor-4 Site // Archaeology, Ethnology & Anthropology of Eurasia. 2007. Vol. 29. P. 16–38.

Derevianko A. P., Markin S. V., Gladyshev S. A., Olsen D. The Early Upper Paleolithic of the Gobi Altai Region in Mongolia (Based on Materials from the Chikhen-2 Site) // Archaeology, Ethnology & Anthropology of Eurasia. 2015. Vol. 3 (43). P. 7–41. DOI: 10.1016/j.aeae.2015.11.004

Derevianko A. P., Olsen D., Tseveendorj D., Krivoshapkin A. I., Petrin V. T., Brantingham P. J. The Stratified Cave Site of Tsagaan Agui in the Gobi Altai (Mongolia) // Archaeology, Ethnology & Anthropology of Eurasia. 2000. Vol. 1. P. 23–36.

Derevianko A. P., Rybin E. P., Gladyshev S. A., Tsybankov A. A., Gunchinsuren B., Olsen D. Early Upper Paleolithic Stone Tool Technologies of Northern Mongolia: the Case of Tolbor-4 and Tolbor-15 // Archaeology, Ethnology & Anthropology of Eurasia. 2013. Vol. 4 (56). P. 21–37.

Gillam J. C., Gladyshev S. A., Gunchinsuren B., Olsen J. W., Tabarev A. V., Rybin E. P., 2014. Update on Paleolithic Research in Northern Mongolia // Legacy. 2014. Vol. 2. P. 22–23.

Gladyshev S. A., Olsen J. W., Tabarev A. V., Kuzmin Y. V. Chronology and Periodization of Upper Paleolithic Sites in Mongolia // Archaeology, Ethnology & Anthropology of Eurasia. 2010. Vol. 3 (43). P. 33–40.

Gladyshev S. A., Olsen J. W., Tabarev A. V., Jull A. J. The Upper Paleolithic of Mongolia: Recent Finds and New Perspectives // Quatenary International. 2012. Vol. 281. P. 36–46. DOI: 10.1016/j.guaint.2012.01.032

Gladyshev S. A., Tabarev A. V. New Data on the Early Upper Paleolithic of Northern Mongolia // Current Research in the Pleistocene. 2009. Vol. 26. P. 17–18.

Kanomata Y., Murata H., Umekawa T., Hong H., Yanagida T., Akoshima K., Suzuki M., Inoue I., Hayase R., Ohara K. Study of Cave Sites in Kyushu Region: Report of the Third Term Excavation at the Fukui Cave // Bulletin of the Tohoku University Museum. 2015. Vol. 14. P. 5–200 (*In Japanese*).

Khatsenovich A. M., Rybin E. P., Gunchinsuren B., Olsen J. W., Shelepaev R. A., Zotkina L. V., Bolorbat T., Popov A. Y., Odsuren D. New Evidence for Paleolithic Human Behavior in Mongolia: The Kharganyn Gol 5 site // Quatenary International. 2017. Vol. 442. P. 78–94. DOI: 10.1016/j.quaint.2016.10.013.

Kolobova K. A., Krivoshapkin A. I., Pavlenok K. K. Carinated Pieces in Paleolithic Assemblages of Central Asia// Archaeology, Ethnology & Anthropology of Eurasia. 2014. Vol. 4 (60). P. 13–29.

Rybin E. P. Tools, Beads, and Migrations: Specific Cultural Traits in the Initial Upper Paleolithic of Southern Siberia and Central Asia // Quatenary International. 2014. Vol. 347. P. 39–52. DOI: 10.1016/j.quaint.2014.04.031

Rybin E. P., Khatsenovich A. M., Gunchinsuren B., Olsen J. W., Zwyns N. The Impact of the LGM on the Development of the Upper Paleolithic in Mongolia // Quatenary International. 2016a. Vol. 425. P. 69–87. DOI:10.1016/j.quaint.2016.05/001

Sato H., Izuho M., Morisaki K. Human Cultures and Environmental Changes in the Pleistocene-Holocene Transition in the Japanese Archipelago // Quatenary International. 2011. Vol. 237. P. 93–102. DOI: 10.1016/j.quaint.2011.01.006

Slavinsky V. S., Rybin E. P., Belousova N. E. Variation in Middle and Upper Paleolithic Reduction Technology of Kara-Bom, the Altai Mountains: Refitting Studies // Archaeology, Ethnology & Anthropology of Eurasia. 2016. Vol. 1 (44). P. 39–50. DOI: 10.17746/1563-0102.2016.44.1.039-050

Tabarev A. V. Blades and Microblades, Percussion and Pressure: Towards the Evolution of Lithic Technologies of the Stone Age Period, Russian Far East // The Emergence of Pressure Blade Making: From Origin to Modern Experimentation. New York : Springer, 2012. P. 329–346.

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EMERGENCE OF MICROLITHIC PRODUCTION IN MONGOLIA: RESEARCH TERMINOLOGY AND CHRONSTRATIGRAPHIC POSITION OF LITHIC INDUSTRIES IN EASTERN AND SOUTHERN ASIA

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Abstract: Territory of Mongolia is situated in the center of Asia, a crossroad of the potential migration routes, that connect different Eurasian macroregions. Here an example of earliest appearance and long-term existence of small blade and microblade production has been found. Beyond that, the industries, that appeared within limited area of the Middle Selenga Basin in the late MIS3 — early MIS2, contained the earliest for Northern and Central Asia geometric and non-geometric microliths. They have been found in the sediments of Kharganyn Gol 5 and Tolbor-4, — 16 and –21. They end up in LGM — post-LGM which cause depopulation in the region and following changes in the human groups, occupying this territory. An understanding of the character, causes and specifics of such early appearance of the microblade and bladelet production, and especially geometric microliths, impose the arrangement and definition of the terminology, associated with microlithic assemblages in Asia.

This is due to the fact that in the archaeological definitions of both processes and the desired forms of artifacts associated with the production and use of microliths, there are significant discrepancies that complicate the understanding of the described phenomena. The article provides an overview of the research terminology of microlithization processes, and also determines the position of the microlithic complexes of Mongolia in the Upper Paleolithic system of the eastern part of Asia.

Keywords: Mongolia, East Asia, Upper Paleolithic, lithic industries, microlithic technology

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ВОЗНИКНОВЕНИЕ МИКРОЛИТИЧЕСКОГО ПРОИЗВОДСТВА В МОНГОЛИИ: ИССЛЕДОВАТЕЛЬСКАЯ ТЕРМИНОЛОГИЯ И ХРОНОСТРАТИГРАФИЧЕСКАЯ ПОЗИЦИЯ ИНДУСТРИЙ В ВЕРХНЕМ ПАЛЕОЛИТЕ ВОСТОЧНОЙ И ЮЖНОЙ ЧАСТИ АЗИИ

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Резюме: На территории Монголии, находящейся в центре Азии на перекрестке потенциальных миграционных путей, связывающих различные макрорегионы Евразии, фиксируется пример раннего возникновения и долгого существования мелкопластинчатой и микропластинчатой традиции расщепления. Кроме того, в конце морской изотопной стадии 3 и начале морской изотопной стадии 2 на ограниченной территории в пределах среднего течения Селенги в седиментах стоянок Толбор-4, 16 и 21 засвидетельствовано наиболее раннее в Центральной Азии появление индустрий, содержащих микролиты. Их существование пресекается в период последнего ледникового максимума, связанного с возможной депопуляцией территории и последующей сменой населения. Понимание характера, причин и особенностей столь раннего появления производства микропластин и пластинок и собственно микролитов требует систематизации и определения терминологии, относящейся к микролитическим ассамбляжам на территории Азии. Это вызвано тем, что в археологических дефинициях как процессов, так и желаемых форм артефактов, связанных с производством и использованием микролитов, существуют значительные разночтения, затрудняющие понимание описываемых явлений. В статье приводится обзор исследовательской терминологии процессов микролитизации, а также определяется положение микролитических комплексов Монголии в системе верхнего палеолита восточной части Азии.

Ключевые слова: Монголия, Восточная Азия, верхний палеолит, каменные индустрии, микролитическая технология

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Introduction

The early origin of pressure microblade production in Asia has always been a controversial issue. Sporadically found early cores for pressure microblade production are the weak evidence of micropressure technique, as well as early appearance of percussion microblade production does not prove its connection with later pressure technology.

The territory of Mongolia is situated in the center of Asia, crossroads of the potential migration routes, that connect different Eurasian macroregions. Here an example of earliest appearance and long-term existence of small blade and microblade production has been found [Gladyshev, 2017; Gladyshev, Tabarev, 2017, 2018]. Beyond that, the industries, that appeared within limited area of the Middle Selenga Basin in the late MIS3 — early MIS2, contained the earliest for Northern and Central Asia geometric and non-geometric microliths. They have been found in the sediments of Kharganyn Gol 5 and Tolbor-4, — 16 and –21. They end up in LGM — post-LGM which cause depopulation in the region and following changes in the human groups, occupying this territory [Mao et al., 2021]. An understanding of the character, causes and specifics of such early appearance of the microblade and bladelet production, and especially geometric microliths, impose the arrangement and definition of the terminology, associated with microlithic assemblages in Asia. Frequently, there are various discrepancies in the archaeological definitions of the processes, byproducts and targeted blanks related to microlith production and utilization which makes it difficult to understand these processes.

Little is known about small-blade or bladelet production in the Upper Paleolithic of eastern Central Asia and southern Siberia before pressure microblade technology first appeared in these regions during or immediately after the LGM. There are also some ambiguities in the statement of small- or microblade technology here. The term "small-blade production" is used by different scholars in different ways. The most widespread definition is the production of small blades [Faivre, 2012], metrically distinct to bladelets by the limit in 12 mm — the maximal width of blank, determined for Epipaleolithic of Maghreb [Tixier, 1963; Inizan et al., 1999]. But under circumstances when bladelets and small blades were produced within one *chaîne opératoire*, all end-products are called small-blade blanks [Inizan et al., 1999; Soriano, Villa, Wadley, 2007]. At the same time, Kuhn & Elston [2002] pointed at the limit of 9 mm "to distinguish between retouched blades and (microlithic) retouched bladelets in Levant, that wouldn't work in Northeast Asia according to them, where microblades are much smaller. In American archaeology, the width of microblades ranges from 1–11 mm, and blanks wider than 11 mm are considered as blades [Taylor, 1962; Sollberger, Patterson, 1976]. Japanese archaeology considers the laminar blanks with width less than 12 mm as the microblades. Many researchers choose the dimension of laminar flakes that traditionally, following Inizan et al. [1999], used for their description in assemblages from Central Asia and Altai, based on the their width: microblades — less than 6 mm, bladelets — from 7 to 12 mm, blades up to 12 mm [Kolobova et al., 2013; Rybin et al., 2017]. Talking about microblade technology in northeast Asia, where, indeed, the common limit for microblades width is 6 mm, we usually mean pressure technique of this type of blank production, highly standardized, resulted from narrow set of microblade core types and appeared during or after LGM at the continental part of northeastern Asia, and cannot be comparable to percussive bladelets and microliths directly.

It is a clear example of intricate terminology that we use describing the processes of the small laminar blank production. Here we consider the definitions of the main terminology offered by regional researchers, in the background of the process of microlithization in Northern, Southern and Central Asia. This study may forward the adequate estimation of phenomenon, associated with microliths and early microflaking, newly discovered for the last decade in Mongolia. Here we offer to consider and distinct few terms, before the actual consideration of small laminar blank production in eastern Central and northeast Asia — small-blade, bladelet, and microblade production as well as definition of microliths.

Small-blade production

This term first appeared to describe the industries of middle stage of Upper Paleolithic in Central Siberia's Yenisei River basin, where the targeted laminar blanks were much shorter compared to IUP large blade production [Lisitsyn, 1996, 2000; Akimova, 2008]. "Small blades" present the laminar blanks 2–5 cm long with retouched both lateral edges and, frequently, transversal edges, that were the tool-marker of Middle Upper Paleolithic between 22,000–11,000 years ago and predefined the targeted blank in knapping technology [Kharevich et al., 2015]. The last was based on reduction of specific small flat unidirectional cores as well as prismatic and narrow-faced cores [Lisitsyn, 1996]. Besides small blades, the number of other blanks was defined there: retouched "small" bladelets (length up to 30 mm and width 6–10 mm) and "medium" bladelets (length 30–50 mm and width up to 15 mm). Afontova Culture assemblages contain large blades as well as microblades with regular parallel dorsal scars with width up to 4 mm [Abramova, 1979; Lisitsyn, 2000]. The presence of few reduction strategies, targeted to the different kinds of laminar blanks fostered high diversity of terms, but small-blade production is basic definition to characterize the Middle Upper Paleolithic industries with blades no longer than 20–50 mm and its production from the specifically prepared cores in Middle Siberia.

About the same definition has been used for laminar blanks with length 40–50 mm from Mousterian complex of Combe-Grenal, levels 29–30. These small blades were produced within one reduction strategy together with bladelets from flake-cores up to 40 mm long [Faivre, 2012]. Therefore, essentially, small blades are defined by the measurements of their length, not width. Several types of cores are character to these industries: subprismatic cores with half-closed flaking surface, often cylindrical or barrel-like shape; prismatic cores with two striking platforms and two flaking surfaces or one closed flaking surface for bidirectional small blade production; rare narrow-faced cores. The most pronounced feature of these cores is reduced striking platform, oblique to the backside [Kharevich et al., 2015].

Bladelet production

Bladelets as the by-products appear in Middle Paleolithic, and through time their production isolates oneself from Levallois point and blade production and became the one of the targeted blanks, flaked from specifically prepared cores by the end of that Paleolithic stage [Boëda, Bonilauri, 2006; Pastoors, Tafelmaier, 2010]. Early bladelet industry itself usually is associated with the Aurignacian and Upper Paleolithic in Western Europe and Southwest Asia [Bon, 2006; Boëda et al., 2015]. In eastern Eurasia, bladelet production first appears in Initial Upper Paleolithic assemblages of Obi-Rakhmat in Uzbekistan, Kara Bom and Ust Karakol in the Altai region. Here bladelets were produced from burin-cores and/or narrow-faced cores

[Krivoshapkin, Kuzmin, Jull, 2010; Zwyns et al., 2012]. Another type of bladelet production is presented in Upper Paleolithic complexes in western Central Asia: Middle and Late stages of the Kulbulak Culture; at Dodekatym-2, layers 5 and 4–2 respectively; Kulbulak, layer 2.1; Shugnou, layer 1 and the Samarkandskaya site [Kolobova et al., 2013]. Carinated bladelet production appeared here about 23,000 years ago and existed along with bladelet production from narrow-faced cores and, together with the toolkit, included triangular microliths, chisel-like tools, backed, retouched and Dufour bladelets, were very similar to the Baradostian in the Zagros region (Ibid). Metric parameters of width for targeted removal here are less than 12 mm, uniting bladelets and microblades as well [Kolobova et al., 2011]. Here we regard bladelet production as a complex of special core types, prepared for production of this kind of targeted blanks and its products by itself with width from 6 to 12 mm.

Percussive and pressure microblade production

Since Northeast Asia is thought to be one place where pressure microblade production emerged [Takakura, 2012; Gómez Coutouly, 2018; Keates, Postnov, Kuzmin, 2019; Song et al., 2019] and includes many various regions with local archaeological terminologies and traditions, it is important to mention it here.

The Russian archaeological tradition still does not have a special term to distinguish percussive and pressure microblade technology. A microblade is a laminar blank, less than 6 mm long and produced from a variety of specialized microcores, by percussion or pressure. Currently, some researchers are very strict, defining microblade technology as pressure flaking [Pavlenok, 2015; Keates, Postnov, Kuzmin, 2019] and even narrower — flaking from wedge-shaped, prismatic or conical cores [Morlan, 1970], but some still include both techniques in this definition [Gladyshev, 2017; Gladyshev & Tabarev, 2018]. Technique descriptions are based upon core type or Japanese terminology, e.g. wedge-shaped technology — the Yubetsu technique etc.

The Chinese archaeological tradition did not initially distinguish between definitions of "microblades" and "microliths" [Chen, Wang, 1989]. At the end of the 1970s it was decided to limit the term "microlith" to a narrow range of artifacts — microblades, microblade cores and tools on microblades [An, 1978]. So, the definition of "microlith" means the same as "microblade industry," not "small tools." There are several techniques described for microblade production in China, some are similar to those known in Russian and Japanese archaeology [Chen & Wang, 1989].

The most complex definitions of techniques, used in microblade technology, are based on archaeological material from Japanese archipelago [Nakazawa et al., 2005; Nakazawa, Akai, 2017; Sato, Tsutsumi, 2007; Takakura, 2012]. At least 7 microblade techniques are known in that region, as well as well-developed approach to distinct obsidian microblades, produced by pressure, indirect percussion and direct percussion [Takakura, 2012]. At the same time, not all techniques indispensably suppose pressure production: obsidian wedge-shaped cores could be utilized by indirect or direct percussion also [Pelegrin, 2003; Takakura, 2012].

For us, the width of laminar blank will be the determinant factor to divide microblades in assemblages. Despite that, in some research the length can be the main parameter, since the ranges of width among laminar blanks overlap [Brunet, 2012]. Supposedly pressure

microblades, described here, have straight and parallel arises [Inizan et al., 1999] and parallel edges. If some examinations of microblade assemblages fair based upon a several components, e.g. wedge-shaped microcores, microblades and retouched microblades [Keates, Postnov, Kuzmin, 2019], in our case we need to cut this list, and stay with microcores and microblades or retouched microblades only. It is an unavoidable step, because most of the sites in northern Mongolia are workshops, with shorter lists of artifact categories. Microblade industries in Mongolia could be based on wedge-shaped, wedge-shaped on bifaces, conical, semiconical, boat-shaped, cylindrical, and bullet (or pencil-shaped) cores.

Microliths

Pargeter [2016] points that some of researchers define microliths –artifacts with lengths 2–3 cm or shorter, produced by any kind of percussion or pressure, and geometric microliths that have a standardized shape (trapezoids, rectangles, triangles, etc.) and made on bladelets, intentionally fragmented, often by microburin or "truncation notch+snap" techniques [Ibid]. Clarkson et al. [2018], following Pargeter [2016] suppose that a "microlith package," consisting of three components — backing, miniaturization, and microblade production from prismatic cores — can be "unpacked," because these components occur independently. They contemplate the convergence of microlithic technology.

It has been supposed that microlithic technology first appeared in Africa about 80–60 ka BP and spread into Southern Asia: specific types of microliths have been distributed in Eastern Africa and Hindustan along the coast of Indian Ocean [Mellars, 2006; Clarkson et al., 2009, 2018; Mishra, Chauhan, Singhvi, 2013; Blinkhorn, 2018]. The earliest evidence of the backed microliths were found on the southern realm of Indian subcontinent in Sri-Lanka. Flake tools with size less than 50 mm are known in Fa-Hien Lena cave, Sri Lanka, dated to 48–45 ka BP [Wedage et al., 2019].

The other center of possibly independent geometric microlith origin is Levant. Here, in the Epipaleolithic period about 20–10 ka BP there was a tendency to form the tools (backed blades, truncated bladelets, varios geometric microliths and lunates) with invasive and blunt retouch and microburin technique. This trend led to Final Epipaleolithic approach to reshape every small elongated spall into microlith [Belfer-Cohen, Goring-Morris, 2002].

To sum up, intentionally predetermined shape with backing, in addition to arbitrary, but mainly with small size unifies these artifacts, is defined as a microlith. These tools have specific advantages: standardized shape, transportability, availability to be replaced in composite tools and possible usage as the inserts of projectile weapon, that may play significant role in reconstruction of paleoecological conditions.

Discussion

Mongolia has been considered as a possible place of micropressure origin [Gladyshev, Tabarev, 2018]. Production of the small laminar blanks here has a long history and evolution. We consider this evolution to understand the connections or disconnections between different small blade technologies. Bladelet production in the lithic industries appears in Initial Upper Paleolithic complexes ca. 45–40 cal. ka in Mongolia and Russian Altai (Kara-Bom, Tolbor 4, Tolbor 16) [Derevianko et al., 1998, 2007; Zwyns et al., 2014].

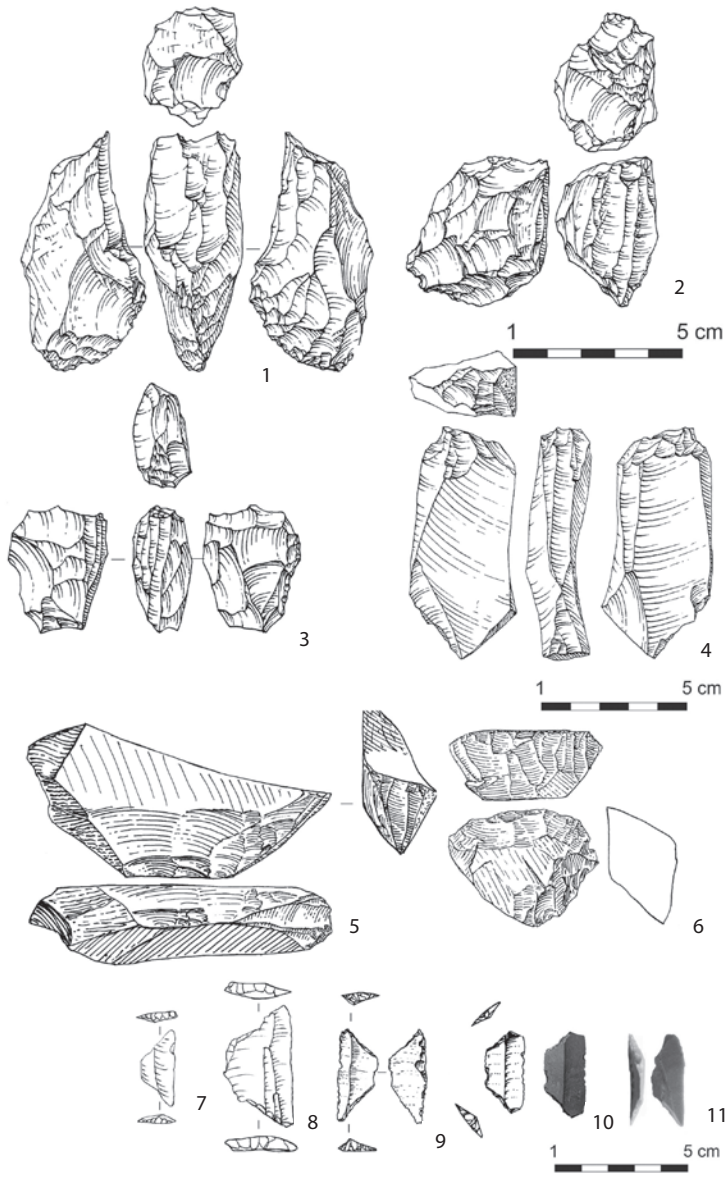

Fig. 1. Selected artifacts from Initial Upper Paleolithic – Late Upper Paleolithic industries of Northern Mongolia: 1–2 – bladelet cores, Tolbor-4, AH5; 3 – bladelet core, Tolbor-4, AH6; 4 – burin-core, Tolbor-4, AH6; 5 – carinated core, Tolbor-4, AH5; 6 – carinated core, Tolbor-4, AH4; 7–9 – trapezes, Kharganyn-Gol-5, AH4; 10 – trapeze, Tolbor-21, AH2; 11 – trapeze, Tolbor-4, AH6

Рис. 1. Артефакты из индустрии начального – позднего верхнего палеолита Северной Монголии: 1–2 – нуклеусы для пластинок, Толбор-4, гор. 5; 3 – нуклеус для пластинок, Толбор-4, гор. 6; 4 – нуклеус-резец, Толбор-4, гор. 6; 5 – кареноидный нуклеус, Толбор-4, гор. 4; 7–9 – трапеции, Харганын-Гол-5, гор. 4; 10 – трапеция, Толбор-21, гор. 2; 11 – трапеция, Толбор-4, гор. 6

Core types reflect an intentional bladelet production, independent from blade production (Fig. 1.-*1–3*). The most numerous type of core, aimed to bladelet production, is narrow-faced. Another type represents the series of small flat short cores with one or two striking platforms. This type of cores has rectangular shape and flat cross-section. It was an independent reduction method, because a number of them were left on the initial stage of utilization, with cortex on the flaking surface. The other type is subprismatic / prismatic circular-shaped cores with single or two opposite striking platforms, close to so-called "barrel-shaped" cores. The most remarkable type of bladelet nuclei is burin-core (Fig. 1.-*4*). Carinated cores are very few (Fig. 1.-*5, 6*). Having appeared in Northern Mongolia about 38000 BP, this type made a fleeting appearance in later complexes of Tolbor group. Some of carinated cores were retouched on the final stage of its utilization. Retouch is situated on the platform edge, forming the working edge of high end-scraper. Most of these types, except burin-cores, can be found in the Early Upper Paleolithic industries in Northern Mongolia. In the end of this period remarkable tool types appeared in Northern Mongolia — geometric microliths, presented by segments and trapezes (Fig. 1.-*7–11*). Approximate age of these complexes falls within a range from 30 to 18 cal. ka. They were replaced by complexes with pressure microblade production. Considering the chronological gaps between the time being of these technologies, high diversity of technologies, as well as poor presentation of pressure microblade technology, it seems that Mongolia was the transitional territory for multiple populations with different technologies. It is still questionable that any of those technologies originated in this region.

Conclusion

Our review highlighted wide and, occasionally, controversial spectrum of definition and views, accompanying the research problems of microlithization of lithic tools during the Late Pleistocene in Asia and interpretation of microlithic tools. It is more likely that microlithic technology appeared and disappeared repeatedly. Independent invention of microlithic technology has been supposed for several regions. Mongolia is potentially an important area for understanding of microlithic technology distribution. Here it is more likely that IUP small blade production appeared as the result of direct migration from the Altai Mountains. The presence of specific microlithic technology in the end of MIS3 can not be reliably associated with migration processes or independent origin. We suggest that the Tolbor group of sites in the Middle Selenga basin contains the earliest evidence of its appearance at the territory of southern Siberia and eastern part of Central Asia.

REFERENCES

Abramova Z. A. Paleolit Eniseya. Afontovskaya kul'tura. [Paleolithic of Enisey. Afontova Culture]. Novosibirsk : Nauka, 1979. 156 p. *(In Russ.)*

Akimova E. V. Rannesartanskaya industriya melkih plastin v finale pozdnego paleolita Srednego Eniseya: k probleme formirovaniya arheologicheskih refugiumov [Early Sartan Small Blade Industry in the Final Late Paleolithic of Middle Yenisei: the Problem of Archaeological Refugium Forming]. Problemy biologicheskoj i kulturnoj adaptacii chelovecheskih populyacij. T. 1: Arheologiya. Adaptacionnye strategii drevnego naseleniya Severnoj Evrazii: syr'e i priyomy obrabotki [Problems of Biological and Cultural Adaptation of Human Populations.

Vol. 1: Archaeology. Adaptation Strategies of the Ancient Population of Northern Eurasia: Raw Materials and Processing Techniques]. SPb. : Nauka, 2008. Pp. 37–47. *(In Russ.)*

An Zh. The Mesolithic Remains in Hailar — Also on the the Origin and the Tradition of Microliths. Kaogu Xuebao (Chinese Journal of Archaeology). 1978. Vol. 3. Pp. 289–316.

Belfer-Cohen A., Goring-Morris A. N. Why Nicroliths? Microlithization in the Levant. Thinking Small: Global Per-spectives on Microlithic Technologies. Arlington : AP3A, 2002. Pp. 57–68.

Blinkhorn J. Buddha Pushkar Revisited: Technological Variability in Late Palaeolithic Stone Tools at the Thar Desert Margin, India. Journal of Archaeological Science: Reports. 2018. Vol. 20. Pp. 168–182.

Boëda E., Bonilauri S. The Intermediate Paleolithic : the First Bladelet Production 40,000 Years Ago. Anthropologie-International Journal of Human Diversity and Evolution. 2006. Vol. 44 (1). Pp. 75–92.

Boëda E., Bonilauri S., Kaltnecker E., Valladas H., Al-Sakhel H. Un débitage lamellaire au Proche-Orient vers 40 000 ans cal BP. Le site d'Umm el Tlel, Syrie central // L'anthropologie. 2015. Vol. 119. Pp. 141–169.

Bon. F. A Brief Overview of Aurignacian Cultures in the Context of the Industries of the Transition from the Middle to the Upper Paleolithic. Towards a Definition of the Aurignacian. Lisbon: Instituto Português de Arqueologia (Trabalhos de Arqueologia 45). 2006. Pp. 133–144.

Brunet, F. The Technique of Pressure Knapping in Central Asia: Innovation or Diffusion? The Emergence of Pressure Blade Making: From Origin to Modern Experimentation. Québec : Springer, 2012. Pp. 307–328.

Chen Ch., Wang X.–Q. Upper Paleolithic Microblade Industries in North China and Their Relationships with Northeast Asia and North America. Arctic Anthropology. 1989. Vol. 2(26). Pp. 127–156.

Clarkson C., Hiscock P., Mackay A., Shipton C. Small, Sharp, and Standardized: Global Convergence in Backed-Microlith Technology. Convergent Evolution in Stone-Tool Technology. Cambridge : MIT Press, 2018. Pp. 175–200.

Clarkson C., Petraglia M., Korisettar R., Haslam M., Boivin N., Crowther A., et al. The Oldest and Longest Enduring Microlithic Sequence in India: 35 000 Years of Modern Human Occupation and Change at the Jwalapuram Locality 9 Rockshelter. Antiquity. 2009. Vol. 83(320). Pp. 326–348.

Derevianko A. P., Petrin V. T., Rybin E. P., Chevalkov L. M. Paleoliticheskie komplexy stratificirovannoy chasti stoyanki Kara-Bom (mustye i verkhniy paleolit) [Paleolithic Complexes of the Stratified Part of the Kara-Bom Site (Mousterian/Upper Paleolithic]. Novosibirsk : IAET, 1998. 235 p. (*In Russ., English, French*).

Derevianko A. P., Zenin A. N., Rybin E. P., Gladyshev S. A., Tsybankov A. A., Olsen J. W., Tseveendorj D., Gunchinsuren, B. The Technology of Early Upper Paleolithic Lithic Reduction in Northern Mongolia: the Tolbor-4 site. Archaeology, Ethnology and Anthropology of Eurasia. 2007. Vol. 29. Pp. 16–38.

Faivre J.-Ph. A Material Anecdote but Technical Reality: Bladelet and Small Blade Production during the Recent Middle Paleolithic at Combe-Grenal Rock Shelter. Lithic Technology. 2012. Vol. 37. Pp. 5–25.

Gladyshev S. A. Svidetel'stva primeneniya tehniki mikrorasshchepleniya v kompleksah rannego verhnego paleolita mnogoslojnyh stratificirovannyh stoyanok Gobijskogo Altaya [Evidence of Micropercussion Technique in the Complexes of the Early Upper Paleolithic at the Multilayered Stratified Sites in the Gobi Altai]. Problemy arheologii, etnografii, antropologii Sibiri i sopredel'nyh territorij [Problems of Archaeology, Ethnography and Anthropology of Siberia and Neighboring territories]. Novosibirsk : Izd-vo In-ta arheologii i etnografii SO RAN, 2017. Vol. 23. Pp. 202–205 *(In Russ.)*.

Gladyshev S. A., Tabarev A. V. Nekotorye problemy izucheniya mikroplastinchatogo rasshchepleniya v rannem verhnem paleolite Severnoj Mongolii [Some Problems of Studies of Microblade Percussion in the Early Upper Paleolithic of Norhtern Mongolia]. Teoriya i praktika arheologicheskih issledovanij [Theory and Practice of Archaeological Research]. 2017. Vol. 17 (1). Pp. 154–166. *(In Russ.)*

Gladyshev S. A., Tabarev A. V. Mikroplastinchatoe rasshcheplenie v rannem verhnem paleolite Mongolii [Microblade Production in the Early Upper Paleolithic of Mongolia]. Stratum Plus : Archaeology and Cultural Anthropology. 2018. No. 1. Pp. 339–351. (*In Russ.*)

Gómez Coutouly Y. A. The emergence of pressure knapping microblade technology in Northeast Asia. Radiocarbon. 2018. Vol. 60. Pp. 821–855.

Inizan M.-L., Reduron-Ballinger M., Roche H., Tixier J. Technology and Terminology of Knapped Stone. Nanterre : C.R.E.P., 1999. 191 p.

Keates S. G., Postnov A. V., Kuzmin, Y. V. Towards the Origin of Microblade Technology in Northeastern Asia. Vestnik of Saint Petersburg University. History. 2019. Vol. 64. Pp. 390–414.

Kharevich V. M., Akimova E. V., Stasyuk I. V., Tomilova E. A. Tehnologiya proizvodstva plastin v kamennoj industrii kul'turnogo sloya 19 stoyanki Listvenka [Blade Production Technology in the Industry of Layer 19 of the Listvenka Site]. Stratum Plus. Cultural Anthropology and Archaeology. 2015. No. 1. Pp. 321–331. *(In Russ.)*

Kolobova K. A., Flas D., Derevianko A. P., Pavlenok K. K., Islamov U. I., Krivoshapkin A. I. The Kulbulak Bladelet Tradition in The Upper Paleolithic of Central Asia. Archaeology, Ethnology and Anthropology of Eurasia. 2013. Vol. 41 (2). Pp. 2–25. https://doi.org/10.1016/j.aeae.2013.11.002.

Kolobova K. A., Krivoshapkin A. I., Derevyanko A. P., Islamov U. I. Dodekatym-2 Paleolithic site (Uzbekistan) // Archaeology, Ethnology, and Anthropology of Eurasia. 2011. Vol. 48 (4). Pp. 2–12.

Krivoshapkin A., Kuzmin Y., Jull A. J. Chronology of the Obi-Rakhmat Grotto (Uzbekistan): First Results on the Dating and Problems of the Paleolithic Key Site in Central Asia // Radiocarbon. 2010. Vol. 52 (2–3). Pp. 549–554.

Kuhn S., Elston R. G. Introduction: Thinking Small Globally. Thinking Small: Global Perspectives on Microlithization. Archaeological Paper No. 12. Washington : American Anthropological Association, 2002. Pp. 1–8.

Lisitsyn N. F. Pozdnij paleolit Chulymo-Enisejskogo mezhdurech'ya [Late Paleolithic of Chulym-Enisej Interfluve]. Trudy IIMK RAN [Proceedings of the IIMK RAN]. Sankt-Petersburg : Peterb. vostokovedenie, 2000. Vol. 2. 230 p. *(In Russ.)*

Lisitsyn N. F. Srednij etap pozdnego paleolita Sibiri [Middle Stage of Siberian Late Paleolithic]. Rossijskaya arheologiya. 1996. №4. Pp. 5–17. *(In Russ.)*

Mao X., Zhang H., Qiao S., Liu Y., Chang F., Xie P., Zhang M., Wang T., Li M., Cao P., Yang R., Liu F., Dai Q., Feng X., Ping W., Lei C., Olsen J. W., Bennett E. A., Fu Q. The Deep Population History of Northern East Asia from the Late Pleistocene to the Holocene. Cell. 2021. Vol. 184. Pp. 1–11. https://doi.org/10.1016/j.cell.2021.04.040.

Mellars P. Why Did Modern Human Populations Disperse from Africa 60,000 Years Ago? A New Model. Proceedings of the National Academy of Sciences. 2006. Vol. 103. P. 9381.

Mishra S., Chauhan N., Singhvi A. K. Continuity of Microblade Technology in the Indian Subcontinent Since 45 ka: Implications for the Dispersal of Modern Humans. PLoS ONE. 2013. Vol. 8(7) Pp. e69280. https://doi.org/10.1371/journal.pone.0069280

Morlan R. E. Wedge-shaped Core Technology in Northern North America. Arctic Anthropology. 1970. Vol. 7(2). Pp. 17–37.

Nakazawa Y., Akai F. Late-Glacial Bifacial Microblade Core Technologies in Hokkaido: An Implication of Human Adaptation along the Northern Pacific Rim. Quaternary International. 2017. Vol. 442. Pp. 43–54. https://doi: 10.1016/j.quaint.2016.07.019.

Nakazawa Y., Izuho M., Takakura J., Yamada S. Toward an Understanding of Technological Variability in Microblade Assemblages in Hokkaido. Japan. Asian Perspectives. 2005. Vol. 44. Pp. 276–292.

Pargeter J. Lithic Miniaturization in Late Pleistocene Southern Africa. Journal of Archaeological Science: Reports. 2016. Vol. 1010. Pp. 221–236.

Pastoors A., Tafelmaier Y. Bladelet Production, Core Reduction Strategies, and Efficiency of Core Configuration at the Middle Palaeolithic site Balver Höhle (North Rhine Westphalia, Germany). Quartär. 2010. Vol. 57. Pp. 25–41.

Pavlenok G. D. Tehnologiya izgotovleniya klinovidnyh nukleusov v selenginskoj kul'ture Zapadnogo Zabajkal'ya (po materialam stoyanki Ust'-Kyahta-3) [Technology of Wedge-Shaped Cores Production in the Selenga Culture of Western Tansbaikalia]. Izvestiya Altajskogo gosudarstvennogo universiteta. Ser.: Istoricheskie nauki i arheologiya. 2015. No. 3/2 (87). Pp. 178–184. *(In Russ.)*

Pelegrin J. Blade Making Techniques from the Old World: Insights and Applications to Mesoamerican Obsidian Lithic Technology. Mesoamerican Lithic Technology: Experimentation and Interpretation. Salt Lake City : The University of Utah Press, 2003. Pp. 55–71.

Rybin E. P., Khatsenovich A. M., Zwins N., Gunchinsurehn B., Paine C., Bolorbat Ts., Anojkin A. A., Kharevich V. M., Odsuren D., Margad-Erdene G. Stratigrafiya i kul'turnaya posledovatel'nost' stoyanki Tolbor-21 (Severnaya Mongoliya): itogi rabot 2014–2016 godov i dal'nejshie perspektivy issledovanij [Stratigraphy and Cultural Sequence of the Tolbor 21 Site (Northern Mongolia): the Results of the 2014–2016 Excavation Campaigns and Perspectives of Further Investigations]. Teoriya i praktika arheologicheskih issledovanij [Theory and Practice of Archaeological Research]. 2017. Vol. 15. No. 4 (20). Pp. 158–168. *(In Russ.)*

Sato H., Tsutsumi T. The Japanese Microblade Industries: Technology, Raw Material Procurement, and Adaptations. Origin and Spread of Microblade Technology in Northern Asia and North America. Burnaby (BC) : Archaeology Press, Simon Fraser University, 2007. Pp. 57–78.

Sollberger J. B., Patterson L. W. Prismatic Blade Replication. American Antiquity. 1976. Vol. 41. Pp. 517–531.

Song Y., Grimaldi S., Santaniello F., Cohen D. J., Shi J., Bar-Yosef O. Re-thinking the Evolution of Microblade Technology in East Asia: Techno-Functional Understanding of the Lithic Assemblage from Shizitan 29 (Shanxi, China). PLoS One. 2019. Vol. 14 (2). P. e0212643.

Soriano S., Villa P., Wadley L. Blade Technology and Tool Forms in the Middle Stone Age of South Africa: the Howiesons Poort and Post-Howiesons Poort at Rose Cottage Cave. Journal of Archaeological Science. 2007. Vol. 34 (2007). Pp. 681–703.

Takakura J. Emergence and Development of the Pressure Microblade Production: a View from the Upper Paleolithic of Northern Japan. The Emergence of Pressure Blade Making. Québec : Springer, 2012. Pp. 285–306.

Taylor W. E. A Distinction between Blades and Microblades in the American Arctic. American Antiquity. 1962. Vol. 27. Pp. 425–426.

Tixier J. Typologie de l'Epipaléolithique du Maghreb. Mémoires du Centre de Recherches anthropologiques et préhistoriques et ethnographiques 2. Paris : Arts et Métiers graphiques, 1963. 212 p.

Wedage O., Picin A., Blinkhorn J., Douka K., Deraniyagala S., Kourampas N., Perera N., Simpson I., Boivin N., Petraglia M., Roberts P. Microliths in the South Asian Rainforest ~45–4 ka: New Insights from Fa-Hien Lena Cave, Sri Lanka. PLoS ONE. 2019. Vol. 14(10). P. e0222606. https://doi.org/10.1371/journal.pone.0222606

Zwyns N., Gladyshev S. A., Gunchinsuren B., Bolorbat T., Flas D., Tabarev A. V., Dogandzic T., Gillam G. C., Khatsenovich A. M., Odsuren D., Purevjal K.-E., Richards M., Stewart J., Talamo S. The Open-Air Site of Tolbor 16 (Northern Mongolia): Preliminary Results and Perspectives. Quaternary International. 2014. Vol. 347. Pp. 53–65.

Zwyns N., Rybin E. P., Hublin J.-J., Derevianko A. P. Burin-Core Technology and Laminar Reduction Sequence in the Initial Upper Paleolithic from Kara-Bom (Gorny-Altai, Siberia). Quaternary International. 2012. Vol. 259. P. 33–47.

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Абрамова З. А. Палеолит Енисея. Афонтовская культура. Новосибирск : Наука, 1979. 156 с.

Акимова Е. В. Раннесартанская индустрия мелких пластин в финале позднего палеолита Среднего Енисея: к проблеме формирования археологических рефугиумов // Проблемы биологической и культурной адаптации человеческих популяций. Т. 1: Археология. Адаптационные стратегии древнего населения Северной Евразии: сырье и приемы обработки. СПб. : Наука, 2008. С. 37–47.

Гладышев С. А. Свидетельства применения техники микрорасщепления в комплексах раннего верхнего палеолита многослойных стратифицированных стоянок Гобийского Алтая // Проблемы археологии, этнографии, антропологии Сибири и сопредельных территорий. Новосибирск : Изд-во Ин-та археологии и этнографии СО РАН, 2017. Т. XXIII. С. 202–205.

Гладышев С. А., Табарев А. В. Некоторые проблемы изучения микропластинчатого расщепления в раннем верхнем палеолите Северной Монголии // Теория и практика археологических исследований. 2017. Т. 17. № 1. С. 154–166.

Гладышев С. А., Табарев А. В. Микропластинчатое расщепление в раннем верхнем палеолите Монголии // Stratum Plus: Archaeology and Cultural Anthropology. 2018. № 1. С. 339–351.

Лисицын Н. Ф. Средний этап позднего палеолита Сибири // Российская археология. 1996. № 4. С. 5–17.

Лисицын Н. Ф. Поздний палеолит Чулымо-Енисейского междуречья // Тр. ИИМК РАН. СПб. : Петерб. востоковедение, 2000. Т. 2. 230 с.

Павленок Г. Д. Технология изготовления клиновидных нуклеусов в селенгинской культуре Западного Забайкалья (по материалам стоянки Усть-Кяхта-3) // Известия Алтайского государственного университета. Сер.: Исторические науки и археология. 2015. № 3/2 (87). С. 178–184.

Рыбин Е. П., Хаценович А. М., Звинс Н., Гунчинсурэн Б., Пэйн К., Болорбат Ц., Анойкин А. А., Харевич В. М., Одсурен Д., Маргад-Эрдэнэ Г. Стратиграфия и культурная последовательность стоянки Толбор-21 (Северная Монголия): итоги работ 2014–2016 годов и дальнейшие перспективы исследований // Теория и практика археологических исследований. 2017. Т. 15. № 4 (20). С. 158–168.

Харевич В. М., Акимова Е. В., Стасюк И. В., Томилова Е. А. Технология производства пластин в каменной индустрии культурного слоя 19 стоянки Лиственка // Stratum Plus: Культурная антропология и археология. Санкт-Петербург; Кишинев; Одесса; Бухарест. 2015. № 1. С. 321–331.

An Zh. The Mesolithic Remains in Hailar — Also on the the Origin and the Tradition of Microliths. Kaogu Xuebao (Chinese Journal of Archaeology). 1978. Iss. 3. Pp. 289–316.

Belfer-Cohen A., Goring-Morris A. N. Why microliths? Microlithization in the Levant // Thinking Small: Global Per-spectives on Microlithic Technologies. 2002. Arlington: AP3A. Pp. 57–68.

Blinkhorn J. Buddha Pushkar revisited: Technological variability in Late Palaeolithic stone tools at the Thar Desert margin, India // Journal of Archaeological Science: Reports. 2018. Vol. 20. Pp. 168–182.

Boëda E., Bonilauri S. The Intermediate Paleolithic : the first bladelet production 40,000 years ago // Anthropologie-International Journal of Human Diversity and Evolution. 2006. Vol. 44 (1). Pp.75–92.

Boëda E., Bonilauri S., Kaltnecker E., Valladas H., Al-Sakhel H. Un débitage lamellaire au Proche-Orient vers 40 000 ans cal BP. Le site d'Umm el Tlel, Syrie centrale // L'anthropologie. 2015. Vol. 119. Pp. 141–169.

Bon F. A brief overview of Aurignacian cultures in the context of the industries of the transition from the middle to the upper Paleolithic // Towards a Definition of the Aurignacian. Lisbon : Instituto Português de Arqueologia (Trabalhos de Arqueologia 45), 2006. Pp. 133–144.

Brunet F. The Technique of Pressure Knapping in Central Asia: Innovation or Diffusion? // The Emergence of Pressure Blade Making: From Origin to Modern Experimentation. Québec: Springer. 2012. Pp. 307–328.

Clarkson C., Petraglia M., Korisettar R., Haslam M., Boivin N., Crowther A., et al. The oldest and longest enduring microlithic sequence in India: 35 000 years of modern human

occupation and change at the Jwalapuram Locality 9 rockshelter // Antiquity. 2009. Vol. 83(320). Pp. 326–348.

Clarkson C., Hiscock P., Mackay A., Shipton C. Small, Sharp, and Standardized: Global Convergence in Backed-Microlith Technology // Convergent Evolution in Stone-Tool Technology. Cambridge : MIT Press, 2018. Pp. 175–200.

Chen Ch., Wang X.-Q. Upper Paleolithic microblade industries in North China and their relationships with Northeast Asia and North America // Arctic Anthropology. 1989. Vol. 2(26). Pp. 127–156.

Derevianko A. P., Petrin V. T., Rybin E. P., Chevalkov L. M. Paleoliticheskie komplexy stratificirovannoy chasti stoyanki Kara-Bom (mustye i verkhniy paleolit) [Paleolithic Complexes of the Stratified Part of the Kara-Bom Site (Mousterian/Upper Paleolithic]. Novosibirsk : IAET, 1998. 235 p. (*In Russian, English, French*).

Derevianko A. P., Zenin A. N., Rybin E. P., Gladyshev S. A., Tsybankov A. A., Olsen J. W., Tseveendorj D., Gunchinsuren B. The technology of early Upper Paleolithic lithic reduction in Northern Mongolia: the Tolbor-4 site // Archaeology, Ethnology and Anthropology of Eurasia. 2007. Vol. 29. Pp. 16–38.

Faivre J.-Ph. A material anecdote but technical reality: bladelet and small blade production during the recent Middle Paleolithic at Combe-Grenal rock shelter // Lithic Technology. 2012. Vol. 37. Pp. 5–25.

Gómez Coutouly Y. A. The emergence of pressure knapping microblade technology in Northeast Asia // Radiocarbon. 2018. Vol. 60. Pp. 821–855.

Inizan M.-L., Reduron-Ballinger M., Roche H., Tixier J. Technology and Terminology of Knapped Stone. Nanterre : C.R.E.P., 1999. 191 p.

Kolobova K. A., Krivoshapkin A. I., Derevyanko A. P., Islamov U. I. Dodekatym-2 Paleolithic site (Uzbekistan) // Archaeology, ethnology and anthropology of Eurasia. 2011. Vol. 48 (4). Pp. 2–12.

Kolobova K. A., Flas D., Derevianko A. P., Pavlenok K. K., Islamov U. I., Krivoshapkin A. I. The Kulbulak Bladelet Tradition in The Upper Paleolithic of Central Asia // Archaeology, Ethnology and Anthropology of Eurasia. 2013. Vol. 41 (2). Pp. 2–25. https://doi.org/10.1016/j.aeae.2013.11.002.

Kuhn S., Elston R. G. Introduction: Thinking Small Globally. // Thinking small: Global perspectives on microlithization. Archaeological Paper No. 12. Washington : American Anthropological Association, 2002. Pp. 1–8.

Keates S. G., Postnov A. V., Kuzmin Y. V. Towards the origin of microblade technology in Northeastern Asia // Vestnik of Saint Petersburg University. History. 2019. Vol. 64. Pp. 390–414.

Krivoshapkin A., Kuzmin Y., Jull A. J. Chronology of the Obi-Rakhmat grotto (Uzbekistan): first results on the dating and problems of the Paleolithic key site in Central Asia // Radiocarbon. 2010. Vol. 52. (2–3). Pp. 549–554.

Mao X., Zhang H., Qiao S., Liu Y., Chang F., Xie P., Zhang M., Wang T., Li M., Cao P., Yang R., Liu F., Dai Q., Feng X., Ping W., Lei C., Olsen J.W., Bennett E.A., Fu Q. The deep population history of northern East Asia from the Late Pleistocene to the Holocene // Cell. 2021. Vol. 184. Pp. 1–11. https://doi.org/10.1016/j.cell.2021.04.040.

Mellars P. Why did modern human populations disperse from Africa 60,000 years ago? A new model // Proceedings of the National Academy of Sciences. 2006. Vol. 103. P. 9381.

Mishra S., Chauhan N., Singhvi A.K. Continuity of Microblade Technology in the Indian Subcontinent Since 45 ka: Implications for the Dispersal of Modern Humans // PLoS ONE. 2013. Vol. 8(7) Pp. e69280. https://doi.org/10.1371/journal.pone.0069280

Morlan R. E. Wedge-shaped core technology in northern North America // Arctic Anthropology. 1970. Vol. 7(2). Pp. 17–37.

Pargeter J. Lithic miniaturization in late Pleistocene southern Africa // Journal of Archaeological Science: Reports. 2016. Vol. 1010. Pp. 221–236.

Pastoors A., Tafelmaier Y. Bladelet production, core reduction strategies, and efficiency of core configuration at the Middle Palaeolithic site Balver Höhle (North Rhine Westphalia, Germany) // Quartär. 2010. Vol. 57. Pp. 25–41.

Pelegrin J. Blade Making Techniques from the Old World: Insights and Applications to Mesoamerican Obsidian Lithic technology. // Mesoamerican Lithic Technology: Experimentation and Interpretation. Salt Lake City : The University of Utah Press, 2003. Pp. 55–71.

Nakazawa Y., Akai F. Late-Glacial Bifacial Microblade Core Technologies in Hokkaido: An Implication of Human Adaptation along the Northern Pacific Rim // Quaternary International. 2017. Vol. 442. Pp. 43–54, https://doi: 10.1016/j.quaint.2016.07.019.

Nakazawa Y., Izuho M., Takakura J., Yamada S. Toward an understanding of technological variability in microblade assemblages in Hokkaido, Japan // Asian Perspectives. 2005. Vol. 44. Pp. 276–292.

Sato H., Tsutsumi T. The Japanese microblade industries: technology, raw material procurement, and adaptations // Origin and Spread of Microblade Technology in Northern Asia and North America. Burnaby (BC): Archaeology Press, Simon Fraser University. 2007. Pp. 57–78.

Song Y., Grimaldi S., Santaniello F., Cohen D.J., Shi J., Bar-Yosef O. Re-thinking the evolution of microblade technology in East Asia: Techno-functional understanding of the lithic assemblage from Shizitan 29 (Shanxi, China) // PLoS One. 2019. Vol. 14 (2). P. e0212643.

Takakura J. Emergence and development of the pressure microblade production: a view from the Upper Paleolithic of Northern Japan // The Emergence of Pressure Blade Making. Québec : Springer, 2012. Pp. 285–306.

Sollberger J. B., Patterson L. W. Prismatic blade replication // American Antiquity. 1976. Vol. 41. Pp. 517–531.

Soriano S., Villa P., Wadley L. Blade Technology and Tool Forms in the Middle Stone Age of South Africa: the Howiesons Poort and Post-Howiesons Poort at Rose Cottage Cave // Journal of Archaeological Science. 2007. Vol. 34 (2007). Pp. 681–703.

Taylor W. E. A distinction between blades and microblades in the American Arctic // American Antiquity. 1962. Vol. 27. Pp. 425–426.

Tixier J. Typologie de l'Épipaléolithique du Maghreb. Mémoires du Centre de recherches anthropologiques, préhistoriques et ethnographiques 2. Paris : Arts et Métiers graphiques, 1963. 212 p.

Wedage O., Picin A., Blinkhorn J., Douka K., Deraniyagala S., Kourampas N., Perera N., Simpson I., Boivin N., Petraglia M., Roberts P. Microliths in the South Asian rainforest ~45–4 ka: New insights from Fa-Hien Lena Cave, Sri Lanka // PLoS ONE. 2019. Vol. 14(10). P. e0222606. https://doi.org/10.1371/journal.pone.0222606

Zwyns N., Rybin E. P., Hublin J.-J., Derevianko A. P. Burin-core technology and laminar reduction sequence in the initial Upper Paleolithic from Kara-Bom (Gorny-Altai, Siberia) // Quaternary International. 2012. Vol. 259. P. 33–47.

Zwyns N., Gladyshev S. A., Gunchinsuren B., Bolorbat T., Flas D., Tabarev A. V., Dogandzic T., Gillam G. C., Khatsenovich A. M., Odsuren D., Purevjal K.-E., Richards M., Stewart J., Talamo S. The open-air site of Tolbor 16 (Northern Mongolia): preliminary results and perspectives // Quaternary International. 2014. Vol. 347. Pp. 53–65.

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